Fremont County

Pre-Disaster Mitigation Plan

January 2015

Fremont County Office of Emergency Management
615 Macon Avenue
Canon City, CO 81212

Fremont County
HAZARD MITIGATION PLAN UPDATE

DECEMBER 2014

Prepared for:
Fremont County Office of Emergency Management
615 Macon Avenue
Cañon City, CO 81212

Prepared by:

TETRA TECH
complex world | CLEAR SOLUTIONS™

216 16th Street, Suite 1500
Denver, CO 80202

Project #103S3162

Fremont County
Hazard Mitigation Plan Update

TABLE OF CONTENTS

Appendices

LIST OF TABLES

LIST OF FIGURES

No. Title *Page No.*

ACKNOWLEDGMENTS

Project Manager

Mr. Steve Morrisey
Director
Fremont County Office of Emergency Management
615 Macon Avenue
Cañon City, Colorado 81212
Phone: 719-276-7422
Email: steve.morrisey@fremontco.com

Consultants

Tetra Tech, Inc., Laura D. Johnston, Project Manager

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Disaster Mitigation Act (DMA) is federal legislation that requires proactive, pre-disaster planning as a prerequisite for some funding available under the Robert T. Stafford Act. The DMA encourages state and local authorities to work together on pre-disaster planning. The planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

Hazard mitigation is the use of long- and short-term strategies to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. It is impossible to predict exactly when and where disasters will occur or the extent to which they will impact an area, but with careful planning and collaboration among public agencies, stakeholders and citizens, it is possible to minimize losses that disasters can cause. The responsibility for hazard mitigation lies with many, including private property owners; business and industry; and local, state and federal government.

Fremont County and a partnership of local governments within the County have developed and maintained a hazard mitigation plan to reduce risks from natural disasters and to comply with the DMA.

PLAN UPDATE

Federal regulations require monitoring, evaluation, and updating of hazard mitigation plans. An update provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and evaluate whether there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is no longer in compliance with the DMA.

A regional partnership that included Fremont County prepared *The Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for the Upper Arkansas Area* in November 2003, referred to as the "UAA HMP" in this document. The following provides the history behind UAA HMP. The UAA HMP background is not from direct knowledge, but is assembled through discussions with other jurisdictions and the geographic information system (GIS) department for Fremont County. The UAA HMP was developed by the Fremont County Office of Emergency Management and Regional GIS Authority and encompassed Lake, Chaffee, Park, Fremont and Custer counties. The UAA HMP did not specifically address Fremont County hazards or mitigation projects in detail due to the regional nature of the plan, which focused on large hazard themes that extended throughout the Upper Arkansas area. Furthermore, the UAA HMP focused on hazard examples and recommendations that were in the southern end of the UAA because the writer's experience base was in that area. As a consequence, the UAA HMP did not assign offices or departments with the primary responsibilities to complete projects or recommendations and the suggested actions or concepts lacked a funding source as well as a timeframe for completion. There were no indications or evidence of funding, assigning supervisory responsibility, or tracking of any mitigation projects while preparing to develop the current HMP for Fremont County. Given the lack of specificity in the UAA HMP and the lack of executive oversight of the plan if it was adopted by the Board of County Commissioners (BOCC), there are no records of any further work, meetings, or correspondence related to the 2003 UAA HMP. It is for the above reasons that the Fremont County Office of Emergency Management elected to develop a completely new plan specifically for Fremont County.

The development of this new plan specific to Fremont County consisted of the following phases:

- **Phase 1, Organize and Review**—A planning team was assembled to provide technical support for the plan update, consisting of key County staff from the Office of Emergency Management and a technical consultant. The first step in developing the plan update was to re-establish a planning partnership. Planning partners participating in the update were the Cities of Florence and Cañon City, and the Town of Brookside. A Steering Committee was assembled to oversee the plan update, consisting of planning partner staff and community representatives from the

planning area. Coordination with other county, state, and federal agencies involved in hazard mitigation occurred throughout the plan update process. This phase included a comprehensive review of the UAA HMP, the Colorado State Hazard Mitigation Plan, and existing programs that may support or enhance hazard mitigation actions.

- **Phase 2, Update the Risk Assessment**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. This process assesses the vulnerability of people, buildings and infrastructure to natural hazards. All facets of the risk assessment of the plan were re-visited by the planning team and updated with the best available data and technology. The work included the following:
  - Hazard identification and profiling
  - Assessment of the impact of hazards on physical, social, and economic assets
  - Vulnerability identification
  - Estimates of the cost of potential damage.
- **Phase 3, Engage the Public**—A public involvement strategy agreed upon by the Steering Committee was implemented by the planning team – all meetings were open to the public. Public meetings were held to present the risk assessment as well as the draft plan. Participation in the hazard mitigation survey occurred across the County, a County website included plan updates, and there were multiple media releases.
- **Phase 4, Assemble the Updated Plan**—The planning team and Steering Committee assembled key information into a document to meet the DMA requirements for all planning partners.
- **Phase 5, Adopt/Implement the Plan**—Once pre-adoption approval has been granted by Colorado's Office of Emergency Management and Region VIII of the Federal Emergency Management Agency, the final adoption phase will begin. Each planning partner will individually adopt the updated plan. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every 5 years. Throughout the life of this plan, a representative of the original Steering Committee will provide a consistent source of guidance and oversight.

MITIGATION GUIDING PRINCIPLE, GOALS AND OBJECTIVES

The following guiding principle for this plan process guided the Committee:

- Develop and maintain a disaster-resistant Fremont County and communities within that is more resilient to the physical devastation and resulting economic impacts associated with all natural hazard events.

The following plan goals and objectives were determined by the Committee:

- **Goal 1:** Develop support for mitigation among local jurisdictions and local officials.
  - **Objective 1A**: Continually assess ongoing disaster preparedness programs and activities to implement changes that improve disaster preparedness for Fremont County.
  - **Objective 1B:** Enhance training with all agencies in the County and community to improve disaster preparedness.
  - **Objective 1C:** Communicate and collaborate mitigation and disaster preparedness programs across the County.

- **Goal 2:** Enhance countywide understanding and awareness of community preparedness needs.
  - **Objective 2A**: Educate the public about preparedness activities and mitigation goals, allowing each citizen the opportunity to reduce personal risk and to increase property protection.
  - **Objective 2B:** Adopt codes, standards, rules and regulations to ensure compliance with mitigation standards, goals, and requirements.
  - **Objective 2C:** Adopt recognized mitigation programs in the County.
- **Goal 3:** Enhance interagency collaboration throughout the County and with adjacent neighbors.
  - **Objective 3A:** Continue to work with the Emergency Services Committee in Fremont County to address emergency and disaster-related issues and concerns.
  - **Objective 3B:** Continue to work with area partners through mutual aid agreements and long-term planning efforts.
  - **Objective 3C:** Review, update and enhance Memorandum(s) of Understanding with the intent to ensure adequate mutual aid availability exists between agencies.
- **Goal 4:** Improve emergency service capabilities.
  - **Objective 4A:** Enhance interagency operations by strengthening the Emergency Operations Center (EOC) capabilities across jurisdictional boundaries.
  - **Objective 4B:** Enhance EOC capabilities by developing and implementing operational policies, practices, and procedures.
- **Goal 5:** Ensure readiness through a variety of training mechanisms, including opportunities involving public officials and community members regarding the identified hazards, to improve long-term planning and mitigation activities.
  - **Objective 5A:** Conduct exercises and training regarding the prevention and mitigation of Fremont County hazards.
- **Goal 6:** Enhance the safety of residents and businesses by protecting public and private infrastructure and critical facilities from the effects of natural and human-caused hazards.
  - **Objective 6A**: Reduce the frequency and/or severity of natural hazards in Fremont County.
  - **Objective 6B:** Ensure that countywide measures are taken addressing specific risks to infrastructure posed by identified hazards and the resultant critical infrastructure needs and develop a funding mechanism for the priority areas.
  - **Objective 6C:** Explore diverse public notification systems for impending hazards.
  - **Objective 6D:** Ensure that the public has more than one means of obtaining information about emergencies and disasters in the County through development of redundant notification systems.
  - **Objective 6E**: Periodically test these systems to ensure operational capacity of systems.
- **Goal 7:** Reduce the vulnerability of local assets to the potential impacts of natural hazards in Fremont County.
  - **Objective 7A:** Work to reduce the frequency, severity, and potential impacts of wildfires in Fremont County via proactive measures and education.
  - **Objective 7B:** Work to reduce the severity and potential impacts of flooding in Fremont County via proactive measures and education.

  - **Objective 7C:** Work to reduce the frequency, severity, and potential impacts of drought in Fremont County via proactive measures, water saving actions, and education.
  - **Objective 7D:** Work to reduce the potential impacts of severe winter weather in Fremont County via proactive measures, preparedness, and education.
- **Goal 8:** Ensure hazard awareness and risk reduction principles are institutionalized into the Fremont County jurisdictions' daily activities, processes, and functions.
  - **Objective 8A:** Be proactive in incorporating emergency management plans into all other institutional County plans, documents, and practices
  - **Objective 8B:** Incorporate risk reduction principles into policy documents and initiatives.

MITIGATION INITIATIVES

Mitigation initiatives presented in this update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 54 mitigation initiatives for implementation by individual planning partners as listed in Table ES-1.

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
FREMONT COUNTYWIDE MITIGATION INITIATIVES																	
Initiative #1—Public Information and Awareness **Description:** Bring all-hazard awareness and education to public venues (Using the Firewise Trailer) **Lead & Support Agency:** OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM and Volunteer Time, available grants.	Ongoing	G1,2,3, 5 & 8 O1B,C, 2A, 3A & 5A
Initiative #2— Floodplain Mapping – Swissvale Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$45,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #3 — Floodplain Mapping – Howard Community **Description:** Mapping of area within Zone A flood zone for Howard community **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$50,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #4 — Flood Plain Mapping – Cotopaxi Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$40,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #5— Detailed Floodplain Mapping – Texas Creek Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$40,000.	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #6 — Detailed Floodplain Mapping – Penrose Area **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$150,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #7 — Detailed Floodplain Mapping – C-3 and C-4 Dam Area **Description:** Base Flood Mapping of area within inundation zones of both C-3 and C-4 dams **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$150,000	Fremont County, CWCB, NRCS	Short term	G2, 6, 7, &8 O2A, 2B, 6B, 7B, & 8A
Initiative #8 — Floodway Determination Mapping of Arkansas River from Ash Street to S.H. 115 **Description:** Floodway determination mapping of Arkansas River in Eastern Fremont County **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$90,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #9 — Beaver Park and Bear Creek Retention/Detention Ponds **Description:** Construct a series of 8 detention ponds on Bear Creek to prevent flooding on private lands and County roads **Lead & Support Agency:** Fremont County DOT and NCRS																	
High	New	High				X							SIP	(M) $36,000	Fremont County, CWCB, NRCS, Grant funding with local share	Short term	G6&7 O6B7B
Initiative #10 — Right-of-Way Debris Management **Description:** Clear ROW for EM multiple uses **Lead & Support Agency:** FDOT, OEM (coordination with State Forest Service)																	
High	New	High	X					X	X				NRP	Med	County Budget for DOT, available grants	Ongoing	G4, 6, 7 O6A, 7A &7D
Initiative #11— Wildfire protection **Description:** Develop and implement CWPPs for different areas of the County **Lead & Support Agency:** OEM and local fire districts, Federal agencies																	
High	New	High						X					EAP	Med	County Budget for OEM , available grants	Ongoing	G2 O 2C
Initiative #12 — Fuel Reduction and increase carrying capacity of drainage channel – Phantom Canyon drainage **Description:** Ensure adequate flow of major drainage and removal of fuel loading **Lead & Support Agency:** Fremont County/government entity (BLM) or land owner																	
High	New	High				X		X					NRP	(H) $2,000,000	County and BLM Budgets	Long term	G1 O1C, G6 & 7 O6A & 7A&B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #13— Stream Channel Armoring **Description:** Armoring stream and dry wash pipeline crossings in channels vulnerable to erosion **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X			X	X	X	X				SIP	(H) $765,000	Grant funding with possible Fremont Sanitation District cost share	Long term	G3, 6 & 7 O3B, 6B, 7B
Initiative #14— Fuel Storage **Description:** Mobile fuel storage containers and truck **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(M) $78,700	Grant funding with possible Fremont Sanitation District cost share	Short term	G3 & 6 O3B & 6B
Initiative #15— Watertight manhole lids **Description:** Installation of 554 watertight frames and lids located in floodplains. **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med				X							SIP	$277,000	Grant funding with possible Fremont Sanitation District cost share	Short term	G3 & 7 O3B &7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #16— Backup Communication System **Description:** Two-way radio system for alternate means of communication **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X	X	X	X	X	X	X	X	X	X	SIP	(L) $5975	Grant funding with possible Fremont Sanitation District cost share.	Short term	G3 & 4 O3A & 4A
Initiative #17— Backup Power Generator at Service Center **Description:** (2) 25 kW Diesel-powered generators **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X	X	X	X	X	X	X	X	X	X	SIP	(L) $38,000	Grant funding with possible Fremont Sanitation District cost share.	Short term	G6 O6B
Initiative #18— Ultraviolet (UV) Disinfection System Upgrade **Description:** Upgrade UV disinfection system to increase treatment capacity **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X			X	X						SIP	(H) $450,000	Grant funding with possible Fremont Sanitation District cost share.	Med term	G3 & 7 O3B &7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #19— Floodplain Mapping **Description:** Accurate LiDAR mapping of Arkansas River and Hayden Creek. Identify evacuation and road closure areas in the event of flooding. Will also allow targeted and cost-effective mitigation measures. **Lead & Support Agency:** Western Fremont Fire Protection District																	
High	New	High				X							NRP	High	General funds and grants	Short term	G2, 6 & 7, O2A, 6B, &7B
Initiative #20— Arkansas Penrose Pipeline Project to Diversify Raw Water Source **Description:** Arkansas-Penrose Pipeline Project: acquisition of raw water on the Arkansas River; diversion of water from a location near Penrose; construction of a conveyance pipeline to Penrose for beneficial use of the District's constituents; raw water storage. **Lead & Support Agency:** Penrose Water District																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(H) $9,750,000	Colorado Department of Natural Resources-Colorado Water Conservation Board: Loan for 90% of Project Estimate. Colorado Department of Local Affairs: Grant for $500,000. Penrose Water District: Funding balance of Project Estimate	Short term	G6&7, O6A&7C

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
CAÑON CITY MITIGATION INITIATIVES																	
Initiative #21— Floodplain and Hazard Mapping **Description:** 8 drainages and river basin – update detail floodplain/floodway mapping. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							NRP & EAP	(H) $1,567,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #22— Flood Control – Abbey Drainage Basin **Description:** Multiple actions including riprapping channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced concrete box culverts, and reinforced concrete pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $16,245,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #51— Flood Control – Orchard Avenue Drainage Basin **Description:** Multiple actions including stabilizing channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced box culverts, detention basin work, and reinforced concrete pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $9,742,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Short Term/Long Term	G2, 6, &7 O2A, 6B, & 7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #45— Fuel Load Thinning at Multiple Locations Throughout the BLM Managed Forest (Royal Gorge Field Office) **Description:** Mechanical thinning to reduce hazardous fuel; reduce hazardous fuel; protect Wildland Urban Interface (WUI); improve response to wildland fire; improve firefighter safety; improve forest and rangeland health; protect threatened and endangered species; control epidemic insects and disease; restore ecosystems. **Lead & Support Agency:** USDI - Bureau of Land Management																	
High	New	High	X		X	X	X	X	X				NSP	(H) varies by project	USDI - Bureau of Land Management	Long term	G6&7, O6A & 7A
Initiative #46— Arkansas Mountain Stewardship - Prescribed Fire **Description:** Prescribed fire to reduce hazardous fuel; protect Wildland Urban Interface (WUI); improve response to wildland fire; improve firefighter safety; improve forest and rangeland health; protect threatened and endangered species; control epidemic insects and disease; restore ecosystems. **Lead & Support Agency:** USDI - Bureau of Land Management																	
High	New	High	X		X	X	X	X	X				NSP	(H) varies by project	USDI - Bureau of Land Management	Long term	G6&7, O6A & 7A
Initiative #47— Review and Update Plans and Procedures to Improve Disaster Response Efforts **Description:** Countywide response agencies and other personnel will meet periodically as part of a Planning Committee or Emergency Services Committee to review, update and develop operating plans and procedures to improve disaster response efforts among residents and geographical areas of Fremont County. **Lead & Support Agency:** OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP, LPR	Low	County Budget for OEM	On-going	G1,3,4&8 O1A, 1C, 3A,3B, 3C, 4B, 8A, & 8B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #48— Review and Update of Emergency Operations Center Capabilities **Description:** Countywide response agencies and other personnel involved in EOC operations will meet regularly to improve, develop and enhance EOC operational procedures for future incidents. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM	On-going	G1&4 O1A, 1C, 4A, & 4B
Initiative #49— Continue to Improve Communication of Hazards to Residents **Description:** Continue development and participation in the regional Public Information Group, which works with members of local state and federal agencies in and around Fremont County to improve communications with residents before, during, and after a disaster or incident. The group offers multiple methods of dispersing information to residents of the County and the region. Development and participation involves regular meetings and training as necessary. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP, LPR	Low	County Budget for OEM	On-going	G1,2,&6 O1B, 1C, 2A, 6C, & 6D
Initiative #50— Coordination of Testing of Emergency Communication Systems **Description:** Tests of emergency notification systems will be scheduled and coordinated with local, county, and regional agencies. These tests may be scheduled and tracked during meetings of personnel involved in the EOC operations, the regional Public Information Group, or the Planning Committee and Emergency Services Committee. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM	On-going	G3&6 O3A & 6E

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #23— Flood Control – Four Mile Creek Drainage Basin **Description:** Multiple actions including channel improvements, construction of detention basin, and RCBC. Lead & Support Agency: City of Cañon City																	
High	New	High				X							SIP	(H) $2,235,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #24— Flood Control – Hogback Area Drainage Basin **Description:** Construction of 10 detention basins and installation of 3 culverts in the Hogback Basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(M) $250,000	City of Cañon City Stormwater Utility, HMGP, CWCB, GOCO	Short term	G2, 6, &7 O2A, 6B, & 7B
Initiative #25— Flood Control – N. 9th Street Drainage Basin **Description:** Construction of storm sewer and inlets on 9th Street in Cañon City **Lead & Support Agency**: City of Cañon City																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(H) $5,000,000	City of Cañon City Stormwater Utility, HMGP, CWCB, CDOT	Long term	G2, 6, &7 O2A, 6B, & 7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #26— Flood Control – North Sand Creek Drainage Basin **Description:** Erosion repair work and installation of corrugated metal piping and concrete reinforced box culverts in the North Sand Creek Drainage Basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High			X								SIP	(H) $1,879,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Long term	G2, 6, &7 O2A, 6B, & 7B
Initiative #27— Flood Control – Northeast Cañon Drainage Basin **Description:** Multiple actions including riprapping channels, channel improvements, installation of one oversized detention basin, reinforced concrete box culverts, and arch pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High			X								SIP	(H) $9,275,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #28— Flood Control – South Sand Creek Drainage Basin **Description:** Multiple actions including installation of a pedestrian crossing and ditch crossing, open channels, construction of drop structures, reinforced concrete box culverts, reinforced concrete pipe, and a detention basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High			X								SIP	(H) $9,082,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #29— Drought Mitigation **Description:** Implement a plan to provide our water users with information regarding how to use water efficiently inside/outside the home or business. Create an on-line Water Efficiency Plan for Homeowners and Business Owners. Providing information to our water users will give them the tools that they can use to develop efficient water usage habits. This in turn will save them money and help save a finite water resource. **Lead & Support Agency:** City of Cañon City Water Department																	
High	New	High			X			X					EAP	Low	City of Cañon City Water Department	Short term	G2&7 O2A&7A
Initiative #30— Wildfire Education and Awareness Program **Description:** Community presentations, printing/purchase of educational materials **Lead & Support Agency:** Cañon City Area Fire Protection District																	
High	New	High						X					EAP	M $10-$100,000	Misc. Grants	Ongoing	G2&7 O2A, 7A, & 7C
Initiative #31— Local Planning and Regulations **Description:** Develop and adopt a WUI Building Code **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City																	
High	New	High						X					LPR	M $10-$100,000	Misc. Grants	Ongoing	G2, 7, &8 O2B, 7A, & 8B
Initiative #32— Structure and Infrastructure Projects **Description:** Expand and enhance the availability of water supplies in the WUI areas **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City																	
High	New	High						X					SIP	H (>$100,000)	Grants	Ongoing	G7 O7A

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #33 - Structure and Infrastructure Projects **Description:** Creating defensible space around structures, infrastructure, and critical facilities. **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City, utility companies																	
High	New	High						X					SIP	H (>$100,000)	Grants	Ongoing	G2&7 O2A, 2C,7A,&7D
Initiative #34— Natural Systems Protection **Description:** Perform regular maintenance activities for fuel management, including cutting and maintaining firebreaks in WUI areas and sponsoring local slash and chipping programs for residents. **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City, utility companies																	
High	New	High						X					NRP	H (>$100,000)	Grants	Ongoing	G2, 3,&7 O2A, 2C,3A,7A,&7D
Initiative #35— Install actuators on control gates of the Cañon City Hydraulic Ditch main canal. **Description:** Actuators are electrically controlled systems allowing for regulation of water levels in the canal. The actuators stop the flow of irrigation water into the canals during heavy rain events. This does not address the additional problems of stormwater runoff into the canals that could cause flooding. **Lead & Support Agency:** City of Cañon City and Fremont County																	
High	New	High				X							SIP	High	FEMA, Colorado Water Conservation Board, Fremont County & Cañon City	5 yrs	G6&7 O6B&7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
BROOKSIDE MITIGATION INITIATIVES																	
Initiative #36— Vegetative Fuel Reduction **Description:** • Seek funding and real assistance to reduce vegetative fuels where natural vegetation and weeds interface with structures and infrastructure. • Continue to develop partnerships with other organizations to implement wildfire mitigation plans and other hazard reduction programs. • Create and maintain defensible space around structures and infrastructure. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X			X	X	X		X			SIP, NRP	(M) $75,000	Federal, State or local sources	Short term	G2, 3,&7 O2A, 2C,3A,7A,&7D
Initiative #37 — Disaster-resistant community **Description:** Provide all residents/businesses with appropriate emergency preparedness information and supplies. Encourage residents to take personal action to protect private property from all potential disaster scenarios. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X			X	X	X		X			EAP	(L) $5,000	Federal, State or local sources	Short term	G2&7 O2A,7A, 7B, 7C, &7D
Initiative #38 — Drought-resistant community **Description:** Identify alternative water supplies for time of drought. Develop mutual aid agreements with alternative suppliers. **Lead & Support Agency:** Town of Brookside																	
Med	New	Med			X								LPR; SIP	TBD	Federal, State or local sources	Ongoing	G3,6,&7 O3B, 3C, 6B, & 7C

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #39 — Earthquake Resistant Buildings/Infrastructure **Description:** Update building codes and practices related to appropriate levels of seismic safety. Further enhance seismic risk assessment to target high hazard buildings. **Lead & Support Agency:** Town of Brookside																	
Low	New	Low	X	X	X	X	X	X	X	X	X	X	SIP; LPR	(M) $20,000	Federal, State or local sources	Long term	G2&6 O2B&6B
Initiative #40 — Thunderstorm run-off controls **Description:** Implement structural and non-structural flood mitigation measures for flood-prone properties. Seek engineering and project assistance to mitigate stormwater runoff. Develop and begin to implement a systematic process to evaluate and upgrade aging infrastructure such as transportation, drainage, utilities, and others that could be affected during a major natural disaster. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP; LPR	(H) $400,000	Federal, State or local sources	Ongoing	G6&7 O6B&7B
FLORENCE MITIGATION INITIATIVES																	
Initiative #41— Floodplain and Hazard Mapping **Description:** Determine regulatory floodway limits within City of Florence **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	(M) $85,000	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA	Short term	G7 O7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #42— Bridge Reconstruction **Description:** Existing bridge decks are obstructions to flood water flow. Raise decks to enable flood flow to remain in designated channels instead of inundating broad floodplains in populated areas. **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR	Long Term	G6&7 O6B&7B
Initiative #43— Provide Stormwater Detention Pond **Description:** Obtain land sufficient for detention of runoff in two locations to mitigate downstream flooding and to improve discharge water quality from City storm drainage systems **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA	Long Term	G7 O7B
Initiative #44— Oak Creek Flood Channel Enlargement **Description:** Existing channel geometry is an obstruction to flood water flow. Increase channel dimensions to enable flood flow to remain in designated channel instead of inundating broad floodplain in populated areas. **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR	Long Term	G7 O7B

TABLE ES-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #52— Backup Emergency Mobile Communications System **Description:** Mobile communication vehicle and two-way radio system for alternative communication for use in case of failure of County system. **Lead & Support Agency:** City of Florence																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, other grants	Short Term	G3 & 4 O3A & 4A
Initiative #53— Identify and remove dangerous trees and branches from City streetscape **Description:** Identify and remove decayed trees and limbs to prevent or minimize property damage and loss of life in high wind storms **Lead & Support Agency:** City of Florence																	
Med	New	Med	X		X	X	X	X	X		X		SIP, NRP	High	City of Florence, NRCS, DOLA, CDOT, FHWA, other grants	Short Term	G6 & 7 O6A, 6E, 7C & 7D
Initiative #54— Identify earthquake-prone unreinforced structures **Description:** Assess and identify non-reinforced structures prone to earthquake damage. **Lead & Support Agency:** City of Florence																	
Med	New	Med										X	LPR, EAP	Low	DOLA, other grants	Short Term	G6 & 8 O6B & 8B

Hazard ID Codes: SS=Severe Storms (Thunderstorms, High Winds, and Hail); LS=Landslide; D/ET=Drought and Extreme Heat; F=Flood; T=Tornado; WF=Wildfire; SWW=Severe Winter Weather; DF=Dam Failure, SSS= Subsidence/Sinkholes/Soil Erosion; EQ=Earthquake

PART 1—
THE PLANNING PROCESS

CHAPTER 1.
INTRODUCTION TO THE PLANNING PROCESS

1.1 WHY PREPARE THIS PLAN?

1.1.1 The Big Picture

Hazard mitigation is defined as a way to alleviate the loss of life, personal injury, and property damage that can result from a disaster through long- and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many, including private property owners; business and industry; and local, state, and federal government.

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) required state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. The DMA increased the emphasis on planning for disasters before they occur.

The DMA encourages state and local authorities to work together on pre-disaster planning. It promotes "sustainable hazard mitigation," which includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

1.1.2 Local Concerns

Several factors initiated this planning effort:

- Fremont County is exposed to hazards that have caused past damage.
- Limited local resources make it difficult to be pre-emptive in reducing risk. Eligibility for federal financial assistance is paramount to promote successful hazard mitigation in the area.
- Fremont County and its partners participating in this plan want to be proactive in preparing for the probable impacts of natural hazards.
- *The Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for the Upper Arkansas Area (*referred to as the "UAA HMP" in this document), completed in November 2003, was never formally approved by the Federal Emergency Management Agency (FEMA) Region VIII and was never recognized by FEMA as an official plan. Thus, Fremont County does not currently have a FEMA-approved mitigation plan in place, which could limit County access to emergency funds after a disaster declaration.

1.1.3 Purposes for Planning

This hazard mitigation plan update identifies resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of the planning partners and their citizens. One of the benefits of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. FEMA encourages multi-jurisdictional planning under its guidance for the DMA. This plan will help guide and coordinate mitigation activities throughout the planning area. The plan was developed to meet the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.

- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment that focuses on Fremont County hazards of concern.
- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the County, and puts all partners on the same planning cycle for future updates.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing planning partners that participate in the CRS program to maintain or enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

1.2 WHO WILL BENEFIT FROM THIS PLAN?

All citizens and businesses of Fremont County are the ultimate beneficiaries of this hazard mitigation plan update. The plan reduces risk for those who live in, work in, and visit the County. It provides a viable planning framework for all foreseeable natural hazards that may impact the County. Participation in development of the plan by key stakeholders in the County helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.3 ELEMENTS OF THIS PLAN

This plan includes all federally required elements of a disaster mitigation plan:

- Countywide elements:
  - A description of the planning process
  - The public involvement strategy
  - A list of goals and objectives
  - A countywide hazard risk assessment
  - Countywide mitigation initiatives
  - A plan maintenance strategy.
- Jurisdiction-specific elements for each participating jurisdiction:
  - A description of the participation requirements established by the Steering Committee

The following appendices include information or explanations to support the main content of the plan:

- Appendix A—A glossary of acronyms and definitions
- Appendix B—Public outreach information, including the hazard mitigation questionnaire and summary and documentation of public meetings
- Appendix C—A menu of mitigation alternatives reviewed for this plan
- Appendix D—Worksheets for each recommended mitigation action
- Appendix E—Plan adoption resolutions from planning partners
- Appendix F—A template for progress reports to be completed as this plan is implemented.

All planning partners will adopt the plan in its entirety.

CHAPTER 2.
PLAN UPDATE—WHAT HAS CHANGED

2.1 THE PREVIOUS PLAN

A regional partnership prepared the UAA HMP in 2003. The UAA HMP was developed by the Fremont County Office of Emergency Management and Regional GIS Authority and encompassed Lake, Chaffee, Park, Fremont and Custer counties. The UAA HMP did not specifically address Fremont County hazards or mitigation projects in detail due to the regional nature of the plan, which focused on large hazard themes that extended throughout the Upper Arkansas area. Furthermore, the UAA HMP focused on hazard examples and recommendations that were in the southern end of the UAA because the writer's experience base was in that area. As a consequence, the UAA HMP did not assign offices or departments with the primary responsibilities to complete projects or recommendations and the suggested actions or concepts lacked a funding source, as well as a timeframe for completion. There were no indications or evidence of funding, assigning supervisory responsibility, or tracking of any mitigation projects while preparing to develop the current HMP for Fremont County. Given the lack of specificity in the UAA HMP and the lack of executive oversight of the plan if it was adopted by the Board of County Commisioners (BOCC), there are no records of any further work, meetings, or correspondence related to the 2003 UAA HMP. It is for the above reasons that the Fremont County Office of Emergency Management elected to develop a completely new plan specifically for Fremont County. A description of the components and findings of the UAA HMP is included in this section to provide background information.

Based on a public survey, 22 hazards were rated on a scale of 1 (least threatening) to 10 (most threatening). In addition, emergency responders ranked the 22 hazards from 1 (greatest risk) to 22 (least risk). Based on these assessments, 13 of the hazards were selected for evaluation in the plan. Table 2-1 lists the hazards, their public threat rating, and their risk ranking by emergency responders.

TABLE 2-1.
HAZARDS EVALUATED FOR 2003 UPPER ARKANSAS AREA HAZARD MITIGATION PLAN

Hazard	Public Threat Rating (1 = least threat; 10 = most threat)	Emergency Responder Rank (1 = greatest risk; 22 = least risk)
Wildland fire	8.6	1
Flash flood	6.3	2
Drought	7.9	4
Winter storm	6.0	5
Seasonal flooding	6.8	7
High winds	6.7	8
Avalanche	2.8	14
Landslide	3.3	16
Lightning and thunder	6.4	17
Earthquake	2.2	18
Tornado	3.3	19
Volcanic eruption	1.3	21
Asteroid or comet impact	1.6	22

The plan identified goals, objectives, and mitigation actions for four hazards: wildland fire, drought, flash flooding, and winter storm. Five objectives were then identified as the plan's highest priorities. The 2003 top-priority objectives and their associated actions are as follows:

- Wildland fire Goal 2, Objective 1—Improve the defensibility of residential and commercial properties against wildland fire:
  - Action #1—Institute voluntary programs for homeowners and businesses in the wildland-urban interface area.
  - Action #2—Add provisions to existing zoning and building codes and regulations for roofing and siding, defensible areas, evacuation routes, access for fire-suppression, etc.
  - Action #3—Support statewide initiatives to restore all land divisions to the definition for a subdivision, thereby making 35-acre and larger parcels subject to local subdivision regulations.
- Wildland fire Goal 1, Objective 2—Reduce the fuel load at strategic locations in the wildland-urban interface area:
  - Action #1—Develop parcel-specific model for wildland fire risk analysis.
  - Action #2—Work with federal agencies to identify high-risk properties at the wildland-urban interface area.
  - Action #3—Develop partnerships to fund and execute the fuel-mitigation projects.
- Drought Goal 2, Objective 1—Reduce the vulnerability of municipal water supplies:
  - Action #1—Acquire more senior water rights.
  - Action #2—Construct more water storage facilities.
  - Action #3—Establish "Water Banks" or similar mechanism to protect both the agricultural and municipal centers in the region.
- Flash flooding Goal 1, Objective 1—Establish a stormwater management program:
  - Action #1—Establish service area limits for the Stormwater Management District by mapping drainage basin boundaries.
  - Action #2—Analyze impervious areas to establish fee basis.
  - Action #3—Pass a resolution to form a Stormwater Management District.
  - Action #4—Develop an organization to administer the Stormwater Management District.
  - Action #5—Identify areas that are subject to damage from stormwater runoff.
  - Action #6—Propose stormwater control projects to reduce the severity of flash flooding within the District boundaries.
  - Action #7—Find partners to finance stormwater control projects.
  - Action #8—Execute stormwater control projects.
- Flash flooding Goal 2, Objective 1—Improve administration of the FEMA flood-hazard area
  - Action #1—Incorporate FIRM maps into local GIS systems
  - Action #2—Partner with FEMA to update and improve the accuracy of Flood Hazard Area boundaries.

2.2 WHY UPDATE?

Title 44 of the Code of Federal Regulations (44 CFR) stipulates that hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. As mentioned previously, Fremont County participated in a mitigation planning process in 2003. However, this plan was never officially approved by FEMA. Regardless, if the plan had been adopted, it would now have expired. Typically, this provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and evaluate whether there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

2.3 THE PLAN—WHAT IS DIFFERENT?

The 2003 UAA HMP was the first effort in the region to develop a natural hazard risk assessment and mitigation actions based on a vulnerability analysis. Mitigation actions presented in the UAA HMP were not specific to Fremont County and did not include measurable projects to report on or carry forward in the development of this 2014 Fremont County Hazard Mitigation Plan. The actions presented in the 2003 UAA HMP appear to be general mitigation objectives and not actions, many of which are similar to the hazard-specific goals and objectives in this plan. In addition, there appears to be confusion in the plan about terminology for goals and actions.

Quasi-mitigation goals/objectives were included in the 2003 UAA HMP for wildland fire, flash flood, drought and winter storm. The actions presented do not include details (lead agency, funding sources, timeline, etc.) that would allow for the successful execution and implementation of the specified projects. The plan states there were no cost effective mitigation measures identified for seasonal flooding, high winds, avalanche, landslide, earthquake, lightning, thunder, and tornado. The top 5 mitigation goals included:

1. Wildland fire - improve the defensibility of residential and commercial properties against wildland fire.
2. Wildland fire - reduce the fuel load at strategic locations in the WUI.
3. Drought - reduce the vulnerability of municipal water supplies.
4. Flash-flooding - establish a stormwater management program.
5. Flash-flooding - improve administration of FEMA flood-hazard areas.

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers states and FEMA mitigation planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA mitigation planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*. The following tables and checklists (Sections 1, 2, and 3) are from the *Local Mitigation Plan Review Tool*:

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

<table>
<tr><td>Jurisdiction:
Fremont County, CO</td><td colspan="2">Title of Plan:
Fremont County Hazard Mitigation Plan Update</td><td>Date of Plan:
December 2014</td></tr>
<tr><td colspan="2">Local Point of Contact:
Steve Morrisey</td><td colspan="2" rowspan="3">Address:
615 Macon Avenue
Cañon City, CO 81212</td></tr>
<tr><td colspan="2">Title: Director</td></tr>
<tr><td colspan="2">Agency:
Fremont County Office of Emergency Management</td></tr>
<tr><td colspan="2">Phone Number:
(719) 276-7422</td><td colspan="2">E-Mail:
steve.morrisey@fremontco.com</td></tr>
</table>

State Reviewer:	Title:	Date:
Patricia L. Gavelda	Local Hazard Mitigation Planning Program Manager	December, 2014

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region VIII		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET

MULTI-JURISDICTION SUMMARY SHEET									
#	Jurisdiction Name	Jurisdiction Type	Jurisdiction Contact	Email	Requirements Met (Y/N)				
					A. Planning Process	B. HIRA	C. Mitigation Strategy	D. Update Rqtms.	E. Adoption Resolution
1	Fremont County	County	Steve Morrisey	steve.morrisey@fremontco.com					
2	Town of Brookside	Incorporated Town	Renee Bolkema	townhallbrookside@bresnan.net					
3	City of Cañon City	Incorporated City	Adam Lancaster	atlancaster@canoncity.org					
4	City of Florence	Incorporated City	Don Moore	dmoore@florencecolorado.org					

SECTION 2:
REGULATION CHECKLIST

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	**Part 1 in its entirety.**		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	**Chapter 3, section 3.2-3.7**		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	**Chapter3, section 3.7**		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	**Chapter3, section 3.7, Chapter 6**		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	**Chapter 19**		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	**Chapter 19, Section 19.2**		
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	**Part 2, Chapters 7 – 17 Section 2 - for hazard profile and location discussion**		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	**Part 2, Chapters 7 – 17 Section 2.1 and 2.3 - for hazard past events and frequency discussion**		

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan**	**Met**	**Not Met**
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	**Part 2, sections -2.1 and 5.1 of Chapters 7 to 17**		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	**Part 2, Chapter 6, multiple sections**		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	**Part 2, Chapter 6 & 7**		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	**Part 2, Chapter 6 & 7, multiple sections**		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	**Part 1 Chapter 4**		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	**Part 3, Chapter 18. Sections 18.1 – 18.3**		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	**Part 2, Chapter 18, sections .1-.4**		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	**Part 3, Chapter 20, section 20.6.6**		
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	**Part 2 , Sections 8.6, 9.7, 10.7, 11.7, 12.7, 13.7, 14.7, 15.7, 16.7 and 17.6.**		

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan	Met	Not Met
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	**NA – New Plan**		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	**NA – New Plan**		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	**Pre-adoption review. Documentation to be provided upon issuance of pre-adoption approval by CDEM and FEMA region VIII**		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	**Pre-adoption review. Documentation to be provided upon issuance of pre-adoption approval by CDEM and FEMA region VIII**		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Element B: Hazard Identification and Risk Assessment

Element C: Mitigation Strategy

Element D: Plan Review, Evaluation, and Implementation (Plan Updates Only)

B. Resources for Implementing Your Approved Plan

CHAPTER 3.
PLAN METHODOLOGY

3.1 GRANT FUNDING

This planning effort was supplemented by a grant from the Colorado Division of Homeland Security and Emergency Management and the Colorado Water Conservation Board. The County Office of Emergency Management was the applicant agent for the grant. The grant was applied for in 2012 and funding was appropriated in 2013. It covered 75 percent of the cost for development of this plan; the County, City of Florence, and City of Cañon City covered the balance. Fremont County hired Tetra Tech, Inc. to assist with development and implementation of the plan. The Tetra Tech project manager assumed the role of the lead planner, reporting directly to a County-designated project manager, Emergency Manager Steve Morrisey.

3.2 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

Fremont County opened this planning effort to all eligible local governments in the County. The planning partners covered under this plan are shown in Table 3-1.

TABLE 3-1.
COUNTY AND CITY PLANNING PARTNERS

Jurisdiction	Point of Contact	Title
Fremont County	Steve Morrisey	Emergency Manager
Town of Brookside	Renee Bolkema	Town Clerk
City of Cañon City	Adam Lancaster	City Engineer
Town of Coal Creek	Invited but did not participate	NA
City of Florence	Don Moore	City Planner
Town of Rockvale	Invited but did not participate	NA
Town of Williamsburg	Invited but did not participate	NA

Each jurisdiction wishing to join the planning partnership was asked to commit to the process and have a clear understanding of expectations. These include:

- Each partner will support and participate in the meetings of the Steering Committee overseeing the development of the update. Support includes allowing this body to make decisions regarding plan development and scope on behalf of the partnership.
- Each partner will provide support as needed for the public involvement strategy developed by the Steering Committee in the form of mailing lists, possible meeting space, and media outreach such as newsletters, newspapers or direct-mailed brochures.
- Each partner will participate in plan update development activities such as:
  - Steering Committee meetings
  - Public meetings or open houses
  - Workshops and planning partner training sessions
  - Public review and comment periods prior to adoption.

Attendance will be tracked at such activities, and attendance records will be used to track and document participation for each planning partner. All participating communities are expected to attend and actively participate in all meetings.

- Each partner will be expected to review the risk assessment and identify hazards and vulnerabilities specific to its jurisdiction. Contract resources will provide jurisdiction-specific mapping and technical consultation to aid in this task, but the determination of risk and vulnerability ranking will be up to each partner.
- Each partner will be expected to review the mitigation recommendations chosen for the overall county and evaluate whether they will meet the needs of its jurisdiction. Projects within each jurisdiction consistent with the overall plan recommendations will need to be identified, prioritized, and reviewed to identify their benefits and costs.
- Each partner will be required to sponsor at least one public meeting to present the draft plan at least 2 weeks prior to adoption.
- Each partner will be required to formally adopt the plan.
- Each partner agrees to the plan implementation and maintenance protocol.

Failure to meet these criteria may result in a partner being dropped from the partnership by the Steering Committee, and thus losing eligibility under the scope of this plan.

3.3 DEFINING THE PLANNING AREA

The planning area was defined to consist of all of Fremont County. All partners to this plan have jurisdictional authority within this planning area.

3.4 THE STEERING COMMITTEE

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. A Steering Committee was formed to oversee all phases of the plan. The members of this committee included key planning partner staff, citizens, and other stakeholders from within the planning area. Table 3-2 lists the committee members.

The Steering Committee agreed to meet a minimum of three times or as needed throughout the course of the plan's development. The consultant and Fremont County Emergency Manager facilitated each Steering Committee meeting, which addressed a set of objectives based on the work plan established for the plan. The Steering Committee met three times from March 2014 through July 2014. Meeting agendas, notes and attendance logs can be found in Appendix B of this document. All Steering Committee meetings were open to the public and posted to the County website.

TABLE 3-2.
STEERING COMMITTEE MEMBERS

Name	Jurisdiction/Agency	Name	Jurisdiction/Agency
Tony Adamic	Fremont County DOT	Debbie Mitchell	Fremont Conservation District
Debbie Bell	Fremont County BOCC	Don Moore	Florence
Todd Bell	Deer Mountain Fire	Steve Morrisey	Fremont County Office of Emergency Management
Renee Bolkema	Brookside	Jim Otis	Cotopaxi
Bob Bush	Fremont County GIS	Tim Payne	Fremont County

TABLE 3-2.
STEERING COMMITTEE MEMBERS

Name	Jurisdiction/Agency	Name	Jurisdiction/Agency
Shannon Byerly	Cañon City Police Department	Richard Romano	NRCS Cañon City
Dale Carrol	Penrose Water District and Florence Fire Department	Brian Rupp	Fremont County Sanitation District
M. Colon	CC Hydraulic Ditch Co.	T. Sanders	Beaver Creek Water District
Allen Cooper	Cañon City Police Department	Steve Sanger	Fremont County Sheriff's Office and Cotopaxi Fire Department
Glenda DeBekker	Cañon City	Ed Skerjanec	BLM
David DelVecchio	Cañon City Fire District	Lisa Studts	Cañon City Museum
Greg Goodland	USFS	Jason Swanson	FBOP
John Grieve	CSFS	Rebecca Vettese	St. Thomas Moore Hospital
Bob Hartzman	Cañon City	John Walker	Western Fremont FPD
C. Hildebrand/ Dennis Corbin	Department of Corrections	Tom Waters	CO Parks and Wildlife
Lisa Hyams	CC/Grandview Hydraulic Ditch Co.	Sharon Whitney	Fruitland Water
Doug Koehn	Oil Creek Ditch Co.	Dennis Wied	Cañon City
Adam Lancaster	Cañon City	Hart Wright	SW Hwy 115 FPD
Gene MacKinnon	Florence FPD	Helen Blake	Fremont County Resident
Gerald Meloni	Cañon City	Trent Rondell	Allstate Insurance/Resident

The planning team made a presentation at a Steering Committee meeting which was open to the public on March 3, 2014 to introduce the mitigation planning process. The Steering Committee, planning partners and public all were encouraged to participate in the plan update process. Key meeting objectives were as follows:

- Steering Committee purposes and responsibilities
- Plan partners and signators and responsibilities
- Provide an overview of the Disaster Mitigation Act
- Describe the reasons for a plan
- Outline the County work plan
- Community participation and survey
- Develop plan mitigation goals and objectives
- Hazard analysis review
- Critical facilities discussion.

3.5 COORDINATION WITH OTHER AGENCIES

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)). This task was accomplished by the planning team as follows:

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee.
- **Agency Notification**—The following agencies were invited to participate in the plan development process from the beginning and were kept apprised of plan development milestones:
  - State of Colorado Office of Emergency Management
  - Upper Arkansas Council of Governments
  - Colorado State Forest Service
  - United States Forest Service
  - Colorado Department of Transportation
  - Bureau of Land Management
  - Natural Resource Conservation Service

  These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. These agencies supported the effort by attending meetings or providing feedback on issues.
- **Pre-Adoption Review**—All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan website (see Section 3.7). Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the State of Colorado for a pre-adoption review to ensure program compliance.

3.6 REVIEW OF EXISTING PROGRAMS

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). Chapter 6 of this plan provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation initiatives. In addition, the following programs can affect mitigation within the planning area:

- Fremont County
  - Fremont County Master Plan – 2001
  - Basic Emergency Operations Plan
  - Fremont County Subdivision Regulations – 2000
- Community Wildfire Protection Plans (CWPP) including:
  - Fremont County CWPP
  - Four Mile – Currant Creek CWPP – 2013
  - Garden Park CWPP – 2013
  - Southwest Cañon CWPP – 2014

An assessment of all planning partners' regulatory, technical and financial capabilities to implement hazard mitigation initiatives is presented in Chapter 7. Many of these relevant plans, studies and regulations are cited in the capability assessment.

3.7 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The CRS expands on these requirements by making CRS credits available for optional public involvement activities. The strategy for involving the public in this plan emphasized the following elements:

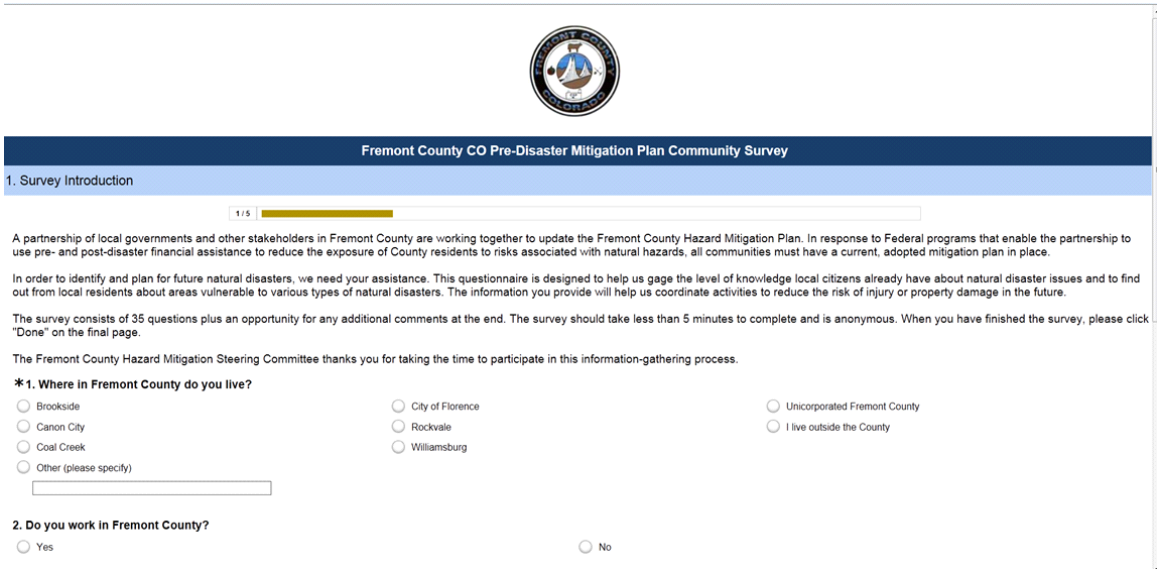
- Include members of the public on the Steering Committee.
- Use a community survey/questionnaire to evaluate whether the public's perception of risk and support of hazard mitigation has changed since the initial planning process.
- Attempt to reach as many planning area citizens as possible using multiple media.
- Identify and involve planning area stakeholders.

3.7.1 Stakeholders and the Steering Committee

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the hazard mitigation plan, including planning partners. The effort to include stakeholders in this process included stakeholder participation on the Steering Committee. Stakeholders were encouraged to attend and participate in all committee meetings.

3.7.2 Survey/Questionnaire

A hazard mitigation plan questionnaire (see Figure 3-1) was developed to gauge household preparedness for natural hazards; the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards; and the perceived impact of natural hazards on Fremont County residents and businesses. This on-line questionnaire was designed to help identify areas vulnerable to one or more natural hazards. The answers to its 36 questions helped guide the Steering Committee in prioritizing hazards of impact and in selecting goals, objectives and mitigation strategies. Just under 100 questionnaires were completed during the course of this planning process. The complete questionnaire and a summary of its findings can be found in Appendix B.



Fremont County CO Pre-Disaster Mitigation Plan Community Survey

1. Survey Introduction

1 / 5

A partnership of local governments and other stakeholders in Fremont County are working together to update the Fremont County Hazard Mitigation Plan. In response to Federal programs that enable the partnership to use pre- and post-disaster financial assistance to reduce the exposure of County residents to risks associated with natural hazards, all communities must have a current, adopted mitigation plan in place.

In order to identify and plan for future natural disasters, we need your assistance. This questionnaire is designed to help us gage the level of knowledge local citizens already have about natural disaster issues and to find out from local residents about areas vulnerable to various types of natural disasters. The information you provide will help us coordinate activities to reduce the risk of injury or property damage in the future.

The survey consists of 35 questions plus an opportunity for any additional comments at the end. The survey should take less than 5 minutes to complete and is anonymous. When you have finished the survey, please click "Done" on the final page.

The Fremont County Hazard Mitigation Steering Committee thanks you for taking the time to participate in this information-gathering process.

*1. Where in Fremont County do you live?

Brookside
Canon City
Coal Creek
City of Florence
Rockvale
Williamsburg
Unincorporated Fremont County
I live outside the County
Other (please specify)

2. Do you work in Fremont County?

Yes
No

Figure 3-1. Sample Page from Questionnaire Distributed to the Public

3.7.3 Meetings

Three Steering Committee meetings, which were all open to the public, as well as one meeting before the Board of County Commissioners were held during the planning process. Meetings were held on March 3, 2014, May 15, 2014, and July 23, 2014 in Room 207 of the Fremont County Administration Building in Cañon City (see Figure 3-2). The draft plan was then presented and reviewed before the Fremont County BOCC on XXX XX, 2014. The meeting format allowed attendees to access to handouts, maps and other resources and have direct conversations with project staff. Reasons for planning and information generated for the risk assessment were shared with attendees via a PowerPoint presentation. Planning partners and the planning team were present to answer questions. Local media outlets were informed of the meetings and the process.

Figure 3-2. Public Meeting May 15, 2014

3.7.4 Press Releases/News Articles

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each public meeting. The planning effort received press coverage as shown in Figure 3-3.

What's Happening In Fremont County - Canon City Daily Record

Print Email

What's Happening In Fremont County

POSTED 02/28/2014 07 00 32 AM MST

Fundraiser for Martha Naab set for Sunday

(/portlet/article/html/imageDisplay.jsp?contentItemRelationshipId=5764214)
Martha Naab

Dawn Schmittel has offered My Brother's Place for a day of fun and fundraising for Martha Naab, who is suffering from some serious medical issues, at noon Sunday. The day will start with music from The Geezers.

Maverick Kelly, Bill O'Brien, Sam Toman and Pete Santilli will entertain from noon to 3 p.m. The Atomic Fireballs will take over at 4 p.m. and continue with music and a jam session until 7 p.m. There will be food to purchase, including ham and beans and red chili with all the fixings. Martha Henderson has donated a quilt for raffle, there will be a 50/50 drawing and drink specials all day.

County invites participation in countywide natural hazard mitigation plan

0 Share

Fremont County is the lead agency for the development of a freestanding County-wide multi-jurisdictional plan to mitigate damage from a variety of potential natural hazards, including floods, earthquakes, wildfires, dam failures, drought and severe weather. Partnering with the County in this plan update are the cities of Canon City and Florence, in addition to other jurisdictions. Local jurisdictions are required to have an adopted Hazard Mitigation Plan to be eligible for and better position to receive financial resources in advance of, and after a disaster and to qualify for mitigation funding from the Federal Emergency Management Agency.

The Fremont County Office of Emergency Management will host a meeting to kick off the process to develop the Fremont County Hazard Mitigation Plan. Officials from Fremont County, Cañon City, Florence, State and local agencies, members of the public and other interested stakeholders are invited to participate in the planning effort. The kick off meeting is scheduled for 10 a.m. Monday in room 207 of the Fremont County Building at 615 Macon Ave.

The 2014 Fremont County Multi-Hazard Mitigation Plan will address a comprehensive list of hazards.

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Hazard mitigation planning is the process by which hazards that threaten a community are identified, their likely impacts are assessed, mitigation goals are set, and appropriate strategies/actions for reducing risk are developed, prioritized, and implemented. The county has retained the professional services of Tetra Tech, a firm that specializes in hazard mitigation and emergency management planning.

The county and consultant will organize a Hazard Mitigation Planning Committee to facilitate development of this plan update. Upon preliminary approval by the Colorado Office of Emergency Management and FEMA Region VIII, the plan will be presented to the Fremont County Board of County Commissioners and the participating town and city councils for formal adoption.

Attend to the kickoff meeting to learn more about hazard mitigation and the plan process. For more information on this project and how to become involved, call Steve Morrisey at (719) 276-7422 or email steve.morrisey@fremontco.com (mailto:steve.morrisey@fremontco.com).

Print Email

Fremont County invites participation in community-wide natural hazard mitigation plan

Steve Morrisey, Fremont County Emergency Manager

POSTED 02/26/2014 11 15 01 AM MST

Fremont County is the lead agency for the development of a freestanding County-wide multi-jurisdictional plan to mitigate damage from a variety of potential natural hazards, including floods, earthquakes, wildfires, dam failures, drought and severe weather. Partnering with the County in this plan update are the cities of Canon City and Florence, in addition to other jurisdictions. Local jurisdictions are required to have an adopted Hazard Mitigation Plan to be eligible for and better position to receive financial resources in advance of, and after a disaster and to qualify for mitigation funding from the Federal Emergency Management Agency.

The Fremont County Office of Emergency Management will be hosting a meeting to kick off the process to develop the Fremont County Hazard Mitigation Plan. Officials from Fremont County, Cañon City, Florence, State and local agencies, members of the public and other interested stakeholders are invited to participate in the planning effort. The kick off meeting is scheduled for 10 a.m. Monday in room 207 of the Fremont County Building at 615 Macon Ave.

0 Share

The 2014 Fremont County Multi-Hazard Mitigation Plan will address a comprehensive list of hazards.

A hazard mitigation steering committee has been appointed to assess the likely impacts of these hazards to the people and assets of the Fremont County planning area, establish updated goals, and prioritize projects to reduce the impacts of future disasters on people and property within Fremont County. The purpose of the kickoff meetings is to inform the planning committee, participating jurisdictions, and other interested stakeholders about the purpose and process of the plan and to establish the specific goals and objectives of the Plan itself in compliance with State and FEMA directives.

The Disaster Mitigation Act of 2000 requires local governments to have a FEMA-approved hazard mitigation plan to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs.

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Hazard mitigation planning is the process by which hazards that threaten a community are identified, their likely impacts are assessed, mitigation goals are set, and appropriate strategies/actions for reducing risk are developed, prioritized, and implemented. The County has retained the professional services of Tetra Tech, a firm that specializes in hazard mitigation and emergency management planning.

The County and consultant will organize a Hazard Mitigation Planning Committee to facilitate development of this plan update. Upon preliminary approval by the Colorado Office of Emergency Management and FEMA Region VIII, the plan will be presented to the Fremont County Board of County Commissioners and the participating town and city councils for formal adoption.

Please come to the kickoff meeting to learn more about hazard mitigation and the plan process. For more information on this project and how to become involved, contact Steve Morrisey at 719-276-7422, or e-mail at steve.morrisey@fremontco.com.

1

What's Happening In Fremont County - Canon City Daily Record

Print Email

What's Happening In Fremont County

POSTED 05/14/2014 07:52:55 PM MDT

Mitigation plan meeting set for today

The public is invited to a Pre-Disaster Mitigation Plan meeting at 10 a.m. today in Room 207 of the Fremont County Administration building at 615 Macon Ave.

For more information, call Steve Morrisey, Fremont County Office of Emergency Management, at 276-7422.

Fallen officers honored during National Police Week

This week is National Police Week, a time when communities, family members, friends and fellow officers gather to remember and honor the law enforcement officers "who made the ultimate sacrifice," states a press release issued by the Cañon City Police Department.

"Police work can be very dangerous," CCPD Chief Paul Schultz said. "Cañon City police officers are honored to serve their community and join their brothers and sisters throughout the country in remembering those killed in the line of duty."

0 Share

According to the release, "the names of 286 officers killed in the line of duty (were) added to the National Law Enforcement Officers Memorial in Washington, D.C." It states the names added are those of "100 officers who were killed during 2013" and "186 officers who died in previous years, but whose stories of sacrifice had been lost to history until now." The formal dedication took place Tuesday during the 26th Annual Candlelight Vigil in Washington, D.C.

Thursday is National Peace Officers Memorial Day, and the country will be honoring the fallen police officers with a ceremony hosted by the Fraternal Order of Police and the Fraternal Order of Police Auxiliary on the west steps of the U.S. Capitol, according to the release.

Local citizens are also able to observe National Peace Officers Memorial Day by flying their flags at half staff. The release states that Thursday "is one of only two days each year during which government agencies, businesses and residents" are encouraged to fly their U.S. flags at half staff to pay tribute to American law enforcement officers.

Daily Record Staff

Figure 3-3. Planning Process Press Coverage

3.7.5 Internet

At the beginning of the plan development process, a the County posted information regarding the update process, a link to the community survey and a link to the mitigation plan on the County website

(http://www.co.Fremont.co.us/; see Figure 3-4). The website was used to keep the public posted on plan development milestones and to solicit relevant input. Information on the plan development process, the Steering Committee, the questionnaire, and phased drafts of the plan were made available to the public on the site throughout the process. The County intends to keep a link on the website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 3-4. Sample Pages from the Fremont County Website

3.8 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 3-3 summarizes important milestones in the development of the plan.

TABLE 3-3.
PLAN DEVELOPMENT MILESTONES

Date	Event	Description	Attendance
2013			
3/01	Submit grant application	Seek funding for plan development process	N/A
10/01	Notified grant funding secured	Funding secured.	N/A
8/26	Initiate consultant procurement	Seek a planning expert to facilitate the process	N/A
12/30	Select Tetra Tech to facilitate plan development	Facilitation contractor secured	N/A
2014			
1/14	Contract signed	Notice to proceed given to Tetra Tech	N/A
2/2	Identify Steering Committee	Formation of the Steering Committee	N/A
3/3	Steering Committee/Stakeholder Meeting #1	Presentation on plan process given, participation, review of goals and objectives, etc.	County, Brookside, Cañon City & Florence
5/15	Steering Committee Meeting #2	Review Community Survey, Review of Hazard Identification and Risk Assessment, Review and Update Plan Goals and Objectives	County, Brookside, Cañon City, & Florence
7/23	Steering Committee Meeting #3	Mitigation initiatives presentation and project development	County, Brookside, Cañon City & Florence
Ongoing	Public Outreach	News articles and website posting	N/A
11/14	Draft Plan	Internal review draft provided to Steering Committee	N/A
12/09	Public Comment Period	Initial public comment period of draft plan opens. Draft plan posted on plan website with press release notifying public of plan availability	N/A
12/14	Public Outreach	Final public meeting on draft plan	N/A
X/X	Adoption	Adoption window of final plan opens	N/A
X/X	Plan Approval	Final draft plan submitted to Colorado Division of Homeland Security and Emergency Management for review and approval	N/A
X/X	Plan Approval	Final plan approved by FEMA	N/A

CHAPTER 4.
GUIDING PRINCIPLE, GOALS, AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Steering Committee established a guiding principle, a set of goals and measurable objectives for this plan, based on data from the preliminary risk assessment and the results of the public involvement strategy. The guiding principle, goals, objectives and initiatives in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Initiatives were prioritized based on the initiative meeting multiple objectives.

4.1 GUIDING PRINCIPLE

A guiding principle focuses the range of objectives and initiatives to be considered. This is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The guiding principle for the Fremont County Hazard Mitigation Plan Update is as follows:

> **Develop and maintain a disaster-resistant Fremont County and communities within that is more resilient to the physical devastation and resulting economic impacts associated with all natural hazard events.**

4.2 GOALS

The following are the mitigation goals for this plan:

- **Goal 1:** Develop support for mitigation among local jurisdictions and local officials.
- **Goal 2:** Enhance countywide understanding and awareness of community preparedness needs.
- **Goal 3:** Enhance interagency collaboration throughout the County and with adjacent neighbors.
- **Goal 4:** Improve emergency service capabilities.
- **Goal 5:** Ensure readiness through a variety of training mechanisms including opportunities involving public officials and community members regarding the identified hazards, to improve long-term planning and mitigation activities.
- **Goal 6:** Enhance the safety of residents and businesses by protecting public and private infrastructure and critical facilities from the effects of natural and human-caused hazards.
- **Goal 7:** Reduce the vulnerability of local assets to the potential impacts of natural hazards in Fremont County.
- **Goal 8:** Ensure hazard awareness and risk reduction principles are institutionalized into the Fremont County jurisdictions' daily activities, processes, and functions.

4.3 OBJECTIVES

The objectives are used to help establish priorities and support the agreed upon goals. The objectives are as follows:

- Objectives in support of Goal 1:
  - **Objective 1A**: Continually assess ongoing disaster preparedness programs and activities to implement changes that improve disaster preparedness for Fremont County.
  - **Objective 1B:** Enhance training with all agencies in the County and community to improve disaster preparedness.
  - **Objective 1C:** Communicate and collaborate mitigation and disaster preparedness programs across the County.

- Objectives in support of Goal 2:
  - **Objective 2A**: Educate the public about preparedness activities and mitigation goals, allowing each citizen the opportunity to reduce personal risk and to increase property protection.
  - **Objective 2B:** Adopt codes, standards, rules, and regulations to ensure compliance with mitigation standards, goals, and requirements.
  - **Objective 2C:** Adopt recognized mitigation programs in the County.
- Objectives in support of Goal 3:
  - **Objective 3A:** Continue to work with the Emergency Services Committee in Fremont County to address emergency and disaster-related issues and concerns.
  - **Objective 3B:** Continue to work with area partners through mutual aid agreements and long-term planning efforts.
  - **Objective 3C:** Review, update, and enhance Memorandum(s) of Understanding with the intent to ensure adequate mutual aid availability exists between agencies.
- Objectives in support of Goal 4:
  - **Objective 4A:** Enhance interagency operations by strengthening the Emergency Operations Center (EOC) capabilities across jurisdictional boundaries.
  - **Objective 4B:** Enhance EOC capabilities by developing and implementing operational policies, practices, and procedures.
- Objective in support of Goal 5:
  - **Objective 5A**: Conduct exercises and training regarding the prevention and mitigation of Fremont County hazards.
- Objectives in support of Goal 6:
  - **Objective 6A**: Reduce the frequency and/or severity of natural hazards in Fremont County.
  - **Objective 6B**: Ensure that countywide measures are taken addressing specific risks to infrastructure posed by identified hazards and the resultant critical infrastructure needs and develop a funding mechanism for the priority areas.
  - **Objective 6C:** Explore diverse public notification systems for impending hazards.
  - **Objective 6D:** Ensure that the public has more than one means of obtaining information about emergencies and disasters in the County through development of redundant notification systems.
  - **Objective 6E:** Periodically test of these systems to ensure operational capacity of systems.
- Objectives in support of Goal 7:
  - **Objective 7A:** Work to reduce the frequency, severity, and potential impacts of wildfires in Fremont County via proactive measures and education.
  - **Objective 7B:** Work to reduce the severity and potential impacts of flooding in Fremont County via proactive measures and education.
  - **Objective 7C:** Work to reduce the frequency, severity, and potential impacts of drought in Fremont County via proactive measures, water saving actions, and education.

  - **Objective 7D:** Work to reduce the potential impacts of severe winter weather in Fremont County via proactive measures, preparedness, and education.

- Objectives in support of Goal 8:
  - **Objective 8A:** Be proactive in incorporating emergency management plans into all other institutional County plans, documents, and practices.
  - **Objective 8B:** Incorporate risk reduction principles into policy documents and initiatives

PART 2—
RISK ASSESSMENT

CHAPTER 5.
IDENTIFIED HAZARDS OF CONCERN AND RISK ASSESSMENT METHODOLOGY

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Hazard identification—Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- Vulnerability identification—Determine the impact of natural hazard events on the people, property, environment, economy, and lands of the region.
- Cost evaluation—Estimate the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan update evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the DMA (44 CFR, Section 201.6(c)(2)).

5.1 IDENTIFIED HAZARDS OF CONCERN

For this plan, the Steering Committee considered the full range of natural hazards that could impact the planning area and then listed hazards that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, this plan addresses the following hazards of concern:

- Dam failure
- Drought and extreme temperature
- Earthquake
- Flood
- Landslide
- Severe winter weather
- Thunderstorms, high winds, and hail
- Tornado
- Subsidence/sinkholes/soil erosion
- Wildfire.

5.2 CLIMATE CHANGE

Climate includes patterns of temperature, precipitation, humidity, wind and seasons. Climate plays a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. "Climate change" refers to changes over a long period of time. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of natural hazards around the world. Impacts include the following:

- Snow cover losses will continue, and declining snowpack will affect snow-dependent water supplies and stream flow levels around the world.

- The risk of drought and the frequency, intensity, and duration of heat waves are expected to increase.
- More extreme precipitation is likely, increasing the risk of flooding.
- The world's average temperature is expected to increase.

Climate change will affect communities in a variety of ways. Impacts could include an increased risk for extreme events such as drought, storms, flooding, and wildfires; more heat-related stress; and the spread of existing or new vector-born disease into a community. In many cases, communities are already facing these problems to some degree. Climate change influences the frequency, intensity, extent, or magnitude of the problems.

This hazard mitigation plan update addresses climate change as a secondary impact for each identified hazard of concern. Each chapter addressing one of the hazards of concern includes a section with a qualitative discussion on the probable impacts of climate change for that hazard. While many models are being developed to assess the potential impacts of climate change, none are currently available to support hazard mitigation planning. As these models are developed in the future, this risk assessment may be enhanced to better measure these impacts.

5.3 METHODOLOGY

The risk assessments in Chapter 8 through Chapter 17 describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk of each hazard:

- Identify and profile each hazard – The following information is given for each hazard:
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
  - Warning time likely to be available for response.
- Determine exposure to each hazard – Exposure was evaluated by overlaying hazard maps, when available, with an inventory of structures, facilities, and systems to identify which of them would be exposed to each hazard. When hazard mapping was not available, a more qualitative discussion of exposure is presented.
- Assess the vulnerability of exposed facilities – Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and FEMA's hazard modeling program called HAZUS-MH were used to perform this assessment for the flood, dam failure, and earthquake hazards. Outputs similar to those from HAZUS were generated for other hazards, using maps generated by the HAZUS program.

5.4 RISK ASSESSMENT TOOLS

5.4.1 Earthquake and Flood—HAZUS-MH

Overview

In 1997, FEMA developed the standardized Hazards U.S., or HAZUS, model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. HAZUS was later expanded into a multi-hazard methodology, HAZUS-MH, with new models for estimating potential losses from hurricanes and floods.

HAZUS-MH is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation, and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

HAZUS-MH provides default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1** – All of the information needed to produce an estimate of losses is included in the software's default data. These data are derived from national databases and describe in general terms the characteristic parameters of the planning area.
- **Level 2** – More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3** – This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

Application for This Plan

The following methods were used to assess specific hazards for this plan:

- Flood – A Level 2, general building stock analysis, was performed. GIS building and assessor data (replacement cost values and detailed structure information) were loaded into HAZUS-MH. An updated inventory was used in place of the HAZUS-MH defaults for essential facilities, transportation, and utilities. Current Fremont County digital flood insurance rate maps (DFIRM) were used to delineate flood hazard areas and estimate potential losses from the 100-year flood event and a 500-year flood event. Using the DFIRM floodplain boundaries and a countywide 10-meter digital elevation model (DEM), flood depth grids were generated using the Enhanced Quicklook tool and integrated into the model.

  Note: Flood maps for Fremont County are available at the Fremont County Office of Emergency Management.

- Dam Failure – Dam failure inundation mapping for the planning area was available for Fremont County; however, the mapping was not in a format that could be used by HAZUS.

- Earthquake – A Level 2 analysis was performed to assess earthquake risk and exposure. The arbitrary event and probabilistic options in the HAZUS earthquake module were used for the analysis of this hazard. The arbitrary events were chosen based on the Colorado Geological Survey's 2005 statewide earthquake analysis using HAZUS. An updated general building stock inventory was developed using replacement cost values and detailed structure information from assessor tables. An updated inventory of essential facilities, transportation and utility features was used in place of the HAZUS-MH defaults. Two scenario events and one probabilistic event were modeled:
  - The scenario events were a Magnitude-7.5 event on the North Sangre de Cristo Fault and a Magnitude-7.0 event on the Ute Pass Fault
  - The standard HAZUS analysis for the 500-year probabilistic event was run.

5.4.2 Other Hazards of Concern

For hazards of concern that are not directly modeled in HAZUS, future losses could not be estimated. However, HAZUS-MH is able to map hazard areas and calculate exposures if geographic information is available on the locations of the hazards and inventory data. Areas and inventory susceptible to some of the hazards of concern were mapped and exposure was evaluated. For other hazards, a qualitative analysis was conducted using the best available data and professional judgment. Locally relevant information was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. The primary data source was the Fremont County GIS database, augmented with state and federal data sets. Additional data sources for specific hazards were as follows:

- **Tornado, Thunderstorms, Hail, and Wind –** Data provided by NOAA Storm Prediction Center.
- **Landslide** – Datasets of mapped landslides at various scales provided by the Colorado Geological Survey's Landslide Inventory Program
- **Wildfire** – Information on wildfire hazards areas was provided by the Colorado State Forest Service's Colorado Wildfire Risk Assessment Portal (COWRAP)
- **Drought** – National Drought Mitigation Center
- **Extreme Heat and Severe Cold** – Western Regional Climate Center
- **Severe Winter Weather and Thunderstorms** – National Climatic Data Center
- **Subsidence** – Datasets from the Colorado Geological Society regarding evaporite-bearing bedrock and known coal mining hazard areas.

5.4.3 Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. The results do not predict precise results and should be used only to understand relative risk. Over the long term, Fremont County and its planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

CHAPTER 6.
FREMONT COUNTY PROFILE

Fremont County covers approximately 1,500 square miles in south-central Colorado (see Figure 6-1). The County lies along the Arkansas River valley at the foot of the Rocky Mountains. Cañon City is the largest city in the County and is the County seat. Florence is an incorporated city 10 miles southeast of Cañon City. The other incorporated communities are the Towns of Brookside, Coal Creek, Rockvale and Williamsburg. The County is the 16th most populous of Colorado's 64 counties, with a 2012 population of 47,011.

Fremont County and its incorporated cities and towns have fire protection districts and volunteer fire agencies, two medical districts that provide medical services to the majority of the County, city police and county sheriff offices, and a search and rescue organization. These entities are responsible for the initial emergency response in the area. Fremont County is home to 13 state and federal prisons, which together employ the most people of any industry or business in the region.

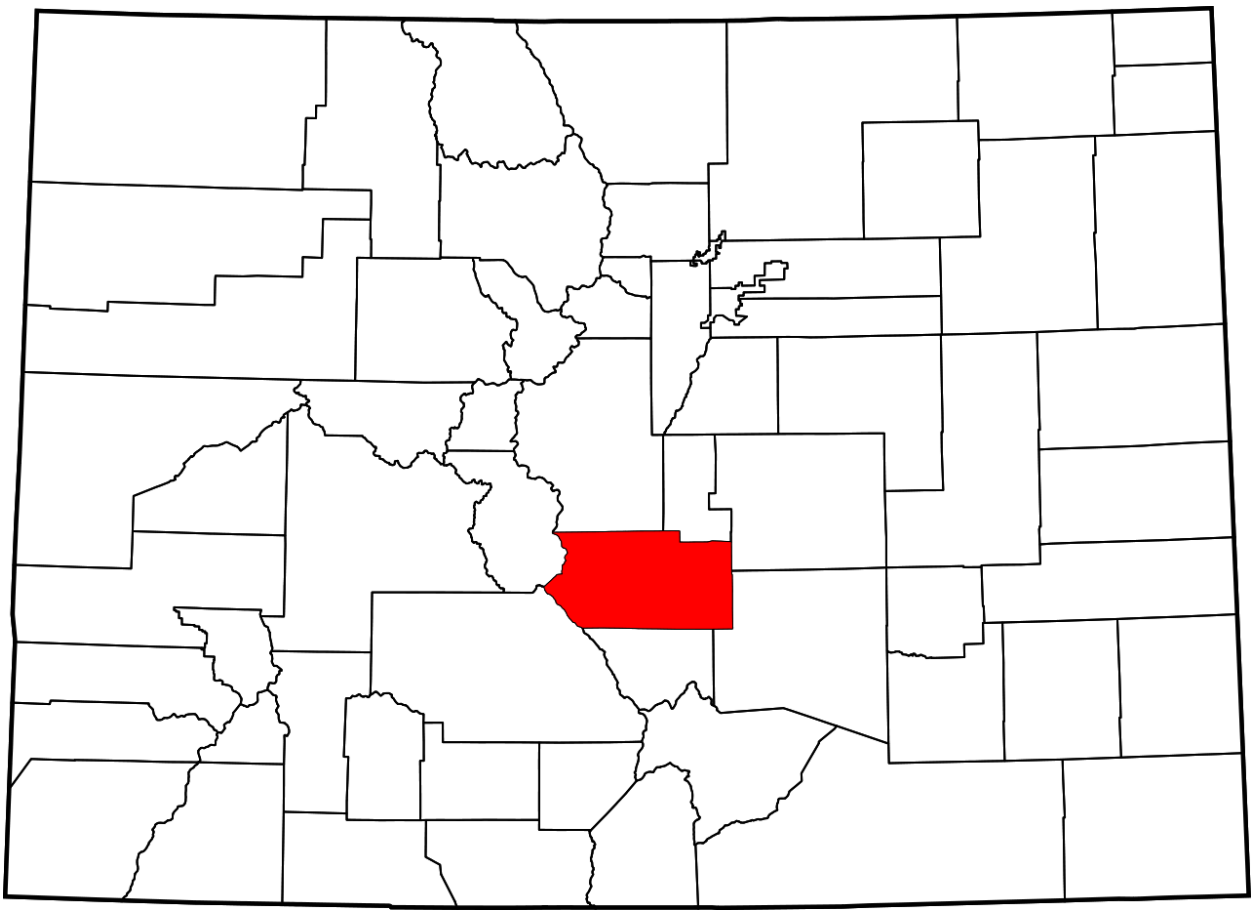


Figure 6-1. Location of the Fremont County Planning Area within the State of Colorado

Fremont County consists primarily of rural, undeveloped land dedicated to the production of livestock. Increasingly, private lands are being developed (especially when adjacent to public lands) as residential areas, usually limited to 35-acre parcels as a minimum. Many subdivisions of earlier vintage also exist where lots as small as 1 acre each lie adjacent to public lands. Table 6-1 summarizes key landowners in the County.

TABLE 6-1.
PRIMARY LANDOWNERS IN FREMONT COUNTY

Owner	Property Owned (acres)	Percentage of County
U.S. Forest Service	98,944	10.0%
U.S. Bureau of Land Management	338,212	34.4%
Other Federal Lands	6,161	0.6%
Colorado State Land	77,865	7.9%
Private/Local Government	463,489	47%
Total	**984,671**	

Source: Fremont County Community Wildfire Protection Plan

6.1 HISTORICAL OVERVIEW

Fremont County took its name from western explorer Captain John C. Fremont, who, along with his scout Kit Carson, mapped the territory in 1843. The Pikes Peak Gold Rush in 1859 brought more residents, resulting in the settlement of Cañon City, Florence, and the Hardscrabble area. In 1861, Fremont County became one of the original 17 counties created by the Colorado Territorial Legislature, with Cañon City as the County seat. Throughout its history, the County has attracted growth with its mild climate, rich soils, available water supply, abundant mineral resources, and outstanding natural beauty.

The majestic Royal Gorge Canyon has been the focal point of Fremont County history since prehistoric times. Lt. Zebulon Pike explored the canyon in the winter of 1806 by traveling up the frozen Arkansas River. The Royal Gorge Bridge, owned by the City of Cañon City, is one of the major attractions in Fremont County. This, along with other nearby natural attractions such as the Arkansas River, the National Forest, and the beauty of the surrounding land, draws numerous tourists to the area year round with a peak during the summer season.

Early in 1860, the first mining claim for coal was filed in Fremont County near what is now known as Coal Creek. Shortly after an "oil seep" was discovered, oil production began in Fremont County. Since these early finds, mining for iron, gypsum, marble, limestone, and granite have also taken place and the current mining boom for aggregates has been thriving for several years.

The first Colorado Territory prison was built in Fremont County in 1871, 5 years before Colorado became a state. Since that early time, Fremont County has been home to a large number of state and federal correctional facilities.

6.2 MAJOR PAST HAZARD EVENTS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. The planning area has experienced 14 events since 1955 for which federal disaster declarations were issued. These events are listed in Table 6-2.

Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid large-scale events in the future. Still, many natural hazard events do not trigger federal disaster declaration protocol but have significant impacts on their communities. These events are also

important to consider in establishing recurrence intervals for hazards of concern. More detailed event tables can be found in the individual hazard profile sections.

TABLE 6-2.
PAST FEDERAL DISASTER DECLARATIONS IN FREMONT COUNTY

Disaster Declaration[a]	Description	Incident Dates
DR-33[b]	Flood	5/25/1955
DR-59[b]	Flood	6/12/1956
DR-200	Tornadoes, severe storms and flooding	6/19/1965
EM-3025	Drought	1/29/1977
DR-1276	Flooding	4/29 - 5/19/1999
DR-1421	Wildfires	4/23 - 8/6/2002
FS-2410	Iron Mountain Fire	6/2 - 6/10/2002
FS-2421[b]	Hayman Fire	6/8 - 7/20/2002
EM-3185	Snow	3/17 - 3/20/2003
EM-3224	Hurricane Katrina evacuation	8/29 - 10/1/2005
FM-2923	Duckett Fire	6/15 - 6/24/2011
DR-4133	Royal Gorge Fire	6/11 - 6/16/2013
EM-3365	Severe storms, flooding, landslides, and mudslides	9/11 - 9/30/2013
DR-4145	Severe storms, flooding, landslides, and mudslides	9/11 - 9/30/2013

a. Federal disaster declarations are coded as follows: DR = Major Disaster Declaration; EM = Emergency Declaration; FM = Fire Management Assistance; FS = Fire Suppression Authorization
b. Declaration was statewide for Colorado, did not apply specifically to Fremont County

Source: FEMA Disaster Declarations Summary - Open Government Dataset (http://www.fema.gov/media-library/assets/documents/28318?id=6292)

6.3 CLIMATE

Due to its diverse topography, the climate of Fremont County is highly varied and conditions can change quickly. There is also a great variation of weather conditions across the seasons. Average temperature tends to decrease with increases in elevation, roughly 4 degrees Fahrenheit per 1,000 feet, with subzero temperatures common in winter. The majority of snowfall occurs during March and April. Due to the generally high elevation of western areas of the County, summers are relatively cool in the western part of the County and warm in the eastern part. While precipitation is normally highest in the months of July and August, in certain years the summer months can be very dry. Early fall tends to be temperate and dry. Total annual precipitation is 16 inches coming mostly in spring and summer. Based on information from the National Oceanic and Atmospheric Administration (NOAA), Fremont County receives an average of 10,700 cloud-to-ground lightning strikes per year.

The Western Regional Climate Center reports data from the Cañon City weather station in Fremont County. Table 6-3 contains temperature summaries for the station. Figure 6-2 graphs the daily temperature averages and extremes.

TABLE 6-3.
FREMONT COUNTY TEMPERATURE SUMMARIES CAÑON CITY STATION

Period of record	3/1/1893 – 3/31/2013
Winter[a] Average Minimum Temperature	22.5°F
Winter[a] Mean Temperature	36.6ºF
Summer[a] Average Maximum Temperature	86.8°F
Summer[a] Mean Temperature	72.2ºF
Maximum Temperature	107°F; July 11, 1954
Minimum Temperature	-30°F; February 12, 1905
Average Annual # Days >90°F	41.5
Average Annual # Days <32°F	129.8

a. Winter: December, January, February; Summer: June, July, August
Source: Western Regional Climate Center, www.wrcc.dri.edu/

Source: Western Regional Climate Center, www.wrcc.dri.edu/

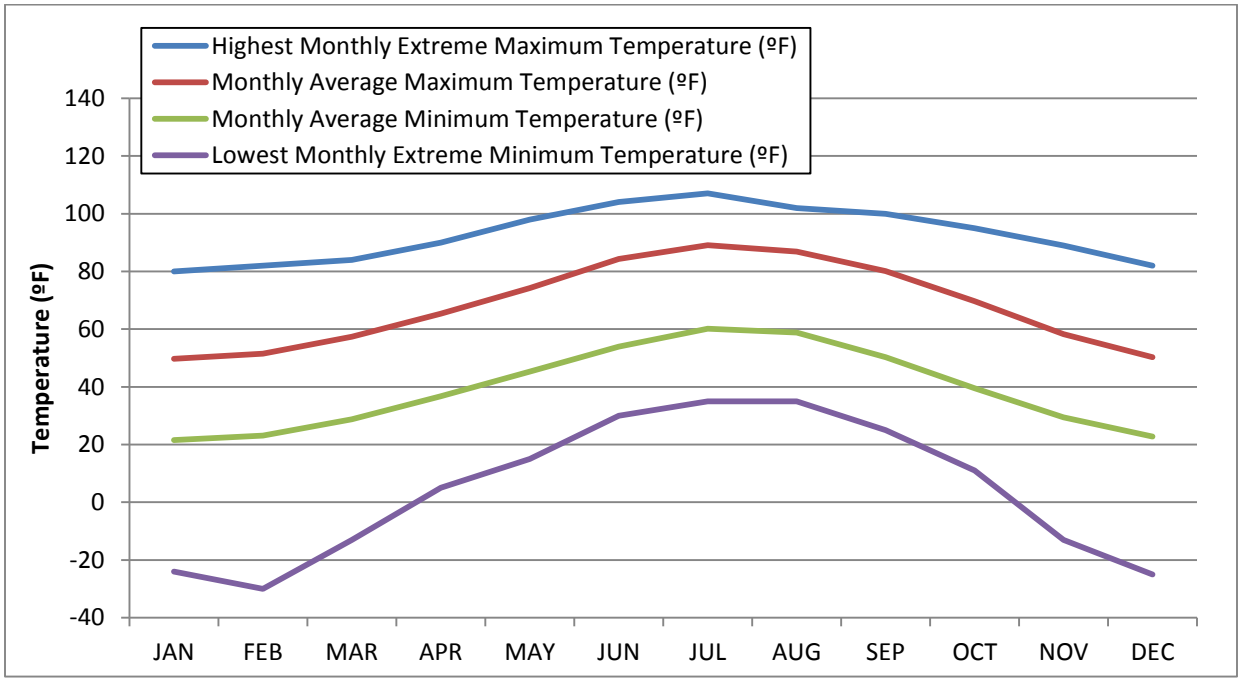


Figure 6-2. Cañon City Station Monthly Temperature Data (3/1/1983 – 3/31/2013)

Figures 6-3 and 6-4 show the geographic distribution of average minimum and maximum temperatures in Fremont County. Figure 6-5 shows geographic distribution of annual average precipitation.

Figure 6-3. Annual Average Minimum Temperature (1981-2010)

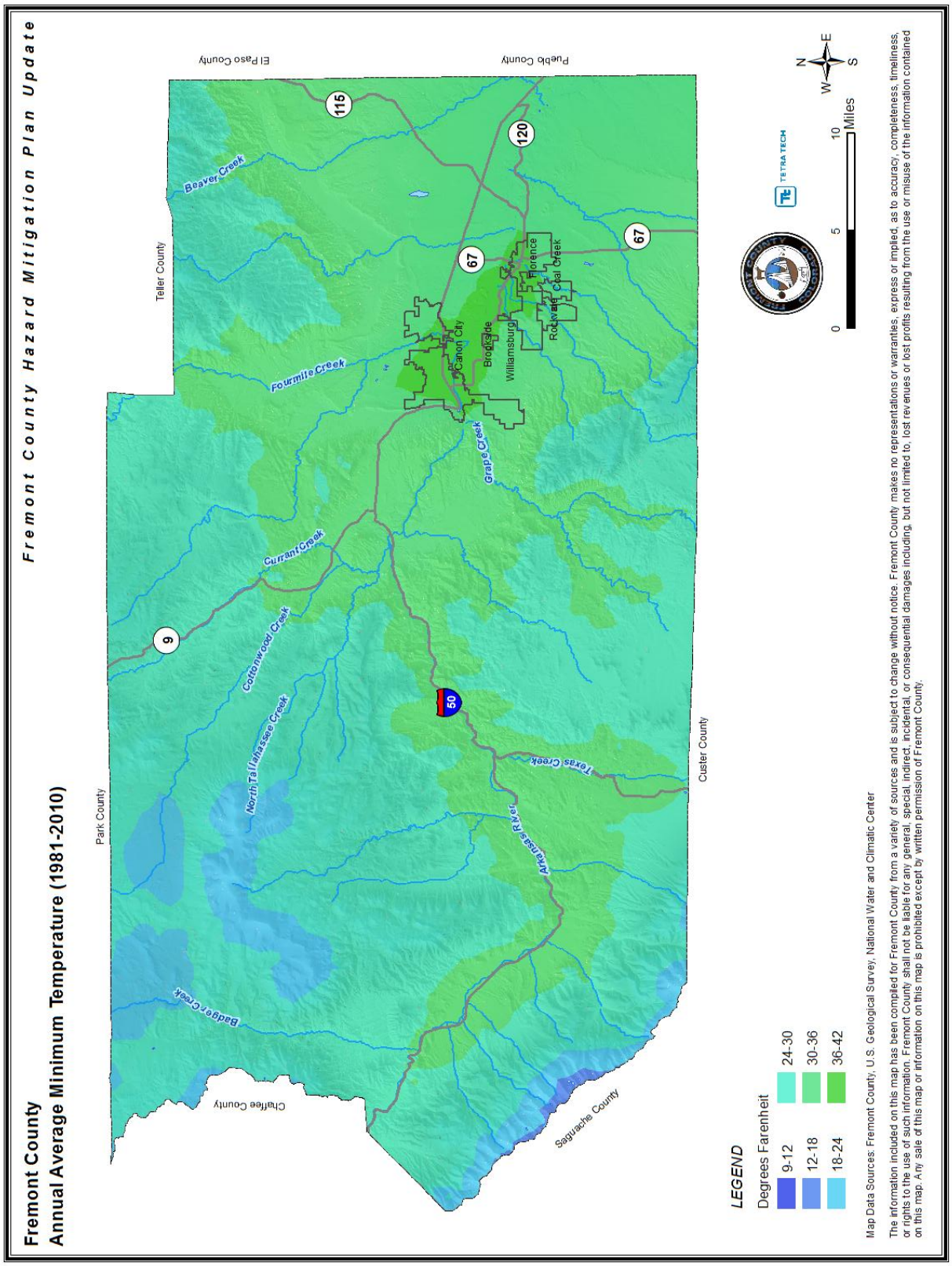


Figure 6-4. Annual Average Maximum Temperature (1981-2010)

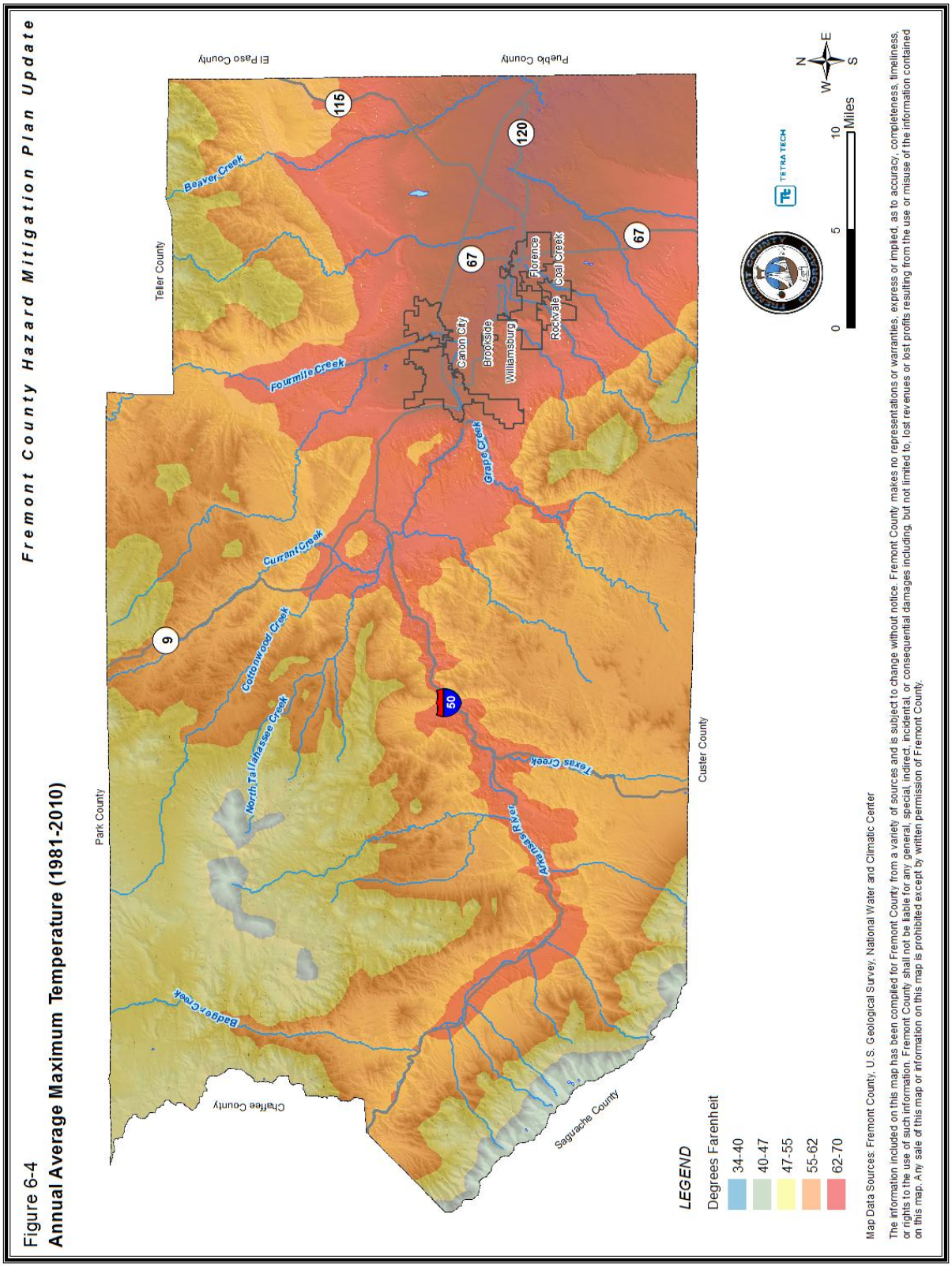
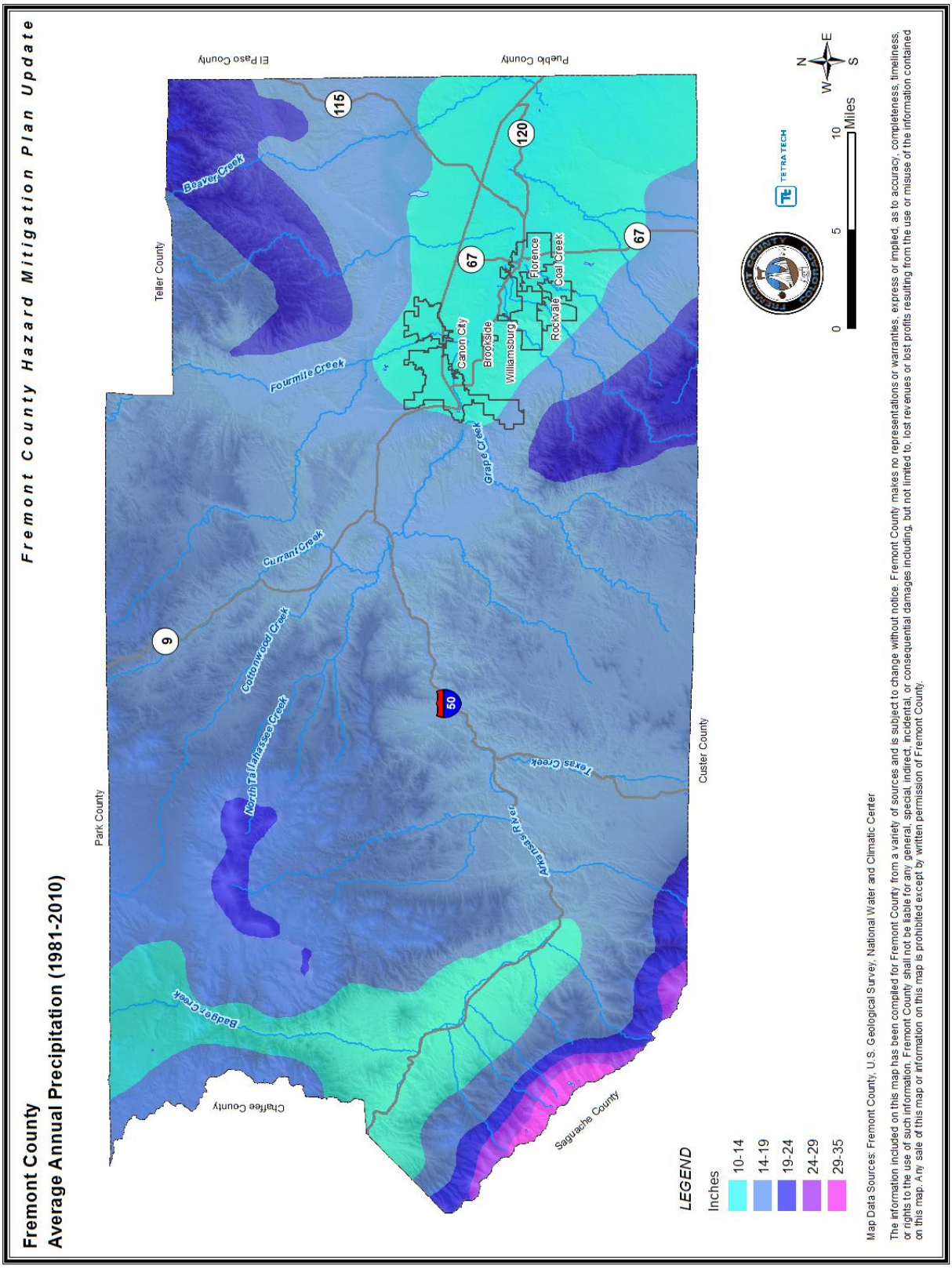


Figure 6-5. Annual Average Precipitation (1981-2010)



6.4 GEOLOGY AND SOILS

The geology of Fremont County varies from the plains in the eastern portion of the County to the Sangre De Cristo Mountain range that forms the western boundary of Fremont County. According to the Colorado Geological Survey, the plains are characterized predominantly by sedimentary rocks and the mountainous regions of Fremont County are comprised of a structurally complex assortment of igneous, metamorphic, and sedimentary rocks, with the igneous and metamorphic rocks predominating at higher elevations. Fremont County is within the Arkansas River Basin and the County is bisected from west to east by the upper Arkansas River. At the Royal Gorge, located outside of Cañon City, the Arkansas River has carved a canyon approximately 1,000 feet deep.

6.5 CRITICAL FACILITIES AND INFRASTRUCTURE

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These become especially important after a hazard event. As defined for this hazard mitigation plan update, critical facilities include but are not limited to the following (as defined by the Colorado Water Conservation Board):

- Essential services facilities:
  - Public safety (police stations, fire and rescue stations, emergency vehicle and equipment storage, and, emergency operation centers)
  - Emergency medical (hospitals, ambulance service centers, urgent care centers having emergency treatment functions, and non-ambulatory surgical structures but excluding clinics, doctors' offices, and non-urgent care medical structures that do not provide these functions)
  - Designated emergency shelters
  - Communications (main hubs for telephone, broadcasting equipment for cable systems, satellite dish systems, cellular systems, television, radio, and other emergency warning systems, but excluding towers, poles, lines, cables, and conduits)
  - Public utility plant facilities for generation and distribution (hubs, treatment plants, substations and pumping stations for water, power and gas, but not including towers, poles, power lines, buried pipelines, transmission lines, distribution lines, and service lines)
  - Air transportation lifelines (airports [municipal and larger], helicopter pads and structures serving emergency functions, and associated infrastructure [aviation control towers, air traffic control centers, and emergency equipment aircraft hangars]).
- Hazardous materials facilities:
  - Chemical and pharmaceutical plants
  - Laboratories containing highly volatile, flammable, explosive, toxic, or water-reactive materials
  - Refineries
  - Hazardous waste storage and disposal sites
  - Aboveground gasoline or propane storage or sales centers.
- At-risk population facilities:
  - Elder care (nursing homes)
  - Congregate care serving 12 or more individuals (day care and assisted living)
  - Public and private schools (pre-schools, K-12 schools, before-school and after-school care serving 12 or more children)

- Facilities vital to restoring normal services:
  - Essential government operations (public records, courts, jails, building permitting and inspection services, community administration and management, maintenance and equipment centers)
  - Essential structures for public colleges and universities (dormitories, offices, and classrooms only).

Table 6-4 summarizes the general types of critical facilities and infrastructure in each municipality and unincorporated County areas. Table 6-5 summarizes the critical infrastructure within the 100-year floodplain. Figure 6-6 through Figure 6-12 show the location of critical facilities and Figure 6-13 through Figure 6-19 show the location of critical infrastructure in the County. Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with each planning partner. Critical facilities and infrastructure were analyzed in HAZUS to help rank risk and identify mitigation initiatives. The risk assessment for each hazard discusses critical facilities with regard to that hazard.

