2025 DRAFT Castle Valley, Utah

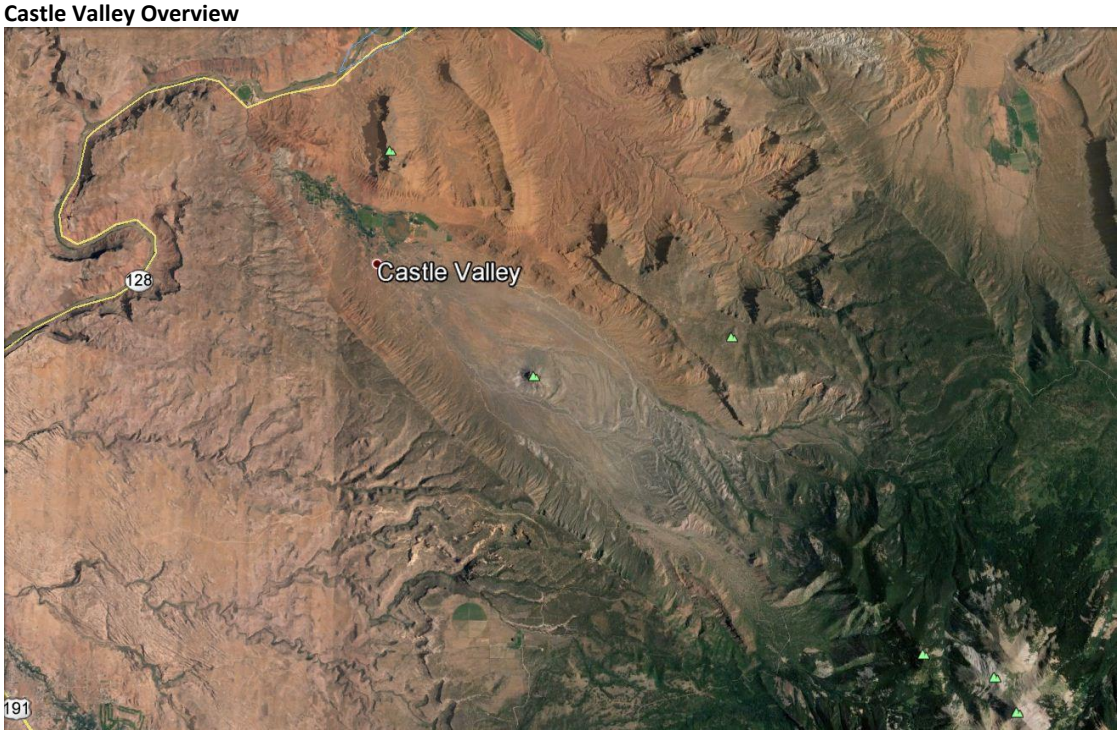
Hazard Mitigation Plan

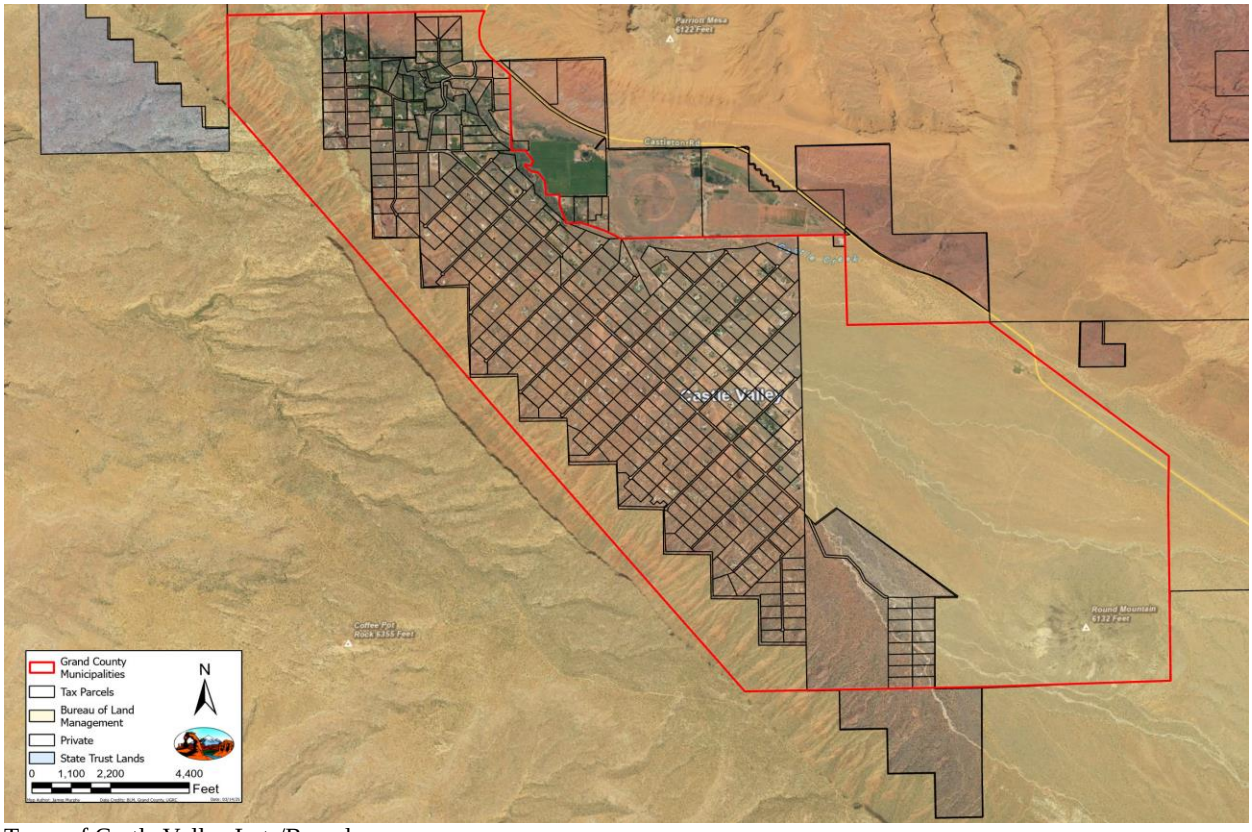
TABLE OF CONTENTS

2. DEFINTIONS
2. BACKGROUND
INTRODUCTION
PURPOSE
SCOPE
3. FUNDING
3. PROFILE, CASTLE VALLEY, UTAH
5. PLANNING PROCESS
9. 2020 REVIEW AND UPDATE OF EXISTING PLAN
10. RESOURSES
12. POTENTIAL HAZARDS WITH RISK ASSESSMENTS & MITIGATION STRATEGIES
12. FIRE
18. FLOOD
23. SEVERE WEATHER
28. POWER OUTAGES
29. COMMUNICATIONS
33. ROCK FALL
36. DROUGHT
39. WATER CONTAMINATION
44. SUSIDENCE
46. EARTHQUAKE
51. BIOLOGICAL HAZARDS
55. 2025 RECOMMENDED PRIORITY PROJECTS
56. 2020 PRIORITY PROJECT RESULTS
59. PLAN MAINTENANCE PROCESS
60. TABLE OF APPENDICES


Logan
Kemmerer
Green River
Rock Springs
Brigham City
Montello
North Ogden
Evanston
Syracuse
South Ogden
Manila
SALT LAKE CITY
Coalville
West Jordan
Heber City
Tooele
Lehi
Vernal
Eagle Mountain
Provo
Duchesne
Roosevelt
Spanish Fork
Nephi
Helper
Wellington
Manti
Castle Dale
Fruita
Palisa
Fillmore
Green River
Grand Junction
Richfield
Loa
Hanksville
Beaver
Junction
Monticello
Parowan
Panguitch
Cedar City
Blanding
Cortez
St. George
Hurricane

Castle Valley Overview





Town of Castle Valley Lots/Boundary

DEFINITIONS

Catastrophic Disaster: An event that results in large numbers of deaths and injuries; causes extensive damage or destruction of facilities that provide and sustain human needs; produces an overwhelming demand on State and local response resources and mechanisms; causes a severe long-term effect on general economic activity; and severely affects State, local, and private-sector capabilities to begin and sustain response activities. Note: the Stafford Act provides no definition for this term. (**FEMA,** *FRP Appendix B*, 1992)

Hazard: "A potential event or situation that presents a threat to life and property." (**FEMA**, *Hazards Analysis for Emergency Management (Interim Guidance)*, September **1983**, p. 5)

BACKGROUND

INTRODUCTION:

The Castle Valley Hazard Mitigation Plan is a localized plan that details the several natural and manmade hazards that are specific to Castle Valley and the Town of Castle Valley municipality, located in Grand County in the State of Utah. (See Appendix A1 –A2) This plan fulfills the requirements set forth by the Disaster Mitigation Act of 2000 (DMA 2000). The DMA 2000 requires a hazard mitigation plan in order to be eligible for mitigation grants made available by the Federal Emergency Management Agency (FEMA).

PURPOSE:

The Castle Valley Hazard Mitigation Plan is designed to evaluate and identify local hazards that would negatively affect Castle Valley. The plan outlines mitigation strategies for each hazard with an assessment to the potential benefit, the financial viability and community acceptance /political viability. The plan will be an important step in outlining and recommending government roles, public participation, regulations and emergency systems to create a safer environment for citizens and efficient emergency response.