TABLE 6-4.
CRITICAL FACILITIES IN THE PLANNING AREA

Facility Type	Trauma Care	Government Functions	Protective Functions	Schools	Hazardous Materials	**Total**
Brookside	0	1	0	1	0	**2**
Cañon City	1	4	4	7	8	**24**
Coal Creek	0	1	0	0	0	**1**
Florence	0	1	2	4	2	**9**
Rockvale	0	1	0	0	0	**1**
Williamsburg	0	1	0	0	0	**1**
Unincorporated	0	2	9	8	9	**28**
Total	**1**	**11**	**15**	**20**	**19**	**66**

TABLE 6-5.
CRITICAL INFRASTRUCTURE IN THE 100-YEAR FLOODPLAIN

Facility Type	Bridges	Water Storage	Waste Water	Power	Communications	Transportation	Dams	**Total**
Brookside	0	1	0	0	0	0	0	**1**
Cañon City	10	2	1	2	0	0	2	**17**
Coal Creek	1	0	0	0	0	0	0	**1**
Florence	6	0	1	0	1	0	0	**8**
Rockvale	2	0	0	0	0	0	0	**2**
Williamsburg	2	0	0	0	0	0	0	**2**
Unincorporated	112	5	1	1	6	3	13	**141**
Total	**133**	**8**	**3**	**3**	**7**	**3**	**15**	**172**

Figure 6-6. Critical Facilities in Fremont County

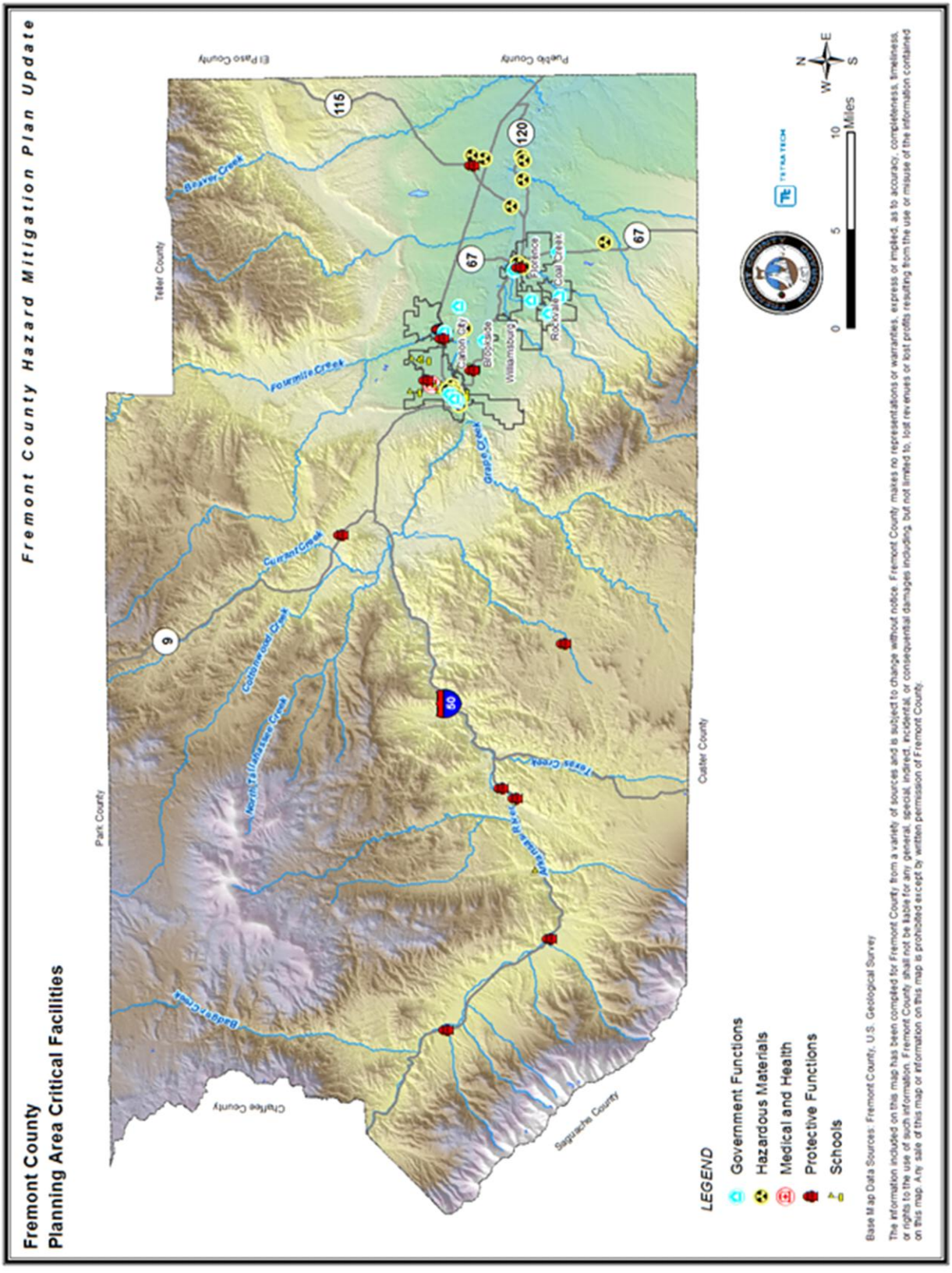


Figure 6-7. Critical Facilities in the Town of Brookside

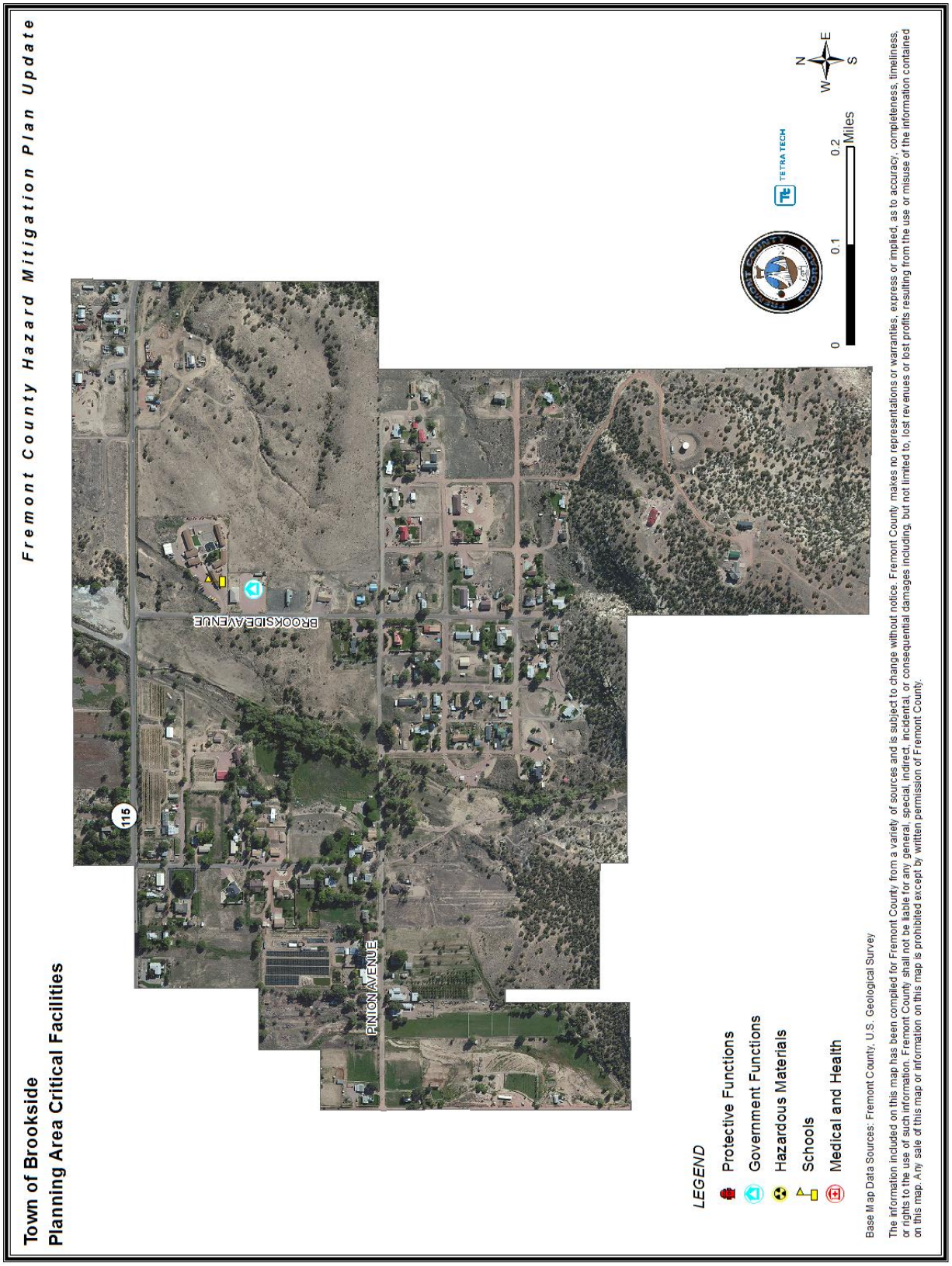


Figure 6-8. Critical Facilities in the City of Cañon City

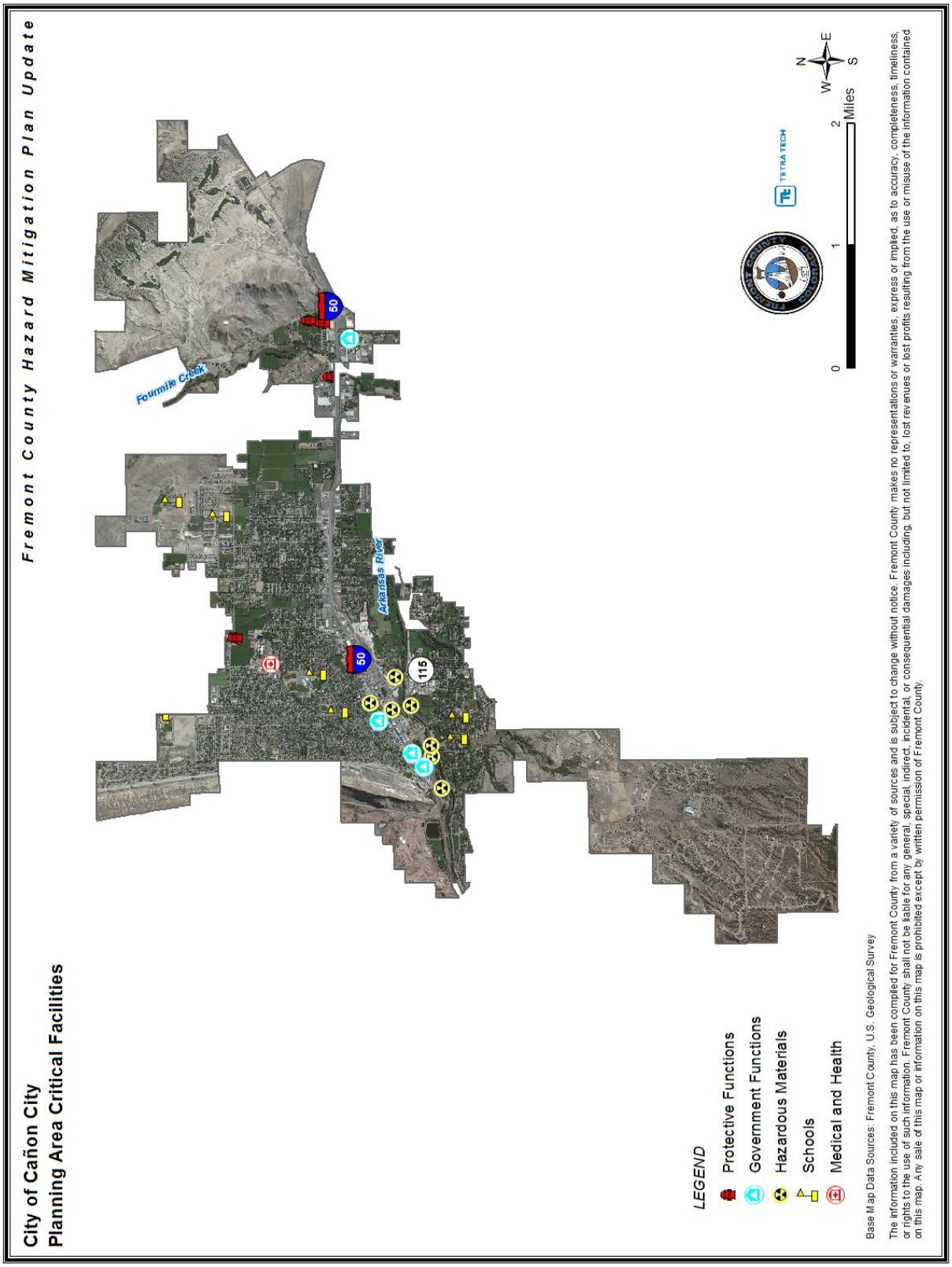


Figure 6-9. Critical Facilities in the Town of Coal Creek

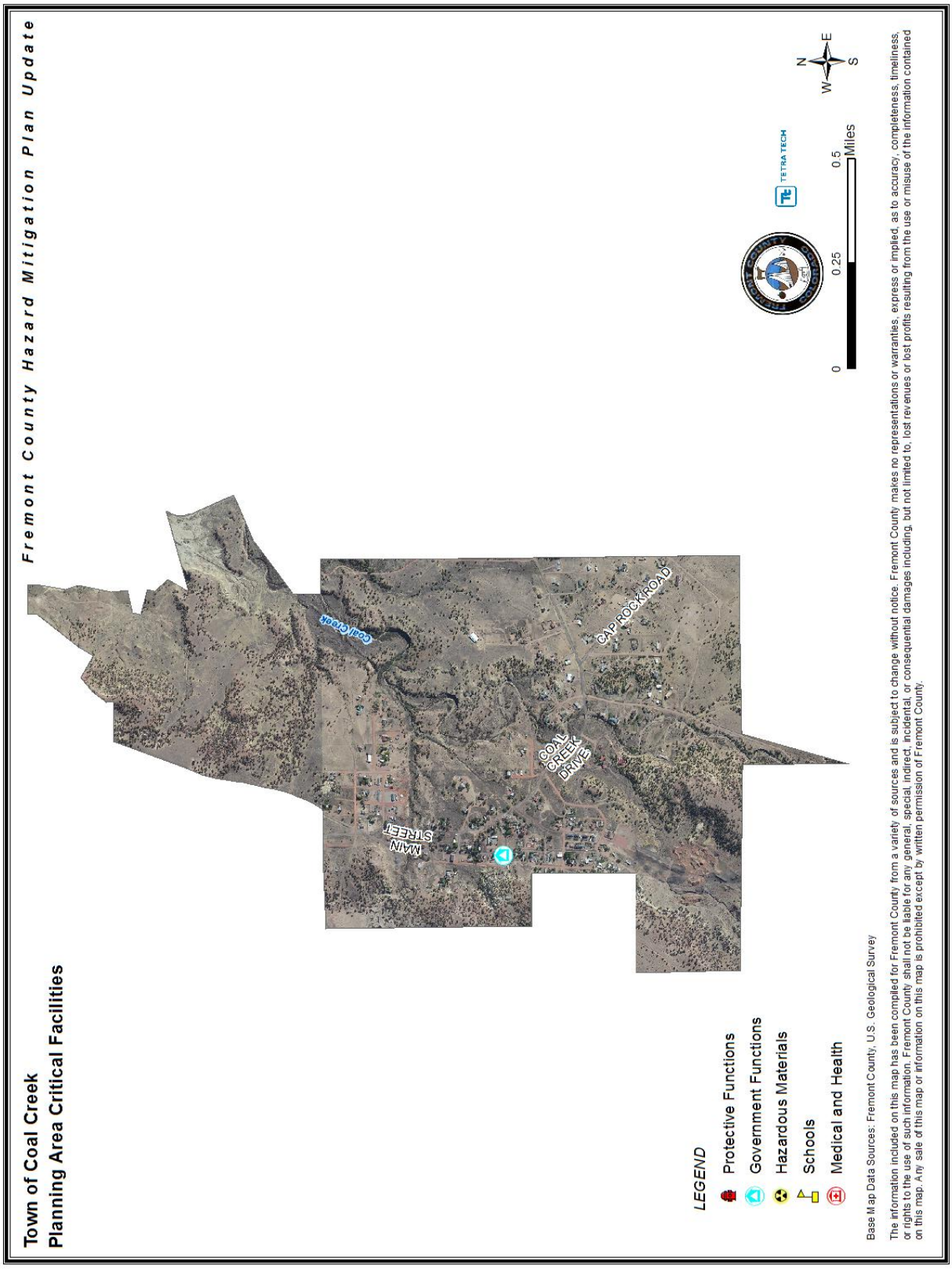


Figure 6-10. Critical Facilities in the City of Florence

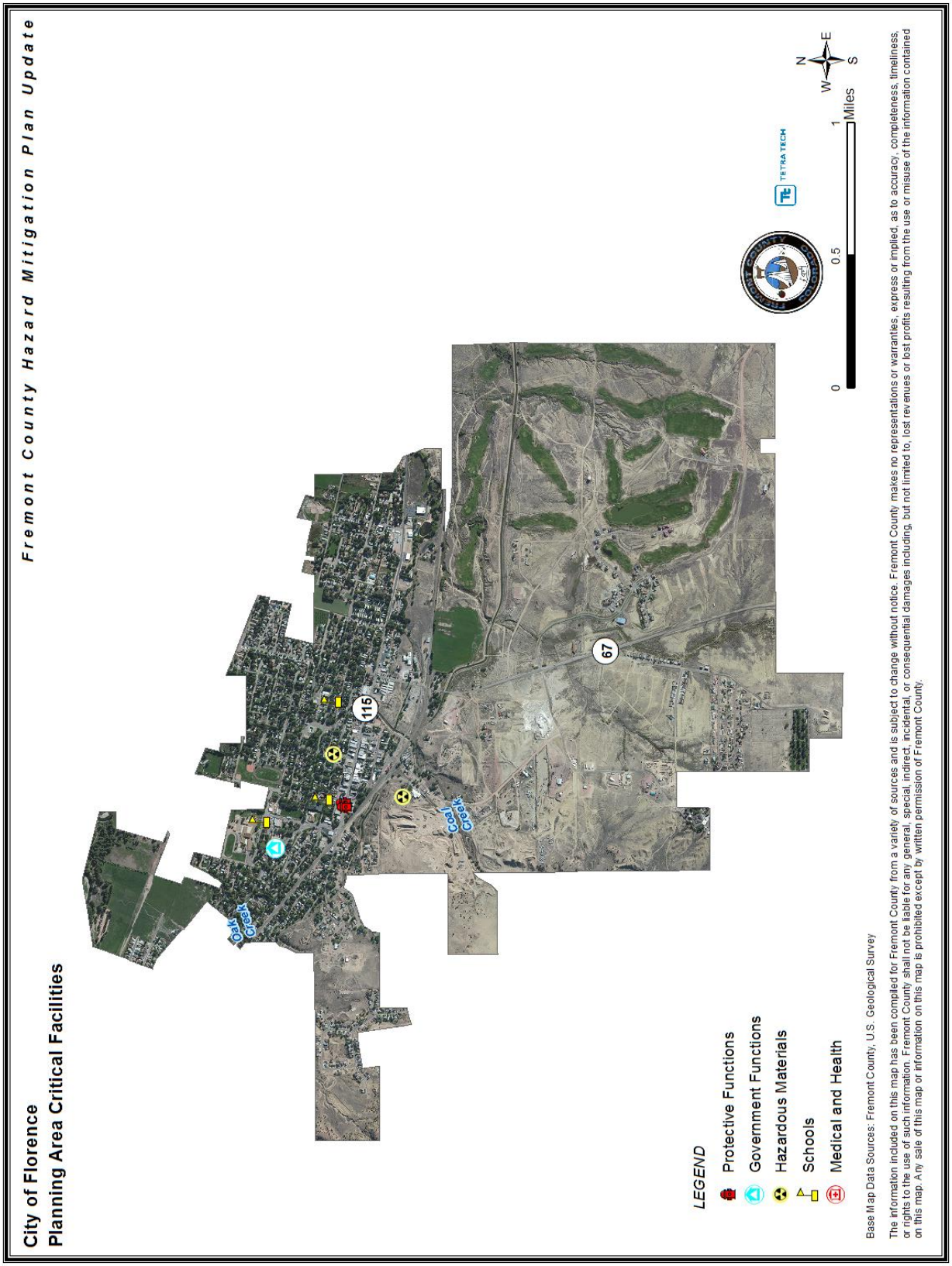


Figure 6-11. Critical Facilities in the Town of Rockvale

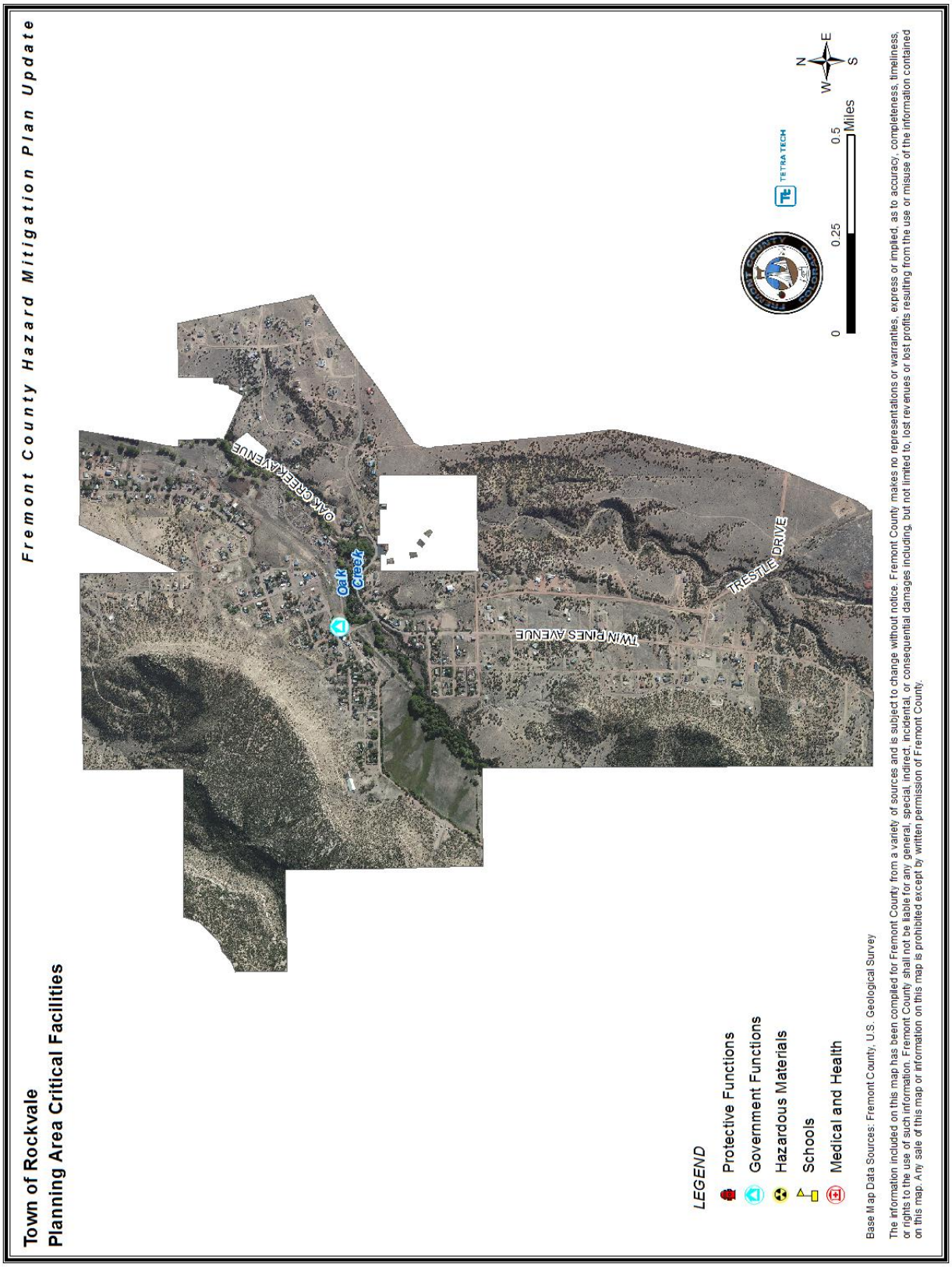


Figure 6-12. Critical Facilities in the Town of Williamsburg

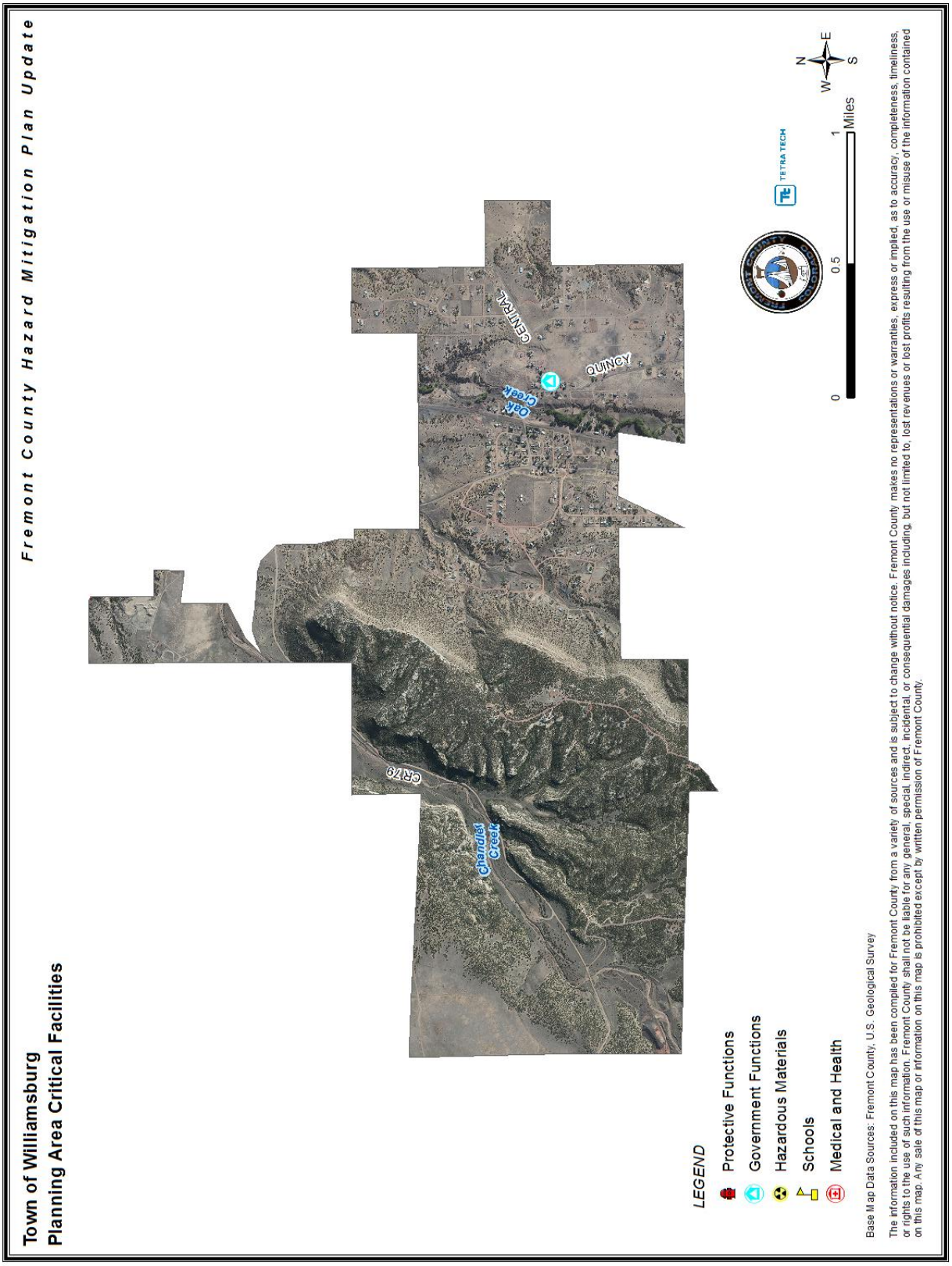


Figure 6-13. Critical Infrastructure in Fremont County

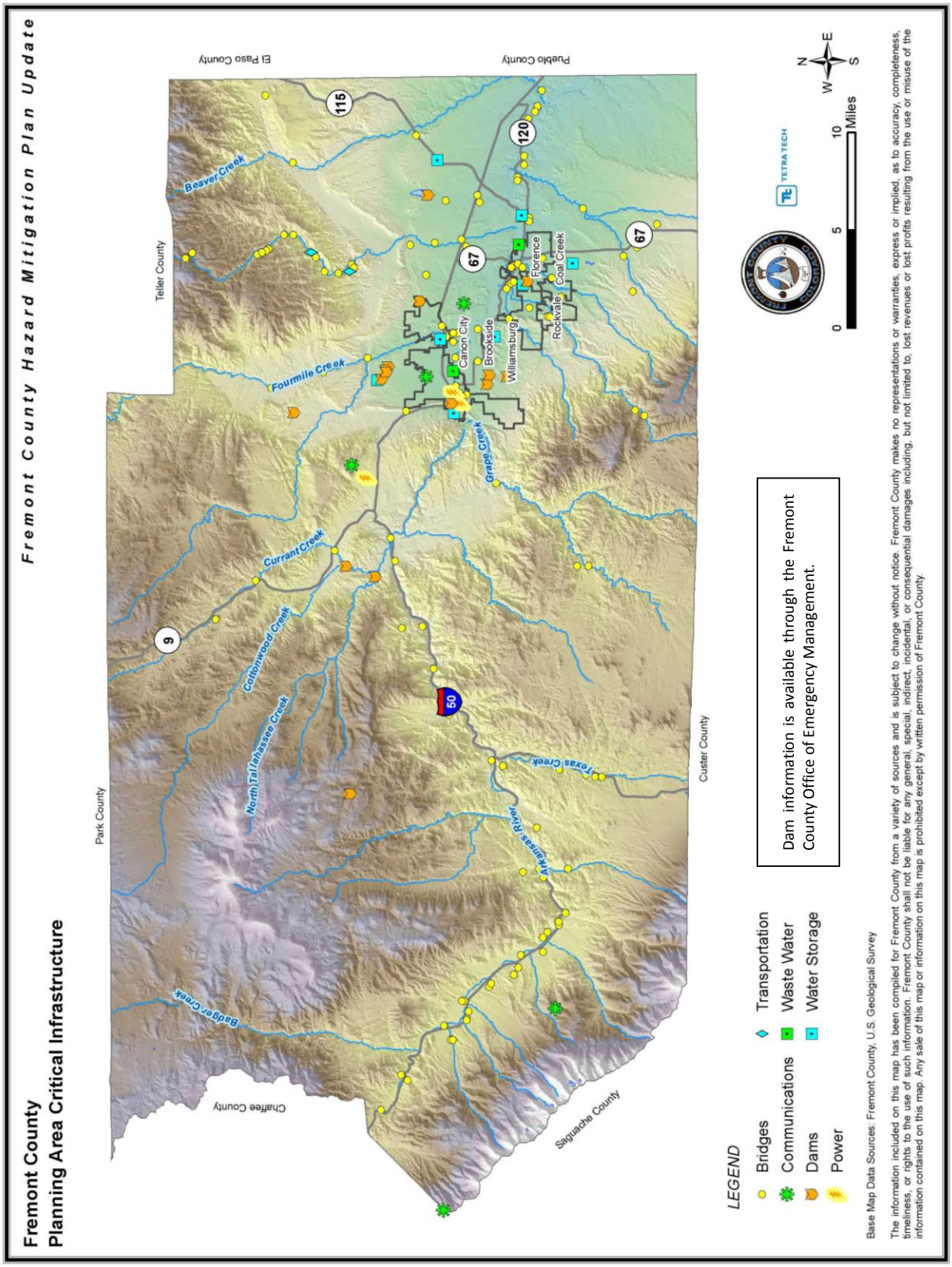


Figure 6-14. Critical Infrastructure in the Town of Brookside

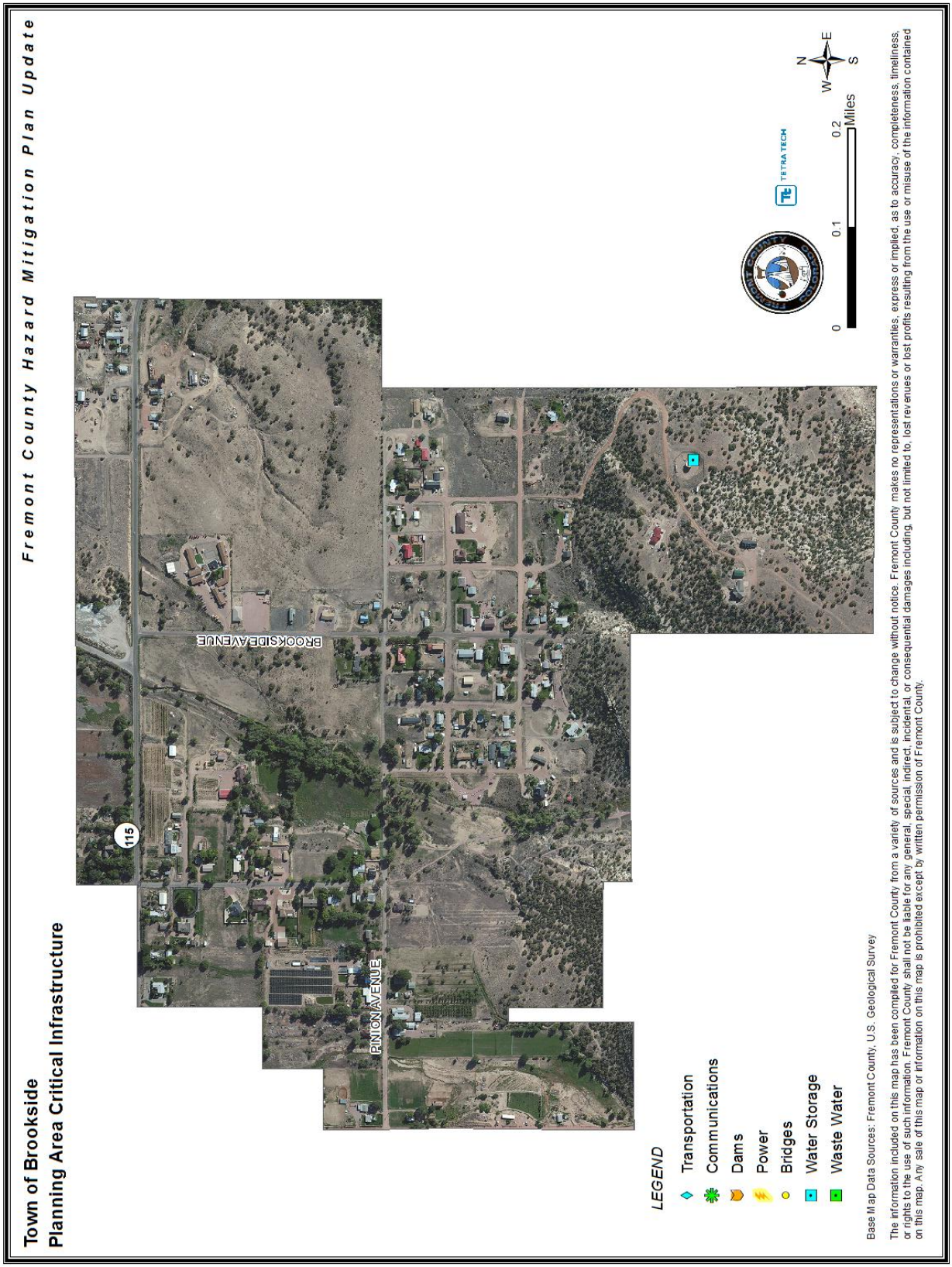


Figure 6-15. Critical Infrastructure in the City of Cañon City

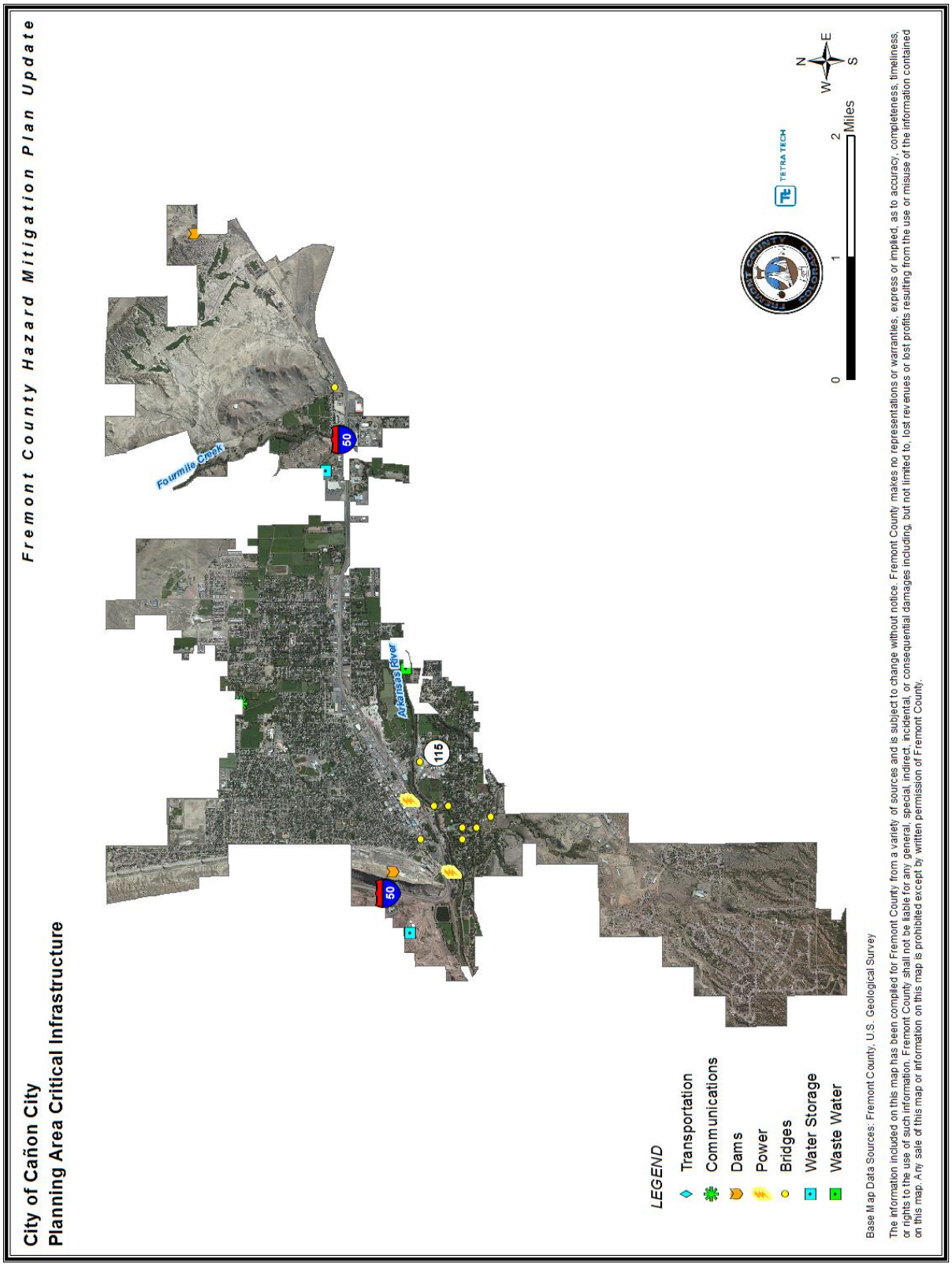


Figure 6-16. Critical Infrastructure in the Town of Coal Creek

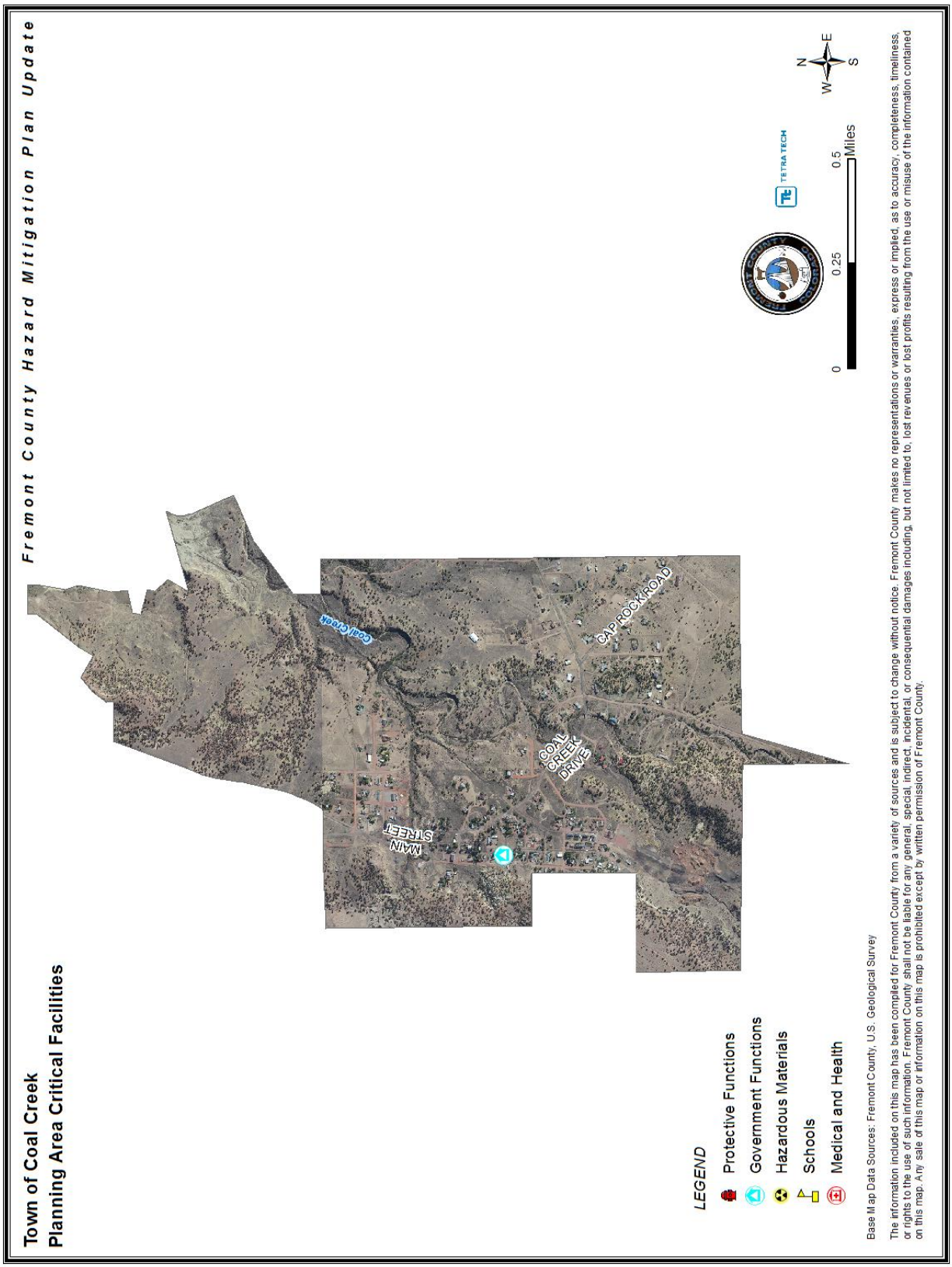


Figure 6-17. Critical Infrastructure in the City of Florence

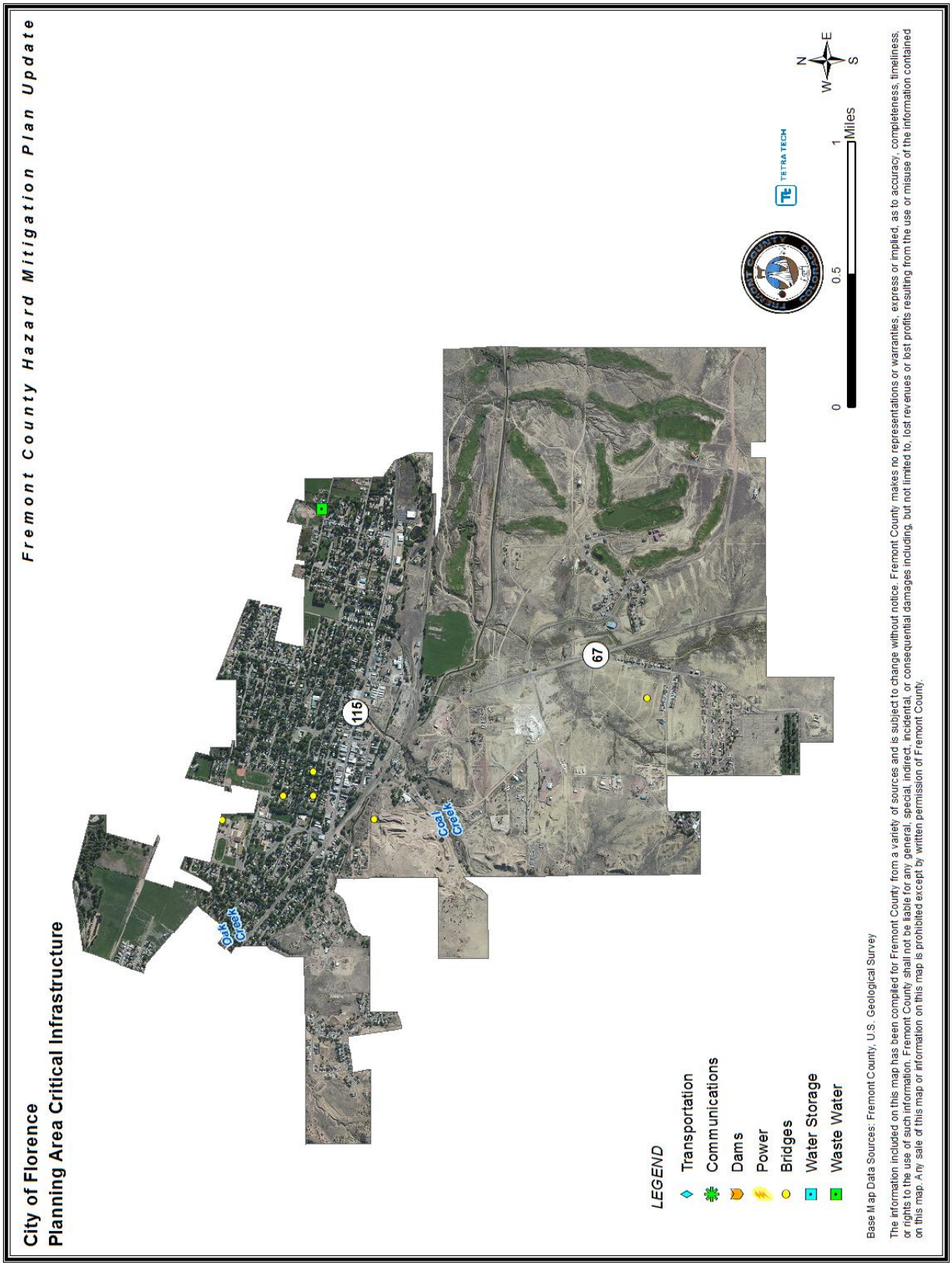


Figure 6-18. Critical Infrastructure in the Town of Rockvale

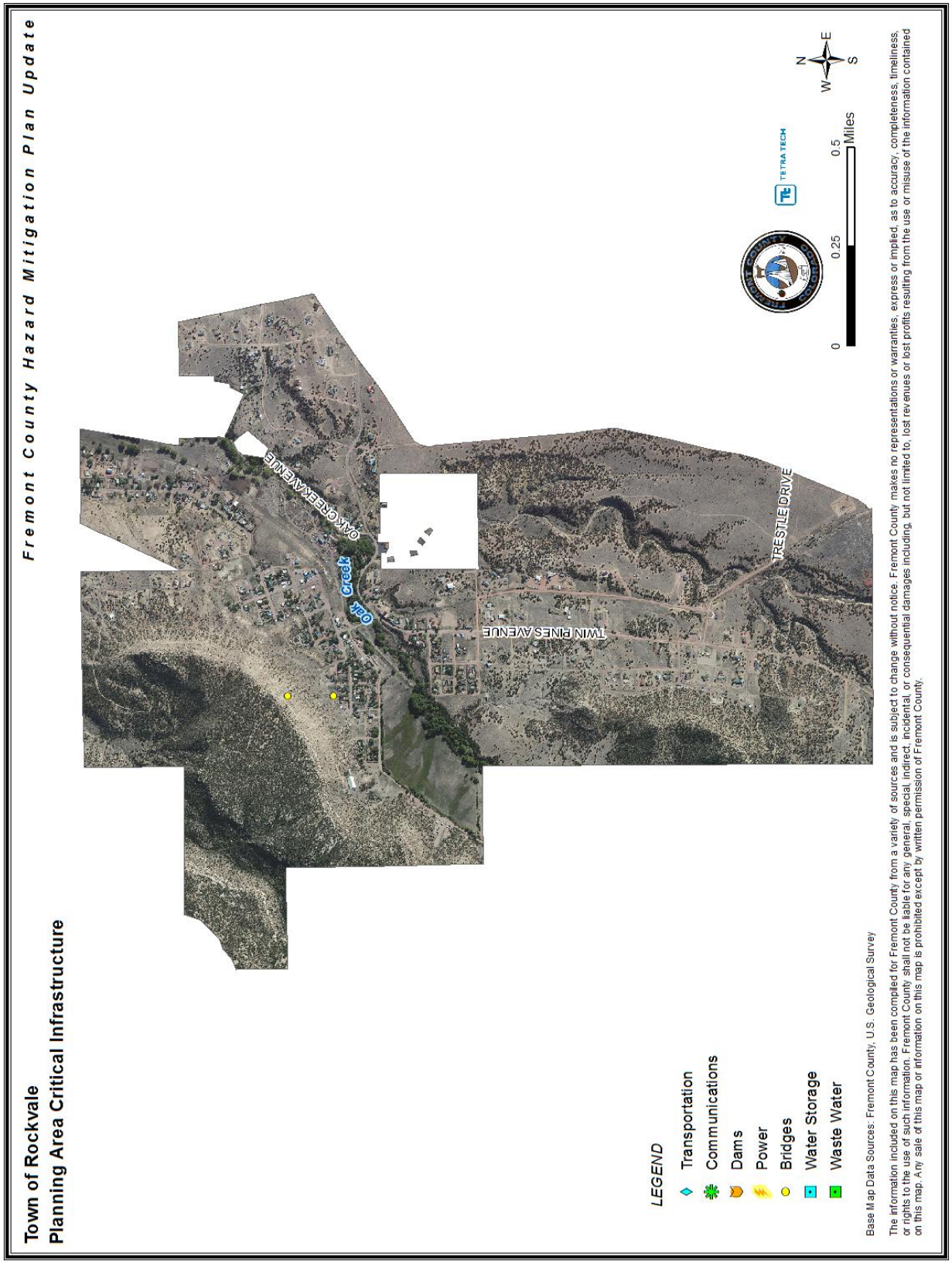
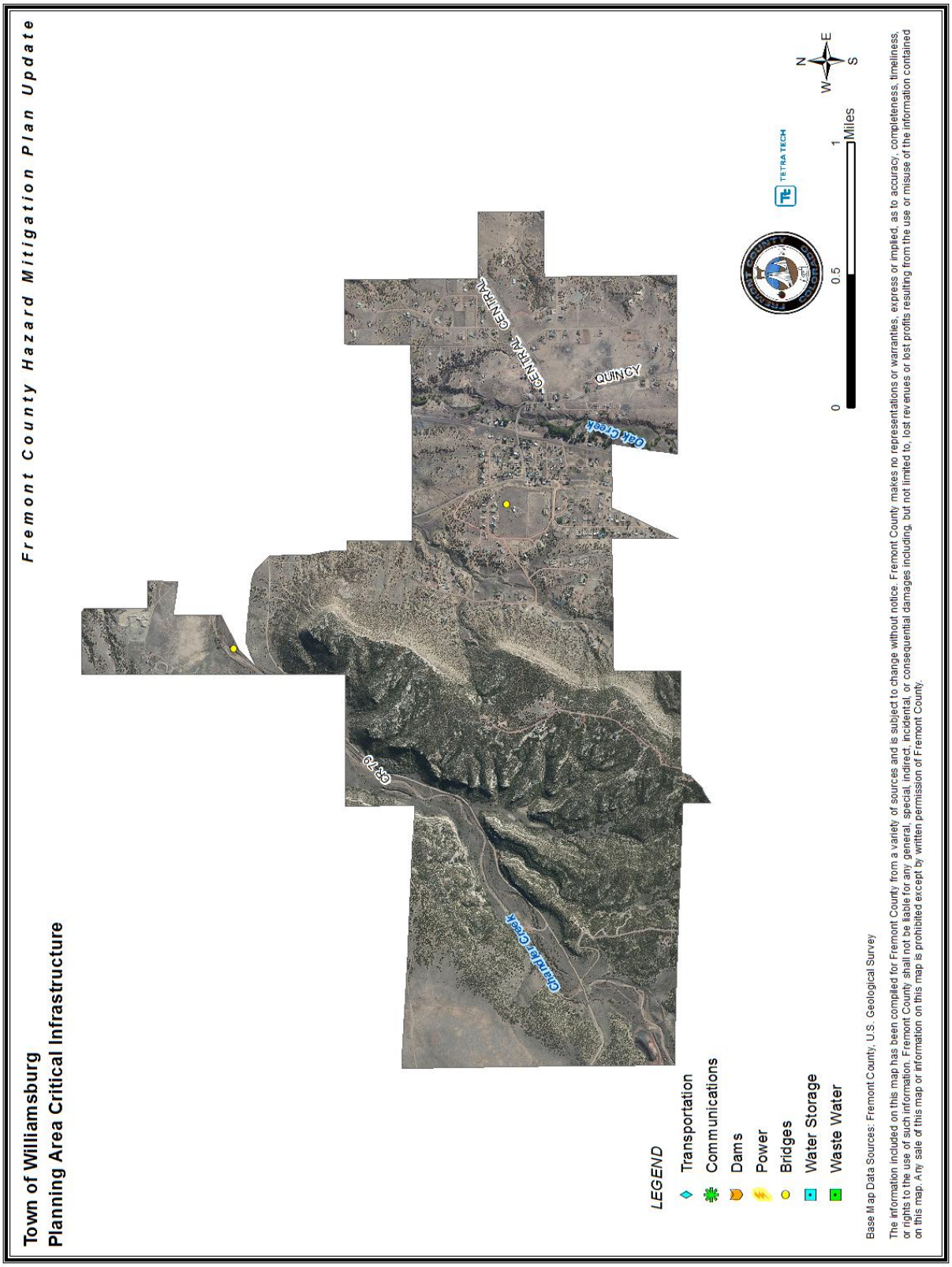


Figure 6-19. Critical Infrastructure in the Town of Williamsburg



6.6 DEMOGRAPHICS

Information on population and how it has changed in the past and may change in the future is needed for making informed decisions about the future. Population directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. Population changes are useful socio-economic indicators, as a growing population generally indicates a growing economy, and a decreasing population signifies economic decline.

Some populations are at greater risk from hazard events because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly (especially older single men), the disabled, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would assist the County in extending focused public outreach and education to these most vulnerable citizens. Select Census 2012 demographic and social characteristics for Fremont County are shown in Table 6-6.

TABLE 6-6.
FREMONT COUNTY 2012 DEMOGRAPHIC AND SOCIAL CHARACTERISTICS

	Fremont County	Brookside	Cañon City	Coal Creek	Florence	Rockvale	Williamsburg
Gender/Age (% of Total Population)							
Male	58.7	55.3	56.4	50.8	52.4	50.4	48.8
Female	41.3	44.7	43.6	49.2	47.6	49.6	51.2
Under 5 years	4.4	2.0	6.0	6.9	6.5	6.1	4.4
65 years and over	17.7	14.6	19.2	23.3	18.5	14.2	19.0
Race/Ethnicity (% of Total Population)							
White	85.0	88.4	87.8	97.8	89.8	96.4	87.2
American Indian/Alaska Native	1.9	0	1.4	0	1.6	0	1.4
Asian	1.1	0.5	0.9	0	3.3	0	0
Black or African American	5.9	0	4.9	0	0.1	0	0
Hawaiian or Pacific Islander	0.1	0	0	0	0.1	0	0
Other Race	4.1	4.5	3.3	0	3.5	0	0.3
More Than One Race	1.8	6.5	1.6	2.2	1.6	3.6	11.1
Hispanic or Latino (of any race)	12.4	8.5	11.2	0.9	9.8	5.6	4.6
Education							
High school graduate or higher (% of Total >25 Population)	83.5	85.8	82.8	86.2	87.2	79.7	86.7

Source: U.S. Census Bureau, 2012, www.census.gov

6.6.1 Population

Fremont County is the 16th most populous of Colorado's 64 counties. Colorado's Department of Local Affairs estimated the planning area's population at 47,011 as of 2012. Table 6-7 shows planning area population data from 1990 through 2012. The total Fremont County population increased 43 percent from 1990 to 2000 and 1.4 percent from 2000 to 2012.

TABLE 6-7.
FREMONT COUNTY 2012 POPULATION ESTIMATES

	Total Population					
	1990	1995	2000	2005	2010	2012
Brookside	183	219	215	225	233	245
Cañon City	12,687	14,631	15,631	16,050	16,408	16,404
Coal Creek	157	216	316	354	343	343
Florence	2,990	3,513	3,673	3,783	3,881	3,868
Rockvale	321	398	426	457	487	498
Williamsburg	253	738	707	689	662	667
Unincorporated Area	15,663	20,807	25,402	24,889	24,840	24,986
County Total	**32,254**	**40,522**	**46,370**	**46,447**	**46,854**	**47,011**

Source: Colorado Department of Local Affairs
https://dola.colorado.gov/demog_webapps/mpeParameters.jsf;jsessionid=d3953e08cbc6801412bc17561485

The cities of Cañon City and Florence are the County's principal population centers. In 1990, 45.7 percent of the planning area's residents lived outside incorporated areas, compared to 51.0 percent in 2012. Cañon City made up 37.0 percent of the overall County population in 1990 and 33.5 percent in 2012. Growth from 1990 to 2012 ranged from 29 percent to 164 percent in incorporated areas, and was 60 percent in unincorporated areas.

Figure 6-20 shows 5-year population changes in the planning area and the State Colorado from 1990 to 2010 and the 2-year change from 2010 to 2012. Between 1990 and 2012, Colorado's population grew by 57.5 percent (about 3.8 percent per year) while the planning area's population increased by 43.2 percent (3.0 percent per year).

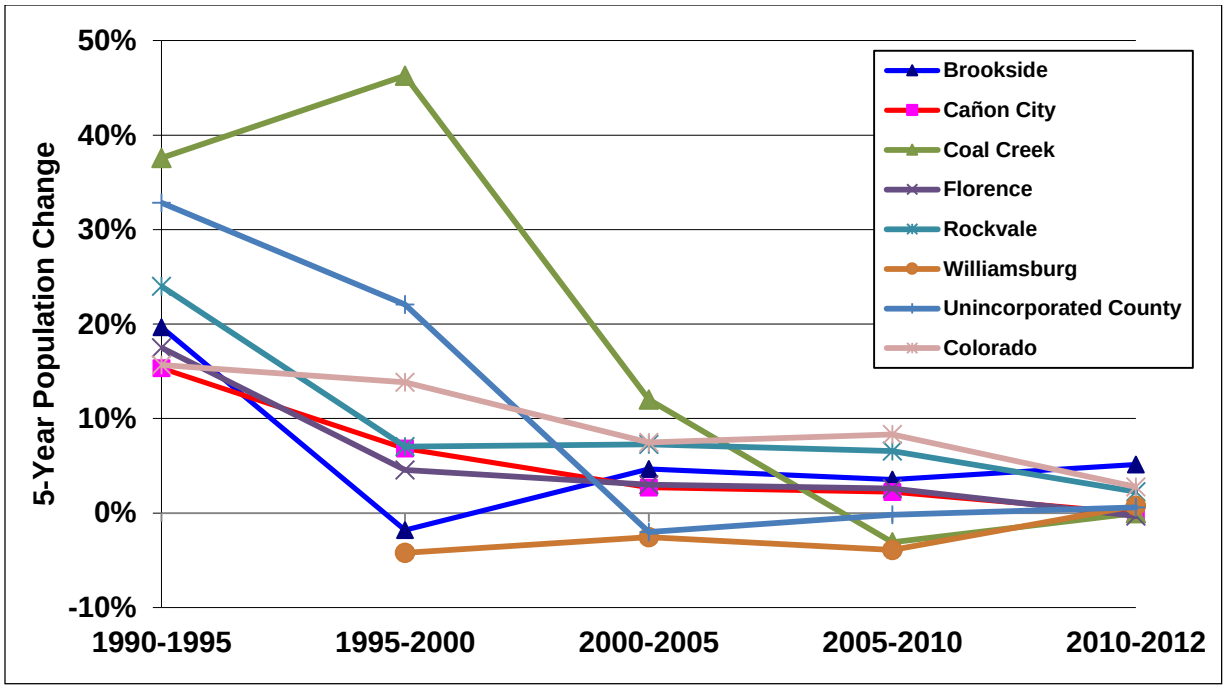


Figure 6-20. State of Colorado and Planning Area Population Growth

6.6.2 Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The overall age distribution for the planning area is illustrated in Figure 6-21. Based on U.S. Census data estimates, 17.7 percent of the planning area's population is 65 or older. According to U.S. Census data, 37.9 percent of the County's over-65 population has disabilities of some kind. Census estimates for 2012 indicate that 24.6 percent of Fremont County families have children under 18 and are below the poverty line. It is also estimated that 13.0 percent of the County's population is 14 or younger.

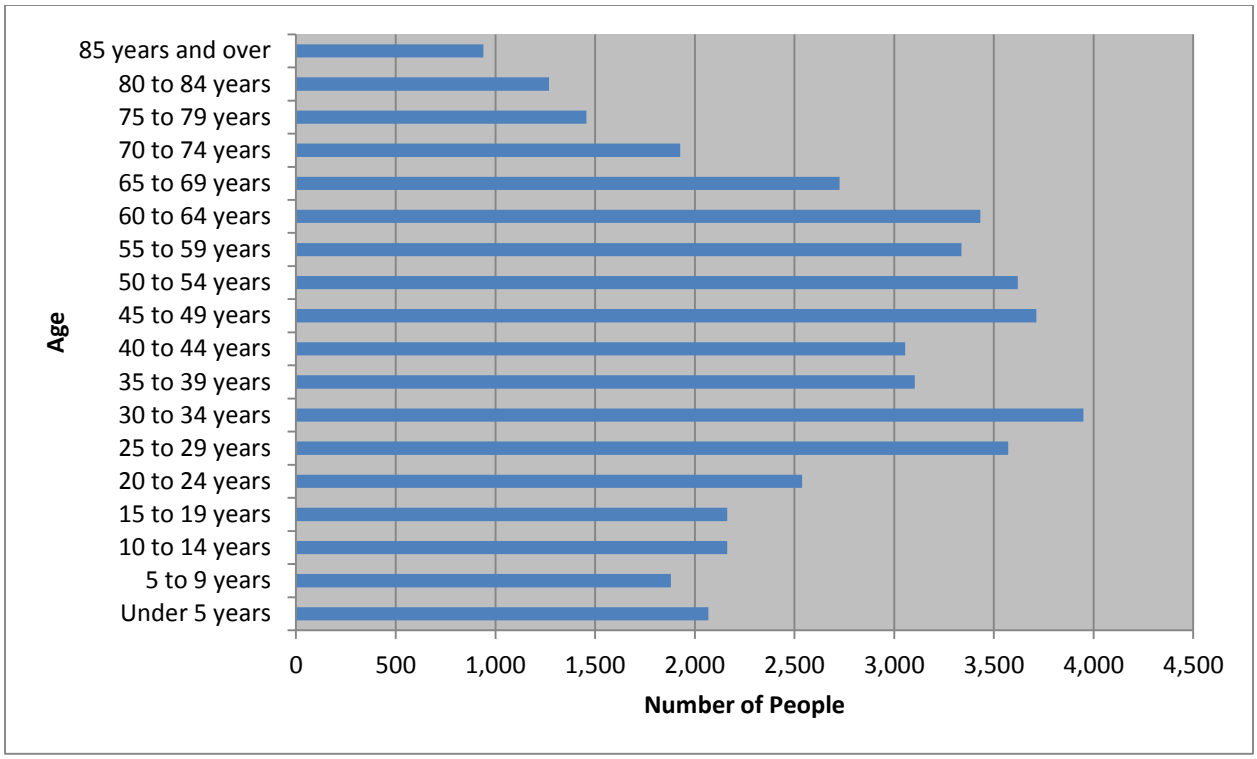


Figure 6-21. Fremont County Age Distribution

6.6.3 Disabled Populations

The 2010 U.S. Census estimates that 54 million non-institutionalized Americans with disabilities live in the U.S. This equates to about one-in-five persons. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to the 2010 Census, 17.3 percent of the population in the planning area lives with some form of disability.

6.6.4 Ethnic Population

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to the U.S. Census, the racial composition of the planning area is predominantly white, at about 85 percent. The largest minority populations are African American at 5.9 percent and "some other race" at 4.1 percent. The population also is 12.4 percent Hispanic. Figure 6-22 shows the population distribution by race in the planning area.

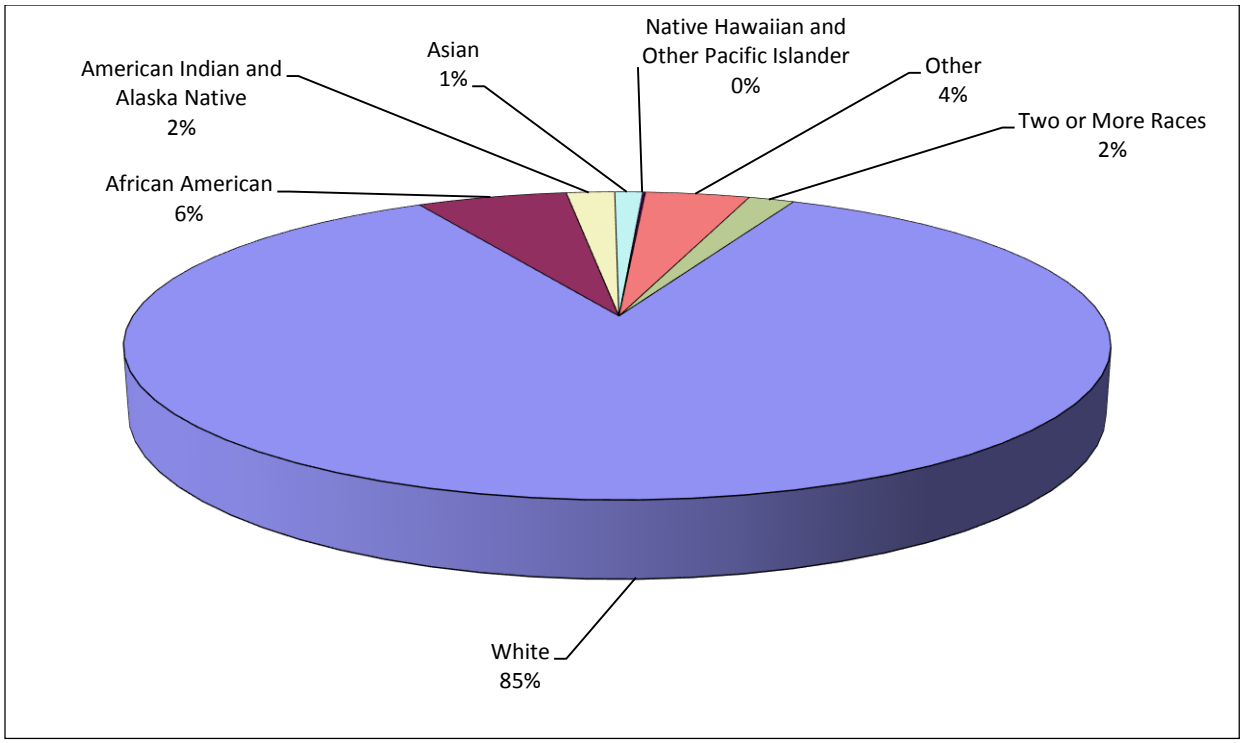


Figure 6-22. Fremont County Race Distribution

The planning area has a 4.4-percent foreign-born population. Other than English, the most commonly spoken language in the planning area is Spanish. The census estimates 5.7 percent of the residents speak English "less than very well."

6.7 ECONOMY

Select 2012 economic characteristics estimated for Fremont County by the U.S. Census Bureau are shown in Table 6-8.

TABLE 6-8.
FREMONT COUNTY ECONOMIC CHARACTERISTICS

	Fremont County	Brookside	Cañon City	Coal Creek	Florence	Rockvale	Williamsburg
% of Families below poverty level	11.7	2.9	15.3	13.5	14.1	11.7	11.0
% of Individuals below poverty level	15.1	2.0	18.9	15.5	18.1	13.8	12.7
Median home value	$161,100	$154,700	$152,800	$93,000	$113,800	$160,200	$117,600
Median household income	$40,893	$63,571	$39,804	$42,500	$33,177	$36,850	$41,932
Per capita income	$19,379	$29,865	$19,520	$16,567	$19,427	$18,852	$20,691
% of Population >16 in Labor Force	39.4	69.4	43.1	49.6	59.1	52.9	49.8
% of Population Employed	36.3	66.9	39.7	42.7	52.7	41.2	42.7

Source: U.S. Census Bureau, 2012, www.census.gov

6.7.1 Income

In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau estimates, per capita income in the planning area in 2012 was $19,379, and the median household income was $40,893. It is estimated that about 8 percent of households receive an income between $100,000 and $149,999 per year and 3.0 percent are above $150,000 annually. Families with incomes below the poverty level in 2012 made up 11.7 percent of all families and 15.1 percent of the total County population.

6.7.2 Employment Trends

According to the Colorado Department of Labor and Employment, Fremont County's unemployment rate as of December 2013 was 8.1 percent, compared to a statewide rate of 5.9 percent. Figure 6-23 compares Colorado's and Fremont County's unemployment trends from 2003 through 2013. Fremont County's unemployment rate was lowest in 2007 at 4.7 percent and peaked in 2010 at 10.5 percent.

Source: U.S. Bureau of Labor Statistics, 2014

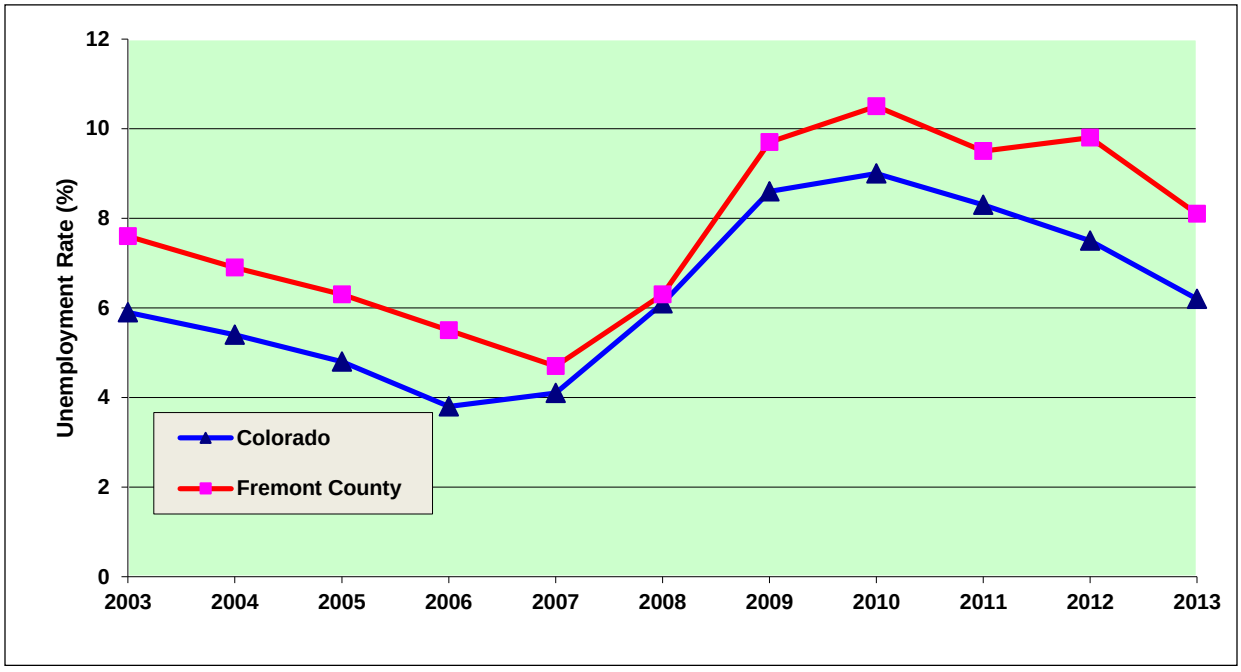


Figure 6-23. State of Colorado and Fremont County Unemployment Rate

According to the American Community Survey, about 39 percent of Fremont County's population 16 years and older is in the labor force, including 47 percent of women and 34 percent of men.

6.7.3 Occupations and Industries

According to U.S. Census data, the 2011 distribution of occupation types by percent of total employment in Fremont County was as follows:

- Management, business, science, and arts occupations, 27.3 percent
- Service occupations, 29.4 percent
- Sales and office occupations, 21.2 percent
- Natural resources, construction, and maintenance occupations, 13.4 percent
- Production, transportation, and material moving occupations, 8.6 percent.

According to 2012 Census data, the planning area's economy is strongly based in the education, health care and social assistance industries (21.8 percent of total employment), followed by the public administration (14.8 percent), and retail trade (12.4 percent). Figure 6-24 shows the distribution of industry types in Fremont County, based on share of total employment.

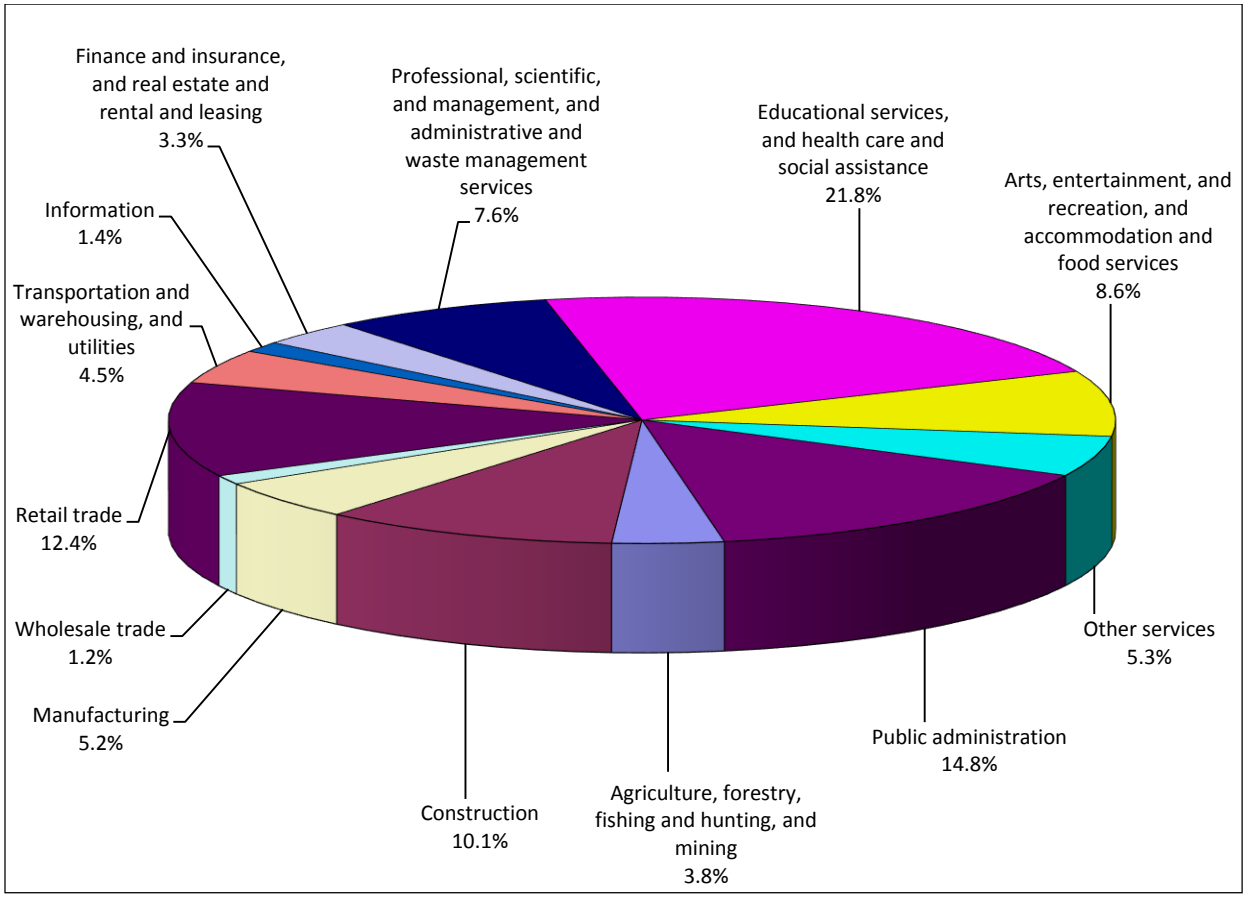


Figure 6-24. Percent of Total Employment by Industry in Fremont County

According to the Colorado Department of Labor and Employment, the following are the largest employers in Fremont County (Colorado LMI, 2014 Gateway website, https://www.colmigateway.com):

- Colorado State Penitentiary
- Arrowhead Correctional Center
- Four Mile Correctional Center

- St. Thomas More Hospital
- Fremont Correctional Facility
- Walmart Supercenter
- Territorial Correctional Facility
- Royal Gorge Bridge Company.

The U.S. Census estimates that 76.2 percent of Fremont County workers commute alone (by car, truck or van) to work, and mean travel time to work is 22.5 minutes.

6.8 FUTURE TRENDS IN DEVELOPMENT

The municipal planning partners have adopted comprehensive plans that govern land use decision and policy making in their jurisdictions. Decisions on land use will be governed by these programs. This plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in the planning area.

All municipal planning partners will incorporate this hazard mitigation plan update in their comprehensive plans by reference. This will help ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

TABLE 6-9.
PRESENT LAND USE IN PLANNING AREA

Present Use Classification	Area (acres)	% of total
Agriculture	290,747	29.6
Commercial	2,609	0.3
Government/Institutional	29,143	3.0
Industrial	5,010	0.5
Natural Resource Extraction	8,073	0.8
Residential	58,554	6.0
Vacant Land	58,273	5.9
Other	2,955	0.3
Uncategorized	527,778	53.7
Total	**983,141**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

6.9 LAWS AND ORDINANCES

Existing laws, ordinances and plans at the federal, state and local level can support or impact hazard mitigation initiatives identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Pertinent federal, state and local laws are described below.

6.9.1 Federal

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program funds are available to communities. This plan is designed to meet the requirements of DMA, improving the planning partners' eligibility for future hazard mitigation funds.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- **Endangered** means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- **Threatened** means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- **Critical habitat** means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- **Section 4: Listing of a Species**—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- **Section 7: Consultation**—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.

- **Section 9: Prohibition of Take**—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding, or sheltering.
- **Section 10: Permitted Take**—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- **Section 11: Citizen Lawsuits**—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

The Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. The County and Cañon City participate in the NFIP and have adopted regulations that meet the NFIP requirements. At the time of the preparation of this plan, both Cañon City and the County were in good standing with NFIP requirements.

6.9.2 State and Regional

Colorado Division of Emergency Management

Pursuant to House Bill 12-1283, the former Division of Emergency Management moved from the Department of Local Affairs to the newly created Division of Homeland Security and Emergency Management under the Colorado Department of Public Safety, effective July 1, 2012. The division is now comprised of three offices:

- Office of Emergency Management
- Office of Preparedness
- Office of Prevention and Security

Homeland Security and Emergency Management operate under the following division mission: "The mission of the Division of Homeland Security and Emergency Management is to support the needs of local government and partner with them before, during, and after a disaster and to enhance preparedness statewide by devoting available resources toward prevention, protection, mitigation, response, and recovery, which will ensure greater resiliency of our communities." The Division vision is: "The vision of the Division of Homeland Security and Emergency Management is to unify homeland security and

emergency management within the Colorado Department of Public Safety to support tribal and local government and ensure State and Federal agency coordination."

Colorado Water Conservation Board

The Colorado Water Conservation Board (CWCB) is an agency of the State of Colorado. The CWCB Flood Protection Program is directed to review and approve statewide floodplain studies and designations prior to adoption by local governments. The CWCB is also responsible for the coordination of the NFIP in Colorado and for providing assistance to local communities in meeting NFIP requirements. This includes CWCB prepared or partnered local floodplain studies.

Colorado Geological Survey

The Colorado Geological Survey is a state government agency within the Colorado Department of Natural Resources whose mission is to help reduce the impact of geologic hazards on the citizens of Colorado, to promote responsible economic development of mineral and energy resources, provide geologic insight into water resources, provide avalanche safety training and forecasting, and to provide geologic advice and information to a variety of constituencies. The Colorado Avalanche Information Center is housed in the Colorado Geological Survey.

Colorado State Forest Service

The mission of the Colorado State Forest Service is to provide for the stewardship of forest resources and to reduce related risks to life, property, and the environment for the benefit of present and future generations. Its fire preparedness and response strategic priority is to provide leadership in wildland fire protection for state and private lands in Colorado and reduce wildfire-related loss of life, property, and critical resources.

Upper Arkansas Area Council of Governments

The UAACOG is a voluntary coalition of county and municipal governments that believes working together as a region has both social and economic benefits. UAACOG provides services for the benefit of individuals, families, businesses, and local governments in four counties along the Upper Arkansas River Basin in central Colorado. The UAACOG, together with the four counties of Fremont, Chaffee, Custer and Lake, provides quality services to promote self-sufficiency and healthy lifestyles for individuals and families by enabling them to improve their lives.

UAACOG was formed in 1974 under federal legislation and State Executive Order allowing the formation of "regional councils." The UAACOG Board of Directors, comprised of eight elected officials representing the four counties, one commissioner from each county, and one municipal elected official (usually the mayor) from each county, directs the activities of UAACOG. The UAACOG staff is responsible for carrying out the Council's direction.

The purpose of the organization is to provide community services on a regional basis that are not practical or efficient to provide on an individual county or municipal basis. The Articles of Incorporation emphasize the need for a regional council based on the recognition that people in the region form a single community and are bound together not only physically, but economically and socially.

UAACOG published the Fremont County Economic Development Strategy (CEDS) in 2010. The CEDS identified the following goals for Fremont County:

- Economic Development
- Improve Community Facilities and Services
- Improve Transportation
- Renewable Energy
- Water Resource Development

- Improve Housing
- Increase Recreation and Tourism

6.9.3 Fremont County

County government is made up of the following offices and departments:

- Airport
- Assessor
- Attorney
- Building and Environmental Health
- Clerk and Recorder
- Colorado State University Cooperative Extension
- Commissioners
- Coroner
- County Manager
- Emergency Management
- Finance
- Human Resources
- Human Services
- Information Technologies
- Planning and Zoning
- Public Health
- Sheriff
- Transportation
- Treasurer
- Veterans Services
- Weed Control

The organizational chart for Fremont County government is shown in Figure 6-25. Fremont County Organizational Chart.

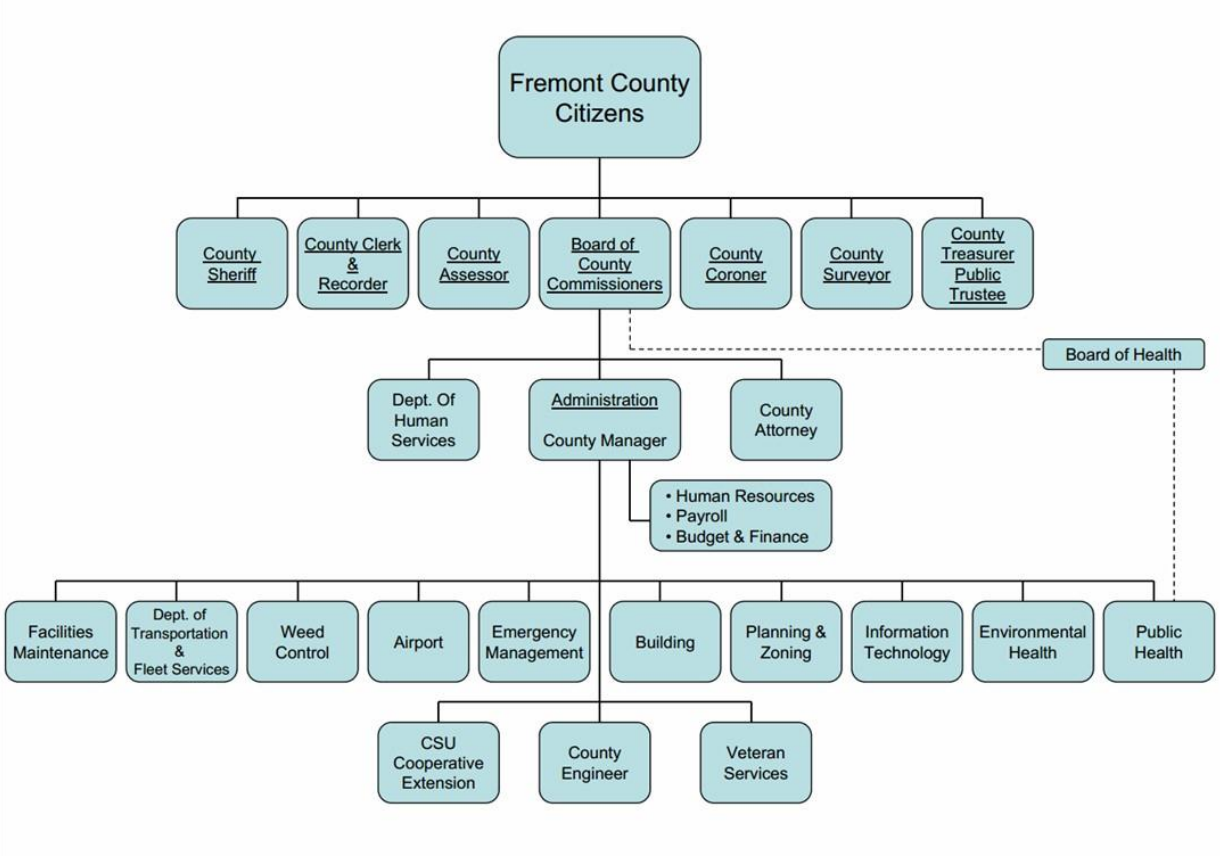


Figure 6-25. Fremont County Organizational Chart

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Fremont County Master Plan, 2001

The 2001 Fremont County Master Plan is the official document for guiding both the public and private sector in land use decisions for the County. It outlines the goals and objectives developed by Fremont County and addresses a planning period up to the year 2011. The Master Plan was reviewed by the Planning Commission and Department of Planning and Zoning staff. The original Master Plan was adopted by the Planning Commission on August 7, 1990. The Master Plan was amended in 2001 to update demographics and reflect changes in land use issues brought on by County growth and diversities in land use that have occurred since 1990. This document is currently being updated.

During the 2001 revision of the plan, the Planning Commission identified several important development trends and that a planning document, such as the Master Plan, was required to provide a long-range outline for future land use development of Fremont County. These trends included:

- Prison industry growth
- Rafting and tourist industry growth
- Paleontological discoveries
- Continued growth in the County senior population
- Development of industrial park(s)
- Increased urban activities
- County urbanization and the "bedroom-community" syndrome

The Master Plan includes goals, objectives, and strategies – many of which integrate and complement the hazard mitigation plan initiatives. The following goals, objectives, and strategies directly or indirectly mitigate hazards identified in this plan:

- **Goal A:** Create a safe, functional, and environmentally sound transportation system. The aesthetic quality of the County should be given careful consideration when locating, designing, or upgrading any part of the transportation system in order to preserve and enhance public enjoyment of facilities such as mountain roads, bridges, and scenic overlooks.
  - **Objective A2:** When new roads are constructed, encourage conformance to the natural contours of the existing landscape in order to minimize soil disturbance and cut and fill.
- **Goal B:** Future urban development should be located within or adjacent to existing urban areas in order to eliminate haphazard sprawl, to assure the provision of adequate urban services, and to maximize return on funds invested in public facilities and services. Future rural development should be located in or adjacent to the core areas of the communities of Swissvale, Wellsville, Howard, Coaldale, Cotopaxi, Hillside, Texas Creek, and Parkdale.
  - **Objective B3:** All areas of proposed development where public water is not available will document access to an adequate means of water storage for fire protection.
- **Goal D:** Encourage farm and rural ranch land to remain in active and productive use.
  - **Objective D2:** Discourage conversion of agricultural water to non-agricultural uses, except in cases when the associated land is adjacent to or in an urban service area and the land is changing to an urban use.
    - **Strategy D2.1:** Promote protection of productive agricultural land through purchase of conservation easements under a capital development program entitled the Fremont Heritage Conservation Fund, a transfer of development rights program, and the County's right to farm resolution.
    - **Strategy D2.2:** Encourage the development of additional water resources for domestic use by the municipalities, and the continued use of existing agricultural water resources for agriculture.
- **Goal E:** Ensure the provision of adequate, dependable, and cost effective sewer and water facilities, and to guide new development to locate in proximity to existing and proposed sewer and water facilities.
  - **Objective E2:** Require evidence prior to project approval of: a) a safe and reliable method of wastewater treatment and disposal, and b) an adequate water supply for domestic and fire protection purposes.
- **Goal F:** Provide affordable, diverse, and quality housing alternatives to accommodate County residents. Housing should not be detrimental to public health, safety or moral welfare, and it should preserve the scenic quality of the area.
  - **Objective F4:** Development will be prohibited, or mitigated, as permitted through County flood damage prevention regulations, in any FEMA designated floodplain or geologically unstable area, or in areas of statewide concern identified by County implementation of CRS 24-65-104 (House Bill 1041).
  - **Objective F6:** Construction of homes will be encouraged in locations which minimize the extension of roads, water, sewer, new utility services, fire protection, emergency services, law enforcement, and/or existing utility systems.
  - **Objective F7:** Residential development in areas outside fire protection districts are encouraged to comply with the National Interagency Fire Center's Protecting Your Home

from Wildland Fire, considering "safe zones" around structures, fire-retardant construction materials, removal of standing dead trees, and fuels reduction measures.

- **Goal G:** Ensure the maintenance of adequate and dependable levels of community services necessary to support all existing and future residents of the County.
  - **Objective G5:** Develop adequate services including police protection, fire protection, and emergency medical services for all areas of the County.
  - **Objective G6:** Encourage the creation of a separate fire protection district for the Penrose/Beaver Park Area.
- **Goal H:** Encourage a land use pattern which considers the ecological and environmental sensitivity of the land, does not overburden the capacity of the land, and promotes the health, safety, and welfare of all County residents. Preserve the cultural resources of the County.
  - **Objective H1:** The County will review all proposed development in terms of potential environmental impacts on land, water, air, and wildlife, and place the burden of proof to mitigate any potential impacts with the developer.
    - **Strategy H1.1:** New development applicants will be required to submit Reclamation Plans to ensure that projects will be designed in a manner that minimizes grading, vegetative disturbance, and intrusion onto natural waterway courses, canyons, and prominent landmarks.
    - **Strategy H1.2:** Amend Subdivision Regulations to require designation of "building envelopes" with impact assessments, rather than setback requirements for new residential development. Building envelopes will be designed to avoid hazard areas, the tops of ridgelines, open fields and agricultural infrastructure. Building envelopes will be designated at the minimum size necessary to construct a building on the lot so the area disturbed is minimized.
- **Goal L:** Minimize damaged caused by storm events.
  - **Objective L1:** Work with federal, state and local entities to develop and coordinate a regional stormwater drainage plan that mitigates problems associated with flooding in Fremont County.
    - **Strategy L1.1:** Develop an Intergovernmental Agreement with Cañon City delineating County and City responsibilities in stormwater management in areas of the County upstream of the City.
    - **Strategy L1.2:** Provide input to the City's impending Stormwater Management Plan, and partner in the development of management strategies.
    - **Strategy L1.3:** Encourage incentive programs to mitigate stormwater issues with regard to volumes and quality in association with existing residential, agricultural, commercial and industrial areas.
    - **Strategy L1.4:** Discourage development in areas that would negatively impact existing floodways.
    - **Strategy L1.5:** Encourage development of drainage facilities that have positive impacts on wildlife habitats and natural areas.
    - **Strategy L1.6:** Encourage development of drainage facilities that preserve and have positive impacts on culturally and or historically significant areas.
    - **Strategy L1.7:** Develop strategies to minimize individual on-site stormwater detention while encouraging regional channelization and detention, reducing the amount of land dedicated to detention, maintenance issues for on-site detention facilities, and

enforcement of deed and plat restrictions that may be required in association with development.

- **Objective L2:** Coordinate stormwater drainage plans with existing and future park and open space plans in the region to ensure proper and regionally beneficial utilization of lands in potentially affected areas.
- **Objective L3:** Develop and enforce stormwater drainage regulations that address and mitigate stormwater issues with regard to volumes and quality associated with new residential, agricultural, commercial, and industrial development.
  - **Strategy L3.1:** Assure that stormwater quality and drainage control are addressed in the Fremont County Flood Damage Prevention Resolution, Subdivision Regulations and Building Codes (for multi-family, commercial and industrial construction) consistent with Colorado statutes, regulations of the Colorado Department of Public Health and Environment, and the federal Clean Water Act.

The Fremont County Master Plan also includes general goals, objectives and strategies for six distinct Planning Districts within the County. The Districts were developed during the late 1990s by identifying areas that encompass similar social, economic, and physical conditions. The districts include:

- District One – The Urban Growth District
- District Two – The Penrose/Beaver Park District
- District Three – The Mountain District
- District Four – The Royal Gorge Impact District
- District Five – Arkansas Valley District
- District Six – The Plains District

District One, the Urban Growth District, is composed of two distinguishable, but related areas: the County lands surrounding Cañon City, and those around Florence. The following objectives and strategies identified for District One directly or indirectly mitigate hazards identified in this plan:

- **Objective A1:** Existing elements of the County subdivision regulations, Planned Unit Development regulations, and land use code will continue in effect both inside and outside the Cañon City urban growth boundaries in the Urban Growth District.
  - **Strategy A1.1:** All site-built homes in this District will be built to the standards of the Uniform Building Code, and manufactured housing will meet Department of Housing and Urban Development (HUD) standards.
  - **Strategy A1.2:** Stormwater volume and quality will be considered during review of all commercial and residential developments within the district.
  - **Strategy A1.3:** Soil type limitations should be considered in determining locations for manufactured housing projects and site-built residential projects.
- **Objective A2:** No development should be allowed to occur within floodplains throughout the district. Density transfer, as allowed by regulation (planned unit development or multi-family zoning), should be considered if the non-buildable ground in floodplains is included within the development as passive open space or some other acceptable use, and the entire parcel is contiguous.
  - **Strategy A2.1:** The current Fremont County Flood Damage Prevention Regulations will be amended to reflect this policy for the Urban Growth District outside the municipal urban growth boundaries.

- **Objective A6:** Housing should be allowed to develop at urban densities inside the urban growth boundaries of Cañon City.
  - **Strategy A6.2:** Clustering units, open space buffers, and compatible architecture should be considered when designing and reviewing the proposed project. Water, sewer, stormwater drainage, and road system issues should be considered when determining allowable densities.
- **Objective A12:** Neighborhood business centers should be allowed in designated Neighborhood Business Zones of the district and should include only uses of a type and size to service a neighborhood (e.g., grocery store, laundromats, real estate office, etc.).
  - **Strategy A12.1:** Criteria for location and design of this type of commercial use will be as follows:
    - The architectural and landscaping design of the neighborhood center should be compatible with surrounding residential uses
    - The major tenant of the complex should be a grocery store
    - The maximum size of the commercial center should be 5 acres
    - The traffic patterns and volume generated by a proposed development should not adversely affect the surrounding area
    - Stormwater drainage must be adequately addressed with regard to volume, quality and the existing drainage system for the area
- **Objective A14:** Construction should not be allowed within hazard areas such as floodplains, mine subsidence areas, or rockfall areas as identified through FEMA mapping and HB 1041 mapping. Density transfer should be allowed between contiguous parcels, as long as the overall development pattern of the area is not negatively impacted and the hazard areas can be utilized as open space.
- **Objective A18:** Stormwater volume and quality will be considered during review of all commercial and residential developments within the district.

District Two, the Penrose/Beaver Park District, is a large unincorporated area with the potential to develop into an urban area, based on the historic platting that currently exists in the area. The following objectives and strategies identified for District Two directly or indirectly mitigate hazards identified in this plan:

- **Objective B1:** A sub-area plan for the Penrose/Beaver Park District will be prepared based on the information and guidelines provided in the Master Plan. The sub-area plan will weigh growth pressures at the projected rates of growth, water system expansion options and their potential finance schemes, impacts of septic system proliferation, and other local government needs in the district. Recommendations concerning organization of services will be provided by the plan.
- **Objective B5:** Historic use of the land in farming and orchard operations should be encouraged in order to utilize the irrigation rights available in the area.

District Three, the Mountain District, incorporates a wide variety of landform, vegetation, and other environmental conditions, ranging from open, rolling meadows, to steep wooded mountainsides. This district is not contiguous, but is made up of two large areas: the northern one-quarter of the County, containing approximately 500 square miles, and the south-central portion of the County, containing approximately 250 square miles. The following objectives and strategies identified for District Three directly or indirectly mitigate hazards identified in this plan:

- **Objective C5:** Development should be precluded in areas of 30 percent or greater slopes, unless the applicant can sufficiently mitigate the inherent problems associated with

development on steep slopes. The applicant will identify areas of 30 percent or greater slopes, and if such areas are used for development the developer should show adequate mitigation measures.

- **Objective C6:** Grading and slope stabilization plans should be required for that portion of a site exceeding 15 percent slopes.
- **Objective C7:** All development within this district will be required to follow the guidelines developed by the National Interagency Fire Center's Protecting Your Home from Wildland Fire, considering "safe zones" around structures, fire-retardant construction materials, removal of standing dead trees, and fuels reduction measures.
- **Objective C14:** Develop regulations to minimize the impact of 35-acre developments, with regard to wildlife, wildfire, road construction and maintenance, visual impacts, law enforcement, fire protection, and impacts on the schools and other community services and facilities.

District Four, the Royal Gorge Impact District, is a nearly rectangular area straddling Highway 50 along the plateau immediately north of the Royal Gorge. Encompassed in this area is approximately 4 miles of the State Highway 9 corridor north from its intersection with Highway 50, and 6 miles of the Royal Gorge road leading south. None of the objectives and strategies identified for District Four directly or indirectly mitigate hazards identified in this plan.

District Five, the Arkansas Valley District, encompasses the Arkansas River Valley and scenic mountain areas in the U.S. Highway/Arkansas River corridor west of the Parkdale area. The following objectives and strategies identified for District Five directly or indirectly mitigate hazards identified in this plan.

- **Objective E2:** Existing County setback requirements, building height limitations and flood zone regulations will be strictly enforced for all residential, commercial, and recreation-related developments along waterways in the district.
- **Objective E7:** All development within the district will be required to adhere to the fire prevention guidelines outlined by the National Interagency Fire Center's Protecting Your Home from Wildland Fire, considering "safe zones" around structures, fire-retardant construction materials, removal of standing dead trees, and fuels reduction measures.

District Six, the Plains District, includes a large area of land that lies generally to the east, south, and north of the City of Florence. None of the objectives and strategies identified for District Six directly or indirectly mitigate hazards identified in this plan.

Subdivision Regulations of Fremont County, Colorado, 2000 (as amended)

The Fremont County Subdivision Regulations established rules, regulations and standards governing the subdivision of land within the unincorporated areas of Fremont County, set forth the procedure to be followed by the BOCC and the Planning Commission in applying and administering these rules, regulations and standards, and set forth the penalties for the violation thereof as established by law. The Subdivision Regulations were designed and enacted for the purpose of promoting the health, safety and general welfare of the public and to establish standards of subdivision design, which will encourage the development of sound, economical, stable neighborhoods and create a healthy environment for present and future inhabitants of Fremont County by:

1. Minimizing and controlling any detrimental impact brought about by the integration of proposed subdivisions with existing land uses;
2. Promoting orderly, efficient and integrated development of Fremont County;
3. Ensuring conformance of land subdivision plans with the public improvement plans of the County and its various municipalities;

4. Ensuring coordination of inter-municipal public improvement plans of the County and its various municipalities;
5. Encouraging well-planned subdivisions by establishing adequate standards for design and improvements;
6. Improving land survey monuments and records by establishing standards for surveys and plats;
7. Safeguarding the interests of the public, the homeowner, and subdivider;
8. Securing equitable handling of all subdivision plans by providing uniform procedures and standards;
9. Preventing loss and injury from fire in wooded or hazardous terrain;
10. Preserving natural vegetation and cover and promoting the natural beauty of Fremont County;
11. Preventing and controlling erosion, sedimentation, and other pollution of surface and subsurface water;
12. Preventing flood damage to persons and properties and minimizing expenditures for flood relief and flood control projects;
13. Restricting building on flood lands, shorelines, areas covered by poor soils, or in areas poorly suited for building or construction;
14. Preventing loss and injury from landslides, mud flows, and other geologic hazards;
15. Providing adequate space for the future development of schools and parks to serve the population;
16. Assuring the planning for and provision of an adequate and safe sources of water and means of sewage disposal;
17. Regulating the subdivision or use of land on the basis of the impact thereof on the community or surrounding areas; and
18. Otherwise planning for and regulating the use of land so as to provide planned and orderly use of land and protection of the environment.

Fremont County Zoning Resolution and Maps, 2009 (as amended)

The Fremont County Zoning Resolution consists of a resolution and maps establishing zoning districts in Fremont County and regulating the use of buildings, structures and land for trade, industry, residence, recreation, public and other purposes; the location, height, bulk and size of buildings and other structures; the lot size and percentage that may be occupied; the size of yards, courts and other open spaces; and the density and distribution of population. The regulations were designed and enacted for the purpose of promoting the health, safety, morals, convenience, order, prosperity and welfare of the present and future inhabitants of Fremont County, including lessening the congestion in the streets or roads, or reducing the waste of excessive amounts of roads; promoting energy conservation; securing safety from fire, floodwater and other dangers; providing adequate light and air; classifying land uses and land development and utilization; protecting the tax base; securing economy in governmental expenditures; fostering the State's agricultural and other industries and protecting both urban and non-urban development.

Fremont County Resolutions and Ordinances

Fremont County has adopted resolutions and ordinances that directly or indirectly mitigate hazards identified in this plan. These resolutions include the following:

- **Resolution No. 40, Series of 2008:** A resolution adopting the International Building Code, International Residential Code and International Energy Conservation Code, 2006 editions as the Building Code of Fremont County, effective July 1, 2008
- **Resolution No. 38, Series of 2011:** Adopting revised Fremont County Flood Damage Prevention Regulations, and amendments as part of Resolution No. 21, Series of 2012

- **Ordinance No. 1, Series of 2012:** An ordinance restricting open fires and open burning in the unincorporated areas of Fremont County and establishing a permitted requirement for slash pile burning
- **Resolution No. 29, Series of 2013:** A resolution prohibiting the sale, use, and possession of fireworks in the unincorporated areas of Fremont County in accordance with Fremont County Ordinance Number 1, Series of 2012

Fremont County Basic Emergency Operations Plan

The purpose of the Fremont County Emergency Operations Plan (EOP) is to:

- Identify the roles, responsibilities and actions required of County departments and other agencies in preparing for and responding to major emergencies and disasters;
- Ensure a coordinated response by local, state, and federal governments by the use of NIMS in managing emergencies or disasters; to save lives, prevent injuries, protect property and the environment, and to return the affected area to a state of normalcy as quickly as possible;
- Provide a framework for coordinating, integrating, and administering the emergency operations plans and related programs of local, state, and federal governments;
- Provide for the integration and coordination of volunteer agencies and private organizations involved in emergency response and relief efforts.

The EOP uses the all-hazard approach addressing a full range of complex and constantly changing requirements in anticipation of or in response to threats or acts of major disasters (natural or technological), terrorism, and other emergencies. The EOP does not specifically address long-term reconstruction, redevelopment, and mitigation measures. The EOP details the specific incident management roles and responsibilities of departments and agencies involved in emergency management. This plan also helps establish coordination roles of the County departments and agencies. The EOP was designed to address hazards such as flooding, tornadoes, wildfires, severe weather, landslide, drought, earthquake, dam failure, hazardous materials, and terrorism.

The EOP includes emergency support functions (ESF) to provide a concise overview of the incident command structure for each type of incident. The ESFs provide functions and identify responsibilities for each time of incident and the necessary support elements that may be required.

Fremont County Community Wildfire Protection Plan

The Fremont County Community Wildfire Protection Plan (CWPP) is a direct extension of the National Fire Plan authorized by Congress, as a response to the tragic summer wildfires of 2000. As a component of the National Fire Plan, the CWPP is meant to help coordinate fire readiness efforts between local communities and federal agencies through four major goals.

1. Ensure firefighting resources are available.
2. Rebuild communities and ecosystems damaged by wildfire.
3. Thin vegetation in areas where public lands and developing areas meet.
4. Help local residents to reduce fire risk and improve fire protection.

This CWPP has been developed to assist the Sheriff, Fire Officials, and residents of Fremont County in the identification of private and public lands at risk of severe wildfire and explore strategies for the prevention and suppression of such fires.

Fremont County has four County Fire Protection Districts: Cañon City, Florence, South Arkansas, and Deer Mountain. Some remaining unincorporated land is covered by multiple volunteer fire departments, including Howard, and the Tallahassee Volunteer Fire Protection.

Local fire departments/protection districts and the County Sheriff share responsibility for wildland fire suppression on private land jointly. All private land that does not fall under the boundaries of local firefighting agencies is covered by the Sheriff's Wildland Fire Team. The Bureau of Land Management has initial attack responsibility on most BLM and Forest Service lands within Fremont County. The Forest Service in Salida has initial attack responsibility for federal lands along the western-most boundary of Fremont County. Fremont County is a participant in the State Emergency Fire Fund. As a participant, the State agrees to come to the aid of the County should suppression resource needs exceed the capability of suppression resources of the County.

Four Mile – Currant Creek Community Wildfire Protection Plan, 2013

The Tallahassee Fire Protection District together with the Southern Park Fire Protection District (Park County) and the Four Mile Fire Protection District (Teller County) developed a Community Wildfire Protection Plan in 2013 in conjunction with the Bureau of Land Management, U.S. Forest Service, the Colorado State Forest Service and the Fremont County Office of Emergency Management. The intent of the CWPP was to take a closer look at the scientific factors that influence fire behavior in a particular area or region. Four recommendations came out of the Fremont County portion of the plan:

1. Each individual community should take responsibility for reducing the fire hazards to structures and properties. While there are plans to provide service for structure fire protection, it is not yet available. Fuel reduction around structures is the first line of defense and will decrease the hazards for the property owner.
2. Subdivisions in this area are widely spaced and have few access roads. Emergency evacuation options should be investigated and plans should be created for each community with assistance from the fire department. Alternate routes should be identified whenever possible.
3. Water for fire suppression is in short supply throughout the service area. Communities should investigate and install cisterns at suitable locations to improve the capabilities of fire suppression efforts.
4. Many of the communities in the high priority areas are bordered by BLM lands. These boundaries should be given high priority for fuel reduction projects by appropriate methods.

Garden Park Community Wildfire Protection Plan, 2013

The Garden Park Community, in consultation with local fire officials, County, state, and federal agencies and other interested parties, developed the Garden Park CWPP in 2013 and in conjunction with the Bureau of Land Management, U.S. Forest Service, the Colorado State Forest Service and the Colorado Office of Emergency Management. The Garden Park community area is north of Cañon City and covers approximately 37,319 acres. Garden Park contains four subdivisions with 65 lots and an additional 74 parcels of private land. The plan assists the Garden Park community in the identification of subdivision and surrounding private and public lands at risk from wildfire. It identifies strategies for reducing wildfire fuels while improving forest health, supporting the local economy, and improving firefighting response capabilities.

Southwest Cañon Community Wildfire Protection Plan, 2014

The Southwest Cañon CWPP was completed in February 2014. The Southwest Cañon area is on the southwest corner of Cañon City. It covers approximately 12,340 acres, with 3,620 acres classified as WUI by the Colorado State Forest Service. The area contains 1,225 total parcels within the boundary. Of the 1,225 parcels, approximately 60 percent are considered improved and 40 percent unimproved. The CWPP was developed to address issues such as wildfire response, hazard mitigation, community preparedness, training, equipment, or structure protection.

Fremont County Office of Emergency Management

The Office of Emergency Management coordinates with all County fire and EMS services, as well as the Sheriff's Office, to prepare and plan for emergencies in Fremont County. In addition, communication is maintained with state and federal agencies for coordination in the event of large disasters, natural or manmade. The mission of the office is as follows:

> *Our mission is to provide the planning, organization, standardization and integration of all county first responders; enabling them to work together as a single coordinated unit during all phases of Emergency Management including:*
>
> - *Mitigation*
> - *Preparedness*
> - *Response*
> - *Recovery*

Fremont County Department of Building and Environmental Health

The mission of the Department of Building and Environmental Health is to help protect the citizens of Fremont County by establishing and enforcing minimum building requirements in order to reduce the potential hazards of unsafe construction, to assist the general public with the application and permit process and to conduct the department's business in a timely, efficient and professional manner.

The Fremont County Building Department serves all of the unincorporated portions of Fremont County. The department enforces the International Building Code, the International Residential Code and the International Energy Conservation Code, 2006 editions, as amended by resolution of the Fremont BOCC in Resolution No. 40, Series of 2008.

Fremont County Department of Planning and Zoning

The Fremont County Department of Planning and Zoning is a service, information, and enforcement-oriented entity, primarily dealing with land use issues in the unincorporated areas of Fremont County. The department provides information regarding the Fremont County Zoning Resolution, Subdivision Regulations, FEMA FIRMs for Fremont County, and the Colorado Geological Survey Mine Subsidence Maps.

Fremont County Department of Public Health

The mission of the Department of Public Health is to protect and preserve the health of the citizens of Fremont County. Public health nurses provide a variety of services including immunizations, preventive assessments of children and the elderly and a full range of services designed to assist individuals and groups to attain and maintain good health and to cope with illnesses.

Fremont County Department of Transportation

The Fremont County Department of Transportation is responsible for the maintenance and construction of those roadway and drainage structure assets sustained through the direct and indirect efforts of Fremont County.

Fremont Search and Rescue

Fremont Search and Rescue, Inc. is a non-profit volunteer organization that is dispatched through the Fremont County, Colorado Sheriff's Office. Fremont Search and Rescue provides its services to the entire County rendering emergency aid to all, 24 hours a day, whenever needed. Its membership consists of professionally trained technical rope rescue and swiftwater rescue technicians, emergency medical technicians and first responders, as well as technical search and rescue management personnel. Fremont

Search and Rescue members give freely of their own time and money in order to acquire the life-saving skills and knowledge required to provide safe and successful search and rescue operations.

Fremont County Conservation District

The mission of the Fremont County Conservation District is to promote and assist Fremont County land users in the stewardship and sustainability of natural resources through available technical, financial, and educational resources. It is a division of the local government and was formed in 1946.

6.9.4 Town of Brookside

The Town of Brookside has multiple plans and functions in place that guide growth and development within the community. The town staff includes the two Planning and Zoning officers and the Town Clerk, who have significant responsibility for the development and implementation of development plans, codes and regulations in the town. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities within the Town of Brookside.

Brookside Master Plan, 2001

The Brookside Master Plan is the official policy document of the Brookside Planning and Zoning Committee, the Town Board of Trustees, and the Town of Brookside. The plan provides a concise statement of the town's policies for future development within its town limits and the surrounding potential annexation area. The plan was developed to:

- Establish a framework for preserving and enhancing the existing community
- Communicate the land use and development polices of the town to the citizens, landowners, developers, and other government entities
- Provide a basis for updating zoning and subdivision regulations
- Provide a basis for intergovernmental agreements
- Encourage government agencies and private developers to design projects in harmony with the natural characteristics of the land, the capabilities of public services and facilities, and existing development
- Provide a basis for setting priorities and funding mechanisms for public capital improvements.

The plan lists the town's principal issues, goals, and recommendations for actions. The following issues, goals, and actions are related to hazard mitigation:

Issue 1: The Town Natural Environment

- **Key Policy:** Ensure that the impacts of new development on the natural environment are recognized and that measures are implemented to mitigate potential negative impacts.
- **Key Policy:** Require environmentally sensitive designs for all types of development that preserve desirable natural features, create favorable space for wildlife, and minimize pollution.
- **Key Policy:** Promote public education regarding energy conservation techniques.
- **Key Policy:** Strictly enforce Town ordinances that protect the natural environment and aesthetic quality of the Town.
- **Actions: Wetlands and Flood Zones**
  - The Town shall prohibit any development in areas which have been officially designated as floodway areas.

  - The Town requires that any proposed activities within or adjacent to wetland areas are to be referred by the developer to appropriate state or federal agencies as designated by the Town to ensure compliance with existing requirements for the preservation of wetlands and/or for the mitigating of the effects of such proposed activities.

- **Actions: Rockfall and Steep Slope Areas**
  - The Town shall prohibit development in areas which have been designated steep slope or slide areas. The Town shall further prohibit any development which could endanger public safety or property by being located on or near areas determined to be geologically unstable. Subsidence reports certified by qualified professionals, as prescribed by the Colorado Geological Survey, shall be required prior to development in any areas known or suspected of being undermined, to probe the safety of these areas.
  - The Town acknowledges the importance of the natural aesthetic features of the hillsides and ridge lines to the visual quality of the area. Development of these areas shall respond to the preservation of views and natural features, and mitigate potential environmental problems that are associated with building on steep slopes.
- **Actions: Water and Air Quality**
  - The Town will work toward attainment of federal and state environmental standards by cooperating with the environmental agencies and participating in programs designed to reduce pollution.
  - The Town will require best management practices as maintained by the USDA Natural Resource Conservation Service and CSU Cooperative Extension to be utilized for the control of soil erosion and non-point source pollution, such as run-off from fertilized farmland.

Issue 6: The Land Use Plan

- **Key Policy:** Developments with requirements beyond existing levels of police and fire protection, parks, roads, schools, and utilities shall not be allowed to develop unless it is demonstrated that such services can be adequately funded and maintained. Such demonstration will be the developer's responsibility.
- **Actions:**
  - Consider the environmental impacts of all development.
  - Design parking and accesses to minimize stormwater run-off.

Issue 7: Housing

- **Key Policy:** Continued enforcement of the Uniform Building Code.
- **Key Policy:** Ongoing update of Zoning and Subdivision Ordinances.
- **Actions:**
  - Limit residential development in natural hazard areas and require construction modification to mitigate impacts to natural areas.
  - Provide information to the public as to the types and location of natural hazards.
  - Assure accessibility of emergency vehicles to residential areas.

Brookside Land Development Use and Zoning Code, 2002 (as amended)

The Brookside Land Development Use and Zoning Code was adopted in 2002 and amended in 2008 (Ordinance No. 04-08). It is the intent of the zoning code to ensure the orderly, efficient and integrated development of the Town in a way that both promotes the health, safety, and general welfare of its residents and that is compatible and protective of the natural environment. Among other goals, the purpose of the zoning code is to prevent loss of life and property from fire, flooding, geologic hazards, and other natural or man-made dangers.

Brookside Building Permits/Inspection

All building permits in the Town of Brookside are issued and inspected through the Town government. The Town of Brookside retains a building inspector to enforce the Land Development Use and Zoning Code.

6.9.5 City of Cañon City

The City of Cañon City government is made up of the following offices and departments:

- City Administration
- City Clerk
- Community Development (Planning and Zoning, Building, Code Enforcement)
- Engineering (Includes Streets Division)
- Equipment Repair
- Finance/Sales Tax
- Library and Museum
- Parks, Forestry, and Cemetery
- Police
- Water Department (Water Treatment Plant and Water Distribution Division)

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Cañon City Comprehensive Master Plan Update, 2001

The Cañon City Comprehensive Master Plan was updated in 2001 with support from the Cañon City Planning Commission and the community, including the Fremont County Commissioners, the Cañon City Chamber of Commerce, and the UAACOG. The original Comprehensive Plan was completed in 1979. The plan include the following elements:

- **The Vision Process:** An outline and graphic reflects public discussion about what people would like Cañon City to be.
- **Assets:** The important elements of Cañon City that the community should preserve and enhance.
- **Values:** A description of the important values against which to measure all projects.
- **Snapshot in Time:** A description of the existing conditions in Cañon City: How is it working today? How is the economy? Is the infrastructure in good shape and does it function well?
- **Goals, Objectives, and Strategies:** A major component of the comprehensive plan. Strategies are ranked and key participants are delineated.

- **Framework Diagram:** A map of Cañon City's sub-areas, connections, and natural features that illustrates the overall growth patterns for Cañon City and directs its growth and development; focuses the discussion of how individual ideas and projects fit into the overall system; and creates a common understanding, logic, and a language for the discussion of the future of Cañon City.
- **Implementation Plan:** Prioritizes and assigns responsibility for the various recommended strategies as outlined under designated goals and objectives.

The Comprehensive Master Plan Update includes goals, objectives and strategies, many of which integrate and complement the hazard mitigation plan initiatives. The following goals, objectives, and strategies directly or indirectly mitigate hazards identified in this plan:

- **Goal:** Promote planning and design efforts, which establish a sense of community, both in terms of theme and identity.
  - **Objective:** Establish landscaping standards and/or programs that complement the surrounding community or environment.
    - **Strategy:** Evaluate and maintain a tree and/or woodlot ordinance to preserve and protect the naturally forested areas.
  - **Objective:** Recognize Cañon City as a destination place.
    - **Strategy:** Once significant historic, cultural, and natural features are quantified, protect, preserve and promote these features for the enjoyment of the community and the promotion of tourism.
- **Goal:** Establish land use opportunities that are compatible with the character and needs of the community.
  - **Objective:** While providing adequate safeguards to minimize the impacts of intense land use activities on roads, adjacent land uses, and the environment, continue to allow adequate areas for commercial, retail, and industrial activities.
    - **Strategy:** Revise zoning ordinance to require preliminary site plan meetings between developers and City officials and where appropriate County officials.
    - **Strategy:** Within the zoning ordinance, continue to evaluate and maintain standards for uses that have potentially harmful side effects to the environment (i.e., stormwater, drainage, and soil erosion).
    - **Strategy:** Within the zoning ordinance, evaluate and adopt design standards (including buffer zones and landscaping requirements) that mitigate conflicting land uses.
    - **Strategy:** Work in conjunction with Fremont County to develop access control and traffic impact standards for City and County roads within the growth management area.
    - **Strategy:** Work in conjunction with CDOT to ensure proper roadway access and capacity for proposed new development along the state and U.S. highways.
    - **Strategy:** Revise the zoning ordinance and amend the zoning map to include an "overlay zone" of transitional land use areas in which specific land use criteria and standards are applied to new and/or expanding land use activities.
- **Goal:** Implement a parks, trails, and open space master plan and provide recreational opportunities that meet the needs of the community.
  - **Objective:** As a component of a parks, trails, and open space master plan, consider open space criteria that protect natural resources, wildlife, slopes, ridgelines, view sheds, and cultural sites.

- **Strategy:** Provide good stewardship in the preservation of City-owned open spaces, greenways, and natural areas.
- **Strategy:** Identify, rate, and map the environmentally sensitive areas, which may need special considerations for protection.

Cañon City Municipal Code

Some of the chapters in the Cañon City Municipal Code have provisions related, directly or indirectly, to hazard mitigation. These provisions are discussed below:

- **Title 8 Health and Safety**
  - **Chapter 8.48: Fireworks –** This chapter includes restrictions on the use of fireworks inside and outside city limits.
  - C**hapter 8.50: Open Fires and Outdoor Burning –** This chapter includes provisions for City personnel to issue and enforce orders banning outdoor fires and restricting access to hazardous fire areas.
  - **Chapter 8.70: Stormwater Illicit Discharges and Permit Requirements –** The purpose of this chapter is to regulate non-stormwater discharges to the storm drainage system, and to protect and enhance the water quality of watercourses, water bodies, and wetlands.
  - **Chapter 8.80: Floodplain Management Regulations –** The purpose of this chapter is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas.
- **Title 9 Public Peace, Morals, and Welfare**
  - **Chapter 9.44: Overnight camping and open fires in Red Canyon Park, Temple Canyon Park, and the Royal Gorge Park –** This chapter includes a provision regarding the safe use of open fires within the Red Canyon Park, Temple Canyon Park and Royal Gorge Park.
- **Title 13 Public Utilities**
  - **Chapter 13.04: Water Regulations –** This chapter allows the city administrator to govern the use of water in case of an emergency.
  - **Chapter 13.10: Stormwater Utility –** This chapter is intended to promote the public health, safety, and welfare by permitting the movement of emergency vehicles during storm or flooding periods; minimize storm and flood losses and the damage resulting from uncontrolled stormwater runoff in the city; and provide for the establishment and implementation of a master drainage plan for effective stormwater and flood management. Note: The City of Cañon City is a permitted Phase II MS4 (Small Municipal Separate Storm Water System) community.

Cañon City Subdivision and Development Regulations

The goal of the Subdivision and Development Regulations of the City of Cañon City is to promote the health, safety, convenience, order, prosperity, and welfare of the present and future inhabitants of the City. This goal includes the following objectives that relate directly or indirectly to hazard mitigation:

- Provide open spaces and facilities for adequate stormwater management.
- Provide protection from geologic hazards and flood prone areas.

Cañon City Resolutions and Ordinances

Cañon City has adopted resolutions and ordinances that directly or indirectly mitigate hazards identified in this plan. These resolutions include the following:

- Ordinance No. 5, Series of 2012 – An ordinance updating and codifying the City's Floodplain Regulations

Hogbacks Open Space and Recreational Area Plan

The purpose of the Hogbacks Open Space and Recreational Area Plan was to provide an accessible and enjoyable experience for users of the space while minimizing the environmental impacts. The Hogbacks Open Space is an approximately 500-acre area of undeveloped land between Cañon City and Highway 50. The Hogbacks area was designated as open space by the City of Cañon City in 2008. The plan includes several actions to address the loss of topsoil, erosion, and drainage problems that affect the Hogback Open Space area, including revegetation and improvements to storm drains.

Grading, Erosion, and Sediment Control Plan Manual

The City of Cañon City prepared the Grading, Erosion, and Sediment Control Plan Manual to promote environmentally sound construction practices to limit the erosion and stormwater runoff created when soil is disturbed during construction activities.

6.9.6 Town of Coal Creek

The Town of Coal Creek has multiple plans and functions in place that guide growth and development within the community. The Town's planning mechanisms include the Coal Creek Comprehensive Plan and the Town of Coal Creek Land Use and Zoning Codes (2013).

The Coal Creek Comprehensive Plan included the following qualities that attribute to Coal Creek's small town vision and character:

1. Walkable and pedestrian oriented recreational trail system.
2. Variety of housing types.
3. Safe and secure.
4. Friendly, opportunity to know one's neighbors and care for one another.
5. Rural, unique natural setting with wide open views.
6. Small central business district with locally owned businesses.
7. No excessive traffic.
8. Quiet, slower paced environment.
9. Town-wide activities.
10. Cultural heritage

The Land Use and Zoning Codes include community design standards (Article 2), zoning codes (Article 3) and subdivision codes (Article 4).

6.9.7 City of Florence

The City of Florence government is made up of the following offices and departments:

- Administration
- City Clerk
- City Manager
- Finance Department
- Municipal Court
- Planning and Zoning Department

- Police Department
- Public Works
- Water Department

Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Florence Municipal Code

The City of Florence Municipal Code includes provisions concerning the administration and organization of the City animals, buildings, abandoned automobiles, peddlers, finances, streets, nuisances, traffic, offenses, civil defense, elections, and zoning. Some of the chapters in the Florence Municipal Code have provisions related, directly or indirectly, to hazard mitigation. These provisions are discussed below:

- **Title 8 – Health and Safety**
  - **Chapter 8.24 (Fire Prevention):** Contains regulations for open burning and the storage of flammable material and prohibits use of fireworks.
- **Title 13 – Public Services**
  - **Chapter 13.24 (Protection of Water Supply):** Establishes City of Florence Watershed District; restricts activities that may negatively impact the City's water supply.
- **Title 15 – Buildings and Construction**
  - **Chapter 15.04 (Primary and Secondary Codes and Building Standards Adopted by Reference):**
    - Adoption of the 2006 editions of the International Building Code, International Residential Code, International Mechanical Code, International Energy Code, and International Existing Building Code.
    - Adoption of the Flood Damage Prevention Resolution of the City of Florence as the official floodplain development resolution of the City.
    - Adoption of the Flood Insurance Rate Study and Accompanying Flood Insurance Rate Maps, dated September 19, 2007.
  - **Chapter 15.14 (Flood Damage Prevention and Protection):** Official action to carry out the objectives of the NFIP, and review building permit application and subdivision proposals.
- **Title 17 – Zoning** The ordinance codified in this title is for the purpose of implementing the comprehensive plan of the City and is the Florence Land Use Code.

City of Florence Subdivision Regulations, 1995 (as amended)

In 1995, the City Council of the City of Florence passed Ordinance 9-95, adopting new subdivision regulations for the City of Florence. The City Council also adopted by reference the revised 2001 edition of the Standard Construction Specifications and Standard Details for the City of Pueblo, Colorado Department of Public Works in 2003. These regulations govern the subdivision of land within the City of Florence.

City of Florence Phased Water Conservation Plan, 2003

The Phased Water Conservation Plan outlines the acceptable use of water by customers during varying conditions, including periods of drought. The plan covers indoor uses (drinking water, toilets, dishwashers, laundry) and outdoor uses (irrigation, washing vehicles). The plan also includes provisions for rate increases to promote conservation of water.

6.9.8 Town of Rockvale

The Town of Rockvale has multiple regulations and ordinances in place that guide growth and development within the community. The Town staff includes the Town Administrator and other part-time or contract employees. The Town's planning mechanisms include the following:

- Building Codes – The Town adopted the Uniform Building Code (1994 edition) and the International Energy Conservation Code (2006 edition).
- Emergency Action Plan
- Five Year Master Plan, 2012 - 2017
- Planning and Zoning Regulations
- Water Conservation Plan, 2013
- Flood Damage Prevention Ordinance, 2012 (including the Colorado Floodplain Damage Prevention Ordinance as a regulation for the Town of Rockvale).

CHAPTER 7.
HAZARD MITIGATION CAPABILITIES ASSESSMENT

The planning team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of an agency's mission, programs and policies, and evaluates its capacity to carry them out.

7.1 FREMONT COUNTY

7.1.1 Legal and Regulatory Capabilities

Table 7-1 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Fremont County.

TABLE 7-1.
FREMONT COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	Yes	The 2001 Fremont County Master Plan is the official document for guiding both the public and private sector in land use decisions for the County. Currently being updated.
Zoning ordinance	Yes	The Fremont County Zoning Resolution (2009) (last amended Resolution No. 17, Series of 2014 – dated 5/27/14) establishes zoning districts in the unincorporated areas of Fremont County and regulates the use of buildings, structures, and land for trade, industry, residence, recreation, public, and other purposes; the location, height, bulk and size of buildings and other structures; the lot size and percentage that may be occupied; the size of yards, courts and other open spaces; and the density and distribution of population.
Subdivision ordinance	Yes	The Fremont County Subdivision Regulations (2000, as amended) (last amended Resolution No. 14, Series of 2014 – 4/8/14) established rules, regulations and standards governing the subdivision of land within the unincorporated areas of Fremont County.
Growth management	Yes	Growth management is accomplished through compliance with the Fremont County Zoning Resolution and Subdivision Regulations, as guided by the Fremont County Master Plan.
Floodplain ordinance	Yes	Fremont County Zoning Resolution and Subdivision Regulations, as amended through Resolution No. 38, Series of 2011: Adopting revised Fremont County Flood Damage Prevention Regulations, and amendments as part of Resolution No. 21, Series of 2012. Floodplain ordinance administered by Building Department.
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Ordinance No. 1, Series of 2012: An ordinance restricting open fires and open burning in the unincorporated areas of Fremont County and establishing a permitted requirement for slash pile burning Resolution No. 29, Series of 2013: A resolution prohibiting the sale, use, and possession of fireworks in the unincorporated areas of Fremont County in accordance with Fremont County Ordinance Number 1, Series of 2012

TABLE 7-1.
FREMONT COUNTY REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Building code	Yes	The International Building Code, International Residential Code and International Energy Conservation Code, 2006 editions, were adopted as the Building Code of Fremont County (Resolution No. 40, Series of 2008, effective July 1, 2008)
Erosion or sediment control program	No	Individual Property Erosion Control Maps are required as dictated in the Fremont County Subdivision Regulations for Preliminary Plats. However, no overall County Erosion Management Program has been identified. The Fremont County Conservation District (under the Colorado Department of Agriculture, Natural Resource Conservation Service) offers programmatic assistance in Fremont County.
Stormwater management	Yes	Stormwater drainage plans are required for all developments through the Subdivision and Zoning Regulations.
Site plan review requirements	Yes	The County Planning and Zoning Department administers a "Site Specific Development Plan" review process – vested property right in conjunction with a subdivision.
Capital improvement plan	Yes	
Economic development plan	Yes	Goals, objectives, and strategies were developed in the Fremont County Master Plan to guide economic development of the County.
Local emergency operations plan	Yes	Fremont County Emergency Operations Plan
Other special plans	Yes	Fremont County Community Wildfire Protection Plan; Four Mile – Currant Creek Community Wildfire Protection Plan; Garden Park Community Wildfire Protection Plan; Southwest Cañon Community Wildfire Protection Plan
Flood insurance study or other engineering study for streams	Yes	The Department of Planning and Zoning is the local repository for the FEMA FIRM for the unincorporated areas of the County and makes the maps available for public review. The department maintains flood insurance rate maps in conjunction with the NFIP.
Elevation certificates	Yes	The Fremont County Building Department keeps records of Flood Elevation Certificates on file in its office.

7.1.2 Administrative and Technical Capabilities

Table 7-2 identifies the County personnel responsible for activities related to mitigation and loss prevention in Fremont County.

TABLE 7-2.
FREMONT COUNTY ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Department of Planning and Zoning
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Building and Environmental Health Department/Fremont County Engineer
Planner/engineer/scientist with an understanding of natural hazards	Yes	Department of Planning and Zoning/Fremont County Engineer
Personnel skilled in GIS	Yes	Department of Planning and Zoning/Fremont County GIS Authority
Full-time building official	Yes	Building and Environmental Health Department
Floodplain manager	Yes	Department of Planning and Zoning. Administered by the Building Department
Emergency manager	Yes	Department of Emergency Management
Grant writer	No	
Other personnel	Yes	Environmental Health Department and Public Health Department
GIS data: Hazard areas	No	
GIS data: Critical facilities	Yes	Fremont County GIS Authority
GIS data: Building footprints	No	
GIS data: Land use	Yes	Fremont County GIS Authority
GIS data: Links to Assessor's data	Yes	Fremont County GIS Authority
Warning systems/services (Reverse callback, cable override, outdoor warning signals)	Yes	911 based emergency phone notifications, EAS, Fremont County Emergency Notification System, neighborhood warning procedures
Other		

7.1.3 Financial Capabilities

Table 7-3 identifies financial tools or resources that Fremont County could use to help fund mitigation activities.

TABLE 7-3.
FREMONT COUNTY FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	No

TABLE 7-3.
FREMONT COUNTY FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Impact fees for new development	Yes
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

7.2 TOWN OF BROOKSIDE

7.2.1 Legal and Regulatory Capabilities

Table 7-4 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the Town of Brookside.

TABLE 7-4.
BROOKSIDE REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	Yes	Brookside Master Plan (2001)
Zoning ordinance	Yes	Brookside Land Development Use and Zoning Code (2002, as amended)
Subdivision ordinance	Yes	Subdivision regulations are included in the Brookside Land Development Use and Zoning Code.
Growth management	Yes	Growth management is accomplished through compliance with the Land Development Use and Zoning Code, as guided by the Brookside Master Plan.
Floodplain ordinance	Yes	At FEMA's request, Brookside passed floodplain ordinances in 2007, 2008, and 2013
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Some stormwater, erosion control, and slope provisions are included in the Brookside Land Development Use and Zoning Code.
Building code	Yes	The Town of Brookside adopted the International Building Code and international Residential Code (2003 editions), and the International Energy Conservation Code (2006 edition).
Erosion or sediment control program	No	
Stormwater management	No	
Site plan review requirements	Yes	Site plan review requirements are listed in Section IV (Site Plans) of the Brookside Land Development Use and Zoning Code.

TABLE 7-4.
BROOKSIDE REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Capital improvements plan	No	
Economic development plan	Yes	Key policies and actions to guide economic development of the Town are included in the Brookside Master Plan.
Local emergency operations plan	No	The Town of Brookside works in conjunction with the Fremont County Office of Emergency Management.
Other special plans	Yes	SEMS plan (required by USDA) for water utility system
Flood insurance study or other engineering study for streams	Yes	Previous FEMA floodplain maps show no floodplains in Brookside.
Elevation certificates	No	

7.2.2 Administrative and Technical Capabilities

Table 7-5 identifies the Town personnel responsible for activities related to mitigation and loss prevention in Brookside.

TABLE 7-5.
BROOKSIDE ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes (limited)	Planning and Zoning Representative
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Planning and Zoning Representative/Town Building Inspector
Planner/engineer/scientist with an understanding of natural hazards	No	
Personnel skilled in GIS	No	
Full-time building official	Yes	Planning and Zoning Department/Town Building Inspector (when necessary)
Floodplain manager	No	
Emergency manager	No	The Town of Brookside works in conjunction with the Fremont County Emergency Manager.
Grant writer	Yes	Town Clerk
Other personnel	Yes	Town Clerk
GIS data: Hazard areas	No	
GIS data: Critical facilities	No	
GIS data: Building footprints	No	
GIS data: Land use	No	

TABLE 7-5.
BROOKSIDE ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
GIS data: Links to Assessor's data	No	
Warning systems/services (Reverse callback, cable override, outdoor warning signals)	Yes	County 911 based emergency phone notifications
Other	Yes	Local TV or radio station

7.2.3 Financial Capabilities

Table 7-6 identifies financial tools or resources that Brookside could use to help fund mitigation activities.

TABLE 7-6.
BROOKSIDE FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

7.3 CITY OF CAÑON CITY

7.3.1 Legal and Regulatory Capabilities

Table 7-7 lists regulatory and planning tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Cañon City.

TABLE 7-7.
CAÑON CITY REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	Yes	Cañon City Comprehensive Master Plan (updated 2001)
Zoning ordinance	Yes	Title 17 of the Cañon City Municipal Code addresses zoning. Chapter 17.04: General Provisions and Map are enforced by the City Planning and Zoning Division, located within the Community Development Department
Subdivision ordinance	Yes	Cañon City Subdivision and Development Regulations
Growth management	Yes	Cañon City Subdivision and Development Regulations, as guided by the Comprehensive Master Plan
Floodplain ordinance	Yes	Cañon City Municipal Code, Chapter 8.80 (Floodplain Management Regulations)
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Grading, Erosion, and Sediment Control Plan and Cañon City Municipal Code, Chapters 8.48 (Fireworks), 8.50 (Open Fires and Outdoor Burning), 8.70 (Stormwater Illicit Discharges and Permit Requirements), 9.44 (Overnight camping and open fires in Red Canyon Park, Temple Canyon Park, and the Royal Gorge Park), 13.04 (Water Regulations), 13.10 (Stormwater Utility)
Building code	Yes	The City adopted the 2006 editions of the International Residential Code, International Building Code, International Mechanical Code, International Energy Conservation Code, and International Fuel Gas Code
Erosion or sediment control program	Yes	Grading, Erosion, and Sediment Control Plan
Stormwater management	Yes	Cañon City Municipal Code, Chapters 8.70 (Stormwater Illicit Discharges and Permit Requirements) and 13.10 (Stormwater Utility)
Site plan review requirements	Yes	The Cañon City Planning and Zoning Division, within the Community Development Department, enforce the building site plan review process as required by the municipal code.
Capital improvements plan	Yes	
Economic development plan	Yes	Goals, objectives, and strategies were developed in the Cañon City Comprehensive Master Plan to guide economic development of the City.
Local emergency operations plan	Yes	The City has internal emergency operations plans as well as work in tandem with the Fremont County Emergency Management.
Other special plans	Yes	The City has a drainage basin plan for all major basins located within the City.
Flood insurance study or other engineering study for streams	Yes	The Engineering Department maintains flood insurance rate maps in conjunction with the NFIP.
Elevation certificates	Yes	

7.3.2 Administrative and Technical Capabilities

Table 7-8 identifies the City personnel responsible for activities related to mitigation and loss prevention in Cañon City.

TABLE 7-8.
CAÑON CITY ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Community Development (Planning and Zoning Division) and Engineering Departments
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Community Development (Building Division) and Engineering Departments
Planner/engineer/scientist with an understanding of natural hazards	Yes	Community Development and Engineering Departments
Personnel skilled in GIS	Yes	The Engineering Department collects and maintains City information and coordinates with the Fremont County GIS Authority.
Full-time building official	Yes	Community Development Department – Building Division
Floodplain manager	Yes	Engineering Department (Two professional engineers and one certified floodplain manager). Funds available through City stormwater program for professional consulting services, studies, and oversight for compliance with NFIP.
Emergency manager	No	Cañon City works in conjunction with the Fremont County Emergency Manager.
Grant writer	No	
Other personnel	No	
GIS data: Hazard areas	Yes	
GIS data: Critical facilities	Yes	
GIS data: Building footprints	Yes	
GIS data: Land use	Yes	
GIS data: Links to Assessor's data	Yes	
Warning systems/services (Reverse callback, cable override, outdoor warning signals)	Yes	911 based emergency phone notifications
Other	Yes	Local television channel (Channel 19 Government Access)

7.3.3 Financial Capabilities

Table 7-9 identifies financial tools or resources that Cañon City could use to help fund mitigation activities.

TABLE 7-9.
CAÑON CITY FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other (Stormwater Utility Fees)	Yes

7.4 CITY OF FLORENCE

7.4.1 Legal and Regulatory Capabilities

Table 7-10 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Florence.

TABLE 7-10.
FLORENCE REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General plan	No	
Zoning ordinance	Yes	Title 17 (Zoning) of the Florence Municipal Code
Subdivision ordinance	Yes	Title 16 (Subdivisions) of the Florence Municipal Code and the City of Florence Subdivision Regulations (1995)
Growth management	Yes	Growth management is accomplished through Title 16 of the Florence Municipal Code and the City of Florence Subdivision Regulations.
Floodplain ordinance	Yes	Titles 15 (Buildings and Construction) and 17 (Zoning) include provisions for floodplain management, specifically Chapter 15.14 (Flood Damage Prevention and Protection); Floodplain Development Resolution No. 24-2011 (11/24/11)
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	Chapters 8.24 (Fire Prevention) and 13.24 (Protection of Water Supply) of the Florence Municipal Code
Building code	Yes	The City adopted the 2006 editions of the International Building Code, International Residential Code, International Mechanical Code, International Energy Code, International Existing Building Code (Chapter 15.04 of the Florence Municipal Code).

TABLE 7-10.
FLORENCE REGULATORY MITIGATION CAPABILITIES MATRIX

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
Erosion or sediment control program	No	
Stormwater management	No	
Site plan review requirements	Yes	Site Specific Development Plan review is required as outlined in Title 16 (Subdivisions) of the Florence Municipal Code. The City Planning Commission must review all plans and make recommendations to the City Council.
Capital improvements plan	No	
Economic development plan	No	
Local emergency operations plan	No	The City of Florence works in conjunction with the Fremont County Office of Emergency Management.
Other special plans	No	
Flood insurance study or other engineering study for streams	Yes	Flood Insurance Study, dated January 6, 2012
Elevation certificates	Yes	The City Building Department maintains a record of elevations, as required by City Municipal Code Chapter 15.14.030.

7.4.2 Administrative and Technical Capabilities

Table 7-11 identifies the City personnel responsible for activities related to mitigation and loss prevention in Florence.

TABLE 7-11.
FLORENCE ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Planning and Zoning Department
Engineer/professional trained in construction practices related to buildings or infrastructure	Yes	Planning and Zoning Department
Planner/engineer/scientist with an understanding of natural hazards	Yes	Planning and Zoning Department
Personnel skilled in GIS	Yes	The Planning and Zoning Department collects City information and coordinates with the Fremont County GIS authority.
Full-time building official	Yes	City Manager

TABLE 7-11.
FLORENCE ADMINISTRATIVE/TECHNICAL MITIGATION CAPABILITIES MATRIX

Personnel Resources	Yes/No	Department/Position
Floodplain manager	Yes	City Manager
Emergency manager	No	The City of Florence works in conjunction with the Fremont County Emergency Manager.
Grant writer	Yes	Volunteer team
Other personnel	No	
GIS data: Hazard areas	No	
GIS data: Critical facilities	No	
GIS data: Building footprints	No	
GIS data: Land use	No	
GIS data: Links to Assessor's data	No	
Warning systems/services (Reverse callback, cable override, outdoor warning signals)	Yes	911 based emergency phone notifications, EAS, warning sirens
Other	Yes	Local radio station

7.4.3 Financial Capabilities

Table 7-12 identifies financial tools or resources that Florence could use to help fund mitigation activities.

TABLE 7-12.
FLORENCE FINANCIAL MITIGATION CAPABILITIES MATRIX

Financial Resources	Accessible/Eligible to Use (Yes/No)
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for water, sewer, gas, or electric services	Yes
Impact fees for new development	Yes
Incur debt through general obligation bonds	Yes
Incur debt through special tax bonds	Yes
Incur debt through private activities	No
Withhold spending in hazard prone areas	No
Other	No

CHAPTER 8.
DAM FAILURE

DAM FAILURE RANKING			
Fremont County	Canon City	Florence	Brookside
Medium	Medium	Low	Low

8.1 GENERAL BACKGROUND

8.1.1 Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

DEFINITIONS

Dam—A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water. Flood control and storm runoff detention dams are included (2-CCR 402-1, Rule 4, Section 4.2.5).

Dam Failure—An uncontrolled release of impounded water due to structural deficiencies in dam.

Emergency Action Plan—A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. It contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency. (FEMA 64)

High Hazard Dam—Dams where failure or operational error will probably cause loss of human life. (FEMA 333)

Significant Hazard Dam—Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can impact other concerns. Significant hazard dams are often located in rural or agricultural areas but could be located in areas with population and significant infrastructure. (FEMA 333)

Levee—A man-made structure, usually an earthen embankment or concrete floodwall, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide reasonable assurance of excluding temporary flooding from the leveed area.

8.1.2 Causes of Levee Failure

The following information is excerpted from the State of Colorado Flood Mitigation Plan. The HAZUS-MH database and the U.S. Army Corp of Engineers National Levee Database list no known levees in Fremont County. It is possible that there are levees located within the County that are not listed in these databases.

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure. Unfortunately, in the rare occurrence when a levee system fails or is overtopped, severe flooding can occur due to increased elevation differences associated with levees and the increased water velocity that is created. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the amount of water.

The complicated nature of levee protection was made evident by events such as Hurricane Katrina. Flooding can be exacerbated by levees that are breached or overtopped. As a result, FEMA and the U.S. Army Corps of Engineers are re-evaluating their policies regarding enforcement of levee maintenance and post-flood rebuilding. Both agencies are also conducting stricter inspections to determine how much protection individual levees actually provide. The CWCB is committed to aiding local governments with the increased levels of compliance with federal regulations. CWCB will assist qualifying entities who are in good standing with the NFIP through technical and financial assistance. CWCB assistance may include grant funding, participation in levee inspections, assistance in developing Maintenance Deficiency Correction Plans, site visits, and participation in public hearings. In addition, the CWCB will also discourage the construction of new levees to protect new developments, and instead encourage other types of flood mitigation projects.

8.1.3 Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

Colorado Rules and Regulations for Dam Safety and Dam Construction

The *Colorado Rules and Regulations for Dam Safety and Dam Construction* (2-CCR 402-1, January 1, 2007) apply to any dam constructed or used to store water in Colorado. These rules apply to applications for review and approval of plans for the construction, alteration, modification, repair, enlargement, and removal of dams and reservoirs, quality assurance of construction, acceptance of construction, non-jurisdictional dams, safety inspections, owner responsibilities, emergency action plans, fees, and restriction of recreational facilities within reservoirs. Certain structures (defined in Rule 17) are exempt from these Rules. The purpose of the rules is to provide for the public safety through the Colorado Safety of Dams Program by establishing reasonable standards and to create a public record for reviewing the performance of a dam.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, 1997).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every 5 years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors and evaluates seismic research and applies it in investigating and performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

8.2 HAZARD PROFILE

8.2.1 Past Events

Colorado has a history of dam failure, with more than 130 known dam failures since 1890. A number of dams were breeched in September 2013, but none were in Fremont County. According to the *State Engineer's 27th Annual Report on Dam Safety to the Colorado General Assembly Fiscal Year 2010-11 and 2011-12*, no jurisdictional dam failures occurred in Colorado in water year 2010-2011 or water year 2011-2012. Fourteen dam safety incidents were logged for the same time period statewide. Dam safety incidents are defined as situations at dams that require an immediate response by dam safety engineers.

Incidents also included on the WY 11-12 list were associated with the large and damaging wildfires that occurred, particularly the High Park fire and the Waldo Canyon fire. These fires were tracked to ensure no damage would occur on dams within or near the fire areas.

There have been no reported dam failures in Fremont County since the failure of Shaeffer Dam in June of 1921. The U.S. Army Corps of Engineers describes the events that led to the dam failure as follows (Johnson, 2011).

> *Cloudbursts over the upper Arkansas River basin on 3 June 1921 caused a rapid rise in the Arkansas River and in Fountain Creek at Pueblo. They climbed as much as 3.5 feet in fifteen minutes and overtopped Pueblo's floodwalls and levees. The flood created 6.5 feet over the levees and high velocity currents swept over the city, destroying bridges, water supply and sewage systems, telephone communications, and electric power lines. The flood washed out all but one bridge, destroyed five hundred buildings and drowned 156 people.*
>
> *Recovery efforts had just begun when Schaeffer Dam up Beaver Creek failed, releasing another wall of water. The resulting flood destroyed the towns of Portland and Swallows and, because Pueblo's flood protection system was already breached, it disastrously inundated the city a second time.*

If failure were to occur on dams outside of Fremont County that lie along the Arkansas River, Grape Creek, and Beaver Creek waterways, there would be significant impacts for the people and property within the County.

8.2.2 Location

HAZUS-MH contains a database of dams based on the National Inventory of Dams. This database lists 14 dams in the County and classifies dams based on the potential hazard to the downstream area resulting from failure or mis-operation of the dam or facilities:

- **High Hazard Potential**—Probable loss of life (one or more)
- **Significant Hazard Potential**—No probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns; often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure
- **Low Hazard Potential**—No probable loss of human life and low economic or environmental losses; losses are principally limited to the owner's property

Based on these classifications, there are 4 high hazard dams and 2 significant hazard dams in Fremont County. These dams are listed in Table 8-1. Figure 8-1. High and Significant Hazard Dams shows locations of the high-potential-loss dams in the County.

TABLE 8-1.
HIGH AND SIGNIFICANT HAZARD DAMS IN FREMONT COUNTY

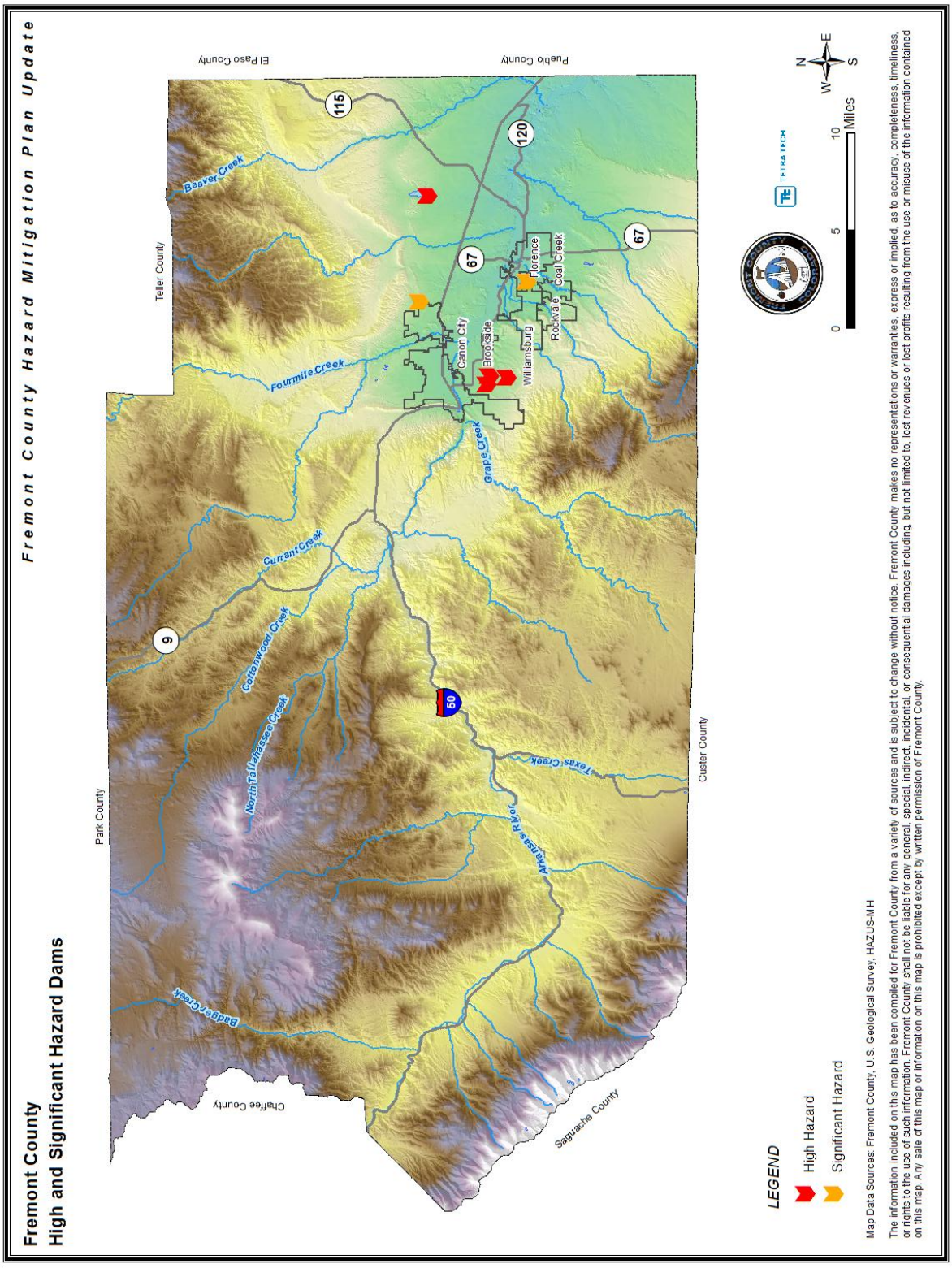
Name	River	Near City	Max Storage (Acre-Feet)	Hazard Class
Brush Hollow	Brush Hollow Creek	Pueblo	5,071	High
Cañon Watershed C-3	Sand Creek	Cañon City	1,900	High
Cañon Watershed Detention C-4	Arkansas River-TR	Cañon City	410	High
Cotter Tailings	Sand Creek-OS	Cañon City	5,400	High
Dry Creek Flood Control	Dry Creek	Florence	242	Significant
Mud Gulch Detention MG-1	Arkansas River-TR	Florence	773	Significant

Source: HAZUS-MH 2.1 National Inventory of Dams

There are an uncounted number of 'non-jurisdictional' dams on public and private lands in the County. These are small dams that normally do not store water but may impound water during heavy precipitation events. Because they are not monitored or maintained, there is potential for them to overtop or fail and cause flooding and property damage during a significant rainfall event. The extent and risk associated with these dams is not known.

The areas of the County most likely to be impacted by a dam failure are the Beaver Creek area and along the Arkansas River. Fremont County could be impacted by several high hazard dams that are located outside of the County. If a failure of one of these high hazard dams occurred, it could result in loss of life. Most of the High Hazard Dams are located outside of the County and their drainages enter Fremont County either by direct drainage through parts of the County or by inflow into the Arkansas River upstream from Fremont County.

Figure 8-1. High and Significant Hazard Dams



8.2.3 Frequency

Based on one occurrences of dam failure in the past 95 years in Fremont County, it is estimated that there is between 1- and 10-percent chance of occurrence in any given year, or a recurrence interval of 11 to 100 years.

8.2.4 Severity

The U.S. Army Corps of Engineers developed the classification system shown in Table 8-2 for the hazard potential of dam failures. The Corps of Engineers hazard rating systems are both based only on the potential consequences of a dam failure; neither system takes into account the probability of such failures.

TABLE 8-2.
CORPS OF ENGINEERS HAZARD POTENTIAL CLASSIFICATION

Hazard Category[a]	Direct Loss of Life[b]	Lifeline Losses[c]	Property Losses[d]	Environmental Losses[e]
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

8.2.5 Warning Time

Warning time for dam failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours (U.S. Army Corps of Engineers, 1997).

Emergency action plans for all high hazard dams that would affect Fremont County are on file with the Fremont County Office of Emergency Management. Additionally, possible evacuation routes in the event of a failure have been identified.

8.3 SECONDARY HAZARDS

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

8.4 CLIMATE CHANGE IMPACTS

Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams have historically experienced increases in stream flows from earlier dam releases.

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

8.5 EXPOSURE AND VULNERABILITY

Overall, dam failure impacts would likely be limited in Fremont County, with 10 to 25 percent of the planning area affected. Roads closed due to dam failure floods could result in serious transportation disruptions due to the limited number of roads in the County.

8.5.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system.

8.5.2 Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads, and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

8.5.3 Environment

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks.

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways. This could result in destruction of downstream habitat and could have detrimental effects on many species of animals.

8.6 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by general plans. The safety elements of the general plans establish standards and plans for the protection of the community from hazards. Dam failure is not typically addressed as a standalone hazard in the safety elements, but flooding is. The planning partners have established comprehensive policies regarding sound land use in identified flood hazard areas. Most of the areas vulnerable to the more severe impacts from dam failure are likely to intersect the mapped flood hazard areas. Flood-related policies in the general plans will help to reduce the risk associated with the dam failure hazard for all future development in the planning area.

8.7 SCENARIO

An earthquake in the region could lead to liquefaction of soils around a dam. This could occur without warning during any time of the day. A human-caused failure such as a terrorist attack also could trigger a catastrophic failure of a dam that impacts the planning area. While the probability of dam failure is very low, the probability of flooding associated with changes to dam operational parameters in response to climate change is higher. Dam designs and operations are developed based on hydrographs with historical record. If these hydrographs experience significant changes over time due to the impacts of climate change, the design and operations may no longer be valid for the changed condition. This could have significant impacts on dams that provide flood control. Specified release rates and impound thresholds may have to be changed. This would result in increased discharges downstream of these facilities, thus increasing the probability and severity of flooding.

8.8 ISSUES

The most significant issue associated with dam failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. Important issues associated with dam failure hazards include the following:

- Federally regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams that estimates inundation depths is needed to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.

- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.

CHAPTER 9.
DROUGHT AND EXTREME HEAT

DROUGHT AND EXTREME HEAT RANKING			
Fremont County	Canon City	Florence	Brookside
Medium	High	Medium	High

DEFINITIONS

Drought—The cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts health, well-being, and quality of life.

Extreme Heat— Summertime weather that is substantially hotter or more humid than average for a location at that time of year.

9.1 GENERAL BACKGROUND

9.1.1 Drought

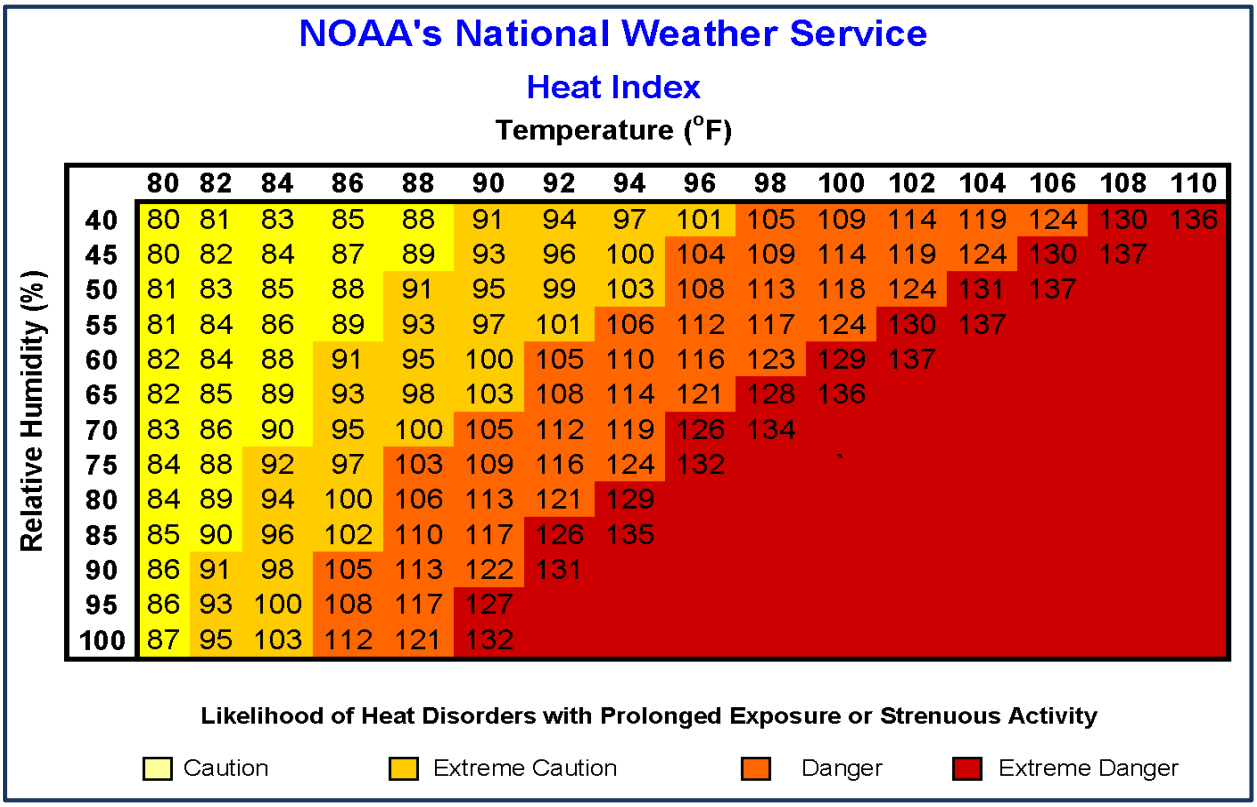
Drought is a normal phase in the climatic cycle of most geographical areas. According to the National Drought Mitigation Center, drought originates from a deficiency of precipitation over an extended period, usually a season or more. This results in a water shortage for some activity, group, or environmental sector. Drought is the result of a significant decrease in water supply relative to what is "normal" in a given location. Unlike most disasters, droughts normally occur slowly but last a long time. There are four generally accepted operational definitions of drought (National Drought Mitigation Center, 2006):

- **Meteorological drought** is an expression of precipitation's departure from normal over some period of time. Meteorological measurements are the first indicators of drought. Definitions are usually region-specific, and based on an understanding of regional climatology. A definition of drought developed in one part of the world may not apply to another, given the wide range of meteorological definitions.
- **Agricultural drought** occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.
- **Hydrological drought** refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. After precipitation has been reduced or deficient over an extended period of time, this shortage is reflected in declining surface and subsurface water levels. Water supply is controlled not only by precipitation, but also by other factors, including evaporation (which is increased by higher than normal heat and winds), transpiration (the use of water by plants), and human use.
- **Socioeconomic drought** occurs when a physical water shortage starts to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with the supply and demand of an economic good.

Defining when drought begins is a function of the impacts of drought on water users, and includes consideration of the supplies available to local water users as well as the stored water they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors.

9.1.2 Extreme Heat

Excessive heat events are defined by the U.S. EPA as "summertime weather that is substantially hotter or more humid than average for a location at that time of year" (EPA, 2006). Criteria that define an excessive heat event may differ among jurisdictions and in the same jurisdiction depending on the time of year. Excessive heat events are often a result of more than just ambient air temperature. Heat index tables (see Figure 9-1) are commonly used to provide information about how hot it feels, which is based on the interactions between several meteorological conditions. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.



Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Figure 9-1. Heat Index Table

9.2 HAZARD PROFILE

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Precipitation is the main source of Colorado's water supply. Annual precipitation in the populated areas of the planning area is approximately 11 to 15 inches per year. According to the 2013 State Drought Response Plan, "there are no major rivers that flow into Colorado (McKee et al., 1999). There are several major river basins originating in the Colorado Rockies, which flow out of the State, providing water to much of the southwestern United States, and contributing to the Missouri and Mississippi rivers as well. Thus, Colorado earns its title as "the Mother of Rivers" (Colorado Water Conservation Board, 2013). This supply is stored

in five forms throughout the State: snowpack, streamflow, reservoir water, soil moisture, and groundwater (Mckee and others, 2000).

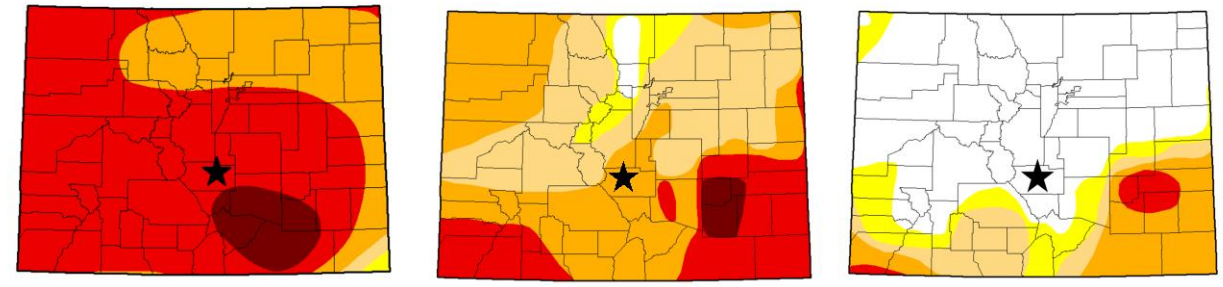
9.2.1 Past Events

Drought

According to the 2004 Drought and Water Supply Assessment, Colorado has experienced multiple severe droughts. Colorado has experienced drought in 2012-2013, 2000-2004, 1996, 1994, 1990, 1989, 1975-1979, 1963-1965, 1951-1957, 1931-1941, and 1893-1905. According to the 2010 Colorado Drought Mitigation and Response Plan, between 2007 and March 2010, there were six drought reported impacts in Fremont County that resulted in USDA Secretarial Disaster Declarations: S1843, S1947, S2327, S2802, S2987 and S3548. In order to receive these designations, damages and losses must have resulted in the production loss of at least 30 percent of one crop in the County as the result of a natural disaster (Colorado Water Conservation Board, 2013).

Beginning in 1998, the Colorado Front Range, including Fremont County, experienced below-normal precipitation and unseasonably dry air masses. Drought conditions continued over the next few years and the forests throughout the region became drier with each passing season. Drought conditions worsened in the winter of 2001/2002 and set the stage for the Hayman fire, which is the largest fire in Colorado history to date. Conditions began improving in the second half of 2003. During drought events, Cañon City has discussed the possibility of limiting water usage. Figure 9-2 compares the severity of the drought in Colorado in June 2002 (three days after the start of the Hayman fire) with the severity of the drought in August 2013 as well as the drought conditions as of 2014 (September conditions). The maps illustrate significantly improved conditions in Colorado and Fremont County 2013 over the 2002 situation and improving conditions in 2014.

Source: National Drought Mitigation Center



State Drought Conditions

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
12/31/2002	0	100	99.66	98.98	72.73	7.06
8/27/2013	1.91	98.09	98.81	93.65	22.17	2.46
9/9/2014	63.14	36.86	25.25	15.58	2.67	0.00

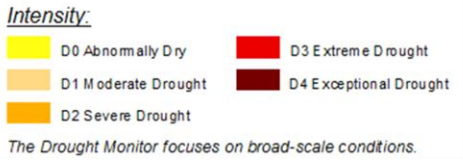


Figure 9-2. U.S. Drought Monitor

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time. The Drought Impact Reporter contains information on 643 impacts from droughts that affected Fremont County between 2004 and February 2014. Most of the impacts (324) were classified as "agriculture." Other impacts include "society and public health" (92), "fire" (120), "tourism and recreation" (38), and "water supply and quality" (150). These categories are described as follows:

- **Agriculture**—Drought effects associated with agriculture, farming, aquaculture, horticulture, forestry, or ranching. Examples of drought-induced agricultural impacts include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; insect infestation; plant disease; increased irrigation costs; cost of new or supplemental water resource development (wells, dams, pipelines) for agriculture; reduced productivity of rangeland; forced reduction of foundation stock; closure/limitation of public lands to grazing; high cost or unavailability of water for livestock, Christmas tree farms, forestry, raising domesticated horses, bees, fish, shellfish, or horticulture.
- **Society and Public Health -** Drought effects associated with human, public and social health include health-related problems related to reduced water quantity or quality, such as increased concentration of contaminants; loss of human life (e.g., from heat stress, suicide); increased respiratory ailments; increased disease caused by wildlife concentrations; increased human disease caused by changes in insect carrier populations; population migration (rural to urban areas, migrants into the United States); loss of aesthetic values; change in daily activities (non-recreational, like putting a bucket in the shower to catch water); elevated stress levels; meetings to discuss drought; communities creating drought plans; lawmakers altering penalties for violation of water restrictions; demand for higher water rates; cultural/historical discoveries from low water levels; cancellation of fundraising events; cancellation/alteration of festivals or holiday traditions; stockpiling water; public service announcements and drought information websites; protests; and conflicts within the community due to competition for water.
- **Fire**—Drought often contributes to forest, range, rural, or urban fires, fire danger, and burning restrictions. Specific impacts include enacting or increasing burning restrictions, fireworks bans, increased fire risk, occurrence of fire (number of acres burned, number of wildfires compared to average, people displaced, etc.), state of emergency during periods of high fire danger, closure of roads or land due to fire occurrence or risk, and expenses to state and county governments of paying firefighters overtime and paying equipment (helicopter) costs.
- **Tourism and Recreation**—Drought effects associated with recreational activities and tourism include closure of state hiking trails and hunting areas due to fire danger; water access or navigation problems for recreation; bans on recreational activities; reduced license, permit, or ticket sales (e.g., hunting, fishing, ski lifts, etc.); losses related to curtailed activities (e.g., bird watching, hunting and fishing, boating, etc.); reduced park visitation; and cancellation or postponement of sporting events..
- **Water supply and Quality**—Drought effects associated with water supply and water quality include dry wells, voluntary and mandatory water restrictions, changes in water rates, increasing of water restrictions, increases in requests for new well permits, changes in water use due to water restrictions, greater water demand, decreases in water allocation or allotments, installation or alteration of water pumps or water intakes, changes to allowable water contaminants, water line damage or repairs due to drought stress, drinking water turbidity, change in water color or odor, declaration of drought watches or warnings, and mitigation activities.

Extreme Heat

The Western Regional Climate Center does not report data summaries from any stations in Fremont County, but does report summaries from a station in Pueblo (Pueblo Memorial Airport). Table 9-1 contains temperature summaries related to extreme heat for the station.

TABLE 9-1.
TEMPERATURE DATA FROM PUEBLO MEMORIAL AIRPORT (1996-2008)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature (degrees Fahrenheit)												
Average Maximum Temperature	47.9	51.0	60.1	67.3	78.3	88.0	94.3	89.9	82.4	70.2	57.3	47.8
Average Minimum Temperature	14.3	17.3	25.3	33.4	43.5	52.1	59.5	57.4	47.5	34.4	22.9	14.5
Average Temperature	31.1	34.2	42.7	50.3	60.9	70.1	76.9	73.7	64.9	52.3	40.1	31.1
Extreme Temperatures (degrees Fahrenheit)												
Extreme Maximum Temperature	81	79	84	90	102	103	109	105	100	92	85	79
Average Number of Days												
Maximum Temperature above 90	0.0	0.0	0.0	0.1	3.9	14.6	23.9	18.6	8.2	0.5	0.0	0.0
Maximum Temperature above 75	0.2	0.5	4.0	9.7	20.6	27.7	30.8	29.7	24.3	12.4	3.4	0.2

9.2.2 Location

Drought

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The ***Palmer Crop Moisture Index*** measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season. Figure 9-3 shows this index for the week ending April 12, 2014.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale. Figure 9-4 shows this index for February 2014.
- The ***Palmer Drought Index (PDI)*** measures the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during a given month is dependent on the current weather patterns plus the cumulative patterns of previous months. Weather patterns can change quickly from a long-term drought pattern to a long-term wet pattern, and the PDI can respond fairly rapidly. Figure 9-5 shows this index for February 2014.
- The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop and it takes longer to recover from them. The ***Palmer Hydrological Drought Index***

(PHDI), another long-term index, was developed to quantify hydrological effects. The PHDI responds more slowly to changing conditions than the PDI. Figure 9-6 shows this index for February 2014.

- While the Palmer indices consider precipitation, evapotranspiration and runoff, the ***Standardized Precipitation Index (SPI)*** considers only precipitation. In the SPI, an index of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The SPI is computed for time scales ranging from one month to 24 months. Figure 9-7 shows the 24-month SPI map for May 2011 through April 2013.

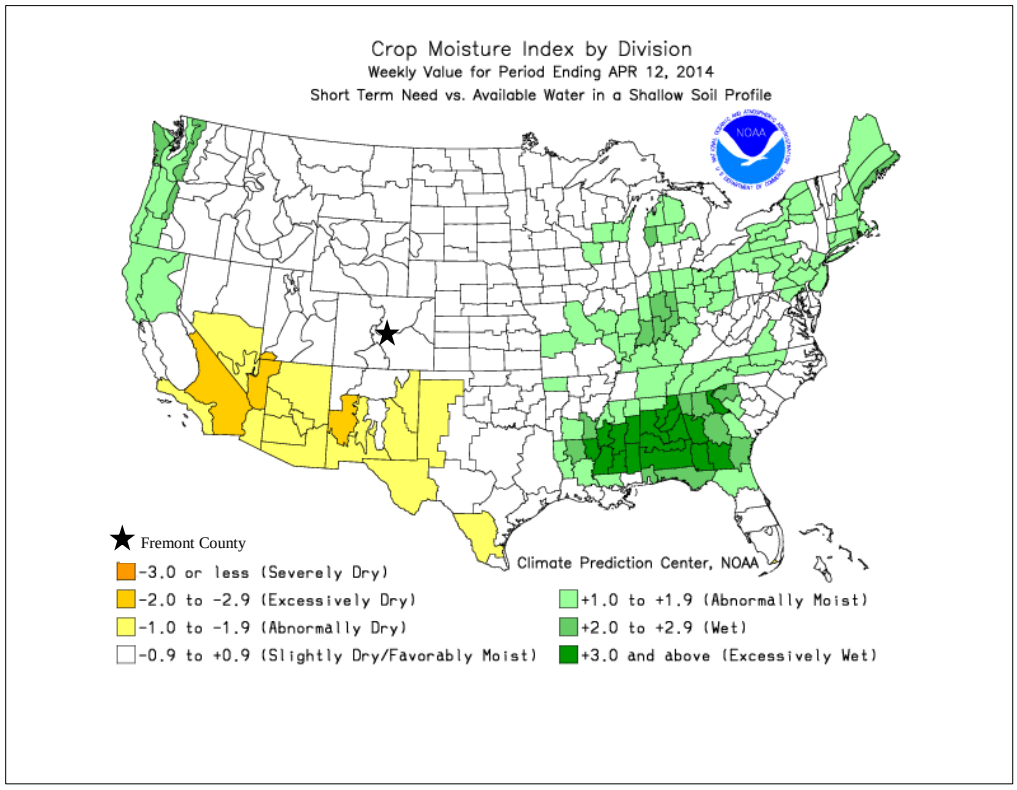


Figure 9-3. Crop Moisture Index for Week Ending April 12, 2014

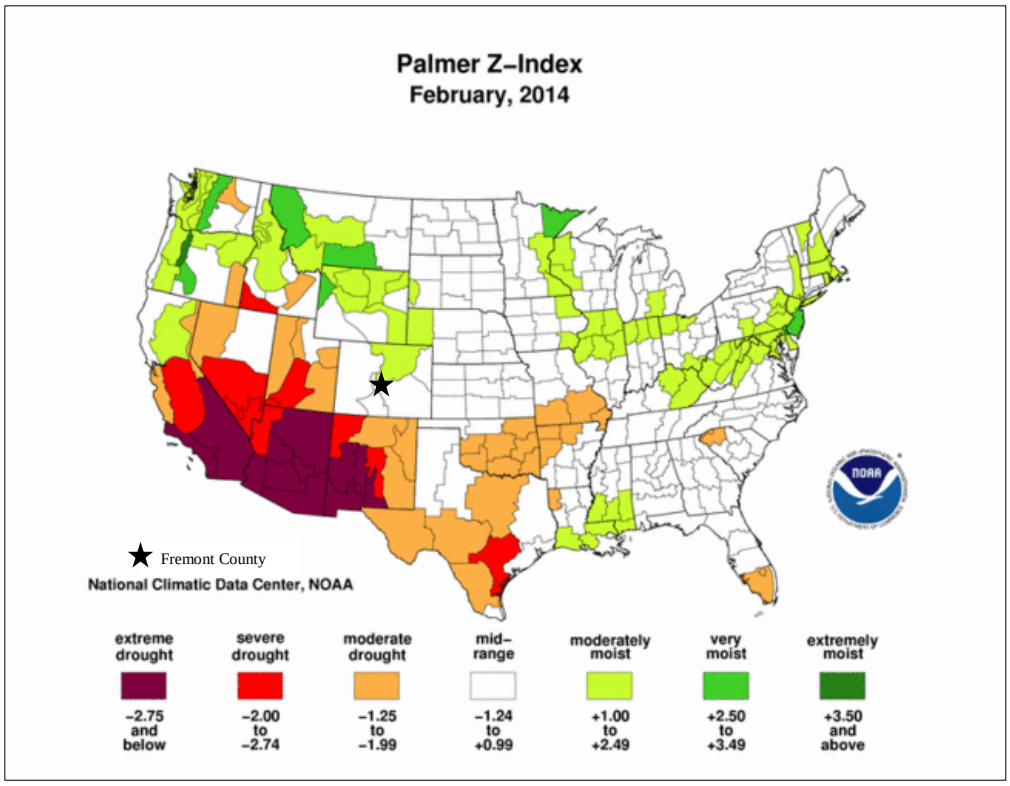


Figure 9-4. Palmer Z Index Short-Term Drought Conditions (February 2014)

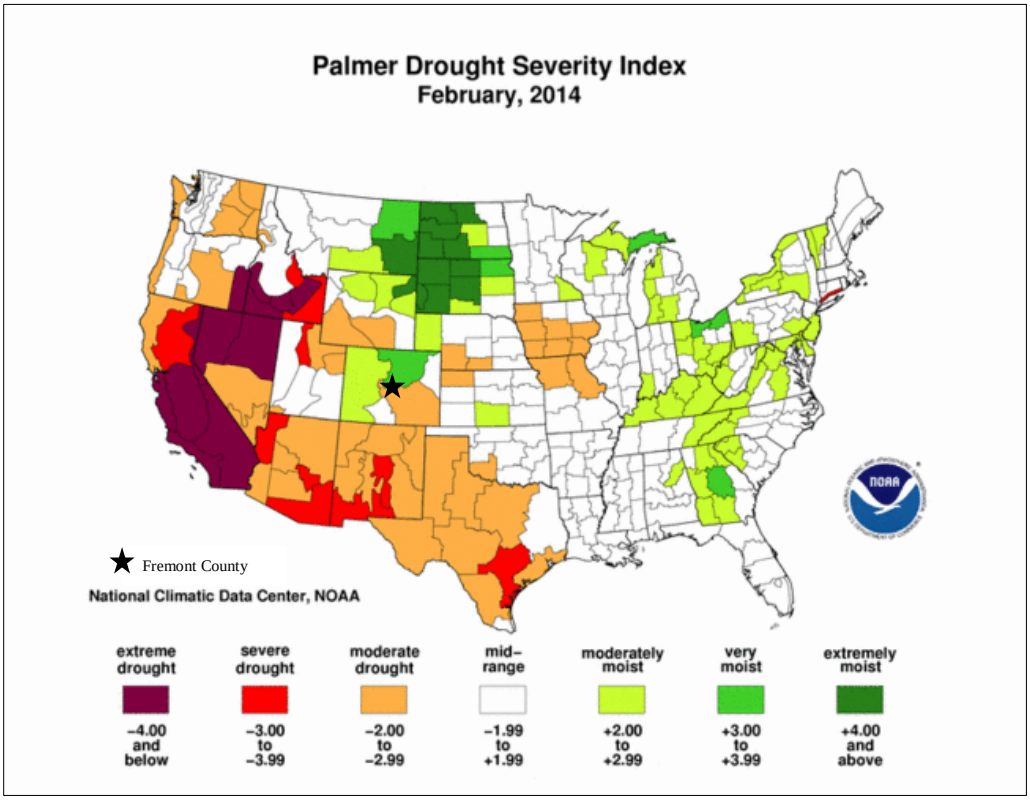


Figure 9-5. Palmer Drought Severity Index (February 2014)

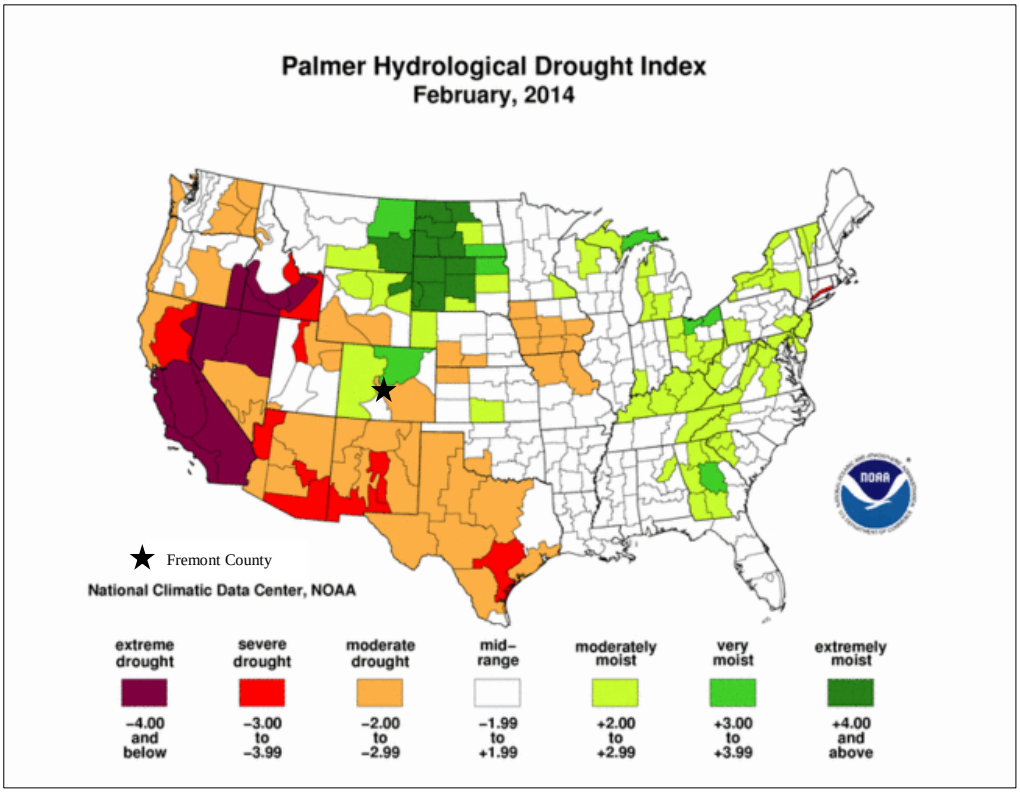


Figure 9-6. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (February 2014)

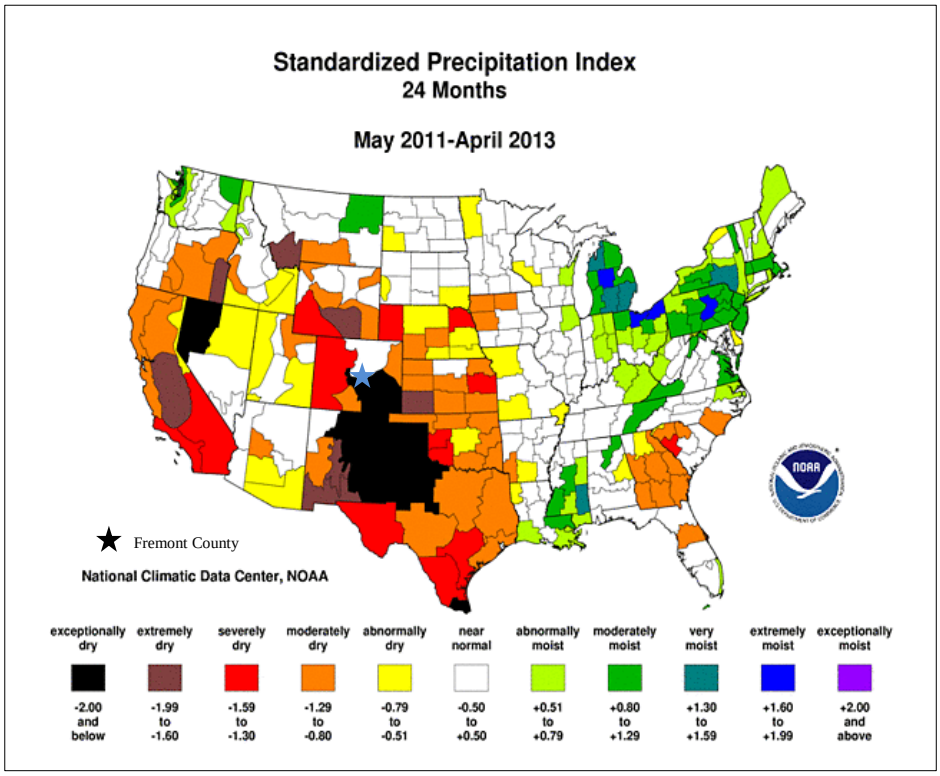


Figure 9-7. 24-Month Standardized Precipitation Index (May 2011 – April 2013)

Due to Colorado's semiarid conditions, drought is a natural but unpredictable occurrence in the state. However, because of natural variations in climate and precipitation sources, it is rare for all of Colorado to be deficient in moisture at the same time. Single season droughts over some portion of the state are quite common.

The entire County is at risk to drought conditions**.** Drought is one of the few hazards that has the potential to directly or indirectly impact every person in the County as well as adversely affect the local economy.

Extreme Heat

The entire County is at risk to extreme heat events; however, these events may be exacerbated in urban areas, where reduced air flow, reduced vegetation and increased generation of waste heat can contribute to temperatures that are several degrees higher than in surrounding rural or less urbanized areas. This phenomenon is known as urban heat island effect.

9.2.3 Frequency

Drought

The probability of a future drought in Fremont County is likely, with between 10 and 100 percent chance of occurrence in any given year, or a recurrence interval of 10 years or less. According to information from the Colorado Drought Mitigation and Response Plan, over 119 years (1893 to 2012) there were seven recorded drought incidents that totaled 41 dry years. Based on this historical information, the probability of a drought occurring in any given year is 34.5 percent. Short duration droughts occur much more frequently. According to a study cited in the Colorado Drought Mitigation and Response Plan, they occur somewhere in Colorado in nearly 9 out of every 10 years. (McKee and others, 2000).

Extreme Heat

There is no information available regarding the number of extreme heat events that have occurred in the County and, therefore, no way to assess the frequency of such events. There are 70 days per year on average where temperatures exceed 90 degrees.

9.2.4 Severity

Drought

Drought impacts are wide-reaching and may be economic, environmental, or societal. The most significant impacts associated with drought in Colorado are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. An ongoing drought may leave an area more prone to beetle kill and associated wildfires. Drought conditions can also cause soil to compact, increasing an area's susceptibility to flooding, and reduce vegetation cover, which exposes soil to wind and erosion. A reduction of electric power generation and water quality deterioration are also potential problems. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in streams and groundwater decline.

According to the information in this hazard profile, a drought's impact on Fremont County could be considered critical—25 to 50 percent of property severely damaged; shutdown of facilities for at least 2 weeks; or injuries or illnesses that result in permanent disability. Due to the high probability of severe drought, the overall significance is considered medium with moderate potential impact. Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- Agricultural – Drought threatens crops that rely on natural precipitation.

- Water supply – Drought threatens supplies of water for irrigated crops and for communities.
- Fire hazard – Drought increases the threat of wildfires from dry conditions in forest and rangelands.

On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly.

When measuring the severity of droughts, analysts typically look at economic impacts on a planning area. A drought directly or indirectly impacts all people in affected areas. All people could pay more for water if utilities increase their rates due to shortages. Agricultural impacts can result in loss of work for farm workers and those in related food processing jobs. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

Drought also is often accompanied by extreme heat. When temperatures reach 90ºF and above, people are vulnerable to sunstroke, heat cramps, and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries. Crops can be vulnerable as well.

Additionally, there is increased danger of wildfires associated with most droughts. Millions of board feet of timber have been lost, and in many cases erosion occurred, which caused serious damage to aquatic life, irrigation, and power production by heavy silting of streams, reservoirs, and rivers.

Extreme Heat

Based on the information in this hazard profile, the magnitude/severity of extreme temperatures is limited—10 to 25 percent of property severely damaged; shutdown of facilities for more than a week; or injuries/illnesses that are treatable or do not result in permanent disability. Overall significance is considered low: minimal potential impact.

9.2.5 Warning Time

Drought

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions. Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Colorado is semiarid, thus, drought is a regular and natural occurrence in the State. The main source of water supply in the state is precipitation and much of this occurs in the winter as snowfall. Although drought conditions are difficult to predict, low levels of winter snowpack may act as an indicator that drought conditions are occurring.

Extreme Heat

NOAA issues watch, warning and advisory information for extreme heat.

9.3 SECONDARY HAZARDS

Drought

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. According to the State of Colorado 2013 Drought Response Plan, economic impacts may also occur for industries that are water intensive such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation and wildfire preservation. Additionally, a reduction of electric power generation and water quality deterioration are also potential effects. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought may also weaken trees in areas already affected by mountain pine beetle infestations, causing more extensive damage to trees and increasing wildfire risk, at least temporarily. An ongoing drought that severely inhibits natural plant growth cycles may impact critical wildlife habitats. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline (Colorado Water Conservation Board, 2013).

Extreme Heat

Excessive heat events can cause failure of motorized systems such as ventilation systems used to control temperatures inside buildings.

9.4 CLIMATE CHANGE IMPACTS

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. From 1987 to 1989, losses from drought in the U.S. totaled $39 billion (OTA, 1993). More frequent extreme events

such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages.

The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

9.5 EXPOSURE

All people, property, and environments in the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions. Populations living in densely populated urban areas are likely to be more exposed to extreme heat events.

9.6 VULNERABILITY

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. Extreme heat can exacerbate the effects of drought.

9.6.1 Population

Drought

The planning partnership has the ability to minimize any impacts on residents and water consumers in the County should several consecutive dry years occur. No significant life or health impacts are anticipated as a result of drought within the planning area

Extreme Heat

According to the U.S. EPA the individuals with the following combinations or characteristics are typically at greater risk to the adverse effects of excessive heat events: individuals with physical or mobility constraints, cognitive impairments, economic constraints, and social isolation.

9.6.2 Property

Drought

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Extreme Heat

Typically the only impact extreme heat has on general building stock is increased demand on air conditioning equipment, which in turn may cause strain on electrical systems.

9.6.3 Critical Facilities

Drought

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning

area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

Extreme Heat

Power outages may occur as a result of extreme heat events. Additionally, transportation systems may experience disruption in services. According to the State of Colorado Hazard Mitigation Plan, concrete pavements have experienced "blowouts or heaves" both on local highway and the higher volume parkway and interstate systems. Blowouts occur when pavements expand and cannot function properly within their allotted spaces. Pavement sections may rise up several inches during such events. These conditions can cause motor vehicle accidents in their initial stages and can shut down traffic lanes or roadways entirely until such times as the conditions are mitigated (Colorado Division of Emergency Management, 2011).

9.6.4 Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

9.6.5 Economic Impact

Economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. Agricultural industries will be impacted if water usage is restricted for irrigation. The tourism sector may also be impacted.

9.7 FUTURE TRENDS IN DEVELOPMENT

Each municipal planning partner in this effort has an established comprehensive plan that includes policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought. All planning partners reviewed their general plans under the capability assessments performed for this effort. Deficiencies identified by these reviews can be identified as mitigation initiatives to increase the capability to deal with future trends in development. Vulnerability to drought will increase as population growth increases, putting more demands on existing water supplies. Future water use planning should consider increases in population as well as potential impacts of climate change.

9.8 SCENARIO

An extreme multiyear drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out throughout the planning area, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon by the planning partnership, causing social and political conflicts. If such conditions persisted for several years, the economy of Fremont County could experience setbacks, especially in water dependent industries.

9.9 ISSUES

The following are extreme heat and drought-related issues:

- Identification and development of alternative water supplies
- Utilization of groundwater recharge techniques to stabilize the groundwater supply
- The probability of increased drought frequencies and durations due to climate change
- The promotion of active water conservation even during non-drought periods
- Increasing vulnerability to drought over time as demand for water from different sectors increases
- The effects of climate change may result in an increase in frequency of extreme heat events
- The effects of recent droughts have exposed the vulnerability of the planning areas economy to drought events.

CHAPTER 10.
EARTHQUAKE

EARTHQUAKE RANKING			
Fremont County	**Canon City**	**Florence**	**Brookside**
Low	Low	Low	Medium

DEFINITIONS

Earthquake—The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

Epicenter—The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Fault—A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

Focal Depth—The depth from the earth's surface to the hypocenter.

Hypocenter—The region underground where an earthquake's energy originates.

Liquefaction—Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

10.1 GENERAL BACKGROUND

10.1.1 How Earthquakes Happen

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Although there are probably still some unrecognized active faults, nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

10.1.2 Earthquake Classifications

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as **magnitude**; or by the impact on people and structures, measured as **intensity**.

Magnitude

Currently the most commonly used magnitude scale is the moment magnitude (M_w) scale, with the follow classifications of magnitude:

- Great—$M_w \geq 8$
- Major—$M_w = 7.0 - 7.9$
- Strong—$M_w = 6.0 - 6.9$
- Moderate—$M_w = 5.0 - 5.9$
- Light—$M_w = 4.0 - 4.9$
- Minor—$M_w = 3.0 - 3.9$
- Micro—$M_w < 3$

Estimates of moment magnitude roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now the most often used estimate of large earthquake magnitudes.

Intensity

Currently the most commonly used intensity scale is the modified Mercalli intensity scale, with ratings defined as follows (USGS, 1989):

- I. Not felt except by a very few under especially favorable conditions
- II. Felt only by a few persons at rest, especially on upper floors of buildings.
- III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it is an earthquake. Standing cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
- IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing cars rocked noticeably.
- V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
- VI. Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
- VII. Damage negligible in buildings of good design and construction; slight in well-built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken.
- VIII. Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
- IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
- X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

- XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
- XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

10.1.3 Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g., single-family dwellings). Longer period response components create the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 10-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

TABLE 10-1.
MERCALLI SCALE AND PEAK GROUND ACCELERATION COMPARISON

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA[a] (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X - XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity
Sources: USGS, 2008; USGS, 2010

10.1.4 Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction, a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 10-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the

earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E, and F. In general, these areas are also most susceptible to liquefaction.

TABLE 10-2.
NEHRP SOIL CLASSIFICATION SYSTEM

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

10.2 HAZARD PROFILE

Earthquakes can last from a few seconds to over 5 minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides, or releases of hazardous material, compounding their disastrous effects.

Small, local faults produce lower magnitude quakes, but ground shaking can be strong and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

10.2.1 Past Events

Colorado has a relatively short period of historical records for earthquakes. An earthquake and fault map developed by the Colorado Geological Survey depicts the location of historical epicenters and potentially active faults in that state. Figure 10-1 shows the mapping for Fremont County and vicinity. The map shows the following recorded earthquake events in Fremont County:

- **March 16, 1985** – Salida area, Magnitude 3.2
- **April 16, 1987** – Howard area, Magnitude 2.7
- **January 26, 2008** – 8 miles northeast of Cotopaxi, Magnitude 3.1
- **July 26, 2008** – 17 miles east of Cañon City, Magnitude 2.6
- **September 12, 2008** – 15 miles north-northwest of Westcliffe, Magnitude 2.5

Source: Colorado Geological Survey (http://dnrwebmapgdev.state.co.us/cgsonline/)

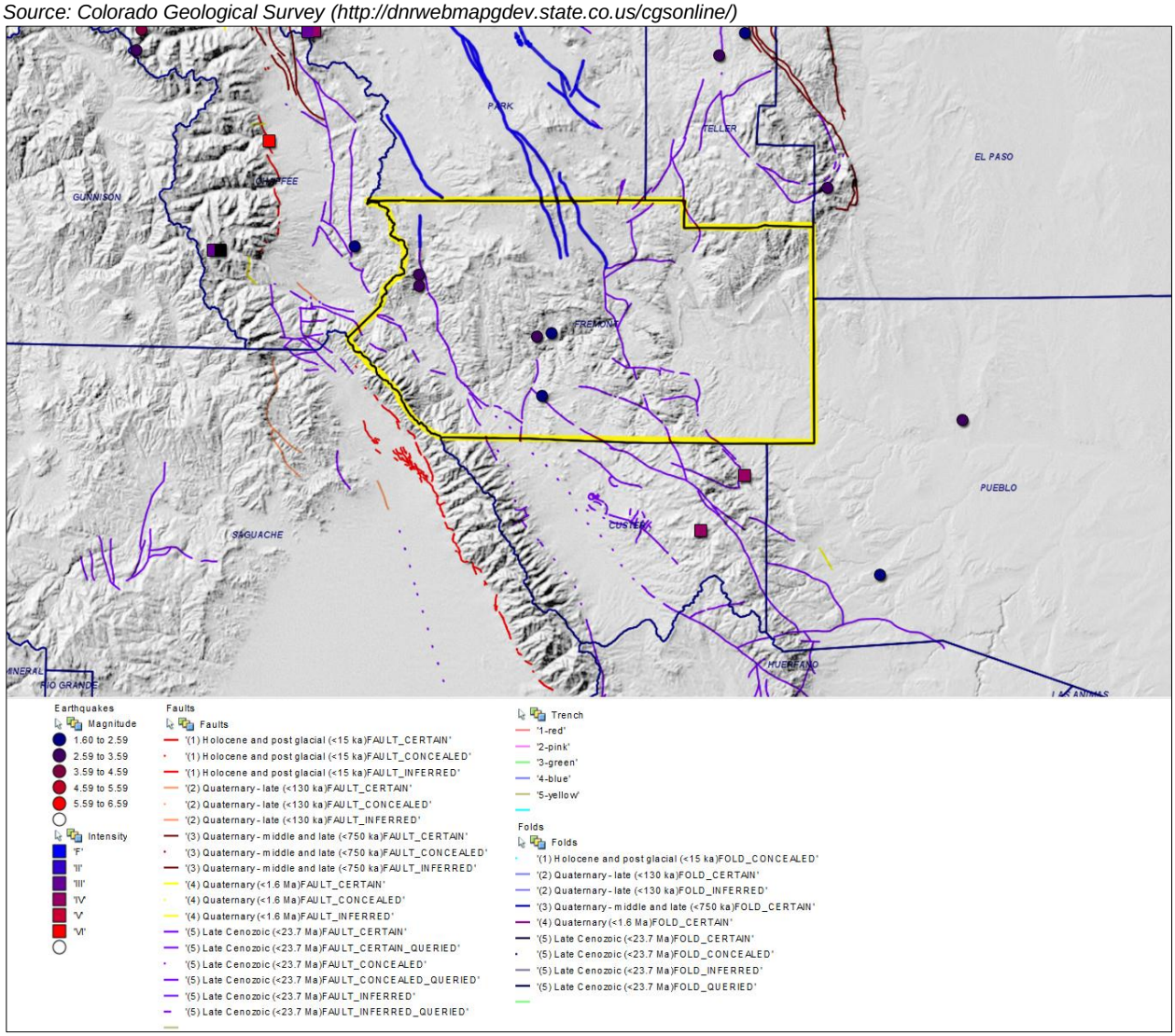


Figure 10-1. Earthquake Hazard Map for Central Colorado

10.2.2 Location

Geological research indicates that faults capable of producing earthquakes are prevalent in Colorado. There are about 90 potentially active faults in Colorado with documented movement within the last 1.6 million years. Figure 10-1 and Figure 10-2 show potentially active faults in Fremont County and in all of Colorado, respectively.

Source: Colorado Earthquake Hazard Mitigation Council 2008

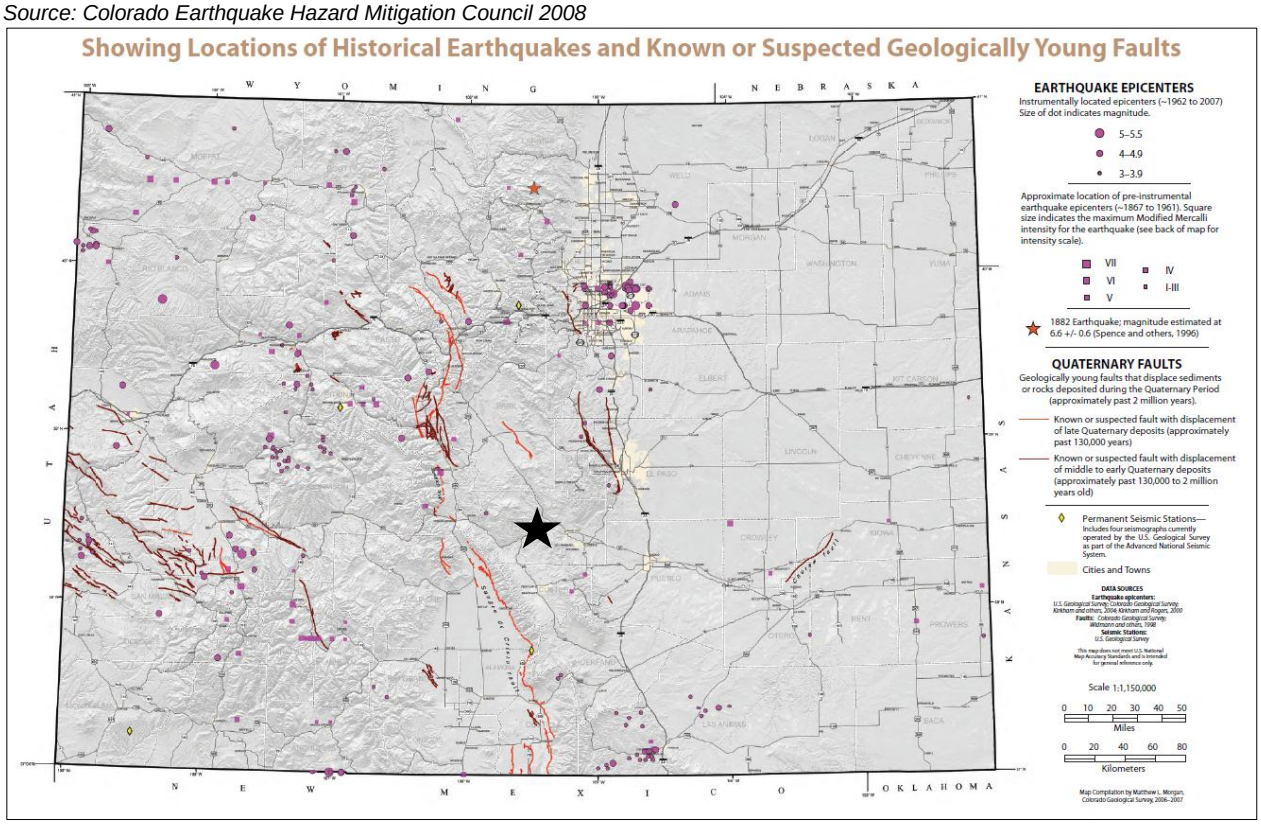


Figure 10-2. Colorado Earthquakes and Fault Map

Faults have been classified based on the geologic time frame of their latest suspected movement (in order of activity occurrence, most recent is listed first):

- H—Holocene (within past 15,000 years)
- LQ—Late Quaternary (15,000 to 130,000 years)
- MLQ—Middle to Late Quaternary (130,000 to 750,000 years)
- Q—Quaternary (approximately past 2 million years)
- LC—Late Cenozoic (approximately past 23.7 million years)

Known named faults in Fremont County include the Ilse Fault, the Pleasant Valley Fault, the Currant Creek Fault Zone, the Rice Mountain Fault, the Alvarado Fault, the Box Canyon and Quarry Faults, the Dead Mule Gulch Fault, the Westcliffe Fault, the Fourmile Creek Fault, the Texas Creek Fault, the High Park Fault Zone and Bare Hills Fault, the Parkdale Faults, and the Wet Mountain Fault. All are classified as late Cenozoic, the oldest classification of fault.

The impact of an earthquake is largely a function of the following components:

- Ground shaking (ground motion accelerations)
- Liquefaction (soil instability)
- Distance from the source (both horizontally and vertically).

Mapping that shows the impacts of these components was used to assess the risk of earthquakes within the planning area. While the impacts from each of these components can build upon each other during an earthquake event, the mapping looks at each component individually. Three earthquake scenarios were selected for this plan:

- **North Sangre de Cristo Scenario** (see Figure 10-3) — A Magnitude 7.5 event with an epicenter approximately 43 miles south-southwest of Cañon City. This is a HAZUS-MH arbitrary-event scenario, which is defined by the location of its epicenter and by its magnitude. The epicenter is defined by latitude and longitude. The user specifies the magnitude, depth, type, rupture orientation and length.
- **Ute Pass Fault Zone Scenario** (see Figure 10-4) — A Magnitude 7.0 event with an epicenter approximately 35 miles north-northeast of Cañon City. This is a HAZUS-MH arbitrary-event scenario, which is defined by the location of its epicenter and by its magnitude. The epicenter is defined by latitude and longitude. The user specifies the magnitude, depth, type, rupture orientation and length.
- **500-Year Probabilistic Scenario** (see Figure 10-5) — This is a HAZUS-MH probabilistic-event scenario, which allows the user to generate estimates of damage and loss based on the seismic hazard for a specified return period.

10.2.3 Frequency

Research based on Colorado's earthquake history suggests that an earthquake of 6.3 or larger has a one percent (1 percent) probability of occurring each year somewhere in Colorado (Charlie, Doehring, Oaks Colorado Earthquake Hazard Reduction Program Open File Report 93-01, 1993). According to the U.S. Geological Survey, the probability that a magnitude 5 or greater earthquake will occur in the next 50 years in Fremont County is 10 percent or less. Small earthquakes that cause no or little damage are more likely. Overall, the probability of a damaging earthquake somewhere in the County is considered occasional, 1- to 10-percent chance of occurrence in any given year, or a recurrence interval of 11 to 100 years.

Figure 10-3. North Sangre de Cristo M7.5 Event

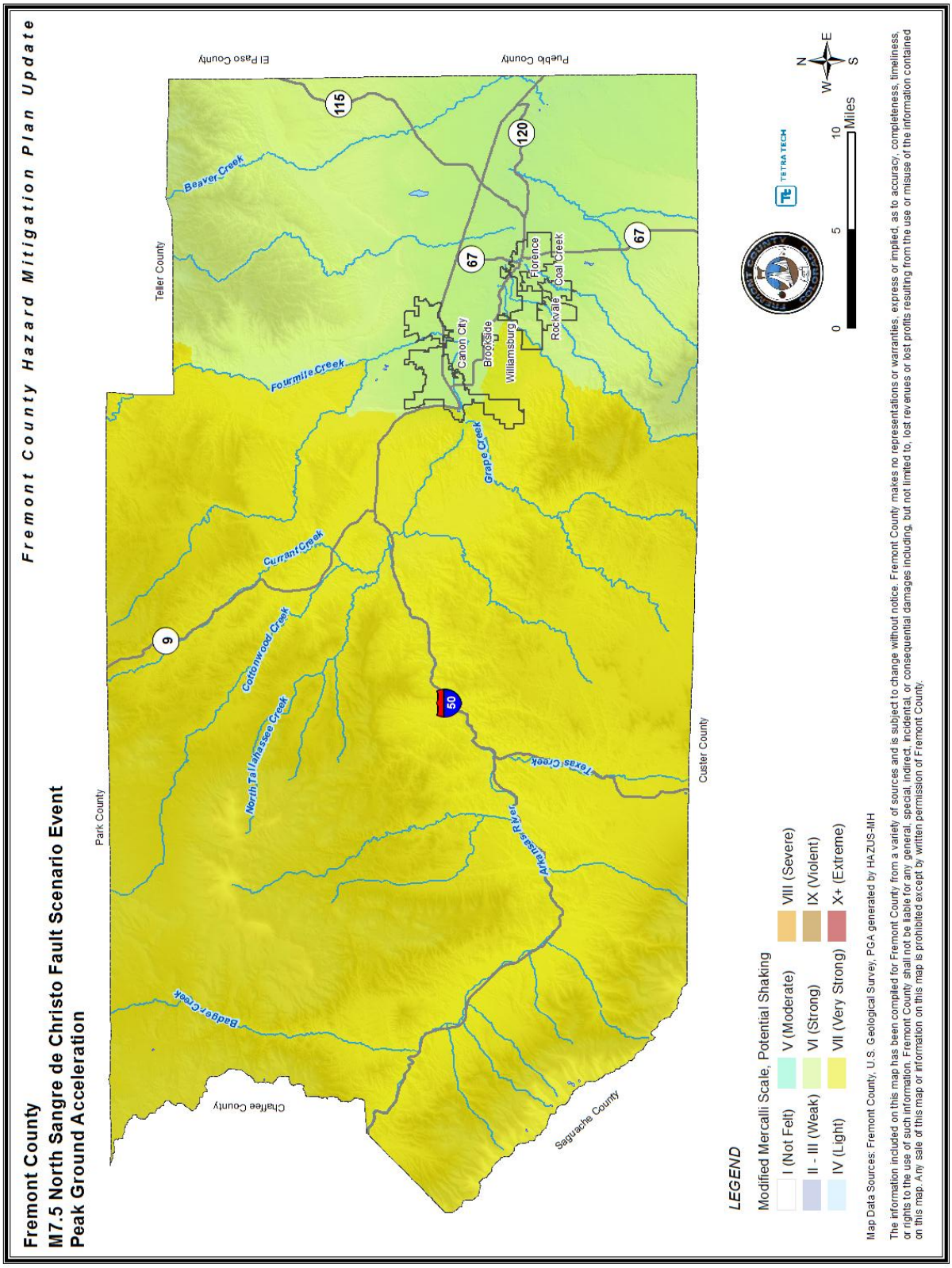


Figure 10-4. Ute Pass Fault M7.0 Event

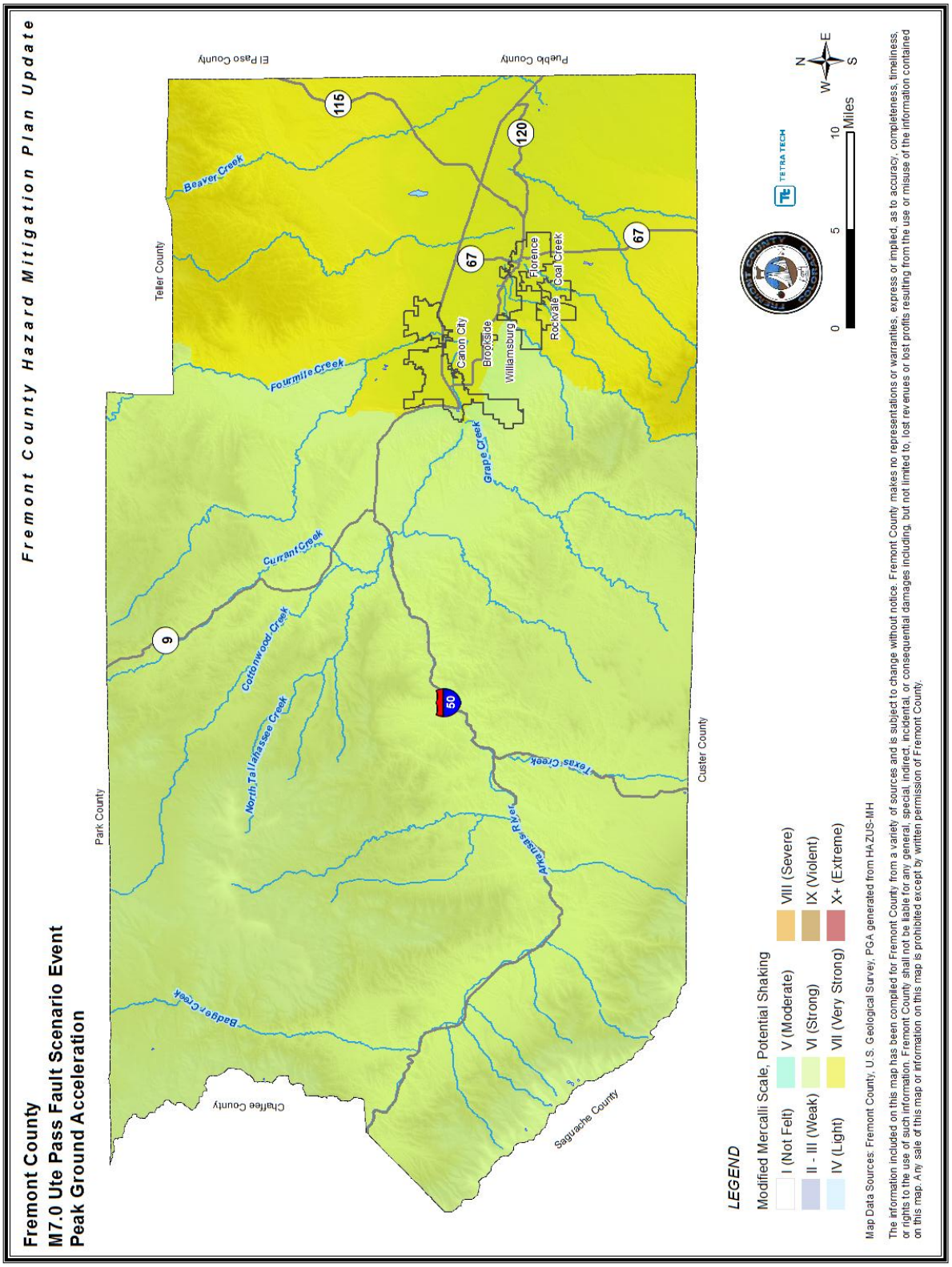
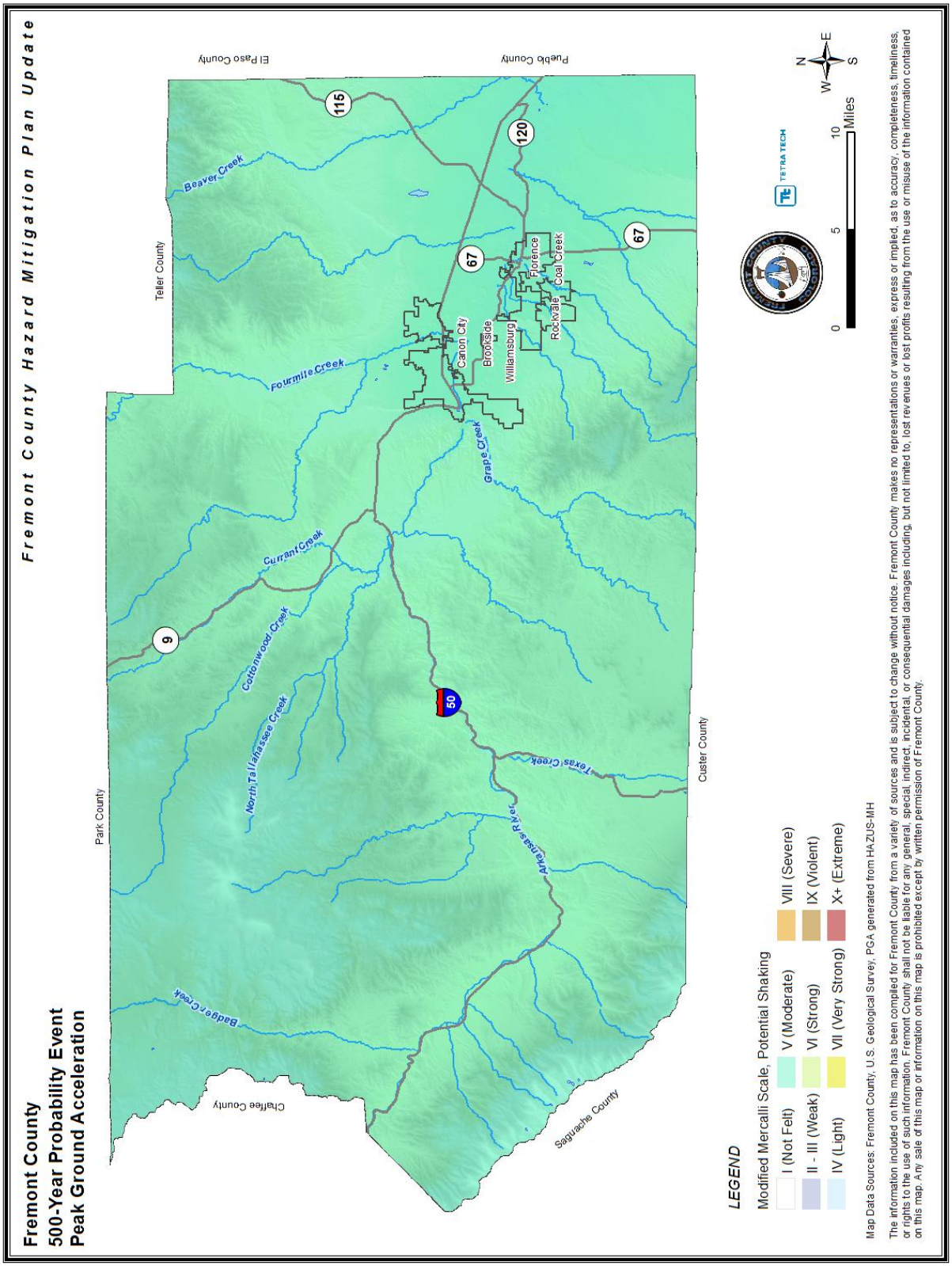


Figure 10-5. 500-Year Probability Event



10.2.4 Severity

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Damage and life loss can be particularly devastating in communities where buildings were not designed to withstand seismic forces (e.g., historic structures). Other damage-causing effects of earthquakes include surface rupture, fissuring, settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, rock falls, liquefaction, fires, dam failure, and hazardous materials incidents.

According to the information in this hazard profile, a large earthquake's impact on the County could be considered critical—25 to 50 percent of property severely damaged; shutdown of facilities for at least 2 weeks; or injuries or illnesses result in permanent disability. Due to the low probability of damaging earthquakes, the overall significance is considered medium, with moderate potential impact.

The severity of an earthquake can be expressed in terms of intensity or magnitude. Intensity represents the observed effects of ground shaking on people, buildings, and natural features. The USGS has created ground motion maps based on current information about several fault zones. These maps show the PGA that has a certain probability (2 percent or 10 percent) of being exceeded in a 50-year period, as shown in Figure 10-6. The PGA is measured in numbers of g's (the acceleration associated with gravity).

Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is calculated based on the amplitude of the earthquake waves recorded on instruments. Whereas intensity varies depending on location with respect to the earthquake epicenter, magnitude is represented by a single, instrumentally measured value for each earthquake event.

In simplistic terms, the severity of an earthquake event can be measured in the following terms:

- How hard did the ground shake?
- How did the ground move? (horizontally or vertically)
- How stable was the soil?
- What is the fragility of the built environment in the area of impact?

Source: FEMA.gov

SDC	MAP COLOR	EARTHQUAKE HAZARD	POTENTIAL EFFECTS OF SHAKING*
A	White	Very small probability of experiencing damaging earthquake effects.	
B	Gray	Could experience shaking of moderate intensity.	Moderate shaking—Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
C	Yellow	Could experience strong shaking.	Strong shaking—Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built structures.
D0	Light brown	Could experience very strong shaking (the darker the color, the stronger the shaking).	Very strong shaking—Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.
D1	Darker brown		
D2	Darkest brown		
E	Red	Near major active faults capable of producing the most intense shaking.	Strongest shaking—Damage considerable in specially designed structures; frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Shaking intense enough to completely destroy buildings.

* Abbreviated descriptions from The Modified Mercalli Intensity Scale.

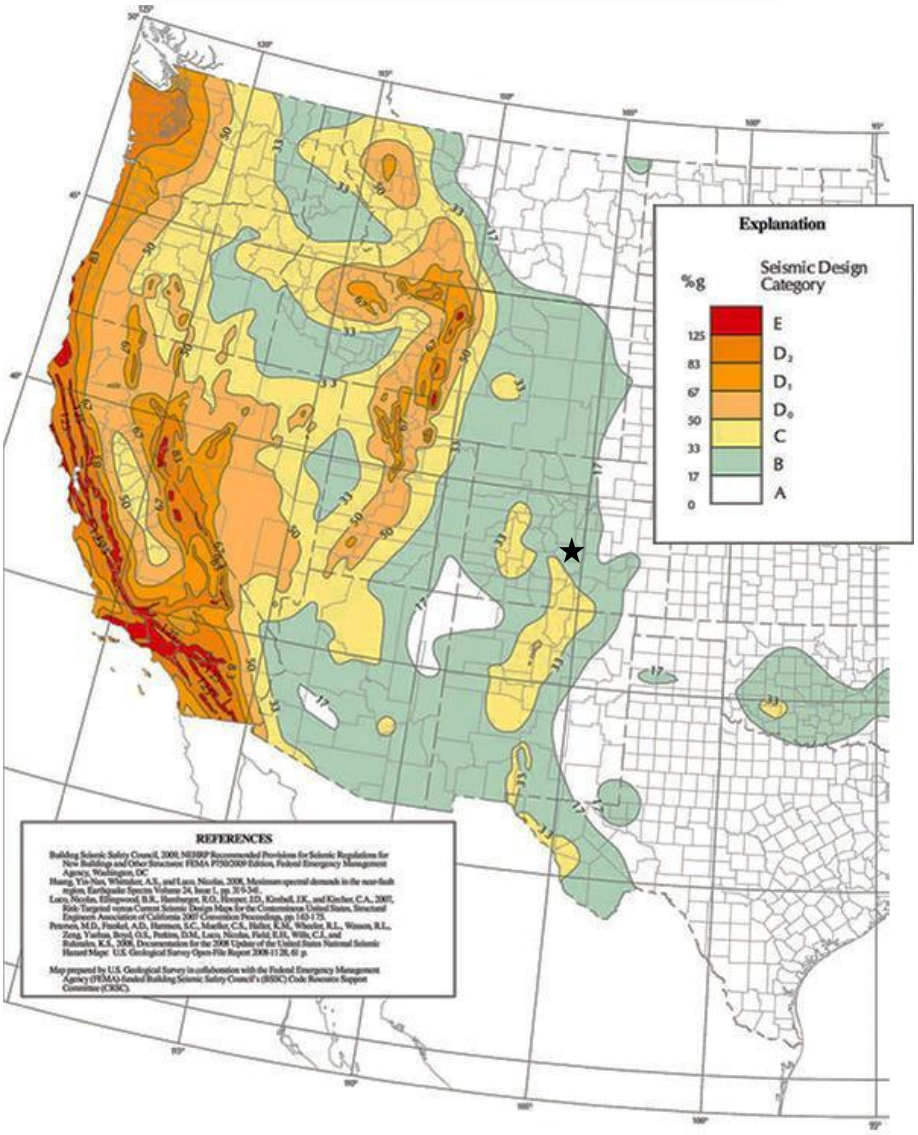


Figure 10-6. Earthquake Hazard and Potential Effects of Shaking

10.2.5 Warning Time

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often estimate when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Colorado and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in Colorado are difficult to estimate.