SCOPE:

The Castle Valley Hazard Mitigation Plan includes all incorporated and unincorporated areas in Castle Valley. The plan addresses all natural hazards identified by the Federal Emergency Management Agency. All hazards that may affect Castle Valley and its residents are analyzed. Hazard mitigations are discussed in both long and short term goals in mind. The implementation of each mitigation strategy is discussed and possible resources and funding options are identified.

FUNDING:

Funding for the mitigation planning process has been largely by volunteer hours. Minimal costs for office supplies, such as paper, ink, and hours worked by the Town clerk will also be included.
Funding for mitigation strategies include budgeting by the Town of Castle Valley and the Grand County Service Area for Castle Valley Fire Protection District (Castle Valley Fire Protection District and possible grant and loan sources. Possible Grant and loan sources include: Permanent Impact Fund Board (C.I.B.), Department of Agriculture (USDA), Rural Development Grants, credit unions, and other Grant Websites.
Recruiting volunteers for some of the mitigation efforts was also considered.
Volunteer hours will be counted at the current FEMA rate.
Town Clerk hours are counted at the current FEMA rate.

PROFILE

General:
Castle Valley was initially a large ranch which was subdivided into five-acre minimum lots and a portion of unsubdivided land (now Town of Castle Valley municipal boundaries) platted, and recorded on May 11, 1973. The Town of Castle Valley was officially incorporated on July 26, 1985.

The 2020 US Census stated that the population of the Town of Castle Valley was 347 as compared to the 2010 US Census which stated a population of 3319 for the Town. The 2020 US Census also showed the following demographics for Town residents:

Male	212	White	315
Female	136	African American	5
Under 18	45	American Indian or Alaska Native	1
20-34 years old	9	Asian	2
35-49 years old	60	Native Hawaiian and Pacific Islander	0
50-64 years old	30	Other	0
65 years old and over	204	Identified by two or more	24

Castle Valley is surrounded by large tracts of open space and minimally developed public land that provides a natural setting, integral to the character of the Town. The sensitive nature of the land and water of Castle Valley and the effects of climate change call for creative and new ways of managing Town and surrounding lands and our local and global environments.

Government:
The Town of Castle Valley has an elected 5 member Town Council including a Mayor. The Town also has a Planning and Land Use Commission, a Road Committee and the Hazard Mitigation Committee that meet monthly in open and public meetings in accordance with Utah Code 52-4. The Town Council adopts Ordinances and Resolutions with recommendations and public hearings presented from each committee and works together to ensure the health and safety of Valley residents. Ordinance 85-3 is the Town's governing Land Use Ordinance and governs and protects the resources and natural setting of Castle Valley. Ordinance 95-6 outlines processes and forms that make residents aware of natural hazards when going through the building process. Ordinance 2007-6 Prohibits Fire Hazards in periods of high fire danger. Ordinance 1996-1 protects the Town's Watershed. The Town also adopted Ordinance 2013-1 which created the Hazard Mitigation Committee. Many regional Hazard Mitigation plans have been adopted in the past by Resolutions by the Town Council as well as a "Firewise Standard" Resolution.

Land Use:
Castle Valley is a rural residential and agricultural community, made up of five-acre minimum lots with single-family homes and accessory buildings in association with low-impact livestock and agricultural uses. The Town currently allows home and premises businesses, but no other commercial or industrial activity is permitted.

The Town has a modest level of public facilities and services. A community building was built on the Town lot in 2004 and serves as a gathering place for community and Town government events. The Town building is the only non-affiliated public facility in the Town and houses the Town office, meeting rooms, and a branch of the Grand County Public Library. The Town lot is home to a fire station owned and managed by the Castle Valley Fire Protection District, a shed for Roads Department equipment, a basketball court, playground and an outdoor picnic area. The Town has a small, part-time staff. The Town has a cemetery that is maintained by the Grand County Cemetery District. There is private commercial garbage removal service for residents. There is no municipal water delivery system or wastewater treatment facility.

Water:
Water is provided through individual wells and waste is managed by individual septic wastewater disposal systems. Castle Valley's aquifer is the sole source of drinking water for its residents and an irreplaceable resource.

The Castle Valley Aquifer was declared as a Sole Source Aquifer by the Federal Environmental Protection Agency in 2001[1] (See Appendix CW-1) and classified by the Utah Division of Water Quality as "pristine" in certain areas, however water quality varies in different parts of the Town. About 40% of the Town's lots have very hard water that must be purified in order to drink. The aquifer is extremely vulnerable to contamination. It is an unconsolidated valley-fill type and exposed at the surface with no overlying confining geologic formation. This allows contaminates to move more quickly downward to the water supply. The Town has six monitoring wells for measuring water quality changes over time. There are approximately 6,700 acre feet of water in the watershed during a wet period and around 5,700 during a dry period. There are just over 6,900 acre feet of water rights in the valley so it is effectively at full appropriation.
Two streams originating from the La Sal mountains pass through the town boundaries: Castle Creek which is perennial and Placer Creek which is intermittent. There are several users with water rights for Castle Creek that use the partially spring fed creek for irrigation purposes. The Water Management Plan approved in 2025 provides in-depth analysis of the water system in the CV watershed and addresses water rights and water quality protection issues and options for the future.

Transportation and Roads:
Castle Valley is served by County Road 96. State Highway 128, which is about 1.7 miles outside of the Town's municipal boundary, is the principal transportation access to the Town. Castle Valley Drive serves as the main road leading in and out of the Town. Shafer Lane has been dedicated as an emergency ingress and egress road for emergency responders and for the public should Castle Valley Drive become impassable. Castle Valley Drive is the only paved (chipped sealed) Town road and is paved for the first 3.64 miles. The remaining portion of Castle Valley Drive is gravel and dirt. All other Town roads are either crowned dirt and/or gravel and ~~are~~ comprise approximately 17 miles in combined length. Roads on the west side of Castle Valley Drive proceed to the base of Porcupine Rim. This results in progressively steeper grades, some exceeding 20%, making winter maintenance difficult and in some cases impossible.

The Town Roads Department is responsible for maintenance and improvements of all Town roads and for all drainages within the Town's easements. This includes flood control, dirt work, paving/chip sealing of Castle Valley Drive, signage for all Town roads, snow removal for dirt roads that receive winter maintenance, and Town vehicle and equipment maintenance and repair. Castle Valley contracts with Grand County Road Department to provide winter snow removal from Castle Valley Drive.

Fire Protection and Emergency Preparedness:
Castle Valley is a Wildland Urban Interface - a place where residential areas border and interact with undeveloped wildland vegetation. The Town and outlying areas are served by the Grand County Service Area for Castle Valley Fire Protection District (Castle Valley Fire Protection District), which funds and manages the Castle Valley Volunteer Fire Department. In 2004, Castle Valley received Firewise Communities/USA recognition status. On behalf of the Castle Valley community, the Castle Valley Fire District maintains this status with annual membership in Firewise Communities, a project of the National Fire Protection Association

Comment [PH1]: How does HMP jibe with Castle Valley Fire District Wildfire Preparedness Plan 2019?

[1] Environmental Protection Agency, August 6, 2001, Sole source aquifer Notice of final determination for the Castle Valley Aquifer System, Castle Valley, UT: Environmental Protection Agency, (FRL-7024-2).

Until recently residents with medical emergencies experienced an approximate 30 to 45 minute response time from Grand County EMS who travel from Moab. The Grand County Emergency Special Service District and the Castle Valley Fire District established an Emergency Medical Response (EMR) team for more rapid, first response to medical emergencies. These trained EMR's cannot ~~do~~ conduct transports, but do have a non-transport ambulance with medical supplies to treat patients until Grand County EMS arrives. The EMR team also received training involving the emergency helicopter contractor that recently established itself in the Moab area.

PLANNING PROCESS

Section Contents

1. Town of Castle Valley participation and Plan adoption
2. Hazard Mitigation Planning Process
3. Public and Other Stakeholder Involvement
4. Integration with Existing Plans

1. Town of Castle Valley planning participation and Plan adoption.
On December 18, 2013 in open session the Town of Castle Valley passed Ordinance 2013-1 creating a local Hazard Mitigation Committee. The Town of Castle Valley Town Council formally adopted Resolution 2016-1. The first Castle Valley Hazard Mitigation Plan was approved by the State of Utah and FEMA in March 2016. In 2020 the Plan was updated and approved by the State. Now in 2025 , this is the second Plan update.

2. Hazard Mitigation Planning Process
The Castle Valley Hazard Mitigation Plan was developed through interaction between the Hazard Mitigation Planning Committee for the Town of Castle Valley, the Town of Castle Valley Municipality and Planning and Land Use Commission, Grand County Service Area for Castle Valley Fire Protection District, CERT (Community Emergency Response Team), the Grand County Office of Emergency Management and the local community.

The tasks of the Hazard Mitigation Planning Committee:

- Attend Meetings
- Represent interests of Castle Valley and its residents
- Collect information on jurisdiction's resources
- Identify and prioritize the threat of local hazards
- Facilitate development of jurisdiction's mitigation strategy.
- Create local hazard mitigation plan according to FEMA's guidelines set forth in "State and Local Mitigation Planning How-To-Guide"
  dated April 2023 FEMA 386-1

Beginning January 28, 2025, the Hazard Mitigation Planning Committee meets on the fourth Tuesday of each month in open and public meetings. The Hazard Mitigation Committee will continue to meet until a draft is ready for approval. They will review and update the plan every 4 years or as new information becomes available and will hold public hearings to seek community input.