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

10.3 SECONDARY HAZARDS

Earthquakes can cause large and sometimes disastrous landslides and mudslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts, or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes.

10.4 CLIMATE CHANGE IMPACTS

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

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

10.5 EXPOSURE

10.5.1 Population

The entire population of Fremont County is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil type their homes are constructed on, their proximity to fault location, etc. Whether impacted directly or indirectly, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

10.5.2 Property

According to County Assessor records, there are 16,707 buildings in the planning area, with a total assessed value of $5.22 billion. Since all structures in the planning area are susceptible to earthquake impacts to varying degrees, this total represents the Countywide property exposure to seismic events. Most of the buildings (94 percent) are residential.

10.5.3 Critical Facilities and Infrastructure

All critical facilities in the planning area are exposed to the earthquake hazard. Table 6-4 lists the number of each type of facility by jurisdiction. Hazardous materials releases can occur during an earthquake from fixed facilities or transportation-related incidents. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities holding hazardous materials are of particular concern because of possible isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

10.5.4 Environment

Secondary hazards associated with earthquakes will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly impact surrounding habitat. It is also possible for streams to be rerouted after an earthquake. This can change the water quality, possibly damaging habitat and feeding areas. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology.

10.6 VULNERABILITY

Earthquake vulnerability data was generated using a Level 2 HAZUS-MH analysis. Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up.

10.6.1 Population

Three population groups are particularly vulnerable to earthquake hazards:

- **Linguistically Isolated Populations**——Approximately 12 percent of the planning area population over 5 years old speaks a primary language other than English. Problems arise when there is an urgent need to inform non-English speaking residents of an earthquake event. They are vulnerable because of difficulties in understanding hazard-related information from predominantly English-speaking media and government agencies.
- **Population Below Poverty Level**—Families with incomes below the poverty level in 2012 made up 11.7 percent of all families and 15.2 percent of the total county population. These families may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Poorer residents are also less likely to have insurance to compensate for losses in earthquakes.
- **Population Over 65 Years Old**—Approximately 18 percent of the residents in the planning area are over 65 years old. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Impacts on persons and households in the planning area were estimated for the 500-year probabilistic earthquake, North Sangre de Cristo scenario event and the Ute Pass Fault scenario event through the Level 2 HAZUS-MH analysis. Table 10-3 summarizes the results.

TABLE 10-3.
ESTIMATED EARTHQUAKE IMPACT ON PERSONS AND HOUSEHOLDS

	Number of Displaced Households	Number of Persons Requiring Short-Term Shelter
500-Year Earthquake	1	0
North Sangre de Cristo	164	109
Ute Pass Fault Scenario	37	25

10.6.2 Property

Building Age

Table 10-4 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using these time periods, the planning team used HAZUS to identify the number of structures in the planning area by date of construction. The number of structures does not reflect the number of total housing units, as many multi-family units and attached housing units are reported as one structure. Approximately 32 percent of the planning area's structures were constructed after the Uniform Building Code was amended in 1994 to include seismic safety provisions. Approximately 21 percent were built before 1933 when there were no building permits, inspections, or seismic standards. Downtown Florence and Cañon City both contain older building stock.

TABLE 10-4.
AGE OF STRUCTURES IN PLANNING AREA

Time Period	Number of Current Planning Area Structures Built in Period	Significance of Time Frame
Pre-1933	3,514	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1933-1940	231	In 1940, the first strong motion recording was made.
1941-1960	1,812	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1961-1975	2,147	In 1975, significant improvements were made to lateral force requirements.
1976-1993	3,708	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1994 - present	5,295	Seismic code is currently enforced.
Total	**16,707**	

Loss Potential

Property losses were estimated through the Level 2 HAZUS-MH analysis for the 500-year earthquake, North Sangre de Cristo and the Ute Pass scenario events. Table 10-5, Table 10-6, and Table 10-7 show the results for two types of property loss:

- Structural loss, representing damage to building structures

- Non-structural loss, representing the value of lost contents.

The total of the two types of losses is also shown in the tables. A summary of the property-related loss results is as follows:

- For a 500-year probabilistic earthquake, the estimated damage potential is $4,302,232, or 0.08 percent of the total replacement value for the planning area.
- For a 7.5-magnitude North Sangre de Cristo Fault event, the estimated damage potential is $315,073,777, or 6.03 percent of the total replacement value for the planning area.
- For a 7.0-magnitude Ute Pass Fault event, the estimated damage potential is $115,574,239, or 2.21 percent of the total replacement value for the planning area.

TABLE 10-5.
LOSS ESTIMATES FOR 500-YEAR PROBABILISTIC EARTHQUAKE

	Estimated Loss Associated with Earthquake		
	Structure	Contents	Total
Brookside	$17,688	$2,851	$20,539
Cañon City	$768,002	$153,071	$921,073
Coal Creek	$1,528	$296	$1,824
Florence	$64,471	$12,462	$76,933
Rockvale	$2,483	$481	$2,964
Williamsburg	$10,551	$1,932	$12,483
Unincorporated	$2,756,574	$509,843	$3,266,417
Total	**$3,621,297**	**$680,935**	**$4,302,232**

TABLE 10-6.
LOSS ESTIMATES FOR NORTH SANGRE DE CRISTO SCENARIO EARTHQUAKE

	Estimated Loss Associated with Earthquake		
	Structure	Contents	**Total**
Brookside	$907,977	$208,933	$1,116,910
Cañon City	$80,381,158	$20,643,814	$101,024,972
Coal Creek	$64,685	$21,659	$86,344
Florence	$3,664,995	$1,005,013	$4,670,008
Rockvale	$105,082	$35,185	$140,267

TABLE 10-6.
LOSS ESTIMATES FOR NORTH SANGRE DE CRISTO SCENARIO EARTHQUAKE

	Estimated Loss Associated with Earthquake		
	Structure	Contents	**Total**
Williamsburg	$577,933	$165,828	$743,761
Unincorporated	$163,847,993	$43,443,521	$207,291,514
Total	**$249,549,824**	**$65,523,953**	**$315,073,777**

TABLE 10-7.
LOSS ESTIMATES FOR UTE PASS FAULT SCENARIO EARTHQUAKE

	Estimated Loss Associated with Earthquake		
	Structure	Contents	**Total**
Brookside	$463,110	$137,469	$600,579
Cañon City	$20,788,560	$6,217,894	$27,006,454
Coal Creek	$34,514	$11,608	$46,122
Florence	$2,086,579	$629,035	$2,715,614
Rockvale	$56,069	$18,857	$74,926
Williamsburg	$247,836	$77,268	$325,104
Unincorporated	$64,877,927	$19,927,514	$84,805,441
Total	**$88,554,595**	**$27,019,644**	**$115,574,239**

The HAZUS-MH analysis also estimated the amount of earthquake-caused debris in the planning area for the 500-year earthquake, North Sangre de Cristo and the Ute Pass Fault scenario events, as summarized in Table 10-8.

TABLE 10-8.
ESTIMATED EARTHQUAKE-CAUSED DEBRIS

	Debris to Be Removed (tons)
500-Year Earthquake	1,376
North Sangre de Cristo Fault Scenario	164,579
Ute Pass Fault Scenario	42,228

10.6.3 Critical Facilities and Infrastructure

Level of Damage

HAZUS-MH classifies the vulnerability of critical facilities to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model was used to assign a vulnerability category to each critical facility in the planning area except hazmat facilities and "other infrastructure" facilities, for which there are no established damage functions. The analysis was performed all scenario events. Table 10-9, Table 10-10 and Table 10-11 summarize the results.

TABLE 10-9.
ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM 500-YEAR EARTHQUAKE

Category	No Damage	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage
Medical and Health	1	0	0	0	**0**
Government Functions	11	0	0	0	**0**
Protective Functions	9	6	0	0	**0**
Schools	19	1	0	0	**0**
Bridges	133	0	0	0	**0**
Water Supply	8	0	0	0	**0**
Wastewater	3	0	0	0	**0**
Power	3	0	0	0	**0**
Communications	6	0	0	0	**0**
Transportation	5	0	0	0	**0**
Total	**198**	**7**	**0**	**0**	**0**

TABLE 10-10.
ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM NORTH SANGRE DE CRISTO SCENARIO EVENT

Category	No Damage	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage
Medical and Health	0	0	1	0	0
Government Functions	11	0	0	0	0
Protective Functions	9	2	1	0	3
Schools	19	1	0	0	0
Bridges	124	0	0	5	4
Water Supply	1	7	0	0	0
Wastewater	1	2	0	0	0
Power	0	3	0	0	0
Communications	3	3	0	0	0
Transportation	4	1	0	0	0
Total	**172**	**19**	**2**	**5**	**7**

TABLE 10-11.
ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM UTE PASS SCENARIO EVENT

Category	No Damage	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage
Medical and Health	0	0	1	0	0
Government Functions	11	0	0	0	0
Protective Functions	9	6	0	0	0
Schools	19	1	0	0	0
Bridges	133	0	0	0	0
Water Supply	0	8	0	0	0
Wastewater	0	3	0	0	0
Power	0	3	0	0	0
Communications	4	2	0	0	0
Transportation	4	1	0	0	0
Total	**180**	**24**	**1**	**0**	**0**

Time to Return to Functionality

HAZUS-MH estimates the time to restore critical facilities to fully functional use. Results are presented as probability of being functional at specified time increments: 1, 3, 7, 14, 30 and 90 days after the event. For example, HAZUS-MH may estimate that a facility has 5 percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. The analysis of critical facilities in the planning

area was performed for all scenario events. Table 10-12, Table 10-13 and Table 10-14 summarize the results.

10.6.4 Environment

The environment vulnerable to earthquake hazard is the same as the environment exposed to the hazard.

TABLE 10-12.
FUNCTIONALITY OF CRITICAL FACILITIES FOR 500-YEAR EVENT

Planning Unit	# of Critical Facilities	Probability of Being Fully Functional (%)					
		at Day 1	at Day 3	at Day 7	at Day 14	at Day 30	at Day 90
Medical and Health	1	93	93	99	99	99	99
Government Functions	11	97	97	99	99	99	99
Protective Functions	15	72	73	97	98	99	99
Schools	20	93	94	99	99	99	99
Bridges	133	99	99	99	99	99	99
Water Supply	8	97	99	99	99	99	99
Wastewater	3	95	99	99	99	99	99
Power	3	96	99	99	99	99	99
Communications	6	99	99	99	99	99	99
Transportation	5	99	99	99	99	99	99
Total/Average	**205**	94	95	99	99	99	99

TABLE 10-13.
FUNCTIONALITY OF CRITICAL FACILITIES FOR NORTH SANGRE DE CRISTO SCENARIO EVENT

Planning Unit	# of Critical Facilities	Probability of Being Fully Functional (%)					
		at Day 1	at Day 3	at Day 7	at Day 14	at Day 30	at Day 90
Medical and Health	1	2	2	9	9	44	60
Government Functions	11	59	60	87	87	99	99
Protective Functions	15	31	32	59	60	79	85
Schools	20	54	55	83	84	97	98
Bridges	133	80	84	87	87	88	92
Water Supply	8	66	94	97	98	98	99
Wastewater	3	52	83	96	97	98	99
Power	3	49	82	97	99	99	99
Communications	6	85	96	97	99	99	99
Transportation	5	98	99	99	99	99	99
Total/Average	**205**	**58**	**69**	**81**	**82**	**90**	**93**

TABLE 10-14.
FUNCTIONALITY OF CRITICAL FACILITIES FOR UTE PASS SCENARIO EVENT

Planning Unit	# of Critical Facilities	Probability of Being Fully Functional (%)					
		at Day 1	at Day 3	at Day 7	at Day 14	at Day 30	at Day 90
Medical and Health	1	19	19	48	49	89	93
Government Functions	11	64	65	90	90	99	99
Protective Functions	15	50	50	82	83	94	96
Schools	20	65	66	89	89	98	99
Bridges	133	93	94	96	96	96	98
Water Supply	8	52	87	93	94	95	99
Wastewater	3	35	69	89	92	92	98
Power	3	45	79	96	99	99	99
Communications	6	89	97	98	99	99	99
Transportation	5	96	98	99	99	99	99
Total/Average	**205**	**61**	**72**	**88**	**89**	**96**	**98**

10.7 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by master plans adopted by the County and its planning partners as well as local permitting departments and zoning maps. The information in this plan provides the participating partners a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The International Building Code also establishes provisions to address seismic risk.

10.8 SCENARIO

An earthquake does not have to occur within the planning area to have a significant impact on the people, property and economy of the County. Any seismic activity of 6.0 or greater on faults within the planning area would have significant impacts throughout the County. Earthquakes of this magnitude or higher would lead to massive structural failure of property on highly liquefiable soils. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including landslides and mudslides that would further damage structures. River valley hydraulic-fill sediment areas are also vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils.

10.9 ISSUES

Important issues associated with an earthquake include but are not limited to the following:

- Approximately 32 percent of the planning area's building stock was built prior to 1975, when seismic provisions became uniformly applied through building code applications.
- Critical facility owner should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.

- Earthquakes could trigger other natural hazard events such as dam failures and landslides, which could severely impact the County.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Failures could happen at multiple locations, increasing the impacts of the individual events.
- The cost of retro-fitting buildings to meet earthquake seismicity standards may be cost-prohibitive.
- Dams located in the County may not have been engineered to withstand probable seismic events.
- Information regarding liquefaction susceptibility of soils in the planning area is lacking.

CHAPTER 11.
FLOOD

FLOOD RANKING			
Fremont County	Canon City	Florence	Brookside
High	Medium	High	Low

11.1 GENERAL BACKGROUND

11.1.1 Flood

The following section is excerpted from the 2013 State of Colorado Flood Mitigation Plan.

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from:

- the overflow of stream banks,
- the unusual and rapid accumulation of runoff of surface waters from any source, or
- mudflows or the sudden collapse of shoreline land.

DEFINITIONS

Flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

100-Year Floodplain—The area flooded by a flood that has a 1-percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

Return Period—The average number of years between occurrences of a hazard (equal to the inverse of the annual likelihood of occurrence).

Riparian Zone—The area along the banks of a natural watercourse.

Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel. Rate of rise, magnitude (or peak discharge), duration, and frequency of floods are a function of specific physiographic characteristics. Generally, the rise in water surface elevation is quite rapid on small (and steep gradient) streams and slow in large (and flat sloped) streams.

The causes of floods relate directly to the accumulation of water from precipitation, rapid snowmelt, or the failure of manmade structures, such as dams or levees. Floods caused by precipitation are further classified as coming from: rain in a general storm system, rain in a localized intense thunderstorm, melting snow, rain on melting snow, and ice jams. Floods may also be caused by structural or hydrologic failures of dams or levees. A hydrologic failure occurs when the volume of water behind the dam or levee exceeds the structure‘s capacity resulting in overtopping. Structural failure arises when the physical stability of the dam or levee is compromised due to age, poor construction and maintenance, seismic activity, rodent tunneling, or myriad other causes. For more information on floods resulting from dam and levee failure refer to Chapter 8 of this plan.

General Rain Floods

General rain floods can result from moderate to heavy rainfall occurring over a wide geographic area lasting several days. They are characterized by a slow steady rise in stream stage and a peak flood of long duration. As various minor streams empty into larger and larger channels, the peak discharge on the mainstream channel may progress upstream or downstream (or remain stationary) over a considerable length of river. General rain floods can result in considerably large volumes of water. The general rain flood season is historically from the beginning of May through October. Because the rate of rise is slow and the time available for warning is great, few lives are usually lost, but millions of dollars in valuable public and private property are at risk.

Thunderstorm Floods

Damaging thunderstorm floods are caused by intense rain over basins of relatively small area. They are characterized by a sudden rise in stream level, short duration, and a relatively small volume of runoff. Because there is little or no warning time, the term "flash flood" is often used to describe thunderstorm floods. The average number of thunderstorm days per year in Colorado varies from less than 40 near the western boundary to over 70 in the mountains along the Front Range. The thunderstorm flood season in Colorado is from the middle of July through October.

Snowmelt Floods

Snowmelt floods result from melting of winter snowpack in the high mountain areas. Snowmelt floods typically begin as spring runoff appears, after the first spring warming trend. If the warming trend continues up to 8 to 10 consecutive days in a basin where the snowpack has a water content more than about 150 percent of average, serious flooding can develop. The total duration of snowmelt floods is usually over a period of weeks rather than days. They yield a larger total volume in comparison to other types of floods in Colorado. Peak flows, however, are generally not as high as flows for the other types. A single cold day or cold front can interrupt a melting cycle causing the rising water to decline and stabilize until the cycle can begin again. Once snowmelt floods have peaked, the daily decreases are moderate, but fairly constant. Snowmelt flooding usually occurs in May, June, and early July.

Rain on Snowmelt Floods

Rain on snow flooding occurs most often in Colorado during the month of May. It is at this time of year that large general rainstorms occur over western Colorado. These rainstorms are most often caused when warm moist air from the Gulf of Mexico begins pushing far enough north that it begins to affect western weather. In combination with this movement of air mass is the continued possibility of cold fronts moving into Colorado from the Pacific Northwest. When these weather phenomena collide, long lasting general rainstorms can often occur. Rain on snowmelt exacerbates an already tenuous situation as snowmelt waters rush down heavily incised stream channels. Any abnormal increase in flow from other sources usually causes streams to leave their banks.

During the summer months of May and June when rivers are running high, there is a potential for flooding due to rain falling on melting snow. Usually such rain is over a small part of a basin, and the resulting flood is of short duration and may often go unnoticed in the lower reaches of a large drainage basin. To some extent, the cloud cover associated with the rain system can slow the melting cycle and offset the compound effect. In some cases, however, rainfall may be heavy and widespread enough to noticeably affect peak flows throughout the basin.

Ice Jam Floods

Ice jam floods can occur by two phenomena. In the mountain floodplains during extended cold periods of 20 to 40 degrees below zero, the streams ice over. The channels are frozen solid and overbank flow occurs, which results in ice inundation in the floodplains. Ice jam floods can occur when frozen water in the upper reaches of a stream abruptly begins to melt due to warm Chinook winds. Blocks of ice floating downstream can become lodged at constrictions and form a jam. The jam can force water to be diverted from the stream channel causing a flood. An ice jam can also break up, suddenly causing a surge of water as the "reservoir" that was formed behind it is suddenly released. Ice jamming occurs in slow moving streams where prolonged periods of cold weather are experienced. Sometimes the ice jams are dynamited, allowing a controlled release of the backed up water to flow downstream.

11.1.2 Floodplain

A floodplain is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

11.1.3 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to estimate the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

11.1.4 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

11.1.5 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains.

It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

11.1.6 Federal Flood Programs

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRM), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Fremont County and all its incorporated communities except Brookside participate in the NFIP program. Structures permitted or built in the County before then are called "pre-FIRM" structures, and structures built afterwards are called "post-FIRM." The insurance rate is different for the two types of structures. The effective date for the current countywide FIRM is July 3, 2012. The County and participating communities are currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff. Maintaining compliance under the NFIP is an important component of flood risk reduction.

The Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information

- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

Figure 11-1 shows the nationwide number of CRS communities by class as of May 2012, when there were 1,211 communities receiving flood insurance premium discounts under the CRS program.

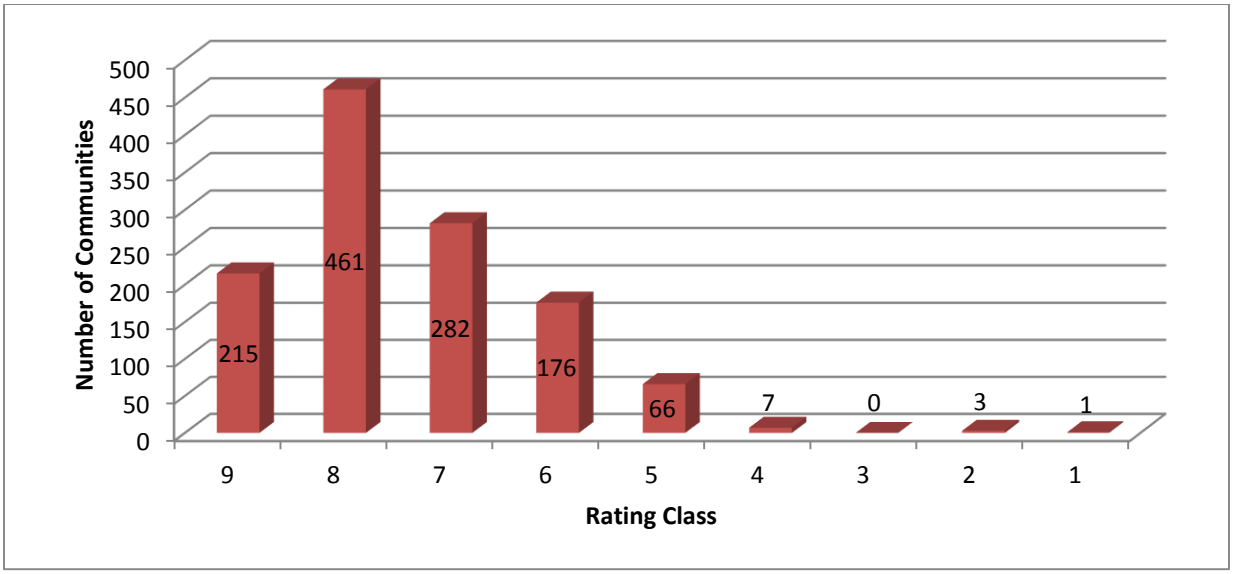


Figure 11-1. CRS Communities by Class Nationwide as of May 2012

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks.

Fremont County and the City of Cañon City participate in the CRS program. Cañon City has been participating since October 1992 and has a current rating class of 8. Fremont County has been participating since October 1993 and has a current rating class of 9. At this time, Florence does not participate in the CRS program.

11.2 HAZARD PROFILE

In the past, Fremont County has had significant seasonal floods along the Arkansas River; however, these floods have been greatly reduced by the construction of large reservoirs along the Colorado Front Range. Additionally, many streams and creeks in the area have been diverted into irrigation ditches for agricultural uses. This has also helped to reduce the impacts of seasonal floods in the planning area.

Flooding in the County is now predominantly the result of snowmelt and cloudbursts that result in flash flooding. Severe flash flooding poses the greatest risk. These rain events are most often microbursts, which produce a large amount of rainfall in a short amount of time. Flash floods, by their nature, occur suddenly but usually dissipate within hours. Despite their sudden nature, the National Weather Service is usually able to issue advisories, watches, and warnings in advance of a flood. In mountainous, rugged terrain, runoff can damage drainage systems or cause them to fail.

The potential for flooding can change and increase through various land use changes and changes to land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities (e.g., development). These changes can also be created by other events such as

wildfires. Wildfires create hydrophobic soils, a hardening or "glazing" of the earth's surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff, erosion, and downstream sedimentation of channels.

Potential flood impacts include loss of life, injuries, and property damage. Floods can also affect infrastructure (water, gas, sewer, and power utilities), transportation, jobs, tourism, the environment, and ultimately local and regional economies.

11.2.1 Past Events

The National Climatic Data Center Storm Events Database includes flood events that happened in Fremont County between 1996 and 2013, as listed in Table 11-1.

TABLE 11-1.
FREMONT COUNTY FLOOD EVENTS, 1996 - 2013

Location	Date	Event Type	Estimated Damage Cost	
			Property	Crops
Fremont County	9/15/2013	Flash Flood	$600,000	$0
Penrose	9/12/2013	Flash Flood	$0	$0
Parkdale	8/10/2013	Flash Flood	$0	$0
Parkdale	8/9/2013	Flash Flood	$0	$0
Coal Creek	7/31/2012	Flash Flood	$30,000	$0
Parkdale	8/2/2010	Flash Flood	$0	$0
Cotopaxi	7/30/2010	Flash Flood	$0	$0
Cañon City	7/26/2009	Flash Flood	$0	$0
Texas Creek	7/26/2009	Flash Flood	$5,000	$0
Cañon City	7/25/2009	Flash Flood	$0	$0
Texas Creek	7/26/2008	Flash Flood	$75,000	$0
Penrose	7/5/2006	Flash Flood	$2,000,000	$0
Penrose	8/5/2001	Flash Flood	$0	$0
Cañon City	7/13/2001	Flash Flood	$0	$0
Cañon City	8/13/2000	Flash Flood	$0	$0
Cañon City	8/6/1997	Flood	$0	$0
Penrose	6/10/1997	Flood	$0	$0
Penrose	8/4/1999	Flash Flood	$0	$0
Cañon City	8/8/1996	Flash Flood	$800,000	$0
Cañon City	8/1/1996	Flash Flood	$40,000	$0
Cañon City	8/1/1996	Flash Flood	$0	$0
Cañon City	8/1/1996	Flash Flood	$0	$0
Florence	7/12/1996	Flash Flood	$0	$0
Cotopaxi	6/14/1996	Flash Flood	$0	$0
Cañon City	6/14/1996	Flash Flood	$0	$0

Source: National Climatic Data Center

Notable incidents from the Storm Events Database and Fremont County are described below:

- **August 1991** - Cañon City received as much as 6 inches of rain in 45 minutes. Prior to the storm, the ground had been saturated from previous storms causing an ideal environment for flooding. No deaths or injuries were reported, but the damage to structures and facilities was calculated to be $554,202.
- **June 14, 1996** - Rainfall rates of 1 to 2 inches per hour produced a reported 15-foot wall of water to cascade down Bernard Creek north of the town of Cotopaxi, forced people to evacuate their homes, washed out a bridge, and derailed four empty rail cars.
- **August 1 – 2, 1996** - In 20 minutes, 1 1/2 inches of rain fell and washed out Copper Gulch Road, washing one vehicle off the road into Copper Gulch. The vehicle and two uninjured passengers were washed downstream for 1 mile. The roadway received damage from the wall of mud and water.
- **August 8, 1996** - Strong thunderstorms moved across eastern Fremont County, producing rainfall totals ranging from 2 1/2 to 5 inches. The heavy rainfall caused extensive damage to structures and roads in Cañon City. The flood caused damage to 22 businesses and 162 homes with damages estimated to be approximately $500,000.
- **June 10, 1997** - Heavy rain in the Red Creek and Beaver Creek drainage basins caused the creeks to flood from their source to the Arkansas River. Some campers and residents had to be evacuated, but no known widespread damage to property occurred.
- **August 6, 1997** - Heavy rain caused small stream and urban flooding in the Cañon City area. Two young boys playing in an irrigation ditch were swept to their deaths shortly after 1:00 p.m.
- **July 5, 2006** - Four to 6 inches of rain fell in approximately 2 hours on already saturated ground and caused significant flash flooding over a part of eastern Fremont County. The drainage basins of Beaver, Brush Hollow and Eightmile Creeks were overwhelmed, while several roads (County Roads 123 and 132, Phantom Canyon Road, State Highway 115) and bridges were washed out or damaged. Brush Hollow Creek was particularly destructive, overwhelming the culvert at State Highway 115 between Penrose and Florence. For a time, the fast-flowing water was over 200 yards wide across the road. That portion of Highway 115 over the culvert was completely destroyed and remained closed for 6 weeks. County Road 123 was severely damaged by Eightmile Creek. All the water from the Eightmile and Brush Hollow drainage basins emptied into the Arkansas River upstream from the Portland River gage. The resulting river rise was extraordinary; in fact, a record crest for that part of the Arkansas River (13 feet) was measured. The gage's instruments were completely submerged for a time, and debris nearly destroyed the gage. Severe flooding occurred on Beaver Creek, which empties into the Arkansas River downstream of the Portland gage. A paleo-hydrologist with the USGS in Denver estimated that the flow in Beaver Creek went from a trickle to about 13 feet in less than 15 minutes – a true "wall of water" flash flood.
- **July 26, 2008** - Heavy rain caused extreme runoff which undermined and washed away three sections of Copper Gulch Road. Around a dozen motorists were stranded on the road as 4 to 6 feet of water was running across the road. Seven miles of the road was closed during the cleanup and repair. There were no injuries. The Deer Mountain flood destroyed sections of County Road 28 causing disruption to access of the Deer Mountain area until road crews repaired the damaged sections.
- **July 31, 2012 -** Heavy rain caused flash flooding south of Florence. The normally dry Mineral Creek flooded and undermined a bridge on State Highway 67, 5 miles south of Florence. The bridge had to be rebuilt. The road was reopened on August 26, 2012.

- **August 9, 2013** – As background information, very heavy rainfall of around 1.5 inches (with rainfall rates up to 5 inches per hour) occurred across the Waldo and Williams Canyon watersheds, producing flooding on U.S. Highway 24 and in Manitou Springs. Flash flooding occurred from Cascade to Waldo Canyon along U.S. Highway 24. One man drowned in the debris flow near the mouth of Waldo Canyon. In Fremont County, water flowed deeper than 6 inches across U.S. Highway 50 on the Parkdale hill. County Road 132 was blocked as a result of this event.
- **September 12, 2013 -** An area of heavy rain moved from northeast Fremont County to western El Paso County, causing flash flooding. County roads were flooded on either side of State Highway 115.

11.2.2 Location

Fremont County is in the Arkansas River basin. All streams in the County are either direct or indirect tributaries of the Arkansas River, which closely parallels Highway 50 that runs east to west across the County. Small creeks in the County that flow into the Arkansas River include: Four Mile Creek, Grape Creek, Badger Creek and Texas Creek. These streams normally flow year round, although they may dry up during unusually dry years. Additionally, large irrigation canals (not mapped) also contribute to local flooding. There may be additional small pockets within Cañon City that may experience flooding on a regular basis.

The 2013 State of Colorado Flood Hazard Mitigation Plan describes the Arkansas River basin as follows, "Of all the river basins in Colorado, the Arkansas River basin encompasses the greatest surface area of the state at 28,268 square miles. It extends over the entire southeastern corner of Colorado, and 18 counties lie within the area of the basin. Elevation in the basin varies from 14,000 feet at the headwaters near Leadville to 3,340 feet at the Colorado-Kansas border. The major population centers in the basin are Colorado Springs with roughly 431,834 people and Pueblo with a population of about 107,772. The population of the counties that lie within the basin is expected to grow by nearly half a million people between 2000 and 2030, placing major strains on water usage and increasing the number of people exposed to flood hazards" (Colorado Water Conservation Board, 2013).

Fremont County has 23,869 acres in the 100-year floodplain and 24,503 acres in 500-year floodplain. Table 11-2 shows the distribution of the acreage across the jurisdictions of the planning area.

TABLE 11-2.
ACREAGE IN 100-YEAR AND 500-YEAR FLOODPLAIN BY JURISDICTION

	Area (acres)	
Jurisdiction	100-Year	500-Year
Brookside	0.03	0.03
Cañon City	758	1,117
Coal Creek	34	42
Florence	330	362
Rockvale	62	75
Williamsburg	79	89
Unincorporated	22,606	22,818
Total	**23,869**	**24,503**

11.2.3 Frequency

Seasonal flooding on the Arkansas River has been decreasing through time due to the increased attention to water management issues along the Arkansas River drainage basin. Flash floods, however, are still considered to be highly likely to occur. Floods are considered to be highly likely to recur, with nearly a 100-percent chance of occurrence in any given year. This probability is based on the 25 event events over 17 years reported in the Storm Events Database.

11.2.4 Severity

Based on the information in this hazard profile, the magnitude/severity of flooding is limited – with less than 10 percent of structures damaged; shutdown of facilities for more than a week; or injuries/illnesses that are treatable and do not result in permanent disability. Overall significance is considered medium: moderate potential impact. Figure 11-2 shows the Special Flood Hazard Areas in Fremont County. Figure 11-3 through Figure 11-7 show the Special Flood Hazard Areas for each planning partner, besides the Town of Brookside which has not mapped flood risk.

Figure 11-2. Special Flood Hazard Areas in Fremont County

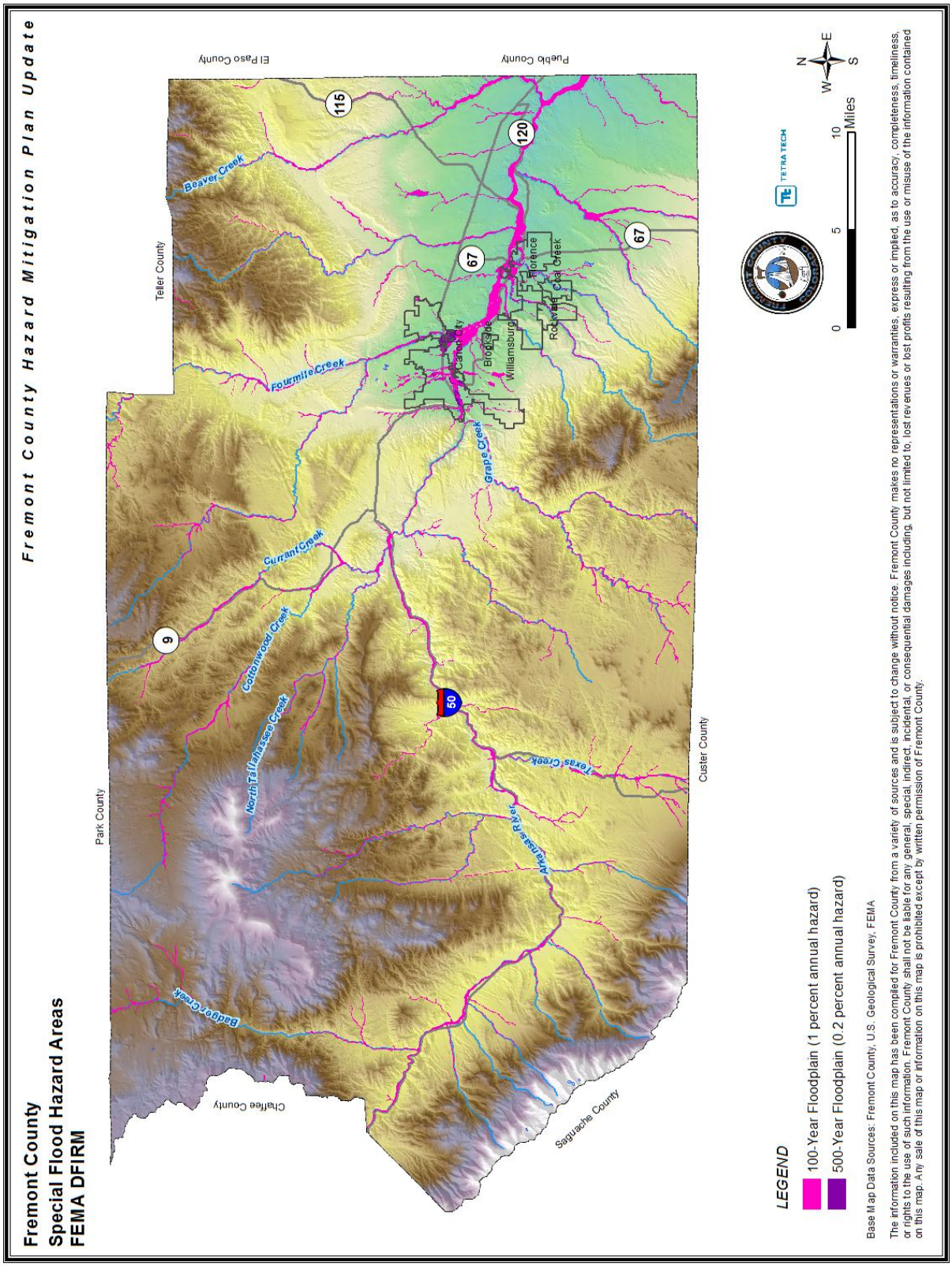


Figure 11-3. Special Flood Hazard Areas in the City of Cañon City

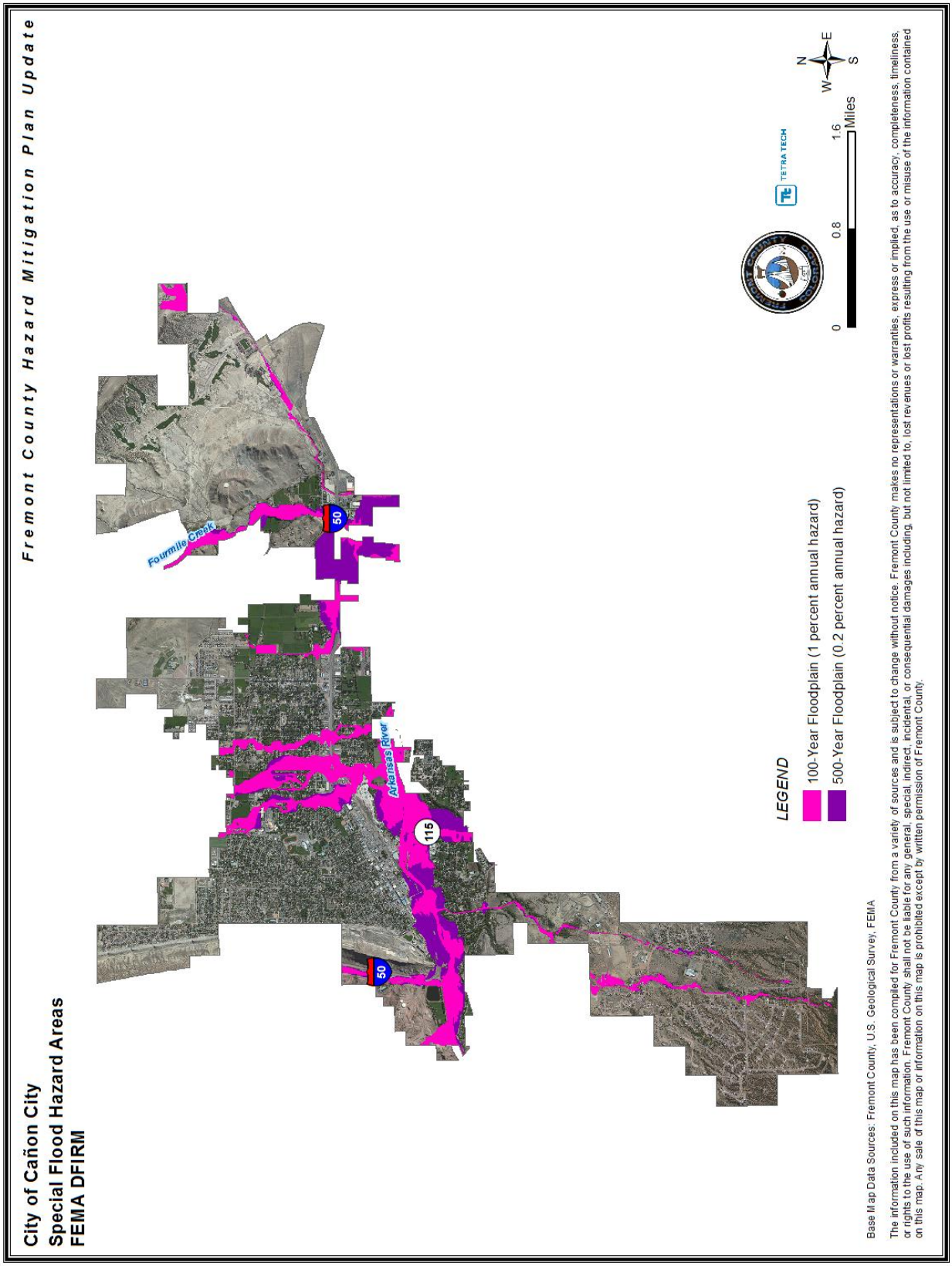


Figure 11-4. Special Flood Hazard Areas in the Town of Coal Creek

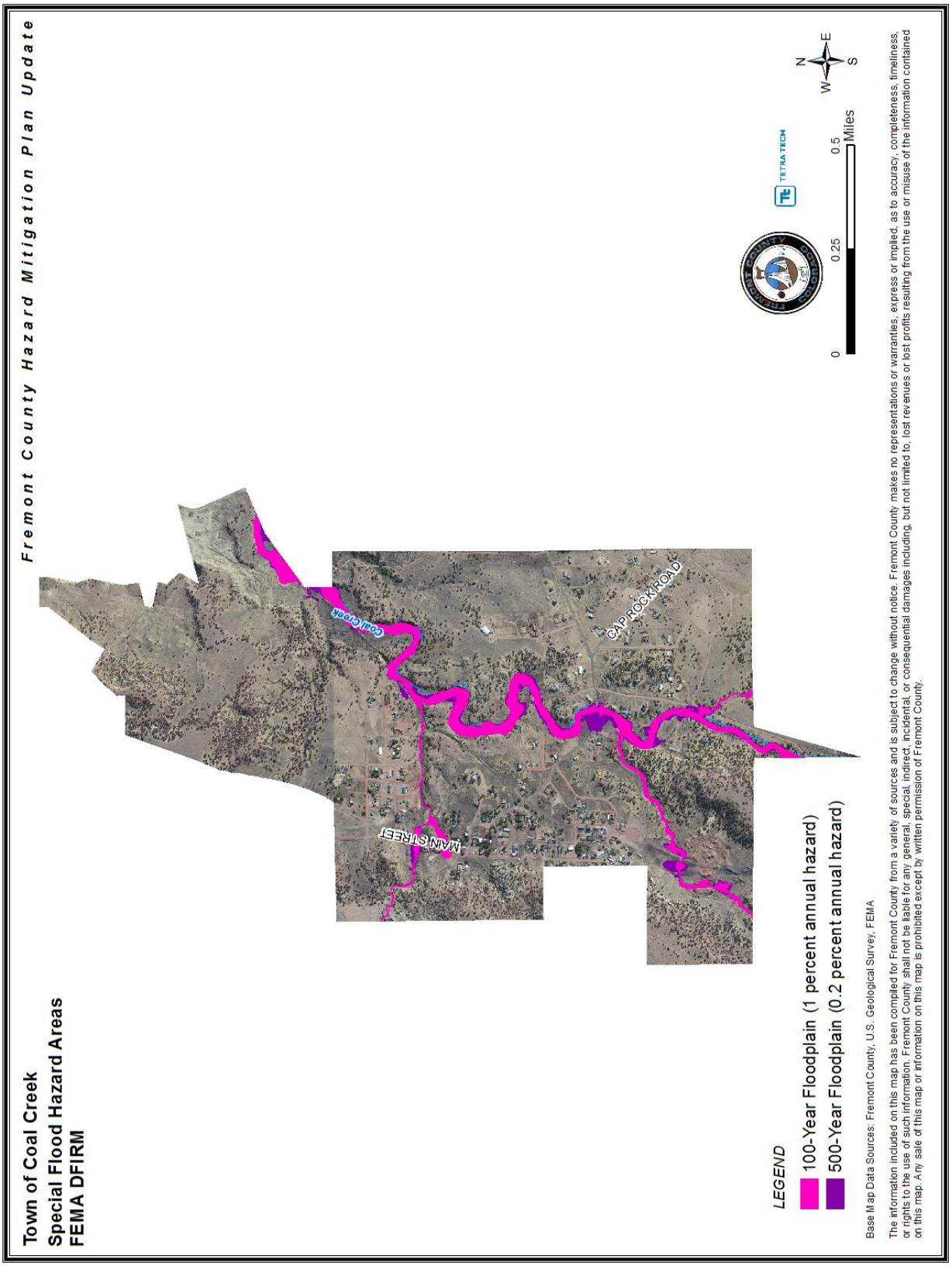


Figure 11-5. Special Flood Hazard Areas in the City of Florence

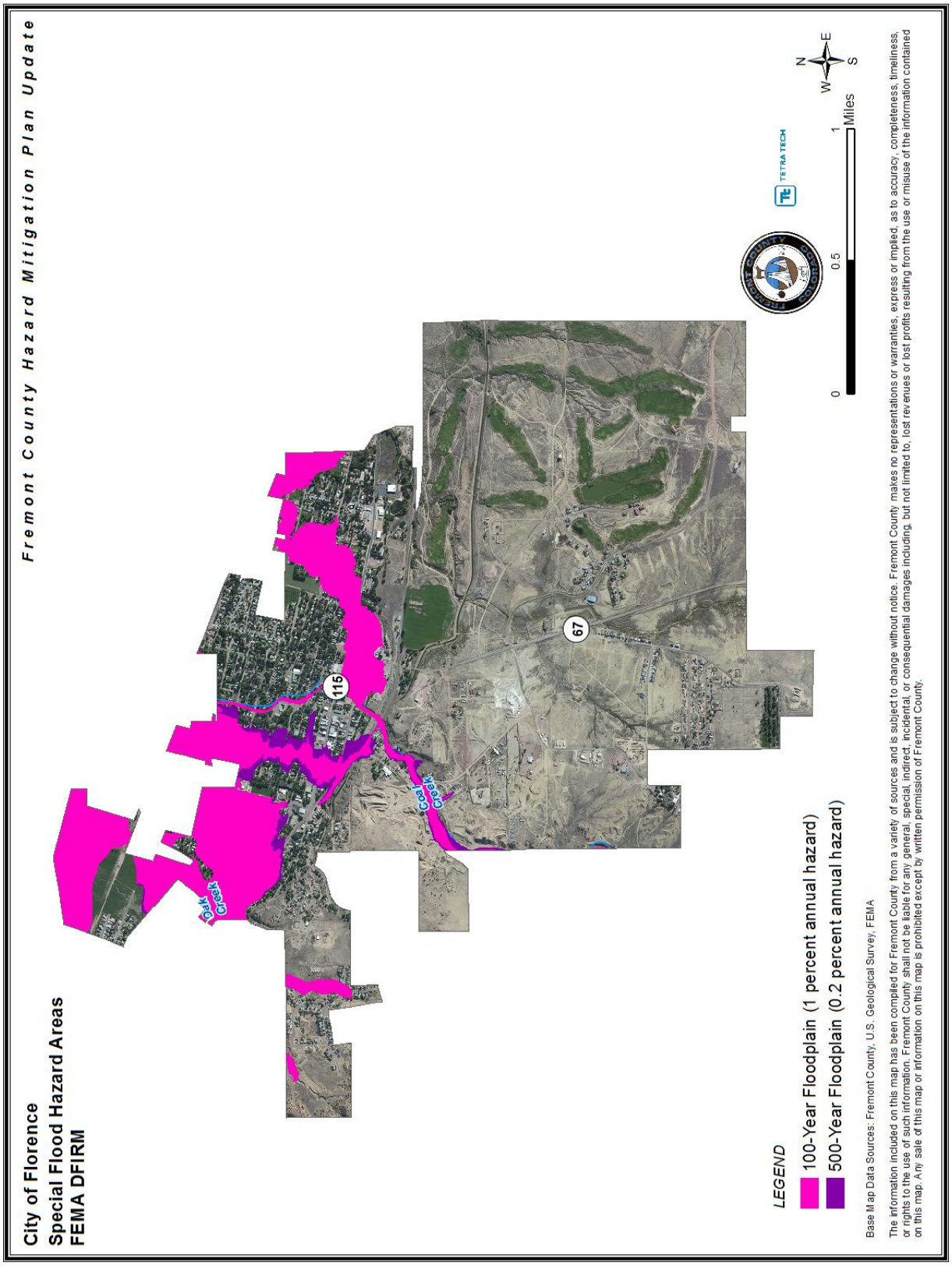


Figure 11-6. Special Flood Hazard Areas in the Town of Rockvale

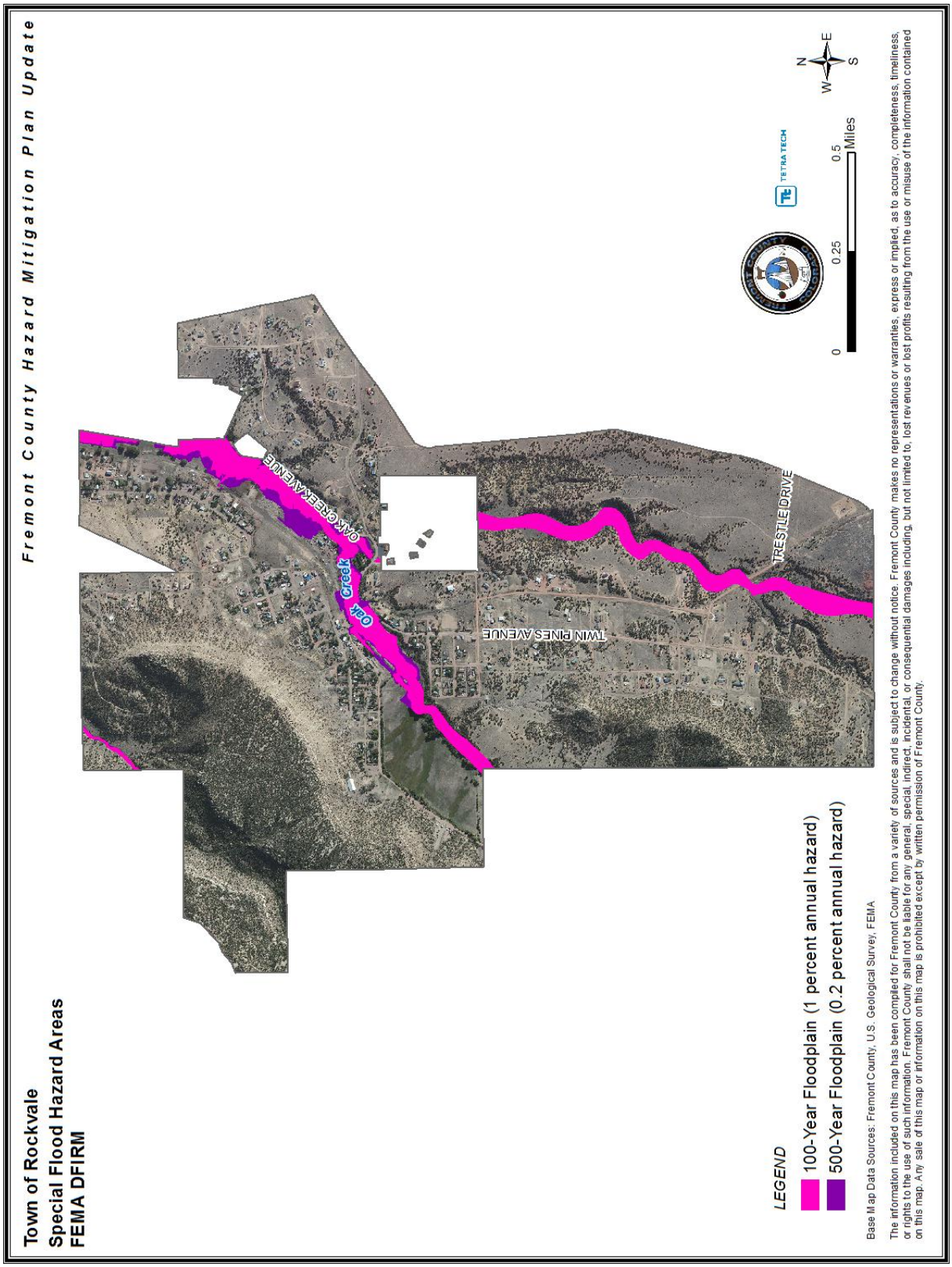
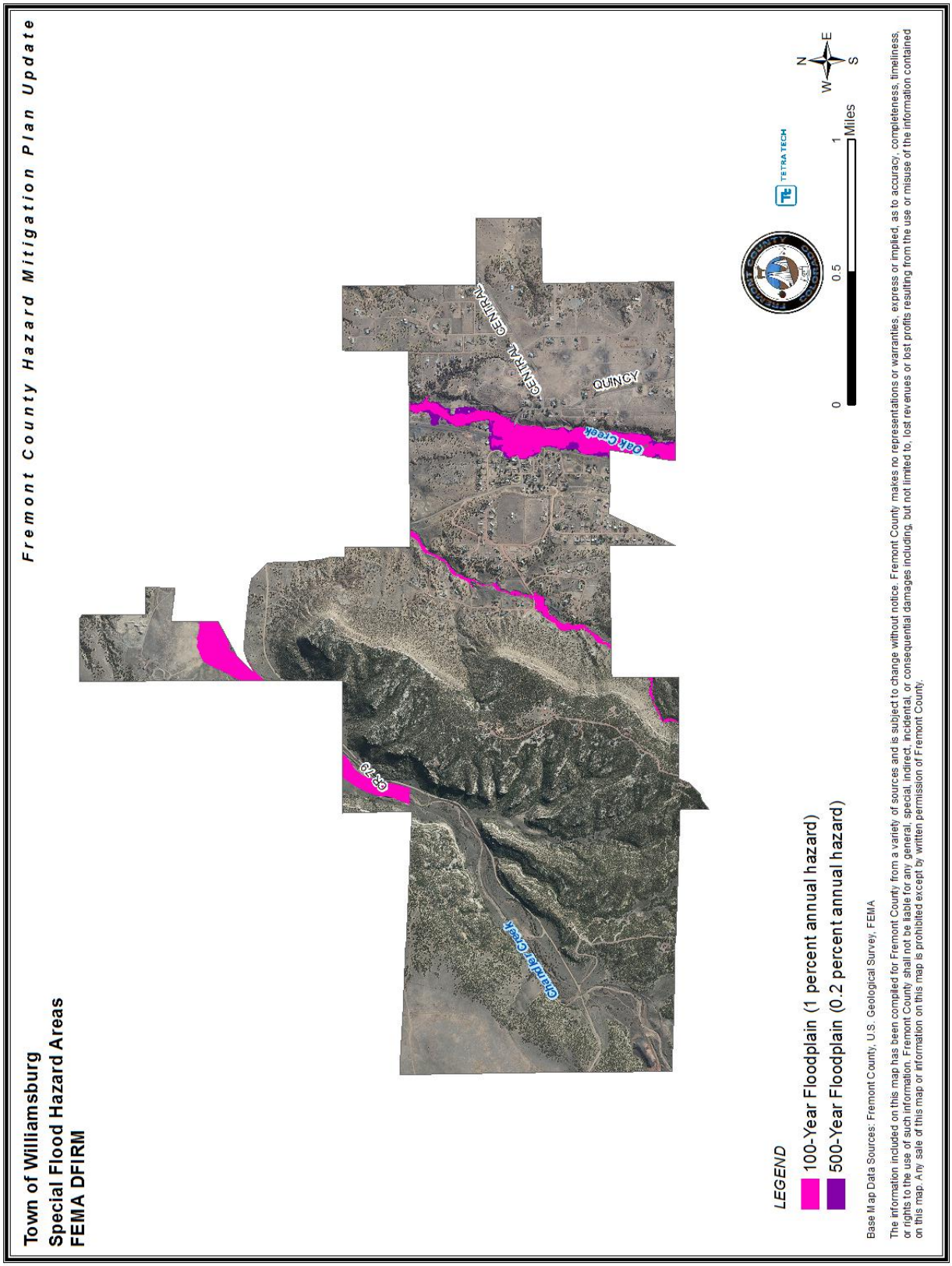


Figure 11-7. Special Flood Hazard Areas in the Town of Williamsburg



11.2.5 Warning Time

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

11.3 SECONDARY HAZARDS

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers.

11.4 CLIMATE CHANGE IMPACTS

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

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management, and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness, and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood events (e.g., 10-year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

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

11.5 EXPOSURE

The Level 2 HAZUS-MH protocol was used to assess the risk and vulnerability to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, which has a level of

accuracy acceptable for planning purposes. Where possible, the HAZUS-MH default data was enhanced using local GIS data from county, state and federal sources.

11.5.1 Population

Population counts of those living in the floodplain in the planning area were generated by analyzing tax assessor building locations that intersect with the 100-year and 500-year floodplains identified on FIRMs. The methodology used to generate population estimates intersected tax assessor building location data with the identified floodplains. Total population was estimated by multiplying the number of structures by the average Fremont County household size of 2.08 persons per household. Using this approach, it was estimated that the exposed population for the entire county is 2,617 within the 100-year floodplain (5.6 percent of the total county population). For the unincorporated portions of the County, it is estimated that the exposed population is 1,073 within the 100-year floodplain (4.3 percent of the total unincorporated county population). In the 500-year floodplain it is estimated that 3,365 people countywide live within the floodplain (4.9 percent of the total County population). For the unincorporated portions of the County there are 1,229 people exposed (7.2 percent of the total unincorporated County population).

11.5.2 Property

Present Land Use

Table 11-3 and Table 11-4 show the present land uses in the 100-year and 500-year floodplains for the entire planning area. In the 100-year floodplain, 41 percent of the floodplain is agricultural land, 12.1 percent is residential, and 30.4 percent is uncategorized. The 500-year floodplain is similar to the 100-year floodplain with 40.7 percent of the floodplain categorized as agricultural land, 12.4 percent as residential, and 30.2 percent as uncategorized.

TABLE 11-3.
PRESENT LAND USE IN 100-YEAR FLOODPLAIN

Present Use Classification	Area (acres)	% of total
Agriculture	9,832	41.2
Commercial	250	1.0
Government/Institutional	1,208	5.1
Industrial	598	2.5
Natural Resource Extraction	144	0.6
Residential	2,899	12.1
Vacant Land	1,564	6.6
Other	113	0.5
Uncategorized	7,254	30.4
Total	**23,862**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

TABLE 11-4.
PRESENT LAND USE IN 500-YEAR FLOODPLAIN

Present Use Classification	Area (acres)	% of total
Agriculture	9,978	40.7%
Commercial	329	1.3%
Government/Institutional	1,229	5.0%
Industrial	600	2.4%
Natural Resource Extraction	144	0.6%
Residential	3,039	12.4%
Vacant Land	1,613	6.6%
Other	153	0.6%
Uncategorized	7,409	30.2
Total	**24,494**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

Structures in the Floodplain

Table 11-5 and Table 11-6 summarize the total area and number of structures in the floodplain by municipality. The HAZUS-MH model determined that there are 1,258 structures within the 100-year floodplain and 1,618 structures within the 500-year floodplain. In the 100-year floodplain, about 37 to 41 percent of these structures are in unincorporated areas. Ninety percent are residential and 8 percent are commercial.

TABLE 11-5.
STRUCTURES IN THE 100-YEAR FLOODPLAIN

	Number of Structures in Floodplain							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	**Total**
Brookside	0	0	0	0	0	0	0	**0**
Cañon City	306	45	8	1	2	1	0	**363**
Coal Creek	0	0	0	0	0	0	0	**0**
Florence	328	38	0	0	3	1	0	**370**
Rockvale	5	0	0	0	0	0	0	**5**
Williamsburg	4	0	0	0	0	0	0	**4**
Unincorporated	490	21	0	0	4	1	0	**516**
Total	**1,133**	**104**	**8**	**1**	**9**	**3**	**0**	**1,258**

TABLE 11-6.
STRUCTURES IN THE 500-YEAR FLOODPLAIN

	Number of Structures in Floodplain							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	**Total**
Brookside	0	0	0	0	0	0	0	**0**
Cañon City	473	73	8	1	6	1	0	**562**
Coal Creek	0	0	0	0	0	0	0	**0**
Florence	387	58	1	0	3	1	0	**450**
Rockvale	7	0	0	0	0	0	0	**7**
Williamsburg	8	0	0	0	0	0	0	**8**
Unincorporated	558	26	0	1	5	1	0	**591**
Total	**1,433**	**157**	**9**	**2**	**14**	**3**	**0**	**1,618**

Exposed Value

Table 11-7 and Table 11-8 summarizes the estimated value of exposed buildings in the planning area in the 100-year and 500-year floodplain. This methodology estimated $398 million worth of building-and-contents exposure to the 100-year flood, representing 7.62 percent of the total assessed value of the planning area. Approximately $627 million worth of building-and-contents exposure was estimated to be exposed to the 500-year flood, representing 12 percent of the total assessed value of the planning area.

TABLE 11-7.
VALUE OF STRUCTURES IN 100-YEAR FLOODPLAIN

	Value Exposed			% of Total
	Structure	Contents	**Total**	Assessed Value
Brookside	$0	$0	$0	0.00
Cañon City	$89,331,197	$72,559,398	$161,890,595	7.38
Coal Creek	$0	$0	$0	0.00
Florence	$63,380,487	$42,378,211	$105,758,698	23.61
Rockvale	$350,813	$175,406	$526,219	1.11
Williamsburg	$515,596	$257,798	$773,394	1.44
Unincorporated	$83,481,506	$45,722,561	$129,204,067	5.31
Total	**$237,059,598**	**$161,093,375**	**$398,152,973**	**7.62**

TABLE 11-8.
VALUE OF STRUCTURES IN 500-YEAR FLOODPLAIN

	Value Exposed			% of Total
	Structure	Contents	**Total**	Assessed Value
Brookside	$0	$0	$0	0.00
Cañon City	$164,495,659	$134,675,137	$299,170,796	13.65
Coal Creek	$0	$0	$0	0.00
Florence	$78,737,886	$54,358,586	$133,096,472	29.71
Rockvale	$572,983	$286,492	$859,475	1.82
Williamsburg	$1,142,365	$571,183	$1,713,548	3.18
Unincorporated	$121,444,050	$70,460,930	$191,904,980	7.89
Total	**$366,392,944**	**$260,352,327**	**$626,745,272**	**12.00**

11.5.3 Critical Facilities and Infrastructure

Table 11-9, Table 11-10, Table 11-11, and Table 11-12 summarize the critical facilities and infrastructure in the 100-year and 500-year floodplain of the planning area. Details are provided in the following sections.

TABLE 11-9.
CRITICAL FACILITIES IN THE 100-YEAR FLOODPLAIN

Facility Type	Medical & Health	Government Functions	Protective Functions	Schools	Hazardous Materials	**Total**
Brookside	0	0	0	0	0	**0**
Cañon City	0	0	1	0	1	**2**
Coal Creek	0	0	0	0	0	**0**
Florence	0	1	0	2	0	**3**
Rockvale	0	0	0	0	0	**0**
Williamsburg	0	0	0	0	0	**0**
Unincorporated	0	0	1	0	1	**2**
Total	**0**	**1**	**2**	**2**	**2**	**7**

TABLE 11-10.
CRITICAL FACILITIES IN THE 500-YEAR FLOODPLAIN

Facility Type	Medical & Health	Government Functions	Protective Functions	Schools	Hazardous Materials	**Total**
Brookside	0	0	0	0	0	**0**
Cañon City	0	1	2	0	5	**8**
Coal Creek	0	0	0	0	0	**0**
Florence	0	1	1	2	0	**4**
Rockvale	0	0	0	0	0	**0**
Williamsburg	0	0	0	0	0	**0**
Unincorporated	0	0	1	0	1	**2**
Total	**0**	**2**	**4**	**2**	**6**	**14**

TABLE 11-11.
CRITICAL INFRASTRUCTURE IN THE 100-YEAR FLOODPLAIN

Facility Type	Bridges	Water Storage	Waste Water	Power	Communications	Transportation	Dams	**Total**
Brookside	0	0	0	0	0	0	0	**0**
Cañon City	1	0	1	0	0	0	0	**2**
Coal Creek	0	0	0	0	0	0	0	**0**
Florence	1	0	1	0	0	0	0	**2**
Rockvale	0	0	0	0	0	0	0	**0**
Williamsburg	1	0	0	0	0	0	0	**1**
Unincorporated	21	1	1	0	1	0	1	**25**
Total	**24**	**1**	**3**	**0**	**1**	**0**	**1**	**30**

TABLE 11-12.
CRITICAL INFRASTRUCTURE IN THE 500-YEAR FLOODPLAIN

Facility Type	Bridges	Water Storage	Waste Water	Power	Communications	Transportation	Dams	**Total**
Brookside	0	0	0	0	0	0	0	**0**
Cañon City	2	1	1	1	0	0	0	**5**
Coal Creek	0	0	0	0	0	0	0	**0**
Florence	2	0	1	0	0	0	0	**3**
Rockvale	0	0	0	0	0	0	0	**0**

TABLE 11-12.
CRITICAL INFRASTRUCTURE IN THE 500-YEAR FLOODPLAIN

Facility Type	Bridges	Water Storage	Waste Water	Power	Communications	Transportation	Dams	**Total**
Williamsburg	1	0	0	0	0	0	0	**1**
Unincorporated	22	1	1	0	1	0	1	**26**
Total	**27**	**2**	**3**	**1**	**1**	**0**	**1**	**35**

Utilities and Infrastructure

It is important to identify who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the County, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Dikes can fail or be overtopped, inundating the land that they protect. The following sections describe specific types of critical infrastructure.

Roads

The major roads in the planning area that pass through the 100-year floodplain and thus are exposed to flooding are U.S. Highway 50 and State Highways 115, 120, 67, 69 and 9. In severe flood events, these roads can be blocked or damaged, preventing access to some areas.

Bridges

Flooding events can significantly impact road bridges. These are important because often they provide the only ingress and egress to some neighborhoods. There are 24 bridges that are in or cross over the 100-year floodplain.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

11.5.4 Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

11.6 VULNERABILITY

Many of the areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, infrastructure and environment. The vulnerability analysis was performed at the census-block level. This methodology is likely to overestimate impacts from

both the modelled 100-year and 500-years flood events as it is assumed that both structures and the population are evenly spread throughout census block.

11.6.1 Population

A geographic analysis of demographics using the HAZUS-MH model identified populations vulnerable to the flood hazard as follows. These numbers are all calculated assuming that the population/households are evenly distributed over the census blocks.

- **Economically Disadvantaged Populations**—It is estimated that 29.3 percent of the households within the 100-year floodplain are economically disadvantaged, defined as having household incomes of $20,000 or less.
- **Population over 65 Years Old**—It is estimated that 17.2 percent of the population in the census blocks that intersect the 100-year floodplain are over 65 years old.
- **Population under 16 Years Old**—It is estimated that 18.3 percent of the population within census blocks located in or near the 100-year floodplain are under 16 years of age.

The following impacts on persons and households in the planning area were estimated for the 100-year and 500-year flood events through the Level 2 HAZUS-MH analysis:

- 100-year flood event
  - Displaced population = 4,435
  - Persons requiring short-term shelter = 2,878
- 500-year flood event
  - Displaced population = 5,543
  - Persons requiring short-term shelter = 3,877

11.6.2 Property

HAZUS-MH calculates losses to structures from flooding by looking at depth of flooding and type of structure. Using historical flood insurance claim data, HAZUS-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, local data on facilities was used instead of the default inventory data provided with HAZUS-MH. The analysis is summarized in Table 11-13 for the 100-year flood event. It is estimated that there would be up to $158 million of flood loss from a 100-year flood event in the planning area. This represents 39 percent of the total exposure to the 100-year flood and 3 percent of the total replacement value for the County. Losses are estimated to be $223 million from a 500-year flood event, representing 4.27 percent of the total replacement value for the County (Table 11-14).

TABLE 11-13.
LOSS ESTIMATES FOR 100-YEAR FLOOD EVENT

	Estimated Loss Associated with Flood			% of Total
	Structure	Contents	**Total**	Assessed Value
Brookside	$0	$0	$0	0.00
Cañon City	$21,796,000	$36,946,000	$58,742,000	2.68
Coal Creek	$0	$0	$0	0.00

TABLE 11-13.
LOSS ESTIMATES FOR 100-YEAR FLOOD EVENT

	Estimated Loss Associated with Flood			% of Total Assessed Value
	Structure	Contents	**Total**	
Florence	$11,259,000	$16,563,000	$27,822,000	6.21
Rockvale	$625,000	$357,000	$982,000	2.08
Williamsburg	$496,000	$289,000	$785,000	1.46
Unincorporated	$37,353,000	$32,301,000	$69,654,000	2.86
Total	**$71,529,000**	**$86,456,000**	**$157,985,000**	**3.03**

TABLE 11-14.
LOSS ESTIMATES FOR 500-YEAR FLOOD EVENT

	Estimated Loss Associated with Flood			% of Total Assessed Value
	Structure	Contents	**Total**	
Brookside	$0	$0	$0	0.00
Cañon City	$38,197,000	$68,514,000	$106,711,000	4.87
Coal Creek	$0	$0	$0	0.00
Florence	$13,899,000	$21,824,000	$35,723,000	7.97
Rockvale	$870,000	$500,000	$1,370,000	2.89
Williamsburg	$622,000	$359,000	$981,000	1.82
Unincorporated	$40,473,000	$37,610,000	$78,083,000	3.21
Total	**$94,061,000**	**$128,807,000**	**$222,868,000**	**4.27**

National Flood Insurance Program

Table 11-15 lists flood insurance statistics that help identify vulnerability in the planning area. The County, Cañon City, Coal Creek, Florence, Rockvale, and Williamsburg participate in the National Flood Insurance Program.

TABLE 11-15.
NATIONAL FLOOD INSURANCE PROGRAM STATISTICS

	Date of Entry Initial FIRM Effective Date	Claims, 11/1978 to 7/31/2013	Value of Claims paid, 11/1978 to 12/31/2010
Cañon City	11/3/1982	50	$101,897
Coal Creek	9/19/2007	0	0
Florence	14/4/1984	3	$17,367
Rockvale	10/15/1985	0	0
Williamsburg	9/19/2007	0	0
Fremont County	9/29/1989	10	$34,064
Total		**63**	**$153,328**

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRM for Cañon City was available in 1982 and the first Fremont County FIRM was available in 1989.

The following information from flood insurance statistics is relevant to reducing flood risk:

- The use of flood insurance in the planning area is below the national average.
- The average claim paid in the planning area is far below the national average.

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property.

Repetitive loss properties make up only 1 to 2 percent of flood insurance policies in force nationally, yet they account for 40 percent of the nation's flood insurance claim payments. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss structures have already cost $2.8 billion in flood insurance payments and that numerous other flood-prone structures remain in the floodplain at high risk. The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A recent report on repetitive losses by the National Wildlife Federation found that 20 percent of these properties are outside any mapped 100-year floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies.

FEMA-sponsored programs, such as the CRS, require participating communities to identify repetitive loss areas. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures because no flood insurance policy was in force at the time of loss.

11.6.3 Critical Facilities and Infrastructure

HAZUS-MH was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves to estimate the percent of damage to the building and contents of critical facilities, HAZUS-MH correlates these estimates into an estimate of functional down-time (the estimated time it will take to restore a facility to 100 percent of its functionality). This helps to gauge how long the planning area could have limited usage of facilities deemed critical to flood response and recovery.

The HAZUS critical facility analysis found that, on average, critical facilities would receive 11.7 percent damage to the structure and 60.5 percent damage to the contents during a 100-year flood event. The estimated time to restore these facilities to 100 percent of their functionality is 570 days. For a 500-year flood event critical facilities, on average, would receive 13.0 percent damage to the structure and 57.1 percent damage to the contents.

11.6.4 Environment

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. Loss estimation platforms such as HAZUS-MH are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

11.7 FUTURE TRENDS

Fremont County and its planning partners are equipped to handle future growth within flood hazard areas. All municipal planning partners have master plans that address frequently flooded areas. All partners have committed to linking their master plans to this hazard mitigation plan update. This will create an opportunity for wise land use decisions as future growth impacts flood hazard areas.

Additionally, all municipal planning partners, with the exception of Brookside, which has no mapped flood risk, are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. With communities in the County participating in the CRS program, there is incentive to adopt consistent, appropriate, higher regulatory standards in communities with the highest degree of flood risk. All municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this plan. Communities participating or considering participation in the CRS program will be able to refine this commitment using CRS programs and templates as a guide.

Urban flooding issues that contribute to flash floods are also a concern in more highly developed areas in Fremont County. Jurisdictions in the County are required to develop a stormwater permitting program as mandated by the National Pollutant Discharge Elimination System. This program will help jurisdictions apply effective mitigation measures for stormwater runoff.

11.8 SCENARIO

An intense, short-duration storm could move slowly across the planning area creating significant flash floods with little or no warning. Injuries or fatalities may result if residents are caught off guard by the flood event. Stormwater systems could be overwhelmed and significant flooding could impact a substantial portion of structures within the planning area. Transportation routes could be cut off due to floodwaters, isolating portions of the planning area. These impacts may last after the floodwater recedes as flash floods in the area have been known to cause extensive damage to roadway infrastructure. Areas that have recently experienced wildfires would contribute to the extent of flooding impacts.

11.9 ISSUES

The major issues for flooding are the following:

- Flash flooding that occurs with little or no warning will continue to impact the planning area.
- The duration and intensity of storms contributing to flooding issues may increase due to climate change.
- Flooding may be exacerbated by other hazards, such as wildfires.
- Damages resulting from flood may impact tourism, which may have significant impacts on the local economy.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.

CHAPTER 12.
LANDSLIDE

LANDSLIDE RANKING			
Fremont County	Canon City	Florence	Brookside
Low	Low	Medium	Low

DEFINITIONS

Landslide—The sliding movement of masses of loosened rock and soil down a hillside or slope. Such failures occur when the strength of the soils forming the slope is exceeded by the pressure, such as weight or saturation, acting upon them.

Mass Movement—A collective term for landslides, debris flows, falls and sinkholes.

Mudslide (or Mudflow or Debris Flow)—A river of rock, earth, organic matter and other materials saturated with water.

12.1 GENERAL BACKGROUND

12.1.1 Landslide

A landslide is a general term for a variety of mass-movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Some of the natural causes of ground instability are stream and lakeshore erosion, heavy rainfall, and poor quality natural materials. In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground failure. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation. Landslides typically have a slower onset and can be predicted to some extent by monitoring soil moisture levels and ground cracking or slumping in areas of previous landslide activity.

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 30 percent
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank, or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel.

Flows and slides are commonly categorized by the form of initial ground failure. Figure 12-1 through Figure 12-4 show common types of slides. The most common is the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, although they are less common than other types.

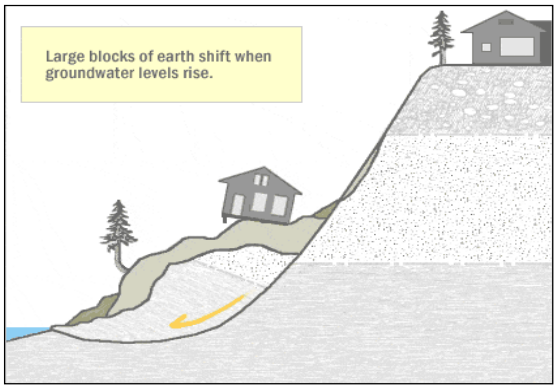


Figure 12-1. Deep Seated Slide

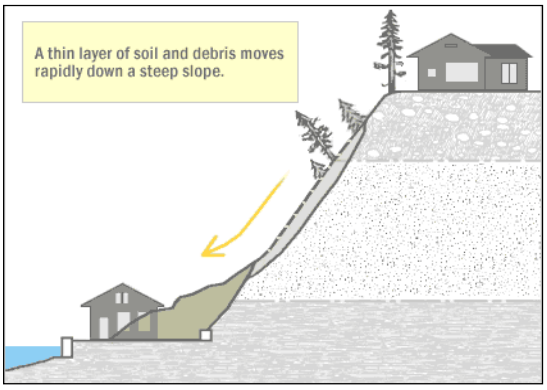


Figure 12-2. Shallow Colluvial Slide

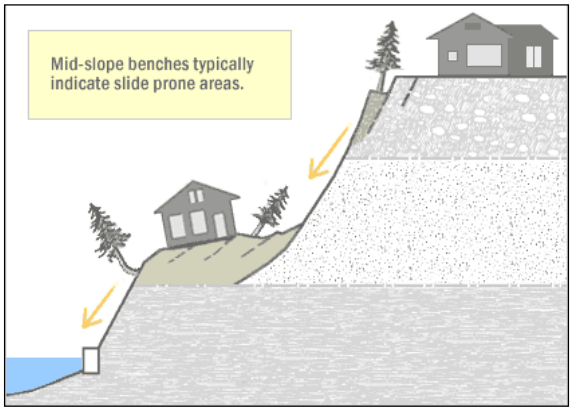


Figure 12-3. Bench Slide

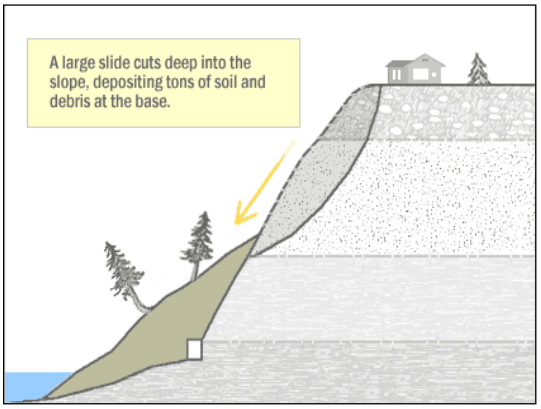


Figure 12-4. Large Slide

Slides and earth flows can pose serious hazard to property in hillside terrain. They tend to move slowly and thus rarely threaten life directly. When they move—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures.

12.1.2 Mud and Debris Flow

According to the Colorado Geological Survey, a mudslide is a mass of water and fine-grained earth that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains-rocks, stones, boulders—the event is called a debris flow. A debris fan is a conical landform produced by successive mud and debris flow deposits, and the likely spot for a future event. The mud and debris flow problem can be exacerbated by wildfires that remove vegetation that serves to stabilize soil from erosion. Heavy rains on the denuded landscape can lead to rapid development of destructive mudflows.

12.1.3 Rock Fall

A rock fall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rock falls. Rock falls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rock fall. Rocks in a rock fall can be of any dimension, from the size of baseballs to houses. Rock falls can threaten human life, impact transportation corridors and communication systems and result in other

property damage. Spring is typically the landslide/rock fall season in Colorado as snow melts and saturates soils and temperatures enter into freeze/thaw cycles. Rock falls and landslides are influenced by seasonal patterns, precipitation and temperature patterns. Earthquakes could trigger rock falls and landslides too.

12.2 HAZARD PROFILE

12.2.1 Past Events

The National Climatic Data Center does not list any landslide events that impacted Fremont County between 1996 and 2013. Additionally SHELDUS (Spatial Hazard Events and Losses Database for the United States) also lists no records of landslide events within the County. However, landslide events have impacted the County.

A rock fall event occurred in Cotopaxi in western Fremont County in 2011. This fall knocked out power lines and closed Highway 50 for a week. Because this road is the only road open through all four seasons that runs east and west through the County, local schools were closed until the highway could be reopened.

Figure 12-5 below shows the rock fall on Highway 50. Figure 12-6 shows the multi-day cleanup of more than 7,000 tons of rock that fell to the roadway.

Figure 12-5. Cotopaxi Rockfall on Highway 50 in 2011

Figure 12-6. Highway 50 Rockslide Cleanup

12.2.2 Location

According to the State of Colorado Hazard Mitigation Plan "Many of Colorado's landslides occur along transportation networks because soil and rock along the transportation corridor has been disturbed by roadway construction. Construction along roads can occur with or without proper landslide hazard mitigation procedures. The cost to maintain, cleanup, monitor, and repair roads and highways from landslide activity is difficult to assess, but the best records come from CDOT, which is responsible for maintaining Colorado roads and highways" (Colorado Division of Emergency Management, 2011).

The best available predictor of where movement of slides and earth flows might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges.

The recognition of ancient dormant mass movement sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

The geographic location of landslides and rock falls throughout Fremont County is isolated and is less than 10 percent of the area. Figure 12-7 shows mapped landslide hazard areas within the County. The only incorporated area in the County with mapped landslide risk is Cañon City shown in Figure 12-8. Rock falls that have occurred in Fremont County are most typically associated with canyons. The areas most affected by landslides-rock falls include Highway 50 in Big Horn Sheep Canyon as well as tributary roads leading into Big Horn Sheep Canyon and Highway 50. Some County roads throughout the area are susceptible to minor rock falls.

Figure 12-7. Landslide Hazard Areas in Fremont County

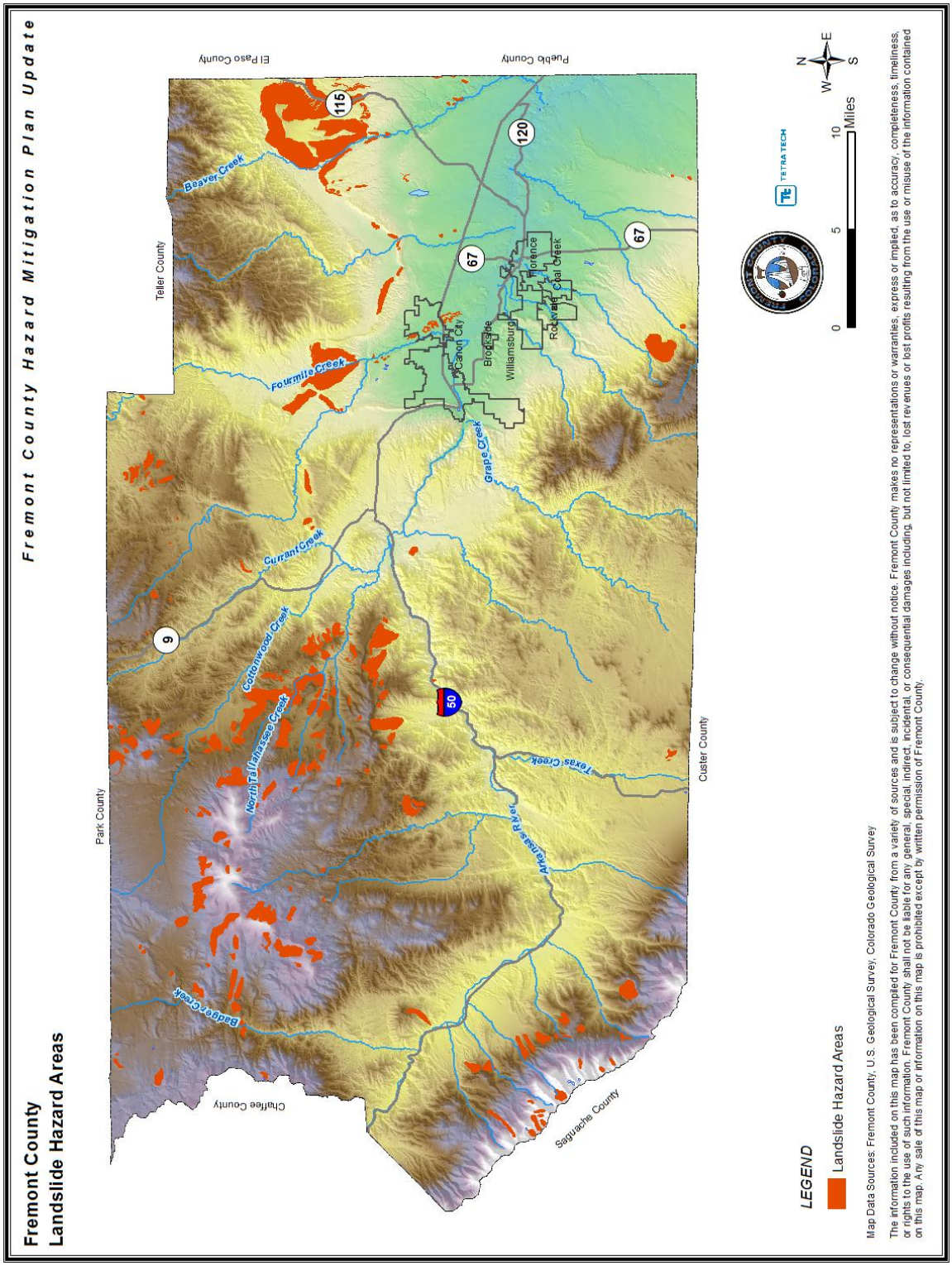
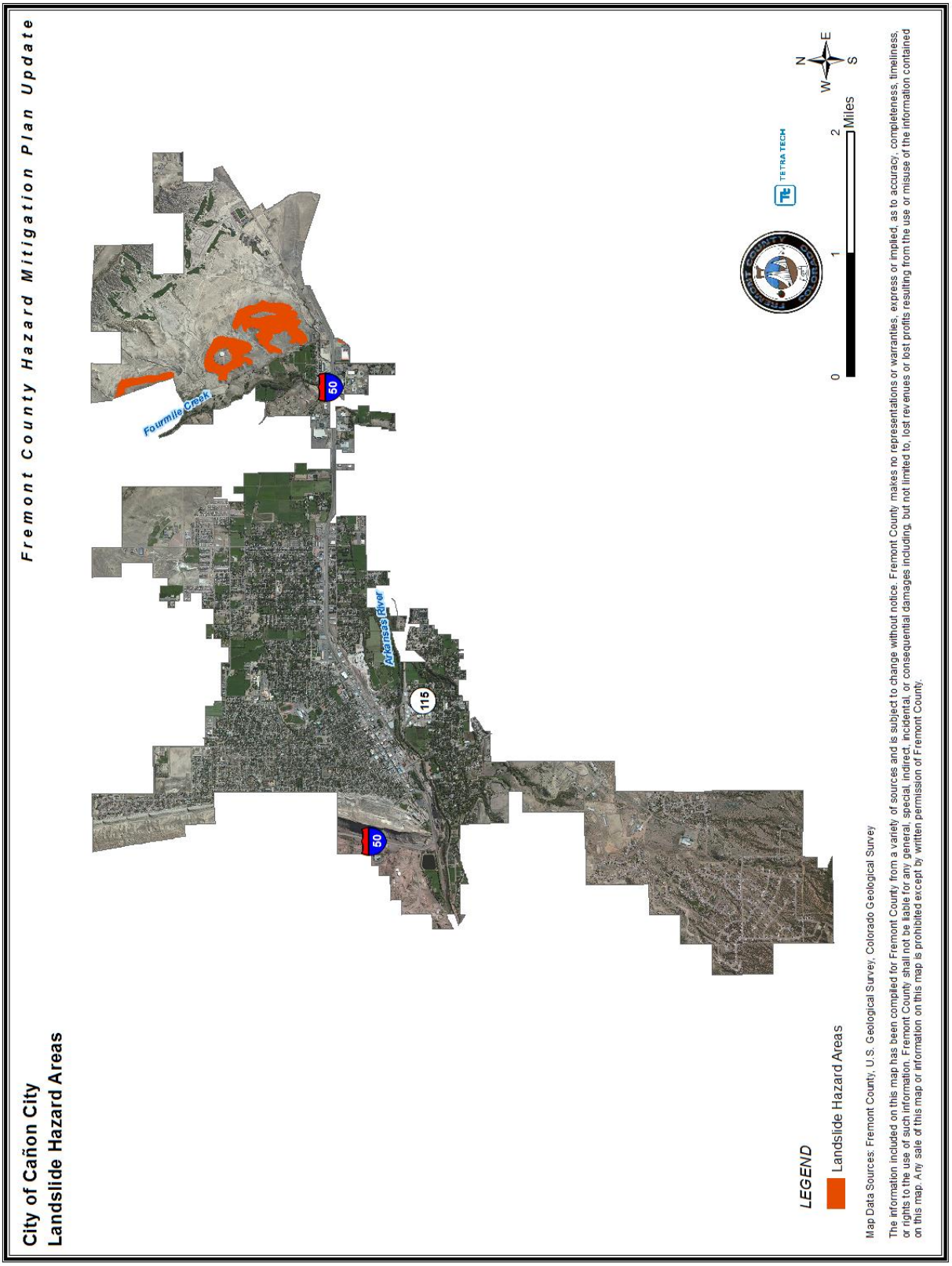


Figure 12-8. Landslide Hazard Areas in the City of Cañon City



12.2.3 Frequency

The frequency of landslide events within the County are difficult to ascertain due to a lack of information regarding past events. For the purposes of this plan it will be assumed that the probability of landslide/debris flow/rock fall events are likely, with a 10- to 100-percent chance of occurrence in any given year, or a recurrence interval of 10 years or less.

12.2.4 Severity

Landslides destroy property and infrastructure and can take the lives of people. Slope failures in the United States result in an average of 25 lives lost per year and an annual cost to society of about $1.5 billion. The magnitude/severity of a landslide/rock fall event in Fremont County is Critical. It is likely that past events have resulted in isolated deaths or multiple injuries as well as major or long term property damage that threatens structural stability; or interruption of essential facilities for 24 to 72 hours.

12.2.5 Warning Time

Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to identify what areas are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis, and respond after the event has occurred. Generally accepted warning signs for landslide activity include:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls, or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased soil content
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows and visible gaps indicating jambs and frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together.

12.3 SECONDARY HAZARDS

Landslides can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation. This could result in economic losses for businesses. More significantly, landslides can limit the ability of emergency response services to access and serve portions of the County and Highway 50. Additionally, rock falls to the river can cause blockages causing flooding, damage rivers or streams, potentially harming water quality,

fisheries, and spawning habitat. Other potential problems resulting from landslides are power and communication failures. Vegetation or poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Landslides also have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents.

12.4 CLIMATE CHANGE IMPACTS

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for landslide occurrences.

12.5 EXPOSURE

Exposure and vulnerability estimates for the landslide hazard were assessed using a methodology based on large assumptions. Most of the landslide risk areas in the County are outside of population centers. The total area of mapped landslide risk is 3.85 percent of the total acreage of the County. Exposure and loss estimates are based on this percentage, which assumes that people and property are spread evenly throughout the County.

12.5.1 Population

Exposure to landslide hazard areas is likely limited. The only mapped hazard areas within incorporated jurisdictions are in the eastern portion of Cañon City. Individuals in recreation areas or driving on roadways may also be exposed to landslide hazards.

12.5.2 Property

Property exposure to landslide hazard areas are also likely to be minimal. Using the assumptions described above, an estimated 3.85 percent or $201 million of the total replacement value of the planning area may be exposed.

12.5.3 Critical Facilities and Infrastructure

No loss estimation of these facilities was performed due to the lack of established damage functions for the landslide hazard. A significant amount of infrastructure can be exposed to mass movements:

- **Roads**—Landslides can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems and delays for public and private transportation. This can result in economic losses for businesses.
- **Bridges**—Landslides can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- **Power Lines**—Power lines are generally elevated above steep slopes; the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses.

12.5.4 Environment

Environmental problems as a result of mass movements can be numerous. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolong periods of time due to landslides.

12.6 VULNERABILITY

12.6.1 Population

In general, all person exposed to landslide hazard areas are considered to be vulnerable. Increasing population and the fact that many homes are built on view property atop or below bluffs and on steep slopes subject to mass movement, increases the number of lives endangered by this hazard.

12.6.2 Property

Loss estimations for the landslide hazards are not based on modeling using damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the replacement value of exposed structures, using the methodology described above. This allows emergency managers to select a range of economic impact based on an estimate of the percent of damage. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction. Table 12-1 shows the general building stock loss estimates in landslide risk areas.

TABLE 12-1.
LOSS ESTIMATES FOR STEEP SLOPE HAZARD AREAS

		Estimated Loss Potential from Landslide		
	Exposed Value	10% Damage	30% Damage	50% Damage
Brookside	$823,616	$82,362	$247,085	$411,808
Cañon City	$84,400,196	$8,440,020	$25,320,059	$42,200,098
Coal Creek	$997,471	$99,747	$299,241	$498,735
Florence	$17,248,470	$1,724,847	$5,174,541	$8,624,235
Rockvale	$1,821,972	$182,197	$546,592	$910,986
Williamsburg	$2,073,771	$207,377	$622,131	$1,036,886
Unincorporated	$93,693,305	$9,369,330	$28,107,991	$46,846,652
Total	**$201,058,801**	**$20,105,880**	**$60,317,640**	**$100,529,400**

12.6.3 Critical Facilities and Infrastructure

There are four critical facilities exposed to the landslide hazard to some degree. A more in-depth analysis of the mitigation measures taken by these facilities to prevent damage from mass movements should be done to evaluate whether they could withstand impacts of a mass movement.

Several types of infrastructure are exposed to mass movements, including transportation, water and sewer and power infrastructure. Highly susceptible areas of the County include mountain roads and transportation infrastructure. At this time all infrastructure and transportation corridors identified as exposed to the landslide hazard are considered vulnerable until more information becomes available.

12.6.4 Environment

The environment vulnerable to landslide hazard is the same as the environment exposed to the hazard, discussed in Section 12.5.4.

12.7 FUTURE TRENDS IN DEVELOPMENT

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Adverse effects can be mitigated by early recognition and avoiding incompatible land uses in these areas or by corrective engineering. The mountainous topography of the County presents considerable constraints to development, most commonly in the form of steeply sloped areas. These areas are vulnerable to disturbance and can become unstable. Most of these areas are adjacent to roadway systems that are heavily used.

Continued adherence to the land development codes and regulations in the planning area will decrease the risk of future development to landslide hazard areas. Development of lands within identified hazard areas are limited to meet the requirements set forth by the Planning and Zoning Offices or the Building Departments of the jurisdiction at the time of construction. Most construction has been limited to areas that are not in these hazard areas.

12.8 SCENARIO

Major landslides in the planning area occur as a result of soil conditions that have been affected by wildfire, natural erosion, severe storms, groundwater, or human development. The worst-case scenario for landslide hazards in the planning area would generally correspond to a severe storm that had heavy rain and caused flooding in burn scar areas. Landslides are most likely during late spring and summer months. After heavy spring and summer rains, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and accumulates on impermeable silt, it will cause weakness and destabilization in the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Burn scars, gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

Mass movements are becoming more of a concern as development moves outside of city centers and into areas less developed in terms of infrastructure. Most mass movements would be isolated events affecting specific areas. It is probable that private and public property, including infrastructure, will be affected. Mass movements could affect bridges that pass over landslide prone ravines and knock out rail service through the County. Road obstructions caused by mass movements would create isolation problems for residents and businesses in sparsely developed areas. Property owners exposed to steep slopes may suffer damage to property or structures. Landslides carrying vegetation such as shrubs and trees may cause a break in utility lines, cutting off power and communication access to residents.

12.9 ISSUES

Important issues associated with landslides in the planning area include the following:

- There are most likely existing homes in landslide risk areas throughout the County. The degree of vulnerability of these structures depends on the codes and standards the structures were constructed to. Information to this level of detail is not currently available.
- As incidents of wildfires increase and hillsides are void of vegetation, rain-soaked hillsides are more likely to slide resulting in increased damage countywide.
- Future development could lead to more homes in landslide risk areas.

- Mapping and assessment of landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be reevaluated.
- The impact of climate change on landslides is uncertain. If climate change impacts atmospheric conditions, then exposure to landslide risks is likely to increase.
- Landslides may cause negative environmental consequences, including water quality degradation.
- The risk associated with the landslide hazard overlaps the risk associated with other hazards such as earthquake, flood, and wildfire. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.

CHAPTER 13.
SEVERE WINTER WEATHER

SEVERE WINTER WEATHER RANKING			
Fremont County	**Canon City**	**Florence**	**Brookside**
Medium	Medium	High	High

DEFINITIONS

Freezing Rain—The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to 6 tons of ice, creating a threat to power and telephone lines and transportation routes.

Severe Local Storm—Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Winter Storm—A storm having significant snowfall, ice, or freezing rain; the quantity of precipitation varies by elevation.

13.1 GENERAL BACKGROUND

Winter storms can include heavy snow, ice, and blizzard conditions. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result in injuries and deaths.

Winter storms in Fremont County, including strong winds and blizzard conditions, can result in property damage, localized power and phone outages and closures of streets, highways, schools, businesses, and nonessential government operations. People can also become isolated from essential services in their homes and vehicles. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can also impact budgets significantly. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

13.1.1 Extreme Cold

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

In 2001, the NWS implemented an updated wind chill temperature index (see Figure 13-1). This index describes the relative discomfort or danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Source: National Weather Service, www.nws.noaa.gov/om/windchill/index.shtml

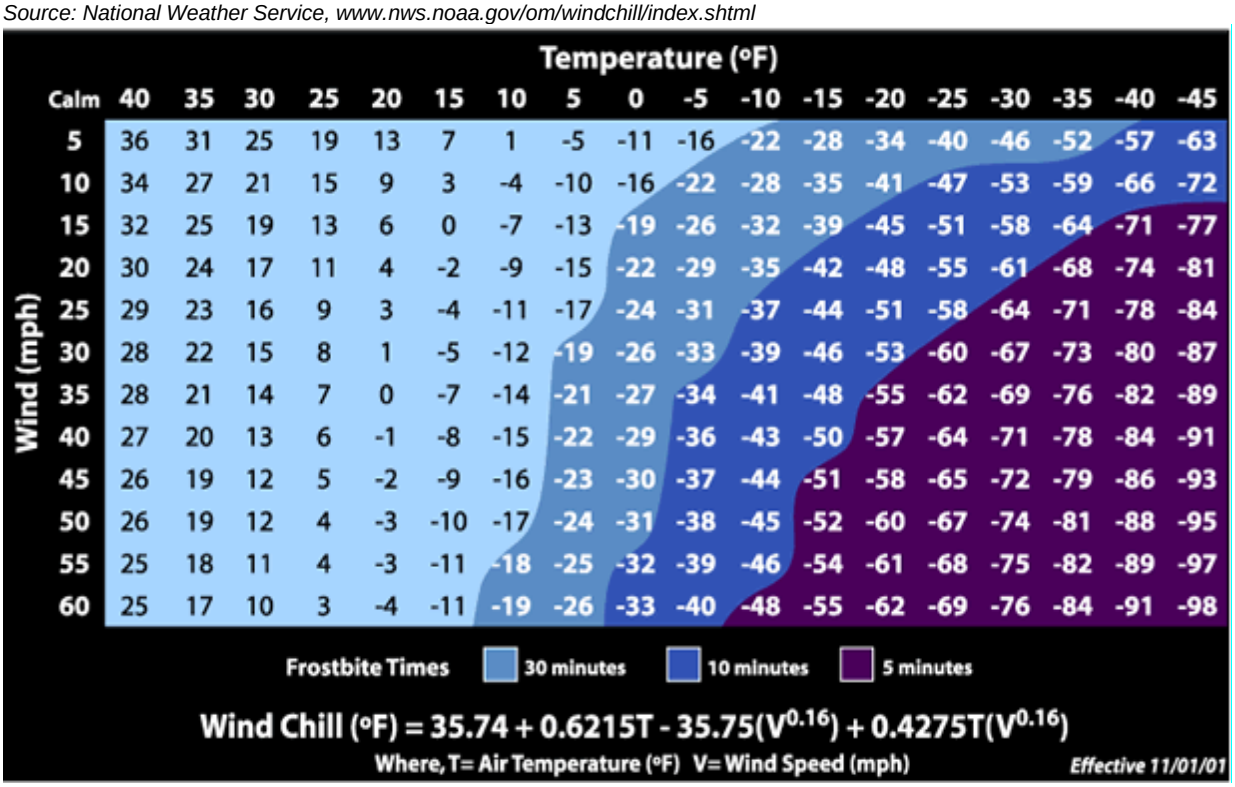


Figure 13-1. National Weather Service Wind Chill Chart

A wind chill watch is issued by the NWS when wind chill warning criteria are possible in the next 12 to 36 hours. A wind chill warning is issued for wind chills of at least negative 25 degrees on the plains and minus 35 degrees in the mountains and foothills.

The Western Regional Climate Center does not report data summaries from any stations in Fremont County, but does report summaries from a station in Pueblo (Pueblo Memorial Airport). Table 13-1 contains temperature summaries related to extreme cold for the station.

TABLE 13-1.
TEMPERATURE DATA FROM PUEBLO MEMORIAL AIRPORT (1996-2008)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature (degrees Fahrenheit)												
Average Maximum Temperature	47.9	51.0	60.1	67.3	78.3	88.0	94.3	89.9	82.4	70.2	57.3	47.8
Average Minimum Temperature	14.3	17.3	25.3	33.4	43.5	52.1	59.5	57.4	47.5	34.4	22.9	14.5
Average Temperature	31.1	34.2	42.7	50.3	60.9	70.1	76.9	73.7	64.9	52.3	40.1	31.1

TABLE 13-1.
TEMPERATURE DATA FROM PUEBLO MEMORIAL AIRPORT (1996-2008)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Extreme Temperatures (degrees Fahrenheit)												
Extreme Minimum Temperature	-15	-10	-6	2	24	35	47	45	21	4	-6	-19
Average Number of Days												
Minimum Temperature below 32	30.2	27.2	25.0	13.4	1.6	0.0	0.0	0.0	0.5	13.2	26.4	30.4
Minimum Temperature below 20	23.0	18.3	8.3	1.1	0.0	0.0	0.0	0.0	0.0	0.9	10.3	22.5
Minimum Temperature below 0	2.9	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.0

Fremont County receives varying amounts of snow throughout the area. Totals remain on average below 2 feet of snow per year on the eastern half and up to 3 feet of snow on the higher western half of the County, generally falling a few inches at a time and then melting off. The ground is not covered in snow for any length of time with the exceptions of north-facing areas and higher elevations.

13.2 HAZARD PROFILE

13.2.1 Past Events

Table 13-2 lists Fremont County severe winter weather events recorded by the National Climatic Data Center from 1996 to 2013. Locations for these records are limited to one of two NCDC-defined zones: Cañon City Vicinity/Eastern Fremont County and West/Central Fremont County below 8,500 feet.

TABLE 13-2.
FREMONT COUNTY WINTER WEATHER EVENTS, 1996 – 2013

Location	Date	Event Type
Cañon City Vicinity / Eastern Fremont County	4/10/2005	Blizzard
West / Central Fremont County Below 8,500 Feet	4/10/2005	Blizzard
West / Central Fremont County Below 8,500 Feet	1/17/1996	Cold/Wind Chill
West / Central Fremont County Below 8,500 Feet	2/1/1996	Cold/Wind Chill
West / Central Fremont County Below 8,500 Feet	2/2/1996	Cold/Wind Chill
West / Central Fremont County Below 8,500 Feet	12/17/1996	Cold/Wind Chill
West / Central Fremont County Below 8,500 Feet	1/11/1997	Cold/Wind Chill
Cañon City Vicinity / Eastern Fremont County	10/29/2002	Heavy Snow
Cañon City Vicinity / Eastern Fremont County	2/5/2003	Heavy Snow
Cañon City Vicinity / Eastern Fremont County	2/18/2003	Heavy Snow
Cañon City Vicinity / Eastern Fremont County	1/2/2004	Heavy Snow
West / Central Fremont County Below 8,500 Feet	2/5/2003	Heavy Snow
West / Central Fremont County Below 8,500 Feet	3/1/2003	Heavy Snow

TABLE 13-2.
FREMONT COUNTY WINTER WEATHER EVENTS, 1996 – 2013

Location	Date	Event Type
West / Central Fremont County Below 8,500 Feet	1/2/2004	Heavy Snow
Cañon City Vicinity / Eastern Fremont County	3/17/2003	Winter Storm
Cañon City Vicinity / Eastern Fremont County	2/11/2004	Winter Storm
Cañon City Vicinity / Eastern Fremont County	11/27/2004	Winter Storm
Cañon City Vicinity / Eastern Fremont County	1/28/2005	Winter Storm
Cañon City Vicinity / Eastern Fremont County	11/28/2006	Winter Storm
Cañon City Vicinity / Eastern Fremont County	12/20/2006	Winter Storm
Cañon City Vicinity / Eastern Fremont County	3/26/2009	Winter Storm
Cañon City Vicinity / Eastern Fremont County	3/23/2010	Winter Storm
Cañon City Vicinity / Eastern Fremont County	1/9/2011	Winter Storm
Cañon City Vicinity / Eastern Fremont County	10/26/2011	Winter Storm
West / Central Fremont County Below 8,500 Feet	1/17/1996	Winter Storm
West / Central Fremont County Below 8,500 Feet	3/14/1996	Winter Storm
West / Central Fremont County Below 8,500 Feet	4/13/1996	Winter Storm
West / Central Fremont County Below 8,500 Feet	2/23/1997	Winter Storm
West / Central Fremont County Below 8,500 Feet	2/26/1997	Winter Storm
West / Central Fremont County Below 8,500 Feet	3/17/2003	Winter Storm
West / Central Fremont County Below 8,500 Feet	12/8/2003	Winter Storm
West / Central Fremont County Below 8,500 Feet	2/1/2004	Winter Storm
West / Central Fremont County Below 8,500 Feet	2/11/2004	Winter Storm
West / Central Fremont County Below 8,500 Feet	4/22/2004	Winter Storm
West / Central Fremont County Below 8,500 Feet	1/28/2005	Winter Storm
West / Central Fremont County Below 8,500 Feet	3/25/2005	Winter Storm
West / Central Fremont County Below 8,500 Feet	10/10/2005	Winter Storm
West / Central Fremont County Below 8,500 Feet	1/19/2006	Winter Storm
West / Central Fremont County Below 8,500 Feet	4/12/2007	Winter Storm
West / Central Fremont County Below 8,500 Feet	4/24/2007	Winter Storm
West / Central Fremont County Below 8,500 Feet	12/7/2007	Winter Storm
West / Central Fremont County Below 8,500 Feet	3/26/2009	Winter Storm
West / Central Fremont County Below 8,500 Feet	10/28/2009	Winter Storm
West / Central Fremont County Below 8,500 Feet	3/23/2010	Winter Storm
West / Central Fremont County Below 8,500 Feet	1/9/2011	Winter Storm
West / Central Fremont County Below 8,500 Feet	10/26/2011	Winter Storm
West / Central Fremont County Below 8,500 Feet	11/21/2013	Winter Storm
Cañon City Vicinity / Eastern Fremont County	1/3/2009	Winter Weather
Cañon City Vicinity / Eastern Fremont County	12/9/2012	Winter Weather

TABLE 13-2.
FREMONT COUNTY WINTER WEATHER EVENTS, 1996 – 2013

Location	Date	Event Type
West / Central Fremont County Below 8,500 Feet	12/9/2012	Winter Weather

Source: National Climatic Data Center

The following are descriptions of severe weather events as described by the County and planning partners in previous hazard mitigation documentation:

- September 28, 1959 – The worst winter storm event in Florence's history: 26 inches of snow, downing trees, power and telephone lines. Approximately half of the City was without power for 5 days. The estimate of damage in 1959 was over $1,000,000.
- March 18, 2003 – A severe winter storm positioned itself over much of Colorado and dropped a significant amount of heavy, wet snow on the state. As much as 4 to 6 feet of snow fell in the Upper Arkansas Area. Most of the local schools were closed for 2 to 3 days. In addition, many offices and portions of the state highways were closed. Rescues were made all over the region to help stranded motorists and assist residents who lost power and services. Some isolated parties needed immediate medical attention while others had run out of propane and thus had no heat. Road crews worked long hours clearing highways and main roads and emergency services were used to handle emergencies in areas where roads were not cleared.

13.2.2 Location

The entire County is susceptible to severe winter storms; although severe winter weather is primarily found in the higher elevations of the County and include the Tallahassee area and upper reaches of the U.S. Highway 50 corridor through Big Horn Sheep Canyon. Ice accumulation becomes a hazard by creating dangerous travel conditions. U.S. Highway 50, State Highway 115, and State Highway 69 are extremely important corridors to move people, supplies and equipment into the region and to reach medical facilities outside of the counties. Many portions of these roads are narrow and curved and an accident on these roads can cause a major disruption in the flow of goods and services to the area.

13.2.3 Frequency

Severe winter storms happen nearly every year in Fremont County and are thus considered highly likely, with nearly 100 percent chance of occurrence in any given year. December, January and February are when severe winter weather occur most frequently in the County.

13.2.4 Severity

The magnitude and severity of severe winter weather in Fremont County is moderate resulting in minor injuries and illnesses; minimal property damage that does not severely threaten structural stability; or interruption of essential facilities and services for less than 48 hours.

13.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe winter storm; however, forecasts for Fremont County are rather limited. Residents generally rely on weather forecasts for Pueblo or Colorado Springs. When forecast are available they can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time.

13.3 SECONDARY HAZARDS

The most significant secondary hazards associated with severe local storms are falling and downed trees, landslides, and downed power lines. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails. Additionally the storms may result in closed highways and blocked roads. It is not unusual for motorists and residents to become stranded. Annually, heavy snow loads and frozen pipes cause damage to residences and businesses. Late season heavy snows will typically cause some plant and crop damage.

13.4 CLIMATE CHANGE IMPACTS

Climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. Nationally, the number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate (see Figure 13-2). The changing hydrograph caused by climate change could have a significant impact on the intensity, duration and frequency of storm events. All of these impacts could have significant economic consequences.

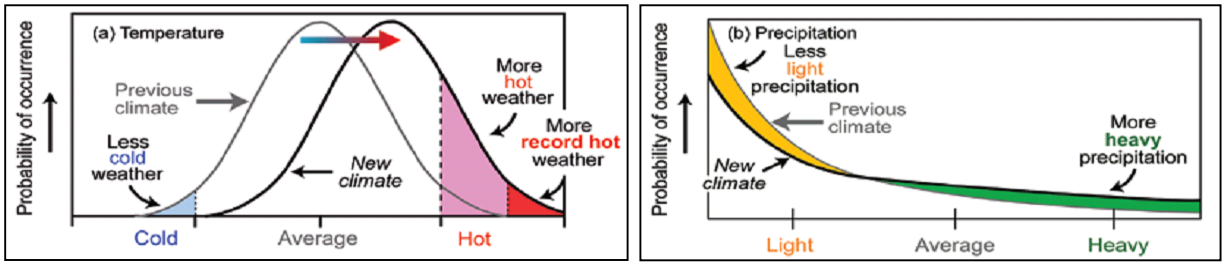


Figure 13-2. Severe Weather Probabilities in Warmer Climates

13.5 EXPOSURE

13.5.1 Population

It can be assumed that the entire planning area is exposed to some extent to severe winter weather events. Certain areas are more exposed due to geographic location and local weather patterns.

13.5.2 Property

According to the Fremont County Assessor, there are 16,707 buildings within the census tracts that define the planning area. Most of these buildings are residential. It is estimated that 66 percent of the residential structures were built without the influence of a structure building code with provisions for wind loads. All of these buildings are considered to be exposed to severe winter weather, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

13.5.3 Critical Facilities and Infrastructure

All critical facilities (see Figure 6-6) are likely exposed to severe winter weather. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water and sewer systems may not function. Roads may become impassable due to ice or snow. Ice accumulation on roadways can create dangerous driving conditions. There are limited county roads that are available to move people and supplies throughout the region. Many of these roads are narrow and curved.

13.5.4 Environment

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees risk major damage and destruction. Flooding events caused by snowmelt can produce river channel migration or damage riparian habitat.

13.6 VULNERABILITY

13.6.1 Population

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe winter weather events and could suffer more secondary effects of the hazard. Commuters who are caught in storms may be particularly vulnerable. Stranded commuters may be vulnerable to carbon monoxide poisoning or hypothermia. Additionally, individuals engaged in outdoor recreation during a severe winter event may be difficult to locate and rescue.

13.6.2 Property

All property is vulnerable during severe winter weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those that are located under or near overhead lines or near large trees may be vulnerable to falling ice or may be damaged in the event of a collapse.

Loss estimations for the severe winter weather hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent and 50 percent of the assessed value of exposed structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 13-3 lists the loss estimates.

TABLE 13-3.
LOSS ESTIMATES FOR SEVERE WINTER WEATHER

		Estimated Loss Potential from Severe Weather		
	Exposed Value	10% Damage	30% Damage	50% Damage
Brookside	$21,392,628	$2,139,263	$6,417,788	$10,696,314
Cañon City	$2,192,212,889	$219,221,289	$657,663,867	$1,096,106,445
Coal Creek	$25,908,326	$2,590,833	$7,772,498	$12,954,163
Florence	$448,012,198	$44,801,220	$134,403,659	$224,006,099
Rockvale	$47,323,953	$4,732,395	$14,197,186	$23,661,976
Williamsburg	$53,864,191	$5,386,419	$16,159,257	$26,932,096
Unincorporated	$2,433,592,333	$243,359,233	$730,077,700	$1,216,796,166
Total	**$5,222,306,518**	**$522,230,652**	**$1,566,691,955**	**$2,611,153,259**

13.6.3 Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from severe winter weather, mostly associated with secondary hazards. Snowstorms can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

13.6.4 Environment

The vulnerability of the environment to severe weather is the same as the exposure, discussed in Section 13.5.4.

13.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by severe storms. The vulnerability of community assets to severe winter storms is increasing through time as more people enter the planning area. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts (flood and landslide) of the severe weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

13.8 SCENARIO

Although severe local storms are infrequent, impacts can be significant, particularly when secondary hazards of flood and landslide occur. A worst-case event would involve prolonged high winds during a winter storm accompanied by thunderstorms. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads, and landslides on steep slopes. Flooding and landslides could further obstruct roads and bridges, further isolating residents.

13.9 ISSUES

Important issues associated with a severe weather in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- The high altitudes and rugged terrain in the planning area exacerbates emergency situations caused by winter storm events.
- Future efforts should be made to identify populations at risk and determine special needs during winter storm events.

CHAPTER 14.
THUNDERSTORMS, HIGH WINDS, AND HAIL

THUNDERSTORMS, HIGH WIND AND HAIL RANKING			
Fremont County	Canon City	Florence	Brookside
High	High	Medium	High

DEFINITIONS

Severe Local Storm—Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Thunderstorm—A storm featuring heavy rains, strong winds, thunder and lightning, typically about 15 miles in diameter and lasting about 30 minutes. Hail and tornadoes are also dangers associated with thunderstorms. Lightning is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding.

Windstorm—A storm featuring violent winds. Windstorms tend to damage ridgelines that face into the winds.

14.1 GENERAL BACKGROUND

14.1.1 Thunderstorms

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), or tornado.

Three factors cause thunderstorms to form: moisture, rising unstable air (air that keeps rising when disturbed), and a lifting mechanism to provide the disturbance. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise (hills or mountains can cause rising motion, as can the interaction of warm air and cold air or wet air and dry air) it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder. Thunderstorms have three stages (see Figure 14-1):

- The *developing stage* of a thunderstorm is marked by a cumulus cloud that is being pushed upward by a rising column of air (updraft). The cumulus cloud soon looks like a tower (called towering cumulus) as the updraft continues to develop. There is little to no rain during this stage but occasional lightning. The developing stage lasts about 10 minutes.
- The thunderstorm enters the *mature stage* when the updraft continues to feed the storm, but precipitation begins to fall out of the storm, and a downdraft begins (a column of air pushing downward). When the downdraft and rain-cooled air spread out along the ground, they form a gust front, or a line of gusty winds. The mature stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes. The storm occasionally has a black or dark green appearance.
- Eventually, a large amount of precipitation is produced and the updraft is overcome by the downdraft beginning the *dissipating stage*. At the ground, the gust front moves out a long distance from the storm and cuts off the warm moist air that was feeding the thunderstorm. Rainfall decreases in intensity, but lightning remains a danger.

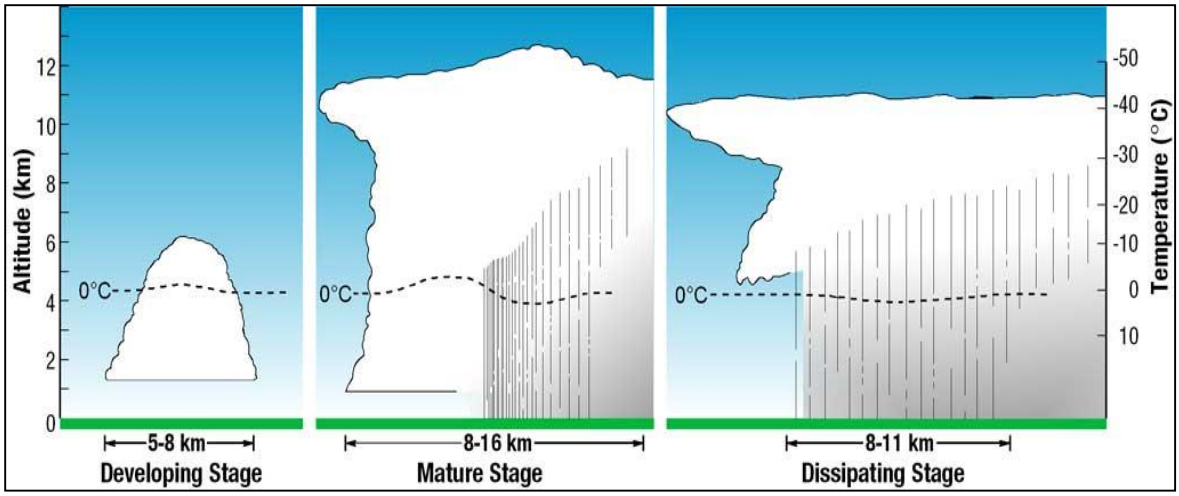


Figure 14-1. The Thunderstorm Life Cycle

There are four types of thunderstorms:

- **Single-Cell Thunderstorms—**Single-cell thunderstorms usually last 20 to 30 minutes. A true single-cell storm is rare, because the gust front of one cell often triggers the growth of another. Most single-cell storms are not usually severe, but a single-cell storm can produce a brief severe weather event. When this happens, it is called a pulse severe storm.
- **Multi-Cell Cluster Storm—**A multi-cell cluster is the most common type of thunderstorm. The multi-cell cluster consists of a group of cells, moving as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster and dissipating cells at the downwind edge. Multi-cell cluster storms can produce moderate-size hail, flash floods, and weak tornadoes. Each cell in a multi-cell cluster lasts only about 20 minutes; the multi-cell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm.
- **Multi-Cell Squall Line—**A multi-cell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge. The line of storms can be solid, or there can be gaps and breaks in the line. Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, but they are best known as the producers of strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo. Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.
- **Super-Cell Storm—**A super-cell is a highly organized thunderstorm that poses a high threat to life and property. It is similar to a single-cell storm in that it has one main updraft, but the updraft is extremely strong, reaching speeds of 150 to 175 miles per hour. Super-cells are rare. The main characteristic that sets them apart from other thunderstorms is the presence of rotation. The rotating updraft of a super-cell (called a mesocyclone when visible on radar) helps the super-cell to produce extreme weather events, such as giant hail (more than 2 inches in diameter), strong downbursts of 80 miles an hour or more, and strong to violent tornadoes.

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Lightning is one of the more dangerous weather hazards in the United States and in Colorado. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage

to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of $6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel can be visible for many miles.

Although not as common, cloud-to-ground lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, the United States monitors an average of 25 million strokes of lightning from the cloud-to-ground every year.

U.S. lightning statistics compiled by the National Oceanic and Atmospheric Administration between 1959 and 1994 indicate that most lightning incidents occur during the summer months of June, July, and August and during the afternoon hours from between 2 and 6 p.m.

14.1.2 High Winds

Damaging winds are classified as those exceeding 60 mph. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds:

- **Straight-line winds**—Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts**—A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts**—A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts**—A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface.

Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.

- **Gust front—**A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho**—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word "derecho" is of Spanish origin and means "straight ahead." Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.
- **Bow Echo**—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

14.1.3 Hail

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Recent studies suggest that super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are "frozen" in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are "balanced" in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail. The National Weather Service classifies hail as non-severe and severe based on hail diameter size. Descriptions and diameter sizes are provided in Table 14-1.

TABLE 14-1.
NATIONAL WEATHER SERVICE HAIL SEVERITY

Severity	Description	Hail Diameter Size
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from NWS.	Pea	1/4"
	Plain M&M	1/2"
	Penny	3/4"
	Nickel	7/8"
Severe Hail	Quarter	1" (severe)
	Half Dollar	1 1/4"

TABLE 14-1.
NATIONAL WEATHER SERVICE HAIL SEVERITY

Severity	Description	Hail Diameter Size
Research has shown that damage occurs after hail reaches around 1" in diameter and larger. Hail of this size will trigger a severe thunderstorm warning from NWS.	Walnut/Ping Pong Ball	1 1/2"
	Golf Ball	1 3/4"
	Hen Egg/Lime	2"
	Tennis Ball	2 1/2"
	Baseball	2 3/4"
	Teacup/Large Apple	3"
	Grapefruit	4"
	Softball	4 1/2"
	Computer CD-DVD	4 3/4"- 5"

14.2 HAZARD PROFILE

14.2.1 Past Events

Thunderstorms

Data from the National Lightning Detection Network ranks Colorado 26th in the nation (excluding Alaska and Hawaii) with respect to the number of cloud-to-ground lightning flashes with an average number of more than 500,000 cloud-to-ground lightning strikes per year. Fremont County has an average of 1 to 5 lightning flashes per square kilometer per year, with higher lightning frequency in the northeastern part of the County.

Figure 14-2 shows state-by-state lightning deaths between 2001 and 2010. Colorado ranks second for the number of deaths at 26. Only Florida, with 62 deaths, had more. In 2006, there were five lightning deaths and 15 reported lightning injuries in Colorado. In an average year in Colorado, three people are killed and 13 are injured.

Source: National Weather Service, www.lightningsafety.noaa.gov/

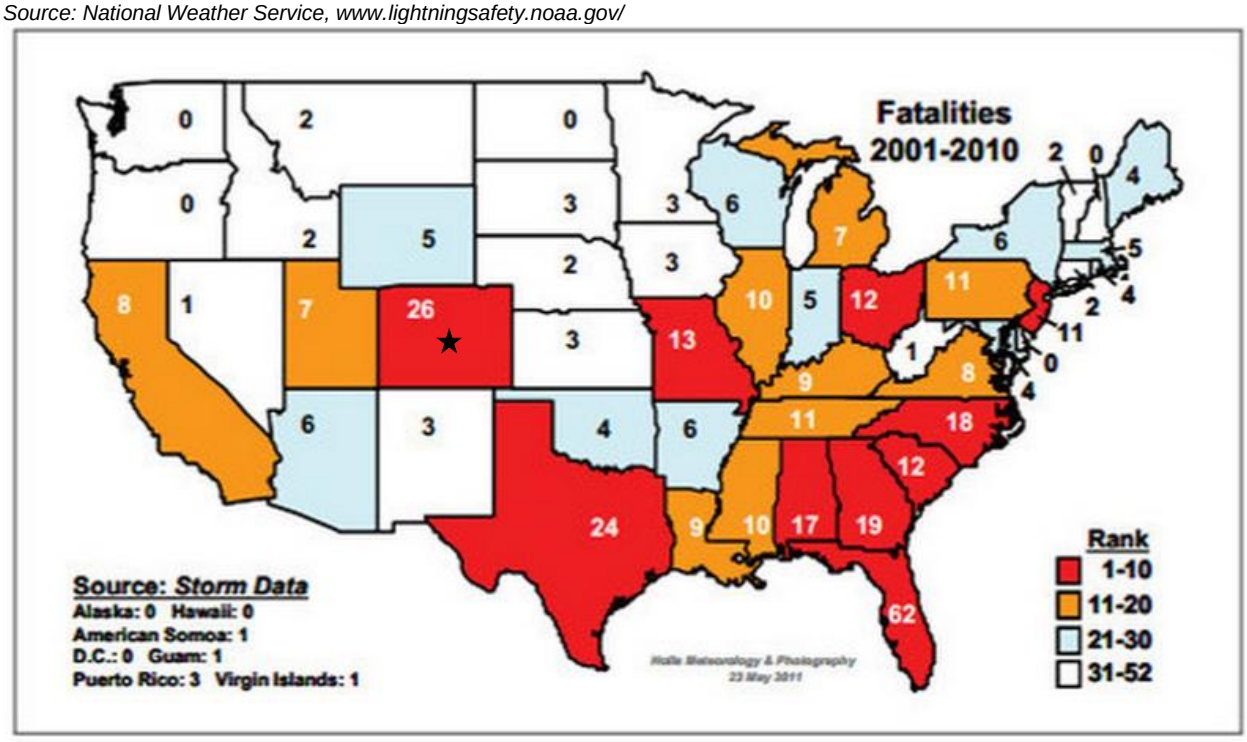


Figure 14-2. Lightning Fatalities in the United States, 2001-2010

According to the National Climatic Data Center Storm Events Database, there were five notable lightning events in Fremont County between 1996 and December 2013:

- July 3, 2008 – Lightning sparked a fire that destroyed two cabins and a vehicle in Howard. The estimated property damage was $150,000.
- July 26, 2006 – A house in Cañon City was struck by lightning, but smoke and water damage was mainly confined to the attic area and a small portion of the house. The estimated property damage was $20,000.
- June 28, 2002 – A double-wide mobile home in Penrose was struck by lightning and caught fire. Two occupants fled the mobile home, which was totally destroyed. The estimated property damage was $30,000.
- August 13, 2000 – A house in Cañon City was struck by lightning, damaging some walls and destroying the electrical wiring. The estimated property damage was $5,000.
- June 7, 1997 – A lightning bolt caused the loss of power and phone service to a correctional facility. Electricity and phone service were restored later that night.

High Winds

High winds occur year round in Fremont County. In the spring and summer, high winds often accompany severe thunderstorms. The varying topography in the area has the potential for continuous and sudden gusting of high winds. According to the State of Colorado State Plan, Chinook winds are a fairly common wintertime phenomena in Colorado. These winds develop in well-defined areas and can be quite strong. Atmosphere conditions are expected to continue unchanged with windstorms remaining a perennial occurrence. Winds of 60 to near 100 mph are possible in and near the foothills in the Cañon City area.

Although these high winds may not be life-threatening, they can disrupt daily activities, cause damage to building and structures, and increase the potential damage of other hazards. Wind resource

information is shown in Figure 14-2 as a proxy for typical wind speeds. Wind resource information is estimated by the National Renewable Energy Laboratory (NREL) to identify areas that are suitable for wind energy applications. The wind resource is expressed in terms of wind power classes, ranging from class 1 (lowest) to class 7 (highest). Each class represents a range of mean wind power density or approximate mean wind speed at specified heights above the ground (in this case, 50 meters above the ground surface). Figure 14-3 shows the wind power class potential density for Fremont County classified as "Poor" to "Superb." Table 14-2 identifies the mean wind power density and speed associated with each classification.

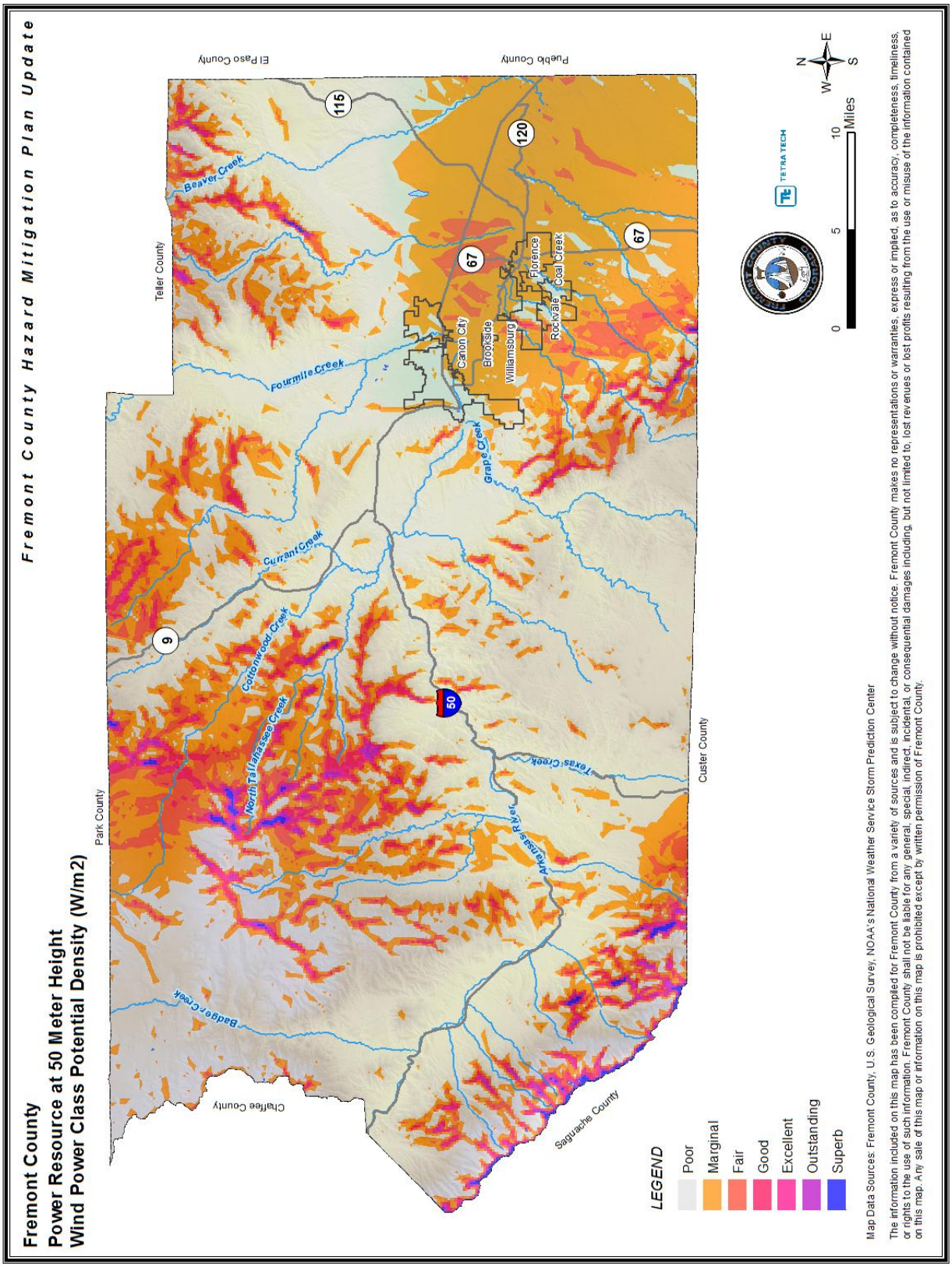
TABLE 14-2.
WIND POWER CLASS AND SPEED

	Wind Power Class	Wind Power Density at 50 meters (W/m^2)	Wind Speed at 50 meters (mph)
Poor	1	0-200	0-12.5
Marginal	2	200-300	12.5-14.3
Fair	3	300-400	14.3-15.7
Good	4	400-500	15.7-16.8
Excellent	5	500-600	16.8-17.9
Outstanding	6	600-800	17.9-19.7
Superb	7	800-2000	19.7-26.6

Source: National Renewable Energy Laboratory Wind Energy Resource Atlas of the United States

mph miles per hour
W/m^2 Watts per square meter

Figure 14-3. Wind Power Resource at 50 Meter Height



Historical severe weather data from the National Climatic Data Center Storm Events Database includes 13 high wind events and five thunderstorm wind events in Fremont County between 1996 and December 2013, as shown in Table 14-3.

TABLE 14-3.
FREMONT COUNTY WIND-RELATED EVENTS, 1996 - 2013

Location	Date	Event Type	Peak Wind Speed (knots)	Estimated Damage Cost	
				Property	Crops
Cañon City Vicinity / Eastern Fremont County	4/15/2003	High Wind	51	$0	$0
West / Central Fremont County Below 8,500 Feet	4/3/2011	High Wind	51	$0	$0
West / Central Fremont County Below 8,500 Feet	1/21/2012	High Wind	51	$0	$0
Cañon City Vicinity / Eastern Fremont County	6/6/2007	High Wind	52	$0	$0
Cañon City Vicinity / Eastern Fremont County	12/31/2011	High Wind	52	$0	$0
West / Central Fremont County Below 8,500 Feet	12/31/2011	High Wind	52	$0	$0
West / Central Fremont County Below 8,500 Feet	2/22/2012	High Wind	52	$0	$0
Cañon City Vicinity / Eastern Fremont County	3/26/2012	High Wind	54	$0	$0
West / Central Fremont County Below 8,500 Feet	4/15/2003	High Wind	61	$0	$0
West / Central Fremont County Below 8,500 Feet	6/6/2007	High Wind	61	$0	$0
West / Central Fremont County Below 8,500 Feet	11/12/2011	High Wind	65	$0	$0
Cañon City Vicinity / Eastern Fremont County	11/12/2011	High Wind	66	$0	$0
West / Central Fremont County Below 8,500 Feet	1/27/1996	High Wind	68	$0	$0
Cañon City	5/30/2001	Thunderstorm Wind	50	$0	$0
Cañon City	9/8/2000	Thunderstorm Wind	52	$0	$0
Penrose	9/8/2000	Thunderstorm Wind	52	$0	$0
Cañon City	7/12/1996	Thunderstorm Wind	52	$0	$0
Cañon City	8/5/2009	Thunderstorm Wind	61	$0	$0

Source: National Climatic Data Center

In addition to the high wind events, the NCDC database lists one dust devil and three tornadoes in Fremont County in the 1996 to 2013 time period:

- June 12, 2012, Dust Devil – A powerful dust devil moved through the Cañon City Head Start property, destroying two 40-foot long carports and damaging another. There was minor damage to a storage shed and some buses, with an estimated cost of $3,000.
- June 15, 2004, Tornado – An F0-rated tornado caused an estimated $1,000 in damage to fencing.
- September 5, 2003, Tornado – An F0-rated tornado over open country of extreme eastern Fremont County caused no known damage. It passed into extreme western Pueblo County.
- June 5, 1997, Tornado – An off-duty Custer County sheriff deputy reported a brief tornado (F0-rated) on the edge of Penrose in an open field. There was no known damage.

Hail

The National Climatic Data Center's Storm Events Database lists 50 hail events in Fremont County between 1996 and 2013. These events are noted in Table 14-4.

TABLE 14-4.
FREMONT COUNTY HAIL EVENTS, 1996 - 2013

Location	Date	Maximum Hail Size (inches)	Location	Date	Maximum Hail Size (inches)
Florence	8/18/2009	0.75	Cañon City	8/9/2004	0.88
Florence	7/21/2009	0.75	Penrose	8/5/2001	0.88
Florence	8/6/2007	0.75	Penrose	6/20/2001	0.88
Florence	6/26/2007	0.75	Cotopaxi	8/3/1998	0.88
Penrose	5/1/2007	0.75	Cañon City	8/16/1996	0.88
Penrose	5/1/2007	0.75	Hillside	6/16/2012	1.00
Penrose	6/10/2003	0.75	Texas Creek	8/3/2011	1.00
Penrose	7/14/2001	0.75	Williamsburg	8/18/2009	1.00
Florence	7/13/2001	0.75	Cañon City	8/5/2009	1.00
Cañon City	5/30/2001	0.75	Rockvale	8/15/2007	1.00
Cañon City	5/30/2001	0.75	Cañon City	7/11/2007	1.00
Cañon City	8/21/2000	0.75	Coaldale	6/27/2007	1.00
Hillside	7/13/2000	0.75	Florence	6/26/2007	1.00
Texas Creek	9/4/1997	0.75	Penrose	6/2/2007	1.00
Cañon City	8/8/1996	0.75	Florence	5/14/2007	1.00
Cañon City	8/8/1996	0.75	Florence	8/26/2006	1.00
Williamsburg	8/18/2009	0.88	Cañon City	7/17/2006	1.00
Penrose	8/24/2008	0.88	Penrose	7/15/2003	1.00
Penrose	8/24/2008	0.88	Cañon City	5/28/2001	1.00
Penrose	8/8/2008	0.88	Hillside	6/16/2012	1.50
Penrose	8/8/2008	0.88	Hillside	8/3/2011	1.75

TABLE 14-4.
FREMONT COUNTY HAIL EVENTS, 1996 - 2013

Location	Date	Maximum Hail Size (inches)	Location	Date	Maximum Hail Size (inches)
Texas Creek	7/3/2008	0.88	Coal Creek	7/21/2009	1.75
Cotopaxi	6/27/2007	0.88	Cañon City	6/21/2004	1.75
Penrose	5/28/2007	0.88	Florence	5/24/2003	1.75
Penrose	5/28/2007	0.88	Cañon City	8/1/1996	3.00

Source: National Climatic Data Center

14.2.2 Location

Severe weather events have the potential to happen anywhere in the planning area. Figure 6-5 shows the distribution of average precipitation over the planning area.

Thunderstorms

The entire extent of Fremont County is exposed to some degree of lightning hazard, though exposed points of high elevation have significantly higher frequency of occurrence.

High Winds

Windstorms could occur anywhere in Fremont County. They have the ability to cause damage over 100 miles from the center of storm activity. Higher elevations could experience the most significant wind speeds, but these areas are generally not developed or populated. Wind events are most damaging to areas that are heavily wooded. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Previous occurrences of damaging high winds and the locations that they occurred are shown in Figure 14-2.

Hail

The entire extent of Fremont County is exposed to the hailstorm hazard. Previous instances of hail events in the County are shown in Figure 14-5.

Figure 14-4. Damaging Wind Events in Fremont County

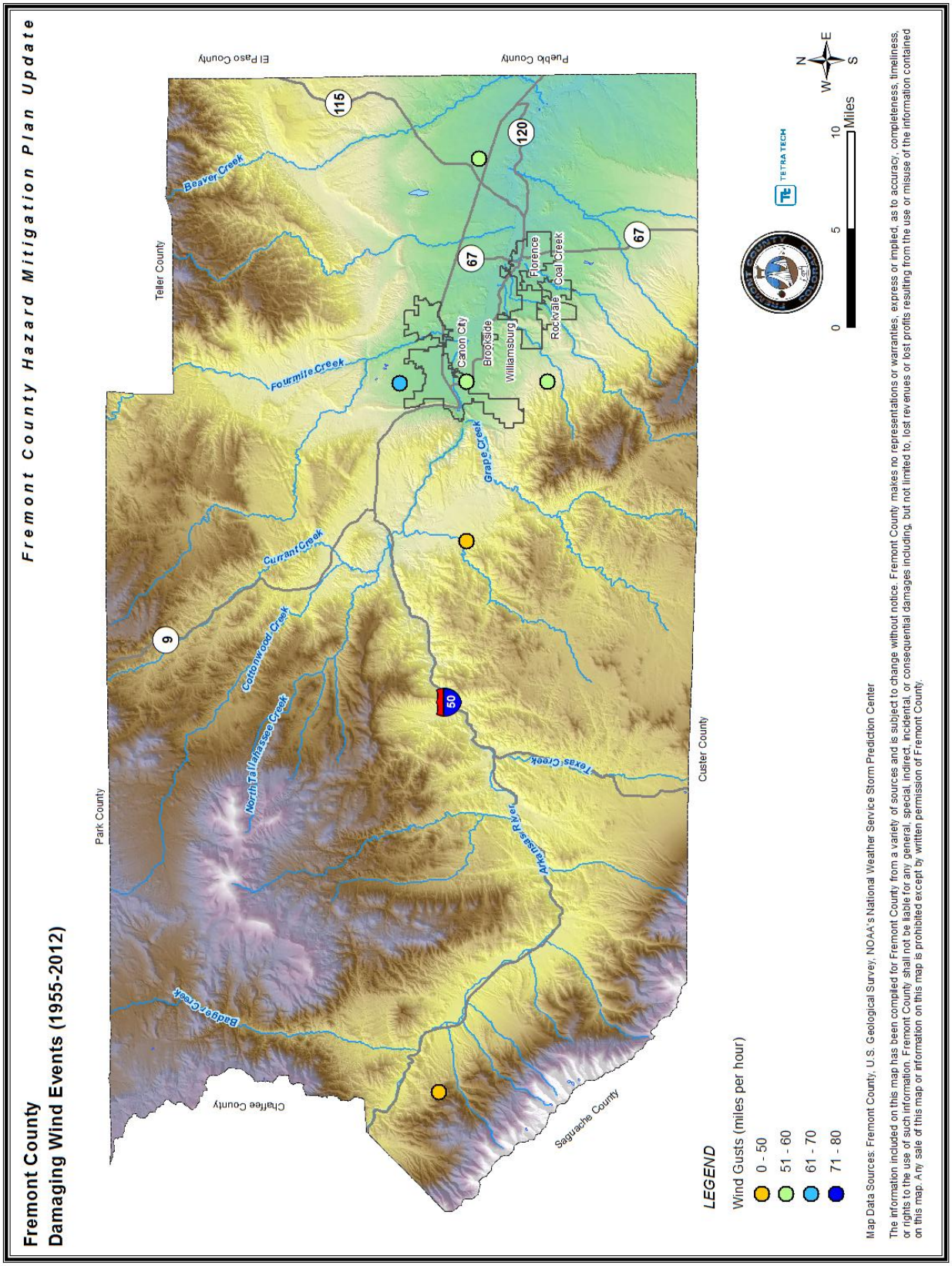
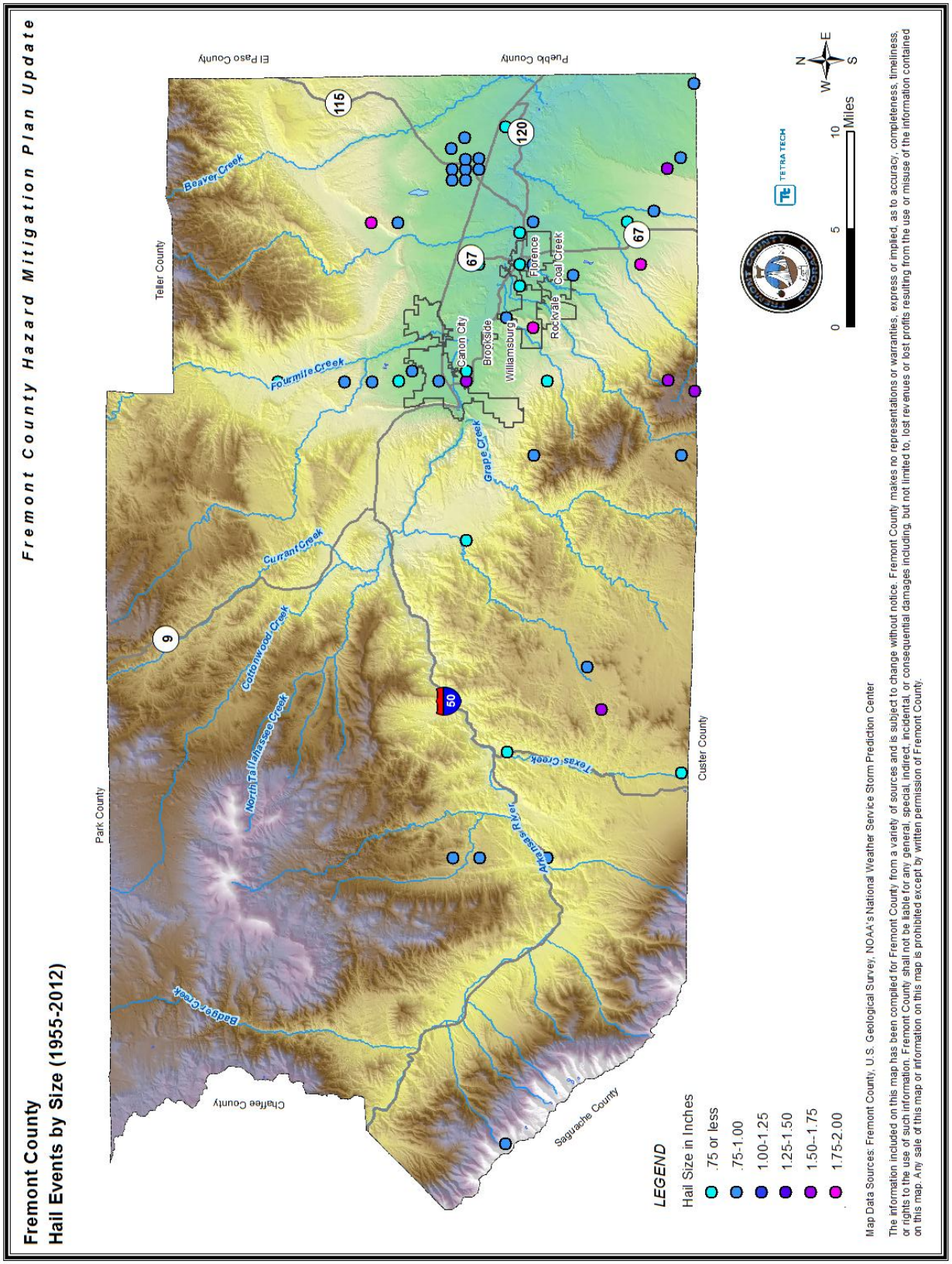


Figure 14-5. Hail Events in Fremont County



14.2.3 Frequency

Thunderstorms

Based on five events in 18 years, a damaging lightning strike occurs every 3 to 4 years on average in Fremont County and is considered likely, with a recurrence interval of 10 years or less.

High Winds

Based on 18 events in 18 years, a damaging high-wind event occurs every year on average in Fremont County and is considered highly likely.

Hail

Based on a record of 50 hailstorm events over an 18-year period, significant hail occurs nearly three times per year on average and is considered highly likely.

14.2.4 Severity

Thunderstorms

Based on the information in this hazard profile the magnitude/severity of thunderstorms is limited—10 to 25 percent of property severely damaged; shutdown of facilities for more than a week; or injuries/illnesses that are treatable and do not result in permanent disability. Overall significance is considered medium (moderate potential impact) due to risk to life safety, power outages, and fire ignitions.

The number of reported injuries from lightning is likely to be low, and County infrastructure losses equate to tens of thousands of dollars each year. The relationship of lightning to wildfire ignitions in the County increases the significance of this hazard.

High Winds

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Wind storms in Fremont County are rarely life threatening, but do disrupt daily activities, cause damage to buildings, and structures, and increase the potential for other hazards, such as wildfire. Winter winds can also cause damage, close highways (blowing snow), and induce avalanches. Winds can also cause trees to fall, particularly those killed by pine beetles or wildfire, creating a hazard to property or those outdoors.

Based on the information in this hazard profile, the magnitude/severity of high winds is considered limited. Overall significance of the hazard is considered low: minimal potential impact.

Hail

Severe hailstorms can be quite destructive. In recent years in the United States, hail causes more than $1.3 billion in damage to property and crops each year representing between 1 and 2 percent of the annual crop value.

Insurance claims resulting from hailstorm damage increased 84 percent in 2012 from their 2010 level according to the National Insurance Crime Bureau. In 2010, there were 467,602 hail damage claims filed in the U.S. That number increased to 689,267 in 2011 and to 861,597 in 2012 – an overall increase of 84 percent from 2010 to 2012.

The nation has experienced severe storms (wind, tornado, hail) that are occurring with more intensity and affecting more areas of the country. While scientists debate why these storms occur, no one argues with their effects – extensive property damage and, many times, loss of life. The property damage can be as minimal as a few broken shingles to total destruction of buildings.

Over 2 million hail damage claims were processed from January 1, 2010, to December 31, 2012, with Colorado ranking fourth in overall claims. The top five states generating hail damage claims were Texas (320,823); Missouri (138,857); Kansas (126,490); Colorado (118,118) and Oklahoma (114,168). Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans and occasionally has been fatal.

With the exception of the May 22, 2008 event and the hailstorm that hit Pueblo on July 29, 2009, Colorado's 10 most costly hailstorms were centered in the Denver metropolitan area (see Table 14-5).

Based on the information in this hazard profile the severity of hailstorms is limited – 10 to 25 percent of property severely damaged; shutdown of facilities for more than a week; or injuries/illnesses that are treatable and do not result in permanent disability. Overall significance is considered medium: moderate potential impact.

TABLE 14-5.
DAMAGE FROM 10 MOST COSTLY HAIL EVENTS IN COLORADO

Date	Location	Cost When Occurred (Millions)	2012 Dollars (Millions)[a]
July 20, 2009	Denver Metro	$767.6	$823.7
July 11, 1990	Denver Metro	$625.0	$1.1 Billion
June 6-15, 2009	Denver Metro	$353.3	$379.1
June 6-7, 2012	CO Front Range	$321.1	$321.1
June 13-14, 1984	Denver Metro	$276.7	$613.1
July 29, 2009	Pueblo	$232.8	$249.8
October 1, 1994	Denver Metro	$225.0	$349.5
May 22, 2008	Windsor	$193.5	$206.9
July 13, 2011	CO Front Range	$164.8	$168.7
June 8-9, 2004	Denver Metro	$146.5	$178.5
August 11, 1997	Denver Metro	$128.0	$183.6
May 22, 1996	Denver Metro	$122.0	$179.0

[a] 2012 estimated cost calculations based on the Consumer Price Index.
Source: Rocky Mountain Insurance Information Association

14.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe storm. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. Weather forecasts for the planning area are limited. People generally rely on weather forecasts for the Pueblo or Colorado Springs areas, as they are the nearest cities with adequate coverage. However, there are significant altitude, geothermal, and jet stream differences from those areas. At times warning for the onset of severe weather may be limited.

14.3 SECONDARY HAZARDS

The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, landslides, and downed power lines. Rapidly melting snow combined with heavy rain

can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails. Fires can occur as a result of lightning strikes. Many locations in the region have minimal vegetative ground cover and the high winds can create a large dust storm, which becomes a hazard for travelers and a disruption for local services. High winds in the winter can turn small amount of snow into a complete whiteout and create drifts in roadways. Debris carried by high winds can also result in injury or damage to property. A wildland fire can be accelerated and rendered unpredictable by high winds, which makes a dangerous environment for firefighters.

14.4 CLIMATE CHANGE IMPACTS

Climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate (see Figure 13-2). The changing hydrograph caused by climate change could have a significant impact on the intensity, duration and frequency of storm events. All of these impacts could have significant economic consequences.

14.5 EXPOSURE

14.5.1 Population

It can be assumed that the entire planning area is exposed to some extent to thunderstorm, high wind, and hail events. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out, while populations in low-lying areas are at risk for possible flooding. It is not uncommon for residents living in more remote areas of the County to be isolated after such events.

14.5.2 Property

According to the Fremont County Assessor, there are 16,707 buildings within the census tracts that define the planning area. Most of these buildings are residential. It is estimated that 66 percent of the residential structures were built without the influence of a structure building code with provisions for wind loads. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building's protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

All of these buildings are considered to be exposed to the thunderstorm, wind, and hail hazard, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

14.5.3 Critical Facilities and Infrastructure

All critical facilities exposed to flooding (Chapter 11) are also likely exposed to risks associated with thunderstorms, high winds, and hail. Additional facilities on higher ground may also be exposed to wind damage or damage from falling trees. The most common problems associated with these weather events are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to secondary hazards such as landslides.

14.5.4 Environment

The environment is highly exposed to thunderstorms, high winds, and hail. Natural habitats such as streams and trees risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flooding events can produce river channel migration or damage riparian habitat.

14.6 VULNERABILITY

14.6.1 Population

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during thunderstorm, wind, and hail events and could suffer more secondary effects of the hazard. Hikers and climbers in the area may also be more vulnerable to severe weather events. Visitors to the area may not be aware of how quickly a thunderstorm can build in the mountains.

14.6.2 Property

All property is vulnerable during thunderstorm, wind, and hail events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Those in higher elevations and on ridges may be more prone to wind damage. Those that are located under or near overhead lines or near large trees may be damaged in the event of a collapse.

Loss estimations for the thunderstorm, wind, and hail hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the replacement value of exposed structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 14-6 lists the loss estimates.

TABLE 14-6.
LOSS ESTIMATES FOR THUNDERSTORMS, HIGH WINDS, AND HAIL

		Estimated Loss Potential from Severe Weather		
	Exposed Value	10% Damage	30% Damage	50% Damage
Brookside	$21,392,628	$2,139,263	$6,417,788	$10,696,314
Cañon City	$2,192,212,889	$219,221,289	$657,663,867	$1,096,106,445
Coal Creek	$25,908,326	$2,590,833	$7,772,498	$12,954,163
Florence	$448,012,198	$44,801,220	$134,403,659	$224,006,099
Rockvale	$47,323,953	$4,732,395	$14,197,186	$23,661,976
Williamsburg	$53,864,191	$5,386,419	$16,159,257	$26,932,096
Unincorporated	$2,433,592,333	$243,359,233	$730,077,700	$1,216,796,166
Total	**$5,222,306,518**	**$522,230,652**	**$1,566,691,955**	**$2,611,153,259**

14.6.3 Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from thunderstorms, wind, and hail, mostly associated with secondary hazards. Landslides caused by heavy prolonged rains can block roads. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes due to landslides, debris, or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region. Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. Lightning events in the County can have destructive effects on power and information systems. Failure of these systems would have cascading effects throughout the County and could possible disrupt critical facility functions.

14.6.4 Environment

The vulnerability of the environment to severe weather is the same as the exposure, discussed in Section 14.5.4.

14.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in master plans and enforced through zoning code and the permitting process also address many of the secondary impacts (flood and landslide) of the severe weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

14.8 SCENARIO

Although severe local storms are infrequent, impacts can be significant, particularly when secondary hazards of flood and landslide occur. A worst-case event would involve prolonged high winds during a winter storm accompanied by thunderstorms. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads, and landslides on steep slopes. Flooding, drifting snow, and landslides could further obstruct roads and bridges, further isolating residents.

14.9 ISSUES

Important issues associated with a severe weather in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- The potential for isolation after a severe storm event is high.
- There is limited information available for local weather forecasts.
- The lack of proper management of trees may exacerbate damage from high winds.

CHAPTER 15.
TORNADO

TORNADO RANKING			
Fremont County	**Canon City**	**Florence**	**Brookside**
Low	Low	Low	Medium

DEFINITIONS

Tornado – Funnel clouds that generate winds up to 500 miles per hour. They can affect an area up to three-quarters of a mile wide, with a path of varying length. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud. They are measured using the Fujita Scale, ranging from F0 to F5, or the Enhanced Fujita Scale.

15.1 GENERAL BACKGROUND

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets. Tornadoes are the most violent of all atmospheric storms. The following are common ingredients for tornado formation:

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity.

Tornadoes can form from individual cells within severe thunderstorm squall lines. They also can form from an isolated super-cell thunderstorm. Weak tornadoes can sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity.

In 2007, the National Weather Service began rating tornadoes using the Enhanced Fujita Scale (EF-scale). The EF-scale is a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators listed in Table 15-1. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures. Table 15-2 describes the EF-scale ratings (NOAA, 2007).

The U.S. experiences more tornadoes than any other country. In a typical year, approximately 1,000 tornadoes affect the U.S. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. Figure 15-1 shows the annual average number of tornadoes between 1991 and 2010. Colorado experienced an average of 53 tornado events annually in that period. Colorado ranks 9th among the 50 states in frequency of tornadoes, but 38th for the number of deaths. Colorado ranks 31st for injuries and 30th for the cost of repairing the damages due to tornadoes. When these statistics are compared to other states by the frequency per square mile, Colorado ranks 28th for injuries per area and 37th for costs per area.

A study from NOAA's National Severe Storms Laboratory used historical data to estimate the daily probability of tornado occurrences across the U.S., regardless of tornado magnitude. Figure 15-2 shows the estimates. The density per 25 square miles in the map's legend indicates the probable number of tornadoes for each 25 square mile cell within the contoured zone that can be expected over a similar period of record.

It should be noted that the density number does NOT indicate the number of events that can be expected across the entire zone on the map.

TABLE 15-1.
ENHANCED FUJITA SCALE DAMAGE INDICATORS

No.	Damage Indicator	No.	Damage Indicator
1	Small barns, farm outbuildings	15	School – 1-story elementary (interior or exterior halls)
2	One or two-family residences	16	School – junior or senior high school
3	Single-wide mobile home	17	Low-rise (1-4 story) building
4	Double-wide mobile home	18	Mid-rise (5-20) building
5	Apt, condo, townhouse (3 stories or less)	19	High-rise (over 20 stories) building
6	Motel	20	Institutional bldg. (hospital, govt. or university)
7	Masonry apt. or motel	21	Metal building system
8	Small retail building (fast food)	22	Service station canopy
9	Small professional (doctor office, bank)	23	Warehouse (tilt-up walls or heavy timber)
10	Strip mall	24	Transmission line tower
11	Large shopping mall	25	Free-standing tower
12	Large, isolated (big box) retail building	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree – hardwood
14	Automobile service building	28	Tree – softwood

TABLE 15-2.
THE FUJITA SCALE AND ENHANCED FUJITA SCALE

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

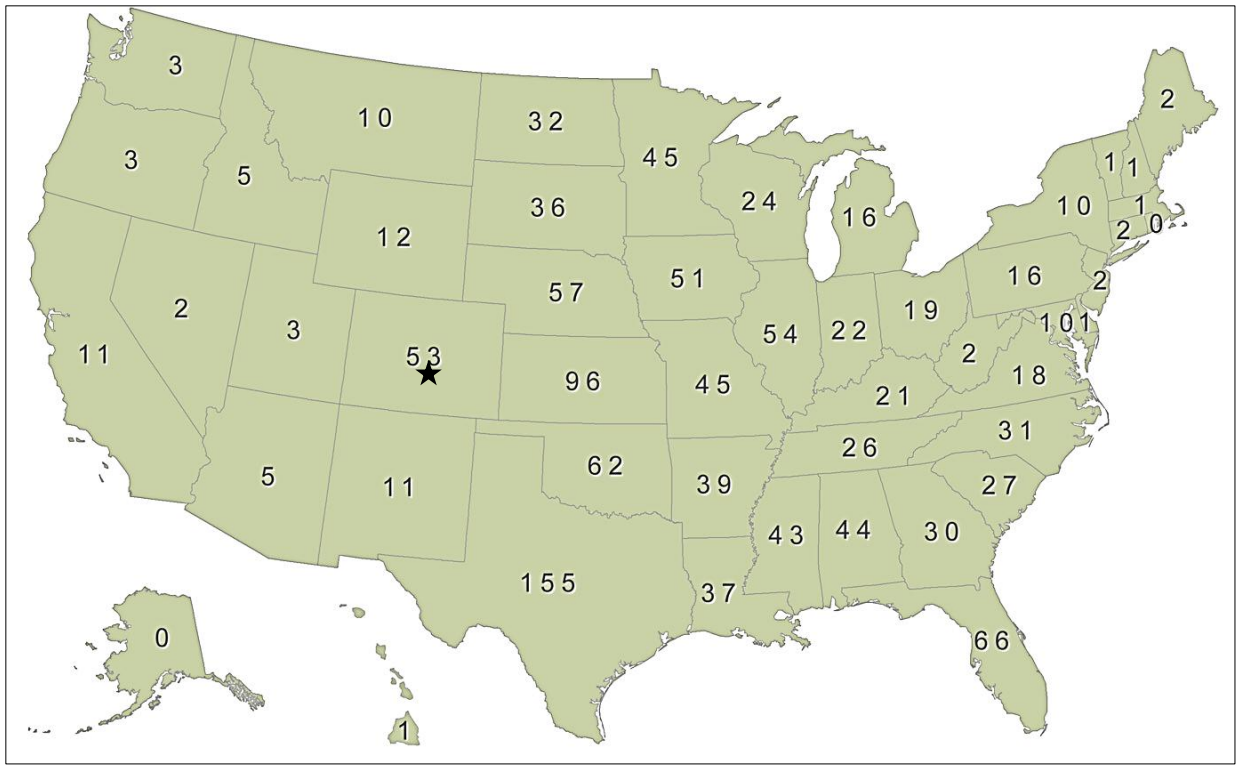


Figure 15-1. Annual Average Number of Tornadoes in the U.S., 1991 to 2010

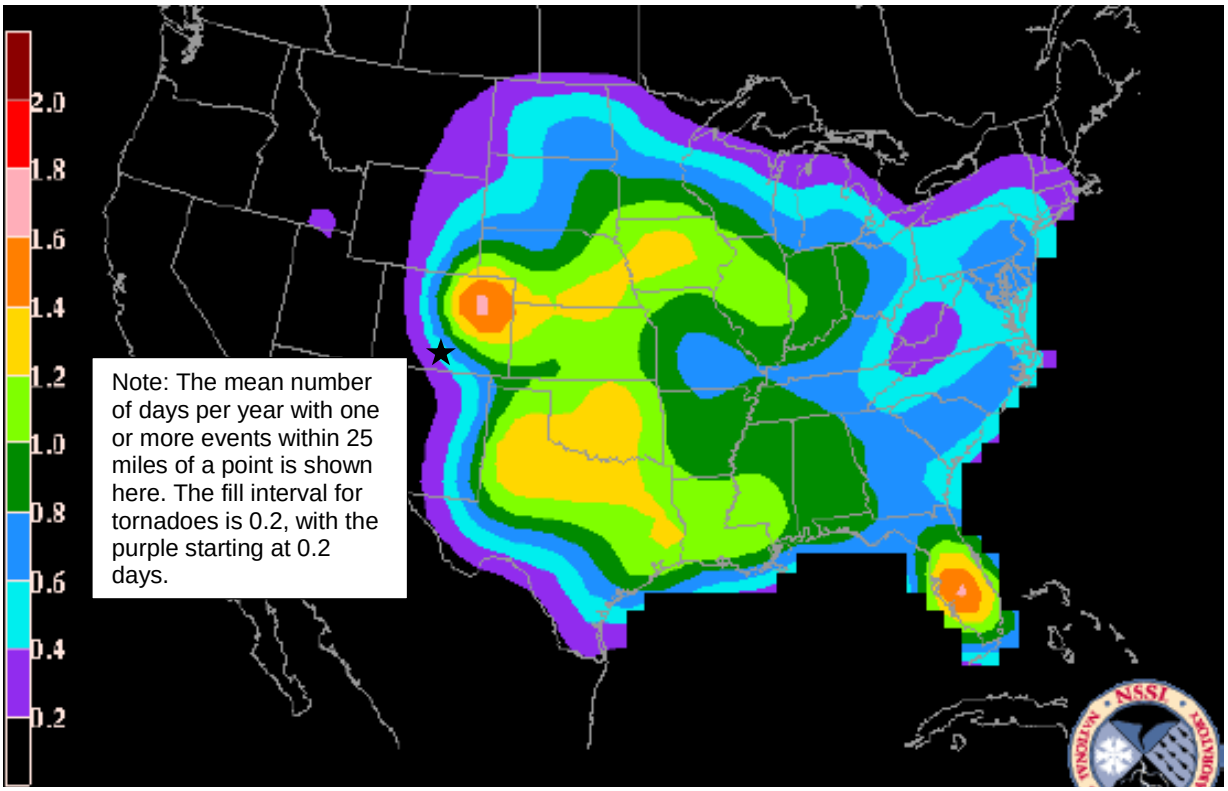


Figure 15-2. Total Annual Threat of Tornado Events in the U.S., 1980-1999

15.2 HAZARD PROFILE

15.2.1 Past Events

Table 15-3 lists tornadoes in Fremont County recorded by the NOAA storm prediction center from 1996 to 2013 that caused property damage. Five tornadoes that have or may have caused property damage have been recorded in the County since 1950, although none have been rated as higher than EF 1. Two other tornados have been recorded in June 1997 and September 2003, but these tornados did not cause any property damage or injuries. There are no known injuries or fatalities from tornadoes within the County and property damage has been minimal. Figure 15-3 shows the location of previous tornado events in the County.

TABLE 15-3.
TORNADOES IN FREMONT COUNTY, 1950 - 2013

Date	Tornado Rating	Injuries	Property Damage	Tornado Length (miles)	Tornado Width (yards)
7/9/1985	1	0	unknown	0.2	30
7/22/1985	1	0	$3,000	0.2	30
4/21/1988	0	0	$4,000	0.3	30
7/13/1989	0	0	$4,000	0.3	30
6/15/2004	0	0	$1,000	1.0	75

15.2.2 Location

Recorded tornadoes in the planning area are typically small and short-lived. They are more likely to occur in the eastern portion of the County.

15.2.3 Frequency

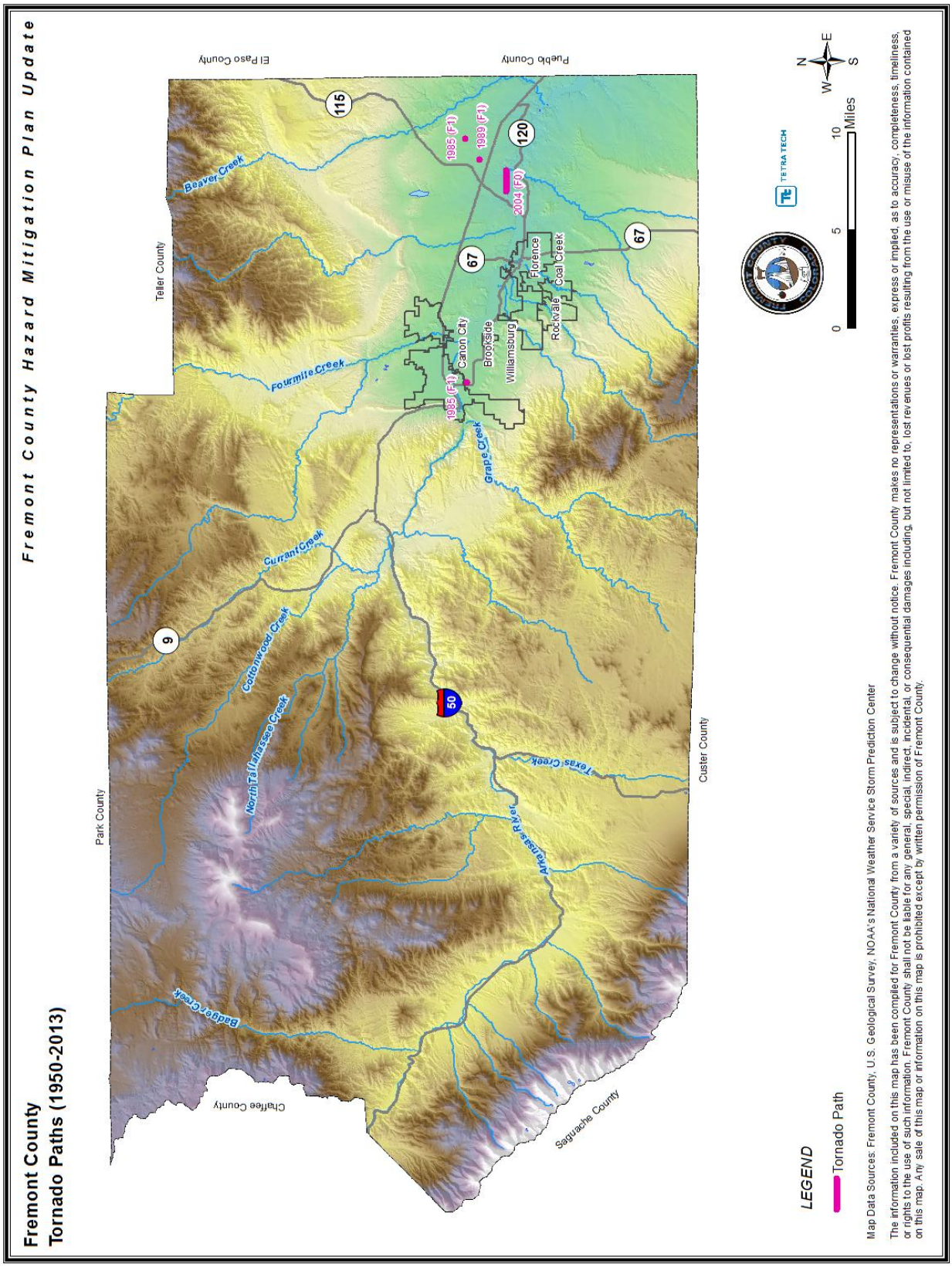
Tornadoes have been reported 9 months of the year in Colorado, with peak occurrences between mid-May through mid-August. State-wide, June is by far the month with the most recorded tornadoes; however, more than half of the tornadoes recorded on Fremont County have occurred in July. Tornadoes occur at all times of the day, with more than half occurring between 3 p.m. and 6 p.m., and about 88 percent occurring between 1 p.m. and 9 p.m.

Table 15-3 lists 5 recorded tornadoes between 1950 and 2013. Because all recorded tornado events have occurred since 1985, frequency is assessed using a 28-year time frame (1985 to 2013). A tornado occurs in the County once every 5 to 6 years on average.

15.2.4 Severity

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike within the populated areas of Fremont County, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed. Historically, tornadoes have not typically been severe or caused damage in the planning area.

Figure 15-3. Tornado Paths in Fremont County



15.2.5 Warning Time

The NOAA's storm prediction center issues tornado watches and warnings for Fremont County:

- **Tornado Watch** - Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA Weather Radio, commercial radio, or television for information.
- **Tornado Warning** - A tornado has been sighted or indicated by weather radar. Take shelter immediately.

Once a warning has been issued, residents may have only a matter of seconds or minutes to seek shelter.

15.3 SECONDARY HAZARDS

Tornadoes may cause loss of power if utility service is disrupted. Additionally, fires may result from damages to natural gas infrastructure. Hazardous materials may be released if a structure is damaged that houses such materials or if such a material is in transport.

15.4 CLIMATE CHANGE IMPACTS

Climate change impacts on the frequency and severity of tornadoes are unclear. According to the Center for Climate Change and Energy Solutions, "Researchers are working to better understand how the building blocks for tornadoes – atmospheric instability and wind shear – will respond to global warming. It is likely that a warmer, moister world would allow for more frequent instability. However, it is also likely that a warmer world would lessen chances for wind shear. Recent trends for these quantities in the Midwest during the spring are inconclusive. It is also possible that these changes could shift the timing of tornadoes or regions that are most likely to be hit" (Center for Climate and Energy Solutions, no date).

15.5 EXPOSURE

15.5.1 Population

It can be assumed that the entire planning area is exposed to some extent to tornadoes. Certain areas are more exposed due to geographic location and local weather patterns.

15.5.2 Property

According to the Fremont County Assessor, there are 16,707 buildings within the census tracts that define the planning area. Most of these buildings are residential. It is estimated that 66 percent of the residential structures were built without the influence of a structure building code with provisions for wind loads. Property located at lower elevations are more likely to be exposed to tornadoes.

15.5.3 Critical Facilities and Infrastructure

All critical facilities (see Figure 6-6) are likely exposed to tornadoes. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water and sewer systems may not function. Roads may become impassable due to downed trees or other debris.

15.5.4 Environment

Environmental features are exposed to tornado risk, although damages are generally localized to the path of the tornado.

15.6 VULNERABILITY

15.6.1 Population

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure after tornado events and could suffer more secondary effects of the hazard.

Individuals caught in the path of a tornado who are unable to seek appropriate shelter are especially vulnerable. This may include individuals who are out in the open, in cars, or who do not have access to basements, cellars, or safe rooms.

15.6.2 Property

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage.

Loss estimations for tornadoes are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the assessed value of exposed structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 15-4 lists the loss estimates.

TABLE 15-4.
LOSS ESTIMATES FOR TORNADO

		Estimated Loss Potential from Tornado		
	Exposed Value	10% Damage	30% Damage	50% Damage
Brookside	$21,392,628	$2,139,263	$6,417,788	$10,696,314
Cañon City	$2,192,212,889	$219,221,289	$657,663,867	$1,096,106,445
Coal Creek	$25,908,326	$2,590,833	$7,772,498	$12,954,163
Florence	$448,012,198	$44,801,220	$134,403,659	$224,006,099
Rockvale	$47,323,953	$4,732,395	$14,197,186	$23,661,976
Williamsburg	$53,864,191	$5,386,419	$16,159,257	$26,932,096
Unincorporated	$2,433,592,333	$243,359,233	$730,077,700	$1,216,796,166
Total	**$5,222,306,518**	**$522,230,652**	**$1,566,691,955**	**$2,611,153,259**

Source: Total building value based on Fremont County tax assessor data received April 2014.

15.6.3 Critical Facilities and Infrastructure

Tornadoes can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Any facility that is in the path of a tornado is likely to sustain damage.

15.6.4 Environment

Environmental vulnerability will typically be the same as exposure (discussed in Section 15.5.4); however, if tornadoes impact facilities that store hazardous materials areas impacted by material releases may be especially vulnerable.

15.7 FUTURE TRENDS IN DEVELOPMENT

All future development will be affected by tornadoes, particularly development that occurs at lower elevations. Development regulations that require safe rooms, basements, or other structures that reduce risk to people would decrease vulnerability. Tornadoes that cause damage are uncommon in the County, so mandatory regulations may not be cost-effective.

15.8 SCENARIO

If an EF3 or higher tornado were to hit populated areas of the County, such as Cañon City, substantial damage to property and loss of life could result. Likelihood of injuries and fatalities would increase if warning time was limited before the event or if residents were unable to find adequate shelter. Damage to critical facilities and infrastructure would likely include loss of power, water, sewer, gas and communications. Roads and bridges could be blocked by debris or otherwise damaged. The most serious damage would be seen in the direct path of the tornado, but secondary effects could impact the rest of the County through loss of government services and interruptions in the transportation network. Debris from the tornado would need to be collected and properly disposed. Such an event would likely have substantial negative effects on the local economy.

15.9 ISSUES

Important issues associated with a tornado in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to tornadoes.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- Roads and bridges blocked by debris or otherwise damaged might isolate populations.
- Warning time may not be adequate for residents to seek appropriate shelter or such shelter may not be widespread throughout the planning area.
- The impacts of climate change on the frequency and severity of tornadoes are not well understood.

CHAPTER 16.
SUBSIDENCE/SINKHOLES/SOIL EROSION

SUBSIDENCE/SINK HOLES/SOIL EROSION RANKING			
Fremont County	Canon City	Florence	Brookside
Low	Low	Low	Low

DEFINITIONS

Ground Subsidence— Ground subsidence is the sinking of land over human-caused or natural underground voids and the settlement of native low density soils.

Soil Erosion— Soil erosion is the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice.

Deposition— Deposition is the placing of eroded material in a new location.

16.1 GENERAL BACKGROUND

16.1.1 Subsidence and Sinkholes

According to the Colorado State Hazard Mitigation Plan, "ground subsidence is the sinking of land over human caused or natural underground voids and the settlement of native low density soils" (Colorado Division of Emergency Management, 2011). Subsidence can occur gradually over time or virtually instantaneously. There are many different types of subsidence; however, in Colorado, there are three types of subsidence that warrant the most concern: settlement related to collapsing soils, sinkholes in karst areas, and the ground subsidence over abandoned mine workings.

Collapsible Soils

Collapsible soils are a group of soils that can rapidly settle or collapse the ground. The most common type of collapsible soil is hydrocompactive soil. According to the Colorado Geological Survey, "hydrocompactive soils form in semi-arid to arid climates in the western US and large parts of Colorado in specific depositional environments" (Colorado Geological Survey, 2014). These soils are low in density and in moisture content and are loosely packed together. Agents that bind these loosely packed particles together, such as clay and silk buttresses, are water sensitive. When water is introduced to these soils, the binding agents may quickly break down, soften, disperse, or dissolve. This results in a reorganization of the soil particles in a more dense arrangement, which in turn results in a net volume loss indicated by resettlement or subsidence at the surface (Colorado Geological Survey, 2014). Volume loss can be between 10 to 15 percent, which can result in several feet of surface-level displacement.

Karst Areas

Most sinkholes in Colorado are related to the dissolution of evaporite minerals or limestone. Evaporite minerals dissolve in water and include gypsum and halite. Rocks containing limestone also form sinkholes based on dissolution by water. The term "karst" describes a landscape that has been shaped by the dissolution of these types of bedrock (Colorado Geological Survey, 2014). According to a newsletter issued by the Colorado Geological Survey, "two characteristics of evaporative bedrock are important. One is that evaporative minerals can flow, like a hot plastic, when certain pressures and temperatures are exceeded. The second, and most important to land use and development is that evaporative minerals dissolve in the presence of freshwater. It is this dissolution of the rock that creates caverns, open fissures, streams out letting from bedrock, breccia pipes, subsidence sags and depressions, and sinkholes" (Colorado Geological Survey, 2001).

Factors leading to the formation of sinkholes in these landscapes may be natural or may be induced by human activities. Natural contributing factors include the downward percolation of surface water through the rock formation or the lateral movement of water within a water table. Human activities that may

contribute to such subsistence include stream channel changes, irrigation ditches, land irrigation leaking or broken pipes, temporary or permanent ponding of surface waters, and mining of soluble materials by means of forced circulation of water (Colorado Geological Survey, 2014).

Abandoned Mine Workings

The underground removal of minerals and rock can undermine underground support systems and lead to void spaces. These voids can then be affected by natural and man-made processes such as caving, changes in flowage, or changes in overlying rock and soil material resulting in collapse or subsidence. Hazards from these abandoned sites are complicated by the fact that many "final mine maps" are inaccurate or incomplete (Colorado Geological Survey, 2014). Mines operating after August 1997 were required by federal and state law to take potential surface subsidence into account; however, mining has been an activity in the state since the 1860s (Colorado Geological Survey, 2001). There are some mapped, known mine hazard areas in Colorado and in Fremont County; however, it is likely that there are additional hazard areas for which no records exist.

16.1.2 Soil Erosion and Deposition

The Colorado Geological Survey defines erosion as "the removal and simultaneous transportation of earth materials from one location to another by water, wind, waves, or moving ice" (Colorado Geological Survey, 2014). Deposition is defined as "the placing of eroded material in a new location" (Colorado Geological Survey, 2014). According to the Colorado Geological Survey, all material that is eroded is later deposited in another location. Both erosion and deposition are continually occurring phenomenon, although the rate of erosion and deposition varies tremendously and can be affected by a variety of factors including rate of scour, type of material being eroded, and the presence or absence of vegetation.

16.2 HAZARD PROFILE

16.2.1 Past Events

Subsidence and Sinkholes

The occurrence of subsidence is an on-going process resulting from natural and human induced causes. There is no known database of subsidence and sinkhole events that have occurred within Fremont County; however the CGS has undergone mapping studies in an effort to identify existing sinkholes and areas that are prone to subsidence events. According to GIS data from CGS there have been ten sinkholes identified in the County, all of which are located in the Coaldale area. Additionally, an internet search identified the following reports of recent subsidence or sinkhole events within the County:

- **September 2013** – During a flooding event impacting Cañon City, a small sinkhole opened up on Central Avenue (Hopper, 2013).
- **April 2004** – An investigation of the C-4 dam in Cañon City indicated that cracks and holes had appeared in the dam. According to an article published in 2011 by Benjamin Doerge and others "The primary cause of the cracking was determined to be differential settlement due to collapse of the foundation materials upon wetting. During the original construction of the dam, a surface layer of highly collapsible aeolian/colluvial soil had been removed, but a lower layer of moderately collapsible alluvium was left in place" (Doerge and others, 2011).

Soil Erosion and Deposition

Soil erosion and deposition are also ongoing events that can be affected by both natural and human-induced processes. Soil erosion and deposition events are continually occurring throughout the County.

16.2.2 Location

Subsidence and Sinkholes

According to the Colorado Geological Survey, "Most catalogued sinkholes of Colorado lie on surficial deposits such as flat-lying glacial outwash terraces, recent valley side sediments, or older deposits on pediment slopes overlying the evaporite bedrock. The highest density of sinkholes that are manifested at the surface in Colorado occur in the Garfield County, Eagle County, Rio Blanco County, and Park County" (Colorado Geological Survey, 2001).

In Fremont County, there are three mapped areas of evaporite-bearing bedrock as well as nine areas where it is known that gypsum mining has occurred. Additionally, there are number of open mine holes on forest service lands. Figure 16-1 shows the evaporite-bearing bedrock areas, known gypsum mining sites and areas with recorded sinkholes. According to a publication from CGS, there is also evidence of collapsible soils around Cañon City, although spatial data was not available for mapping purposes (Colorado Geological Survey, 2001).

Soil Erosion and Deposition

Soil erosion and deposition occur in all parts of the County. Point sources of erosion often occur in areas where humans interact with exposed areas of the earth's surface, such as construction sites. Waterways are continually involved in erosion and deposition processes. Erosion and deposition may be exacerbated in areas where wildfires have occurred. According to the State of Colorado's Hazard Mitigation Plan, "there is a high risk for erosion in the aftermath of a wildfire event. As a fire burns, it destroys plant material and the layers of litter that blanket the floor of an ecosystem. These materials, as well as trees, grasses, and shrubs, buffer and stabilize the soil from intense rainstorms. The plant materials slow runoff to give rainwater time to percolate into the ground. When fire destroys this protective later, rain and wind wash over the unprotected soil and erosion occurs" (Colorado Division of Emergency Management, 2011). Areas in Fremont County that were recently burned are more susceptible to exacerbated erosion and deposition.

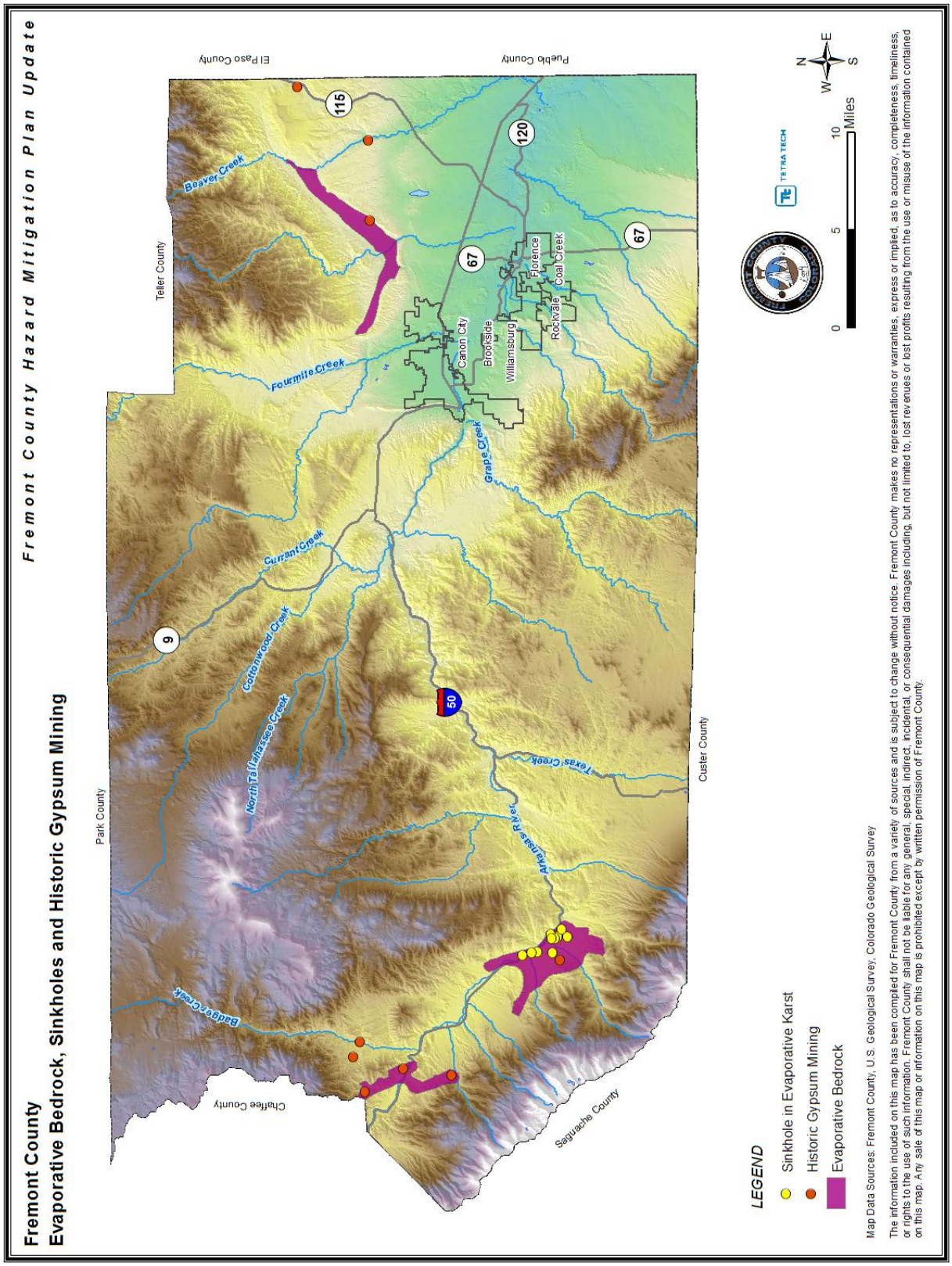
16.2.3 Frequency

Subsidence and sinkholes as well as soil and erosion and deposition are occurring continuously throughout the County. Large precipitation events as well as human activity may influence the frequency of these events within the County.

16.2.4 Severity

The severity of subsidence and sinkholes as well as soil erosion and deposition is largely related to the extent and location of areas that are impacted. Such events can cause property damage as well as loss of life; however, events may also occur in remote areas of the County where there is little to no impact to people or property. According to the CGS, "In general, the type and severity of surface subsidence is governed by the amount of ground surface and the location of removal or compression, and the geological conditions of a particular site" (Colorado Geological Survey, 2014).

Figure 16-1. Evaporative Bedrock, Sinkholes, and Historic Gypsum Mining



16.2.5 Warning Time

Subsidence can happen suddenly and without warning or can occur gradually over time. Soil erosion and deposition generally occurs gradually over time; however, these processes may be intensified as a result of natural or human-induced activities. According to CGS, there are some instances where the rate of subsidence can be calculated, particularly subsidence that occurs as a result of mining activities (Colorado Geological Survey, 2001):

> *Where longwall mining is active and subsidence is a well-documented and predictable action, surface response to ongoing mining can be accurately estimated. However, in the case of room and pillar mines, especially where they are inaccessible and record-keeping may be inaccurate, predictions of when subsidence will happen are not possible.*
>
> *How much subsidence will occur and the features that will appear at the surface depend not only on the type of mining but on geology and several physical features of the voids left by mining. Some general rules of thumb are:*
>
> - *The larger the mine opening height and width, the larger the subsidence feature at the surface,*
> - *The shallower the mine below ground, the more noticeable the surface subsidence evidence; however, in Colorado pits have been found over mines as deep as 350 feet,*
> - *The strength of the rock above the coal seam influences whether subsidence will reach the surface and the kind of features that can appear.*

16.3 SECONDARY HAZARDS

Events that cause damage to improved areas can result in secondary hazards, such as explosions from natural gas lines, loss of utilities such as water and sewer due to shifting infrastructure, and potential failures of reservoir dams. Additionally, these events may occur simultaneously with other natural hazards such as flooding. Erosion can cause undercutting that can result in an increase in landslide or rockfall hazards. Additionally erosion can result in the loss of topsoil, which can affect agricultural production in the area. Deposition can have impacts that aggravate flooding, bury crops, or reduce capacities of water reservoirs.

16.4 CLIMATE CHANGE IMPACTS

Changes in precipitation events and the hydrological cycle may result in changes in the rate of subsidence and soil erosion. According to a 2003 paper published by the Soil and Water Conservation Society (Soil and Water Conservation, 2003):

> *The potential for climate change – as expressed in changed precipitation regimes – to increase the risk of soil erosion, surface runoff, and related environmental consequences is clear. The actual damage that would result from such a change is unclear. Regional, seasonal, and temporal variability in precipitation is large both in simulated climate regimes and in the existing climate record. Different landscapes vary greatly in their vulnerability to soil erosion and runoff. Timing of agricultural production practices creates even greater vulnerabilities to soil erosion and runoff during certain seasons. The effect of a particular storm event depends on the moisture content of the soil before the storm starts. These interactions between precipitation, landscape, and management mean the actual outcomes of any particular change in precipitation regime will be complex.*

16.5 EXPOSURE

16.5.1 Population

Residents of the County living or travelling in areas prone to subsidence and erosion are exposed to the hazard. Population exposure estimates are unavailable; however, the majority of known hazard areas are outside of the County's incorporated areas.

16.5.2 Property

Structures and other improvements located in areas prone to subsistence or soil erosion are exposed to risk from these hazards. Additionally, deposition may result in damage to structures and property.

16.5.3 Critical Facilities and Infrastructure

Any critical facilities or infrastructure that are located on or near areas prone to subsidence or soil erosion are exposed to risk from the hazard. Deposition may result in additional exposure.

16.5.4 Environment

Subsidence, erosion, and deposition are all naturally occurring processes, but can still cause damage to the natural environment. Environments located in areas prone to subsidence and deposition are exposed. Additionally, areas where sediments are deposited are also exposed.

16.6 VULNERABILITY

16.6.1 Population

The risk of injury or fatalities as a result of these hazards are limited, but possible. Spontaneous collapse and opening of voids are rare, but still may occur resulting in death or injury to any people in the area at the time. It is likely that any such injuries would be highly localized to the area directly impacted by an event. Erosion can adversely impact populations who have respiratory issues by reducing air quality, so those with existing respiratory issues are likely to be more vulnerable.

16.6.2 Property

Property exposed to subsidence and erosion can sustain minor damages or can result in complete destruction. According to CGS, merely an inch of differential subsidence beneath a residential structure can cause several thousand dollars of damage. Structures may be condemned as a result of this damage resulting in large losses. FEMA estimates that there are over $125 million in losses in the U.S. annually as a result of subsidence. Structures exposed to erosion hazard areas may be undermined, resulting in damages. This may also result in the condemnation of a structure. Additionally, physical loss land area may occur as a result of erosion.

16.6.3 Critical Facilities and Infrastructure

Subsidence can result in serious structural damage to critical facilities and infrastructure such as, roads, irrigation ditches, underground utilities and pipelines. According to CGS, large ground displacements caused by collapsing soils can totally destroy roads and structures and alter surface drainage. Minor cracking and distress may result as the improvements respond to small adjustments in the ground beneath them. Erosion can also impact structures such as bridges and roads by undermining their foundations. Structures and underground utilities found in areas prone to subsidence or soil erosion can suffer from distress. The shifting and settling of the structure can be seen in a number of ways:

- Settlement, cracking and tilting of concrete slabs and foundations,
- Displacement and cracking in door jams, window frames, and interior walls, or

- Offset cracking and separation in rigid walls such as brick, cinderblock, and mortared rock (Colorado Geological Survey, 2001).

16.6.4 Environment

Ecosystems that are exposed to increased sedimentation as a result of erosion and deposition degrades habitat. However, some erosion and disposition is required for healthful ecosystem functioning. Ecosystems that are already exposed to other pressures, such as encroaching development, may be more vulnerable to impacts from these hazards.

16.7 FUTURE TRENDS IN DEVELOPMENT

According to the State of Colorado Hazard Mitigation Plan (Colorado Division of Emergency Management, 2011):

> *Future development will continue to intersect subsidence hazard areas based on past and project population growth. Important identification and mitigation strategies are necessary in engineering geology and geotechnical investigations within the evaporite terrain mapped. Avoidance is generally the best mitigation solution where subsidence features are exposed at the surface and properly identified. Many older sinkholes may be hidden. Only subsurface inspections, either by investigative trenching, a series of investigative borings, geophysical means, and/or observations made during overlot grading or utility installation, can ascertain whether sinkholes exist within a development area. Ground-modification and structural solutions can help mitigate the threat of localized subsidence. Drainage issues and proper water management are also important. In Colorado's semi-arid climate, additional increases of fresh water may accelerate dissolution and further destabilize certain subsidence areas.*

Jurisdictions in the planning area should ensure that known hazard areas are regulated under their planning and zoning programs. In areas where hazards may be present, permitting processes should require geotechnical investigations to access risk and vulnerability to hazard areas. Erosion issues generally do not impact land use except along river channels. Issues pertaining to land use in these areas are likely addressed through jurisdictional floodplain ordinances and regulations.

16.8 SCENARIO

A worst case scenario would occur if a rapidly occurring sink hole opened up beneath a structure where many individuals lived or worked. This situation could result in a number of injuries or fatalities and would cause extensive damage to the area directly impacted.

16.9 ISSUES

The major issues for subsidence, sinkholes, erosion, and deposition are the following:

- Onset of actual or observed subsidence in many cases is related to changes in land use. Land uses permitted in known hazard areas should be carefully evaluated.
- Knowledge of hydrologic factors is critical for evaluating most types of ground subsidence.
- Abandoned mine information is incomplete. There are likely to be hazardous areas in addition to known locations.
- Some housing developments have had subsidence hazard investigations completed before development. This practice should be expanded.
- Homeowners within an undermined area that were built before 1989 are eligible to participate in the Mine Subsidence Protection Program, a federal program operated by the Mined Land

Reclamation Board of the Division of Minerals and Geology. Homes built after 1989 are not covered.

- Many older sinkholes have been covered with recent soil infilling and are completely concealed at the surface
- Human activities greatly influence the rate and extent of erosion and deposition. Activities should be evaluated before proceeding with them.
- Riverine erosion can reduce water quality and impact aquatic habitat as well as impacting private property and critical infrastructure.
- More detailed analysis should be conducted for critical facilities and infrastructure exposed to hazard areas. This analysis should address how potential structural issues were addressed in facility design and construction.

CHAPTER 17.
WILDFIRE

WILDFIRE RANKING			
Fremont County	Canon City	Florence	Brookside
High	High	High	Medium

17.1 GENERAL BACKGROUND

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson.

Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as wildland urban interface (WUI) areas, where development is adjacent to densely vegetated areas.

Wildfires are of significant concern throughout Colorado. According to the Colorado State Forest Service, vegetation fires occur on an annual basis; most are controlled and contained early with limited damage. For those ignitions that are not readily contained and become wildfires, damage can be extensive. According to the State of Colorado Natural Hazards Mitigation Plan, a century of aggressive fire suppression combined with cycles of drought and changing land management practices has left many of Colorado's forests, including those in Fremont County, unnaturally dense and ready to burn. Further, the threat of wildfire and potential losses is constantly increasing as human development and population increases and the wildland-urban interface expands. Another contributing factor to fuel loads in the forest are standing trees killed by pine bark beetles, which have been affecting the forests of Colorado since 2002, becoming more widespread and a serious

DEFINITIONS

Conflagration—A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup, and explosions are usually the elements behind a wildfire conflagration.

Firestorm—A fire that expands to cover a large area, often more than a square mile. A firestorm usually occurs when many individual fires grow together into one. The involved area becomes so hot that all combustible materials ignite, even if they are not exposed to direct flame. Temperatures may exceed 1000°C. Superheated air and hot gases of combustion rise over the fire zone, drawing surface winds in from all sides, often at velocities approaching 50 miles per hour. Although firestorms seldom spread because of the inward direction of the winds, once started there is no known way of stopping them. Within the area of the fire, lethal concentrations of carbon monoxide are present; combined with the intense heat, this poses a serious life threat to responding fire forces. In very large events, the rising column of heated air and combustion gases carries enough soot and particulate matter into the upper atmosphere to cause cloud nucleation, creating a locally intense thunderstorm and the hazard of lightning strikes.

Interface Area—An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Wildfire—Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because of their distance from firefighting resources, they can be difficult to contain and can cause a great deal of destruction.

concern. According to the Fremont County Hazard Mitigation Community Survey conducted in 2014 (see Appendix B), Fremont County residents believe that wildfire is the greatest threat to their safety.

Fire Protection in Fremont County

Fire protection in Fremont County is divided between Fire Protection Districts, Volunteer Fire Departments, Sheriff's Wildland Fire Team, Bureau of Land Management, and the USDA Forest Service. More information about these divisions is provided in Table 17-1. Multiple community wildfire protection plans are in place, as discussed in Section 6.9.3. These plans include the Fremont County Community Wildfire Protection Plan, the Four Mile-Currant Creek Community Wildfire Protection Plan, the Garden Park Community Wildfire Protection Plan, and the Southwest Cañon Community Wildfire Protection Plan.

TABLE 17-1.
FIRE PROTECTION IN FREMONT COUNTY

Protection Type	Protection Areas
Fire Protection Districts	Western Fremont, Cañon City, Florence, South Arkansas, and Deer Mountain
Volunteer Fire Departments	Tallahassee Volunteer Fire and Howard
Sheriff's Wildland Fire Team	All private lands within the County
Bureau of Land Management	Initial attack responsibility on most BLM and Forest Service lands.
USDA Forest Service	Initial attack responsibility for federal lands along the western-most boundary of the County.

Source: Fremont County Community Wildfire Protection Plan

Vegetation Classes in Fremont County

General vegetation for Fremont County is described in Table 17-2. The most common vegetation classes in the County are Pinyon-Junipur, Mixed Conifer, Grassland, and Shrubland comprising over 77 percent of the acreage in the County.

TABLE 17-2.
VEGETATION CLASSES IN FREMONT COUNTY

Class	Acres	Percent (%)
Grassland	132,602	13.9
Shrubland	118,332	12.4
Aspen	84,422	8.8
Lodgepole Pine	4,849	0.5
Ponderosa Pine	58,785	6.2
Spruce-Fir	17,596	1.8
Mixed Conifer	134,387	14.1
Oak Shrubland	27,337	2.9
Pinyon-Juniper	349,822	36.7
Riparian	7,758	0.8

TABLE 17-2.
VEGETATION CLASSES IN FREMONT COUNTY

Class	Acres	Percent (%)
Introduced Riparian	426	0.0
Agriculture	13,750	1.4
Open Water	675	0.1
Urban and Community	3,353	0.4
Total	**954,095**	**100.0**

Source: Fremont County Wildfire Risk Summary Report

17.2 HAZARD PROFILE

17.2.1 Past Events

Figure 17-1 shows the locations of Fremont County federally reported wildfires that burned 10 acres or more from 1980 through 2012. The fires are listed in Table 17-3.

TABLE 17-3.
WILDFIRES IN FREMONT COUNTY, 1980-2014 (GREATER THAN 10 ACRES)

BLM Fire ID	Fire Name	Cause	Start Date	Acres
NA	Eight Mile	Natural	6/2014	528
NA	Bull Gulch	Natural	6/19/2013	76
657547	Royal Gorge	Human	6/16/13	3,218
623160	Crampton	Natural	7/19/2011	13
NA	Duckett	NA	6/12/2011	4,358
620626	High Park	Human	6/18/2011	46.5
622441	Parkdale	Human	06/21/2010	600
589847	Newlin	Human	7/10/2009	142
585946	Long Ranch	Human	3/16/2009	12
582730	Phantom	Human	11/16/2008	15
583828	Table Mountain	Natural	10/16/2008	15
581741	YMCA Mountain	Natural	7/29/2008	16.5
558197	Ferguson	Human	5/12/2008	190
542782	Goat Park	Natural	6/26/2007	10.3
120941	E Phantom	Natural	3/23/2004	30
115761	Phantom Canyon	Natural	6/21/2003	22
109518	Locke Mountain	Natural	5/19/2002	16
NA	Iron Mountain	Human	6/2/2002	4,436
106806	Big Baldy	Natural	10/1/2001	25
98913	Cooper Mountain	Natural	9/17/2000	64.9

TABLE 17-3.
WILDFIRES IN FREMONT COUNTY, 1980-2014 (GREATER THAN 10 ACRES)

BLM Fire ID	Fire Name	Cause	Start Date	Acres
5490	Fremont 2	Human	5/29/1998	200
15411	Table	Natural	7/20/1996	18.5
43092	Tanner Peak	Natural	5/25/1991	20
47523	Copper Gulch	Human	6/19/1990	200
55890	Milsap Creek	Human	3/20/1988	34
69432	Gorge Hill	Natural	8/29/1985	95
84604	Carrol Creek	Natural	6/24/1981	10
88612	Hamilton	Human	9/19/1980	60

Source: Federal Wildland Fire Occurrence Data, http://wildfire.cr.usgs.gov/firehistory/data.html

Source: http://wildfire.cr.usgs.gov/firehistory/viewer/viewer.htm

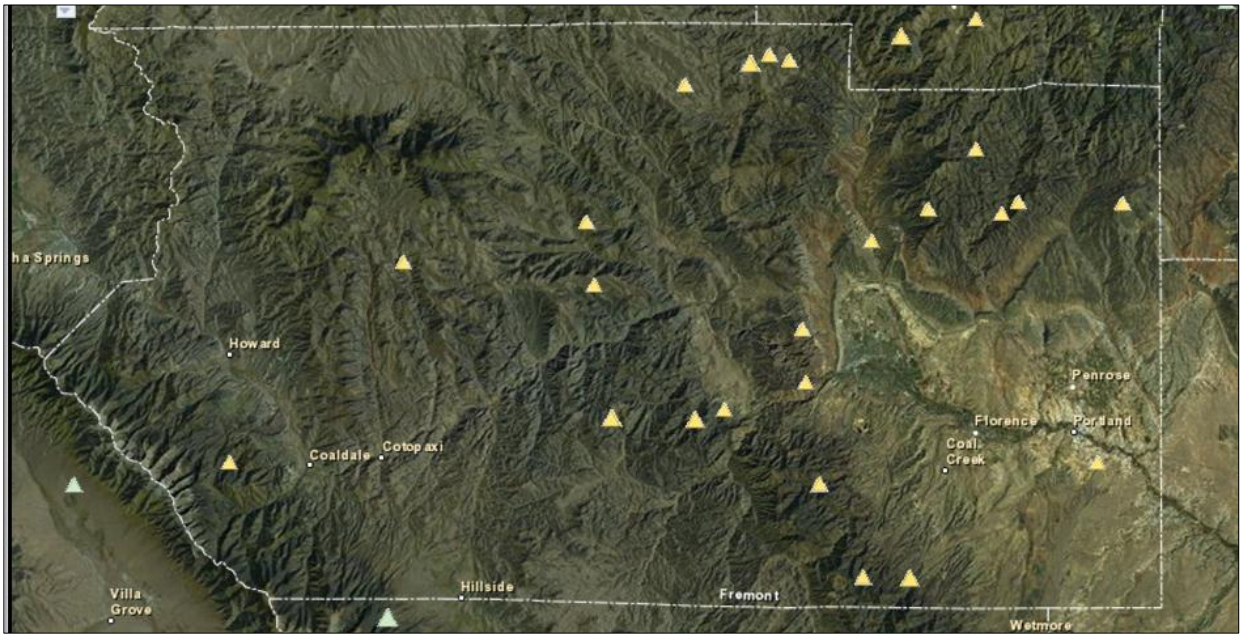


Figure 17-1. Fremont County Wildfires of 10 Acres or Larger, 1980 - 2012

17.2.2 Recent Significant Fires

Iron Mountain Fire (2002)

The Iron Mountain Fire began at 1:30 p.m. on June 2, 2002 on private land in southern Fremont County. The fire quickly grew out of control as a result of southwest winds and spread through the Colorado Acres and Deer Mountain subdivisions, which are located about 12 miles west of Cañon City. There were over 270 incident personnel, 6 engines, 5 dozers, 8 hand crews, and various air resources that responded to the fire. The fire was contained 4 days after it started, but not before it burned 4,436 acres of land, and destroyed 200 structures, including 100 homes. There were no reported injuries or fatalities as a result of the fire, but

numerous animals and livestock were lost. The final damage estimate was $20 million with only about 37 percent covered by insurance (Fremont County Office of Emergency Management, 2003).

The Royal Gorge Fire (2013)

The Royal Gorge Fire started on June 11, 2013 and was 100 percent contained on June 16, 2013. At the peak of the fire, approximately 600 people were evacuated from their homes and almost 900 prisoners were transferred out of the fire threat area. A total of 3,218 acres were burned by the fire. Of this, 16 percent is owned by the Bureau of Land Management, 17 percent is owned privately, and 67 percent is owned by the City of Cañon City. The fire destroyed the Royal Gorge Bridge and Park, resulting in major impacts to the local economy (see Figure 17-2). According to the Governor's Request for Presidential Major Disaster Declaration, all structures at the park, including the historic bridge, were damaged: 48 of the 52 park structures were completely destroyed. The fire directly resulted in the loss of employment for 150 seasonal employees of the park as well as loss of revenue for the City of Cañon City (Office of the Governor of the State of Colorado, 2013).

Source: Fremont County Sheriff's Office

Figure 17-2. View of the Royal Gorge Bridge Area after the 2013 Royal Gorge Fire

Bull Gulch Fire (2013)

The Bull Gulch Fire started on June 19, 2013 as the result of a lightning strike. The fire burned 76 acres 9 miles northeast of Cotopaxi. 100 percent containment was reached at 1:30 p.m. on June 26, 2013. The area burned was covered by a mix of Pinyon, Juniper, and Ponderosa Pine. No structures were lost as a result of the fire (InciWeb, 2013).

17.2.3 Location

According to the Fremont County Community Wildfire Protection Plan, the majority of the land area in the County is publicly owned. Federal lands include BLM lands scattered throughout the County, San Isabel National Forest in the southwest, and southeast of Cañon City in the Wet Mountains. State-owned lands are scattered throughout the County (Fremont County Community Wildfire Plan, no date).

Colorado overall is one of the fastest growing states in the nation. Much of this growth is occurring in the WUI area, where structures and other human improvements meet and mix with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfires. For Fremont County, the Colorado State Wildfire Risk Assessment Program (WRAP) estimates that 95 percent of the County population living outside of the incorporated communities live within the WUI and is at risk from wildfire. Figure 17-3 shows the Fremont County housing density within the WUI.

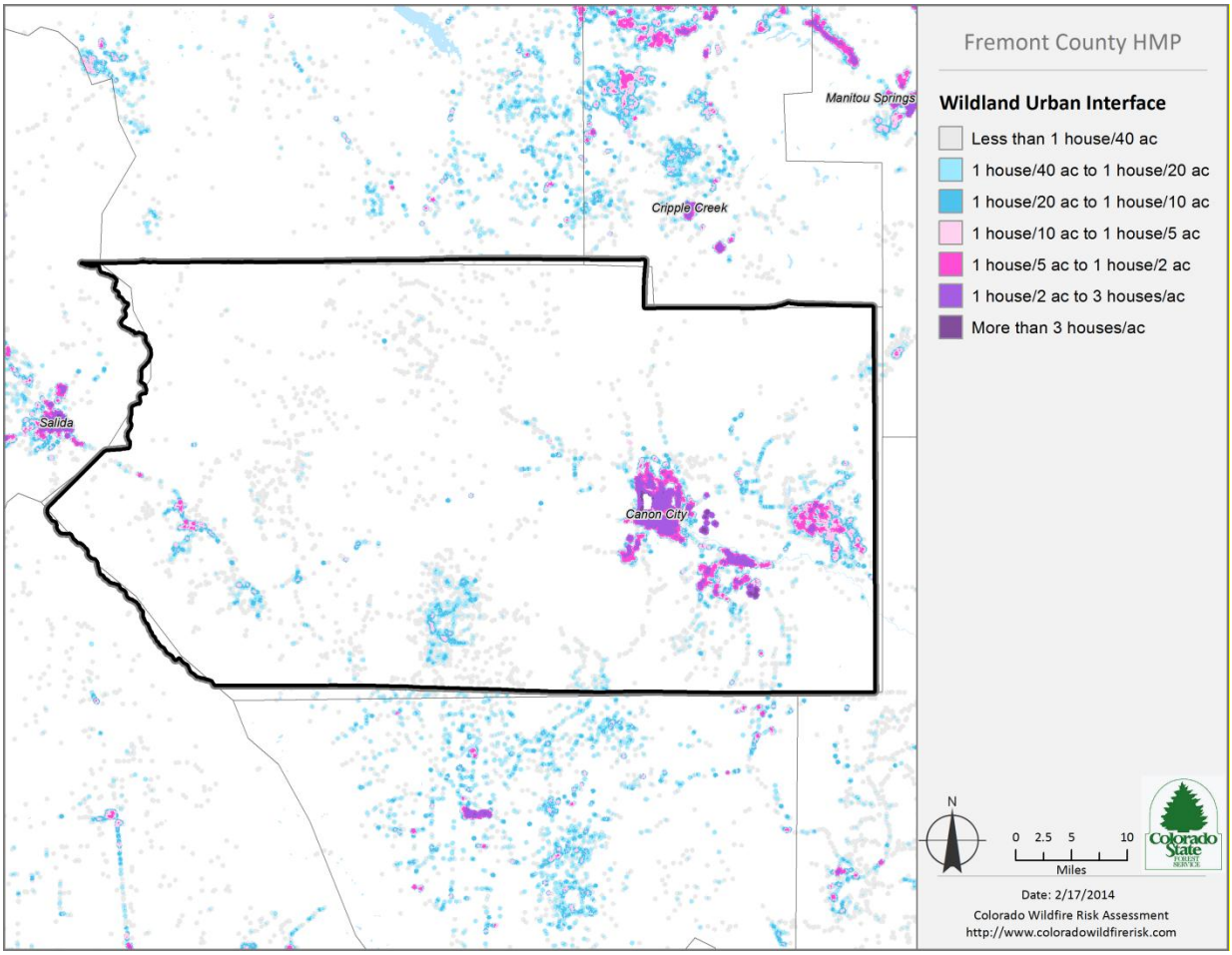


Figure 17-3. Fremont County Housing Density Within the Wildland Urban Interface

The WRAP report for Fremont County maps the WUI Risk Index, which is a rating of the potential impact of a wildfire on people and their homes. The key input reflects housing density (Figure 17-3). The WRAP report states that the location of people living in the WUI and rural areas is essential for defining potential wildfire impacts to people and homes. Figure 17-4 shows the WUI Risk Index for Fremont County.

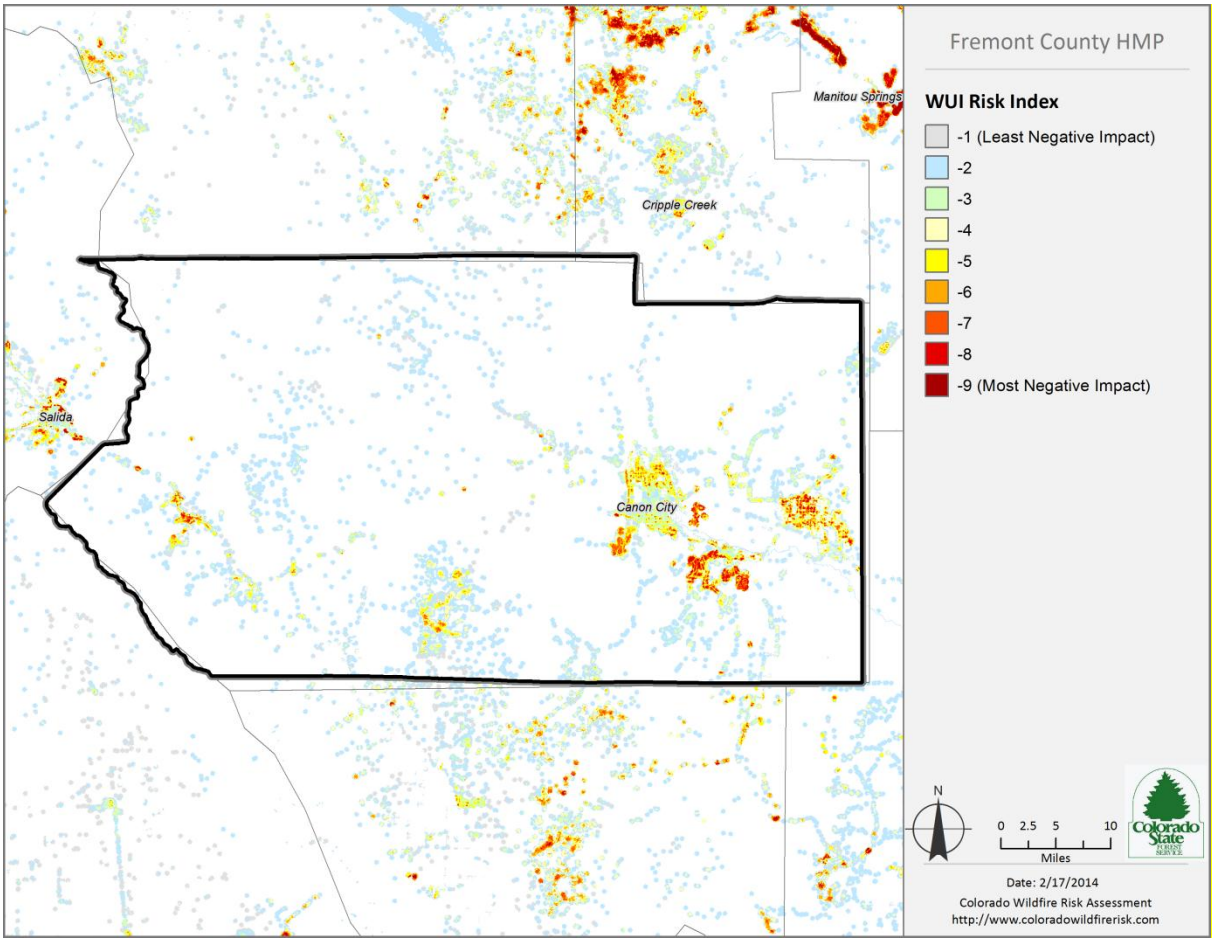


Figure 17-4. Wildland Urban Interface Risk Index for Fremont County

According to the WRAP report for Fremont County, wildfire risk represents the possibility of loss or harm occurring from a wildfire. Risk is derived by combining the wildfire threat and the fire effects assessment outputs. It identifies areas with the greatest potential impacts from a wildfire. Wildfire risk combines the likelihood of a fire occurring (threat) with those areas of most concern that are adversely impacted by fire to derive a single overall measure of wildfire risk. Figure 17-5 shows the wildfire risks for areas within Fremont County.