3. Public and Other Stakeholder Involvement
All Hazard Mitigation Committee meetings are open to the public and are posted in accordance with the Open and Public Meetings Act (Utah Code 52-4-202). The Hazard Mitigation Meeting Agendas and Minutes are posted to the Town's website as well as Utah's Public Notice Website. All Agendas, Minutes and meeting documents are kept in a book which will remain a permanent record in the Town office.

In 2025 Hazard Mitigation Committee meetings were held January 28th , February 25th, March 25th ,April 22nd , May27th, June 24th , July 22nd
Members of the Castle Valley Fire Protection District, Planning and Land Use members and residentse also attended the Hazard Mitigation Committee meetings.

The Hazard Mitigation Committee Members reached out to local groups such as the Castle Valley Academy (formerly Day Star) Academy, Sorrel River Ranch, Red Cliffs Lodge, Castle Valley Irrigation Company, Frontier Communications and Rocky Mountain Power to receive input and seek support in creating the Hazard Mitigation Plan for Castle Valley, Utah.

Public Hearings will be held to review preliminary drafts as well as the final draft of the Castle Valley Hazard Mitigation Plan. Notice of Public Hearings for input on the drafts will be posted with a minimum of 2 weeks before the hearings will be held.

4. Integration with Existing Plans
The Town of Castle Valley participated in the development of and adopted the Southeastern Utah Regional Natural Hazard: Pre-Disaster Mitigation Plan in 2013 and 2020 and has implemented many projects outlined in that plan. This was a broad regional plan and even though Castle Valley was included, it was to a very small degree. The Town then formed the Hazard Mitigation Committee to develop a plan that was more in depth and would better serve the community.

At that time, ata was reviewed from the Town of Castle Valley records including: The Drainage Master Plan, Water Studies, UGS geologic studies, the Town's General Plan, Grand County's Regional Plan, and the Southeastern Utah Hazard Mitigation Plan, The Utah Division of Forestry, Fire and State Lands local Community Fire Plan, private records, newspaper articles and the Castle Valley Fire Protection Districts records were all used in the development of the Castle Valley Hazard Mitigation Plan.

Representatives from the Castle Valley Road Department, Castle Valley Fire Protection District, Castle Valley Town Council, Castle Valley Planning and Land Use Commission, and the Grand County Emergency Manager, brought different aspects to the planning process. The goals and priorities which were incorporated into the plan were brought back to each department to integrate into their capital projects and policies. The Road Department has already implemented a maintenance plan that includes many of the discussed goals and priorities to prevent major flooding in Castle Valley.

4 Step Planning Process:

1. Organized resources: Original 2015 Plan
Assess community support- Introduced the idea and through public meetings determined if there was enough support to begin the planning process.

Build the planning team- Public invitations went out through gatherings, word of mouth and public meetings for those interested in participating in the planning process. After a group was established an ordinance was adopted forming the Hazard Mitigation Committee.

Engage the public- Public hearings were held by the Hazard Mitigation Committee May 13and Oct. 14, 2015. All meetings were open public meetings with members of the community attending and contributing at these meetings..
Input was also taken via letters and email throughout the entire planning process.

Identify and profile hazards- As a group, we listed all hazards which could potentially affect the community, we prioritized the list in order of most probable to occur and which have the greatest impact on the community or have the greatest probability of affecting the community.

Inventory assets and estimate losses- We created a list of resources and assets. Taxable values of private property were obtained from the County Clerk which provides a base for possible losses within each hazard area. The average assessed taxable home value in Castle Valley in November 2015 is $73,659 it would however cost substantially more to replace a household in a disaster. Since property owners maintain their own wells for water, septic tanks, and propane tanks, the main infrastructure that the town maintains are roads. The maintenance, construction and rebuilding of roads and drainages is a part of the town's annual budget.

Comment [PH2]: Clearly this section needs to be updated as of the 2024 property taxable values of homes and other appertuances and the 1 ac land associate eih the residence as well as the additional 4 acres, plus or minus, per lot. Is it worth it research some insurance replacement etc costs in the event of each sort of disaster…??

Benefit cost review- A list of priority projects was created based on actions which were seen as having the greatest impact using resources the community currently has available, or we felt could be budgeted for. Cost analysis was done on each project using known costs for certain items and amounts given by the FEMA schedule for some unknown costs.

2. Develop mitigation plan:
Develop goals and objectives- As a group we decided what we wanted to achieve with our planning process. The committee used FEMA's guidelines set forth in "State and Local Mitigation Planning How-To-Guide "dated September 2002 FEMA 386-1.

Identify and prioritize mitigation actions- As a group we went through each hazard and came up with a list of possible mitigation strategies for each one, we then rated each strategy based on Potential Benefit, Financial Viability and Political Viability. Potential Benefit was given a high, medium or low rating. Financial and Political Viability were rated 1-5 with 1 being easy and 5 being very difficult.

Prepare implementation strategy- We are going to mitigate potential impacts from hazards thru executing the Action Plan Projects and thru community awareness and policy development.

Document the planning process- Each member of the committee was assigned a hazard to profile and research histories on. Each member or team working on a hazard then prepared a summary and history to add to the final plan. Agendas, Minutes and meeting documents were kept of every meeting.

3. Implement the plan and monitor progress:

Adopt the Hazard Mitigation Plan-

The Plan was initially adopted by the Town of Castle Valley on March 16th 2016.

Implement Plan recommendations-

The group will work with the Town and stakeholders to continue to implement parts of the plan and implement priority project within the next 5 years.

Evaluate planning results-

Continual evaluation of planning progress will be ongoing and reviewed with plan every 4 years.

Review and Revise the Hazard Mitigation Plan-

The Hazard Mitigation Committee will review and revise the Hazard Mitigation Plan every 4 years.

2020 Plan

4. 2025 Review and Update of Existing Plan

Assess community support- Introduced the ideas and the process to update the existing 2020 Plan through public meetings.

Build the planning team- Public invitations went out through gatherings, word of mouth and public meetings for those interested in participating in the planning process. After that a group was established in compliance with Ordinance 2013-1 adopted to form the 2025 Hazard Mitigation Committee.

Members include:

Jazmine Duncan- Chair, Mayor- Town of Castle Valley, Fire Dept. member, Emergency Operations Director, CERT member

Dorje Honer- Co- chair, Town of Castle Valley Road Supervisor, Emergency Operations Team Member, Planning and land Use Commissioner.

Ron Drake- Fire Chief, Castle Valley Service District for Fire Protection, CERT member, Castle Valley Comments- Times Independent

Colleen Thompson- Building Permit Agent

Egmont Honer Road Department Equipment Operator

Jocelyn Buck- Town of Castle Valley Clerk.

Engage the public- All meetings were open public meetings with members of the community welcome and contributing on January 28 February 25, March 25,April 22, May 27, June 24. Meetings were hybrid with Zoom and at the anchor site the Town Building #2 Castle Drive . Input was also taken via letters and email throughout the entire review and planning process. The Hazard Mitigation Committee held a Public Hearing on the Plan July 8, 2020.

Identify and profile hazards- As a group we listed all hazards which affect the community, we re-prioritized the list in order of most probable to occur and which have the greatest impact on the community or have the greatest probability of affecting the community. And Biological Hazards was added as a potential hazard.

Inventory assets and estimate losses- We created a list of resources and assets. Taxable values of private property were obtained from the County Clerk which provides a base for possible losses within each hazard area. The average assessed taxable residential building value in Castle Valley November 2015 was $73,659 this value increased to $146,000 in 2019. (These averages do not

include secondary residences or land values). However the costs would be substantially more to replace a household in a disaster. Since property owners maintain their own wells for water, septic tanks, and propane tanks, the main infrastructure that the town maintains are roads. The maintenance, construction and rebuilding of roads and drainages is a part of the Town's annual budget.

Benefit cost review- A list of priority projects was created based on actions which were seen as having the greatest impact using resources the community currently has available, or we felt could be budgeted for. Cost analysis was done on each project using known costs for certain items and amounts given by the FEMA schedule for some unknown costs.

RESOURCES

Town of Castle Valley:

- Town Hall and Library (with Wifi internet access)
- Radio base station , 2 hand held radios
- Road shed
- Maintenance shed
- Fuel storage
- Staff
- Town Council
- Planning and Land Use Commission
- Hazard Mitigation Committee
- Road Committee
- Road Department

Roads Equipment

- 2004 Ford F350 Super Duty Diesel Flatbed
- 2013 CAT 140 Motor grader
- 2014 CAT 420 back Hoe
- 1981 JD 670A Motor Grader 14ft. $130/hr.
- 1983 Ford Dump Truck (8cubic yds.) $60/hr.
- 1998 GMC Dump Truck (8cubic yds.) $60/hr.
- 1000 Gallon Water tank $75/hr.
- 1984 Ford Tractor w/ Boom Mower $60/hr.
- Rock Sieve/Grizzly $15/hr.
- Gas Compressor $20/hr.
- Gas Generator $20/hr.
- Gas Pressure Washer $27/hr.
- 525 Gallon Water Tank
- Insurance

Castle Valley Fire District:

- Station 1
- Station 2
- Portable diesel Generator
- CIB grant purchase of Lot 13 w/ its large volume well.
- Propane generator for Well on Lot 13
- 20 Volunteer personnel
- Commissioners
- Equipment
- #40 Engine
- #39 5Ton Wildland Engine
- #33 Hummer

- #38 Water Tender
- #8-structure
- #37-structure
- #1 chiefs truck
- SCBA Trailer (compressed air unit)
- Radios
- Satellite phone
- Cots/Chairs

Church Groups:

- Castle Valley Academy
- LDS
- Buildings
- Tables and Chairs

Grand County Utah:

- Roads Department
- Snow plow
- Brush Chipper
- Non transport ambulance
- CERT-
- Emergency Manager - Sheriffs' Department – mobile command post and repeater
- County Council

Emergency Medical Special Service District

- C.V. EMRs

Interagency Fire:

- Forestry Fire and State Lands - local representatives.