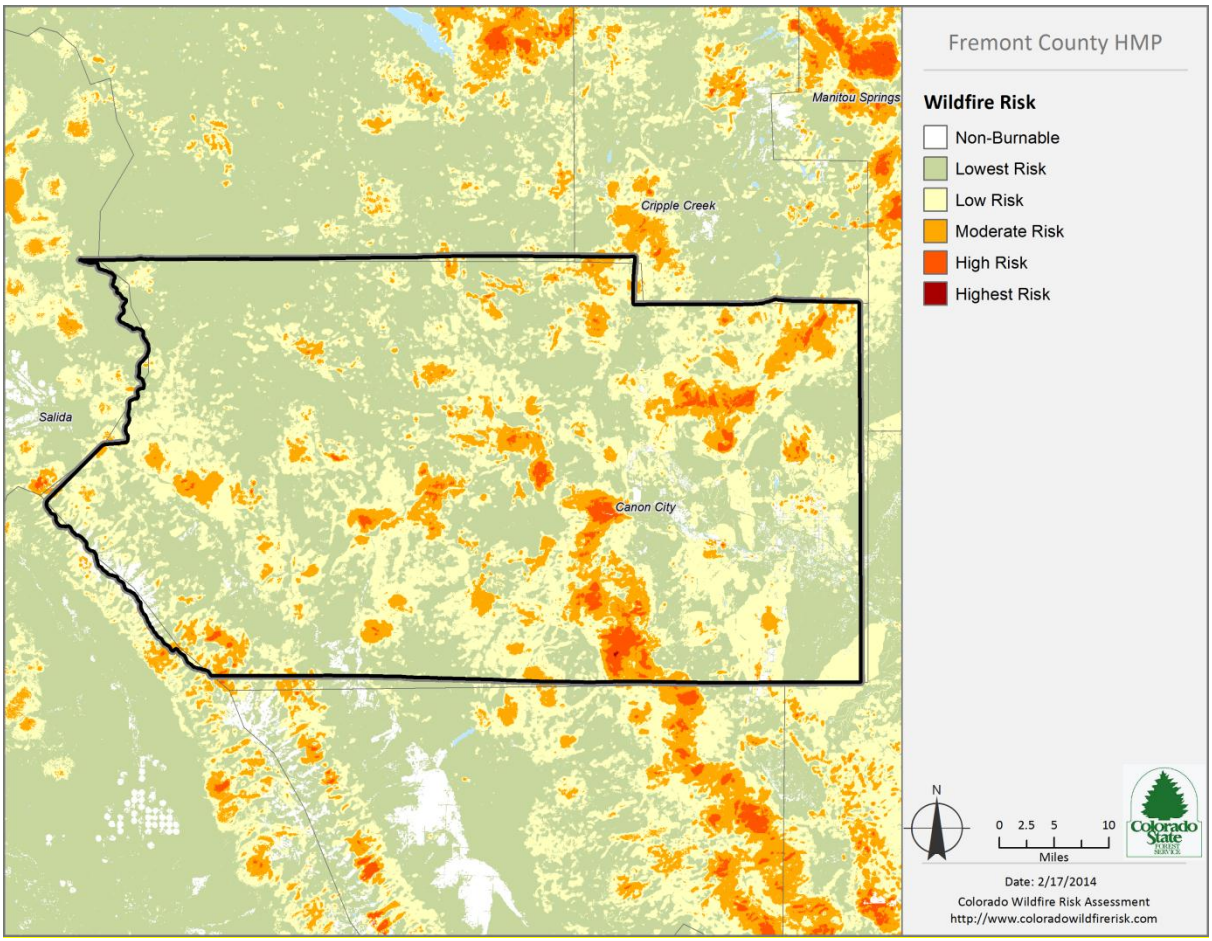


Figure 17-5. Wildfire Risks for Areas in Fremont County

Finally, as stated in the WRAP report, wildfire threat is the likelihood of an acre burning. Threat is calculated by combining multiple landscape characteristics including surface and canopy fuels, fire behavior, historical fire occurrences, weather observations, terrain conditions, etc. The measure of wildfire threat used in Colorado WRAP is called the threat index. Figure 17-6 maps the threat index for Fremont County as identified in the WRAP report.

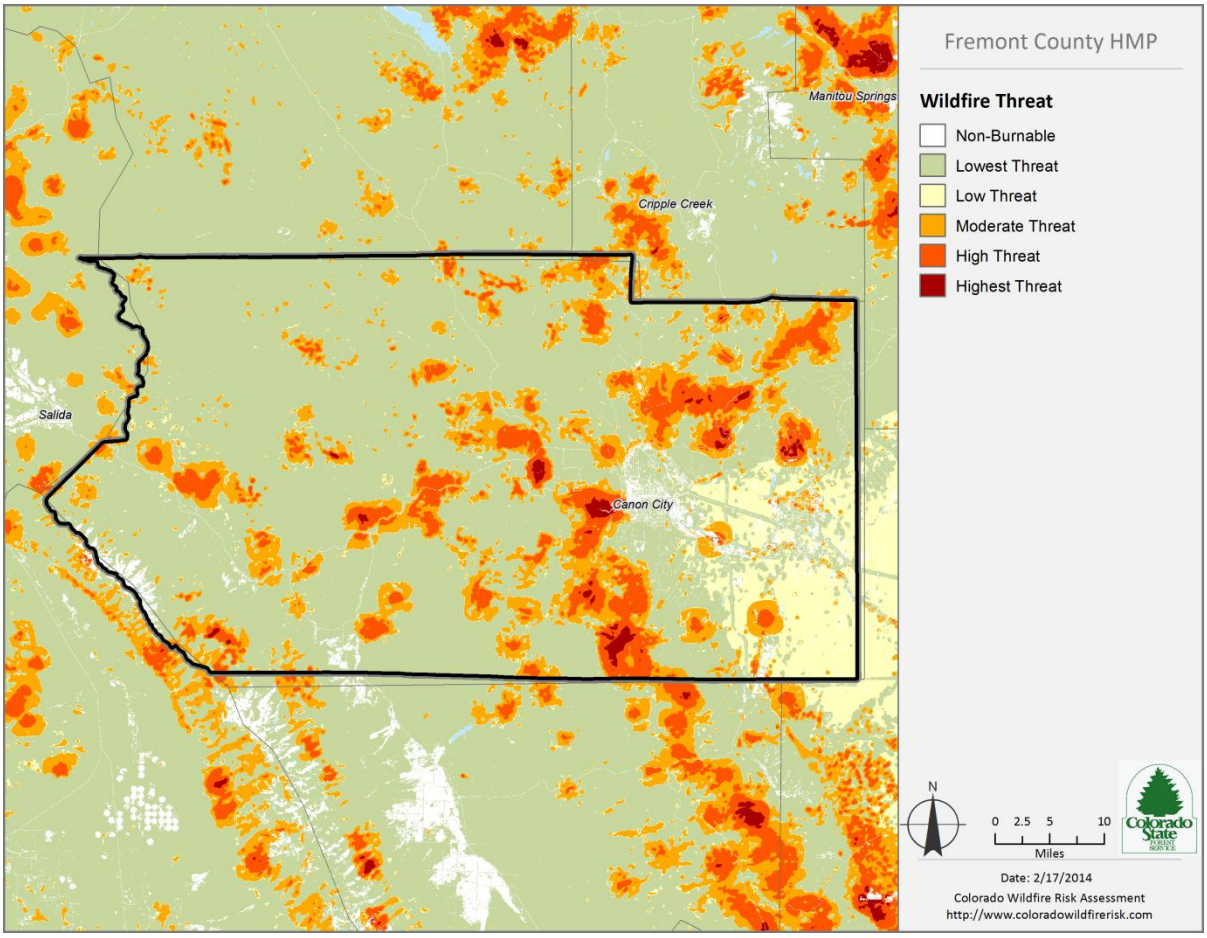


Figure 17-6. Threat Index for Fremont County

The commission that drafted the Fremont County Community Wildfire Protection Plan identified four highest priority fire hazards areas (Fremont County Community Wildfire Plan, no date).

- **Spruce Basin/Indian Springs** – Spruce Basin and Indian Springs are two subdivisions that are each connected to a County road by a single ingress and egress road. Each access is steep and narrow with large amounts of wildland fuels. Many individual home accesses have driveways that are unsuited for response vehicles. Heavy timber is predominant, with steep, sloping ridges. Many homes are summer residences.
- **Deer Mountain** – Heavy wildland fire fuels, steep hills, narrow roads, and a growing housing area combine to make the Glen Vista Subdivision of Deer Mountain a high risk area. Many roads offer only one ingress and egress. The road system is poorly maintained in places and extremely confusing, with many roads starting and stopping only to start up again somewhere else.
- **Coaldale/Howard Southern Boundaries** – The terrain is similar from Coaldale through Howard and up to the Chaffee County boundary on the southern border with the USFS public lands. Many single ingress and egress roads exist. These normally start at U.S. Highway 50 and proceed into, and end, at the National Forest at a much higher elevation. Fairly narrow roads with substantial wildland fire fuels on either side present a high risk factor. New and existing homes are present throughout in areas of Pinon/Juniper up to heavily timbered areas along and inside the public lands. Steeply sloping ridges are the norm. Water sources are rare. Some intermittent and annual streams are present in normal years.

- **Christopher Ranch Subdivision** – The Christopher Ranch Subdivision is located in a steeply sloping area that is heavily wooded with a Pinon/Juniper mix. New housing areas are developing rapidly. Access roads are generally good but are bordered by heavy wildland fire fuels. This area is the near the main route north to the gambling and tourist area of Cripple Creek. Water sources are not readily available.

17.2.4 Frequency

According to the Colorado State Wildfire Risk Assessment Report for Fremont County, there is a 100-percent chance that at least one wildfire will occur each year in Fremont County. Many of these fires will be 5 acres and less.

17.2.5 Severity

Based on the information in this hazard profile, and the widespread impacts, the magnitude/severity of severe wildfires is considered critical – isolated deaths and multiple injuries; major or long-term property damage that threatens structural stability; or interruption of essential facilities and services for 24 to 72 hours – as well as longer duration economic impact due to interrupted tourism, which plays a major part in the economy of Fremont County and its municipalities. Overall significance of the hazard is considered high.

17.2.6 Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Because fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours before a significant electrical storm.

If a fire does break out and spreads rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

17.3 SECONDARY HAZARDS

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires cause the contamination of reservoirs, destroy transmission lines, and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

17.4 CLIMATE CHANGE IMPACTS

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

Historically, drought patterns in the West are related to large-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region.

Climate scenarios project summer temperature increases between 2ºC and 5°C and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide – the so-called "fertilization effect" – could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown. High carbon dioxide levels should enhance tree recovery after fire and young forest regrowth, as long as sufficient nutrients and soil moisture are available, although the latter is in question for many parts of the western United States because of climate change.

17.5 EXPOSURE

Information for the exposure analyses provided in the sections below was downloaded from the Colorado Wildfire Risk Assessment Portal (COWRAP) Wildfire Risk theme from COWRAP website in March 2014. The distribution of risk areas in the planning area are shown in Figure 17-7 through Figure 17-13.

Figure 17-7. Wildfire Risk in Fremont County

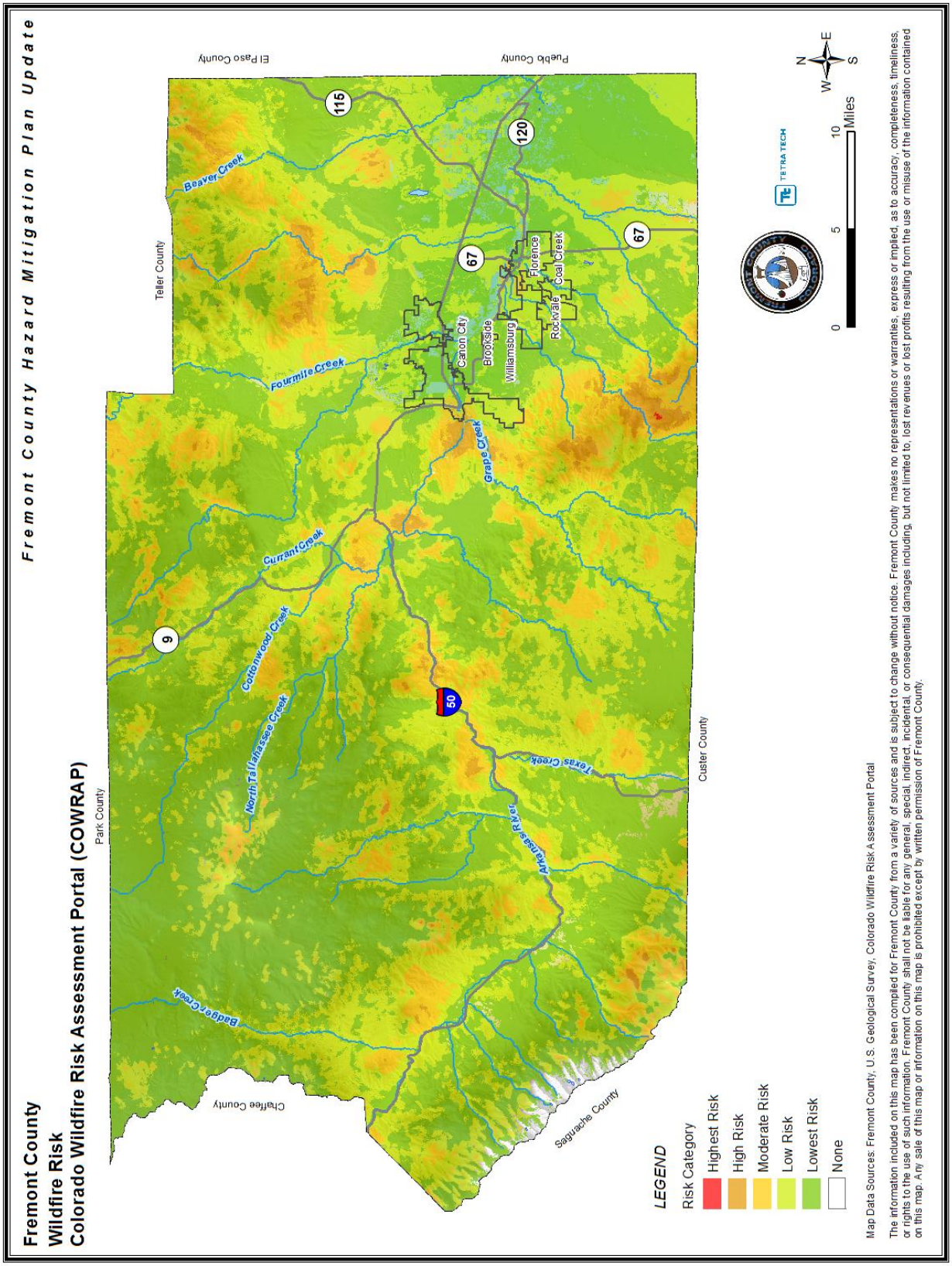


Figure 17-8. Wildfire Risk in the Town of Brookside

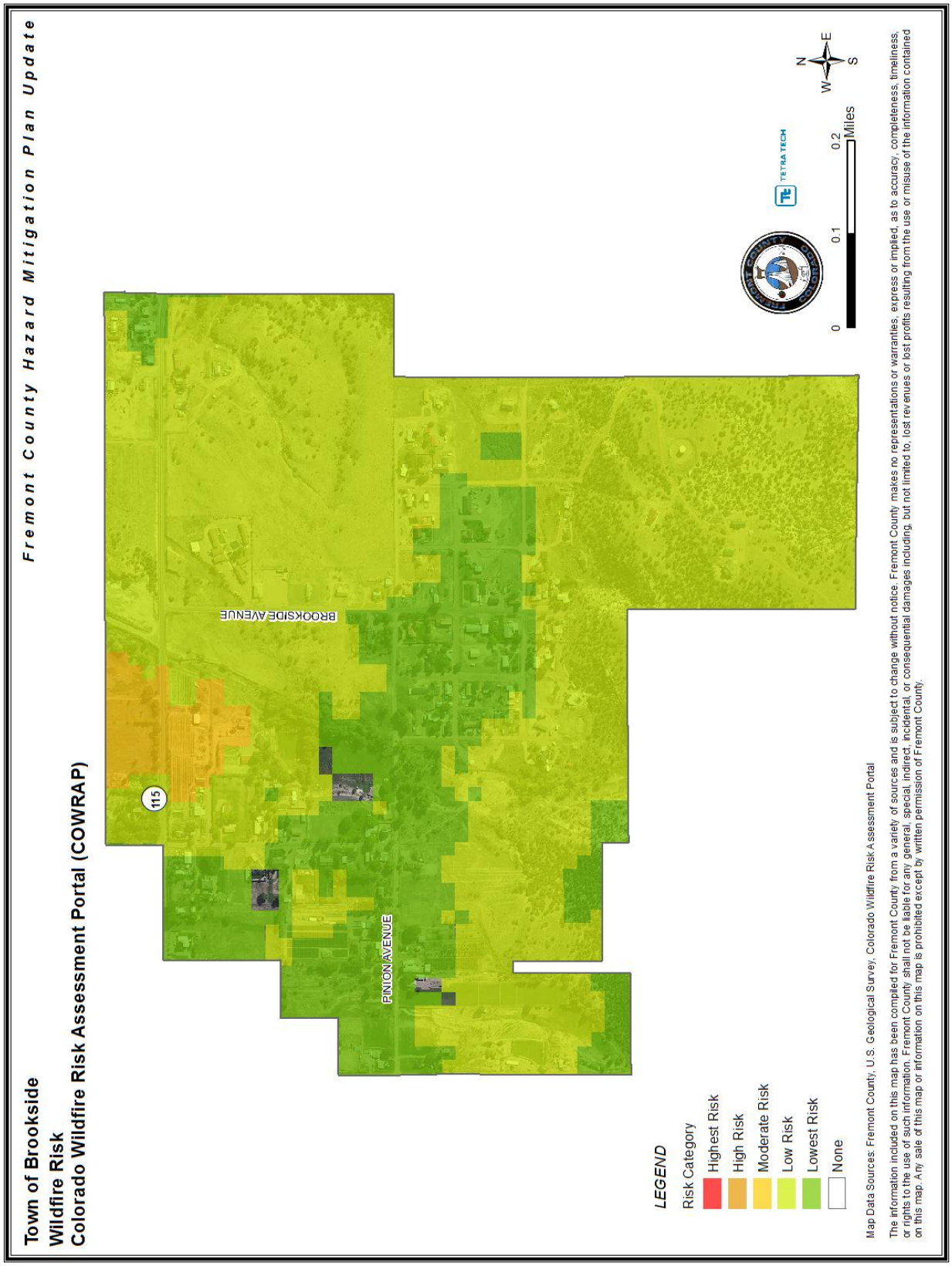


Figure 17-9. Wildfire Risk in the City of Cañon City

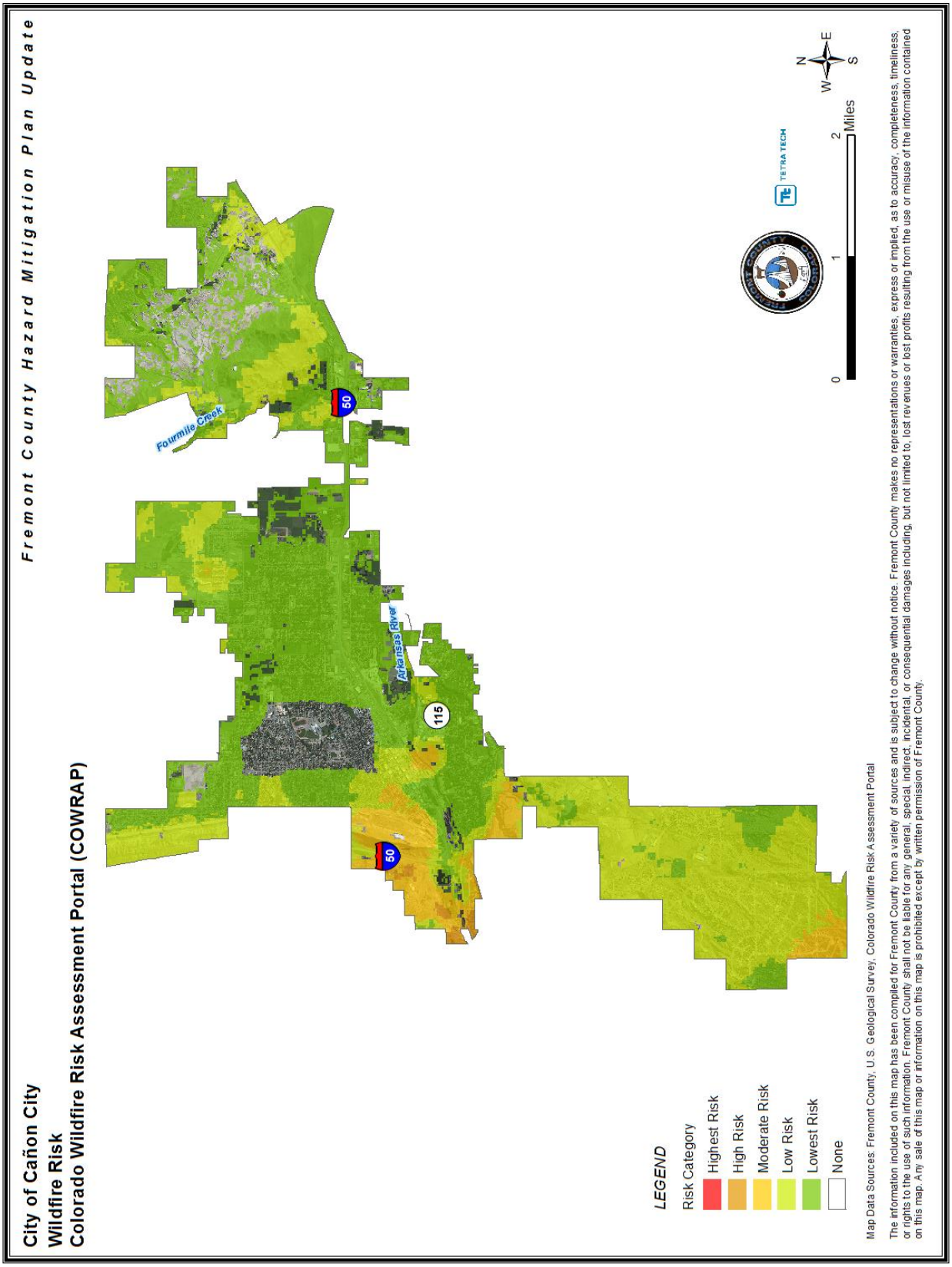


Figure 17-10. Wildfire Risk in the Town of Coal Creek

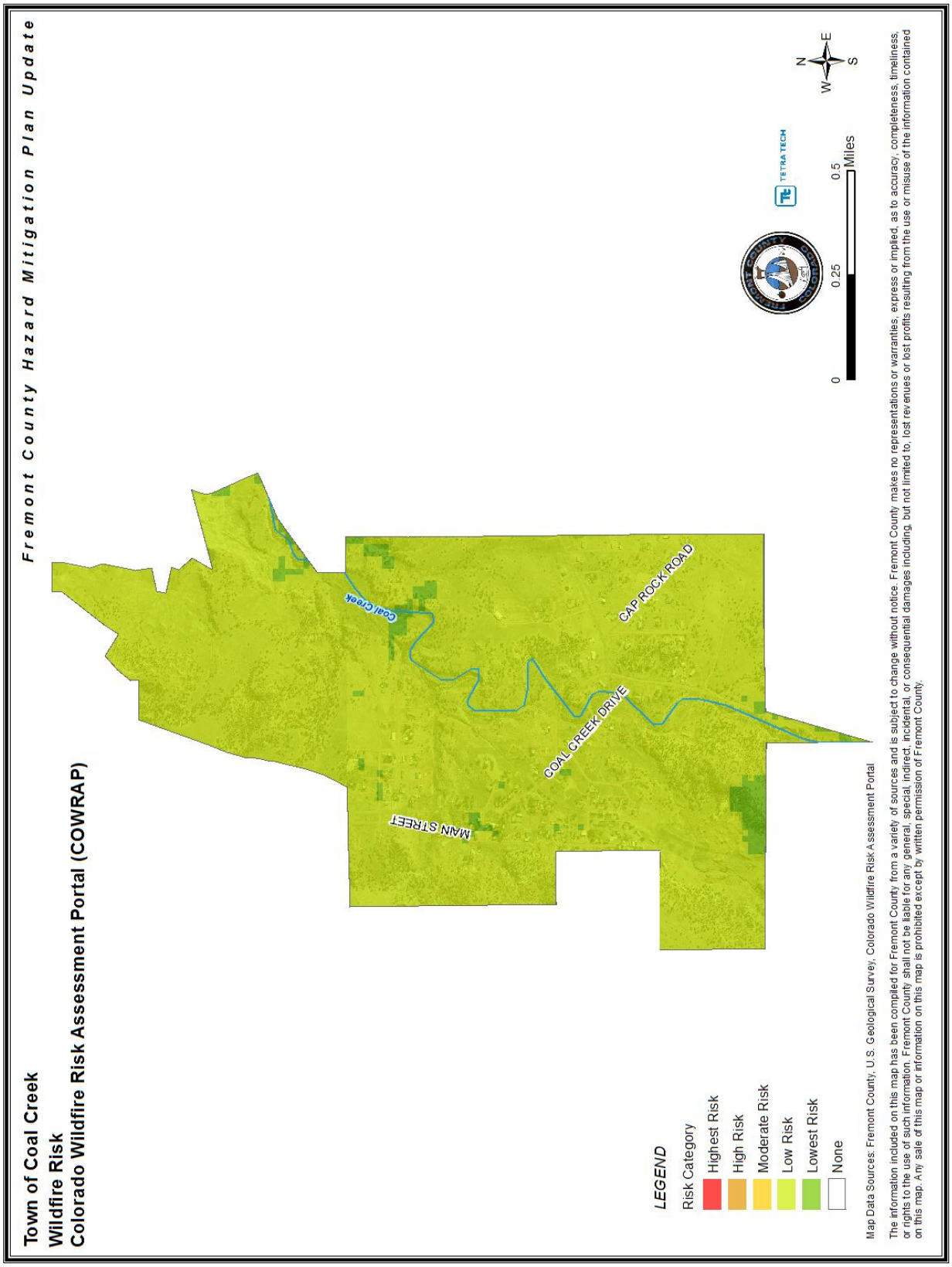


Figure 17-11. Wildfire Risk in the City of Florence

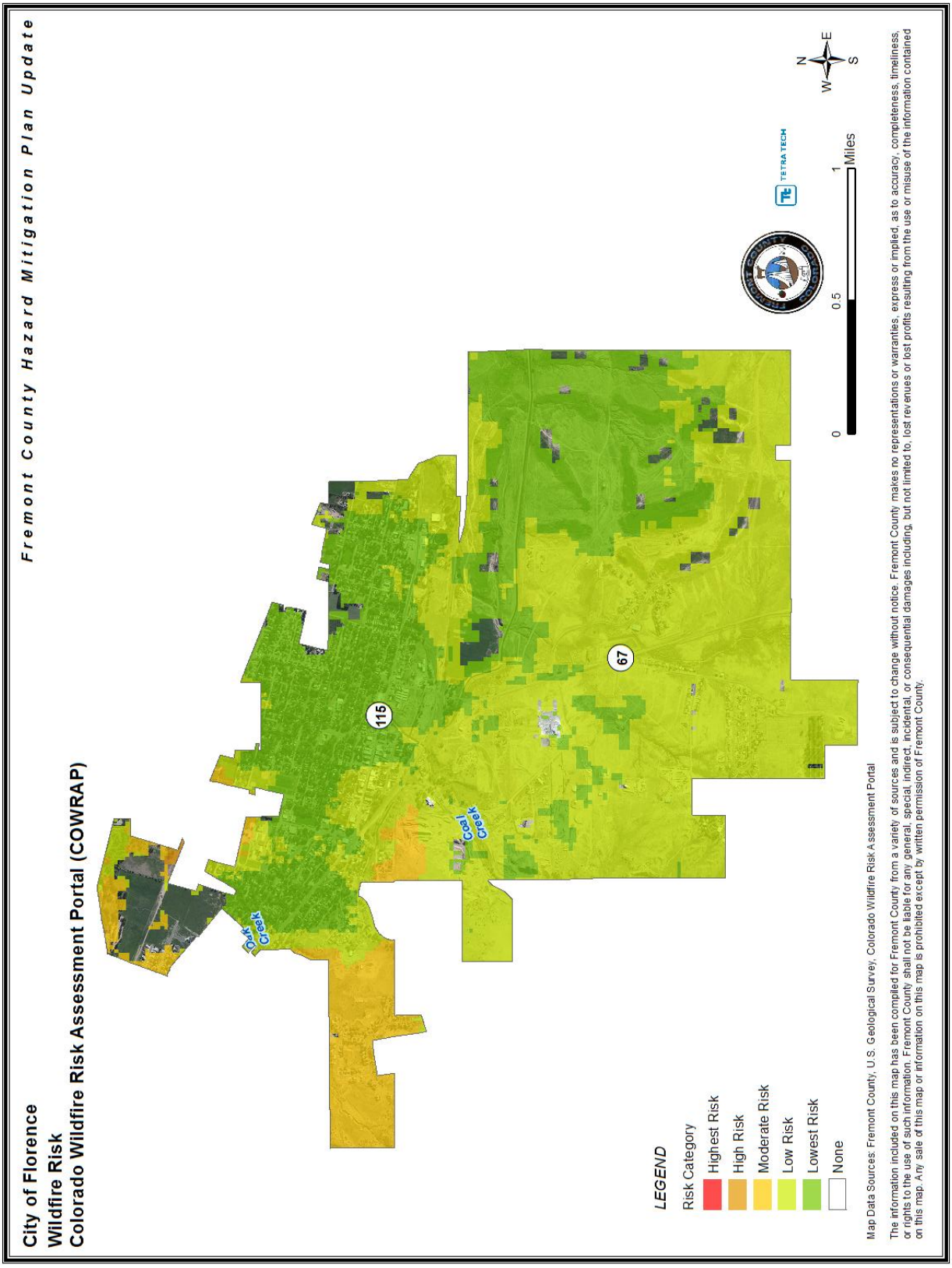


Figure 17-12. Wildfire Risk in the Town of Rockvale

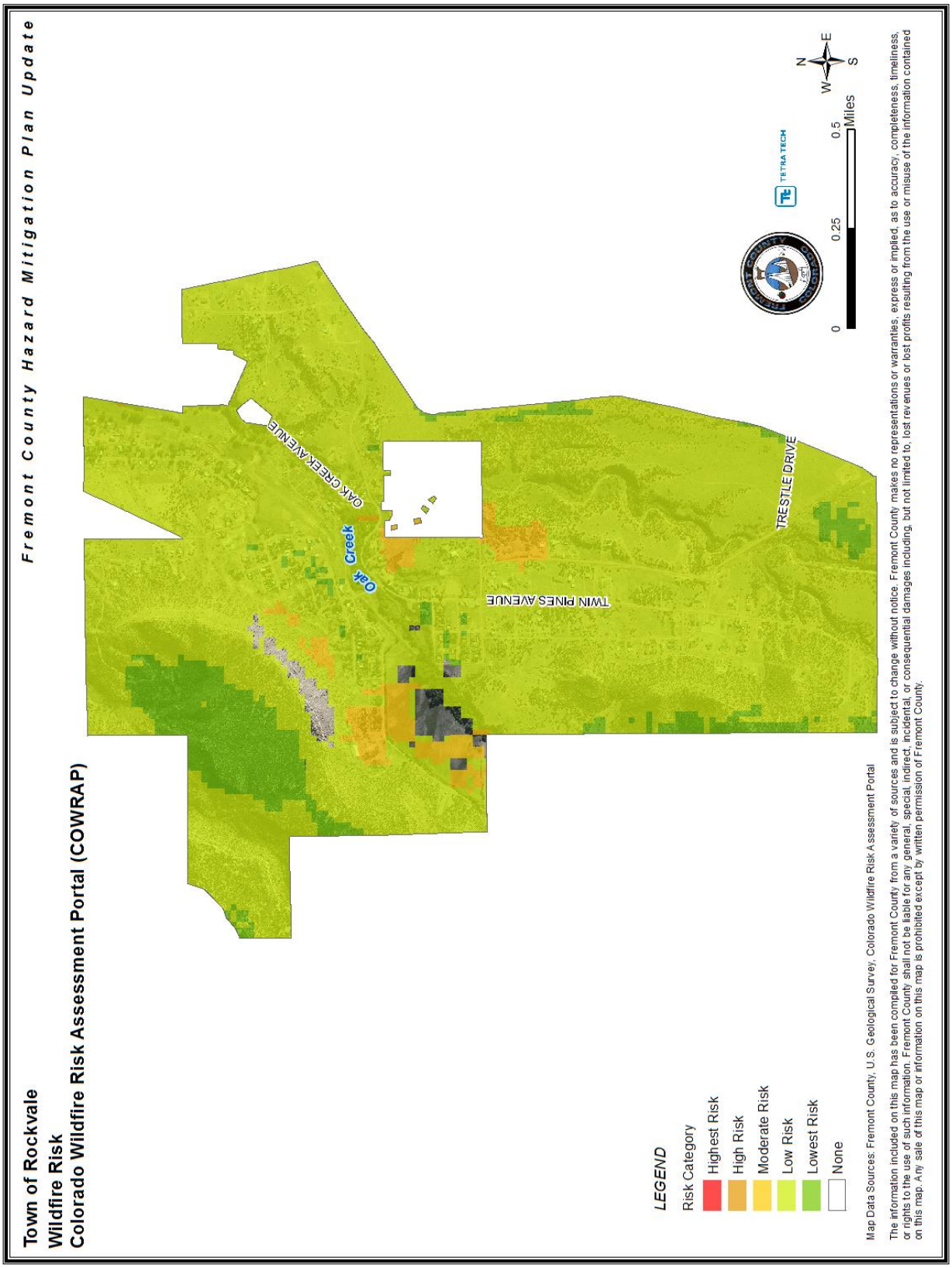
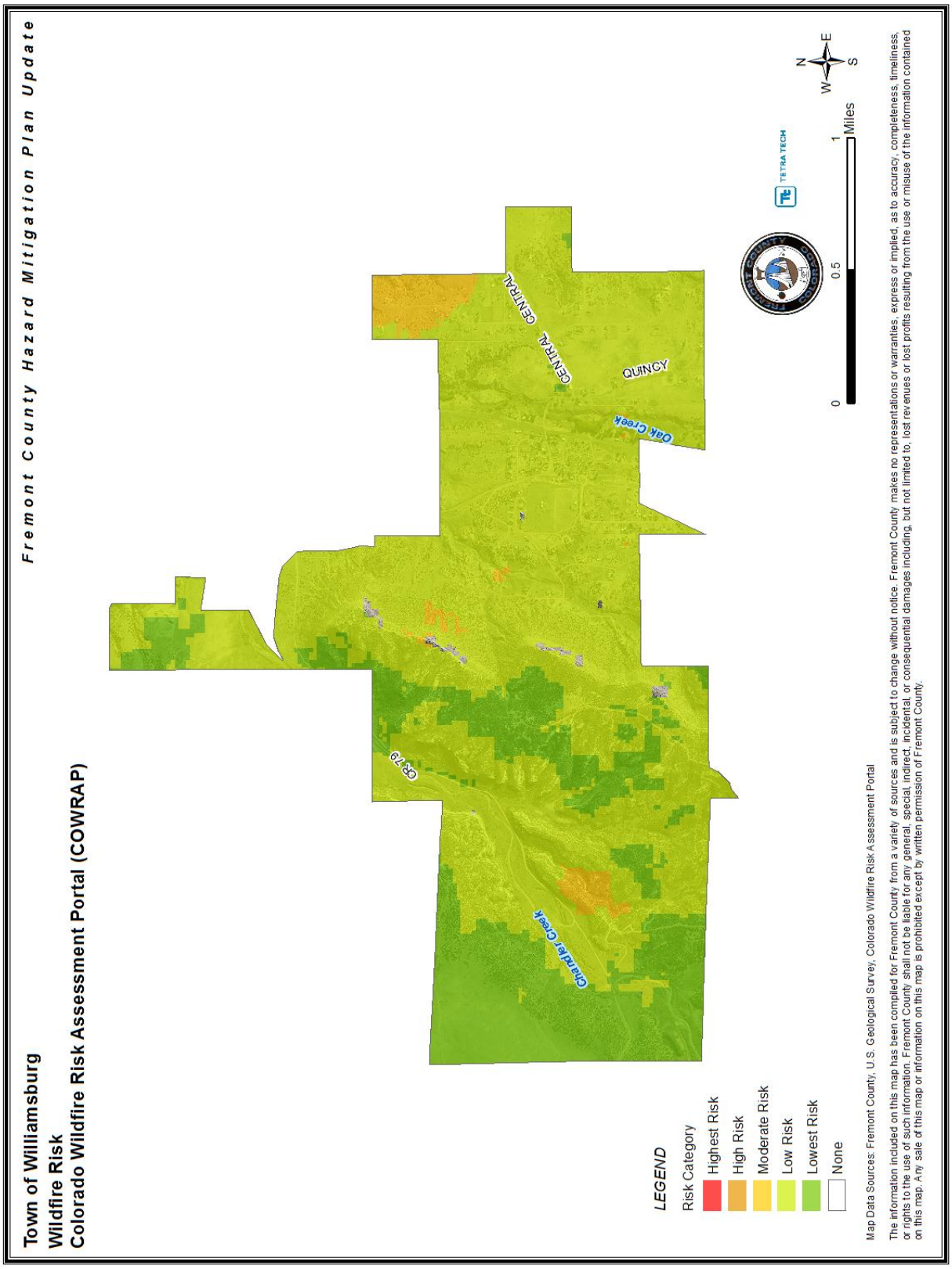


Figure 17-13. Wildfire Risk in the Town of Williamsburg



17.5.1 Population

Population could not be examined by WUI area because census block group areas do not coincide with the fire risk areas. However, population was estimated using the structure count of buildings in the WUI area and applying the census value of 2.08 persons per household for Fremont County. These estimates are shown in Table 17-4.

TABLE 17-4.
POPULATION WITHIN WILDFIRE RISK AREAS

	Lowest and Low Risk		Moderate Risk		High Risk	
	Population	% of Total	Population	% of Total	Population	% of total
Brookside	196	79.8	0	0.0	0	0.0
Cañon City	10,136	61.8	381	2.3	13	0.1
Coal Creek	285	83.1	0	0.0	0	0.0
Florence	2,856	73.8	256	6.6	0	0.0
Rockvale	472	94.8	19	3.8	0	0.0
Williamsburg	441	66.1	13	1.9	0	0.0
Unincorporated	16,105	64.5	603	2.4	25	0.1
Total	**30,491**	**64.9**	**1,271**	**2.7**	**38**	**0.1**

17.5.2 Property

Property damage from wildfires can be severe and can significantly alter entire communities. Table 17-5 through Table 17-8 display the number of structures in the various wildfire hazard zones within the planning area and their values. For all tables, population data are from the 2012 Colorado State Demography Office estimated populations, exposure numbers are based on Fremont County tax assessor data received April 2014, and value is calculated as the number of buildings exposed multiplied by the household average for Fremont County of 2.08 people per building.

TABLE 17-5.
EXPOSURE AND VALUE OF STRUCTURES IN HIGH WILDFIRE RISK AREAS

	Buildings Exposed	Value Exposed			% of Total Assessed Value
		Structure	Contents	Total	
Brookside	0	$0	$0	$0	0.00
Cañon City	6	$1,372,478	$686,239	$2,058,718	0.09
Coal Creek	0	$0	$0	$0	0.00
Florence	0	$0	$0	$0	0.00
Rockvale	0	$0	$0	$0	0.00
Williamsburg	0	$0	$0	$0	0.00
Unincorporated	12	$2,177,854	$1,088,927	$3,266,781	0.13
Total	**18**	**$3,550,332**	**$1,775,166**	**$5,325,499**	**0.10**

TABLE 17-6.
EXPOSURE AND VALUE OF STRUCTURES IN MODERATE WILDFIRE RISK AREAS

	Buildings Exposed	Value Exposed			% of Total Assessed Value
		Structure	Contents	Total	
Brookside	0	$0	$0	$0	0.00
Cañon City	183	$29,390,083	$16,105,132	$45,495,215	2.08
Coal Creek	0	$0	$0	$0	0.00
Florence	123	$19,239,147	$9,619,573	$28,858,720	6.44
Rockvale	9	$1,037,478	$518,739	$1,556,217	3.29
Williamsburg	6	$1,113,355	$556,667	$1,670,032	3.10
Unincorporated	290	$42,512,817	$21,456,359	$63,969,176	2.63
Total	**611**	**$93,292,880**	**$48,256,470**	**$141,549,360**	**2.71**

TABLE 17-7.
EXPOSURE AND VALUE OF STRUCTURES IN LOW WILDFIRE RISK AREAS

	Buildings Exposed	Value Exposed			% of Total Assessed Value
		Structure	Contents	Total	
Brookside	41	$6,266,170	$3,133,085	$9,399,255	43.94
Cañon City	1,276	$331,092,236	$224,437,653	$555,529,888	25.34
Coal Creek	134	$16,739,764	$8,432,642	$25,172,406	97.16
Florence	370	$84,694,021	$61,573,038	$146,267,060	32.65
Rockvale	221	$29,851,452	$15,000,531	$44,851,983	94.78
Williamsburg	206	$32,946,488	$16,473,244	$49,419,731	91.75
Unincorporated	2,724	$470,769,039	$258,895,750	$729,664,789	29.98
Total	**4,972**	**$972,359,169**	**$587,945,942**	**$1,560,305,111**	**29.88**

TABLE 17-8.
EXPOSURE AND VALUE OF STRUCTURES IN LOWEST WILDFIRE RISK AREAS

	Buildings Exposed	Value Exposed			% of Total Assessed Value
		Structure	Contents	Total	
Brookside	53	$7,995,582	$3,997,791	$11,993,374	56.06
Cañon City	3,597	$740,087,076	$498,003,422	$1,238,090,498	56.48
Coal Creek	3	$426,022	$309,899	$735,921	2.84
Florence	1,003	$164,947,592	$103,168,981	$268,116,573	59.85
Rockvale	6	$610,502	$305,251	$915,753	1.94

TABLE 17-8.
EXPOSURE AND VALUE OF STRUCTURES IN LOWEST WILDFIRE RISK AREAS

	Buildings Exposed	Value Exposed			% of Total Assessed Value
		Structure	Contents	Total	
Williamsburg	6	$1,726,142	$863,071	$2,589,214	4.81
Unincorporated	5,019	$944,029,335	$583,915,377	$1,527,944,712	62.79
Total	9,687	**$1,859,822,252**	**$1,190,563,793**	**$3,050,386,045**	**58.41**

Present Land Use

Present land use for each wildfire risk area is described in Table 17-9 and Table 17-10.

TABLE 17-9.
PRESENT LAND USE IN HIGHEST AND HIGH WILDFIRE RISK AREAS

	Highest		High	
Present Use Classification	Area (acres)	% of total	Area (acres)	% of total
Agriculture	0	0.0	1,148	4.8
Commercial	0	0.0	7	0.0
Government/Institutional	1	0.9	2,418	10.1
Industrial	0	0.0	0	0.0
Natural Resource Extraction	0	0.0	108	0.5
Residential	0	0.0	196	0.8
Vacant Land	0	0.0	304	1.3
Other	0	0.0	0	0.0
Uncategorized	86	99.1	19,711	82.5
Total	**87**	**100.0**	**23,892**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

TABLE 17-10.
PRESENT LAND USE IN MODERATE AND LOW WILDFIRE RISK AREAS

	Moderate		Low		Lowest	
Present Use Classification	Area (acres)	% of total	Area (acres)	% of total	Area (acres)	% of total
Agriculture	18,954	11.3	133,940	23.5	307,754	38.0
Commercial	118	0.1	946	0.2	2,778	0.3
Government/Institutional	8,785	5.2	21,397	3.7	14,011	1.7
Industrial	17	0.0	1,187	0.2	5,676	0.7
Natural Resource Extraction	900	0.5	4,924	0.9	6,715	0.8
Residential	5,319	3.2	41,338	7.2	45,581	5.6
Vacant Land	6,670	4.0	40,395	7.1	45,883	5.7
Other	54	0.0	988	0.2	3,745	0.5
Uncategorized	127,006	75.7	325,640	57.1	377,269	46.6
Total	**167,823**	**100.0**	**570,755**	**100.0**	**809,412**	**100.0**

Note: Acreage covers only mapped parcels and thus excludes many rights of way and major water features.

17.5.3 Critical Facilities and Infrastructure

Table 17-11 identifies critical facilities exposed to the wildfire hazard in the County.

TABLE 17-11.
CRITICAL FACILITIES AND INFRASTRUCTURE IN WILDFIRE RISK AREAS

	Number of Critical Facilities in Hazard Zone			
	Lowest Risk	Low Risk	Moderate Risk	High Risk
Medical and Health	0	0	0	0
Government Functions	6	5	0	0
Protective Functions	10	5	0	0
Schools	13	4	0	0
Bridges	56	48	14	6
Water Supply	4	2	1	0
Wastewater	2	0	0	0
Power	2	1	0	0
Communications	4	2	0	0
Transportation	3	0	1	1

TABLE 17-11.
CRITICAL FACILITIES AND INFRASTRUCTURE IN WILDFIRE RISK AREAS

	Number of Critical Facilities in Hazard Zone			
	Lowest Risk	Low Risk	Moderate Risk	High Risk
Dams	7	4	2	0
Hazardous Materials	12	5	1	0
Total	**119**	**76**	**19**	**7**

In the event of wildfire, there would likely be little damage to the majority of infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk to wildfire because most power poles are made of wood and susceptible to burning. In the event of a wildfire, pipelines could provide a source of fuel and lead to a catastrophic explosion.

17.5.4 Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- Damaged Fisheries – Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- Soil Erosion – The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- Spread of Invasive Plant Species – Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- Disease and Insect Infestations – Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- Destroyed Endangered Species Habitat – Catastrophic fires can have devastating consequences for endangered species.
- Soil Sterilization – Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

17.6 VULNERABILITY

Structures, aboveground infrastructure, critical facilities, and natural environments are all vulnerable to the wildfire hazard. There is currently no validated damage function available to support wildfire mitigation planning. Except as discussed in this section, vulnerable populations, property, infrastructure, and environment are assumed to be the same as described in the section on exposure.

17.6.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

17.6.2 Property

Loss estimations for the wildfire hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent, and 50 percent of the assessed value of exposed structures. This allows emergency managers to select a range of economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. Table 17-12 lists the loss estimates for the general building stock for jurisdictions that have an exposure to a wildfire risk category.

TABLE 17-12.
LOSS ESTIMATES FOR WILDFIRE

		Estimated Loss Potential from Wildfire		
	Exposed Value	10% Damage	30% Damage	50% Damage
Brookside	$235,318,910	$23,531,891	$70,595,673	$117,659,455
Cañon City	$24,114,341,781	$2,411,434,178	$7,234,302,534	$12,057,170,890
Coal Creek	$284,991,591	$28,499,159	$85,497,477	$142,495,796
Florence	$4,928,134,173	$492,813,417	$1,478,440,252	$2,464,067,086
Rockvale	$520,563,479	$52,056,348	$156,169,044	$260,281,740
Williamsburg	$592,506,102	$59,250,610	$177,751,830	$296,253,051
Unincorporated	$26,769,515,662	$2,676,951,566	$8,030,854,699	$13,384,757,831
Total	**$57,445,371,697**	**$5,744,537,170**	**$17,233,611,509**	**$28,722,685,848**

17.6.3 Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. In the event of wildfire, there would likely be little damage to most infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of

high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods.

17.7 FUTURE TRENDS IN DEVELOPMENT

According to the Fremont County Community Wildfire Protection Plan, "Fremont County has experienced rapid growth for the past ten years as people move from other areas into our primarily rural landscape. Much of this growth has occurred in the wildland/urban interface area, where private lands are adjacent to Federal or state land. While the risk of wildfire on public land is generally understood, much of the adjacent private land is equally at risk. Private lands adjoining public lands are becoming increasingly valued for their scenic beauty, solitude, and access to recreation opportunities. As development in these continues to increase, the risk to lives, property and resources correspondingly increases" (Fremont County Community Wildfire Protection Plan, 2008).

The expansion of the WUI can be managed with strong land use and building codes. In May 1972, a revision to the Colorado Revised Statutes exempted properties divided into parcels of 35 acres or more from the statutory definition of a subdivision. Tracts of 35-acre lots developed since that time have not been subject to state or local subdivision regulations.

The Fremont County Community Wildfire Protection Plan identified several actions that would directly influence future development in the planning area (Fremont County Community Wildfire Protection Plan, no date).

- **Action Recommendation No. 2 –** Provide improved access for responders through road and trail improvements. All new home construction/subdivisions should be required through zoning/planning regulations to provide adequate ingress and egress routes to each area in case of emergency. Road steepness and width should be adequate to provide safe access for emergency vehicles with turn-around capability provided.
- **Action Recommendation No. 6** – Use the Land Use Code as a vehicle for maintaining the momentum of wildfire management strategies on private and public land.

17.8 SCENARIO

A major conflagration in the planning area might begin with a wet spring, adding to fuels already present on the forest floor. Flash fuels would build throughout the spring. The summer could see the onset of insect infestation. A dry summer could follow the wet spring, exacerbated by dry hot winds. Carelessness with combustible materials or a tossed lit cigarette, or a sudden lightning storm could trigger a multitude of small isolated fires.

The embers from these smaller fires could be carried miles by hot, dry winds. The deposition zone for these embers would be deep in the forests and interface zones. Fires that start in flat areas move slower, but wind still pushes them. It is not unusual for a wildfire pushed by wind to burn the ground fuel and later climb into the crown and reverse its track. This is one of many ways that fires can escape containment, typically during periods when response capabilities are overwhelmed. These new small fires would most likely merge. Suppression resources would be redirected from protecting the natural resources to saving more remote subdivisions.

The worst-case scenario would include an active fire season throughout the American West, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season. While local fire districts would be extremely useful in the urban interface areas, they have limited wildfire capabilities or experience, and they would have a difficult time responding to the ignition zones. Even though the existence and spread of the fire is known, it may not be possible to respond to it adequately, so an initially manageable fire can become out of control before resources are dispatched.

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing tons of sediment into the Arkansas River and creeks, permanently changing floodplains and damaging sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. With the forests removed from the watershed, stream flows could easily double. Floods that could be expected every 50 years may occur every couple of years. With the streambeds unable to carry the increased discharge because of increased sediment, the floodplains and floodplain elevations would increase.

17.9 ISSUES

The major issues for wildfire are the following:

- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Wildfires could cause landslides as a secondary natural hazard.
- Climate change could affect the wildfire hazard.
- Future growth into interface areas should continue to be managed.
- Area fire districts need to continue to train on WUI events.
- Vegetation management activities should be enhanced.
- Regional consistency of higher building code standards such as residential sprinkler requirements and prohibitive combustible roof standards.
- Fire department water supply in high risk wildfire areas.
- Expand certifications and qualifications for fire department personnel. Ensure that all firefighters are trained in basic wildfire behavior, basic fire weather, and that all company officers and chief level officers are trained in the wildland command and strike team leader level.
    - Both the natural and man-made conditions that contribute to the wildland fire hazard are tending to exacerbate through time.
    - Conservative forestry management practices have resulted in congested forests prone to fire and disease.
    - The continued migration of inhabitants to remote areas of the County increases the probability of man-caused ignitions from vehicles, grills, campfires, and electrical devices.
    - Non-native species have become invasive in the area, specifically, Tamarisk and Russian Olive. These species burn readily and pose a threat to homes and other structures in the lower reaches of the County and into municipalities.
    - Revisions to the Colorado Revised Statutes exempted properties divided into parcels of 35 acres or more from the statutory definition of a subdivision restricting the County's ability to enforce County regulations and mitigation.

CHAPTER 18.
PLANNING AREA RISK RANKING

A risk ranking was performed for the hazards of concern described in this plan. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area. The risk ranking was conducted via facilitated brainstorming sessions with the Steering Committee. Estimates of risk were generated with data from HAZUS-MH using methodologies promoted by FEMA. The results are used in establishing mitigation priorities.

18.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High – Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium – Hazard event is likely to occur within 100 years (Probability Factor = 2)
- Low – Hazard event is not likely to occur within 100 years (Probability Factor = 1)
- No exposure – There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the area.

18.2 IMPACT

Hazard impacts were assessed in three categories: impacts on people, impacts on property, and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People** – Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:
  - High – 50 percent or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium – 25 percent to 49 percent of the population is exposed to a hazard (Impact Factor = 2)
  - Low – 25 percent or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact – None of the population is exposed to a hazard (Impact Factor = 0)
- **Property** – Values were assigned based on the percentage of the total ***property value exposed*** to the hazard event:
  - High – 30 percent or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium – 15 percent to 29 percent of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low – 14 percent or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact – None of the total assessed property value is exposed to a hazard (Impact Factor = 0)

- **Economy** – Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total assessed value of the property exposed to the hazard. For some hazards, such as wildfire, landslide, and severe weather, vulnerability was considered to be the same as exposure due to the lack of loss estimation tools specific to those hazards. Loss estimates separate from the exposure estimates were generated for the earthquake and flood hazards using HAZUS-MH.
  - High – Estimated loss from the hazard is 20 percent or more of the total assessed property value (Impact Factor = 3)
  - Medium – Estimated loss from the hazard is 10 percent to 19 percent of the total assessed property value (Impact Factor = 2)
  - Low – Estimated loss from the hazard is 9 percent or less of the total assessed property value (Impact Factor = 1)
  - No impact – No loss is estimated from the hazard (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation initiatives: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the economy was given a weighting factor of 1. The impacts for each hazard are summarized in Table 18-1 through Table 18-3.

TABLE 18-1.
IMPACT ON PEOPLE FROM HAZARDS

	Fremont County		Cañon City		Florence		Brookside	
Hazard	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor
Dam Failure	H	2.60	M	1.8	H	3.0	L	1.0
Drought and Extreme Temperatures	L	1.40	H	2.8	M	2.0	H	3.0
Earthquake	L	1.40	L	1.2	H	3.0	H	3.0
Flood	M	2.06	M	2.2	M	2.0	L	1.0
Landslide	L	1.06	M	1.6	M	2.0	L	1.0
Severe Winter Weather	M	2.06	M	2.2	M	2.0	H	3.0
Subsidence/ Sinkholes/Soil Erosion	L	1.40	L	1.0	L	1.0	M	2.0
Thunderstorms/ High Winds/Hail	L	1.40	M	2.4	L	1.0	H	3.0
Tornadoes	M	1.50	L	1.2	L	1.0	H	3.0
Wildfire	H	2.53	H	2.8	H	3.0	H	3.0

TABLE 18-2.
IMPACT ON PROPERTY FROM HAZARDS

	Fremont County		Cañon City		Florence		Brookside	
Hazard	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor
Dam Failure	H	2.50	M	2.0	H	3.0	L	1.0
Drought and Extreme Temperatures	L	1.40	H	2.6	L	1.0	H	3.0
Earthquake	L	1.46	L	1.2	H	3.0	H	3.0
Flood	M	1.93	H	2.6	M	2.0	M	2.0
Landslide	L	1.13	M	1.8	L	1.0	M	2.0
Severe Winter Weather	L	1.46	M	2.0	M	2.0	H	3.0
Subsidence /Sinkholes/Soil Erosion	L	1.26	M	1.8	M	2.0	L	1.0
Thunderstorms /High Winds/Hail	M	2.00	H	2.6	H	3.0	H	3.0
Tornadoes	M	1.60	L	1.2	L	1.0	H	3.0
Wildfire	H	2.70	H	2.8	H	3.0	H	3.0

TABLE 18-3.
IMPACT ON ECONOMY FROM HAZARDS

	Fremont County		Cañon City		Florence		Brookside	
Hazard	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor
Dam Failure	H	2.55	M	2.0	M	2.0	L	1.0
Drought and Extreme Temperatures	L	1.48	H	3.0	M	2.0	M	2.0
Earthquake	L	1.46	L	1.2	M	2.0	H	3.0
Flood	M	1.80	M	2.4	M	2.0	L	1.0
Landslide	L	1.13	M	1.6	M	2.0	L	1.0
Severe Winter Weather	L	1.45	M	1.8	M	2.0	L	1.0
Subsidence /Sinkholes/Soil Erosion	L	1.13	L	1.0	L	1.0	L	1.0
Thunderstorms /High Winds/Hail	L	1.45	M	2.0	L	1.0	L	1.0
Tornadoes	M	1.80	L	1.0	L	1.0	H	3.0

TABLE 18-3.
IMPACT ON ECONOMY FROM HAZARDS

	Fremont County		Cañon City		Florence		Brookside	
Hazard	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor	High/Med /Low	Factor
Wildfire	H	2.66	H	2.8	H	3.0	H	3.0

18.3 RISK RATING AND RANKING

The risk rating for each hazard was calculated by multiplying the probability factor by the sum of the weighted impact factors for people, property and operations, as summarized in Table 18-4. Based on these ratings, a priority of high, medium, or low was assigned to each hazard. The hazards ranked as being of highest concern vary by jurisdiction but generally include wildfire, flood, and thunderstorms/high winds/hail. Other hazards ranked as being of high or medium concern include drought/extreme temperatures, severe winter weather, and dam failure. The hazards ranked as being of lowest concern are tornadoes, earthquake, landslide, and subsidence/sinkholes/soil erosion. Table 18-5 shows the hazard risk ranking.

TABLE 18-4.
HAZARD RISK PROBABILITY

	Fremont County			**Cañon City**			**Florence**			**Brookside**		
Hazard	**Factor**	**Impact Weighted Sum**	**Total**	**Factor**	**Impact Weighted Sum**	**Total**	**Factor**	**Impact Weighted Sum**	**Total**	**Factor**	**Impact Weighted Sum**	**Total**
Dam Failure	1.3	7.65	9.95	1.80	5.80	10.4	1.00	8.00	8.00	1.00	3.00	3.00
Drought and Extreme Temperatures	2.7	4.28	11.56	3.00	8.40	25.2	3.00	5.00	15.00	3.00	8.00	24.00
Earthquake	1.4	4.32	6.05	1.40	3.60	5.0	1.00	8.00	8.00	1.00	9.00	9.00
Flood	2.6	5.79	15.05	2.60	7.20	18.7	3.00	6.00	18.00	2.00	4.00	8.00
Landslide	1.60	3.32	5.31	2.00	5.00	10.0	3.00	5.00	15.00	1.00	4.00	4.00
Severe Winter Weather	2.60	4.97	12.92	2.60	6.00	15.6	3.00	6.00	18.00	3.00	7.00	21.00
Subsidence /Sinkholes/Soil Erosion	1.40	3.79	5.31	2.00	3.80	7.6	3.00	4.00	12.00	2.00	4.00	8.00
Thunderstorms /High Winds /Hail	2.70	4.85	13.10	2.80	7.00	19.6	3.00	5.00	15.00	3.00	7.00	21.00
Tornadoes	1.40	4.90	6.86	1.20	3.40	4.1	1.00	3.00	3.00	2.00	9.00	18.00
Wildfire	2.70	7.89	21.30	3.00	8.40	25.2	3.00	9.00	27.00	1.00	9.00	9.00

Note: Total = Probability x Impact

TABLE 18-5.
HAZARD RISK RANKING

Hazard Ranking	Fremont County	Cañon City	Florence	Brookside
1	Wildfire	Wildfire	Wildfire	Drought and Extreme Temperatures
2	Flood	Drought and Extreme Temperatures	Flood	Thunderstorms/High Winds/Hail
3	Thunderstorms/High Winds/Hail	Thunderstorms/High Winds/Hail	Severe Winter Weather	Severe Winter Weather
4	Severe Winter Weather	Flood	Drought and Extreme Temperatures	Tornadoes
5	Drought and Extreme Temperatures	Severe Winter Weather	Thunderstorms/High Winds/Hail	Wildfire
6	Dam Failure	Dam Failure	Landslide	Earthquake
7	Tornadoes	Landslide	Subsidence/Sinkholes /Soil Erosion	Flood
8	Earthquake	Subsidence/Sinkholes /Soil Erosion	Earthquake	Subsidence/Sinkholes /Soil Erosion
9	Subsidence /Sinkholes/Soil Erosion	Earthquake	Dam Failure	Landslide

PART 3—
MITIGATION STRATEGY

CHAPTER 19.
MITIGATION ALTERNATIVES

The Steering Committee reviewed a menu of hazard mitigation alternatives that present a broad range of alternatives to be considered for use in the planning area, in compliance with 44 CFR (Section 201.6(c)(3)(ii)). The menu of mitigation initiatives was presented by hazard that is addressed by each initiative. The Committee reviewed the full range of initiatives as well as the County's ability to implement the variety of mitigation initiatives.

Hazard mitigation initiatives recommended in this plan were selected from among the alternatives presented in the menu as well as other projects known to be necessary. The menu provided a baseline of mitigation alternatives that are backed by a planning process, are consistent with the planning partners' goals and objectives, and are within the capabilities of the partners to implement. However, not all the alternatives meet all the planning partners' selection criteria. Thus, the baseline was amended to fit Fremont County's specific needs. The menu reviewed for this plan is presented in Appendix C.

CHAPTER 20.
AREA-WIDE MITIGATION INITIATIVES AND IMPLEMENTATION

20.1 SELECTED COUNTYWIDE MITIGATION INITIATIVES

The planning partners and the Steering Committee determined that some initiatives from the mitigation catalogs could be implemented to provide hazard mitigation benefits countywide. Table 20-1 lists the recommended countywide initiatives, the lead agency for each, and the proposed timeline. The parameters for the timeline are as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

Individual worksheets for each recommended action are provided in Appendix D.

20.2 BENEFIT/COST REVIEW

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

Cost ratings were defined as follows:

- **High** – Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium** – The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low** – The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **High –** Project will provide an immediate reduction of risk exposure for life and property.
- **Medium –** Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- **Low –** Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

For many of the strategies identified in this action plan, the partners may seek financial assistance under the HMGP or PDM programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not

seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define "benefits" according to parameters that meet the goals and objectives of this plan.

20.3 ACTION PLAN PRIORITIZATION

A qualitative benefit-cost review was performed to prioritize each initiative. Table 20-1 shows the priority of each initiative. The priorities are defined as follows:

- **High Priority** – A project that meets multiple objectives (i.e., multiple hazards), has benefits that exceed cost, has funding secured or is an ongoing project, and meets eligibility requirements for the HMGP or PDM grant program. High priority projects can be completed in the short term (1 to 5 years).
- **Medium Priority** – A project that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible under HMGP, PDM or other grant programs. Project can be completed in the short term, once funding is secured. Medium priority projects will become high priority projects once funding is secured.
- **Low Priority** – A project that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for HMGP or PDM grant funding, and for which the time line for completion is long term (1 to 10 years). Low priority projects may be eligible for other sources of grant funding from other programs.

20.4 ANALYSIS OF MITIGATION INITIATIVES

Each planning partner reviewed its recommended initiatives to classify them based on the hazard addressed and the type of mitigation involved. Mitigation types used for this categorization are as follows:

- **Prevention** – Government, administrative, or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection** – Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness** – Actions to inform citizens and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection** – Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services** – Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects** – Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
FREMONT COUNTYWIDE MITIGATION INITIATIVES																	
Initiative #1—Public Information and Awareness **Description:** Bring all-hazard awareness and education to public venues (Using the Firewise Trailer) **Lead & Support Agency:** OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM and Volunteer Time, available grants.	Ongoing	G1,2,3, 5 & 8 O1B,C, 2A, 3A & 5A
Initiative #2— Floodplain Mapping – Swissvale Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$45,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #3 — Floodplain Mapping – Howard Community **Description:** Mapping of area within Zone A flood zone for Howard community **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$50,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #4 — Flood Plain Mapping – Cotopaxi Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$40,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #5— Detailed Floodplain Mapping – Texas Creek Community **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$40,000.	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #6 — Detailed Floodplain Mapping – Penrose Area **Description:** Mapping of area within Zone A flood zone **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$150,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B
Initiative #7 — Detailed Floodplain Mapping – C-3 and C-4 Dam Area **Description:** Base Flood Mapping of area within inundation zones of both C-3 and C-4 dams **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$150,000	Fremont County, CWCB, NRCS	Short term	G2, 6, 7, &8 O2A, 2B, 6B, 7B, & 8A
Initiative #8 — Floodway Determination Mapping of Arkansas River from Ash Street to S.H. 115 **Description:** Floodway determination mapping of Arkansas River in Eastern Fremont County **Lead & Support Agency:** Fremont County Planning and Zoning																	
Med	New	Med				X							NRP	$90,000	Fremont County, CWCB, NRCS	Short term	G6&7 O6B7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #9 — Beaver Park and Bear Creek Retention/Detention Ponds **Description:** Construct a series of 8 detention ponds on Bear Creek to prevent flooding on private lands and County roads **Lead & Support Agency:** Fremont County DOT and NCRS																	
High	New	High				X							SIP	(M) $36,000	Fremont County, CWCB, NRCS, Grant funding with local share	Short term	G6&7 O6B7B
Initiative #10 — Right-of-Way Debris Management **Description:** Clear ROW for EM multiple uses **Lead & Support Agency:** FDOT, OEM (coordination with State Forest Service)																	
High	New	High	X					X	X				NRP	Med	County Budget for DOT, available grants	Ongoing	G4, 6, 7 O6A, 7A &7D
Initiative #11— Wildfire protection **Description:** Develop and implement CWPPs for different areas of the County **Lead & Support Agency:** OEM and local fire districts, Federal agencies																	
High	New	High						X					EAP	Med	County Budget for OEM , available grants	Ongoing	G2 O 2C
Initiative #12 — Fuel Reduction and increase carrying capacity of drainage channel – Phantom Canyon drainage **Description:** Ensure adequate flow of major drainage and removal of fuel loading **Lead & Support Agency:** Fremont County/government entity (BLM) or land owner																	
High	New	High				X		X					NRP	(H) $2,000,000	County and BLM Budgets	Long term	G1 O1C, G6 & 7 O6A & 7A&B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #13— Stream Channel Armoring **Description:** Armoring stream and dry wash pipeline crossings in channels vulnerable to erosion **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X			X	X	X	X				SIP	(H) $765,000	Grant funding with possible Fremont Sanitation District cost share	Long term	G3, 6 & 7 O3B, 6B, 7B
Initiative #14— Fuel Storage **Description:** Mobile fuel storage containers and truck **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(M) $78,700	Grant funding with possible Fremont Sanitation District cost share	Short term	G3 & 6 O3B & 6B
Initiative #15— Watertight manhole lids **Description:** Installation of 554 watertight frames and lids located in floodplains. **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med				X							SIP	$277,000	Grant funding with possible Fremont Sanitation District cost share	Short term	G3 & 7 O3B &7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #16— Backup Communication System **Description:** Two-way radio system for alternate means of communication **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X	X	X	X	X	X	X	X	X	X	SIP	(L) $5975	Grant funding with possible Fremont Sanitation District cost share.	Short term	G3 & 4 O3A & 4A
Initiative #17— Backup Power Generator at Service Center **Description:** (2) 25 kW Diesel-powered generators **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X	X	X	X	X	X	X	X	X	X	SIP	(L) $38,000	Grant funding with possible Fremont Sanitation District cost share.	Short term	G6 O6B
Initiative #18— Ultraviolet (UV) Disinfection System Upgrade **Description:** Upgrade UV disinfection system to increase treatment capacity **Lead & Support Agency:** Fremont Sanitation District																	
Med	New	Med	X			X	X						SIP	(H) $450,000	Grant funding with possible Fremont Sanitation District cost share.	Med term	G3 & 7 O3B &7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #19— Floodplain Mapping **Description:** Accurate LiDAR mapping of Arkansas River and Hayden Creek. Identify evacuation and road closure areas in the event of flooding. Will also allow targeted and cost-effective mitigation measures. **Lead & Support Agency:** Western Fremont Fire Protection District																	
High	New	High				X							NRP	High	General funds and grants	Short term	G2, 6 & 7, O2A, 6B, &7B
Initiative #20— Arkansas Penrose Pipeline Project to Diversify Raw Water Source **Description:** Arkansas-Penrose Pipeline Project: acquisition of raw water on the Arkansas River; diversion of water from a location near Penrose; construction of a conveyance pipeline to Penrose for beneficial use of the District's constituents; raw water storage. **Lead & Support Agency:** Penrose Water District																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(H) $9,750,000	Colorado Department of Natural Resources-Colorado Water Conservation Board: Loan for 90% of Project Estimate. Colorado Department of Local Affairs: Grant for $500,000. Penrose Water District: Funding balance of Project Estimate	Short term	G6&7, O6A&7C

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
CAÑON CITY MITIGATION INITIATIVES																	
Initiative #21— Floodplain and Hazard Mapping **Description:** 8 drainages and river basin – update detail floodplain/floodway mapping. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							NRP & EAP	(H) $1,567,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #22— Flood Control – Abbey Drainage Basin **Description:** Multiple actions including riprapping channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced concrete box culverts, and reinforced concrete pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $16,245,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #51— Flood Control – Orchard Avenue Drainage Basin **Description:** Multiple actions including stabilizing channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced box culverts, detention basin work, and reinforced concrete pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $9,742,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Short Term/Long Term	G2, 6, &7 O2A, 6B, & 7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #45— Fuel Load Thinning at Multiple Locations Throughout the BLM Managed Forest (Royal Gorge Field Office) **Description:** Mechanical thinning to reduce hazardous fuel; reduce hazardous fuel; protect Wildland Urban Interface (WUI); improve response to wildland fire; improve firefighter safety; improve forest and rangeland health; protect threatened and endangered species; control epidemic insects and disease; restore ecosystems. **Lead & Support Agency:** USDI - Bureau of Land Management																	
High	New	High	X		X	X	X	X	X				NSP	(H) varies by project	USDI - Bureau of Land Management	Long term	G6&7, O6A & 7A
Initiative #46— Arkansas Mountain Stewardship - Prescribed Fire **Description:** Prescribed fire to reduce hazardous fuel; protect Wildland Urban Interface (WUI); improve response to wildland fire; improve firefighter safety; improve forest and rangeland health; protect threatened and endangered species; control epidemic insects and disease; restore ecosystems. **Lead & Support Agency:** USDI - Bureau of Land Management																	
High	New	High	X		X	X	X	X	X				NSP	(H) varies by project	USDI - Bureau of Land Management	Long term	G6&7, O6A & 7A
Initiative #47— Review and Update Plans and Procedures to Improve Disaster Response Efforts **Description:** Countywide response agencies and other personnel will meet periodically as part of a Planning Committee or Emergency Services Committee to review, update and develop operating plans and procedures to improve disaster response efforts among residents and geographical areas of Fremont County. **Lead & Support Agency:** OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP, LPR	Low	County Budget for OEM	On-going	G1,3,4&8 O1A, 1C, 3A,3B, 3C, 4B, 8A, & 8B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #48— Review and Update of Emergency Operations Center Capabilities **Description:** Countywide response agencies and other personnel involved in EOC operations will meet regularly to improve, develop and enhance EOC operational procedures for future incidents. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM	On-going	G1&4 O1A, 1C, 4A, & 4B
Initiative #49— Continue to Improve Communication of Hazards to Residents **Description:** Continue development and participation in the regional Public Information Group, which works with members of local state and federal agencies in and around Fremont County to improve communications with residents before, during, and after a disaster or incident. The group offers multiple methods of dispersing information to residents of the County and the region. Development and participation involves regular meetings and training as necessary. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP, LPR	Low	County Budget for OEM	On-going	G1,2,&6 O1B, 1C, 2A, 6C, & 6D
Initiative #50— Coordination of Testing of Emergency Communication Systems **Description:** Tests of emergency notification systems will be scheduled and coordinated with local, county, and regional agencies. These tests may be scheduled and tracked during meetings of personnel involved in the EOC operations, the regional Public Information Group, or the Planning Committee and Emergency Services Committee. **Lead & Support Agency:** Fremont County OEM																	
High	New	High	X	X	X	X	X	X	X	X	X	X	EAP	Low	County Budget for OEM	On-going	G3&6 O3A & 6E

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #23— Flood Control – Four Mile Creek Drainage Basin **Description:** Multiple actions including channel improvements, construction of detention basin, and RCBC. Lead & Support Agency: City of Cañon City																	
High	New	High				X							SIP	(H) $2,235,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #24— Flood Control – Hogback Area Drainage Basin **Description:** Construction of 10 detention basins and installation of 3 culverts in the Hogback Basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(M) $250,000	City of Cañon City Stormwater Utility, HMGP, CWCB, GOCO	Short term	G2, 6, &7 O2A, 6B, & 7B
Initiative #25— Flood Control – N. 9th Street Drainage Basin **Description:** Construction of storm sewer and inlets on 9th Street in Cañon City **Lead & Support Agency**: City of Cañon City																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	(H) $5,000,000	City of Cañon City Stormwater Utility, HMGP, CWCB, CDOT	Long term	G2, 6, &7 O2A, 6B, & 7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #26— Flood Control – North Sand Creek Drainage Basin **Description:** Erosion repair work and installation of corrugated metal piping and concrete reinforced box culverts in the North Sand Creek Drainage Basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $1,879,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Long term	G2, 6, &7 O2A, 6B, & 7B
Initiative #27— Flood Control – Northeast Cañon Drainage Basin **Description:** Multiple actions including riprapping channels, channel improvements, installation of one oversized detention basin, reinforced concrete box culverts, and arch pipe. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $9,275,000	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B
Initiative #28— Flood Control – South Sand Creek Drainage Basin **Description:** Multiple actions including installation of a pedestrian crossing and ditch crossing, open channels, construction of drop structures, reinforced concrete box culverts, reinforced concrete pipe, and a detention basin. **Lead & Support Agency:** City of Cañon City																	
High	New	High				X							SIP	(H) $9,082,000	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County	Ongoing	G2, 6, &7 O2A, 6B, & 7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #29— Drought Mitigation **Description:** Implement a plan to provide our water users with information regarding how to use water efficiently inside/outside the home or business. Create an on-line Water Efficiency Plan for Homeowners and Business Owners. Providing information to our water users will give them the tools that they can use to develop efficient water usage habits. This in turn will save them money and help save a finite water resource. **Lead & Support Agency:** City of Cañon City Water Department																	
High	New	High			X			X					EAP	Low	City of Cañon City Water Department	Short term	G2&7 O2A&7A
Initiative #30— Wildfire Education and Awareness Program **Description:** Community presentations, printing/purchase of educational materials **Lead & Support Agency:** Cañon City Area Fire Protection District																	
High	New	High						X					EAP	M $10-$100,000	Misc. Grants	Ongoing	G2&7 O2A, 7A, & 7C
Initiative #31— Local Planning and Regulations **Description:** Develop and adopt a WUI Building Code **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City																	
High	New	High						X					LPR	M $10-$100,000	Misc. Grants	Ongoing	G2, 7, &8 O2B, 7A, & 8B
Initiative #32— Structure and Infrastructure Projects **Description:** Expand and enhance the availability of water supplies in the WUI areas **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City																	
High	New	High						X					SIP	H (>$100,000)	Grants	Ongoing	G7 O7A

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #33 - Structure and Infrastructure Projects **Description:** Creating defensible space around structures, infrastructure, and critical facilities. **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City, utility companies																	
High	New	High						X					SIP	H (>$100,000)	Grants	Ongoing	G2&7 O2A, 2C,7A,&7D
Initiative #34— Natural Systems Protection **Description:** Perform regular maintenance activities for fuel management, including cutting and maintaining firebreaks in WUI areas and sponsoring local slash and chipping programs for residents. **Lead & Support Agency:** Cañon City Area Fire Protection District, Fremont County, Cañon City, utility companies																	
High	New	High						X					NRP	H (>$100,000)	Grants	Ongoing	G2, 3,&7 O2A, 2C,3A,7A,&7D
Initiative #35— Install actuators on control gates of the Cañon City Hydraulic Ditch main canal. **Description:** Actuators are electrically controlled systems allowing for regulation of water levels in the canal. The actuators stop the flow of irrigation water into the canals during heavy rain events. This does not address the additional problems of stormwater runoff into the canals that could cause flooding. **Lead & Support Agency:** City of Cañon City and Fremont County																	
High	New	High						X					SIP	High	FEMA, Colorado Water Conservation Board, Fremont County & Cañon City	5 yrs	G6&7 O6B&7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
BROOKSIDE MITIGATION INITIATIVES																	
Initiative #36— Vegetative Fuel Reduction **Description:** • Seek funding and real assistance to reduce vegetative fuels where natural vegetation and weeds interface with structures and infrastructure. • Continue to develop partnerships with other organizations to implement wildfire mitigation plans and other hazard reduction programs. • Create and maintain defensible space around structures and infrastructure. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X			X	X	X	X				SIP, NRP	(M) $75,000	Federal, State or local sources	Short term	G2, 3,&7 O2A, 2C,3A,7A,&7 D
Initiative #37 — Disaster-resistant community **Description:** Provide all residents/businesses with appropriate emergency preparedness information and supplies. Encourage residents to take personal action to protect private property from all potential disaster scenarios. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X			X	X	X	X				EAP	(L) $5,000	Federal, State or local sources	Short term	G2&7 O2A,7A, 7B, 7C, &7D
Initiative #38 — Drought-resistant community **Description:** Identify alternative water supplies for time of drought. Develop mutual aid agreements with alternative suppliers. **Lead & Support Agency:** Town of Brookside																	
Med	New	Med			X								LPR; SIP	TBD	Federal, State or local sources	Ongoing	G3,6,&7 O3B, 3C, 6B, & 7C

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #39 — Earthquake Resistant Buildings/Infrastructure **Description:** Update building codes and practices related to appropriate levels of seismic safety. Further enhance seismic risk assessment to target high hazard buildings. **Lead & Support Agency:** Town of Brookside																	
Low	New	Low	X	X	X	X	X	X	X	X	X	X	SIP; LPR	(M) $20,000	Federal, State or local sources	Long term	G2&6 O2B&6B
Initiative #40 — Thunderstorm run-off controls **Description:** Implement structural and non-structural flood mitigation measures for flood-prone properties. Seek engineering and project assistance to mitigate stormwater runoff. Develop and begin to implement a systematic process to evaluate and upgrade aging infrastructure such as transportation, drainage, utilities, and others that could be affected during a major natural disaster. **Lead & Support Agency:** Town of Brookside																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP; LPR	(H) $400,000	Federal, State or local sources	Ongoing	G6&7 O6B&7B
FLORENCE MITIGATION INITIATIVES																	
Initiative #41— Floodplain and Hazard Mapping **Description:** Determine regulatory floodway limits within City of Florence **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	(M) $85,000	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA	Short term	G7 O7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #42— Bridge Reconstruction **Description:** Existing bridge decks are obstructions to flood water flow. Raise decks to enable flood flow to remain in designated channels instead of inundating broad floodplains in populated areas. **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR	Long Term	G6&7 O6B&7B
Initiative #43— Provide Stormwater Detention Pond **Description:** Obtain land sufficient for detention of runoff in two locations to mitigate downstream flooding and to improve discharge water quality from City storm drainage systems **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA	Long Term	G7 O7B
Initiative #44— Oak Creek Flood Channel Enlargement **Description:** Existing channel geometry is an obstruction to flood water flow. Increase channel dimensions to enable flood flow to remain in designated channel instead of inundating broad floodplain in populated areas. **Lead & Support Agency:** City of Florence																	
High	New	High				X							SIP, NRP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR	Long Term	G7 O7B

TABLE 20-1.
RECOMMENDED MITIGATION INITIATIVES

Priority	Project Status	Benefit To County	Hazards Mitigated (*see hazard ID codes at end of table*)										Action Category	Estimated Cost	Target Funding Source	Target Completion Date	Supported by Goal
			SS	LS	D/ET	F	T	WF	SWW	DF	SSS	EQ					
Initiative #52— Backup Emergency Mobile Communications System **Description:** Mobile communication vehicle and two-way radio system for alternative communication for use in case of failure of County system. **Lead & Support Agency:** City of Florence																	
High	New	High	X	X	X	X	X	X	X	X	X	X	SIP	High	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, other grants	Short Term	G3 & 4 O3A & 4A
Initiative #53— Identify and remove dangerous trees and branches from City streetscape **Description:** Identify and remove decayed trees and limbs to prevent or minimize property damage and loss of life in high wind storms **Lead & Support Agency:** City of Florence																	
Med	New	Med	X		X	X	X	X	X		X		SIP, NRP	High	City of Florence, NRCS, DOLA, CDOT, FHWA, other grants	Short Term	G6 & 7 O6A, 6E, 7C & 7D
Initiative #54— Identify earthquake-prone unreinforced structures **Description:** Assess and identify non-reinforced structures prone to earthquake damage. **Lead & Support Agency:** City of Florence																	
Med	New	Med										X	LPR, EAP	Low	DOLA, other grants	Short Term	G6 & 8 O6B & 8B

Hazard ID Codes: SS=Severe Storms (Thunderstorms, High Winds, and Hail); LS=Landslide; D/ET=Drought and Extreme Heat; F=Flood; T=Tornado; WF=Wildfire; SWW=Severe Winter Weather; DF=Dam Failure, SSS= Subsidence/Sinkholes/Soil Erosion; EQ=Earthquake

20.5 PLAN ADOPTION

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. All planning partners fully met the participation requirements specified by the Steering Committee and will seek DMA compliance under this plan. The plan will be submitted for a pre-adoption review to Colorado Office of Emergency Management and FEMA Region VIII prior to adoption. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. All partners understand that DMA compliance and its benefits cannot be achieved until the plan is adopted. Copies of the resolutions adopting this plan for all planning partners can be found in Appendix E.

20.6 PLAN MAINTENANCE STRATEGY

A hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.6(c)(4)):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a 5-year cycle
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- A discussion on how the community will continue public participation in the plan maintenance process.

This chapter details the formal process that will ensure that the Fremont County Hazard Mitigation Plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every 5 years. This chapter also describes how public participation will be integrated throughout the plan maintenance and implementation process. It also explains how the mitigation strategies outlined in this plan will be incorporated into existing planning mechanisms and programs, such as comprehensive land-use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

20.6.1 Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and incorporation of its action items into partner jurisdictions' existing plans, policies, and programs. Together, the action items in the plan provide a framework for activities that the partnership can implement over the next 5 years. The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation initiatives that will be implemented through existing plans, policies, and programs.

The Fremont County Office of Emergency Management will have lead responsibility for overseeing the plan implementation and maintenance strategy. Plan implementation and evaluation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the mitigation action plans.

20.6.2 Steering Committee

The Steering Committee is a total volunteer body that oversaw the development of the plan and made recommendations on key elements of the plan, including the maintenance strategy. It was the Steering

Committee's position that an implementation committee with representation similar to the initial Steering Committee should have an active role in the plan maintenance strategy. Therefore, it is recommended that a Steering Committee remain a viable body involved in key elements of the plan maintenance strategy. The new Steering Committee should strive to include representation from the planning partners, as well as other stakeholders in the planning area.

The principal role of the new implementation committee in this plan maintenance strategy will be to review the annual progress report and provide input to the Fremont County Emergency Manager on possible enhancements to be considered at the next update. Future plan updates will be overseen by a Steering Committee similar to the one that participated in this plan development process, so keeping an interim Steering Committee intact will provide a head start on future updates. Completion of the progress report is the responsibility of each planning partner, not the responsibility of the Steering Committee. It will simply be the Steering Committee's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates.

20.6.3 Annual Progress Report

The minimum task of each planning partner will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to evaluate whether the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The planning team has created a template to guide the planning partners in preparing a progress report (see Appendix F). The plan maintenance Steering Committee will provide feedback to the planning team on items included in the template. The planning team will then prepare a formal annual report on the progress of the plan. This report should be used as follows:

- Posted on the Fremont County Office of Emergency Management website page dedicated to the hazard mitigation plan
- Provided to the local media through a press release
- Presented to planning partner governing bodies to inform them of the progress of initiatives implemented during the reporting period
- For those planning partners that participate in the Community Rating System, the report can be provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit. To meet this recertification timeline, the planning team will strive to complete progress reports between June and September each year.

Uses of the progress report will be at the discretion of each planning partner. Annual progress reporting is not a requirement specified under 44 CFR. However, it may enhance the planning partnership's opportunities for funding. While failure to implement this component of the plan maintenance strategy will not jeopardize a planning partner's compliance under the DMA, it may jeopardize its opportunity to partner and leverage funding opportunities with the other partners. Each planning partner was informed of these protocols at the beginning of this planning process (in the "Planning Partner Expectations" package provided at the start of the process), and each partner acknowledged these expectations when with submittal of a letter of intent to participate in this process.

20.6.4 Plan Update

Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the DMA (44 CFR, Section 201.6(d)(3)). The Fremont County partnership intends to update the hazard mitigation plan on a 5-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than 5 years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of the County or participating city's comprehensive plan

It will not be the intent of future updates to develop a complete new hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a Steering Committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plans will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new partnership policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The partnership governing bodies will adopt their respective portions of the updated plan.

20.6.5 Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the Fremont County Office of Emergency Management's website and by providing copies of annual progress reports to the media. Each planning partner has agreed to provide links to the County hazard mitigation plan website on their individual jurisdictional websites to increase avenues of public access to the plan. The Fremont County Office of Emergency Management has agreed to maintain the hazard mitigation plan website. This site will not only house the final plan, it will become the one-stop shop for information regarding the plan, the partnership and plan implementation. Copies of the plan will be distributed to the public library system in Fremont County Library. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new Steering Committee. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

20.6.6 Incorporation into Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The Fremont County Comprehensive

Plan and the comprehensive plans of the partner cities are considered to be integral parts of this plan. The County and partner cities, through adoption of comprehensive plans and zoning ordinances, have planned for the impact of natural hazards. The plan development process provided the County and the cities with the opportunity to review and expand on policies contained within these planning mechanisms. The planning partners used their comprehensive plans (where applicable) and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a comprehensive plan may trigger an update to the hazard mitigation plan.

All municipal planning partners are committed to creating a linkage between the hazard mitigation plan and their individual comprehensive plans by identifying a mitigation initiative as such and giving that initiative a high priority. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Partners' emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans.

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

REFERENCES

Center for Climate and Energy Solutions. No date. Website accessed April 2014, http://www.c2es.org/science-impacts/basics/faqs/tornadoes.

Colorado LMI. 2014. Colorado LMI Gateway website. Colorado Department of Labor and Employment. Accessed February 13, 2014 at https://www.colmigateway.com

Colorado Division of Emergency Management. 2011. State of Colorado Natural Hazards Mitigation Plan. Available on-line at http://dhsem.state.co.us/sites/default/files/attachments/Cover%20and%20Table%20of%20Contents.pdf.

Colorado Geological Survey. 2001. Rock Talk Vol 4(4). Available on-line at http://geosurvey.state.co.us/pubs/Documents/rtv4n4.pdf.

Colorado Geological Survey. 2014. Website accessed April 2014, http://coloradogeologicalsurvey.org/.

Colorado Water Conservation Board, Department of Natural Resources 2010. Flood Hazard Mitigation Plan. Available on-line at http://cwcb.state.co.us/water-management/flood/documents/coloradofloodmitigationplanupdate2013.pdf.

Colorado Division of Water Resources, Office of the State Engineer. 2013. 27th Annual Report on Dam Safety. Available on-line at http://water.state.co.us/DWRIPub/DWR%20Annual%20Reports/27th_Annual_Report_on_Dam_Safety_WY10-12.pdf.

Colorado Water Conservation Board. 2013. Colorado Drought Mitigation and Response Plan. Available on-line at http://cwcbweblink.state.co.us/WebLink/0/doc/173111/Electronic.aspx?searchid=45a1d11c-9ccf-474b-bed4-2bccb2988870.

Doerge, Benjamin C., Trent Street, John Chua, Rex Stambaugh, and James McHenry. 2011. Using Geotextiles to Repair Earth Dams. The website of Geosynthetics. Available on-line at http://geosyntheticsmagazine.com/articles/0411_f5_dam_repair.html.

FEMA 2010. http://www.fema.gov . Website accessed 2009, 2010, 2011.

FEMA. 2001. Understanding Your Risks; Identifying Hazards and Determining your Risks. FEMA (386-2). August 2001.

FEMA. 2002. Getting Started; Building support for Mitigation Planning; FEMA (386-1). September 2002.

FEMA. 2003. Developing the Mitigation Plan; Identifying Mitigation Actions and Implementing Strategies. FEMA (386-3). April 2003

FEMA. 2004. Using HAZUS-MH for Risk Assessment, How to Guide, FEMA (433). August 2004

FEMA. 2007. FEMA, National Flood Insurance Program, Community Rating System; CRS Coordinator's Manual FIA-15/2007 OMB No. 1660-0022

Fremont County Office of Emergency Management. 2003. Natural Hazard Risk Analysis & Pre-Disaster Mitigation Plan for Upper Arkansas Area.

Fremont County Community Wildfire Protection Plan. No date. Available on-line at http://csfs.colostate.edu/pages/documents/cwpp042308.pdf.

Office of the Governor of the State of Colorado. 2013. Request for Presidential Major Disaster Declaration. Available on-line at http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%222013-

07-
10+Presidential+Major+Disaster+Declaration+Request.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251861578716&ssbinary=true.

Hopper, Brandon. 2013. Flooding causes sinkhole on Cañon City; More rain to come. Daily Record Cañon City News. Published on-line September 12, 2013, http://www.canoncitydailyrecord.com/news/canoncity-local-news/ci_24078740/rain-hits-fremont-county-hard-reports-high-4.

InciWeb: Incident Information System. 2013. Bull Gulch Fire. Available on-line at http://inciweb.nwcg.gov/incident/3442/.

International Strategy for Disaster Reduction. 11/11/2008. "Disaster Risk Reduction Strategies and Risk Management Practices: Critical Elements for Adaptation to Climate Change"

Johnson, Leland R. 2011. Situation Desperate: U.S. Army Engineer Disaster Relief Operations, Origins to 1950. EP 870-1-70. Available on-line at http://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP_870-1-70.pdf.

McKee, Thomas B, Nolan J. Doesken, John Kleist, Catherine J. Shier and William P. Stanton. 2000. A History of Drought in Colorado: Lessons learned and what lies ahead. No. 9 – Second Edition. Colorado State University.

NASA, 2004. http://earthobservatory.nasa.gov/Newsroom/view.php?id=25145 NASA Earth Observatory News Web Site Item, dated August 2, 2004.

NOAA. 2010. http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms. NOAA, National Climatic Data Center website, accessed 2010.

OTA (Congressional Office of Technology Assessment). 1993. Preparing for an Uncertain Climate, Vol. I. OTA–O–567. U.S. Government Printing Office, Washington, D.C.

Soil and Water Conservation Society. 2003. Conservation Implications of Climate Change: Soil Erosion and Runoff from Cropland. Ankeny, IA: Soil and Water Conservation Society. Available on-line at http://www.swcs.org/en/publications/conservation_implications_of_climate_change/.

U.S. Census. 2010. Data from 2010 U.S. Census. U.S. Census Bureau. http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search&geo_id=01000US&_geoContext=01000US%7C04000US06%7C16000US0662938&_street=&_county=Ada+County&_cityTown=Ada+County&_state=04000US16&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fp

U.S. Environmental Protection Agency (EPA). 2006. Excessive Heat Events Guidebook. EPA 430-B-06-005. Available online at http://www.epa.gov/heatisld/about/pdf/EHEguide_final.pdf.

USGS. 1989. The Severity of an Earthquake. U.S. Government Printing Office: 1989-288-913. Accessed online at: http://pubs.usgs.gov/gip/earthq4/severity_text.html

USGS. 2008. An Atlas of ShakeMaps for Selected Global Earthquakes. U.S. Geological Survey Open-File Report 2008-1236. Prepared by Allen, T.I., Wald, D.J., Hotovec, A.J., Lin, K., Earle, P.S. and Marano, K.D.

USGS. 2010. PAGER—Rapid Assessment of an Earthquake's Impact. U.S. Geological Survey Fact Sheet 2010-3036. September 2010.

APPENDIX A.
ACRONYMS AND DEFINITIONS

APPENDIX A.
ACRONYMS AND DEFINITIONS

ACRONYMS

ANSI—American National Standards Institute

ASME—American Society of Mechanical Engineers

CCR—Code of Colorado Regulations

CDBG—Community Development Block Grant

CDSD—Community Development Services Division

CFR—Code of Federal Regulations

CIP—Capital Improvement Plan

CRS—Community Rating System

CWCB—Colorado Water Conservation Board

CWPP—Community Wildfire Protection Plan

DFIRM—Digital Flood Insurance Rate Maps

DHS—Department of Homeland Security

DMA—Disaster Mitigation Act

EAP—Emergency Action Plan

EMPG—Emergency Management Performance Grant

EPA—U.S. Environmental Protection Agency

ESA—Endangered Species Act

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FIRM—Flood Insurance Rate Map

FIS—Flood Insurance Study

GIS—Geographic Information System

HAZUS-MH—Hazards, United States-Multi Hazard

HMGP—Hazard Mitigation Grant Program

IBC—International Building Code

ICC—International Code Council

IFGC—International Fuel Gas Code

IMC—International Mechanical Code

IPC—International Plumbing Code

IRC—International Residential Code

LPR—Local Plans and Regulations

MM—Modified Mercalli Scale

NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program

NOAA—National Oceanic and Atmospheric Administration

NRP—Natural Resource Protection

NSSA—National Storm Shelter Association

NWS—National Weather Service

PDM—Pre-Disaster Mitigation Grant Program

PDI—Palmer Drought Index

PGA—Peak Ground Acceleration

PHDI—Palmer Hydrological Drought Index

PPACG—Pikes Peak Area Council of Governments

SIP—Structure and Infrastructure Project

SFHA—Special Flood Hazard Area

SHELDUS—Special Hazard Events and Losses Database for the US

SPI—Standardized Precipitation Index

USFS—U.S. Forest Service

USGS—U.S. Geological Survey

WRAP—Wildfire Risk Assessment Program

WUI—Wildland Urban Interface

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the NFIP are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water – whether from rainfall, snowmelt, springs, or other sources – flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water reactive materials.
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events.
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65 percent.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water – whether from rainfall, snowmelt, springs or other sources – flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's FIRM. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A FIRM identifies most, but not necessarily all, of a community's floodplain as the SFHA.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Fog: Fog refers to a cloud (or condensed water droplets) near the ground. Fog forms when air close to the ground can no longer hold all the moisture it contains. Fog occurs either when air is cooled to its dew point or the amount of moisture in the air increases. Heavy fog is particularly hazardous because it can restrict surface visibility. Severe fog incidents can close roads, cause vehicle accidents, cause airport delays, and impair the effectiveness of emergency response. Financial losses associated with transportation delays caused by fog have not been calculated in the United States but are known to be substantial.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour [mph]) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (HAZUS-MH) Loss Estimation Program: HAZUS-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The HAZUS-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with

natural hazards. HAZUS-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. HAZUS-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mass movement: A collective term for landslides, mudflows, debris flows, sinkholes, and lahars.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Initiatives (or Mitigation Actions): Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates for the City are based on the methodology that the City used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

Risk Ranking = Probability + Impact (people + property + economy)

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a FIRM. The SFHA is mapped as a Zone A in riverine situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams, and drains where banks have been eroded, sloughed, or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25 percent. For this study, steep slope is defined as slopes greater than 33 percent.

Sustainable Hazard Mitigation: This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: Wildfire refers to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground

utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX B.
PUBLIC OUTREACH

APPENDIX B.
PUBLIC OUTREACH

This appendix includes the agenda, sign-in sheets, and meeting notes from each of the three Steering Committee Meetings. This appendix also include the results of the Fremont County hazard mitigation plan questionnaire, as described in Section 3.7.2. The press releases announcing the update of the Fremont County hazard mitigation plan are shown in Section 3.7.4.

Fremont County, CO Hazard Mitigation Plan Update

Steering Committee Kickoff Meeting

Monday, March 3, 2014

10:00 AM

Agenda

1. Welcome and Introductions
2. Steering Committee purpose and responsibilities
3. Plan Partners and Signators – participation, etc.
4. Overview, purpose and goals of the Update Process
5. Final Result (Example of ToC in packets)
6. Community Participation and Survey as an integral part of this process (in packet)
7. Review, discuss and amend Mitigation Goals and Objectives (in packet)
8. Review of the mitigation actions from the old Upper Arkansas Plan Hazard Mitigation and Update status
9. Hazard analysis review
    a. Hazards prioritized and profiled in Upper Arkansas plan (in packet)
    b. Hazard history (in packets)
    c. Thoughts input etc.
10. Critical Facilities discussion
11. Next steps and next meeting date – ???
12. Adjournment

Tetra Tech Inc. laura.johnston@tetratech.com or 303-312-8807

TETRA TECH

Fremont County, CO Hazard Mitigation Plan Update

***Steer*ing Committee Kickoff Meeting – Meeting Notes**

Monday, March 3, 2014

- Welcome and Introductions – County Emergency Manager Steve Morrisey and Laura Johnston from Tetra Tech
    - Welcomed the members and requested introductions of each of the attending committee member and the organization or municipality they represent
    - Provided an overview of the mitigation plan process, FEMA requirements and the benefits to Fremont County
- Each member of the Committee was provided a folder with handouts and a copy of the presentation slides
- Laura reviewed the purpose and responsibilities of the Steering Committee. Steering Committee members:
    - Provide guidance on their specific community
    - Carry information from the meetings to their community
    - Attend and actively participate in all committee meetings (3)
- Laura discussed Planning Partners and Signators. Each Planning Partner must formally adopt the plan.
- Laura presented the goals for each meeting of the Steering Committee:
    - The goal of the kick-off meeting was to review the goals and objectives and rank the community hazards
    - The goal of the second meeting is to present the results of the hazard risk assessment, and

    - The goal of the third meeting is to identify actions that mitigate the identified hazards.
- Laura discussed the project schedule
- Laura provided an overview of the Plan itself, the purpose and goals of the Plan:
    - FEMA funding eligibility
    - Integration with current County and Community plans
    - CIP/budgeting
    - Better position the community to be more resilient
- Laura discussed the outline and components of the Plan (an example Table of Contents was provided in the folders)
- Laura addressed the Community Participation and Survey as an integral part of this process. A public involvement handout was provided in the packet for distribution or display. Laura discussed the benefits of full community participation in order to result in a true community plan. Community participation may include:
    - Meeting attendance
    - Word of mouth/newspaper reports, etc.
    - On-line survey, which was set up for community input (a link to the survey was provided on the handout).
    - In response to a question, Laura clarified that the community survey will be available until right before the third committee meeting.
- Laura explained the purpose of the goals, objectives and actions discussed in the Plan and reviewed the goals and objectives developed in the previous plan for the Upper Arkansas Area. Laura also presented example goals and objectives for the plan update and asked the committee members to provide suggestions on them during the meeting.
    - The committee suggested that the goals should be written in plain language for community members to easily understand.

- The committee discussed the scope of goals (which should be broad to cover many objectives) and how the plan can be amended to include new actions during yearly reviews or periodic updates.

- Laura reviewed the hazards prioritized and profiled in the Upper Arkansas Area Plan and asked the committee members to rank the hazards as "high," "medium," and "low" in their community.
  - The committee asked how the hazards can vary depending on the location in the county. Laura replied that the goals and objectives should include all interests and areas within the community and that objectives can be developed to target specific areas, not just countywide.
  - Laura explained that community perception is just as important as scientific research into the hazard frequency and severity.
- Laura presented the topic of critical facilities.
  - There was a brief discussion on the definition of "Critical Facilities". Laura shared the CWCB's definition of Critical Facilities and stated that this is the definition that the State has directed us to use (provided in the folder). Copies of a first draft of critical facilities were handed out to several committee members for their review and updates.
- Laura opened up the meeting for discussion and questions:
  - Laura clarified that the Hazard Mitigation Plan was paid for through FEMA grant funding and 25% community funds
  - The committee asked if mitigation actions should be specific - for example, list the particular drainage or creek for the action. Laura responded that the mitigating action should be very specific and that she will send a worksheet for building a project to Steve Morrisey that lists some of the details that can be specified.
  - Laura responded to a question about who can become a partner or participant. Laura stated that other groups, districts, or communities (such as the fire districts) may be eligible if they participate as part of the steering committee and adopt the plan. This question or area has

been under consideration by the State and could really be better answered by a State representative. However, they may also be a participant as part of unincorporated Fremont County.

  - The committee asked if a mitigation action could be funded if it is not part of the plan. Laura explained that new mitigation actions can be easily added to the plan as long as they fall under the existing goals and objectives. The Plan can also be updated as necessary and at least every 5 years to maintain compliance with the Disaster Mitigation Act.

- The date for the next meeting of the Steering Committee was tentatively set for late April or early May. Meeting details will be forthcoming.
- Adjournment

Fremont County
Pre-Disaster Mitigation Meeting
March 3, 2014

GRANDVIEW DITCH CO → CELLARRAT1@AOL.COM

NAME	AGENCY	PHONE	E-Mail
Lisa Hyams	CC & Hydraulic Ditch Co	719-275-6359	& M.CULLEN@BRESNAN.NET
Chuck Hildebrand	DOC/OEM	719-240-1844	
Doug Koehn	Oil Creek Ditch Co	719-429-9882	~~Doug Koehn~~ dougkoehn01@gmail.com
Dale Carroll	Penrose Water District	719-372-~~3~~3289	pewod2@bresnan.net
Helen Blake	county resident	719-275-2423	eaterweed@hotmail.com
Tony Adamic	Fremont County DOT	719 275-2047	Tony.Adamic@fremontco.com
Bob Bush	Fremont GIS	719.276.7434	bob.bush@fremontco.com
Steve Sangen	Fremont 50X Cooper Fire	719 276-5544	on file
Gregg Goodland	USFS San Carlos RD	719-269-8543	sgoodland@fs.fed.us
Ed Skerjanec	BLM	719-269-8561	eskerjan@blm.gov
Todd Bell	Deer Mt Fire	719-942-4046	email-trbelldmvfd@gmail.com
Tim Payne	Fremont Co		Tim.Payne@fremontco.com
Adam Lancaster	City of Canon City	719-269-9011	atlancaster@canoncity.org
Lisa Studts	City of Cañon City (Museum)	719-269-9036	lmstudts@cañoncity.org
Debbie Mitchell	Fremont Conservation Dist	719-275-4465	deborah.mitchell@co.nacdnet.net
Gerald Melon	City of Canon City	719-671-1879	gerald.melon@outlook.com
Becki Vettese	St. Thomas More Hosp	719-285-2619	Rebeccavettese@centura.org
Debbie Bell	BOCC Fremont County Commissioner	719-276-7300	debbie.bell@fremontco.com
John Grieve	CSFS	719 275 6865	John.grieve@colostate.edu
Glenda DeBekker	Canon City	719-276-5265	gdebekker@canoncity.org
Laura D. Johnston	Tetra Tech	303 312 8807	Laura.johnston@tetratech.com
Diane MacMillan	Tetra Tech	303-312-8815	diane.macmillan@tetratech.com

Fremont County
Pre-Disaster Mitigation Meeting
March 3, 2014

NAME	AGENCY	PHONE	E-Mail
Don Moore	City of Florence	719-539-8866	dmoore@florencecolorado.org
Tim Payne	Fremont Co.		
Sharon Whitney	Fruitland Water Co	719-315-2147	SKW58@hotmail.com
Shannon Syverly	Canon City Police Dept.	719-276-5600	SSYVERLY@CANONCITY.ORG
Tom Waters	Colo. Parks + Wildlife	719 539-7289	tom.waters@state.co.us
Kevin Colvin	Fremont Co SO w/Wildland Fire	719-429-9063	cfo.safety1@hotmail.com
Renee Bolkema	Town of Brookside	719-371-3467	townhall brookside@bresnan.net bresnan
Steve Morrissey	Fremont County Fire Protection Dist	719 276 7429	steve.morrissey@fremontco.com
Rick Romano	USDA - NRCS	719-275-4465x3	richard.romano@co.usda.gov
Dave DelVecchio	Canon City Fire Dist.	719-275-8666	ddelvecchio@canonfire.org
Dale Carroll	Florence Fire Protect. Dist	719-429-4141	penwod2@bresnan.net

Fremont County, CO Hazard Mitigation Plan Update

Steering Committee Meeting

Thursday, May 15, 2014

10:00 AM

AGENDA

1. Welcome and Introductions
2. Review of purpose and responsibilities of Steering Committee
3. Review of goals and objectives of Plan (in packet)
4. Community participation and survey results
5. Capabilities assessment
6. Community Participation and Survey as an integral part of this process (in packet)
7. Hazard Analysis review (in packet)
8. Next steps and next meeting date – ???
9. Adjournment

Tetra Tech Inc. laura.johnston@tetratech.com or 303-312-8807

TETRA TECH

Fremont County, CO Hazard Mitigation Plan Update

Steering Committee Meeting – Meeting Notes

Thursday, May 15, 2014

- Welcome and Introductions – Laura Johnston from Tetra Tech
    - Ms. Johnston introduced the consultant team helping the Fremont County Emergency Manager Steve Morrisey with the Plan Update
    - Ms. Johnston welcomed the Steering Committee members and requested introductions of each of the attending committee member and the organization or municipality they represent
- Each member of the Committee was provided with handouts and a copy of the presentation slides
- Ms. Johnston provided an overview of the mitigation plan process, FEMA requirements and the benefits to Fremont County. Ms. Johnston also reviewed the purpose and responsibilities of the Steering Committee. Steering Committee members:
    - Provide guidance on their specific community
    - Carry information from the meetings to their community
    - Attend and actively participate in all committee meetings (3)
- Ms. Johnston briefly discussed Planning Partners and Signators. Each Planning Partner must formally adopt the Plan.
- Ms. Johnston reviewed the goals and objectives developed by the Steering Committee during and since the March 3, 2014 kick-off meeting. The goals and objectives were also given to the Steering Committee members as handouts. Ms. Johnston stated that each mitigation action for each participating municipality must fall under one of the goals and objectives in the Plan.
- Ms. Johnston presented an overview of the results of the Community Participation Survey, which was closed on May 12, 2014. The full results of the survey were provided to the committee members in handouts.