State of Utah:

- Planning support- Brad Bartholomew/ FEMA
- Division of Emergency Management – Mason Kemp
- CIB- Bill Winfield USU /Roads
- Regional engineer, Div. of Water Rights- Cash Stallings
- State Roads and Highway patrol
- South East Utah Health Department- Orion Rodgers
- USU Agriculture extension Cory Farnsworth

Federal Government

- Rural development USDA
- Bureau of Land Management
- FEMA
- EPA
- NRCS- Soil Conservation Agency

Private Sector:

- C.V. business owners
- Private property owners who volunteer
- Privately owned equipment: chainsaws, tractors, back hoes etc.
- Local doctors and nurses
- Water hand pumps on wells
- Frontier Communications
- Rocky Mountain Power
- Red Cliffs Lodge
- Sorrel River Ranch
- School bus
- Outbuildings and spare bedrooms

Moab Scouts BSA & CFI

- Cooking/ feeding Equipment
- Tents/Shades/Tipis/Yurts.
- Misc. Outdoor Gear
- Volunteers and Tools

Moab Area Watershed Partnership

Memorandums of Understandings:

- Grand County Road Department – Snowplowing CV Drive.
- CV Fire Protection District- access to well water on Lot 13.
- Grand County School District- School bus parking.
- Manti-LaSal National Forest – Cooperating Agency Status.
- Grand County Building Department
- CV Fire Protection District with Grand County for equipment use

Social Media

Castle Valley Facebook Community Page
Grand County Sheriff Office Facebook Page
EMR Facebook Page
Grand County Alertsense
Radio Stations: KZMU and KCYN

2025 POTENTIAL HAZARDS WITH RISK ASSESSMENTS & MITIGATION STRATEGIES

FIRE

Goal: To maintain and Improve Fire Resiliency in the Community

BACKGROUND

Castle Valley is a Wildland Urban Interface - a place where residential areas border and interact with undeveloped wildland vegetation. This presents a number of fire-fighting challenges due to Town and residential proximity to large areas of fire-prone vegetation. Trees, shrubs, grasses, and weeds all provide significant fuel for fires; winds, topography, and difficulty of access add to fire hazards. Periods of drought, invasive vegetation, and modern fire suppression practices have helped to increase heavily overgrown areas of dry combustible vegetation. During summer "monsoon" season, frequent thunderstorms and cloudbursts occur, posing a threat to life and property from lightning triggered wildfires and debris flow (flood) events. These variables make Castle Valley very vulnerable to Fire however several mitigation efforts are in place and due to more development there are more firebreaks throughout the municipality.

Over the past 35 years, the Castle Valley Fire Department responded to approximately 100 fires, an average of just under three fires per year. Some years the area experiences a lot of fire activity like 1984, 2009, and 2011, which had eight and nine fires and some years like 1982, 1983 and 2010, for instance, where only two fires were reported. Lightning is the leading cause of fires at nearly one third, followed by human caused fires at 26 percent, and controlled fires that got out of control at 22 percent. Forty-four percent of the fires occur within the Castle Valley Town area and fifteen percent each are in the Castleton area and along State Route 128 and 16 percent of the fires are on State or BLM lands. There have been fires reported in every month but nearly a quarter of the responses occur in July followed by June with 19 percent and August with 13 percent. Grass, brush and trees are the most common source of fire at 75 percent followed by structure fires at 23 percent and vehicle fires at six percent and other sources, like power poles, at four percent. Some fires will burn two or more of these categories. The Fire District has a current Community Wildfire Protection plan that is updated every two years (Appendix F-1) Needs updating

Comment [PH3]: If there is documentation, it would be useful to know what the human causes are — I recall 3 occasions since 2002 when the cause was unattended/abandoned campfires (not on list below) on BLM (hence working with BLM to prohibit camping in CV unless at Climbers' Camp (UOL) or BLM's Castle Rock CG.

Comment [PH4]: Eventhough a small proportion of fire starts, this stat indicated the need to follow through with underground power lines as originally set out in the Town deed restrictions. To name a few issues — Poles are fuels. Lines can arc (wind, birds) and spark. Transformers can burst. Above ground mines is another source and factor in power outage — worst is that with no power people cannot use their wells for water/fire suppression. Above ground power lines are an issue for several sections of this HMP.

RED FLAG DAYS

"A Red Flag Warning means warm temperatures, very low humidities, and stronger winds are expected to combine to produce an increased risk of fire danger."
"All three of the following criteria must be exceeded in order for Red Flag Warning conditions to be met"

1.Sustained 20 ft Winds: >15 mph
2.Relative Humidity: < 25%
3.10 hr Dead Fuel Moisture: <9%

Below is a matrix that describes the Elevated Fire Danger criteria:

Elevated Fire Danger Matrix

Assuming 10-hr dead fuel moisture is less than 10%		2-m Relative Humidity				
		< 20	20-24%	25-34%	35-44%	> 44%
10-m Sustained Wind	5-9kts	Elevated	None	None	None	None
	10-14kts	Elevated	Elevated	Elevated	None	None
	15-19kts	RFW		Elevated	None	None
	20-24kts			Elevated	Elevated	None
	> 24kts			Elevated	Elevated	None

https://www.weather.gov/lsx/redflagcriteria

For Castle Valley region-

Season 2020 (Apr-Sept): 26 Red Flag Days
Season 2021 (Apr-Sept): 22 Red Flag Days
Season 2022 (Apr-Sept): 15 Red Flag Days
Season 2023 (Apr-Sept): 20 Red Flag Days

National Oceanic and Atmospheric Administration

HISTORY

There were not many inhabitants in Castle Valley when the Castle Valley Fire Department was formed in 1976 but the young community had already experienced some disastrous fires and fatalities. Included in those events was a fire involving an A-frame structure near Castle Creek and Castle Valley Drive where a child perished in the building. Former Castle Valley resident and County Fire Warden Robin Donoghue said that he remembered helping Grand County Sheriff Heck Bowman sift through the rubble to find the remains of the young boy's body.
Donoghue and Dave Durrant, another early settler to the valley recognized the need for local fire protection and approached District Ranger Dick Buehler for help in organizing the fire department and acquire equipment. During the summer of 1977 the fire department acquired an excess military 2.5-ton fire truck and obtained a state lease on the property, which now houses Fire Station One on the

Castleton Road. Fire department volunteers eventually built a fire house with money collected by hosting barbeques and other fund raising activities and, when there were enough residents in Castle Valley to form a tax base, formed the Castle Valley Fire Protection District.

Donoghue served as the first fire chief followed by Durrant, Frank Mendonca, John McGann, Dave Seibert, Floyd Stoughton, and Ron Drake. The fire department bought their first engine, a used, refurbished American LaFrance pumper engine in 1994 and took possession of a new International 2,000 gallon pumper/water tender in 2007, which was purchased with a CIB grant. Currently the fire department maintains nine structure and wildland fire vehicles, five of which are owned by the fire district and four are excess military vehicles on loan from the State of Utah. In 2003, the district built a second fire station, which is located behind the Castle Valley Town Hall and in December, 2010 purchased the property where Fire Station I is located, both with funds furnished by CIB grants.
In 2019 the Fire District received a Community Impact Board (CIB) grant to purchase Lot 13 where an established large volume well was located.

Summer 2024 Rocky Mountain Power introduced “enhanced safety settings”. When fire risk is high these settings trigger line deactivation if any debris comes in contact with power lines Then affected lines are inspected by Rocky Mountain Power teams to assess damage, repair and then restore power .Rocky Mountain Power uses data from a network of weather stations to forecast dangerous weather condition. Fire risk modeling alerts them to elevated risk such as dry, hot windy conditions. In extreme conditions they may require a Public Safety Power Shut off to reduce the chances of electrical equipment t starting a fire .In addition if an active fire gets too close to powerline they will also trigger the power shut off .Any of these situations can result in customers experiencing more frequent outages. Additionally RMP has been wrapping their powers poles with fire proof material to mitigation losing poles to fires.

EVENTS:* (Last fourteen years)

Mar 18, 2010	Structure (pole)	Lightning	Castle Valley Drive/Keogh Lane
Aug 5, 2010	Brush Fire	Lightning	Between Pope and Miller Ln.
Jan. 7 2011	Structure Fire	Electrical cause	Sorrel River Ranch
May 18, 2011	Tent fire	Human cause	Mile 21, SR 128
Jun 8, 2011	Trash Fire	Human cause	Sorrel River Ranch
Jun 18, 2011	Arson Fire	Human cause	SR 128
Jul 17, 2011	Brush Fire	Lightning	159 Buchanan Lane
Jul 19, 2011	Brush Fire	Lightning	Porcupine Ranch
Jul 30, 2011	Brush fire	Lightning	Shafer Lane
Dec 8, 2011	Structure/Grass	Human, hot ashes	447 Castle Valley Drive
Feb 10, 2012	Straw fire	Human	SR 128
Apr 19	Dryer fire	Mechanical	Sorrel River Ranch
May 26, 2012	Structure/Brush	Unknown/weather	413 Cliffview Lane
July 13, 2012	Brush Fire	Lightning	Castleton Road #1
Jul 13, 2012	Brush Fire	Lightning	Castleton Road #2
Jul 20, 2012	4 Trees	Lightning	Porcupine Ranch Rd.

Jul 21, 2012	Free Fire	Lightning	Upper 80s section
Aug 23, 2012	Grass Fire	Human	Creekside Lane
Sep 24, 2012	Brush Fire	Lightning	Adobe Mesa (Assist USFS)
Sep 1, 2013	Cedar Trees	Lightning	Upper 80s/BLM
May 30, 2014	Brush	Lightning	South Round Mountain
Jun 15, 2014	Brush	Arson Fire	Mile 13, SR 128
Jul 11, 2014	Tree Fire	Lightning	Castleton Road
Jul 15, 2014	Single Trees	Lightning	272 Pope Lane/350 Taylor Lane
Aug 25, 2014	Tree Fire	Lightning	Gravel Pit, Castleton
Sep 14, 2014	Structure/Dryer	Human	Sorrel River Ranch
Jan 30, 2015	Power pole	Unknown	399 Cliffview
July 22, 2015	Grass Fire	Human	Daystar Academy
July 23 2015	Grass Fire rekindled	Human	Daystar Academy
Aug.1, 2015	Brush	Lightning	Round mountain
Sept. 1, 2015	Single Tree	Lightning	Dewey Bridge
Mar.22, 2016	Tree	Unknown	Hittle Bottom Campground
Apr 16, 2016	Burn pit Fire	Human Caused	Daystar Academy
May 4, 2016	Car Fire	Mechanical	Gateway Road
May 29, 2016	Grass Fire	Unknown	MP 10 SR128
Jun 7, 2016	Power Pole	Unknown	Miller Lane
Jun 12, 2016	Incinerator Fire	Human	Daystar Academy
Jun 25, 2016	Grass Fire	Unknown	CV Drive at Chamisa Ln
Oct 13, 2016	Out of Control burn	Human	Amber Lane
Jun 27, 2017	Grass Fire	Unknown	Castleton Road
July 12, 2017	Power pole	Wind/Lightning	MP 16 SR128
Aug 4, 2017	Grass Fire	Lightning	240 Miller Lane
Sept14, 2017	Tree	Lightning	Shafer Lane
Dec 5, 2017	Structure Fire	Electrical	Willow Basin
July 2, 2018	Grass Fire	Human	395 Castle Valley Dr.
July 7, 2018	3 Fires	Lightning	Keogh, end of CV Drive, Rim
July 8 2018	Brush	Lightning	Base of Adobe Mesa
Apr 27, 2019	Brush	Lightning	384 Castle Valley Dr.
Feb 19, 2020	Chimney	Human	325 Keogh Lane
July 18, 2020	Structure	Human	Creekside lane
July23, 2020	Power pole	Lightening	S.W. Round Mtn
Aug 17, 2020	Tree	Power Pole	395 Castle Valley Dr
Sept 19, 2020	Vehicle	Mechanical	Gateway road
Jan 1, 2021	Brush-Hot coals	Human	446 Castle Valley Dr
Mar 8, 2021	Brush-Daystar	Human	320 Castleton Rd
Mar 13, 2021	Pole Fire	Mechanical	229 Miller Lane
June 15, 2021	Vehicle	Mechanical	Castleton Rd
June 18, 2021	Brush	Human	390 Castle Creek Lane
June 23, 2021	Brush- Daystar	Human	320 Castleton Rd.
June 28,2021	Brush/grass	Unknown	SR & 128 Castleton RD
Aug 15, 2022	Tree	Lightening	Miller Lane
Sept 6, 2022	Tree	Power Pole	391 Castle Creek Lane
2023 No Fires			
Feb 23, 2024	Vehicle	Mechanical	SR 128 M 14

May 24, 2024	Grass	Unknown	Pace Hill
May 25, 2024	Vehicle	Mechanical	SR 128 M 10
June 1, 2024	Grass	Unknown	Pace Hill
July 9, 2022	Tree	Unknown	Hittle Bottom
Aug 3, 2024	Tree	Lightening	Upper 80
Aug 25, 2024	Tree	Lightening	Hittle Bottom
Aug 25, 2024	Tree	Lightening	Andy mesa
Oct 29, 2024	Shed Fire	Human	342 Taylor Lane
Dec16, 2024	Chimney	Human	186 Shafer Lane

*During those years when there were few fire events the Castle Valley Fire Department was still busily involved in responding to false alarms, controlled burn stand-by, medical assists, requested to assist with vehicle accidents and many other important requests.

Fire Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
	X	**Limited**	**10-15%**
		Critical	**25-50%**
		Catastrophic	**More than 50%**
Probability	**X**	**Highly likely**	**More than 50%**
(of occurrence)		**Likely**	**25-50%**
		Possible	**10- 15%**
		Unlikely	**less than 10%**
Location	**Anywhere there is fuel**		
Seasonal Pattern or Conditions	**Year round. – Wildfires, Year Round – Structure fires**		
Duration	**Hours to days.**		
Town Departments and/or Agencies involved	**Town of Castle Valley staff / Road Department, Castle Valley Fire Protection District , Grand County Fire , Grand County Sherriff Department, Castle Valley Emergency Operations team, Bureau of Land Management , State Fire**		

Analysis Used	**Documented events C.V.F.D., identifying resources available currently.**

Risk Assessments and Mitigation Strategies:

While the community can do little to temper the extreme weather that causes fires, much can be done to mitigate the effects of those weather related events. Human caused fires can also be mitigated with public awareness programs and continued participation with the Fire wise Program.

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100%
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% support 3=50 % 4= 75% 5= 100% support/no resistance

1. Mowing Roads to expand the firebreak.
   Potential benefit= 5
   Potential Cost= 2 [24 hrs. for all roads, 2-3x a year]
   Political viability=5

2. Policy changes to require property owners to keep fuel down.
   Potential benefit= 5
   Potential Cost=3
   Political viability=5

3. Increase Fire Wise campaign to increase public awareness. And encourage alternatives to burning such as pickups or mulching/chipping.
   Potential benefit=5
   Potential Cost=1
   Political viability=5

4. Reduce fuel around power poles and ground transformers; get in touch with Rocky Mountain Power.
   Potential benefit= 5
   Potential Cost=1
   Political viability=5

5. Identify water sources with and without power sources. Determine usability and viability for fighting fires and refilling trucks-See Fire Plan.
   Potential benefit=5
   Potential Cost=3
   Political viability=1

6. Gain permission from property owners along the rim to access cistern water supplies.
Potential benefit= 5
Potential Cost=1
Political viability=3

7. Create a program for the emergency siren located on C.V. Drive and the potential to add 2 more sirens at each end of the Valley
Potential benefit= 5
Potential Cost= 2
Political viability= 5

8. Create pre-planned fire breaks in the town and along its boundaries potentially add more fire breaks during flood mitigation work along Placer Creek.
Potential benefit= 5
Potential Cost=4
Political viability= 4

9. Review Town policies for the storage and disposal of fuels and hazardous materials. See Ordinance 85-3 Fuel storage.
Potential benefit= 5
Potential Cost= 1
Political viability= 4

10. Use goat or sheep herds for fuel reduction.
Potential benefit= 5
Potential Cost = unknown
Political viability= 3

11. Have certified Fire Inspector perform structure inspections on request. Need to Confirm availablity
Potential benefit= 5
Potential Cost= 2
Political viability=3-4

12. Identify lots with overgrowth, use Forestry, Fire and State Lands assessments and teach property owners defensible space.
Potential benefit=5
Potential Cost= 1
Political viability= 4

13. Invest in specialized Town equipment to reduce fuels.
    Potential benefit=4
    Potential Cost= 5
    Political viability= 3

14. Reducing fuels on private lots with proper education first.
    Potential benefit= 5
    Potential Cost= 1
    Political viability= 4

15. Encourage residents to maintain 72 hour Kits. And stock the Town Building with 72 hour kit provisions for Staff.

    Potential benefit=5
    Potential Cost= 2
    Political viability= 5

16. Create a Preparedness resource for residents available on the Town website.
    Potential benefit= 5
    Potential Cost= 1
    Political viability= 4

17. Plan to help educate property owners along the green belt on fire vulnerability and defensive space.
    Potential benefit= 5
    Potential Cost= 2
    Political viability= 3-4

18. Provide information to residents that during high fire danger condition residents need to be aware of Rocky Mountain power enhanced safety settings and public safety shut offs and be prepared for outages.