- 90 community members participated in the survey (67 people completed the survey). Mr. Adam Lancaster (Canon City) asked if the participation in the survey was low compared to expectations and if the survey would just reflect the opinions of the Steering Committee instead of the community at large. Ms. Johnston responded that survey participation was low but not out of the ordinary for a rural community. Ms. Johnston explained that the survey was announced in many different places, including the local newspaper and the Fremont County website. Ms. Johnston added that the Steering Committee represents the community's interests during the Plan Update process.
- The Committee members discussed the use of cell phones to receive information on emergencies and issues with relying on power and cell phone towers. Ms. Johnston commented that the online survey is skewered towards people with regular access to computers and the internet so other communication methods should be also evaluated.
- The Committee discussed potential insurance incentives for homeowners to implement hazard mitigation actions. Homeowners insurance is difficult to obtain in areas potentially impacted by wildfires and there are no known disclosure agreements to notify future homeowners of hazards.

- Ms. Diane MacMillan (Tetra Tech) discussed the assessment of the regulatory, administrative/technical, and financial capabilities of each participating municipality. The capabilities assessment is a required element of the Plan and identifies strengths and potential gaps in the ability of the County or municipalities to implement the mitigation actions. Ms. MacMillan sent summary tables to the participating agencies and expects completed/corrected tables by May 23, 2014.
- Ms. Johnston reviewed the hazards prioritized during and after the previous Steering Committee meeting. The hazards were ranked as "high," "medium," or "low" for each community. Ms. Johnston compared the hazard rankings from the Steering Committee versus the hazard ranking from the Community Participation Survey. The hazard rankings were similar, and both the community and the Steering Committee ranked wildfire as the greatest hazard to Fremont County.
- Ms. Johnston discussed the hazard identification and risk assessment for Fremont County. This process involved the identification of hazards, hazard profiles, an inventory of the assets of each community, the capabilities assessment, and loss estimations.
  - Ms. Johnston presented the wildfire risk and threat to Fremont County, based on the Colorado Wildfire Risk Assessment Summary Report (CO-WRAP), prepared by

the State of Colorado. Ms. Johnston asked Mr. Bob Bush (Fremont County GIS Authority) if the latest CO-WRAP included data from recent fires in 2013. Mr. Bush responded that he did not know if the current wildfire data was included but that all of the recent fires were within the dark red areas highlighted on the maps.

- Ms. Renee Bolkema (Brookside Town Clerk) asked for the definition of "Wildfire Threat" and "Wildfire Risk." Mr. John Grieve (Colorado State Forest Service) responded that "Wildfire Threat" referred to the potential occurrence of wildfire in the area and "Wildfire Risk" meant the potential risk of harm to people or structures.
- Mr. Lancaster questioned the accuracy of the floodplain data shown in the presentation. Ms. Johnston and Mr. Bush explained that the data used in the risk assessments was obtained from the County Assessor, which tracks the land use of the area. Ms. Johnston added that the risk assessments used the best data available from FEMA, the County, and the State.

- Ms. Johnston discussed the next steps for the Steering Committee, which focuses on the identification and ranking of hazard mitigation actions.
  - Ms. Johnston stated that each participating municipality needed to have at least one mitigation action for each goal and objective. A worksheet for the hazard mitigation actions was distributed to the Steering Committee with the type of information necessary for the Plan. Ms. Johnston clarified that the worksheet was not necessary for this FEMA region but that the information would be helpful for grant applications. The hazard mitigation actions need to be submitted to Ms. Johnston or Mr. Morrisey by June 13, 2014 or can be submitted during the 3rd Steering Committee meeting. However, it is preferred that the actions are submitted before the meeting so they can be incorporated into the meeting materials. Ms. Johnston will email an electronic version of the worksheet to the Steering Committee.
  - Mr. Bush encouraged the Committee to think of actions beyond just "brick and mortar" projects, like education projects or regulatory actions. Ms. Johnston added that FEMA typically wants a mix of education, administrative, and construction projects.
  - Mr. Bush also requested a list of example mitigation actions. Ms. Johnston responded that she would send the Committee a list of example actions that have been approved for FEMA funding; this list was also included in the handouts for the March 3, 2014 Kick-off Meeting.

- The Committee discussed how non-participating entities (such as the Fire Districts) can submit mitigation actions. Mr. Bush asked if the fire districts would adopt the Plan. Mr. Morrisey responded that the fire districts may adopt the plan if they choose to but they would not be considered a participant because they are not profiled separately in the Plan Update. Ms. Johnston added that FEMA grants needed to be submitted through the County or the participating municipalities. She encouraged the fire districts and other non-participating entities to work closely with the County or municipalities when developing mitigation actions. If the mitigation action would benefit multiple municipalities, it should be submitted under the municipality that would benefit the most from the action.

- The date for the next meeting of the Steering Committee was tentatively set for late June. Meeting details will be forthcoming.
- Adjournment

	Fremont County Pre-Disaster Mitigation Plan 2014 Steering Committee Meeting			May 15, 2014 @ 10:00 AM County Bldg, 615 Macon Avenue, Cãnon City, CO
Did you attend the March 3, 2014 Meeting	Committee Member	Signature	Representing	Email Address
Yes	Adamic, Tony	Tony Adamic	Fremont County DOT	tony.adamic@fremontco.com
No	Beicker, Jim		Fremont County Sheriff's Office	jim.beicker@fremontso.com
No	Bell, Debbie			debbie.bell@fremontco.com
	Bernath, T			tkbernath@canoncity.org
No	Bess, Doug		City of Salida	doug.bess@cityofsalida.com
No	Blue, Jeff			jblue@fsd.co
	Bohlander, R			rbohlander@cotopaxire3.org
Yes	Bolkema, Renee	Renee R Bolkema	Brookside Town Clerk	townhallbrookside@bresnan.net
No	Borre, F		Williamsburg Trustee	fborre62@gmail.com
YES	Bush, Bob		Fremont County GIS	bob.bush@fremontco.com
Yes	Byerly, Shannon			sbyerly@canoncity.org
	Carlson, Victoria		Fremont County PH	
YES	Colon, M	M COLON	CCHydraulic Dist	m.colon@bresnan.net
Yes	DeBekker, Glenda			grdebekker@canoncity.org
No	Delaurentis, Mike			mike.delaurentis@florencecolorado.org
Yes	DelVecchio, David		CCAFPD	ddelvecchio@canonfire.org
	Ditmore, Kevin			kevin.ditmore@canoncity.org
No	Dotson, Doug			dddotson@canoncity.org
	Freda, Patricia			bates59@bresnan.net
No	Giordano, Bill			bill.giordano@fremontco.com
Yes	Goodland, Greg		USFS	ggoodland@fs.fed.us
No	Gooldy, Robin		Canon City Schools	gooldyr@canoncityschools.org
	Greer, Tony			tony@tonygreer.com
Yes	Grieve, John	John Grieve	CSFS	jgrieve@colostate.edu
NO	Hartzman, Bob	Bob Hartzman	Cañon City Water	bwhartzman@canoncity.org
Yes	Hildebrand, Chuck		Dept of Corrections	chuck.hildebrand@doc.state.co.us
	Freda, Patricia			freda.patricia@gmail.com

Fremont County Pre-Disaster Mitigation Plan 2014
Steering Committee Meeting

May 15, 2014 @ 10:00 AM
County Bldg,
615 Macon Avenue, Cãnon City, CO

Did you attend the March 3, 2014 Meeting	Committee Member	Signature	Representing	Email Address
	Katchmar, C			ckatchmar@aol.com
No	Lambrecht, Buddy			lambreb@canoncityschools.org
YES	Lancaster, Adam	[signature]	Canon City	atlancaster@canoncity.org
	Lohnes, Judy			Judy.lohnes@uaacog.com
No	Martin, Ty			ty.martin@fremontso.com
No	McWilliams, Gary			chief.florencefiredepartment@gmail.com
	Meloni, Gerald			gerald.meloni@outlook.com
Yes	Moore, Don	Don Moore	City of Florence	dmoore@florencecolorado.org
Yes	Morrisey, Steve	[signature]	County	
No	Norden, Ed			ed.norden@fremontco.com
no	Otis, Jim	James E. Otis	COTOPAXI	jiotis0411@wildblue.net
No	Patterson, M			mpatterson@florencecolorado.org
Yes	Payne, Tim	[signature]	Fremont County Commissioner	tim.payne@fremontco.com
	Romano, Richard	Debbie Mitchell - affiliate	NRCS Canon City	richard.romano@co.usda.gov
NO	Rupp, Brian	[signature]	Fremont Sanitation District	mailto:brupp@fsd.co
NO	Sanders, Tom	Tom Sanders	Beaver Creek Water	tsanders@beaverparkwater.net
Yes	Sanger, Steve	[signature]	FCSO	steve.sanger@fremontso.com
No	Schultz, Paul			pdschultz@canoncity.org
Yes	Skerjan, Ed (Skerjanic)	Not attending - Goodland here	(BLM)	eskerjan@blm.gov
	Studts, Lisa		Royal Gorge Rgnl Mus.	lmstudts@canoncity.org
No	Sunderman, Calvin			penrosefirechief@yahoo.com
No	Sugars, George			george.sugars@fremontco.com
NO	Swanson, Jason	[signature]	FBOP	jswanson@bop.gov
No	Vendetti, R.		RE-2 Schools	RVendetti@Re-2.org
	Vettese, Rebecca	[signature]	Hospital	RebeccaVettese@Centura.Org
NO	Walker, John	J WALKER	Western Fremont FPD	walkermoore2@hotmail.com
Yes	Hartzman, B			bwhartzman@canoncity.org

	Fremont County Pre-Disaster Mitigation Plan 2014 Steering Committee Meeting			May 15, 2014 @ 10:00 AM County Bldg, 615 Macon Avenue, Cãnon City, CO
Did you attend the March 3, 2014 Meeting	Committee Member	Signature	Representing	Email Address
Yes	~~White~~, Rob Tom Waters	Tom Waters	CO DNR	rob.white@state.co.us tom.waters@state.co.us
	Wright, Hart	Hart W	SW Hwy 115 FPD	chief115vfd@gmail.com 719-238-5236
	???			deb_parkcenter@msn.com
	Grosslight, Gordon			talxfire@gmail.com
	Bell, Todd			trbelldmvfd@gmail.com
	Dennis Wied	D. Wied	Canon City	dennis.canoncity@gmail.com
No	Coleman, Christe		Custer County OEM	ccoem@custercountygov.com
	Coal Creek, Town of		Coal Creek	townofcoalcreek@bresnan.net
	Howard VFD		Howard VFD	hvfd@howard-co.us
	Rockvale, Town of		Rockvale	rockvale@bresnan.net)
	Project Advisors:			
No	Baldwin, Scott		Colorado OEM	scott.baldwin@state.co.us
No	Galveda, Patricia		Colorado OEM	patricia.gavelda@state.co.us
	Johnston, Laura	Laura D. Johnston	Tetra Tech Inc.	Laura.johnston@tetratech.com
yes	MacMillan, Diane	Diane MacMillan	Tetra Tech Inc.	Diane.MacMillan@tetratech.com
	OTHER ATTENDEES:			
no	Allen Cooper	Allen Cooper	CCPD	Acooper@canoncity.org
yes	Debbie Mitchell	Debbie Mitchell	Fremont Cons. Distr	deborah.mitchell@co.fremont.co.us
yes	Doug Koehn	Doug Koehn	OilCrk Ditch Co	dougkoehn@gmail.com
yes	Hale Carroll	Hale Carroll	Penrose Water Dist	penwd2@bresnan.net
yes	Hale Carroll	Hale Carroll	Florence Fire Protect Dist	penwd2@bresnan.net

Fremont County, CO Hazard Mitigation Plan Update

Steering Committee Meeting

Wednesday, July 23, 2014

8:00 AM

AGENDA

1. Welcome and Introductions
2. Reminders
    a. What is Hazard Mitigation?
    b. Plan Partners and Signators
    c. Final Hazard Rankings
    d. Final Mitigation Goals and Objectives
3. Mitigation Actions
    a. Development
    b. Review
    c. Ranking
4. Next Steps
5. Adjournment

Tetra Tech Inc. laura.johnston@tetratech.com or 303-312-8807

TETRA TECH

Fremont County, CO Hazard Mitigation Plan Update

Steering Committee Meeting – Meeting Notes

Wednesday, July 23, 2014

- Welcome and Introductions – Laura Johnston from Tetra Tech
    - Ms. Johnston introduced the consultant team helping the Fremont County Emergency Manager, Steve Morrisey, with the Plan Update
    - Ms. Johnston welcomed the Steering Committee members and requested introductions of each of the attending committee member and the organization or municipality they represent
- Each member of the Committee was provided with handouts and a copy of the presentation slides
- Ms. Johnston provided a refresher on the purpose of hazard mitigation, the responsibilities of the Steering Committee, and the importance of the participation of the Plan Partners and Signators to complete the mitigation process.
- Ms. Johnston reviewed the natural hazards that were prioritized by the Steering Committee for the County and each participating municipality.
- Ms. Johnston reviewed the goals and objectives that were developed by the Steering Committee during previous meetings. Ms. Johnston reminded the committee that at least one mitigation action should be developed to address each goal and objective.
- Ms. Johnston stated that the purpose of the meeting was to review and rank the mitigation actions developed by the plan partners.
    - The mitigation action worksheets were distributed at the May meeting. Completed worksheets were submitted to Mr. Morrisey. Ms. Johnston reminded the committee that each municipality needed to develop at least one mitigation action for each hazard ranked as "High" or "Medium."
    - Ms. Johnston discussed the completed worksheets and stated that Tetra Tech modified the submitted mitigation action worksheets slightly when necessary to meet FEMA's requirements. For example, many worksheets were modified to describe alternatives to the mitigation actions, including no action to address the natural hazards.
    - Ms. Johnston reviewed the modified STAPLEE process on the second page of the mitigation action worksheets. The method analyzes the Social, Technical, Administrative, Political, Legal, Economic, and Environmental aspects of a project. This method is commonly used by public administration officials and planners for making planning decisions. Ms. Johnston stated that the results of the STAPLEE analysis should be used for ranking the mitigation actions but the ranking does not need to follow the STAPLEE scoring exactly.

- Ms. Johnston referred to a summary table of the mitigation actions developed for the County and discussed the ranking process.
    - The mitigation projects were assigned a reference number in the order they were submitted. The table also shows the natural hazards identified by the Steering Committee; hazards ranked "high" are shown in red, hazards ranked "medium" are shown in yellow, and hazards ranked "low" are shown in green.
    - Ms. Johnston stated that four additional mitigation actions for the County had been recently received. These additional actions were not included in the packet of actions emailed to the meeting participants before the meeting, but are included in the summary table and packet of actions distributed to the meeting participants.
    - Ms. Johnston explained that one representative from each entity will rank the top 20 mitigation actions from 1 (highest priority) to 20 (lowest priority). Ms. Johnston stated that each representative will be given a set of stickers with each County mitigation action. The representative will place the stickers of the top 20 projects on the poster boards at the front of the room. The rankings on the poster boards will then be used to make a comprehensive list of the top 20 mitigation actions for the County. These rankings will be documented in the Hazard Mitigation Plan.
    - Ms. Johnston noted that although FEMA requires that the projects are prioritized, the projects do not need to be implemented in order of the ranking in the Hazard Mitigation Plan.
- Ms. Johnston opened the meeting for any questions on the County mitigation actions or for the action sponsors to describe the importance of their proposed action.
    - Mr. Lancaster (Canon City) asked how projects were designated as County projects versus municipality projects. Ms. Johnston responded that she worked with Mr. Morrisey to identify projects that affected residents in portions of unincorporated Fremont County or impacted more than one jurisdiction.
    - Mr. Lancaster commented that several projects seem to overlap either in scope or in geographical area. For example, some of the floodplain mapping project seem to cover the same area within the county. The committee discussed the floodplain mapping projects and how the projects may be funded separately or in sequence. In addition, specifics of the projects (for example, the boundaries for the floodplain mapping) may need to be adjusted to match existing work done by local municipalities. Mr. Lancaster suggested that some projects (for example #1, 11, and 49) might be consolidated into one project to simplify the list of potential actions. Mr. Moore (Florence) suggested that it might make sense to keep the project separated into portions that could be easily funded and implemented.
    - Mr. Moore pointed out that the boundaries for County mitigation action #8 (Floodway Determination Mapping of Arkansas River from Ash Street to Pueblo County line) should be adjusted to state that the mapping would extend from Ash Street to State Highway 115, east of the City of Florence. Mr. Morrisey confirmed that the boundary should be changed. Ms. MacMillan (Tetra Tech) stated that mitigation action #8 will be updated to reflect this change.
    - Mr. Lancaster noted that he had made a mistake on the mitigation action worksheet for action #21. Mr. Lancaster said that he would email the corrected worksheet to Ms. MacMillan and Mr. Morrisey and add a new mitigation action (#51).
- Ms. Johnston and Ms. MacMillan handed out the stickers with the mitigation actions to representatives from each participating entity and the projects were prioritized on the poster boards.

- Ms. MacMillan distributed summary tables and mitigation action worksheets for municipality-specific projects to representatives from Canon City, Florence, and Brookside. The representatives will rank their own projects and return the completed summary table to Ms. MacMillan via email.
    - Ms. Bolkema (Brookside) corrected the STAPLEE ranking of action #40 to be 8 instead of 4.
- Ms. Johnston thanked the members of the steering committee for their work and input on the Hazard Mitigation Plan. Ms. Johnston then reviewed the schedule and remaining activities. A draft copy of the plan will be submitted to Mr. Morrisey in August/September 2014. The revised plan will then be submitted to the State of Colorado for review and to FEMA for final approval. The final plan will be adopted by the plan partners.
- Adjournment

Fremont County Pre-Disaster Mitigation Plan 2014
Steering Committee Meeting

July 23, 2014 @ 8:00 AM
County Bldg, 615 Macon Avenue, Cãnon City, CO

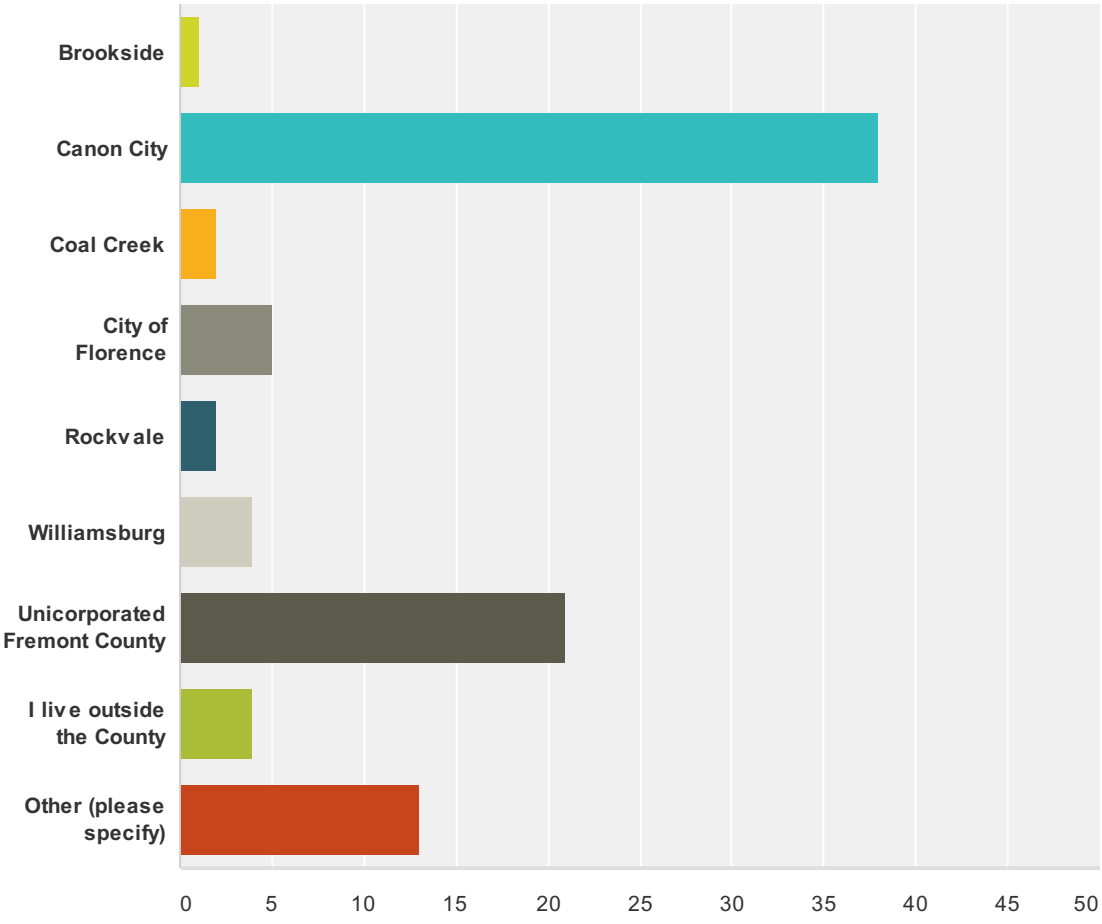
Committee Member	Signature	Representing	Email Address
Freda, Patricia			freda.patricia@gmail.com
Katchmar, C			ckatchmar@aol.com
Lambrecht, Buddy			lambreb@canoncityschools.org
Lancaster, Adam		Canon City	atlancaster@canoncity.org
Lohnes, Judy			Judy.lohnes@uaacog.com
Martin, Ty			ty.martin@fremontso.com
McKinnon, Gene	Gene MacKinnon	Florence FPD	florencefirerescue@Yahoo.Com
McWilliams, Gary			chief.florencefiredepartment@gmail.com
Meloni, Gerald			gerald.meloni@outlook.com
Moore, Don	Don Moore	City of Florence	dmoore@florencecolorado.org
Morrisey, Steve		Fremont County	STEVE.MORRISEY@FREMONTCO.COM
Norden, Ed			ed.norden@fremontco.com
Otis, Jim		Cotopaxi	jjotis0411@wildblue.net
Patterson, M			mpatterson@florencecolorado.org
Payne, Tim		Fremont County Commissioner	tim.payne@fremontco.com
Romano, Richard (Deborah Mitchell for)	Rick Romano	NRCS Canon City	richard.romano@co.usda.gov
Rupp, Brian		Fremont Sanitation District	mailto:brupp@fsd.co
Sanders, Tom	Tom Sanders	Beaver Creek Water	tsanders@beaverparkwater.net
Sanger, Steve		FCSO	steve.sanger@fremontso.com
Schultz, Paul			pdschultz@canoncity.org
Skerjanec, Ed	Ed Skerjanec	BLM	eskerjan@blm.gov
Studts, Lisa		Royal Gorge Rgnl Mus.	lmstudts@canoncity.org
Sunderman, Calvin			penrosefirechief@yahoo.com
Sugars, George			george.sugars@fremontco.com
Swanson, Jason		FBOP	jswanson@bop.gov
Vendetti, R.		RE-2 Schools	RVendetti@Re-2.org
Vettese, Rebecca		Hospital	RebeccaVettese@Centura.Org
Walker, John	John WALKER	Western Fremont FPD	walkermoore2@hotmail.com

Fremont County Pre-Disaster Mitigation Plan 2014 Steering Committee Meeting			July 23, 2014 @ 8:00 AM County Bldg, 615 Macon Avenue, Cãnon City, CO
Committee Member	**Signature**	**Representing**	**Email Address**
Adamic, Tony		Fremont County DOT	tony.adamic@fremontco.com
Beicker, Jim		Fremont County Sheriff's Office	jim.beicker@fremontso.com
Bell, Debbie			debbie.bell@fremontco.com
Bernath, T			tkbernath@canoncity.org
Bess, Doug		City of Salida	doug.bess@cityofsalida.com
Blue, Jeff			jblue@fsd.co
Bohlander, R			rbohlander@cotopaxire3.org
Bolkema, Renee	Renee Bolkema	Brookside Town Clerk	townhallbrookside@bresnan.net
Borre, F		Williamsburg Trustee	fborre62@gmail.com
Bush, Bob		Fremont County GIS	bob.bush@fremontco.com
Byerly, Shannon			sbyerly@canoncity.org
Carroll, Dale	Dale Carroll	Penrose Water	penwd2@bresnan.net
Carlson, Victoria		Fremont County PH	
Colon, M		Canon City Hydraulic Ditch	m.colon@bresnan.net
DeBekker, Glenda	Glenda DeBekker	City of Canon City	grdebekker@canoncity.org
Delaurentis, Mike			mike.delaurentis@florencecolorado.org
DelVecchio, David		CCAFPD	ddelvecchio@canonfire.org
Ditmore, Kevin			kevin.ditmore@canoncity.org
Dotson, Doug			dddotson@canoncity.org
Freda, Patricia			bates59@bresnan.net
Giordano, Bill			bill.giordano@fremontco.com
Goodland, Gregg		USFS	ggoodland@fs.fed.us
Gooldy, Robin		Canon City Schools	gooldyr@canoncityschools.org
Greer, Tony			tony@tonygreer.com
Grieve, John	John Grieve	CSFS	jgrieve@colostate.edu
Hartzman, Bob	Bob Hartzman	Cañon City Water	bwhartzman@canoncity.org
Hyams, Lisa	Lisa Hyams	CC & HYDRAULIC IRRIGATING DITCH CO CELLARRAT1@AOL.COM	
Hildebrand, Chuck (Dennis Corbin for)		Dept of Corrections	chuck.hildebrand@doc.state.co.us

Fremont County Pre-Disaster Mitigation Plan 2014 Steering Committee Meeting			July 23, 2014 @ 8:00 AM County Bldg, 615 Macon Avenue, Cãnon City, CO
Committee Member	**Signature**	**Representing**	**Email Address**
Waters, Tom		CO DNR	tom.waters@state.co.us
White, Rob		CO DNR	rob.white@state.co.us
Wied, Dennis		Canon City	dennis.canoncity@gmail.com
Wright, Hart		SW Hwy 115 FPD	chief115vfd@gmail.com
???			deb_parkcenter@msn.com
Grosslight, Gordon			talxfire@gmail.com
Bell, Todd			trbelldmvfd@gmail.com
Coleman, Christe		Custer County OEM	ccoem@custercountygov.com
Coal Creek, Town of		Coal Creek	townofcoalcreek@bresnan.net
Howard VFD		Howard VFD	hvfd@howard-co.us
Rockvale, Town of		Rockvale	rockvale@bresnan.net)
Project Advisors:			
Baldwin, Scott		Colorado OEM	scott.baldwin@state.co.us
Galveda, Patricia		Colorado OEM	patricia.gavelda@state.co.us
Johnston, Laura		Tetra Tech Inc.	Laura.johnston@tetratech.com
MacMillan, Diane		Tetra Tech Inc.	Diane.MacMillan@tetratech.com
OTHER ATTENDEES:			
Debbie Mitchell	Debbie Mitchell	Fremont Conservation	deborah.mitchell@co.nacdnet.net
Dennis Corbin	Dennis Corbin	DOC	dennis.corbin@state.co.us
Trent Rundell	Trent	ALLSTATE	TrentRundell@allstate.com

Q1 Where in Fremont County do you live?

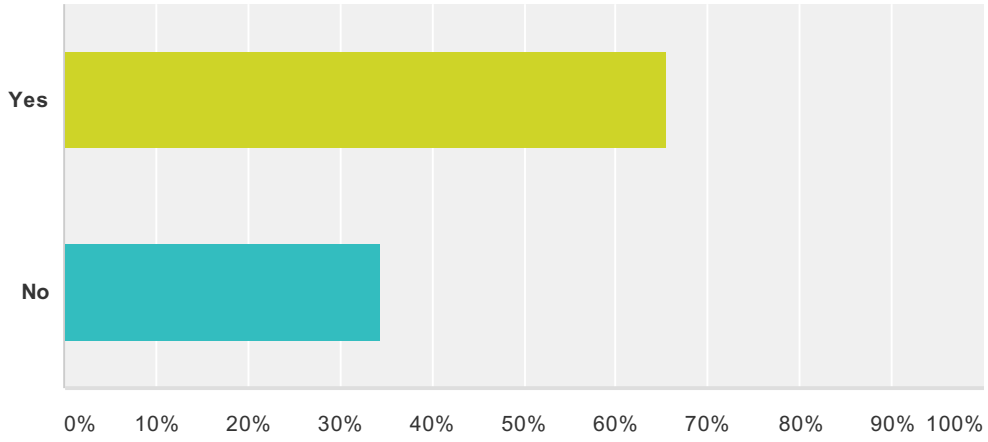
Answered: 90 Skipped: 0



Answer Choices	Responses	
Brookside	1.11%	1
Canon City	42.22%	38
Coal Creek	2.22%	2
City of Florence	5.56%	5
Rockvale	2.22%	2
Williamsburg	4.44%	4
Unicorporated Fremont County	23.33%	21
I live outside the County	4.44%	4
Other (please specify)	14.44%	13
Total		**90**

Q2 Do you work in Fremont County?

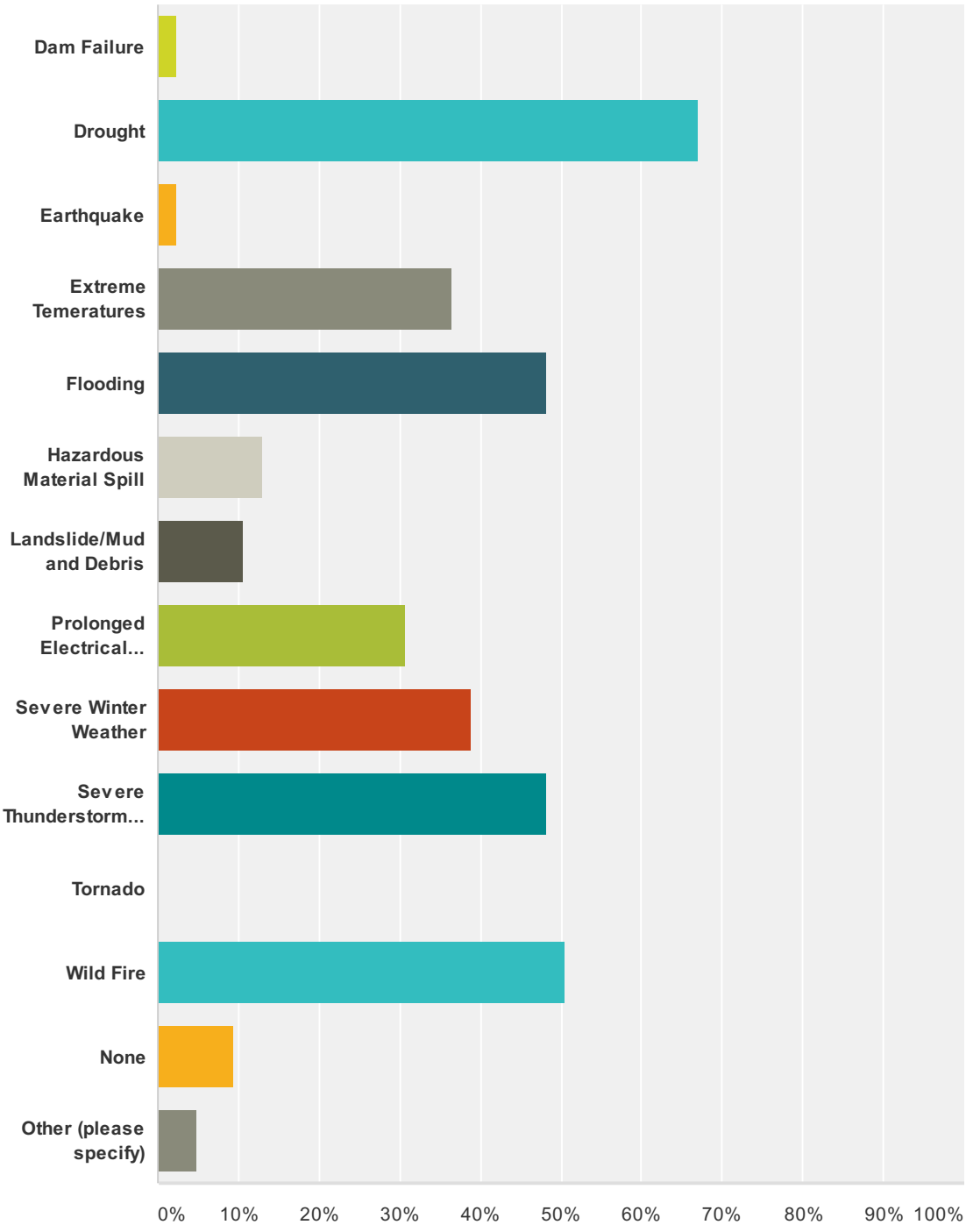
Answered: 84 Skipped: 6



Answer Choices	Responses	
Yes	**65.48%**	55
No	**34.52%**	29
Total		**84**

Q3 Which of the following natural hazard events have you or has anyone in your household experienced in the past 20 years within Fremont County? (Check all that apply)

Answered: 85 Skipped: 5

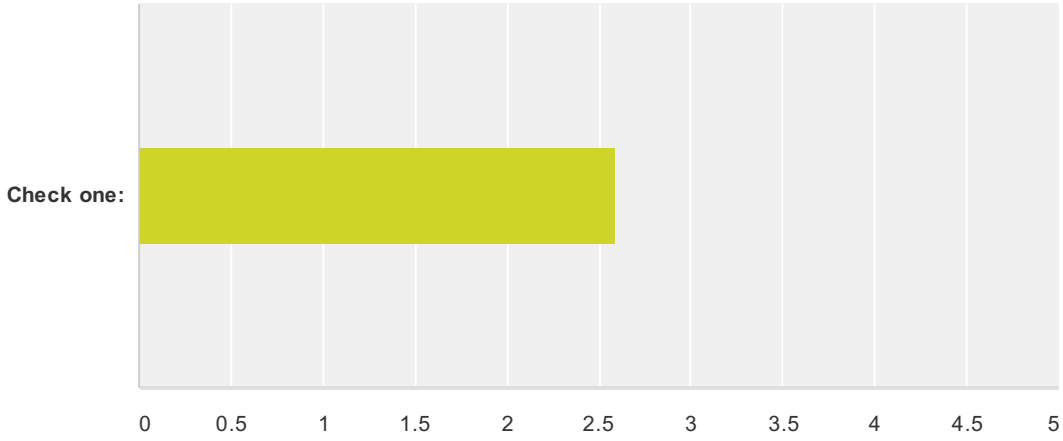


Answer Choices	Responses	
Dam Failure	2.35%	2

Drought	**67.06%**	57
Earthquake	**2.35%**	2
Extreme Temeratures	**36.47%**	31
Flooding	**48.24%**	41
Hazardous Material Spill	**12.94%**	11
Landslide/Mud and Debris	**10.59%**	9
Prolonged Electrical Power Outage	**30.59%**	26
Severe Winter Weather	**38.82%**	33
Severe Thunderstorm/Hail Storm/Wind Event	**48.24%**	41
Tornado	**0.00%**	0
Wild Fire	**50.59%**	43
None	**9.41%**	8
Other (please specify)	**4.71%**	4
Total Respondents: 85		

Q4 How prepared is your household to deal with a natural hazard event?

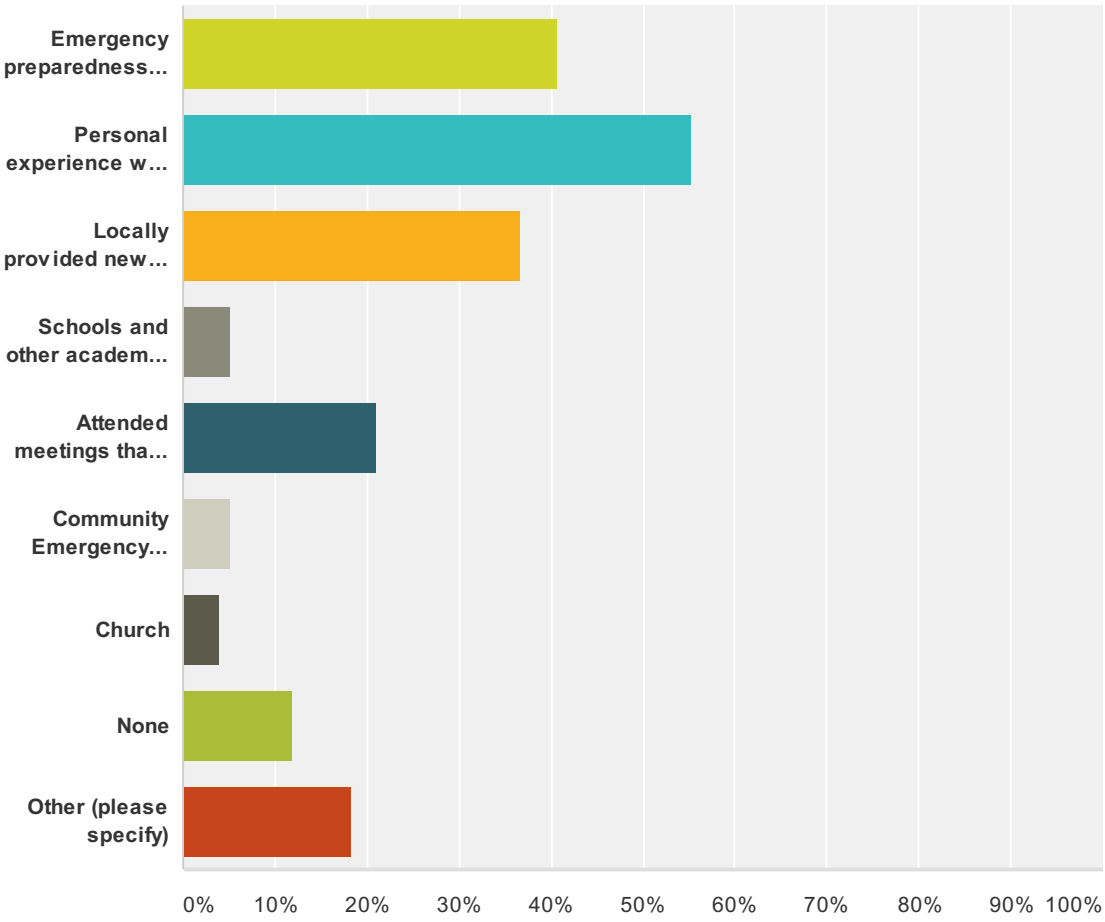
Answered: 76 Skipped: 14



	Not at all prepared	Somewhat prepared	Adequately prepared	Well prepared	Very well prepared	Total	Average Rating
Check one:	**11.84%** 9	**46.05%** 35	**22.37%** 17	**10.53%** 8	**9.21%** 7	76	2.59

Q5 Which of the following have provided you with useful information to help you be prepared for a natural hazard event? (Check all that apply)

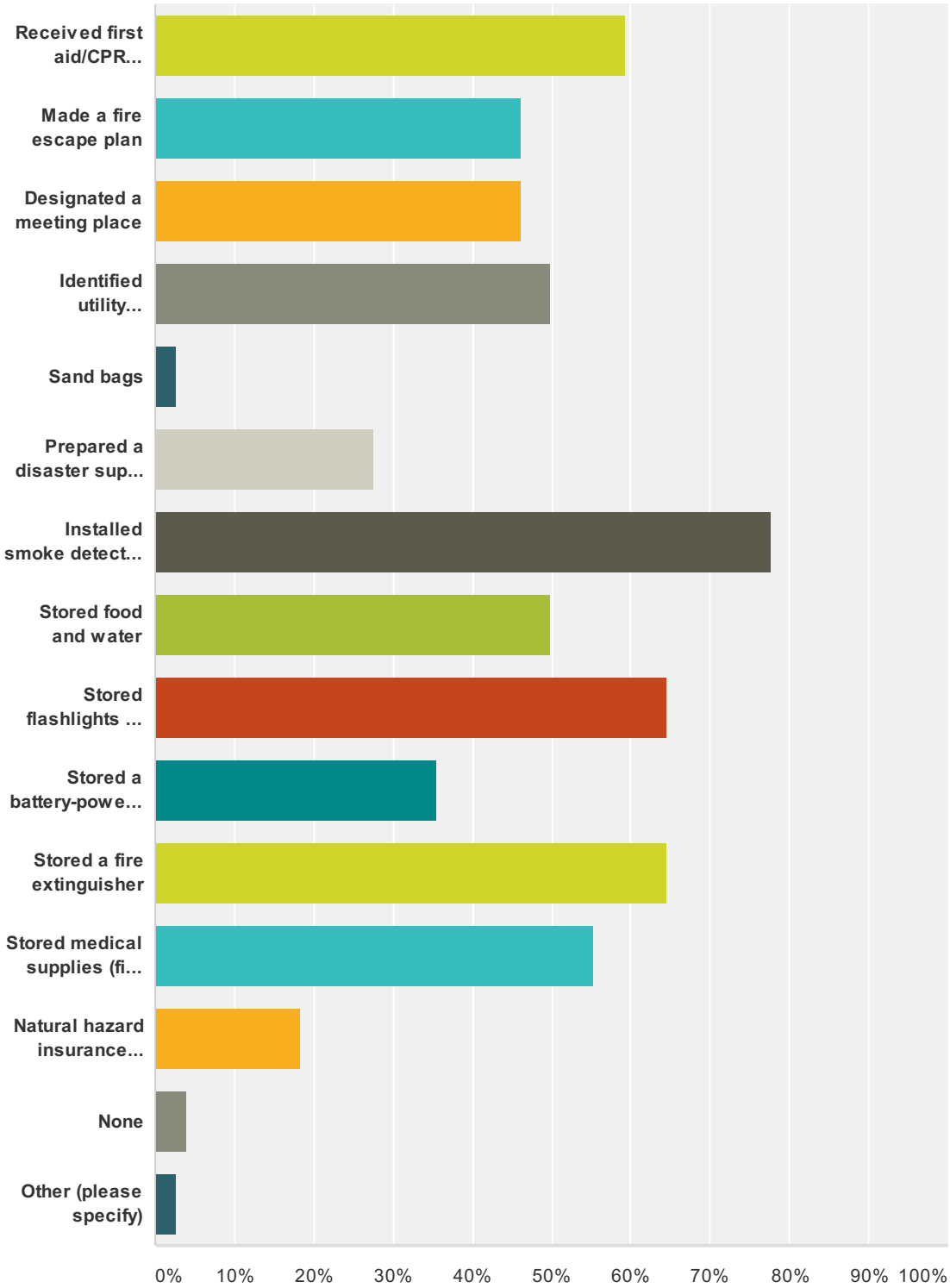
Answered: 76 Skipped: 14



Answer Choices	Responses	
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	**40.79%**	31
Personal experience with one or more natural hazards/disasters	**55.26%**	42
Locally provided news or other media information	**36.84%**	28
Schools and other academic institutions	**5.26%**	4
Attended meetings that have dealt with disaster preparedness	**21.05%**	16
Community Emergency Response Training (CERT)	**5.26%**	4
Church	**3.95%**	3
None	**11.84%**	9
Other (please specify)	**18.42%**	14
Total Respondents: 76		

Q6 Which of the following steps has your household taken to prepare for a natural hazard event? (Check all that apply)

Answered: 76 Skipped: 14

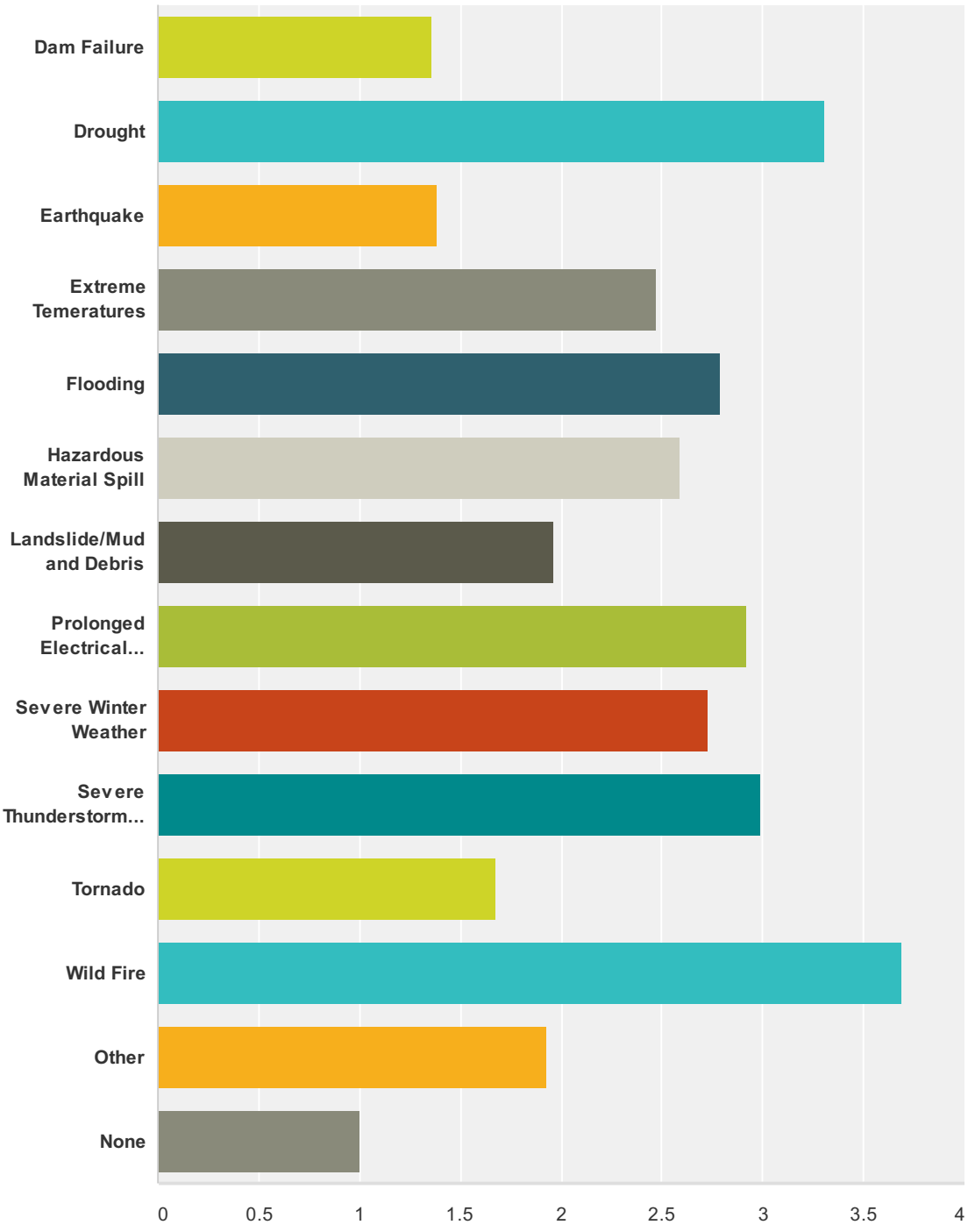


Answer Choices	Responses	
Received first aid/CPR training	59.21%	45

Made a fire escape plan	**46.05%**	35
Designated a meeting place	**46.05%**	35
Identified utility shutoffs	**50.00%**	38
Sand bags	**2.63%**	2
Prepared a disaster supply kit	**27.63%**	21
Installed smoke detectors on each level of the house	**77.63%**	59
Stored food and water	**50.00%**	38
Stored flashlights and batteries	**64.47%**	49
Stored a battery-powered radio	**35.53%**	27
Stored a fire extinguisher	**64.47%**	49
Stored medical supplies (first aid kit, medications)	**55.26%**	42
Natural hazard insurance (Flood, Earthquake, Wildfire)	**18.42%**	14
None	**3.95%**	3
Other (please specify)	**2.63%**	2
Total Respondents: 76		

Q7 How concerned are you about the following natural hazards in Fremont County? (Check one response for each hazard)

Answered: 76 Skipped: 14

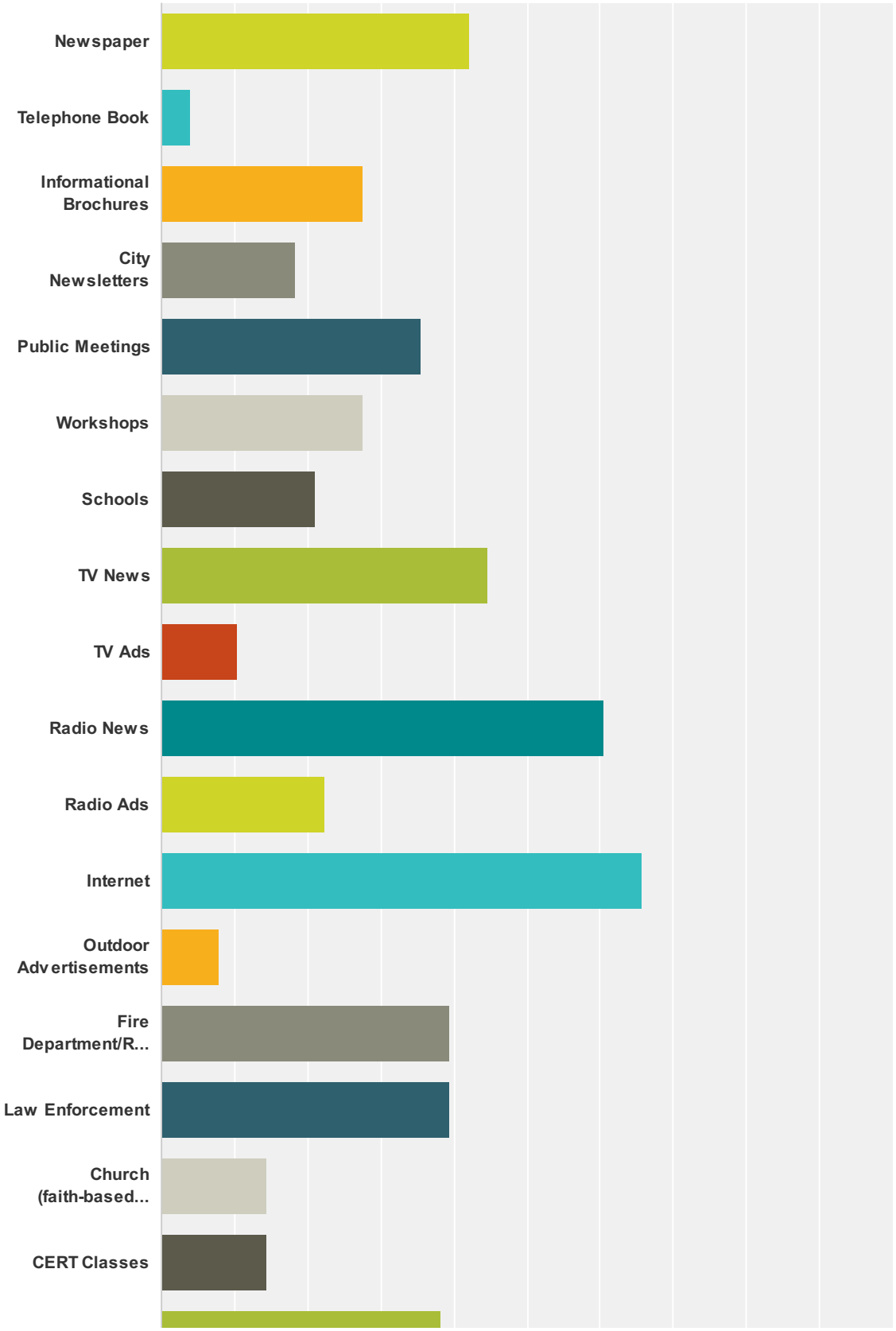


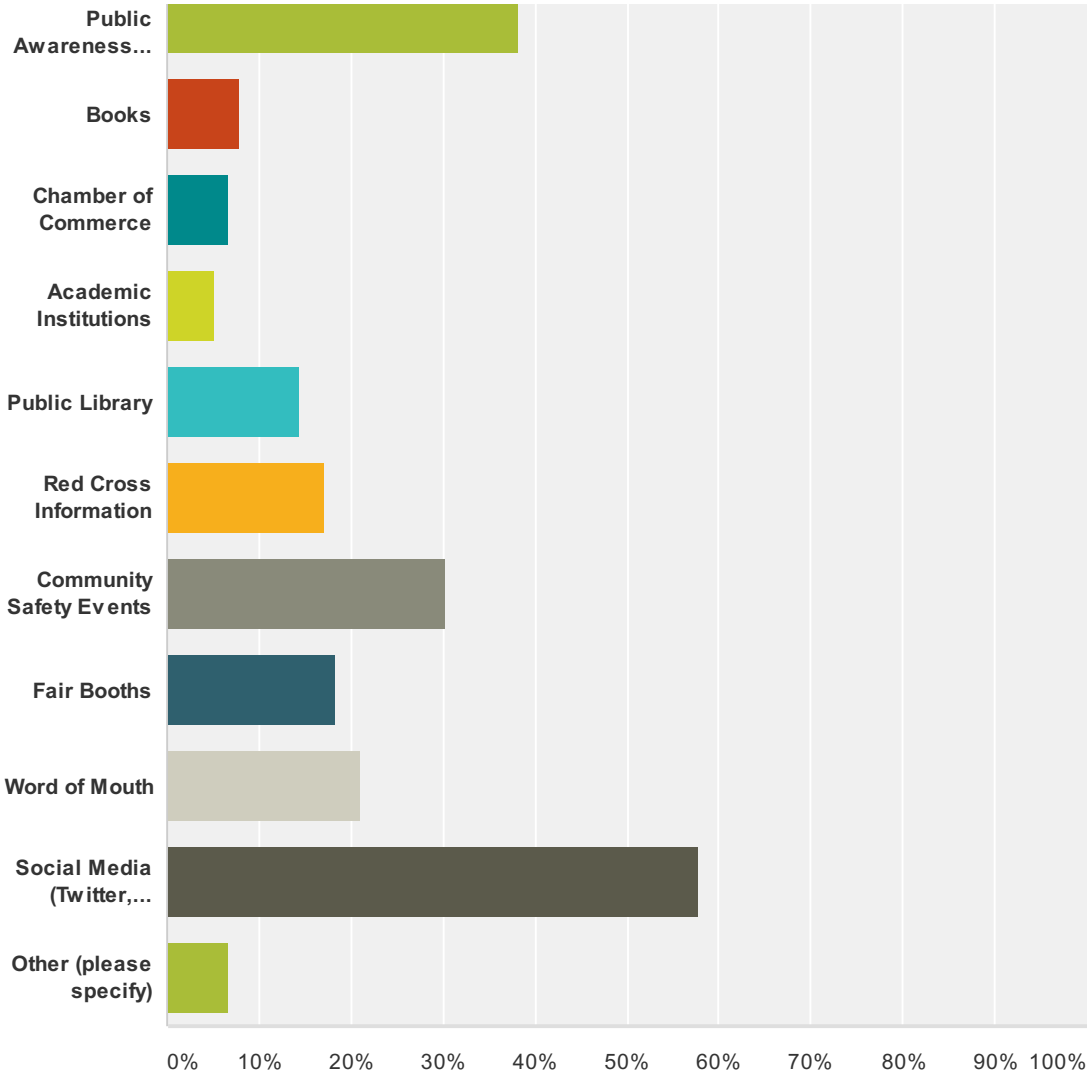
	Not Concerned	Somewhat Concerned	Concerned	Very Concerned	Extremely Concerned	Total	Average Rating
Dam Failure	**73.97%** 54	**17.81%** 13	**6.85%** 5	**1.37%** 1	**0.00%** 0	73	1.36

Drought	**8.00%** 6	**16.00%** 12	**37.33%** 28	**14.67%** 11	**24.00%** 18	75	3.31
Earthquake	**68.06%** 49	**27.78%** 20	**2.78%** 2	**0.00%** 0	**1.39%** 1	72	1.39
Extreme Temeratures	**21.33%** 16	**30.67%** 23	**32.00%** 24	**12.00%** 9	**4.00%** 3	75	2.47
Flooding	**17.81%** 13	**27.40%** 20	**24.66%** 18	**17.81%** 13	**12.33%** 9	73	2.79
Hazardous Material Spill	**22.67%** 17	**29.33%** 22	**21.33%** 16	**20.00%** 15	**6.67%** 5	75	2.59
Landslide/Mud and Debris	**43.66%** 31	**26.76%** 19	**21.13%** 15	**7.04%** 5	**1.41%** 1	71	1.96
Prolonged Electrical Power Outage	**10.81%** 8	**22.97%** 17	**37.84%** 28	**20.27%** 15	**8.11%** 6	74	2.92
Severe Winter Weather	**14.67%** 11	**24.00%** 18	**38.67%** 29	**18.67%** 14	**4.00%** 3	75	2.73
Severe Thunderstorm/Hail Storm/Wind Event	**9.33%** 7	**24.00%** 18	**34.67%** 26	**22.67%** 17	**9.33%** 7	75	2.99
Tornado	**47.22%** 34	**38.89%** 28	**12.50%** 9	**1.39%** 1	**0.00%** 0	72	1.68
Wild Fire	**8.11%** 6	**10.81%** 8	**20.27%** 15	**25.68%** 19	**35.14%** 26	74	3.69
Other	**71.43%** 10	**0.00%** 0	**7.14%** 1	**7.14%** 1	**14.29%** 2	14	1.93
None	**100.00%** 8	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	8	1.00

Q8 Which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)

Answered: 76 Skipped: 14



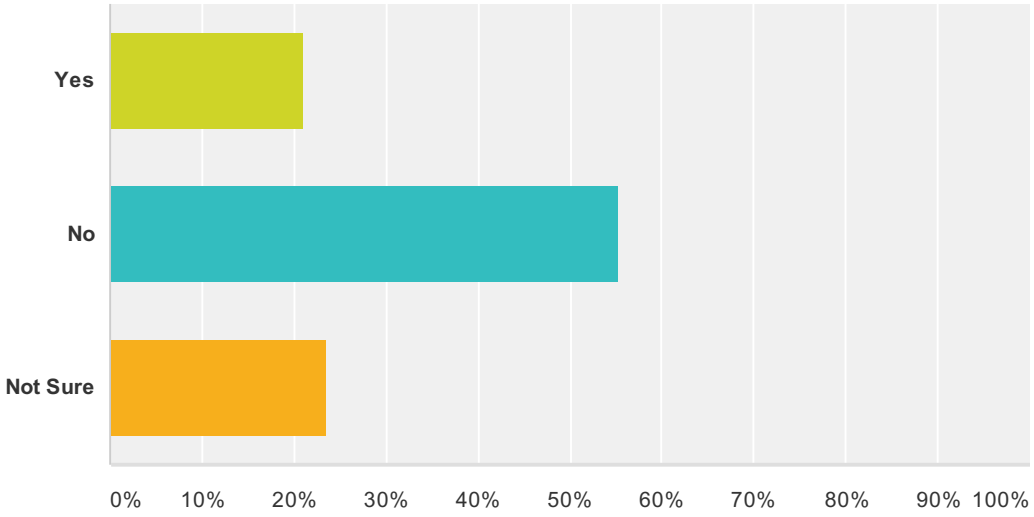


Answer Choices	Responses	
Newspaper	**42.11%**	32
Telephone Book	**3.95%**	3
Informational Brochures	**27.63%**	21
City Newsletters	**18.42%**	14
Public Meetings	**35.53%**	27
Workshops	**27.63%**	21
Schools	**21.05%**	16
TV News	**44.74%**	34
TV Ads	**10.53%**	8
Radio News	**60.53%**	46
Radio Ads	**22.37%**	17
Internet	**65.79%**	50
Outdoor Advertisements	**7.89%**	6

Fire Department/Rescue	**39.47%**	30
Law Enforcement	**39.47%**	30
Church (faith-based institutions)	**14.47%**	11
CERT Classes	**14.47%**	11
Public Awareness Campaign (e.g., Flood Awareness Week, Winter Storm Preparedness Month)	**38.16%**	29
Books	**7.89%**	6
Chamber of Commerce	**6.58%**	5
Academic Institutions	**5.26%**	4
Public Library	**14.47%**	11
Red Cross Information	**17.11%**	13
Community Safety Events	**30.26%**	23
Fair Booths	**18.42%**	14
Word of Mouth	**21.05%**	16
Social Media (Twitter, Facebook, Linkdin)	**57.89%**	44
Other (please specify)	**6.58%**	5
Total Respondents: 76		

Q9 Is your property located in or near a FEMA designated floodplain?

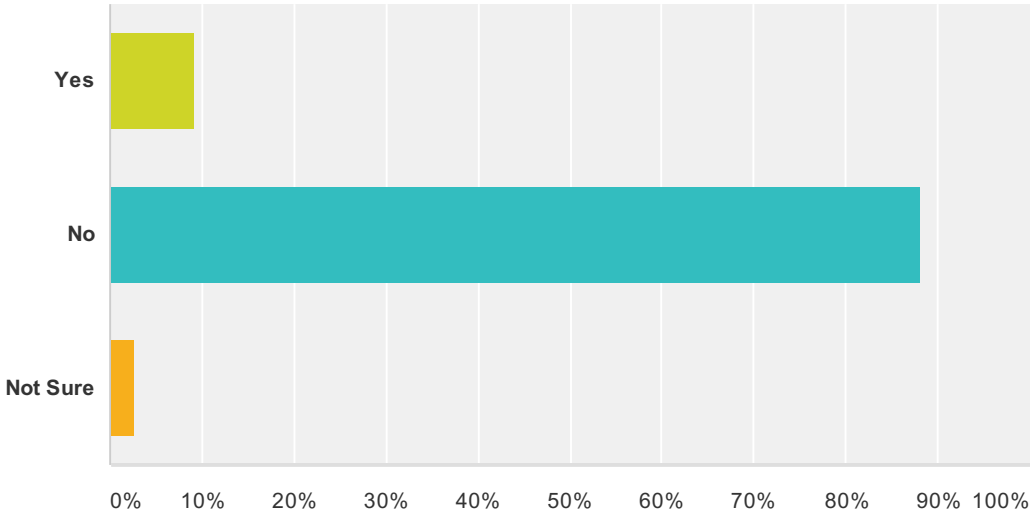
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**21.05%**	16
No	**55.26%**	42
Not Sure	**23.68%**	18
Total		**76**

Q10 Do you have flood insurance?

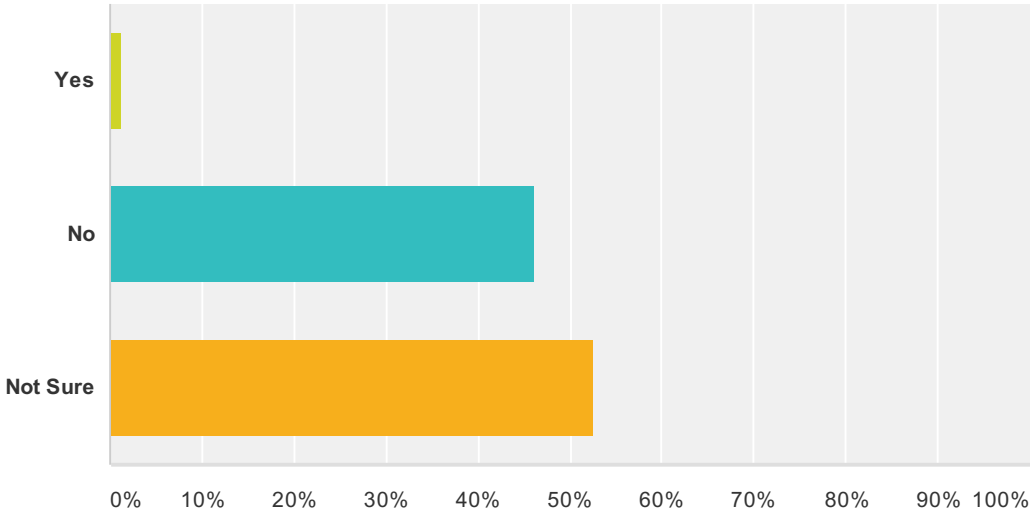
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**9.21%**	7
No	**88.16%**	67
Not Sure	**2.63%**	2
Total		**76**

Q11 Is your property located near an earthquake fault?

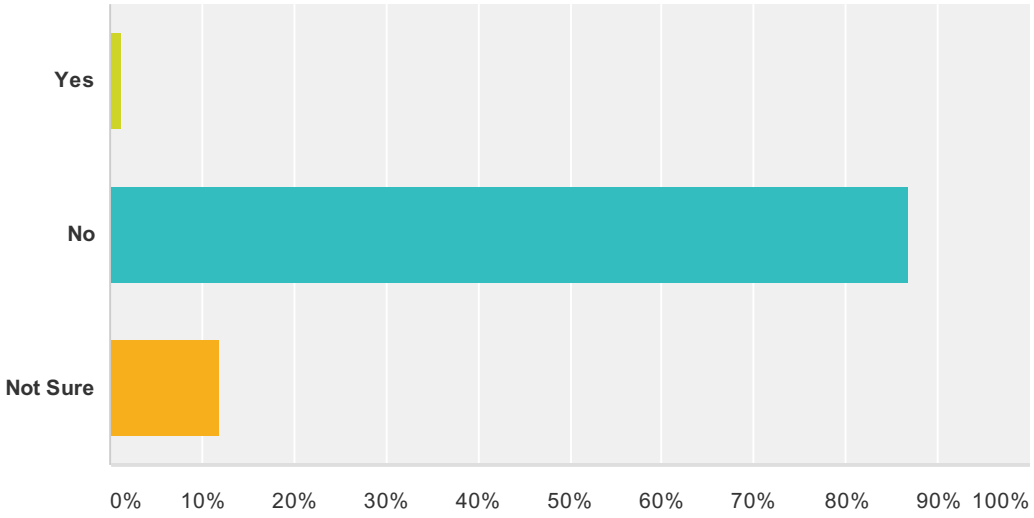
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**1.32%**	1
No	**46.05%**	35
Not Sure	**52.63%**	40
Total		**76**

Q12 Do you have earthquake insurance?

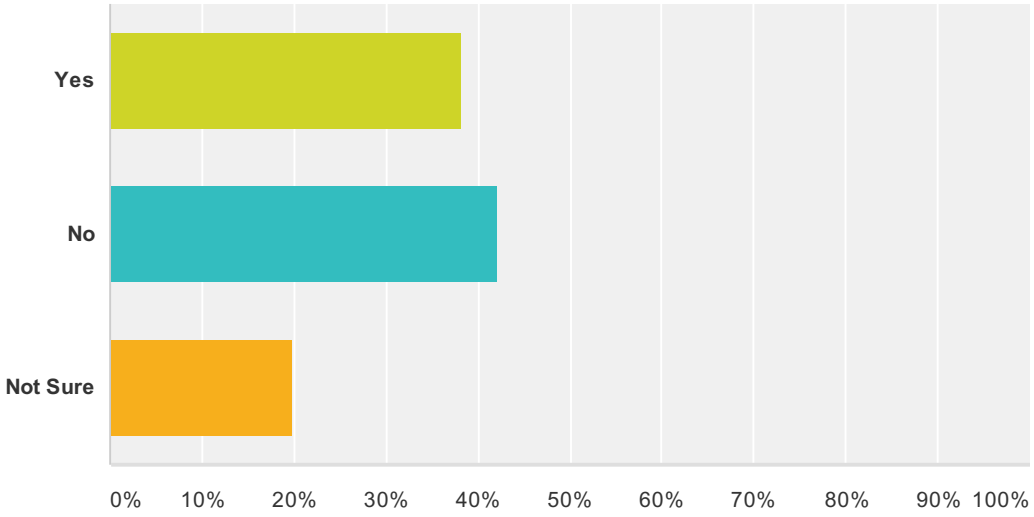
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**1.32%**	1
No	**86.84%**	66
Not Sure	**11.84%**	9
Total		**76**

Q13 Is your property located in an area at risk for wild fires?

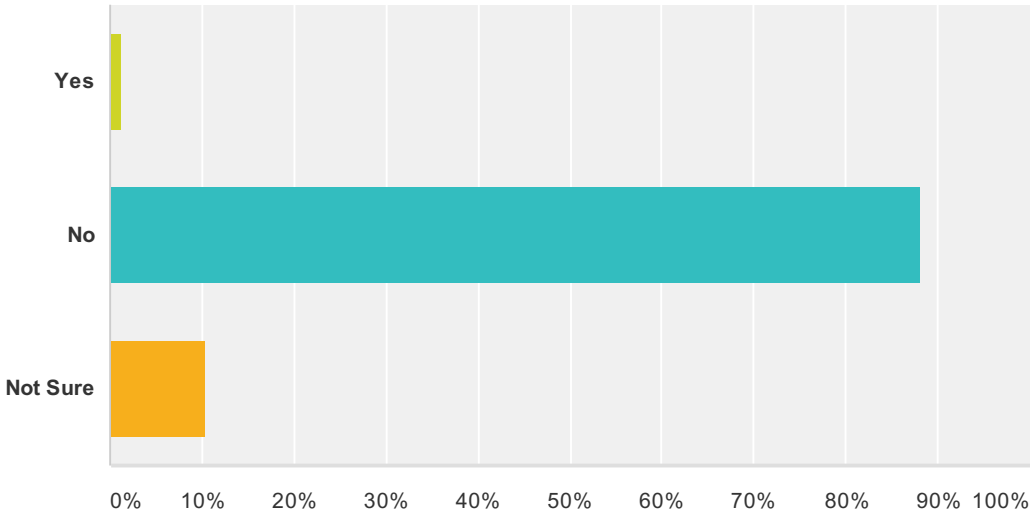
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**38.16%**	29
No	**42.11%**	32
Not Sure	**19.74%**	15
Total		**76**

Q14 Have you ever had problems getting homeowners or renters insurance due to risks from natural hazards?

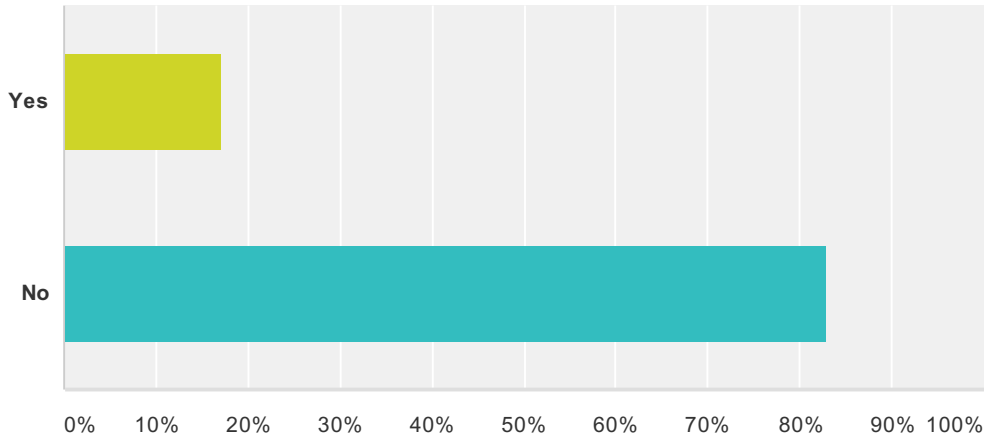
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**1.32%**	1
No	**88.16%**	67
Not Sure	**10.53%**	8
Total		**76**

Q15 Do you have any special access or functional needs within your household that would require early warning or specialized response during disasters?

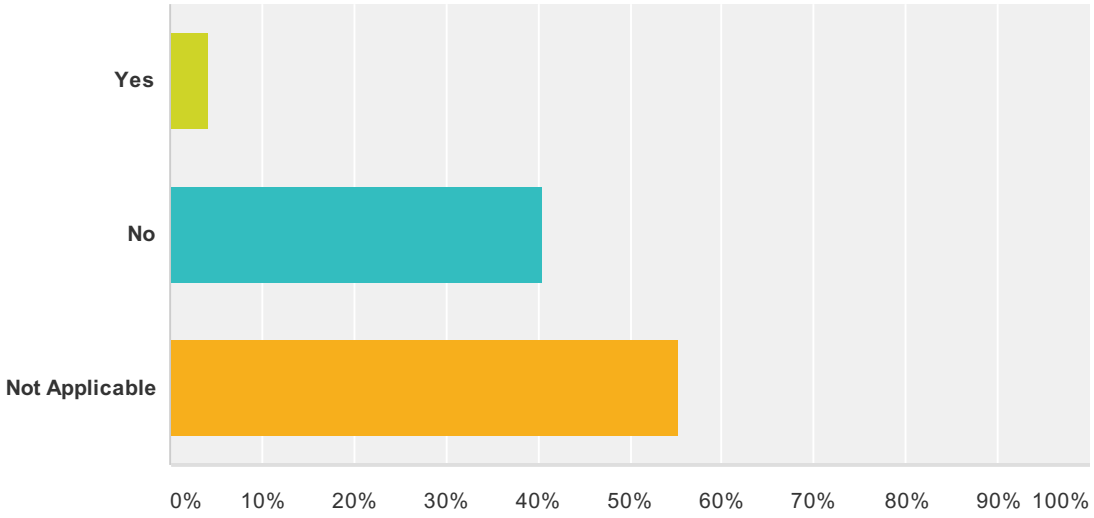
Answered: 76 Skipped: 14



Answer Choices	Responses	
Yes	**17.11%**	13
No	**82.89%**	63
Total		**76**

Q16 If the answer to question # 15 was yes, would you like County Emergency Management personnel to contact you regarding your access and functional needs? If yes, please enter your contact information in the following text box.

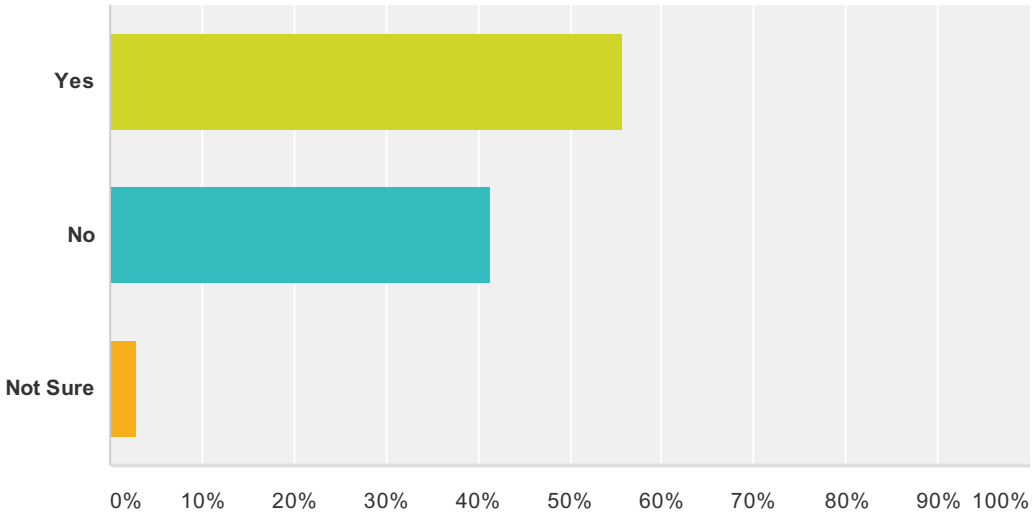
Answered: 47 Skipped: 43



Answer Choices	Responses	
Yes	**4.26%**	2
No	**40.43%**	19
Not Applicable	**55.32%**	26
Total		**47**

Q17 When you moved into your home, did you consider the impact a natural disaster could have on your home?

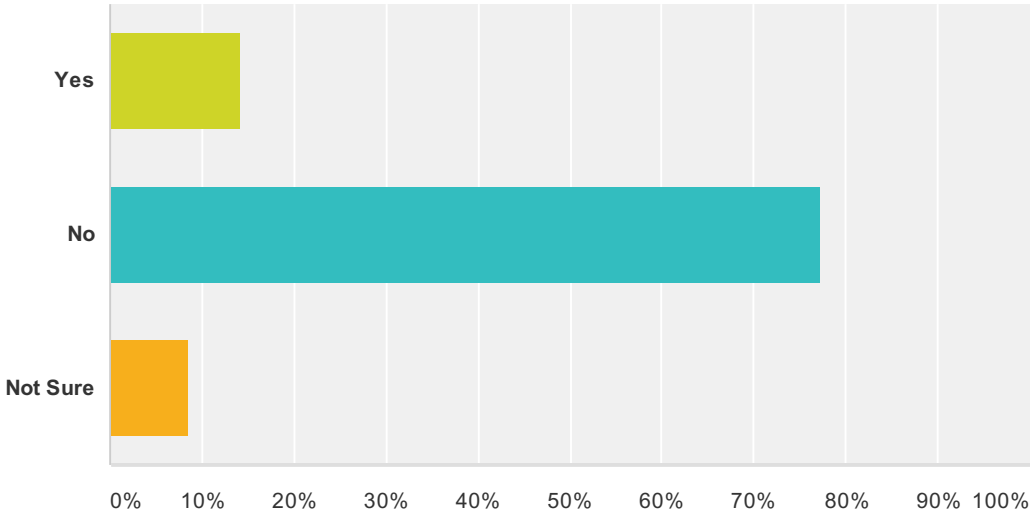
Answered: 70 Skipped: 20



Answer Choices	Responses	
Yes	**55.71%**	39
No	**41.43%**	29
Not Sure	**2.86%**	2
Total		**70**

Q18 Was the presence of a natural hazard risk zone (e.g., dam failure zone, flood zone, landslide hazard area, high fire risk area) disclosed to you by a real estate agent, seller, or landlord before you purchased or moved into your home?

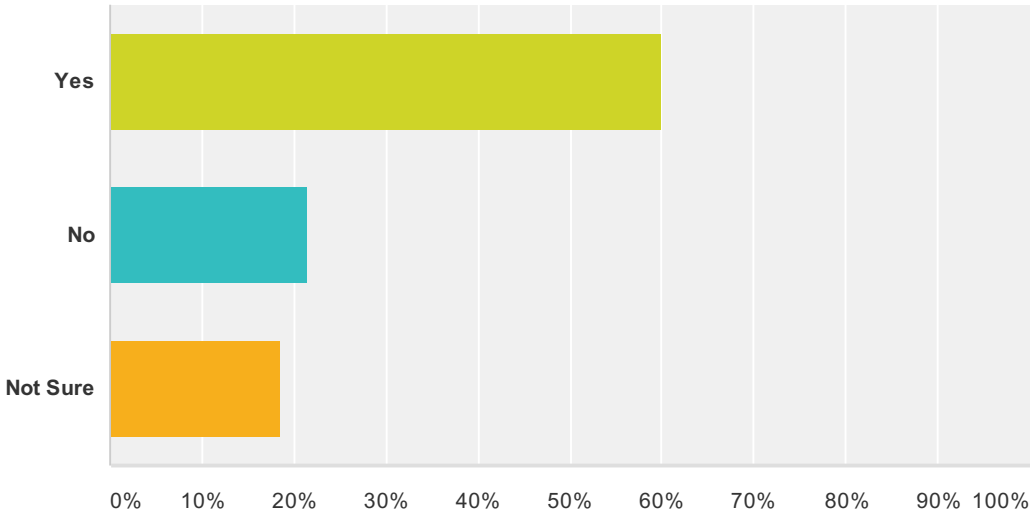
Answered: 70 Skipped: 20



Answer Choices	Responses	
Yes	**14.29%**	10
No	**77.14%**	54
Not Sure	**8.57%**	6
Total		**70**

Q19 Would the disclosure of this type of natural hazard risk information influence your decision to buy or rent a home?

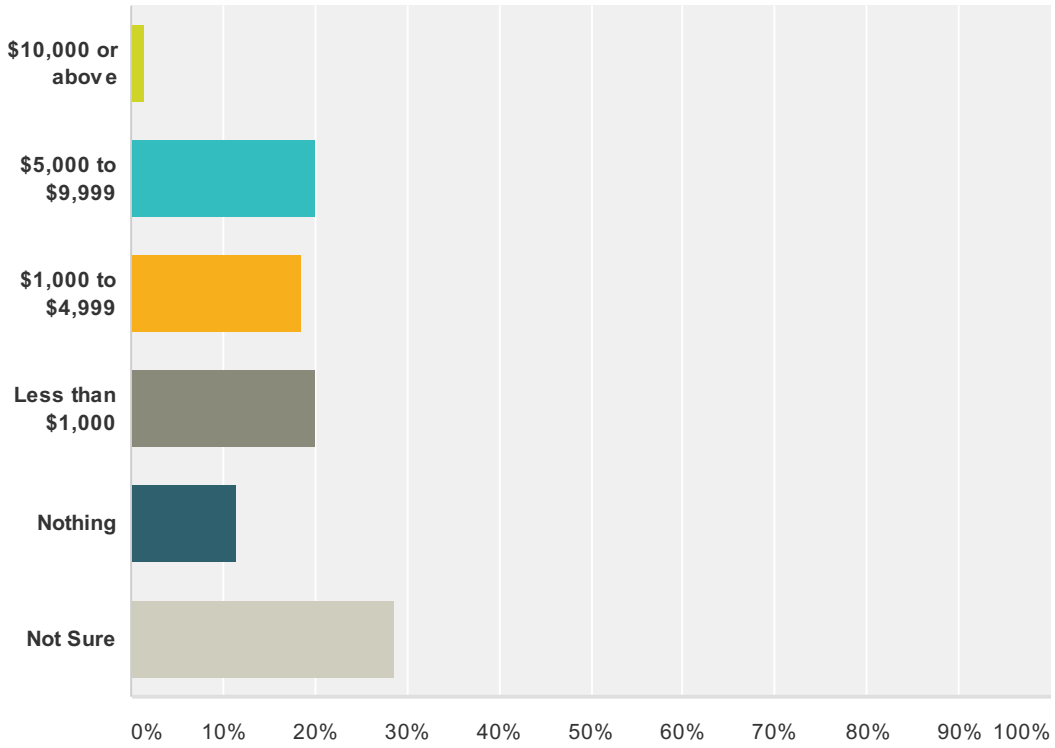
Answered: 70 Skipped: 20



Answer Choices	Responses	
Yes	**60.00%**	42
No	**21.43%**	15
Not Sure	**18.57%**	13
Total		**70**

Q20 How much money would you be willing to spend to retrofit your home to reduce risks associated with natural disasters? (for example, by clearing brush and plant materials from around your home to create a "defensible space" for wildfire, performing seismic upgrades, or replacing a combustible roof with non-combustible roofing)

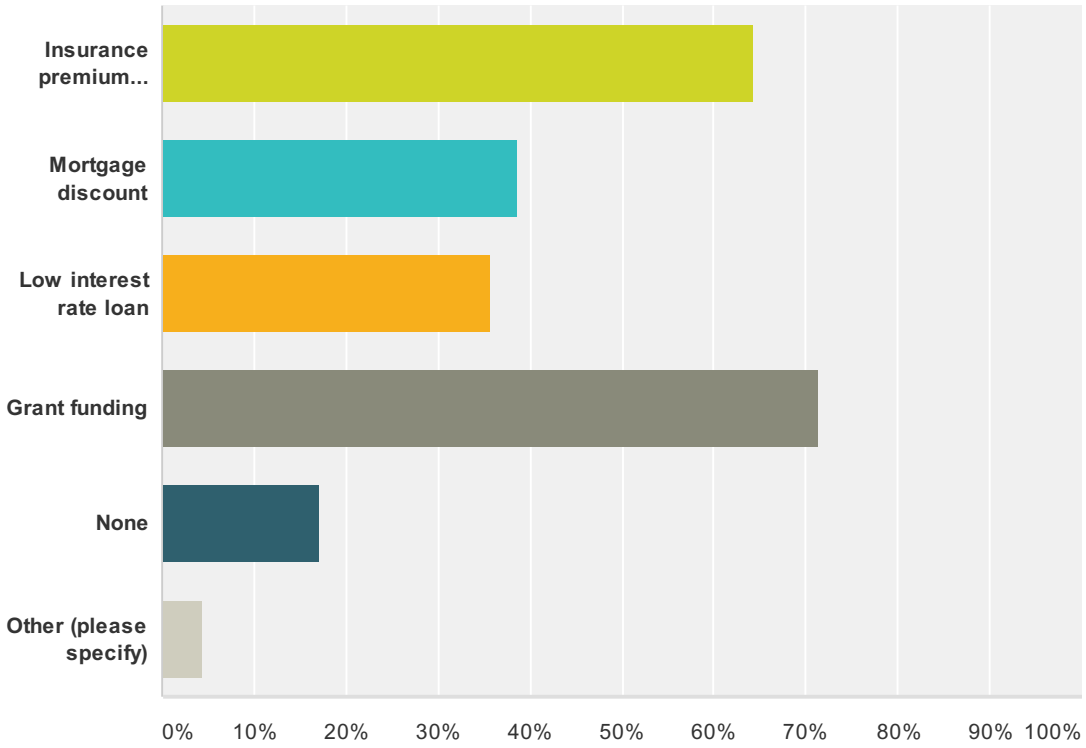
Answered: 70 Skipped: 20



Answer Choices	Responses	
$10,000 or above	**1.43%**	1
$5,000 to $9,999	**20.00%**	14
$1,000 to $4,999	**18.57%**	13
Less than $1,000	**20.00%**	14
Nothing	**11.43%**	8
Not Sure	**28.57%**	20
Total		**70**

Q21 Which of the following incentives would encourage you to spend money to retrofit your home to protect against natural disasters? (Check all that apply)

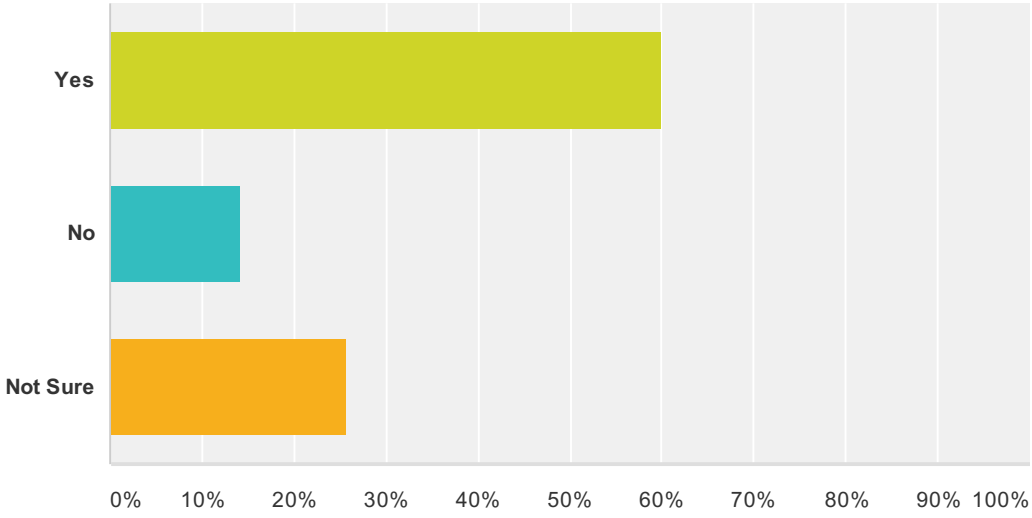
Answered: 70 Skipped: 20



Answer Choices	Responses	
Insurance premium discount	**64.29%**	45
Mortgage discount	**38.57%**	27
Low interest rate loan	**35.71%**	25
Grant funding	**71.43%**	50
None	**17.14%**	12
Other (please specify)	**4.29%**	3
Total Respondents: 70		

Q22 If your property were located in a designated “high hazard” area or had received repetitive damages from a natural hazard event, would you consider a ”buyout” offered by a public agency?

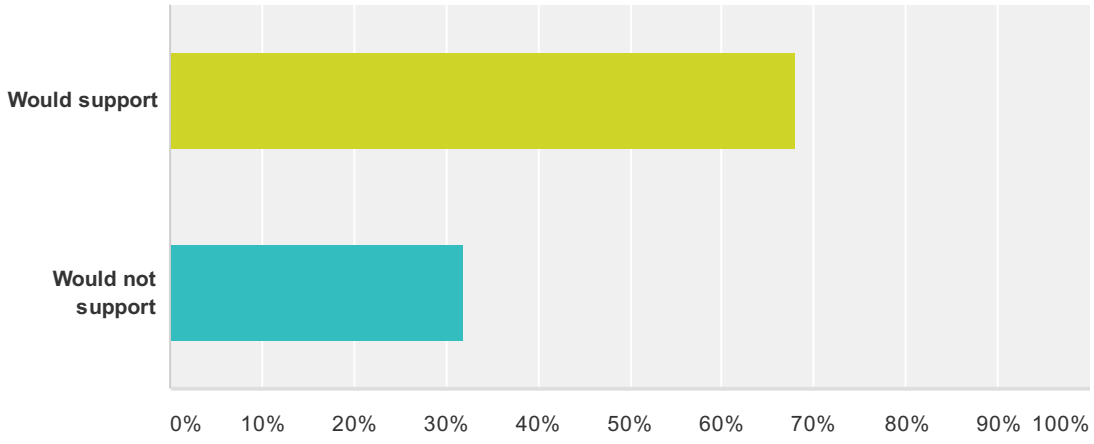
Answered: 70 Skipped: 20



Answer Choices	Responses	
Yes	**60.00%**	42
No	**14.29%**	10
Not Sure	**25.71%**	18
Total		**70**

Q23 Would you support the regulation (restriction) of land uses within known high hazard areas?

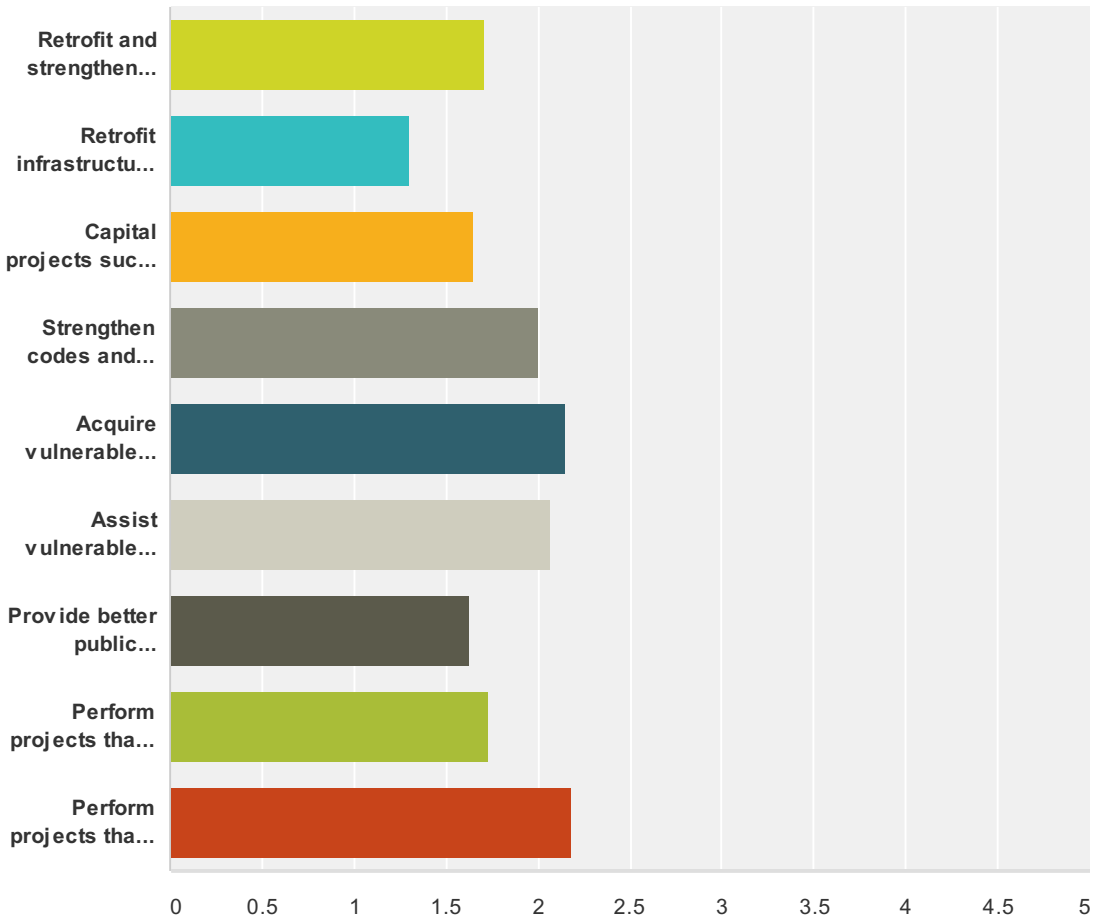
Answered: 69 Skipped: 21



Answer Choices	Responses	
Would support	**68.12%**	47
Would not support	**31.88%**	22
Total		**69**

Q24 What types of projects do you believe the County, State or Federal government agencies should be doing in order to reduce damage and disruption from hazard events within Fremont County? Please rank each option as a high, medium or low priority.

Answered: 68 Skipped: 22

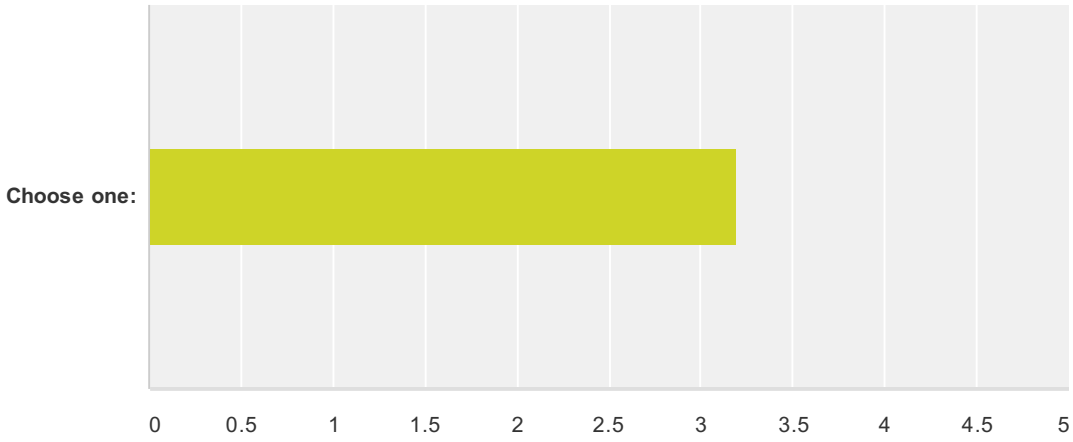


	High	Medium	Low	Total	Average Rating
Retrofit and strengthen essential facilities such as police, fire, schools and hospitals.	**44.12%** 30	**41.18%** 28	**14.71%** 10	68	1.71
Retrofit infrastructure such as roads, bridges, drainage facilities, levees, water supply, waste water and power supply facilities.	**70.15%** 47	**29.85%** 20	**0.00%** 0	67	1.30
Capital projects such as dams, levees, flood walls, drainage improvements and bank stabilization projects.	**43.94%** 29	**46.97%** 31	**9.09%** 6	66	1.65
Strengthen codes and regulations to include higher regulatory standards in hazard areas.	**30.30%** 20	**39.39%** 26	**30.30%** 20	66	2.00
Acquire vulnerable properties and maintain as open space.	**19.40%** 13	**46.27%** 31	**34.33%** 23	67	2.15

Assist vulnerable property owners with securing funding for mitigation.	**17.91%** 12	**56.72%** 38	**25.37%** 17	67	2.07
Provide better public information about risk, and the exposure to hazards within the operational area.	**41.79%** 28	**53.73%** 36	**4.48%** 3	67	1.63
Perform projects that restore the natural environments capacity to absorb the impacts from natural hazards.	**42.42%** 28	**42.42%** 28	**15.15%** 10	66	1.73
Perform projects that mitigate the potential impacts from climate change.	**19.70%** 13	**42.42%** 28	**37.88%** 25	66	2.18

Q25 Please indicate how you feel about the following statement: It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks associated with natural hazards.

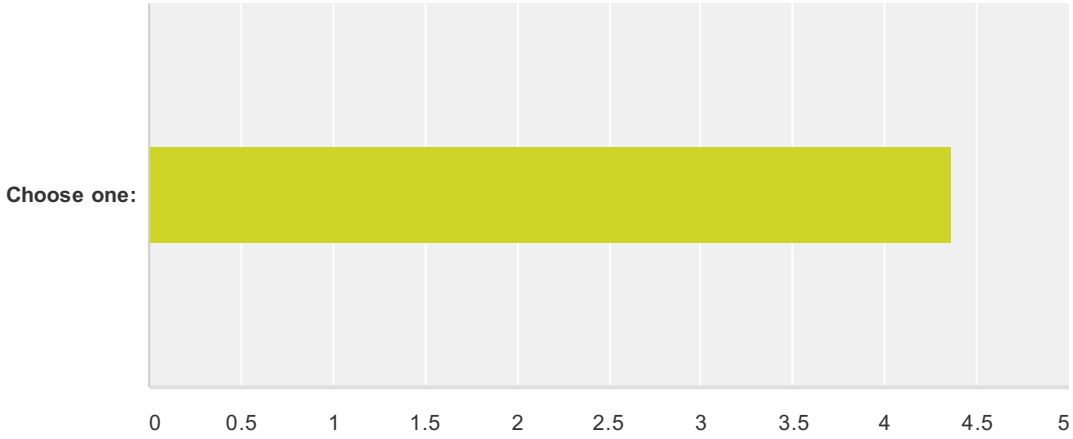
Answered: 69 Skipped: 21



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Average Rating
Choose one:	**20.29%** 14	**10.14%** 7	**15.94%** 11	**37.68%** 26	**15.94%** 11	69	3.19

Q26 Please indicate how you feel about the following statement: It is my responsibility to educate myself and take actions that will reduce my exposure to the risks associated with natural hazards.

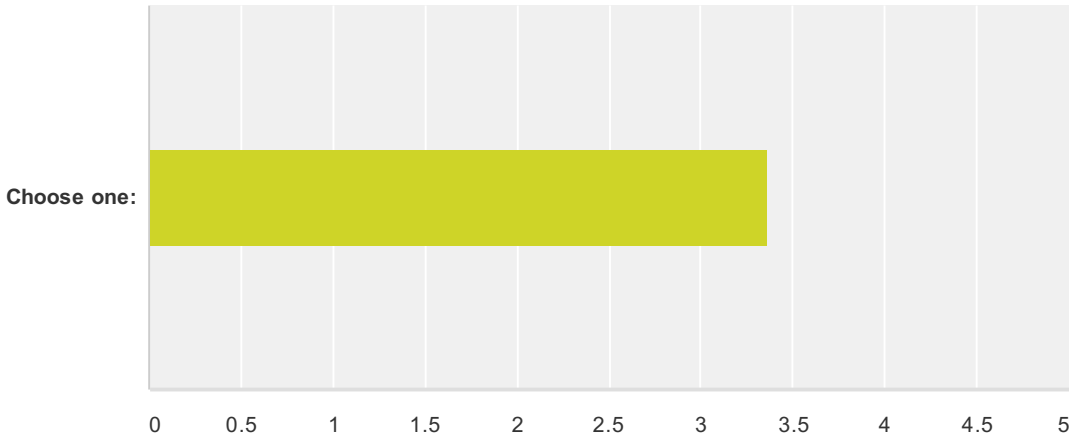
Answered: 70 Skipped: 20



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Average Rating
Choose one:	**4.29%** 3	**2.86%** 2	**5.71%** 4	**27.14%** 19	**60.00%** 42	70	4.36

Q27 Please indicate how you feel about the following statement: Information about the risks associated with natural hazards is readily available and easy to locate.

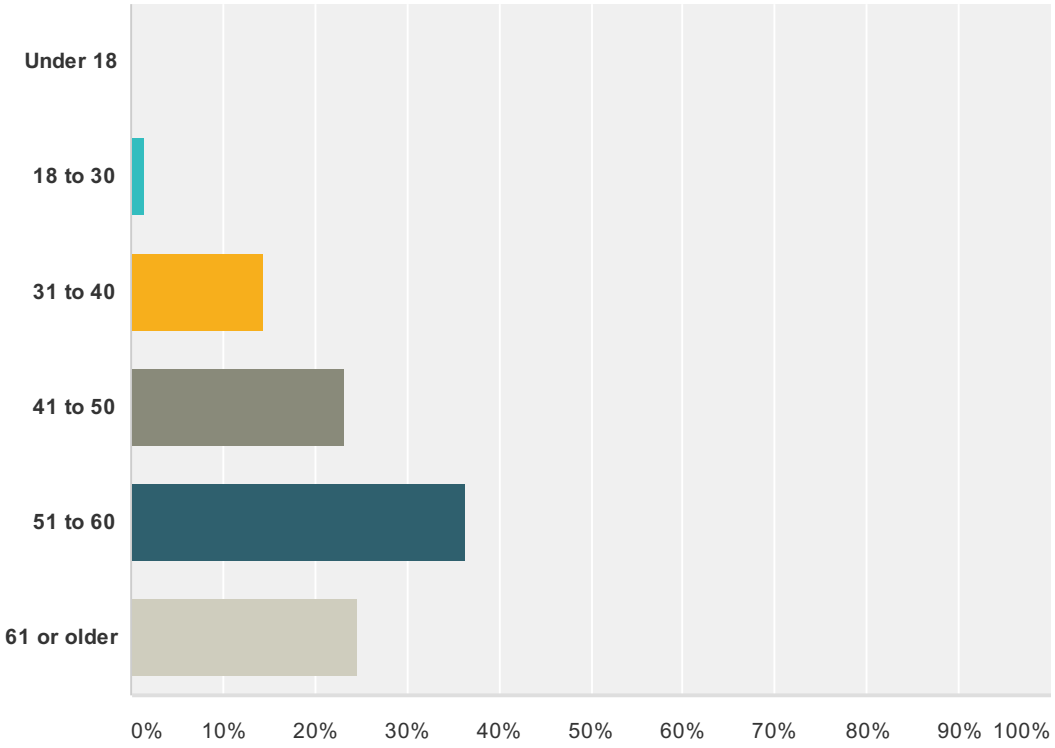
Answered: 70 Skipped: 20



	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	Total	Average Rating
Choose one:	**10.00%** 7	**18.57%** 13	**18.57%** 13	**31.43%** 22	**21.43%** 15	70	3.36

Q28 Please indicate your age range:

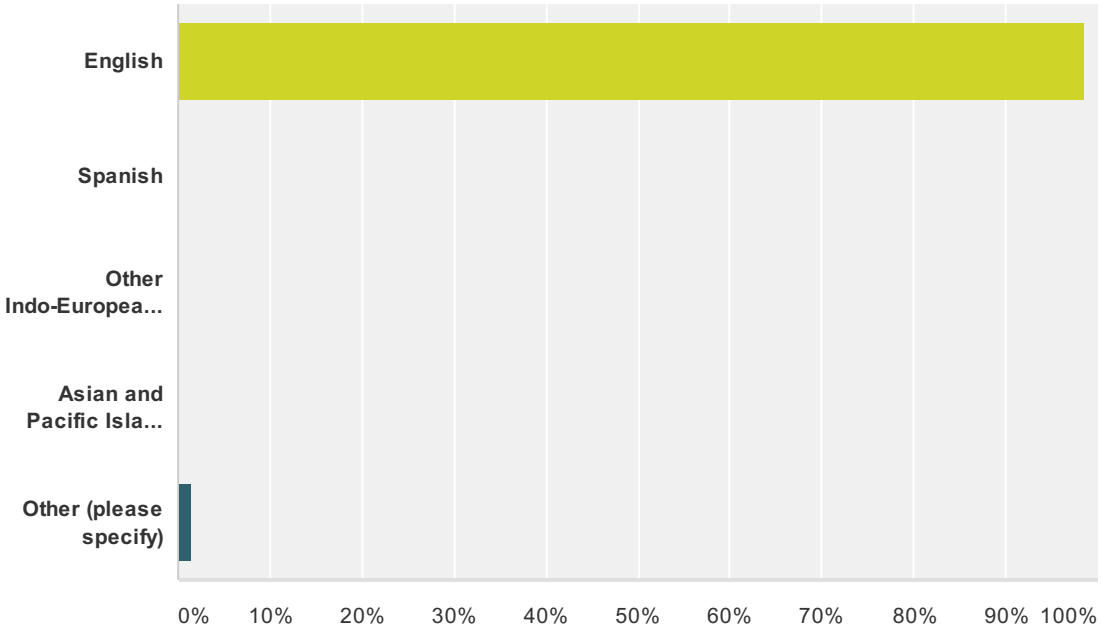
Answered: 69 Skipped: 21



Answer Choices	Responses	
Under 18	**0.00%**	0
18 to 30	**1.45%**	1
31 to 40	**14.49%**	10
41 to 50	**23.19%**	16
51 to 60	**36.23%**	25
61 or older	**24.64%**	17
Total		**69**

Q29 Please indicate the primary language spoken in your household.