    Potential benefit=5
    Potential Cost= 1
    Political viability= 5

FLOOD

Goal: Reduce damage from Floods to infrastructure and property

BACKGROUND

The Town of Castle Valley occupies the lower (northwestern) portion of Castle Valley, extending from the gorge of Castle Creek to the southern side of Round Mountain, Porcupine Rim on the west, the Castle Valley loop road on the east, comprising 448 five acre properties. According to the Town's Drainage Master Plan done in 1988 there are 52 square miles of drainage basins. The Valley ranges in elevation from approximately 4,500 to 5,500 feet above sea level with the adjacent mountains to the southeast rising to approximately 12,000 feet. Vegetative cover on a watershed has a major effect on the amount of precipitation that runs off, an affects the storm water in several ways. Both the foliage and the litter of the plants can retain water for longer thereby lengthening the time of concentration and reduces the peak discharge rate. Castle Valley is vulnerable to flooding in severe concentrated rain events, when the water comes over a longer period of time the multitude of drainages can handle the water quite well, however more and more isolated cloudburst are effecting Castle Valley in very destructive short lived storms. The Castle Valley Road Department works to mitigate and mend the effects of storm water runoff from Placer and Castle Creeks and drainages along Porcupine Rim, Parriott Mesa, Castle Rock, Adobe Mesa, (elevations surrounding Castle Valley).
In April 2024 Ordinance 95-6 Regarding the Building Permit and Other Land Use Processes was amended and Sections 1.3 was added to address Land Disturbances that could change washes ,drainages or watercourses and adversely impact Town roads , public infrastructure and neighboring properties. This Ordinance established a required inspection and permitting policy for the Town to help mitigate potential flood damage. Information on these requirement was sent out to many of the Contractors that work in the valley and was posted on the Town website.,

HISTORY

Within the last 10 years there has been significant rain events that have exceeded the flow of the Colorado River during one period of time on just the Placer Creek drainage. Placer Creek drains into Castle Creek, which flows under Castle Valley Drive through a 10-foot culvert at lot 447. According to the Drainage Master Plan dated September 1988, by Armstrong Consultants, Inc., this area should have had two (2) 10-foot culverts instead of one. This culvert also was never designed to function as a check dam, however due to only one 10 foot culvert, storm water has come within a few feet of exceeding the carrying capacity of this culvert, should storm water overtop the road above this culvert, significant damage may occur to Castle Valley Drive including loss of road surface and underlying earthen fill as well as damage to downstream structures and creating a significant safety hazard.
(See Appendix F-1)
The Town of Castle Valley commissioned a Drainage Master Plan dated September 1988 by Armstrong Consultants, Inc. The recommendations in that Master Plan have yet to be implemented. The facilities designed for the Master Plan are based on a 10 year storm which is a reasonable level of risk for the planned facilities (culverts and channels).
In 2018, the Town secured an emergency egress via the Shafer Lane extension leading out to the Castleton Road This extension also provided faster access to and from Fire Station #1 .
In 2024 at permanent Low Water Crossing was constructed at the first Placer Creek crossing on Castle Valley Drive towards the upper Eighty. This crossing was a constant problem with each flash flood the

residents of the Upper Eighty were cut off from Town until the Road Department repaired the crossing. With this permanent road surface across the creek it will be much easier and faster to clear any flash flood debris and keep the road open.
In 2023 the Planning and Land Use Commission researched the National Flood Insurance Program and had several public information sessions on the plan requirements. Currently the Town of Castle Valley is not participating in the National Flood Insurance Program since the area is not mapped by FEMA.
The State Department of Emergency Management has an ongoing program to do Light Detection and Ranging (Lidar) mapping throughout the State. This technology is a remote sensing method that uses laser pulses to create high resolution, three dimensional maps of the earth's surface. This method is used to locate and evaluate floodplains necessary to participate in the National Flood Insurance Program. Castle Valley will potentially be mapped in the next five years.
Since 2023 the Town has provided sand bags for residents to pick up at the Town Building
(See Appendix FL-2 and FL-3)

Events:

Storm Runoff	19 Aug 2010	Castle Valley	Castle Valley	erosion
Storm Runoff	20 July 2011	Castle Valley	Castle Valley	erosion
Storm Runoff	4 Aug 2011	Castle Valley	Castle Valley	erosion
Flash Flood	6 Oct 2011	Placer Creek crossings Placer Ditch	Upper eighty east Pope	erosion/mud
Flash Flood	26 Oct 2011	Porcupine Rim Drainage	Buchanan	erosion
Flash Flood	14 Jul 2012	Rim Drainage	Keogh/CVD	mud/erosion
Flash Flood	25 Sep 2012	Rim Drainage	Keogh/Pope Holyoak/Miller	mud/erosion
Flash Flood	12 Oct 2012	Placer Drainage	Rimshadow/Pace Miller/Pope/Holyoak Keogh/Taylor/Connector	mud/erosion
Storm Runoff	13 Oct 2012	Castle Valley	Castle Valley	erosion
Flash Flood	23 Oct 2012	Placer Drainage	Miller/CVD/Keogh Holyoak/Buchanan/Pace	mud/erosion
Storm Runoff	8 May 2013	Castle Valley	Castle Valley	erosion
Runoff	17 Jul 2013	Rim Drainage	Keogh/Taylor	mud/erosion
Flash Flood	19 Jul 2013	Placer Drainage	Keogh/Connector	erosion
Flash Flood	29 Jul 2013	Placer Drainage	Placer crossings Holyoak/Miller/Keogh	mud/erosion
Runoff	30 Jul 2013	Placer Drainage	Upper 80/Holyoak	erosion
Runoff	1 Aug 2013	Placer Drainage	Rimshadow/Shafer Miller/Holyoak	mud/erosion
Storm Runoff	23 Aug 2013	Castle Valley	Castle Valley	erosion
Storm Runoff	24 Aug 2013	Castle Valley	Castle Valley	erosion
Storm Runoff	25 Aug 2013	Castle Valley	Castle Valley	erosion
Storm Runoff	1 Sep 2013	Placer Drainage	Connector	road washout

Flash Flood	12 Sep 2013	Placer Drainage	Crossings/Keogh Miller	mud/washout
Flash flood	14 Sep 2013	Placer/Cain Hollow	Upper 80/Chamisa Rimshadow/Shafer Miller/Pope/Keogh	mud/washout
Storm Runoff	18 Sep 2013	Placer Drainage	Crossings/Keogh Miller/Meadow	mud/washout
Storm Runoff	10 Oct 2013	Placer/Cain Hollow	Crossings/Miller	mud/rock, erosion
Storm Runoff	30 Oct 2013	Placer Drainage	Crossings/Miller	mud/rock, erosion
Storm Runoff	10 Feb 2014	Placer Drainage	Lower crossing	erosion
Storm Runoff	13 Aug 2014	Castle Valley	Castle Valley	erosion
Storm Runoff	14 Aug 2014	Castle Valley	Castle Valley	erosion
Storm Runoff	6 Jun 2015	Castle Valley	Castle Valley	erosion
Storm Runoff	30 Aug 2015	Castle Valley	Castle Valley	erosion
Storm Runoff	19 Oct2015	Castle Valley	Castle Valley	erosion
Flash Flood	3 Aug 2016	Porcupine Rim Drainage	Homestead	mud/rock/washout
Flash Flood	3 Aug 2016	Placer/Cain Hollow	Lower/Upper Crossing	washout

Location, Date and Time	Type of Event
Castle Valley, UT 08/03/2016 17:00	Flash Flood
Castle Valley. UT 09/14/2017 13:00	Flash Flood
Castle Valley, UT 07/14/2018 13:30	Debris Flow
Castle Valley, UT 10/04/2018 9:40	Flash Flood

Flood Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
		Limited	**10-15%**
	X	**Critical**	**25-50%**
		Catastrophic	**More than 50%**
Probability		**Highly likely**	**More than 50%**

(of occurrence)	**x**	**Likely**	**25-50%**
		Possible	**10-15%**
		Unlikely	**less than 10%**
Location	**All drainages, creeks and roads.**		
Seasonal Pattern or Conditions	**June- Oct.** **Spring Run-off/ Flash Flood incidents**		
Duration	**Initial flow not more than a few hours, event including clean up could take days or up to months.**		
Town Departments and/or Agencies involved			
Analysis Used	**Historic documentation of events, Town of C.V. road department and the Grand County regional plan and the NCDC. NOAA.gov website. Available resources.** **Town of Castle Valley Drainage Master Plan 1988**		

Comment [PH5]: More accurate is thunderstorms (monsoon season); also location of any particular storm is critical. For example the 2009 debris flood (after the Porcupine Rim Fire 2008) resulted after a 2-3 day rainstorm that fell almost entirely over the LaSals. Storms that com from the west over Porcupine Rim flood the steep side arroyos. The floods (6) in 2024 resulted from very heavy rains hitting Porcupine Rim, east side rims and the LaSals. I do not know how to predict for this type of 'localized' storm variability. And long-term climate studies have predicted - and we are experiencing already this unpredictably - for the southwest particularly our 4—corners area — that storm patterns and frequencies will vary more wildly than in the past.

FLOOD:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100%
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Re-enforce or replace the Castle Creek culvert that flows under Castle Valley Drive, the Town's main ingress and egress.
   Potential benefit= 5
   Potential Cost= 5
   Political viability= 5

2. Build and maintain large catchment ponds in strategic places on both of the main drainages. One below the Upper 80 on the Placer Creek drainage and another on the Castle Creek drainage.
   Potential benefit=5
   Potential Cost= 5
   Political viability= 2

3. Evaluate and consider engineering structural options for armoring major drainage crossings including concrete slips, aprons, culverts and spans.
   Potential benefit= 5
   Potential Cost= 5
   Political viability= 4

4. Design and build pre-fabricated Structures for crossings on upper Placer Creek.
   Potential benefit=5
   Financial viability= 5
   Political viability= 4

5. Obtain needed Waivers from property owners to enable Town of Castle Valley road department to legally work on flood effected areas on private property..
   Potential benefit= 5
   Potential Cost= 1
   Political viability= 4-5

6. Maintain all road crossings and diversions by monitoring and clearing culverts of weeds and sediment and keeping clear, excavating channels, reinforcing and extending berms and maintaining road surfaces.
   Potential benefit= 5
   Potential Cost=2
   Political viability= 5 DELETE?

7. Continue to inform residents and buyers on safe building practices for flood prone areas and ensure land use codes allow for proper flood safety building.
   Potential benefit= 5
   Potential Cost=1
   Political viability=3-4

8. Encourage residents to maintain 72 hour Kits. And stock the Town Building with 72 hour kit provisions for Staff.

   Potential benefit= 5

Potential Cost= 1
Political viability= 5

9. Evaluate culvert capacities throughout the valley.
   Potential benefit= 5
   Potential Cost= 2
   Political viability= 5

10. Re-Channel wash by Lots 312/313 301/302.
    Potential benefit=4
    Potential Cost= 2-3
    Political viability=3

11. Develop a cost share program with residents for flood mitigation projects on private property.
    Potential benefit= 4
    Potential Cost =2-3
    Political viability= 4

12. Increase streambed capacity
    Potential benefit= 5
    Potential Cost =2-3
    Political viability=4

13. Replacing culverts to increase capacity
    Potential benefit= 5
    Potential Cost = 5
    Political viability=4

14. Pursue coordination with the BLM and the Manti LaSal National Forest to do mitigation work in streambeds on Placer, Cain and Castle Creeks above the Town.
    Potential benefit= 5
    Potential Cost = 1
    Political viability= 3-4

SEVERE WEATHER

BACKGROUND

High winds, thunderstorms and severe winter weather are all forms of severe weather which affect our area. High winds typically accompany thunderstorms and frontal systems. They have been responsible for various damages to property. Tornadoes are not a regular occurrence but dust devils which are much lesser tornadoes are sometimes formed. Hail and lightning also accompany thunderstorms. Hail has caused damage to crops on multiple occasions. Lightning is probably the number one severe weather hazard in our area. Lightning has been responsible for numerous fires, both wild and structural. Severe winter weather can include heavy snow fall and prolonged periods of below freezing temperatures. Some homes would need to have heavy snow removed from roofs to prevent roof failure. Castle Valley does not have a municipal water system, people use individual wells for water. Many residents have been without water during prolonged periods of cold because of frozen pipes and pressure systems.

Comment [PH6]: High winds (>50mph) are a potential hazard. And the fact that they have localized patterns that vary throughout the valley at any given event, complicates the risk factors.

Castle Valley experienced a Derecho on June 6, 2020 (maybe the first one) as this type of windstorm is more typical in the Ohio Valley/midwest. NOAA brief definition: if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho. https://www.foxnews.com/us/derecho-utah-north-dakota-plains-severe-weather-wind-report-damage-colorado(see this link https://www.weather.gov/lmk/derecho We had a fruit tree uprooted. TI article: https://www.moabtimes.com/articles/june-6-derecho-left-damage-in-its-wake/

Fox News notes only 2 others reported for the Great Basin area: https://www.foxnews.com/us/derecho-utah-north-dakota-plains-severe-weather-wind-report-damage-colorado

Another event, that exemplifies the combined impacts of wind, fire and communications failures, would be interesting to include is the fire that started May 26, 2012— on Lot 413: https://moabsunnews.com/2012/05/31/high-winds-fanned-flames-in-castle-valley-fire/ Winds that day were high and, unusually, traveled from the east across the fire driving it to Porcupine Rim. The fire got put out! But later the sustained winds coming up river turned into CV and blew up-valley with huge dust clouds. Power and phone service were out regionally due to the high winds. CVFD set up a command post at the Town building. Some residents volunteered to drive to homes and alert folks about the fire, wind and outages. This is a perfect example of the "perfect storm" where the wind variability resulted in unpredictable outcomes and the combined impacts that can occur - thankfully not more dire that day.
The CVAcademy weather station can be searched for a wide variety of 15-minute interval data or summaries for temps, wind, ppt and much much more - a good research tool that is local at least from 2014 to present. These data can be used to identify historical Red Flags days in CV to help assess risk. https://www.usbr.gov/pn/agrimet/agrimetmap/csvuda.html

IMPACT ON COMMUNITY

The impacts of severe weather on the community would depend on the event and duration of the event. Heavy hail can destroy crops. Daystar Farms provides produce for many of Castle Valleys' residents. Severe hail, winds or flooding affecting their farm would also hurt them financially. Many residents also rely on their own crops for food & food storage.
Any severe weather event causing residents to be displaced would impact the community, currently there are not adequate plans in place for temporary housing and backup power for municipal buildings.
High winds and thunderstorms can also cause power and communication outages which slow emergency response times and also have potential to destroy food storage for many residents. Most personal wells are also run on electricity, so outages can leave residents without water, this could impact large portions of the community in event of a fire accompanying thunderstorms.
Heavy snow fall can leave many residents unable to get out for hours while limited staff works to open roads. This also slows emergency response times. Castle Valley has an aging population and many would require help to clear their own roofs and driveways, and there are limited resources for them to find this help. Residents who experience prolonged water outages because of frozen pipes and systems would not have anywhere in Castle Valley to fill water storage containers until their systems are thawed, they would have to rely on neighbors who may allow them to fill or take containers to Moab. All parts of the community are vulnerable to severe weather hazards.

GOALS TO REDUCE AND AVOID LONG TERM VULNERABILITIES

Goals for reducing long term vulnerabilities to severe weather include developing an emergency operations plan that will include the Town of Castle Valley, Castle Valley Fire District, Grand County EMS, Grand County Roads, Grand County Emergency Management, Daystar Academy and Farms, Red Cliffs Lodge, Sorrel River Ranch, members of the community and surrounding communities. 2020 Plan Update :Installing back up power for all municipal buildings and equip at least one municipal building with enough supplies to temporarily house up to 20 people is another goal.

HISTORY

From the time this plan was first adopted in 2016 the following events occurred

Location, Date and Time	Type of Event
Castle Valley, UT 08/03/2016 17:00	Flash Flood
Castle Valley. UT 09/14/2017 13:00	Flash Flood
Castle Valley, UT 07/14/2018 13:30	Debris Flow
Castle Valley, UT 10/04/2018 9:40	Flash Flood

Note:

https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=ALL&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2016&endDate_mm=12&endDate_dd=31&endDate_yyyy=2019&county=GRAND%3A19&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=49%2CUTAH

Storm events are taken from these recorded events at ncdc.noaa.gov. Snow storms occurred during this time as well but none were considered severe enough to be recorded as such.
Below is the previous history of events which was taken from the regional mitigation plan available at the time.

Recorded Severe Winter Weather events	Recorded severe thunder storm events
12/7/1997 Winter Storm	06/2003 lightning
12/19/1997 Winter Storm	07/2003 lightning
12/21/1997 Extreme Cold	09/16/2002 winds over 50mph
12/24/2000 Heavy Snow	06/25/2005 thunderstorm
01/28/2001 Winter Storm	09/23/2005 thunderstorm

11/28/2006 Heavy Snow
12/19/2006 Winter Weather
01/12/2007 Winter Weather Heavy Snow
12/10/2007 Winter Weather
02/03/2008 Winter Weather Heavy Snow
12/13-24/2008 Winter Weather Storm
02/24/2009 Dense Fog
10/27/2009 Winter Weather
12/07/2009 Winter Storm and Blizzard
12/13,18/2009 Dense Fog
12/22/2009 Winter Weather
01/26/2010 Winter Weather
01/28,29/2010 Dense Fog
02/02-04/2010 Dense Fog

02/06/2010 Winter Weather
02/08,16/2010 Dense Fog
02/19/2010 Winter Storm
03/15/2010 Dense Fog
12/29/2010 Winter Storm
Note: taken from regional mitigation plan Grand County

04/05/2006 thunderstorm
06/09/2006 wind over 50mph
06/2006 lightning
07/10/2006 quarter size hail/arches
08/26/2006 wind over 50mph
08/2007 lightning
08/2008 lightning
10/06/2010 wind over 50mph
08/23/2013 thunderstorm/G.C.
Note: info from weather.gov
Grand County
Note: lightning events were recorded
fire events from CV CWPP 2/14/13

Location, Date and Time	Type of Event
Castle Valley, UT 08/03/2016 17:00	Flash Flood
Castle Valley. UT 09/14/2017 13:00	Flash Flood
Castle Valley, UT 07/14/2018 13:30	Debris Flow
Castle Valley, UT 10/04/2018 9:40	Flash Flood

7.25.2021 Heavy Rain / Debris Flow
8.18.2021 Heavy Rain
8.24.2023 Flash Flood
8.25.2023 Hail

Severe Weather Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
	X	**Limited**	**10-15%**
		Critical	**25-50%**
		Catastrophic	**More than 50%**
Probability (of occurrence)	**X**	**Highly likely**	**More than 50%**
		Likely	**25-50%**
		Possible	**10-15%**

		Unlikely **less than 10%**
Location	**Anywhere**	
Seasonal Pattern or Conditions	**Anytime, depending on season, winds in spring and fall, heavy snow fall in winter. Lightning with monsoons**	
Duration	**Hours to days**	
Town Departments and/or Agencies involved		
Analysis Used	**State of Utah hazard plan** **Grand County regional plan** **Weather.gov** **Weather.com/encyclopedia** **Resources available, response times observed**	

SEVERE WEATHER:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit

Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.

Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance.