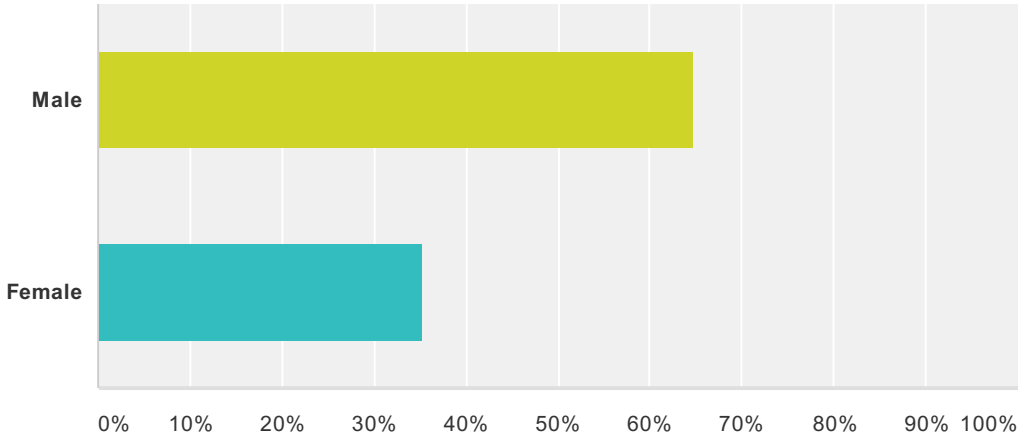
Answered: 69 Skipped: 21



Answer Choices	Responses	
English	**98.55%**	68
Spanish	**0.00%**	0
Other Indo-European Languages	**0.00%**	0
Asian and Pacific Island Languages	**0.00%**	0
Other (please specify)	**1.45%**	1
Total		**69**

Q30 Please indicate your gender:

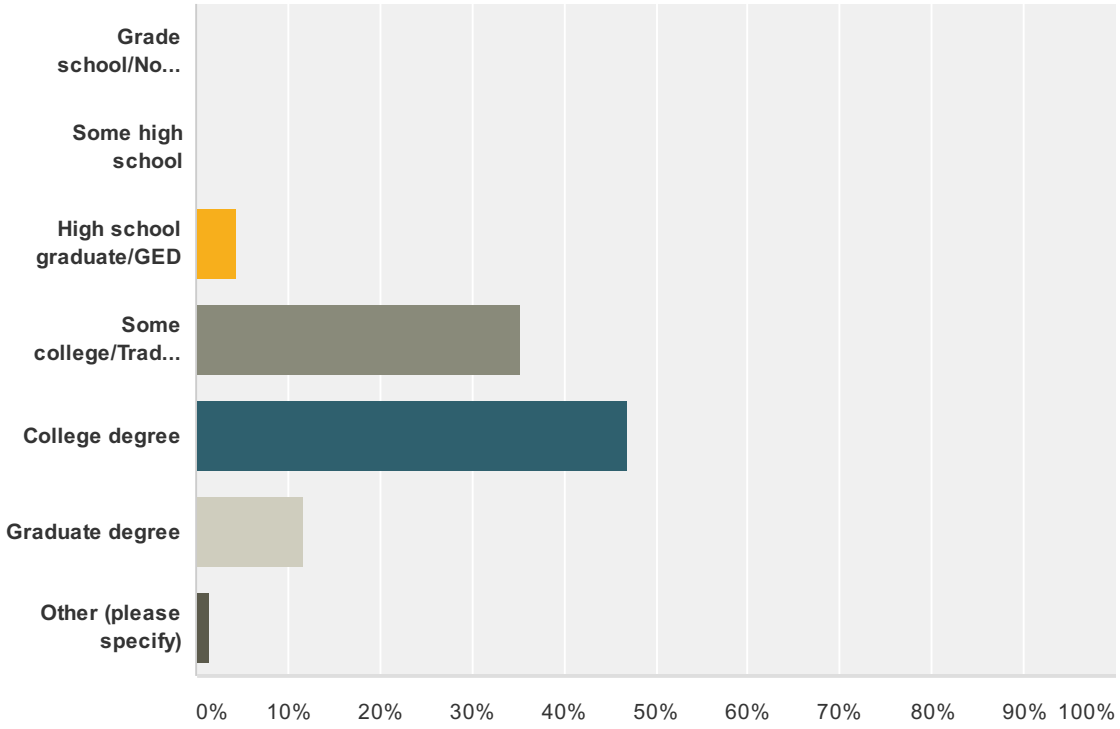
Answered: 68 Skipped: 22



Answer Choices	Responses	
Male	**64.71%**	44
Female	**35.29%**	24
Total		**68**

Q31 Please indicate your highest level of education.

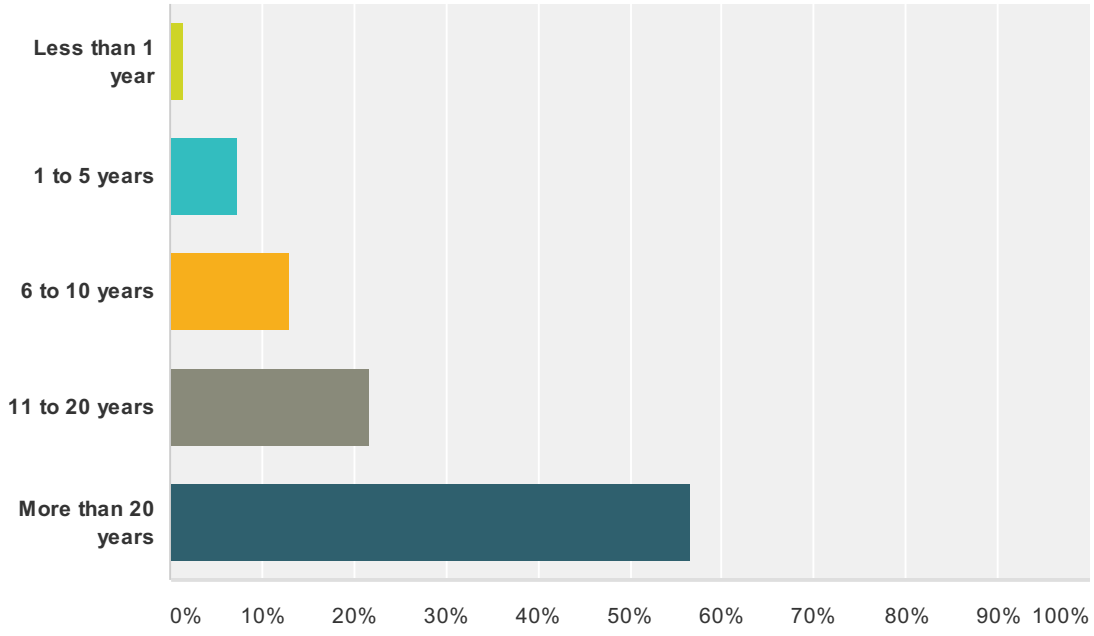
Answered: 68 Skipped: 22



Answer Choices	Responses	
Grade school/No schooling	**0.00%**	0
Some high school	**0.00%**	0
High school graduate/GED	**4.41%**	3
Some college/Trade school	**35.29%**	24
College degree	**47.06%**	32
Graduate degree	**11.76%**	8
Other (please specify)	**1.47%**	1
Total		**68**

Q32 How long have you lived in Fremont County?

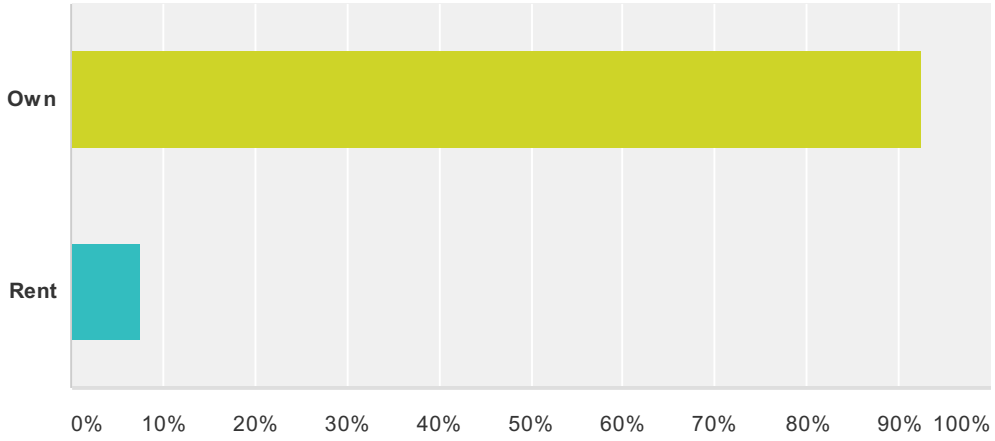
Answered: 69 Skipped: 21



Answer Choices	Responses	
Less than 1 year	**1.45%**	1
1 to 5 years	**7.25%**	5
6 to 10 years	**13.04%**	9
11 to 20 years	**21.74%**	15
More than 20 years	**56.52%**	39
Total		**69**

Q33 Do you own or rent your place of residence?

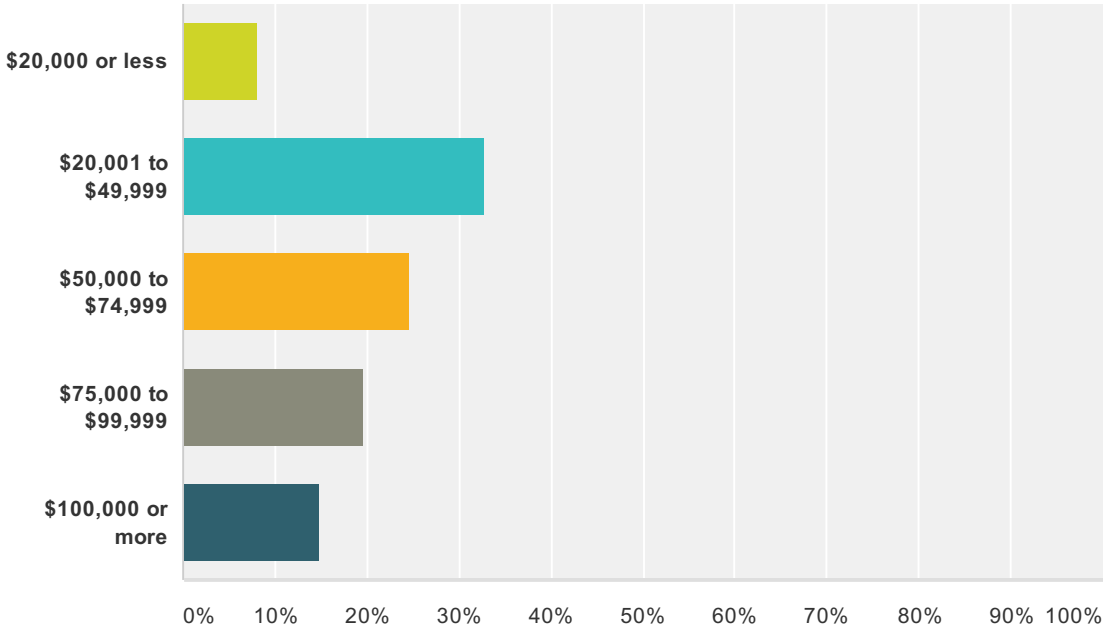
Answered: 67 Skipped: 23



Answer Choices	Responses	
Own	**92.54%**	62
Rent	**7.46%**	5
Total		**67**

Q34 How much is your gross household income?

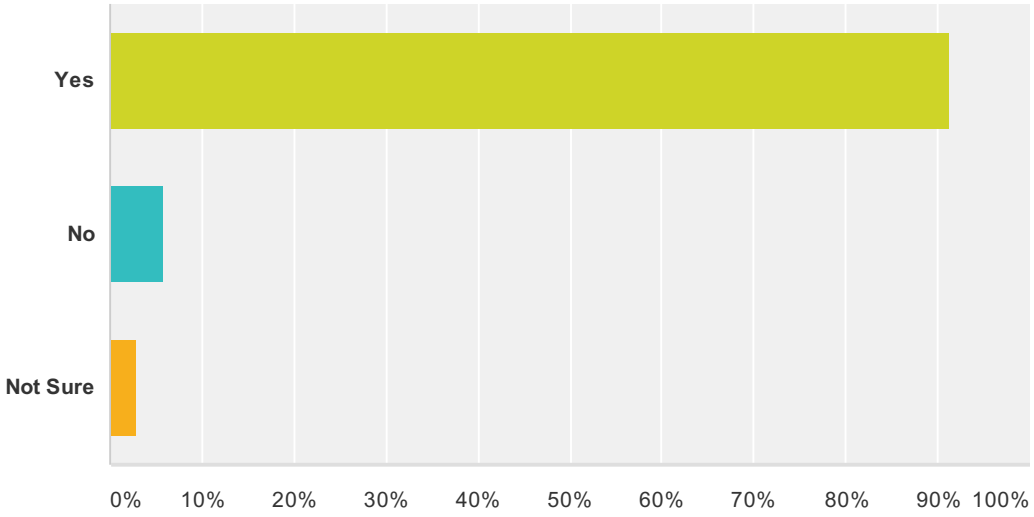
Answered: 61 Skipped: 29



Answer Choices	Responses	
$20,000 or less	**8.20%**	5
$20,001 to $49,999	**32.79%**	20
$50,000 to $74,999	**24.59%**	15
$75,000 to $99,999	**19.67%**	12
$100,000 or more	**14.75%**	9
Total		**61**

Q35 Do you have regular access to the Internet?

Answered: 69 Skipped: 21



Answer Choices	Responses	
Yes	**91.30%**	63
No	**5.80%**	4
Not Sure	**2.90%**	2
Total		**69**

Q36 Comments

Answered: 15 Skipped: 75

APPENDIX C.
MENU OF MITIGATION ALTERNATIVES

APPENDIX C.
MENU OF MITIGATION ALTERNATIVES

Mitigation Categories

The measures that communities and individuals can use to protect themselves from, or mitigate the impacts of, natural and man-made hazards fall into six categories:

1. Public Information and Education
2. Preventive Measures
3. Structural Projects
4. Property Protection
5. Emergency Services, and
6. Natural Resources Protection

SAMPLE MITIGATION INITIATIVES:

Hazard: All Hazards

- Incorporate an Emergency Telephone Notification System into the County/Community Emergency Communications Center
- Construct a new Emergency Operations Center
- Develop a Master Generator Plan for the Lake County
- Public Education & Information Program Development
- Develop a Special Needs registry through the 9-1-1 databases to assist with educating, alerting, evacuating, or responding to vulnerable populations during disaster
- Provide for back-up power sources for County essential services facilities to avoid water shortages during extended power outages
- Provide backup power generators to fueling facilities
- Develop enhanced Emergency Planning for Special Needs populations in the County/Community Emergency Operations Plan and other planning documents
- Work with County Businesses to Develop a disaster Resistant Business Program
- Develop a comprehensive public education program on the dangers of carbon monoxide during extended power outages
- Develop multi-lingual Disaster Education public service announcements and educational videos
- Develop a separate “public safety” information area in all public libraries and public recreation facilities to disseminate disaster safety information appropriate to the area and the season
- Train/Educate builders, developers, architects and engineers in techniques of disaster-resistant homebuilding
- Develop and begin to implement a systematic process to evaluate and upgrade aging infrastructure such as transportation, drainage, utilities, and others that could be affected during a major natural disaster.
- Collaborate with other stakeholders (public, businesses, non-profit organizations, government and regulatory agencies, and others) for public outreach efforts.
- Continue the public outreach strategy to share responsibilities amongst the citizens, federal, state, and local governments.
- Develop and maintain the County’s Office of Emergency Management natural hazards website.
- Continue to pursue additional grants to implement risk reduction projects.
- Develop preparedness guides for County/Community residents and businesses.
- Continue to improve the communication of severe weather warnings, flood warning, and related information.

- Distribute NOAA weather radios to residents that are most vulnerable to severe weather.
- Identify which critical facilities currently have weather radios and feasibility of hard-wiring.
- Develop an improved critical facilities dataset to use in emergency planning efforts and in the 2018 mitigation plan update.
- Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.
- Pursue "Storm Ready" designation
- Adopt Continuity of Operations Plans for all applicable hazards
- Enforce or initiate triggers guiding improvements to structures such as: (< 50% substantial damage/improvements)
- Provide redundancy for critical facilities

Hazard: Floods, Dam/Levee Failure

- Evaluate repetitive loss properties and potential solutions to mitigate existing conditions.
- Continue National Flood Insurance Program (NFIP) and improve the County's Community Rating System (CRS) classification. Examine criteria and establish roles and responsibilities for completion.
- Acquire and remove Repetitive Loss Properties and repeatedly flooded properties where the County's Repetitive Loss and master drainage plans identify acquisition to be the most cost effective and desirable mitigation measure
- Implement structural and non-structural flood mitigation measures for flood-prone properties, as recommended in the basin-wide master drainage plans
- Develop a Dam/Levee Public Education and Evacuation Plan for targeted areas of the community
- Continue to update and revise Basin-wide Master Drainage Plans where changed conditions warrant
- Develop an outreach program aimed at identifying and assisting private dam owners with repairing or decommissioning at risk dams.
- Provide stricter floodplain regulations along the Arkansas River corridor.
- Consider establishing an administrative procedure or change in County/City codes for requiring builders to develop a site drainage plan ensuring "no adverse impact" when they apply for permits for new residential construction.
- Complete GIS and other automated inventories for stormwater, problem drainage areas, DFIRM and other City assets.
- Review compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.

Hazard: Tornadoes, High Winds

- Develop a model SafeRoom project for a Mobile Home Park in the Lake County
- Develop a SafeRoom plan for County/Community facilities
- Individual SafeRoom rebate program
- Educate residents, building professionals and SafeRoom vendors on the ICC/NSSA "Standard for the Design and Construction of Storm Shelters" and consider incorporating into current regulatory measures
- Develop a program which encourages residents to trim or remove trees that could affect power lines
- Develop a program which encourages residents to obtain a NOAA weather radio.
- Secure emergency generators (or alternative power sources) for all critical and vital facilities
- Develop a program which encourages residents to be prepared including generators, 72-hour self-sufficiency kits, NOAA radios, etc.
- Support programs such as "Tree Watch" that proactively manage problem areas by use of selective removal of hazardous trees, tree replacement, etc.

- Establish and enforce building codes that require all roofs to withstand high wind loads
- Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors
- Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines

Hazard: Lightning

- Install Lightning Warning & Alert Systems in public recreation areas
- Install lightning rods on public structures

Hazard: Expansive Soils

- Research the applicability of establishing an administrative procedure or change in County codes for requiring builders to check for expansive soils when they apply for permits for new residential construction and for using foundations that mitigate expansive soil damages when in a moderate or high-risk area.

Hazard: Extreme Heat

- Review the safety of Playground materials during extreme heat events

Hazard: Wildfire

- Implement a Firewise Community Education and Information Program
- Research the availability of use of possible weapons of mass destruction funds available to enhance fire capability in High Risk areas.
- Create and maintain defensible space around structures and infrastructure
- Update building codes to require the use of fire-retardant building materials in high fire hazard areas
- Require Higher regulatory standards - such as a prohibition on combustible roof materials
- Continue to develop partnerships with other organizations to implement wildfire mitigation plans and other hazard reduction programs.
- Complete and maintain a Community Wildfire Protection Plan including the assessment of parcels identified in the Wildland Urban Interface.
- Work with Colorado Forestry Association and Department of Natural Resources to review zoning and ordinances to identify areas to include wildfire mitigation principles.
- Investigate the status of and need to create additional emergency vehicle access in high hazard areas
- Seek alternative water supplies in urban wildland interface areas.

***Hazard:* Earthquake**

- Incorporate earthquakes in the Office of Emergency Management public outreach strategy.
- Work with Colorado Geological to continue the study and analyze earthquakes related to appropriate levels of seismic safety in building codes and practices.
- Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities.
- Develop a post disaster action plan that includes a grant funding and debris removal components.

***Hazard:* Avalanche**

- Ensure hazard maps are current and updated on a regular basis
- Enact tools to help manage development in hazard areas: better land controls, tax incentives, information

- Develop strategy to take advantage of post-disaster opportunities as they arise
- Continue to educate the public on the avalanche hazard and appropriate risk reduction alternatives.

Hazard: **Drought**

- Develop a public education on drought resistance
- Identify alternative water supplies for time of drought. Mutual aid agreements with alternative suppliers.
- Consider providing incentives to property owners that utilize drought resistant landscapes in the design of their homes.
- Develop standards that require drought resistant landscapes on County and community owned facilities
- Implement stormwater retention in regions ideally suited for groundwater recharges.
- Develop a residential and local business program to modify plumbing systems - i.e., water saving kits

APPENDIX D.
WORKSHEETS FOR RECOMMENDED MITIGATION ACTIONS

APPENDIX D.
WORKSHEETS FOR RECOMMENDED MITIGATION ACTIONS

The planning partners and the Steering Committee determined that some actions could be implemented to provide hazard mitigation benefits. The individual worksheets for each recommended action are provided in this appendix.

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 1
Mitigation Action/Initiative: Public Information and Awareness

Assessing the Risk	
Hazard(s) addressed:	Multi - All
Specific problem being mitigated:	Potential impacts of natural hazards on residents, business owners and visitors
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Firewise, Flooding and general hazard awareness training and education presentations brought to the community
	2. Require residents and business owners to attend mitigation awareness class
	3. Do nothing
Action/Project Intended for Implementation	
Description of Selected Action/Project	Bring all-hazard awareness and education to public venues (Using the Firewise Trailer)
Action/Project Category	Education and Awareness Programs (EAP)
Goals/Objectives Met	G1,2,3, 5 & 8 O1B,C, 2A, 3A & 5A
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	OEM
Potential Funding Sources	County Budget for OEM and Volunteer Time, available grants.
Timeline for Completion	Ongoing
Reporting on Progress	

*** Refer to results of Prioritization (page 2)**

Prioritization

Number:
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	General education and awareness may have direct impact on Life Safety for Public
Property Protection	1	
Cost-Effectiveness	1	Cost is minimal as vehicle and material is paid for or free
Technical	1	SME's will provide education
Political	0	Not political in nature
Legal	1	
Fiscal	1	
Environmental	1	Improve individual mitigation awareness
Social	0	No impact
Administrative	0	Overseen by OEM as part of duties
Multi-Hazard	1	Primarily Fire related but has all hazards aspects
Timeline	1	Ongoing
Agency Champion	1	OEM
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 2
Mitigation Action/Initiative: Floodplain Mapping – Swissvale Community

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Mapping of Zone A floodplain and around the Swissvale community
	2. Observe and document future occurrences
	3. Do nothing
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mapping of area within Zone A flood zone
Action/Project Category	Natural Systems Protection (NRP)
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within a flood zone
Estimated Cost	$45,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 2
Mitigation Action/Initiative: Flood Plain Mapping – Swissvale Community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Flood Plain
Property Protection	1	Will keep new structures from being built in actual flood plain
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 3
Mitigation Action/Initiative: Floodplain Mapping – Howard Community

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Mapping of Zone A flood plain and around the Howard community
	2. Observe and document future occurrences
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mapping of area within Zone A flood zone
Action/Project Category	NRP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting.
Estimated Cost	$50,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 3
Mitigation Action/Initiative: Floodplain Mapping – Howard Community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into floodplain
Property Protection	1	Will keep new structures from being built in actual floodplain
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 4
Mitigation Action/Initiative: Flood Plain Mapping – Cotopaxi Community

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Mapping of Zone A floodplain and around the Cotopaxi community
	2. Observe and document future occurrences
	3. Do nothing
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mapping of area within Zone A flood zone
Action/Project Category	NRP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting.
Estimated Cost	$40,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 4
Mitigation Action/Initiative: Flood Plain Mapping – Cotopaxi Community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Flood Plain
Property Protection	1	Will keep new structures from being built in actual flood plain
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 5
Mitigation Action/Initiative: Detailed Floodplain Mapping – Texas Creek Community

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Mapping of Zone A floodplain and around the Texas Creek community
	2. Observe and document future occurrences
	3. Do nothing
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mapping of area within Zone A flood zone
Action/Project Category	NRP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting. More accurate inundation areas.
Estimated Cost	$40,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 5
Mitigation Action/Initiative: Detailed Floodplain Mapping – Texas Creek Community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Floodplain
Property Protection	1	Will keep new structures from being built in actual floodplain
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 6
Mitigation Action/Initiative: Detailed Floodplain Mapping – Penrose Area

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Mapping of Zone A floodplain around the Unincorporated town of Penrose
	2. Observe and document future flood occurrences
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mapping of area within Zone A flood zone
Action/Project Category	NRP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting. More accurate inundation areas.
Estimated Cost	$150,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 6
Mitigation Action/Initiative: Detailed Floodplain Mapping – Penrose Area

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Floodplain
Property Protection	1	Will keep new structures from being built in actual floodplain
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 7
Mitigation Action/Initiative: Detailed Floodplain Mapping – C-3 and C-4 Dam Area

Assessing the Risk	
Hazard(s) addressed:	Flood, dam failure
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Detailed Base Flood Mapping of inundation areas of dams C-3 and C-4 to the Arkansas River
	2. Observe and document future flood occurrences
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Base Flood Mapping of area within inundation zones of both C-3 and C-4 dams
Action/Project Category	NRP
Goals/Objectives Met	G2, 6, 7, &8 O2A, 2B, 6B, 7B, & 8A
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting. More accurate inundation areas. Determines evacuation zone in case of dam failure.
Estimated Cost	$150,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

Prioritization

Number: 6
Mitigation Action/Initiative: Detailed Floodplain Mapping – Penrose Area

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Floodplain
Property Protection	1	Will keep new structures from being built in actual floodplain and identify those that are within
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 8
Mitigation Action/Initiative: Floodway Determination Mapping of Arkansas River from Ash Street to S.H. 115

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Floodway determination mapping of Arkansas River in Eastern Fremont County from Ash Street in Canon City to S.H. 115, east of Florence.
	2. Observe and document future occurrences
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Floodway determination mapping of Arkansas River in Eastern Fremont County
Action/Project Category	NRP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Higher control of building locations within flood zone. Detailed mapping allows more accurate building siting. More accurate inundation areas.
Estimated Cost	$90,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont County Planning and Zoning
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

Number: 8

Mitigation Action/Initiative: Floodway Determination Mapping of Arkansas River Ash Street to Pueblo County line

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keeps residents from moving into Floodway
Property Protection	1	Will keep new structures from being built in actual floodway and identify those that are within
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement
Environmental	0	No Impact
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	0	
Other Community Objectives	0	
Total	8	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 9
Mitigation Action/Initiative: Beaver Park and Bear Creek Retention/Detention Ponds

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding from the Bear creek drainage in Penrose
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Construct detention ponds for the Bear Creek Drainage through Penrose to prevent flooding issues on private lands and county roadways
	2. Divert or pipe flows away from private lands and county roadways.
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Construct a series of 8 detention ponds on Bear Creek to prevent flooding on private lands and county roads
Action/Project Category	SIP
Goals/Objectives Met	G6&7 O6B7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Protects buildings and infrastructure from damage caused by flooding along the Bear Creek drainage
Estimated Cost	$36,000
Priority*	High
Plan for Implementation	
Responsible Organization	Fremont DOT
Potential Funding Sources	Fremont County, CWCB, NRCS
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 9
Mitigation Action/Initiative: Beaver Park and Bear Creek Retention/Detention Ponds

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	NRCS will provide technical help
Political	0	
Legal	1	
Fiscal	1	Will need grant funds to implement along with County funds
Environmental	1	
Social	0	No impact
Administrative	1	
Multi-Hazard	0	Flood related
Timeline	1	Can be done in near future if funds are available
Agency Champion	1	Fremont DOT
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

.

Name of Jurisdiction: Fremont County
Number: 10
Mitigation Action/Initiative: Right-of-Way Debris Management

Assessing the Risk	
Hazard(s) addressed:	Severe Storms, Wildfire, Severe Winter Storms
Specific problem being mitigated:	Debris removal to provide firebreaks, snow storage areas, etc.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Removal and clearing of debris and vegetation along County Right of ways in order to utilize areas as firebreaks and for snow storage during winter storms and for temporary clearance of debris from flooding and windstorms
	2. Haul and store snow offsite
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Clear ROW for multiple uses
Action/Project Category	NRP
Goals/Objectives Met	G4, 6, 7 O6A, 7A &7D
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Medium
Priority*	High
Plan for Implementation	
Responsible Organization	FDOT, OEM (coordination with State Forest Service)
Potential Funding Sources	County Budget for DOT, available grants.
Timeline for Completion	Ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 10
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	Not political in nature
Legal	1	
Fiscal	1	
Environmental	1	
Social	0	No impact
Administrative	0	Overseen by FDOT as part of duties
Multi-Hazard	1	Fire, high winds, severe winter storm
Timeline	1	Ongoing
Agency Champion	1	OEM
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 11
Mitigation Action/Initiative: Wildfire protection

Assessing the Risk	
Hazard(s) addressed:	Wildfire
Specific problem being mitigated:	Wildfire risk awareness and identification of wildfire risk areas
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Develop Community Wildfire Protection Plans for localized areas not currently covered by a CWPP
	2. Rely on countywide CWPP
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Develop and implement CWPPs for different areas of the County
Action/Project Category	EAP
Goals/Objectives Met	G2 O 2C
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Medium
Priority*	High
Plan for Implementation	
Responsible Organization	OEM and local fire districts, Federal agencies
Potential Funding Sources	County Budget for OEM , available grants.
Timeline for Completion	Ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 11
Mitigation Action/Initiative: Wildfire protection

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	General education and awareness may have direct impact on Life Safety for Public
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	
Environmental	1	Improve individual mitigation awareness
Social	0	Improve individual mitigation awareness
Administrative	0	Overseen by OEM and local fire districts as part of duties
Multi-Hazard	1	
Timeline	1	Near-term
Agency Champion	1	OEM and local fire districts
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont County
Number: 12
Mitigation Action/Initiative: Fuel Reduction and increase carrying capacity of drainage channel – Phantom Canyon drainage

Assessing the Risk	
Hazard(s) addressed:	Flooding and Wildfire
Specific problem being mitigated:	Debris plugging the channel and flood water eroding the roadway / bridges and removal of burnable fuels
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Removal of down / dead trees within the channel and fuels for wildfire
	2. Do Nothing
	3. Create alternative storage capacity
Action/Project Intended for Implementation	
Description of Selected Action/Project	Ensure adequate flow of major drainage and removal of fuel loading
Action/Project Category	(NRP)Natural Systems Protection
Goals/Objectives Met	G1 O1C, G6 & 7 O6A & 7A&B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Prevent road flooding, limit spread of wildfire, loss of life and property damage
Estimated Cost	Labor and equipment cost vary with amount of work needed. $2,000,000 est.
Priority*	High
Plan for Implementation	
Responsible Organization	Fremont county/government entity(BLM) or land owner
Local Planning Mechanism	County and BLM Budgets
Potential Funding Sources	Grant Funding with local cost share
Timeline for Completion	Long term / ongoing
Reporting on Progress	

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 12
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	0	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 13
Mitigation Action/Initiative: Stream Channel Armoring

Assessing the Risk	
Hazard(s) addressed:	Flooding/Storm Events
Specific problem being mitigated:	Channel erosion at pipeline crossings
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Armoring stream and dry wash pipelines
	2. Culvert stream
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Armoring stream and dry wash pipeline crossings in channels vulnerable to erosion
Action/Project Category	SIP
Goals/Objectives Met	G3, 6 & 7 O3B, 6B, 7B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Prevention of SSOs
Estimated Cost	$765,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Long term to implement
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 13
Mitigation Action/Initiative: Stream Channel Armoring

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Minimize pathogens discharged to streams
Property Protection	0	
Cost-Effectiveness	0	Expensive
Technical	1	Long term
Political	-1	Minimal public awareness
Legal	1	Pipeline protection required
Fiscal	-1	Cannot be funded under current budgets
Environmental	1	SSO prevention by minimizing damage to pipelines at crossings
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	0	
Timeline	-1	Long term project
Agency Champion	1	FSD
Other Community Objectives	0	Benefits FSD infrastructure mainly
Total	3	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 14
Mitigation Action/Initiative: Fuel Storage

Assessing the Risk	
Hazard(s) addressed:	All Hazards
Specific problem being mitigated:	Availability of fuel during hazard events
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Mobile fuel storage containers and truck 2. Additional USTs 3. Alternate transportation (UTVs)
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mobile fuel storage containers and truck
Action/Project Category	SIP
Goals/Objectives Met	G3 & 6 O3B & 6B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Maintain functionality of WWTP, collections and construction equipment and transportation
Estimated Cost	$78,700
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Short term, once implemented.
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 14
Mitigation Action/Initiative: Fuel Storage

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Maintain WWTP, collections and construction crew functionality
Property Protection	1	Maintain WWTP, collections and construction crew functionality
Cost-Effectiveness	0	Access to fuel rarely interrupted
Technical	1	Long term
Political	-1	Minimal public awareness
Legal	0	No requirements
Fiscal	-1	Cannot be funded under current budgets
Environmental	1	SSO prevention by maintaining construction and collections functionality
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	1	Multiple causes of fuel shortages
Timeline	1	Implementation in less than 5 years
Agency Champion	1	FSD staff support
Other Community Objectives	1	Functioning workforce could assist other entities
Total	7	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 15
Mitigation Action/Initiative: Watertight manhole lids

Assessing the Risk	
Hazard(s) addressed:	Flooding
Specific problem being mitigated:	Minimize excessive inflow at WWTP during storm/flood events.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Watertight manhole lids
	2. Dike and flood gates surrounding WWTP (expense)
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Installation of 554 watertight frames and lids located in floodplains.
Action/Project Category	SIP
Goals/Objectives Met	G3 & 7 O3B &7B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Maintain WWTP functionality. Prevent SSO to Arkansas River.
Estimated Cost	$277,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Short term, once implemented.
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 15
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Minimize pathogen discharge to Arkansas River
Property Protection	-1	Minimal damage reduction to property
Cost-Effectiveness	1	Minimal cost to prevent SSO
Technical	1	Long term
Political	-1	Minimal public awareness
Legal	0	
Fiscal	-1	Cannot be funded under current budgets
Environmental	1	Prevent SSO to Arkansas River
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	0	Limited to storm events and flooding
Timeline	1	Implementation in less than 5 years
Agency Champion	1	FSD staff support
Other Community Objectives	0	
Total	4	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 16
Mitigation Action/Initiative: Backup Communication System

Assessing the Risk	
Hazard(s) addressed:	All Hazards
Specific problem being mitigated:	Communication in absence of power and cellular network function
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Acquisition of two-way radios 2. Satellite phones (limitations, expense) 3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Two way radio system for alternate means of communication
Action/Project Category	SIP
Goals/Objectives Met	G3 & 4 O3A & 4A
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Coordination and organization of treatment, collections & construction activities.
Estimated Cost	$5975
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Short term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 16
Mitigation Action/Initiative: Backup Communication System

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Maintain collection and construction crew functionality
Property Protection	1	Maintain collection and construction crew functionality
Cost-Effectiveness	0	Minimal cost, but rarely lose cell service long term
Technical	0	Limited life
Political	-1	Minimal public awareness
Legal	0	No requirements
Fiscal	-1	Cannot be funded under current budgets
Environmental	-1	
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	1	
Timeline	1	Implementation in less than 5 years
Agency Champion	1	FSD
Other Community Objectives	0	
Total	3	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 17
Mitigation Action/Initiative: Backup Power Generator at Service Center

Assessing the Risk	
Hazard(s) addressed:	All Hazards
Specific problem being mitigated:	Prolonged electrical outage at Fremont Sanitation District service center.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Diesel powered generators at service center
	2. Additional backup generator at WWTP (expense)
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	(2) 25 kW Diesel powered generators
Action/Project Category	SIP
Goals/Objectives Met	G6 O6B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Backup power would maintain functionality of collections, construction and management during emergency situations.
Estimated Cost	$38,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Short term, once implemented.
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 17
Mitigation Action/Initiative: Backup Communication System

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Maintain collection and construction crew functionality
Property Protection	1	Maintain collection and construction crew functionality
Cost-Effectiveness	0	Long term outages are rare
Technical	1	Long term
Political	-1	Minimal public awareness
Legal	0	No requirements
Fiscal	-1	Cannot be funded under current budgets
Environmental	1	SSO prevention by maintaining construction and collections functionality
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	1	Multiple causes of outages
Timeline	1	Implementation in less than 5 years
Agency Champion	1	FSD
Other Community Objectives	1	Functioning workforce could assist other entities
Total	7	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Fremont Sanitation Dist./Fremont County/City of Canon City/Florence
Number: 18
Mitigation Action/Initiative: UV Disinfection System Upgrade

Assessing the Risk	
Hazard(s) addressed:	Flooding/Storm events
Specific problem being mitigated:	Increased inflow at WWTP
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Upgrade UV disinfection system capacity
	2. Dike and flood gates surrounding WWTP (expense)
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Upgrade UV disinfection system to increase treatment capacity
Action/Project Category	SIP
Goals/Objectives Met	G3 & 7 O3B &7B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Avoid loss of WWTP functionality, minimize SSO to Arkansas River.
Estimated Cost	$450,000
Priority*	Medium
Plan for Implementation	
Responsible Organization	Fremont Sanitation District
Potential Funding Sources	Grant funding with possible Fremont Sanitation District cost share.
Timeline for Completion	Less than 5 years to implement, once initiated.
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 18
Mitigation Action/Initiative: UV Disinfection System Upgrade

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Minimize pathogen discharge to Arkansas River
Property Protection	-1	
Cost-Effectiveness	1	Currently the limiting factor in WWTP capacity
Technical	1	Long term
Political	-1	Minimal public awareness
Legal	-1	No requirements to meet current normal demand
Fiscal	-1	Cannot be funded under current budgets
Environmental	1	Minimize SSO to Arkansas River
Social	0	NA
Administrative	1	Could be implemented by Fremont Sanitation District
Multi-Hazard	0	
Timeline	1	Could be implemented in less than 5 years
Agency Champion	1	FSD
Other Community Objectives	0	
Total	3	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Name of Jurisdiction: Western Fremont Fire Protection District
Number: 19
Mitigation Action/Initiative: Floodplain Mapping

Assessing the Risk	
Hazard(s) addressed:	Flooding
Specific problem being mitigated:	Threats to persons and property from risk or threat of flooding within Western Fremont FPD
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Map areas vulnerable to flooding within the Western Fremont FPD
	2. Observe and document future flood occurrences
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Accurate LiDAR mapping of Arkansas River and Hayden Creek. Identify evacuation and road closure areas in the event of flooding. Will also allow targeted and cost-effective mitigation measures.
Action/Project Category	NRP
Goals/Objectives Met	G2, 6 & 7, O2A, 6B, &7B
Applies to existing, future, or not applicable	Future
Benefits (losses avoided)	Focused evacuation and road closures to improve life safety of residents, emergency responders, tourists and motorists
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	Western Fremont Fire Protection District
Potential Funding Sources	General funds and grants
Timeline for Completion	Short term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 19
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Will allow emergency responders to protect persons in threatened areas
Property Protection	1	Will allow property owners to identify hazard and initiate mitigation measures
Cost-Effectiveness	1	Expense limited to initial information acquisition and analysis. One-time funding will provide long-term (decades) benefits.
Technical	1	Experienced contractors and hydrologists readily available
Political	1	Recent flooding in state has heightened public interest and concerns
Legal	1	No legal impediments
Fiscal	0	Will require grant funding or other external financial assistance
Environmental	1	Aircraft overflight - No negative environmental impact
Social	1	No adverse public impact
Administrative	0	Mapping and follow-up hydrological analysis required from contractors, state and federal agencies
Multi-Hazard	1	Will reduce likelihood of inappropriate facility siting in hazardous areas
Timeline	1	Can be completed in less than a year
Agency Champion	1	All impacted jurisdictions and emergency response agencies
Other Community Objectives	1	Will improve land use decision-making and protection of riparian areas. Will also assist in analysis of flood danger following wildfires.
Total	12	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Penrose Water District
Number: 20
Mitigation Action/Initiative: Arkansas Penrose Pipeline Project to Diversify Raw Water Source

Assessing the Risk	
Hazard(s) addressed:	Drought, wildfire, flooding
Specific problem being mitigated:	Single source of raw water supply
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Diversify raw water source: Arkansas-Penrose Pipeline Project - Chosen project due to reliability and diversity of source.
	2. Diversify raw water source: Drill local well(s) - Not chosen due to uncertainty of yield and water quality of local aquifers.
	3. No Action: Not chosen due to risk of health, safety and welfare of District constituency.
Action/Project Intended for Implementation	
Description of Selected Action/Project	Arkansas-Penrose Pipeline Project: Acquisition of raw water on the Arkansas River; Diversion of water from a location near Penrose; Construction of a conveyance pipeline to Penrose for beneficial use of the District's constituents; Raw water storage.
Action/Project Category	SIP - Structure and Infrastructure Project
Goals/Objectives Met	G6&7, O6A&7C
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	A reliable and diverse raw water supply mitigates hazards to health and welfare of the constituency, as well as impacts to maintaining industry standards for property safety (fire suppression), land values, and quality of life caused by a critical reduction, or loss, of a single, primary raw water supply if brought on by long-term drought, wildfire and/or flooding in the watershed that causes damage to upstream structures or adversely impacts water quality, earthquake, landslide and other natural, or manmade disasters or events.
Estimated Cost	$9,750,000.00
Priority*	High

Number: 20

Mitigation Action/Initiative: Arkansas Penrose Pipeline Project to Diversify Raw Water Source

Mitigation Action/Initiative:	
Responsible Organization	Penrose Water District
Local Planning Mechanism	Assessment defining potential risk (hazard), selection of action, and authorizing project to mitigate the defined risk was performed by board and staff of the District, in conjunction with consulting engineers. Lender concurred with need and accepted defined plan of action.
Potential Funding Sources	In Place: – Colorado Department of Natural Resources-Colorado Water Conservation Board: Loan for 90% of Project Estimate – Colorado Department of Local Affairs: Grant for $500,000.00 – Penrose Water District: Funding balance of Project Estimate
Timeline for Completion	Project completion date projected to be by end of month January 2015.
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 5/21/2014 Progress on Action/Project: 40% Complete – Raw water acquired – Change case completed – Local storage acquired – Diversion completed by way of construction of headgate wells along the Arkansas River south of Penrose – Pipeline design 98% complete and scheduled for bid

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 20
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Maintain domestic and essential municipal water services
Property Protection	1	Maintain adequate water supply for fire suppression and protection
Cost-Effectiveness	1	Security of diverse, long-term water supply
Technical	1	Long-term solution
Political	1	Local community and regional governmental support
Legal	0	State does not implement project
Fiscal	1	Project funded by existing budget
Environmental	1	Complies with current environmental regulation and policy
Social	1	No adverse public impacts; Enhances local quality of life
Administrative	1	Penrose Water District has authority of implement and maintain the Project
Multi-Hazard	1	Health & Welfare; Life & Safety; Fire Protection; Water Quality
Timeline	1	Project at 40% completion; Completion by end of January 2015
Agency Champion	1	Total support of governing board, management and operational staff
Other Community Objectives	1	Project supports community ideals
Total	12	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

.

Name of Jurisdiction: City of Cañon City
Number: 21
Mitigation Action/Initiative: Floodplain & Hazard Mapping

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Mapping and/or remapping of all floodplains and approximate Zone A areas.
	2. Map drainages individually
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	8 drainages and river basin – update detail floodplain/floodway mapping.
Action/Project Category	NRP, EAP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$1,567,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County
Timeline for Completion	Ongoing

*** Refer to results of Prioritization (page 2)**

Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 2000 Progress on Action/Project: LOMR Orchard Detention Basin Date: 2007 Progress on Action/Project: County wide DFIRM Date: 2012 Progress on Action/Project: Detailed Study & PMR Four Mile Creek Date: 2012 Progress on Action/Project: Approximate Study & PMR Orchard Ave Basin Date: 2012 Progress on Action/Project: Approximate Study & PMR Abbey Basin east Date: 2012 Progress on Action/Project: Detailed Study & PMR Abbey Basin west Date: 2012 Progress on Action/Project: Detailed Study & PMR Forked Gulch east & main branches Date: 2014 Progress on Action/Project: Detailed Study & PMR Arkansas River west Date: 2014 Progress on Action/Project: Detailed Study & PMR North Sand Creek south

Prioritization

Number: 21
Mitigation Action/Initiative: Floodplain and Hazard Mapping

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

FLOODPLAIN MAPPING & HAZARD ANALYSIS

Basin	Description	Location				Year Completed
North Sand Creek Drainage	Detailed Study & PMR	N. Sand Creek from River to City Limit			$ -	2014
		N. Sand Creet from City Limit to CR69	$ 140,000		$ 140,000	
		Tunnel Drive - Fremont Peak to River	$ 42,000		$ 42,000	
					$ -	
Hogback Area Drainage	Detailed Study & PMR	Hogbacks from Greenway Dr to 3rd Street	$ 56,000		$ 56,000	
					$ -	
North 9th Street Drainage	Detailed Study & PMR	Greenway Dr to River	$ 84,000		$ 84,000	
					$ -	
Northeast Canon Drainage	Updated Detailed Study & PMR	WPA West Branch - North Street to US50	$ 84,000		$ 84,000	
	Updated Detailed Study & PMR	WPA East Branch - Windsor Ave to Central Ave	$ 84,000		$ 84,000	
	Updated Detailed Study & PMR	WPA Main Branch - Central Ave to River	$ 84,000		$ 84,000	
					$ -	
Orchard Ave Drainage	Detailed Study & PMR	Orchard Ave Detention Pond			$ -	2000
	Detailed Study & PMR	Reservoir Rd to Washington Street	$ 63,000		$ 63,000	
	Approxiamate Study & PMR	Central Ave to River			$ -	2012
					$ -	
Abbey Drainage	Detailed Study & PMR	Abbey Detention Basin to River			$ -	2012
	Approxiamate Study & PMR	East Overflow Abbey to River			$ -	2012
	Detailed Study & PMR	East Overflow Abbey to Fourmile Creek	$ 50,000		$ 50,000	
	Detailed Study & PMR	North Street to Abbey Detention Basin	$ 70,000		$ 70,000	
					$ -	
Fourmile Drainage	Detailed Study & PMR	Four Mile Creek - City Limit to River			$ -	2012
	Detailed Study & PMR	Mudd Gulch - City Limit to River			$ -	2012
					$ -	
South Sand Creek Drainage	Detailed Study & PMR	Riverside & Colburn	$ 28,000		$ 28,000	
	Detailed Study & PMR	Plum Creek	$ 42,000		$ 42,000	
	Detailed Study & PMR	Forked Gulch Main Branch - City Limit to River			$ -	2012
	Detailed Study & PMR	Forked Gulch East Branch - City Limit to 1st Street			$ -	2012
	Detailed Study & PMR	Forked Gulch West Branch - City Limit to Mariposa	$ 91,000		$ 91,000	
	Detailed Study & PMR	Oak Creek Gulch - City Limit to River	$ 91,000		$ 91,000	
	Detailed Study & PMR	C-4 Dam - Oak Creek Grade to River	$ 84,000		$ 84,000	
	Detailed Study & PMR	C-3 Dam (S. Sand Creek) - Oak Creek Grade to River	$ 175,000		$ 175,000	
	Detailed Study & PMR	Willow Ln - Pinion Ave to River	$ 84,000		$ 84,000	
					$ -	
Arkansas River	Updated Detailed Study & PMR	River - East City Limit to Black Bridge			$ -	2014
	Updated Detailed Study & PMR	River - Black Bridge to Brewser Ln	$ 190,000		$ 190,000	
	Breach Analysis & Inundation Mapping	Water Treatment Pond A	$ 25,000		$ 25,000	
					$ 1,567,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City
Number: 22
Mitigation Action/Initiative: Flood Control – Abbey Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Multiple actions taken to reduce potential flooding in the Abbey Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Multiple actions including riprapping channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced concrete box culverts, and reinforced concrete pipe.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$16,245,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County
Timeline for Completion	*Short Term/Long Term*
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 2005 Progress on Action/Project: Abbey Detention Basin Date: 2009 Progress on Action/Project: 200' – 48" RCPX3 RR to Fremont Dr at US50 Date: 2010 Progress on Action/Project: 20' Overflow Weir – Hydraulic Ditch

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 22
Mitigation Action/Initiative: Flood Control – Abbey Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

ABBEY DRAINAGE BASIN (Alternate No. 3 modified)

Structure No.	Description	Location				Year Completed
	4500' - 6' Riprap Channel	Arkansas River to East Main Street on Rhodes Ave	$ 700,000		$ 700,000	
	500' - 8' x 4' RCBC	Rhodes Ave at Oil Creek, Spartan, White Pine, Ute	$ 500,000		$ 500,000	
	1000' - 5' Riprap Channel	Arkansas River to East Main Street on Ash	$ 200,000		$ 200,000	
	60' each of 36" & 54" RCP	Arkansas River to East Main Street on Ash	$ 50,000		$ 50,000	
	200' - 48" RCP X3	RR to Fremont Drive under US Hwy 50			$ -	2009
	200' - 48" RCP X3	East Main Street to US Hwy 50 under RR	$ 1,000,000		$ 1,000,000	
	1000' - 8' x 6' RCBC	Between East Main Street & US Hwy 50	$ 1,500,000		$ 1,500,000	
	2200' - 8' x 10' RCBC	Between East Main Street & US Hwy 50	$ 3,500,000		$ 3,500,000	
	1500' - 8' x 16' RCBC	Between East Main Street & US Hwy 50	$ 2,600,000		$ 2,600,000	
	Enlarge Open Channel	Between East Main Street & US Hwy 50	$ -		$ -	
	3200' - 4' open channel	Fremont Drive to Detention Basin, Abbey Property	$ 500,000	$ 50,000.00	$ 550,000	
	4 drop structures in channel	Fremont Drive to Detention Basin, Abbey Property	$ 200,000		$ 200,000	
	Abbey Detention Basin	Abbey Property			$ -	2005
	20' Overflow weir	Abbey Detention Basin and Hydraulic Ditch			$ -	2010
	4 drop structures in channel	Abbey Detention Basin to Central	$ 200,000		$ 200,000	
	1300' - 72" RCP	Field Ave to Abbey Detention Basin on Pear Street	$ 400,000		$ 400,000	
	700' - 72" RCP	Field Ave from Pear Street to Central Ave	$ 200,000		$ 200,000	
	600' - 4' open channel	Raynolds from Abbey Detention Basin to Central Ave	$ 95,000	9000	$ 104,000	
	1800' - 5' open channel	Abbey Detention Basin to Central Ave	$ 280,000	27000	$ 307,000	
	72" RCP	Central Ave	$ 25,000		$ 25,000	
	Inlet/Outlet Improvements	Central Avenue to Elizabeth Street	$ 22,000		$ 22,000	
	2800' - 5' open channel	Central Avenue to South Street	$ 440,000	$ 42,000	$ 482,000	
	Outlet Works at pond	Elizabeth Street to South Street	$ 1,600,000	$ 50,000	$ 1,650,000	
	2 - 54" RCP	South Street	$ 30,000		$ 30,000	
	3000' - 5' open channel	South Street High Street	$ 900,000	$ 45,000	$ 945,000	
	Outlet Works at pond	South Street to High Street	$ 1,000,000	$ 50,000	$ 1,050,000	
	2 - 54" RCP	High Street	$ 30,000		$ 30,000	
					$ 16,245,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City
Number: 23
Mitigation Action/Initiative: Flood Control – Four Mile Creek Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Multiple actions taken to reduce potential flooding in the Abbey Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Multiple actions including channel improvements, construction of detention basin, and RCBC.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$2,235,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County
Timeline for Completion	Short Term/Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 23
Mitigation Action/Initiative: Flood Control – Four Mile Creek Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

FOUR MILE CREEK DRAINAGE BASIN (Alternate No. 2)

Structure No.	Description	Location				Year Completed
2	6' X 14' RCBC	Canon Ridge Road	$ 165,000		$ 165,000	
3	Detention Basin	Fourmile Road	$ 930,000	$ 50,000.00	$ 980,000	
4	6' X 14' RCBC	Fourmile Road	$ 165,000		$ 165,000	
	Mud Gulch - Channel Improvements	CR123 to City Limit Line	$ 825,000	$ 100,000.00	$ 925,000	
					$ 2,235,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City
Number: 24
Mitigation Action/Initiative: Flood Control – Hogback Area Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Construction of detention basins and culverts within the Hogback Area Drainage Basin to mitigate flooding.
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Construction of 10 detention basins and installation of 3 culverts in the Hogback Basin.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$280,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, GOCO
Timeline for Completion	Short Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 1995 Progress on Action/Project: Structures No. 1 Date: 2001 Progress on Action/Project: Structures No. 2, 3, 4, & 9

Number: 24

Mitigation Action/Initiative: Flood Control – Hogback Area Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

HOGBACK AREA BASIN (sub basin of N. 9th Street and NE Canon Basins)

Structure No.	Description	Location				Year Completed
No. 1	Detention Basin	Hogback south of Harding Ave			$ -	1995
No. 2	Detention Basin	Hogback north of Oak Ave			$ -	2001
No. 3	Detention Basin	Hogback south of Phay Ave			$ -	2001
No. 4	Detention Basin	Hogback at Allison Ave			$ -	2001
No. 5	Detention Basin & Culvert	Hogback north of Forest Avenue	$ 70,000		$ 70,000	
No. 8	Detention Basin & Culvert	Hogback at Floral Avenue	$ 80,000		$ 80,000	
No. 9	Detention Basin	Hogback at 3rd Street			$ -	2001
Foothills Drive	Detention Basin & Culvert	Foothills Drive at Miners Ridge Subdivision	$ 80,000		$ 80,000	
Greenway Drive	Detention Basin	Hogback at Greenway Drive	$ 50,000		$ 50,000	
					$ 280,000	

Mitigation Action Worksheet

.

Name of Jurisdiction: City of Cañon City
Number: 25
Mitigation Action/Initiative: Flood Control – N. 9th Street Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Construction of storm sewer and inlets on 9th Street in Cañon City
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Construction of storm sewer and inlets on 9th Street in Cañon City
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$5,000,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, CDOT
Timeline for Completion	Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 25
Mitigation Action/Initiative: Flood Control – N. 9th Street Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	0	
Agency Champion	1	
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

N. 9TH STREET BASIN

Structure No.	Description	Location				Year Completed
	Stormsewer & Inlets	9th Street	$ 5,000,000		$ 5,000,000	
					$ 5,000,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City/Fremont County
Number: 26
Mitigation Action/Initiative: Flood Control – North Sand Creek Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Erosion repair work and installation of piping and box culverts in North Sand Creek Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Erosion repair work and installation of corrugated metal piping and concrete reinforced box culverts in the North Sand Creek Drainage Basin.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$1,879,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County
Timeline for Completion	Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 26
Mitigation Action/Initiative: Flood Control – North Sand Creek Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	0	
Agency Champion	1	
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

NORTH SAND CREEK DRAINAGE BASIN (ALTERNATE NO. 1)

Structure No.	Description	Location	Construction Cost	Land Acquisition	Total Cost	Year Completed
North Sand Creek	200 LF Erosion Repair	Arkansas River to Structure 7	$ 53,000		$ 53,000	
No. 7	40 LF 4-Cell 20' x 8' RCBC	Quarry Road Crossing	$ 945,000		$ 945,000	
North Sand Creek	500 LF Erosion Repair	Structure 7 to US Hwy 50	$ 132,000		$ 132,000	
No. 11	40 LF 3-Cell 20' x 8' RCBC	County Road 69 and North Sand Creek	$ 700,000		$ 700,000	
No. 14	60 LF 48" CMP	County Road 69 East of US Hwy 50	$ 9,000		$ 9,000	
North Sand Creek	150 LF Erosion Repair	County Road 69 to End of Basin	$ 40,000		$ 40,000	
					$ 1,879,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City
Number: 27
Mitigation Action/Initiative: Flood Control – Northeast Canon Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Multiple actions taken to reduce potential flooding in the Northeast Canon Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Multiple actions including riprapping channels, channel improvements, installation of one oversized detention basin, reinforced concrete box culverts, and arch pipe.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$9,275,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County
Timeline for Completion	Short Term/Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 2013 Progress on Action/Project: 1120 Ohio Repetitive Loss Acquisition

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 27
Mitigation Action/Initiative: Flood Control – Northeast Canon Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

NORTHEAST CANON DRAINAGE BASIN (50-year design)

Structure No.	Description	Location				Year Completed
		Arkansas River Outfall to Franklin Avenue				
1A	Additional 8' x 6' RCBC	Outfall to Oil Creek Ditch	$ 900,000		$ 900,000	
	Riprap Lined Channel	Oil Creek Ditch to RR	$ 270,000		$ 270,000	
1B	11' x 5' RCBC	RR to North side US Hwy 50	$ 1,200,000		$ 1,200,000	
1C	11' x 5' RCBC	US Hwy 50 to Franklin Avenue	$ 2,000,000		$ 2,000,000	
		Franklin Avenue to West Tributary			$ -	
	Lined Channel, 3 drop structures	Franklin Avenue to Hydraulic Ditch	$ 600,000		$ 600,000	
	10' x 5' RCBC	Hydraulic Ditch	$ 100,000		$ 100,000	
2	10' x 5' RCBC	Phelps Avenue	$ 100,000		$ 100,000	
	Channel Improvements	Phelps Avenue to Detention Basin No. 1	$ 120,000	$ 40,000	$ 160,000	
3	15' x 5' RCBC	Central Avenue	$ 140,000		$ 140,000	
	Channel Improvements	Central Avenue to West Tributary	$ 50,000		$ 50,000	
		West Tributary to High Street			$ -	
	Channel Improvements	West Tributary to South Street	$ 60,000		$ 60,000	
7	8' x 5' RCBC	South Street	$ 100,000		$ 100,000	
	Channel Improvements	South Street to Fruitland Canal	$ 20,000		$ 20,000	
	8' x 5' RCBC	Fruitland Canal	$ 100,000		$ 100,000	
	Channel Improvements	Fruitland Canal to Detention Basin No. 2	$ 20,000		$ 20,000	
	Detention Basin No. 2 oversized		$ 600,000	$ 100,000	$ 700,000	
	Channel Improvements	Detention Basin No. 2 to High Street	$ 40,000		$ 40,000	
8A	16' x 5' RCBC	High Street	$ 120,000		$ 120,000	
		High Street to Illinois Avenue			$ -	
	Channel Improvements	High Street to East Tributary	$ 240,000		$ 240,000	
	Channel Improvements	East Tributary to Tennessee Avenue	$ 50,000		$ 50,000	
8B	12' x 5' RCBC	Tennessee Avenue	$ 100,000		$ 100,000	
	Channel Improvements	Tennessee Avenue to York Avenue	$ 525,000		$ 525,000	
9	Additional 60" CMP	York Avenue	$ 25,000		$ 25,000	
	Channel Improvements	York Avenue to Illinois Avenue	$ 220,000		$ 220,000	
10	Additional 60" CMP	Illinois Avenue	$ 40,000		$ 40,000	
		West tributary to Detention Basin No. 3			$ -	
	Channel Improvements	Main Channel to 15th Street	$ 30,000		$ 30,000	
4	12' x 5' RCBC	15th Street	$ 100,000		$ 100,000	
	Channel Improvements	15th Street to Fruitland Canal	$ 170,000		$ 170,000	
	12' x 5' RCBC	Fruitland Canal	$ 100,000		$ 100,000	
	Channel Improvements	Fruitland Canal to Washington Street	$ 125,000		$ 125,000	
5	7' x 5' Arch Pipe	Washington Street	$ 50,000		$ 50,000	
6	6' x 3.5' Arch Pipe	9th Street	$ 50,000		$ 50,000	
	Channel Improvements	Washington Street to Detention Basin No. 3	$ 70,000		$ 70,000	
	Detention Basin No. 3 oversized		$ 600,000	$ 100,000	$ 700,000	
					$ 9,275,000	

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City
Number: 28
Mitigation Action/Initiative: Flood Control – South Sand Creek Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Multiple actions taken to reduce potential flooding in the South Sand Creek Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Multiple actions including installation of a pedestrian crossing and ditch crossing, open channels, construction of drop structures, reinforced concrete box culverts, reinforced concrete pipe, and a detention basin. See table below.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$9,082,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, Fremont County
Timeline for Completion	Short Term/Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 28
Mitigation Action/Initiative: Flood Control – South Sand Creek Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	0	
Agency Champion	1	
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

SOUTH SAND CREEK DRAINAGE BASIN (Alternate No. 3)

Structure No.	Description	Location			
		Forked Gulch			
42	4 - 60" RCP	Temple Canon Road & Mariposa Road	$ 200,000		$ 200,000
34	50' x 8' Pedestrian Crossing	Catlin Avenue	$ 200,000		$ 200,000
34	50' x 8' South Canon Ditch Crossing	South Canon Ditch	$ 200,000		$ 200,000
36	4' x 8' RCBC	Valley Road	$ 100,000		$ 100,000
41	4' x 8' RCBC	Valley Road	$ 100,000		$ 100,000
	1500' Open Channel	Valley Road at Temple Canon Road	$ 450,000		$ 450,000
	2000' Open Channel & Drop Structures	2nd Street	$ 1,000,000		$ 1,000,000
		Oak Creek Gulch	$ -		$ -
29	6' x 10' RCBC	Forge Road east of RR	$ 100,000		$ 100,000
28	6' x 12' RCBC	McDaniel Road	$ 100,000		$ 100,000
27	6' x 16' RCBC	Highland Street	$ 100,000		$ 100,000
26	6' x 14' RCBC	Railroad Spur	$ 200,000		$ 200,000
24	2650' - 78" RCP	S. 9th Street	$ 3,000,000		$ 3,000,000
	5000' Open Channel	McDaniel Road to State Hwy 115	$ 1,300,000	$ 150,000	$ 1,450,000
	Detention Basin	Upstream of stormsewer on Hwy 115	$ 1,000,000	$ 100,000	$ 1,100,000
		South Sand Creek			$ -
9	3' x 14' RCBC	Poplar Avenue	$ 100,000		$ 100,000
4	2- 4' x 8' RCBC	Elm Avenue	$ 100,000		$ 100,000
3	2- 3' x 12' RCBC	Between Elm Avenue and Grand Avenue	$ 100,000		$ 100,000
2	2 - 4' x 7' RCBC	Ash Street	$ 100,000		$ 100,000
1	4 - 3' x 6' RCBC	Willow Street	$ 100,000		$ 100,000
		Riverside Drive	$ -		$ -
46	4' X 6' RCBC	Riverside Drive	$ 32,000		$ 32,000
	2000' - Open Channel	2000' Upstream from Structure 46	$ 250,000		$ 250,000
					$ 9,082,000

Mitigation Action Worksheet

Name of Jurisdiction: City of Cañon City Water Department
Number: 29
Mitigation Action/Initiative: Drought Mitigation

Assessing the Risk	
Hazard(s) addressed:	Drought and Extreme Temperatures, Wildfire
Specific problem being mitigated:	Lack of available water supply during drought conditions.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Education and outreach
	2. Upper Arkansas Water Conservancy District's Multi-Storage Project – Cost Impact
	3. Parkdale Quarry Purchase for raw water storage – Cost Impact
Action/Project Intended for Implementation	
Description of Selected Action/Project	Drought Plan: Implement plan to provide our water users with information regarding how to use water efficiently inside/outside the home or business. The creation of an on-line Water Efficiency Plan for Homeowners and Business Owners. Providing information to our water users will give them the tools that they can use to develop efficient water usage habits. This in turn will save them money and help save a finite water resource.
Action/Project Category	EAP
Goals/Objectives Met	G2&7 O2A, 7A, & 7C
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of physical property i.e. landscaping during drought conditions. Loss of disposable income due to having to pay a water bill.
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City Water Department
Potential Funding Sources	City of Cañon City Water Department
Timeline for Completion	Short Term
Reporting on Progress	

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 29
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	0	Developing efficient water usage habits will not have a bearing on protecting lives and preventing injuries.
Property Protection	1	A property/business owner can have several thousands of dollars invested into the landscaping of their yard/business lot and that could be impacted if watering restrictions have to be imposed that adversely affect their ability to adequately irrigate their landscaping.
Cost-Effectiveness	1	An on-line educational program is a very cost effective way of getting the information to water users about the best types of plants, irrigation systems and watering schedules that can be implemented without a big cost impact.
Technical	1	A water efficiency plan applies a lot of common sense to meeting the goals of developing water efficient habits. After all, water use is all about habits.
Political	1	This type of issue is not one that typically creates dissention among water users or City Councilmembers because a lot of individuals these days understand the need to protect our natural resources.
Legal	0	There are no State regulations or requirements that require water providers to practice efficient water use.
Fiscal	1	The only fiscal impact in regards to water "conservation" comes when water providers have to raise rates due to diminished water sales when water users are told that they have to cut back. Promoting using water efficiently helps water users to develop good water usage habits so that when the day comes that watering restrictions may have to be imposed there is not such a knee jerk reaction to the request.
Environmental	1	Developing efficient usage habits can have positive impacts on the environment in that irrigating vegetation adequately but not overdoing it can lead to healthy plants while saving the water user money.
Social	1	All segments of a water provider's users can benefit from developing efficient water usage habits. It can have a huge impact on lower income people who have less income to begin with.
Administrative	1	Being a Municipally Owned Water Provider, the City Water Department has the resources to implement a plan.
Multi-Hazard	0	Developing efficient water usage habits does not help reduce risk to other hazards.
Timeline	1	A program can be developed within a very short time frame.
Agency Champion	1	Who better than your local water provider to pass along information regarding water efficient habits.
Other Community Objectives	1	Those who do not wish to turn turf into rock can still have a beautiful yard by using xeriscape plants that minimize the need for water use. This can in turn create yards that are not an eyesore to be seen by others in the community.
Total	11	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Canon City Area Fire Protection District
Number: 30
Mitigation Action/Initiative: Wildfire Education and Awareness Program

Assessing the Risk	
Hazard(s) addressed:	Wildfire
Specific problem being mitigated:	Community awareness of Wildfire hazards in the WUI and mitigation strategies
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Education and Awareness Program to include "Ready, Set, GO!" and "Firewise Communities, USA"
	2. Create new and unique education program, customized to Fremont County (Cost prohibitive)
	3. No Action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Community presentations, printing/purchase of educational materials
Action/Project Category	EAP
Goals/Objectives Met	G2&7 O2A&7A
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	reduce loss of life and property
Estimated Cost	medium = $10,000-$100,000
Priority*	High
Plan for Implementation	
Responsible Organization	Canon City Area Fire Protection District
Potential Funding Sources	Grants
Timeline for Completion	Ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

Prioritization

Number: 30
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	0	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	12	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Canon City Area Fire Protection District
Number: 31
Mitigation Action/Initiative: Local Planning and Regulations

Assessing the Risk	
Hazard(s) addressed:	Wildfire
Specific problem being mitigated:	Building Code Requirements for WUI areas
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Adopt a modified WUI Building Code
	2 Prohibit construction in WUI areas.
	3. No Action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Develop and adopt a WUI Building Code
Action/Project Category	LPR
Goals/Objectives Met	G2, 7, &8 O2B, 7A, & 8B
Applies to existing, future, or not applicable	Future
Benefits (losses avoided)	reduce loss of life and property
Estimated Cost	medium = $10,000-$100,000
Priority*	High
Plan for Implementation	
Responsible Organization	Canon City Area Fire Protection District, Fremont County, Canon City
Potential Funding Sources	Grants
Timeline for Completion	1-2 years for implementation, then ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 31
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	14	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Canon City Area Fire Protection District
Number: 32
Mitigation Action/Initiative: Structure and Infrastructure Projects

Assessing the Risk	
Hazard(s) addressed:	Wildfire
Specific problem being mitigated:	Improving water supplies in the WUI areas of the community
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Expand existing water supply systems
	2 Construct dedicated cisterns for firefighting operations
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Expand and enhance the availability of water supplies in the WUI areas
Action/Project Category	SIP
Goals/Objectives Met	G7 O7A
Applies to existing, future, or not applicable	Future
Benefits (losses avoided)	reduce loss of life and property, environmental impact
Estimated Cost	high =>$100,000
Priority*	High
Plan for Implementation	
Responsible Organization	Canon City Area Fire Protection District, Fremont County, Canon City
Potential Funding Sources	Grants
Timeline for Completion	2-3 years for implementation, then ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 32
Mitigation Action/Initiative:

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Canon City Area Fire Protection District
Number: 33
Mitigation Action/Initiative: Structure and Infrastructure Projects

Assessing the Risk	
Hazard(s) addressed:	Wildfire, Severe Storms, Winter Storms
Specific problem being mitigated:	Creating defensible space around structures and infrastructure
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Create defensible space around residential and commercial structures, critical infrastructure to include water supply/treatment systems, power lines, gas transmission lines, etc.
	2 Thinning of vegetation in select areas.
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Creating defensible space around structures, infrastructure, and critical facilities.
Action/Project Category	SIP
Goals/Objectives Met	G2&7 O2A, 2C,7A,&7D
Applies to existing, future, or not applicable	Future
Benefits (losses avoided)	reduce loss of life and property, environmental impact
Estimated Cost	high =>$100,000
Priority*	High
Plan for Implementation	
Responsible Organization	Canon City Area Fire Protection District, Fremont County, Canon City, utility companies
Potential Funding Sources	Grants
Timeline for Completion	2-3 years for implementation, then ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

Number: 33

Mitigation Action/Initiative: Creating defensible space around structures and infrastructure

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Canon City Area Fire Protection District
Number: 34
Mitigation Action/Initiative: Natural Systems Protection

Assessing the Risk	
Hazard(s) addressed:	Wildfire, Severe Storms, Winter Storms
Specific problem being mitigated:	Implement a Fuels Management Program
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Implementing a comprehensive fuels management program
	2 Encourage individual property management programs.
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Perform regular maintenance activities for fuel management, including cutting and maintaining firebreaks in WUI areas and sponsoring local slash and chipping programs for residents.
Action/Project Category	NRP
Goals/Objectives Met	G2, 3,&7 O2A, 2C,3A,7A,&7D
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Reduce loss of life and property, environmental impact
Estimated Cost	high =>$100,000
Priority*	High
Plan for Implementation	
Responsible Organization	Canon City Area Fire Protection District, Fremont County, Canon City, utility companies
Potential Funding Sources	Grants
Timeline for Completion	1-3 years for implementation, then ongoing
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 34
Mitigation Action/Initiative: Implement a Fuels Management Program

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: The Canon City Hydraulic and Irrigating Ditch Company
Number: 35
Mitigation Action/Initiative: Install actuators on control gates of the main stem canal

Assessing the Risk	
Hazard(s) addressed:	Flooding
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Install actuators to electronically control water levels in the canal. 2. Identify storm drainage locations into irrigation ditches and release locations. 3. Perform engineering studies which would determine the amount of the release without affecting structures in the waters potential path.
Action/Project Intended for Implementation	
Description of Selected Action/Project	Actuators are electrically controlled systems allowing for regulation of water levels in the canal. The actuators stop the flow of irrigation water into the canals during heavy rain events. This does not address the additional problems of run off storm water into the canals that could cause flooding.
Action/Project Category	SIP
Goals/Objectives Met	G6&7 O6B&7B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Reduce flooding, helping to prevent life and safety endangerment, reduce erosion of soil, private property damage, and prevent erosion of roadways and bridges.
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	City of Canon city and Fremont County
Potential Funding Sources	FEMA, Colorado Water Conservation Board, Fremont County & Canon City
Timeline for Completion	5 years
Reporting on Progress	

Date of Status Report/ Report of Progress	Date: Progress on Action/Project:

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 35
Mitigation Action/Initiative: Install actuators on control gates of the main stem canal

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	0	
Technical	0	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Town of Brookside
Number: 36
Mitigation Action/Initiative: Vegetative Fuel Reduction

Assessing the Risk	
Hazard(s) addressed:	Wildfire, Severe Storms, Winter Storms
Specific problem being mitigated:	Reduce vegetative fuels
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Initiate a multi-step process to increase awareness and reduce fuel loads around structures and infrastructure.
	2. Require Higher regulatory standards - such as a prohibition on combustible roof materials. *Difficult for small town to regulate. Very little new growth. Mostly established buildings*
	3. Work with Colorado Forestry Association and Department of Natural Resources to review zoning and ordinances to identify areas to include wildfire mitigation principles. *Not necessary; small town. Areas are obvious.*
	4. Seek alternative water supplies in urban wildland interface areas. *No known sources available*
Action/Project Intended for Implementation	
Description of Selected Action/Project	• Seek funding and real assistance to reduce vegetative fuels where natural vegetation and weeds interface with structures and infrastructure. • Continue to develop partnerships with other organizations to implement wildfire mitigation plans and other hazard reduction programs. • Create and maintain defensible space around structures and infrastructure
Action/Project Category	SIP, NRP
Goals/Objectives Met	G2, 3,&7 O2A, 2C,3A,7A,&7D
Applies to existing, future, or not applicable	Existing and future; ongoing need to revisit as vegetation grows back.
Benefits (losses avoided)	Protection of life, physical structures from damage and loss of function, and water utility loss and extraordinary financial burden.
Estimated Cost	Medium $75,000
Priority*	High

Plan for Implementation	
Responsible Organization	Town of Brookside.
Potential Funding Sources	Federal, State or local sources
Timeline for Completion	Short term(1-5 years) and OG: (On-going)
Reporting on Progress	
Date of Status Report/ Report of Progress	Date:6/12/2014 Progress on Action/Project: Not begun due to lack of time and personal. Continuing need to address. Not completed.

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 36
Mitigation Action/Initiative: Brookside Vegetative Fuel Reduction

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	0	
Fiscal	-1	Limited financial resources
Environmental	0	
Social	0	
Administrative	0	
Multi-Hazard	1	Would reduce vegetation involved in storm water runoff and winter snow loading
Timeline	1	
Agency Champion	1	Mayor and Board supports action
Other Community Objectives	1	Enhance environmental quality
Total	8	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Town of Brookside
Number: 37
Mitigation Action/Initiative: Disaster-resistant community

Assessing the Risk	
Hazard(s) addressed:	Drought and Extreme Temperatures, Thunderstorms, Severe Winter Weather, Tornadoes, Wildfire and Earthquake
Specific problem being mitigated:	Vulnerability to disaster through lack of awareness
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Education and outreach on disaster preparedness for local residents.
	2. Have informational handouts available at City buildings
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Provide all residents/businesses with appropriate emergency preparedness information and supplies. Encourage residents to take personal action to protect private property from all potential disaster scenarios.
Action/Project Category	EAP
Goals/Objectives Met	G2&7 O2A,7A, 7B, 7C, &7D
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Protection of life and property values, and extraordinary financial burden.
Estimated Cost	$5000
Priority*	HIgh
Plan for Implementation	
Responsible Organization	Town of Brookside.
Potential Funding Sources	Federal, State or local sources
Timeline for Completion	Short term(1-5 years) and OG: (On-going)
Reporting on Progress	
Date of Status Report/ Report of Progress	Date:6/12/2014 Progress on Action/Project: Not begun due to lack of time and personnel and finances. Continuing need to address. Not completed.

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 37
Mitigation Action/Initiative: Brookside Disaster-resistant community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	0	
Political	1	
Legal	0	
Fiscal	1	
Environmental	0	
Social	0	
Administrative	0	
Multi-Hazard	1	
Timeline	0	
Agency Champion	1	Mayor and Board supports action
Other Community Objectives	0	
Total	7	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: Town of Brookside
Number: 38
Mitigation Action/Initiative: Drought-resistant community

Assessing the Risk	
Hazard(s) addressed:	Drought and Extreme Temperature
Specific problem being mitigated:	Vulnerability to drought
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Development of alternative water supplies.
	2. Implement storm water retention in regions ideally suited for groundwater recharges. (Not applicable to water source.)
	3. Consider providing incentives to property owners that utilize drought resistant landscapes in the design of their homes. (Not financially feasible due to lack of funds.)
	4. Develop standards that require drought resistant landscapes on community owned facilities. (Already being done.)
Action/Project Intended for Implementation	
Description of Selected Action/Project	Identify alternative water supplies for time of drought. Mutual aid agreements with alternative suppliers.
Action/Project Category	LPR; SIP
Goals/Objectives Met	G3,6,&7 O3B, 3C, 6B, & 7C
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Protection of life and property values, water utility loss and extraordinary financial burden.
Estimated Cost	Unknown
Priority*	Medium
Plan for Implementation	
Responsible Organization	Town of Brookside.
Potential Funding Sources	Federal, State or local sources
Timeline for Completion	Short term(1-5 years) and OG: (On-going)
Reporting on Progress	
Date of Status Report/ Report of Progress	Date:6/12/2014 Progress on Action/Project: Not begun due to lack of time and personal. Continuing need to address. Not completed.

Number: 38
Mitigation Action/Initiative: Brookside Drought-resistant community

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	0	
Political	1	
Legal	0	
Fiscal	0	Limited financial resources
Environmental	0	
Social	0	
Administrative	0	
Multi-Hazard	1	Would provide water for wildfire fighting
Timeline	0	
Agency Champion	1	Mayor and Board supports action
Other Community Objectives	0	
Total	6	
Priority (High/Med/Low)	Medium	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Town of Brookside
Number: 39
Mitigation Action/Initiative: Earthquake Resistance Buildings/Infrastructure

Assessing the Risk	
Hazard(s) addressed:	Earthquake
Specific problem being mitigated:	Structural and infrastructure damage due to earthquake
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Update building codes and practices to appropriate levels of seismic safety. 2. Educate community on seismic risks to property and infrastructure. 3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Update building codes and practices related to appropriate levels of seismic safety. Further enhance seismic risk assessment to target high hazard buildings
Action/Project Category	SIP; LPR
Goals/Objectives Met	G2&6 O2B&6B
Applies to existing, future, or not applicable	Future
Benefits (losses avoided)	Protection of life, physical structures from damage and loss of function, and water utility loss and extraordinary financial burden.
Estimated Cost	Medium $20,000
Priority*	Low
Plan for Implementation	
Responsible Organization	Town of Brookside
Potential Funding Sources	Federal, State or local sources
Timeline for Completion	Long-term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date:6/12/2014 Progress on Action/Project: Not completed.

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 39
Mitigation Action/Initiative: Brookside Earthquake Resistance Buildings/Infrastructure

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	0	
Property Protection	0	
Cost-Effectiveness	-1	
Technical	-1	
Political	-1	
Legal	-1	
Fiscal	-1	Limited financial resources
Environmental	-1	
Social	-1	
Administrative	-1	
Multi-Hazard	-1	
Timeline	-1	
Agency Champion	-1	
Other Community Objectives	-1	
Total	-12	
Priority (High/Med/Low)	Low	

Mitigation Action Worksheet

Name of Jurisdiction: Town of Brookside
Number: 40
Mitigation Action/Initiative: Thunderstorm run-off controls

Assessing the Risk	
Hazard(s) addressed:	Severe Storms, Flooding
Specific problem being mitigated:	Damages to infrastructure due to excessive storm water run-off
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Assess flood-prone areas within community and options to mitigate.
	2. Upgrade stormwater system throughout community.
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Implement structural and non-structural flood mitigation measures for flood-prone properties. Seek engineering and project assistance to mitigate storm water run-off. Develop and begin to implement a systematic process to evaluate and upgrade aging infrastructure such as transportation, drainage, utilities, and others that could be affected during a major natural disaster.
Action/Project Category	SIP, NRP
Goals/Objectives Met	G6&7 O6B&7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Protection of life and property values, and extraordinary financial burden of infrastructure replacement.
Estimated Cost	High $400,000
Priority*	High
Plan for Implementation	
Responsible Organization	Town of Brookside.
Potential Funding Sources	Federal, State or local sources
Timeline for Completion	Short term(1-5 years) and OG: (On-going)
Reporting on Progress	
Date of Status Report/ Report of Progress	Date:6/12/2014 Progress on Action/Project: Not begun due to lack of time and personal and financial cost. Seeking funding. Not completed.

Prioritization

Number: 40
Mitigation Action/Initiative: Brookside thunderstorm run-off controls

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	-1	
Technical	1	
Political	1	
Legal	1	
Fiscal	-1	
Environmental	1	
Social	1	
Administrative	0	
Multi-Hazard	1	
Timeline	0	
Agency Champion	1	Mayor and Board supports action
Other Community Objectives	1	
Total	8	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence, Colorado
Number: 41
Mitigation Action/Initiative: Floodplain and Hazard Mapping

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Structure Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Enhance detailed mapping of existing floodplain
	2. Respond post-storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Determine regulatory floodway limits within City of Florence
Action/Project Category	SIP, NRP
Goals/Objectives Met	G7 O7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Control of building and public facility locations and elevations within floodplain
Estimated Cost	$85,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA
Timeline for Completion	Short Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 41
Mitigation Action/Initiative: Floodplain and Hazard Mapping

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Informs public and officials of unsafe areas and elevations for development
Property Protection	1	Keeps new structures and substantial improvements from locating in high hazard area of floodplain
Cost-Effectiveness	1	Reduce losses from flood damage
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funding to implement
Environmental	1	No adverse impact
Social	0	
Administrative	1	
Multi-Hazard	1	Will mitigate property loss and reduce debris in storm flow path
Timeline	1	
Agency Champion	1	Much of City is within designated floodplain
Other Community Objectives	0	
Total	11	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence, Colorado
Number: 42
Mitigation Action/Initiative: Bridge Reconstruction

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Structure Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Raise street and State Highway bridges to allow for unimpeded use of roadways and bridges during high water events
	2. Divert stormwater
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Existing bridge decks are obstructions to flood water flow. Raise decks to enable flood flow to remain in designated channels instead of broad floodplains in populated area.
Action/Project Category	SIP, NRP
Goals/Objectives Met	G6&7 O6B&7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Reduce structure and life loss by keeping floodwater within defined flood channels
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR
Timeline for Completion	Long Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 42
Mitigation Action/Initiative: Bridge Reconstruction

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keep floodwater within designed flood flow channels
Property Protection	1	
Cost-Effectiveness	1	Reduce losses from flood damage by reducing flooding
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funding to implement
Environmental	1	No adverse impact
Social	0	
Administrative	1	
Multi-Hazard	1	Will mitigate property loss and reduce area of flooding
Timeline	1	
Agency Champion	1	Much of City is within designated floodplain caused by bridge obstructions
Other Community Objectives	0	
Total	11	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence, Colorado
Number: 43
Mitigation Action/Initiative: Provide Stormwater Detention Pond

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Structure Flooding and Downstream Water Quality
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Obtain land and construct stormwater detention pond
	2. Study possible alternatives to detention ponds
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Obtain land sufficient for detention of runoff in two locations to mitigate downstream flooding and to improve discharge water quality from City storm drainage systems
Action/Project Category	SIP, NRP
Goals/Objectives Met	G7 O7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Reduce structure and life loss by discharging stormwater at regulated rate and at improved quality
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA
Timeline for Completion	Short Term/Long Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 43
Mitigation Action/Initiative: Provide Stormwater Detention Pond

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Reduce downstream flood water discharge surges
Property Protection	1	
Cost-Effectiveness	1	Reduce losses from flood damage by reducing flooding and improving discharge water quality
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funding to implement
Environmental	1	No adverse impact
Social	0	
Administrative	1	
Multi-Hazard	1	Will mitigate property loss and reduce harmful effects of poor quality discharged stormwater
Timeline	1	
Agency Champion	1	
Other Community Objectives	0	
Total	11	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence, Colorado
Number: 44
Mitigation Action/Initiative: Oak Creek Flood Channel Enlargement

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Structure Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Increase floodwater carrying capacity of Oak Creek Channel through City
	2. Divert floodwater away from channel
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Existing channel geometry is obstruction to flood water flow. Increase channel dimensions to enable flood flow to remain in designated channel instead of broad floodplain in populated area.
Action/Project Category	SIP, NRP
Goals/Objectives Met	G7 O7B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Reduce structure and life loss by keeping floodwater within defined flood channel
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, UPRR
Timeline for Completion	Long Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 44
Mitigation Action/Initiative: Oak Creek Flood Channel Enlargement

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Keep floodwater within designated flood flow channel
Property Protection	1	
Cost-Effectiveness	1	Reduce losses from flood damage by reducing flooding
Technical	1	
Political	0	
Legal	1	
Fiscal	1	Will need grant funding to implement
Environmental	1	No adverse impact
Social	0	
Administrative	1	
Multi-Hazard	1	Will mitigate property loss and reduce area of flooding
Timeline	1	
Agency Champion	1	Much of City is within designated floodplain caused by channel obstructions
Other Community Objectives	0	
Total	11	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Name of Jurisdiction: USDI - Bureau of Land Management, Royal Gorge Field Office
Number: 45
Mitigation Action/Initiative: Fuel Load Thinning at Multiple Locations Throughout the BLM Managed Forest (Royal Gorge Field Office)

Assessing the Risk	
Hazard(s) addressed:	Wildland Fire, Severe Storms, Drought Tornado, Severe Winter Storms, Flood
Specific problem being mitigated:	Hazardous Fuel (Vegetation)
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Fuel load thinning at designated locations throughout the BLM forest land (see below for listing of locations)
	2. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mechanical thinning to reduce hazardous fuel. Reduce hazardous fuel; Protect Wildland Urban Interface (WUI); Improve response to wildland fire; Improve firefighter safety; Improve forest and rangeland health; Protect threatened and endangered species; Control epidemic insects and disease; Ecosystem restoration (See project location and acreage in table below).
Action/Project Category	Natural Systems Protection
Goals/Objectives Met	G6&7, O6A & 7A
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Life and property within the WUI; Ecosystem function; Forest and rangeland health; Threatened and endangered species
Estimated Cost	Varies Based on Specific Project – See estimated cost in table below
Priority*	High
Plan for Implementation	
Responsible Organization	USDI - Bureau of Land Management
Potential Funding Sources	BLM
Timeline for Completion	Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 6/10/14 Progress on Action/Project: Planned action, pending funding, incomplete

Prioritization

Number:
Mitigation Action/Initiative: McCoy Gulch – Thinning

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	0	
Administrative	1	
Multi-Hazard	1	
Timeline	0	
Agency Champion	1	
Other Community Objectives	1	
Total	11	
Priority (High/Med/Low)	High	

BLM Proposed Fuel Load Mechanical Thinng Projects		
Project	**Project Acreage**	**Estimated Cost**
McCoy Gulch Thinning	150	$ 45,000.00
Trail Gulch Thinning	600	$ 230,000.00
Seep Springs Thinning	200	$ 75,000.00
Lower Kerr Gulch Mechanical - Thinning	150	$ 33,400.00
Kerr Gulch Lower Fuel Breaks - Thinning	100	$ 48,750.00
High Park Thinning	200	$ 62,000.00
Garden Park Thinning	200	$ 70,000.00
Cooper Mountain Thinning	200	$ 70,000.00
Dawson Ranch FY 12 - Thinning	30	$ 22,500.00
Espinosa Gulch FY 12 - Thinning	100	$ 30,000.00
Oil Well Flats FY 12 - Thinning	100	$ 57,500.00
Dawson Ranch FY 15 - Thinning	30	$ 23,500.00
Garden Park FY 16 CWPP - Thinning	200	$ 80,000.00
Grand Canyon Hills FY 17 - Thinning	150	$ 70,000.00

Mitigation Action Worksheet

Name of Jurisdiction: USDI - Bureau of Land Management, Royal Gorge Field Office
Number: 46
Mitigation Action/Initiative: Arkansas Mountain Stewardship - Prescribed Fire

Assessing the Risk	
Hazard(s) addressed:	Wildland Fire, Severe Storms,Floods, Drought, Tornado, Severe Winter Storms
Specific problem being mitigated:	Hazardous Fuel (Vegetation)
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Prescribed fire to reduce hazardous fuel
	2. No action
	3.
Action/Project Intended for Implementation	
Description of Selected Action/Project	Prescribed fire to reduce hazardous fuel; Protect Wildland Urban Interface (WUI); Improve response to wildland fire; Improve firefighter safety; Improve forest and rangeland health; Protect threatened and endangered species; Control epidemic insects and disease; Ecosystem restoration. (See below for project locations and acreage).
Action/Project Category	Natural Systems Protection
Goals/Objectives Met	G6&7, O6A & 7A
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Life and property within the WUI; Ecosystem function; Forest and rangeland health; Threatened and endangered species
Estimated Cost	Varies Based on Specific Project – See estimated cost in table below
Priority*	High
Plan for Implementation	
Responsible Organization	USDI - Bureau of Land Management
Potential Funding Sources	BLM
Timeline for Completion	Long Term
Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 6/10/14 Progress on Action/Project: Planned action, pending funding, incomplete

Prioritization

Number: 46
Mitigation Action/Initiative: Arkansas Mountain Stewardship – Prescribed Fire

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	0	
Environmental	1	
Social	0	
Administrative	1	
Multi-Hazard	1	
Timeline	0	
Agency Champion	1	
Other Community Objectives	1	
Total	11	
Priority (High/Med/Low)	High	

BLM Proposed Fuel Reduction through Prescribed Fire Projects		
Project	**Project Acreage**	**Estimated Cost**
Arkansas Mountain Stewardship	100	$ 20,000.00
Booger Red Hill - Prescribed Fire	100	$ 20,000.00
Deer Haven - Prescribed Fire	150	$ 50,000.00
Espinosa Gulch - Prescribed Fire	250	$ 50,000.00
Thirty-one Mile Mountain - Prescribed Fire	100	$ 20,000.00
Trail Gulch - Prescribed Fire	300	$ 90,000.00
Cooper FY 12 - Prescribed Burn	475	$ 95,000.00

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Fremont County
Number: 47
Mitigation Action/Initiative: Review and Update Plans and Procedures to Improve Disaster Response Efforts

Assessing the Risk	
Hazard(s) addressed:	Multi-All
Specific problem being mitigated:	Ensure disaster response procedures are adequate to minimize potential impacts of natural hazards
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Review and update disaster response plans and procedures with multiple stakeholders throughout the County to improve disaster response efforts
	2. Rely on each municipality or stakeholder to review and improve their plans separately without multi-jurisdictional collaboration
	3. No action; rely on current plans and procedures to respond to natural hazards without updates or review
Action/Project Intended for Implementation	
Description of Selected Action/Project	County-wide response agencies and other personnel will meet periodically as part of a Planning Committee or Emergency Services Committee to review, update and develop operating plans and procedures to improve disaster response efforts among residents and geographical areas of Fremont County.
Action/Project Category	EAP, LPR
Goals/Objectives Met	G1,3,4&8 O1A, 1C, 3A,3B, 3C, 4B, 8A, & 8B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	OEM
Potential Funding Sources	County Budget for OEM
Timeline for Completion	Ongoing

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 47
Mitigation Action/Initiative: Review and Update Plans and Procedures to Improve Disaster Response Efforts

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	
Environmental	1	
Social	0	
Administrative	0	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Fremont County
Number: 48
Mitigation Action/Initiative: Review and Update of Emergency Operations Center Capabilities

Assessing the Risk	
Hazard(s) addressed:	Multi-All
Specific problem being mitigated:	Ensure disaster response procedures are adequate to minimize potential impacts of natural hazards
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Regular meetings of personnel involved in EOC operations to improve and develop EOC operational procedures for future incidents
	2. Rely on each municipality or stakeholder cooperating in the EOC operations to review and improve their plans separately without multi-jurisdictional collaboration
	3. No action; rely on the current capabilities of the EOC to respond to natural hazards without updates or review
Action/Project Intended for Implementation	
Description of Selected Action/Project	County-wide response agencies and other personnel involved in EOC operations will meet regularly to improve, develop and enhance EOC operational procedures for future incidents.
Action/Project Category	EAP, LPR
Goals/Objectives Met	G1&4 O1A, 1C, 4A, & 4B
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	OEM
Potential Funding Sources	County Budget for OEM
Timeline for Completion	Ongoing

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 48
Mitigation Action/Initiative: Review and Update of Emergency Operations Center Capabilities

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	
Environmental	1	
Social	0	
Administrative	0	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Fremont County
Number: 49
Mitigation Action/Initiative: Continue to Improve Communication of Hazards to Residents

Assessing the Risk	
Hazard(s) addressed:	Multi-All
Specific problem being mitigated:	Communication with residents before, during, and after a disaster or incident
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Continue development and participation in regional Public Information Group to improve communication with residents
	2. Rely on each municipality or stakeholder within the County to inform their residents of natural hazards without coordination with County, State, or Federal agencies
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Continue development and participation in the regional Public Information Group, which works with members of local state and federal agencies in and around Fremont County to improve communications with residents before, during, and after a disaster or incident. The group offers multiple methods of dispersing information to residents of the County and the region. Development and participation involves regular meetings and training as necessary.
Action/Project Category	EAP
Goals/Objectives Met	G1,2,&6 O1B, 1C, 2A, 6C, & 6D
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	OEM
Potential Funding Sources	County Budget for OEM
Timeline for Completion	Ongoing

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 49
Mitigation Action/Initiative: Continue to Improve Communication of Hazards to Residents

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	
Environmental	1	
Social	0	
Administrative	0	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: Fremont County
Number: 50
Mitigation Action/Initiative: Coordination of Testing of Emergency Communication Systems

Assessing the Risk	
Hazard(s) addressed:	Multi-All
Specific problem being mitigated:	Communication with residents before, during, and after a disaster or incident
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Coordinate and schedule testing of emergency notification systems with local, county, and regional organizations 2. Test each emergency notification system separately or only use in response to an incident 3. No action; tests of emergency communication systems will not be scheduled or conducted
Action/Project Intended for Implementation	
Description of Selected Action/Project	Tests of emergency notification systems will be scheduled and coordinated with local, county, and regional agencies. These tests may be scheduled and tracked during meetings of personnel involved in the EOC operations, the regional Public Information Group, or the Planning Committee and Emergency Services Committee.
Action/Project Category	EAP
Goals/Objectives Met	G3&6 O3A & 6E
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Not quantifiable
Estimated Cost	Low
Priority*	High
Plan for Implementation	
Responsible Organization	OEM
Potential Funding Sources	County Budget for OEM
Timeline for Completion	Ongoing

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 50
Mitigation Action/Initiative: Coordination of Testing of Emergency Communication Systems

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	0	
Legal	1	
Fiscal	1	
Environmental	1	
Social	0	
Administrative	0	
Multi-Hazard	1	
Timeline	1	
Agency Champion	1	
Other Community Objectives	0	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

.

Name of Jurisdiction: City of Cañon City
Number: 51
Mitigation Action/Initiative: Flood Control – Orchard Ave Drainage Basin

Assessing the Risk	
Hazard(s) addressed:	Flood
Specific problem being mitigated:	Flooding
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Multiple actions taken to reduce potential flooding in the Orchard Ave Drainage Basin
	2. Mitigate effects of flooding immediately following storm event
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Multiple actions including stabilizing channels, enlarge/open channels, construction of drop structures, inlet/outlet improvements, reinforced box culverts, detention basin work, and reinforced concrete pipe.
Action/Project Category	SIP
Goals/Objectives Met	G2, 6, &7 O2A, 6B, & 7B
Applies to existing, future, or not applicable	Existing and future
Benefits (losses avoided)	Loss of life, property, utilities, transportation, critical facilities
Estimated Cost	$9,742,000
Priority*	High
Plan for Implementation	
Responsible Organization	City of Cañon City
Potential Funding Sources	City of Cañon City Stormwater Utility, HMGP, CWCB, IOOF, Fremont County
Timeline for Completion	Short Term/Long Term

*** Refer to results of Prioritization (page 2)**

Reporting on Progress	
Date of Status Report/ Report of Progress	Date: 1998 Progress on Action/Project: Orchard Ave Detention Basin Date: 1998 Progress on Action/Project: 48" RCP, Channel Improvements Date: 2009 Progress on Action/Project: 54" RCP, Hydraulic Ditch to Central Ave

Prioritization

Number: 51
Mitigation Action/Initiative: Flood Control – Orchard Ave Drainage Basin

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	
Property Protection	1	
Cost-Effectiveness	1	
Technical	1	
Political	1	
Legal	1	
Fiscal	1	
Environmental	1	
Social	1	
Administrative	1	
Multi-Hazard	0	
Timeline	1	
Agency Champion	1	
Other Community Objectives	1	
Total	13	
Priority (High/Med/Low)	High	

ORCHARD AVENUE DRAINAGE BASIN (Alternate No. 4 modified)

Structure No.	Description	Location				Year Completed
	Open Channel and 10' x 5' RCBC	Arkansas River to US Hwy 50	$ 3,000,000	$ 500,000	$ 3,500,000	
	10' x 5' RCBC	US Hwy 50	$ 1,500,000		$ 1,500,000	
	72" RCP	US Hwy 50 to Cherry Street	$ 1,500,000		$ 1,500,000	
	54" RCP	Cherry Street to Central Ave (Cone Ave-Pear)	$ 1,000,000	$ 50,000	$ 1,050,000	
	54" RCP	Hydraulic Ditch to Cherry Street (Orchard Ave)	$ 1,000,000		$ 1,000,000	
	54" RCP	Hydraulic Ditch to Central Avenue (Orchard Ave)			$ -	2009
	54" RCP	Central Avenue to South Street	$ 500,000		$ 500,000	
	Channel Improvements	Central Avenue to South Street	$ 192,000		$ 192,000	
	48" RCP, Channel Improvements	South Street to High Street			$ -	1998
	Orchard Avenue Detention Basin	North of South Street			$ -	1998
	Detention Basin resize	Elizabeth Street and Cone Ave	$ 500,000		$ 500,000	
					$ 9,742,000	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence Police Department
Number: 52
Mitigation Action/Initiative: Backup Emergency Mobile Communications System

Assessing the Risk	
Hazard(s) addressed:	Landslide, Severe Storms, Extreme Temperature, All Hazards
Specific problem being mitigated:	County-wide emergency communications failure
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Mobile communication vehicle and radio system
	2. Satellite phone system
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Mobile communication vehicle and two-way radio system for alternative communication for use in case of failure of County system.
Action/Project Category	SIP, Emergency Services
Goals/Objectives Met	G3 & 4 O3A & 4A
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Reduce structure damage and loss of life by communications with emergency responders and law enforcement
Estimated Cost	High
Priority*	High
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, CWCB, NRCS, DOLA, CDOT, FHWA, other grants
Timeline for Completion	Short Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 52
Mitigation Action/Initiative: Backup Emergency Mobile Communications System

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Maintain emergency services communication locally and County-wide
Property Protection	-1	
Cost-Effectiveness	1	Reduce property losses by faster communication to responders
Technical	1	
Political	1	Minimal public awareness
Legal	1	No requirements
Fiscal	-1	Cannot be funded under current budget
Environmental	1	No adverse impact
Social	1	
Administrative	1	Could be rapidly implemented
Multi-Hazard	1	Required for all hazard types
Timeline	1	Implemented in less than 5 years
Agency Champion	1	City of Florence Police Department
Other Community Objectives	1	
Total	10	
Priority (High/Med/Low)	High	

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence
Number: 53
Mitigation Action/Initiative: Identify and remove dangerous trees and branches from City streetscape

Assessing the Risk	
Hazard(s) addressed:	Severe Winter Weather, Thunderstorms/High Winds/Hail, Tornados, Drought,
Specific problem being mitigated:	Trees and limbs fall on sidewalks and streets in high winds. Trees are up to 100 years old and many are decayed and dying, without visible external indication.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Identify and remove decayed trees and limbs 2. Identify at risk trees and prevent people from walking or driving under them by closing sidewalks or roads, especially during storms 3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Identify and remove decayed trees and limbs to prevent property damage and loss of life in high wind storms
Action/Project Category	SIP, NRP
Goals/Objectives Met	G6 & 7 O6A, 6E, 7C & 7D
Applies to existing, future, or not applicable	Existing and Future
Benefits (losses avoided)	Reduce structure damage and loss of life by removing hazards from public streetscape and parks
Estimated Cost	High
Priority*	Medium
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	City of Florence, NRCS, DOLA, CDOT, FHWA, other grants
Timeline for Completion	Short Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 53
Mitigation Action/Initiative: Identify and remove dangerous trees and branches from City streetscape

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Remove falling tree and limb hazard from public way
Property Protection	1	
Cost-Effectiveness	1	Reduce property losses by removing hazard before storm
Technical	1	
Political	0	Minimal public awareness
Legal	1	No requirements
Fiscal	-1	Cannot be funded under current budget
Environmental	0	
Social	-1	Residents like look of tree-lined streets
Administrative	1	Could be rapidly implemented
Multi-Hazard	0	
Timeline	1	Implemented in less than 5 years
Agency Champion	-1	City of Florence Public Works Department
Other Community Objectives	-1	
Total	3	
Priority (High/Med/Low)	Medium	Very necessary but politically a tough-sell. Huge trees are hard to replace

Mitigation Action Worksheet

Please complete one sheet per action/project with as much detail as possible, using the guidance beginning on page 3 and examples provided by FEMA.

Name of Jurisdiction: City of Florence
Number: 54
Mitigation Action/Initiative: Identify earthquake-prone unreinforced structures

Assessing the Risk	
Hazard(s) addressed:	Earthquake
Specific problem being mitigated:	Failure of 100+-year old structures during an earthquake.
Evaluation of Potential Actions/Projects	
Actions/Projects Considered (name of project and reason for not selecting):	1. Assess and identify non-reinforced structures that are prone to earthquake damage
	2. Partial assessment of downtown buildings only for damage during earthquakes
	3. No action
Action/Project Intended for Implementation	
Description of Selected Action/Project	Assess and identify non-reinforced structures prone to earthquake damage.
Action/Project Category	LPR, EAP
Goals/Objectives Met	G6 & 8 O6B & 8B
Applies to existing, future, or not applicable	Existing
Benefits (losses avoided)	Identify hazardous buildings so building owners can reinforce structures against earthquake, preventing loss of life and property damage
Estimated Cost	Low
Priority*	Medium
Plan for Implementation	
Responsible Organization	City of Florence
Potential Funding Sources	DOLA, other grants
Timeline for Completion	Short Term

*** Refer to results of Prioritization (page 2)**

Prioritization

Number: 53
Mitigation Action/Initiative: Identify earthquake-prone unreinforced structures

Criteria	Numeric Rank (-1, 0, 1)	Provide brief rationale for numeric rank when appropriate
Life Safety	1	Identify earthquake prone structures
Property Protection	1	
Cost-Effectiveness	1	
Technical	0	
Political	0	Minimal public awareness
Legal	0	
Fiscal	-1	Cannot be funded under current budget
Environmental	1	No adverse impact
Social	1	
Administrative	1	Building owner cooperation needed
Multi-Hazard	-1	
Timeline	1	Implemented in less than 5 years
Agency Champion	0	City of Florence Building Department
Other Community Objectives	0	
Total	5	
Priority (High/Med/Low)	Medium	

APPENDIX E.
PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS

APPENDIX E.
PLAN ADOPTION RESOLUTIONS FROM PLANNING PARTNERS

To Be Provided With Final Release

APPENDIX F.
EXAMPLE PROGRESS REPORT

APPENDIX F.
EXAMPLE PROGRESS REPORT

Fremont County
Hazard Mitigation Plan Update
Annual Progress Report

Reporting Period: 2014-2015

Background: Fremont County and participating cities and special purpose districts in the County developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating partners organized resources, assessed risks from natural hazards within the County, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at:

http://www.co.Fremont.co.us/OEM/default.aspx

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2015, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _____, 2020. As of this reporting period, the performance period for this plan is considered to be __% complete. The Hazard Mitigation Plan has targeted 54 hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- __ out of __ initiatives (__%) reported ongoing action toward completion.
- __ out of __ initiatives (__%) were reported as being complete.
- __ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the Fremont County Hazard Mitigation Plan Update. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Fremont County)
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Hazard Mitigation Plan Steering Committee: The Hazard Mitigation Plan Steering Committee, made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on _____, 201_. It was determined through the plan's

development process that a Steering Committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

TABLE 1.
STEERING COMMITTEE MEMBERS

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were __ natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- _____
- _____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each initiative and the prioritization process.

Address the following in the "status" column of the following table:

- *Was any element of the initiative carried out during the reporting period?*
- *If no action was completed, why?*
- *Is the timeline for implementation for the initiative still appropriate?*
- *If the initiative was completed, does it need to be changed or removed from the action plan?*

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
FREMONT COUNTYWIDE MITIGATION INITIATIVES				
Initiative #1 – Public Information and Awareness				
Initiative #2 — Floodplain Mapping – Swissvale Community				
Initiative #3 — Floodplain Mapping – Howard Community				
Initiative #4 — Flood Plain Mapping – Cotopaxi Community				
Initiative #5 — Detailed Floodplain Mapping – Texas Creek Community				
Initiative #6 — Detailed Floodplain Mapping – Penrose Area				
Initiative #7 — Detailed Floodplain Mapping – C-3 and C-4 Dam Area				
Initiative #8 — Floodway Determination Mapping of Arkansas River from Ash Street to S.H. 115				
Initiative #9 — Beaver Park and Bear Creek Retention/Detention Ponds				
Initiative #10 — Right-of-Way Debris Management				
Initiative #11 — Wildfire protection				
Initiative #12 — Fuel Reduction and increase carrying capacity of drainage channel – Phantom Canyon drainage				
Initiative #13 — Stream Channel Armoring				
Initiative #14 — Fuel Storage				
Initiative #15 — Watertight manhole lids				

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
Initiative #16 — Backup Communication System				
Initiative #17 — Backup Power Generator at Service Center				
Initiative #18 — Ultraviolet (UV) Disinfection System Upgrade				
Initiative #19 — Floodplain Mapping				
Initiative #20 — Arkansas Penrose Pipeline Project to Diversify Raw Water Source				
CAÑON CITY MITIGATION INITIATIVES				
Initiative #21 — Floodplain and Hazard Mapping				
Initiative #22 — Flood Control – Abbey Drainage Basin				
Initiative #23 — Flood Control – Four Mile Creek Drainage Basin				
Initiative #24 — Flood Control – Hogback Area Drainage Basin				
Initiative #25 — Flood Control – N. 9th Street Drainage Basin				
Initiative #26 — Flood Control – North Sand Creek Drainage Basin				
Initiative #27 — Flood Control – Northeast Canyon Drainage Basin				
Initiative #28 — Flood Control – South Sand Creek Drainage Basin				
Initiative #29 — Drought Mitigation				
Initiative #30 — Wildfire Education and Awareness Program				
Initiative #31 — Local Planning and Regulations				
Initiative #32 — Structure and Infrastructure Projects				
Initiative #33 – Structure and Infrastructure Projects				

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
Initiative #34 — Natural Systems Protection				
Initiative #35 — Install actuators on control gates of the Cañon City Hydraulic Ditch main canal				
Initiative #45 — Fuel Load Thinning at Multiple Locations Throughout the BLM Managed Forest (Royal Gorge Field Office)				
Initiative #46 — Arkansas Mountain Stewardship - Prescribed Fire				
Initiative #47 — Review and Update Plans and Procedures to Improve Disaster Response Efforts				
Initiative #48 — Review and Update of Emergency Operations Center Capabilities				
Initiative #49: — Continue to Improve Communication of Hazards to Residents				
Initiative #50 — Coordination of Testing of Emergency Communication Systems				
Initiative #51 — Flood Control – Orchard Avenue Drainage Basin				
BROOKSIDE MITIGATION INITIATIVES				
Initiative #36 — Vegetative Fuel Reduction				
Initiative #37 — Disaster-resistant community				
Initiative #38 — Drought-resistant community				
Initiative #39 — Earthquake Resistant Buildings/Infrastructure				
Initiative #40 — Thunderstorm run-off controls				
FLORENCE MITIGATION INITIATIVES				
Initiative #41 — Floodplain and Hazard Mapping				
Initiative #42: — Bridge Reconstruction				
Initiative #43 — Provide Stormwater Detention Pond				

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Status	Status (X, O,✓)
Initiative #44 — Oak Creek Flood Channel Enlargement				
Initiative #52: — Backup Emergency Mobile Communications System				
Initiative #53 — Identify and remove dangerous trees and branches from City streetscape				
Initiative #54 — Identify earthquake-prone unreinforced structures				

Completion status legend:
✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Steering Committee, the following recommendations will be noted for future updates or revisions to the plan:

- _____
- _____
- _____
- _____
- _____

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the Fremont County Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here