1. Backup power sources at municipal buildings. Including propane alternatives for generators.
   Potential benefit= 5
   Potential cost=2-3
   Political viability=4

2. Create an Emergency Operations Plan and train staff on power outage protocol.
   Potential benefit=5
   Potential Cost =1
   Political viability=4

3. Public education on dealing with various severe weather issues.

Potential benefit=5
Potential Cost = 1
Political viability= 5

4. Clear trees and snow from power poles and propane tanks.
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 3

5. Develop and make use of warning systems i.e. Town Siren, social media, “Alert Sense”, weather stations etc.
   Potential benefit= 5
   Potential Cost = 4
   Political viability= 2

6. Have Town Road Department clear roads of trees.
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 3-4

7. Quarterly inspection of road signs
   Potential Benefit=5
   Potential Cost=1
   Political viability= 5

POWER OUTAGES

BACKGROUND

ELECTRICITY

Electricity to Castle Valley is provided by Rocky Mountain Power (RMP), a subsidiary of Pacific Corp. Electricity for Castle Valley “originates from the Rattlesnake substation southeast of Moab, it travels over the top of the LaSal mountains over the Porcupine Rim above Castle Valley to the settlement of Castleton then on to Castle Valley. It continues to Cisco then follows the river to Colorado – a total of

125 miles, it is the longest cul-de-sac power line of all of RMP's electrical lines."[2] The length of the power transmission lines and the difficult terrain it follows adds to the potential for disruptions. Castle Valley is very vulnerable to losing power, for at least short periods of time with longer outages occurring less frequently in comparison.

Disruptions in electricity service are periodic. Disruptions often are associated with adverse weather events, such as high winds and heavy or wet snow falls, or technical failures on the power lines or poles. It is not uncommon for electricity to go out in part or all of Castle Valley at least once a month. Outages can be momentary (although disruptive of electrical equipment), a couple hours in length, or multiple hours and into more than a full day. For example, during the weekend of November 23, 2013, electricity was out for 30 hours "as a result of the wet and heavy snow from the storm that dropped 8 to 10 inches."[3] In May 2012, high winds were responsible for the electricity outage which also coincided with a structure and brush fire in Castle Valley. The power outage caused "additional problems for firefighters since nearby water sources required electrical power to pump water from the ground."[4]

In 2017/ 2018 RMP upgraded its infrastructure to reduce the risks of power disruption to both Castle Valley and other areas served by that electrical line. As a result, power disruptions have been significantly reduced in the Town, but both short- and long-term disruptions can still occur.

In most instances, short disruptions in power are an inconvenience to most residents of Castle Valley. However, longer disruptions impact different residents in different ways: Refrigeration, water supply, HVAC systems and communication can be adversely affected by power outages if an emergency backup is not available.

The cost of electricity outages is difficult to determine. For people who rely upon electricity for their home occupations, any extended outage may have a financial impact. The B&B in Town has lost business due to power outages. For people dependent on electricity for home medical purposes, lengthy outages can become life-threatening. The loss of power hindered the ability of the Castle Valley Fire Department to respond to a fire in the valley in 2012.

In summer of 2024 RMP introduced "enhanced safety settings". When fire risk is high these settings trigger line deactivation if any debris comes in contact with power lines. RMP then inspects affected lines to assess damage, repairs the lines and then restores power. RMP uses data from a network of weather stations to forecast dangerous weather conditions. Fire risk modeling alerts them to elevated risk such as dry, hot windy conditions. In extreme conditions they may require a Public Safety Power Shut Off to reduce the chances of their electrical equipment starting a fire. In addition, if an active fire gets too close to power line, they will also trigger the power shut off. Any of these situations can result in customers experiencing more frequent outages. As a preventative measure RMP has been wrapping their powers poles with fire proof material to mitigate losing poles in fires.

2 "Castle Valley Comments," *Moab Times-Independent*, November 29, 2007.

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Power Outage Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
		Limited	**10-15%**
	X	**Critical**	**25-50%**
		Catastrophic	**More than 50%**
Probability (of occurrence)	**X**	**Highly likely**	**More than 50%**
		Likely	**25-50%**
		Possible	**10-15%**
		Unlikely	**Less than 10%**
Location	**Entire Length of Rattlesnake line**		
Seasonal Pattern or Conditions	**Generally occurs along with severe weather events**		
Town Departments and/or Agencies involved			
Duration	**Seconds to days**		

Analysis Used	**History of occurrence, utility company, Times Independent column, Ron Drake local reporter and Fire Chief.**

POWER OUTAGES:

Mitigation goals include:

- Developing and distributing awareness-raising materials on emergency response options available to Town residents.
- Maintaining the Fire District assistance at the Town Center during power outages.
- Maintaining good working relationships with the Grand County Sheriff's Office for emergency services and with utility companies.
- Assuring that Town ordinances and regulations remain up-to-date to provide clear guidance for emergency prevention and mitigation.

Working with Rocky Mountain Power to mitigate and help prevent potential outages.

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100%
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Assure a culinary water backup source is available for town residents for at least 72 hours.
   Potential benefit= 5
   Potential Cost= 5
   Political viability= 3

2. Increase public awareness of the need to have available 72-hour emergency kits,
   Potential benefit= 5
   Potential Cost= 1
   Political viability= 5

3. Install back-up power for all municipal buildings and church. Have supplies for 20 people, including food, water, bedding etc.
   Potential benefit= 5
   Potential Cost= 3-4
   Political viability= 4

Comment [PH7]: Town Building and Road shed?? What about Fire Stations 1&2?

4. Assure availability of backup water supply and other resources such as fuel, food, firewood, cots, etc.

Potential benefit=5
Potential Cost=5
Political viability= 4

Comment [PH8]: How would this be accomplished by the Town?

Comment [PH9]: The recently approved Water Management Plan offers some ideas about an additional well or other supply source options.

5. Provide information to residents on power banks and other charging options for emergency use.

Potential benefit = 3
Potential Cost= 1
Political viability= 4

29. COMMUNICATIONS

Telephone

Telephone service is available in Castle Valley by:

- Frontier Communications through landline or DSL VoIP (Voice over Internet Protocol) telephone service;
- Emery Telcom through glass fiber service, phone modem and VoIP;
- River Canyon Wireless (RCW) with third party VoIP provider (requires minor changes by RCW);
- Cell phone service in certain locations.
- Satellite phones.

For the most part, telephone service to Castle Valley as provided by Frontier is fairly reliable. A wireless transmission tower from Bald Mesa in the La Sal Mountains south of Castle Valley relays transmissions into and out of the valley, using a reflector above the valley on Porcupine Rim. The reflector directs a signal to a distribution station located near the center of Castle Valley.
Outages have occurred in the service. The most significant recent outage occurred on November 30, 2013. On that date 911 service was down for 10-15 hours. During much of that time, Frontier, local residents, or Grand County emergency services were aware of the outage. Frontier has since responded that similar outages were unlikely to occur in the future. However, in 2018/19 there was a three-month period of frequent disruptions in service, including no phone access, dropped calls and multiple outages of varying length through the day. Each outage was followed by Frontier assuring the Town that the problem was resolved. It was only after three months did Frontier finally update the appropriate equipment which allowed normal service to resume.

Emery Telcom phone services have been reliable so far.

RCW VoIP services have for the most part been reliable, however some areas of the Valley RCW is not available.

Comment [PH10]: Develop a radio communication network for all residents…Neighborhood Radio Watch:
A friend from California (Sierra Foothills/Coloma County) shared these links with me back in 2022:
Here is a link to the slide deck we used in PDF format:https://www.dropbox.com/s/2fdie081ah2r7eq/Coloma%20Lotus%20FSC%20Neighborhood%20Radio%20Watch%20Program%20Update.pdf?dl=0

This link uses these terms that you may not know

FRS: Family Radio Service
The **Family Radio Service** (FRS) is a private, two-way, short-distance voice and data communications service for facilitating family and group activities. The most common use for FRS channels is short-distance, two-way voice communications using small hand-held radios that are similar to walkie-talkies.No license is required.
GMRS: General Mobile Radio Service
The General Mobile Radio Service (GMRS) is **a licensed radio service that uses channels around 462 MHz and 467 MHz**. The most common use of GMRS channels is for short-distance, two-way voice communications using hand-held radios, mobile radios and repeater systems.

https://one.npr.org/?sharedMediaId=1085173827:1085173831

https://www.capradio.org/articles/2022/03/10/in-the-face-of-natural-disasters-amateur-radio-groups-fill-communications-void-in-rural-california/

It is not possible to accurately estimate the cost of disruptions in telephone coverage to Castle Valley residents. Major losses were experienced by Castle Valley residents who depend on telephone service to run home-based businesses. The B&B in Town reported lost reservations due to phone outages.

On several occasions during the 2018/19 outage the Castle Valley Fire Department set up a command post at the Town building with a satellite phone for emergency communication. The command post was run by volunteers at a personal inconvenience and expense.

Some residents are able to access telephone service with their cell phones. Text messages seem to go through more efficiently than telephone connections. Private cell phone companies have said they are unwilling to invest in building a cell tower in or near Castle Valley.

Power outages greatly affect phone service availability. While most providers maintain reliable back-up systems the back-up time varies from mere minutes to a few hours. Furthermore, cordless phones lose connectivity when power is disrupted even though the phone service is available.

Internet

In 2017 River Canyon Wireless introduced internet service to Castle Valley, thereby expanding options for residents. Until then Internet service was provided only by Frontier Communications. River Canyon Wireless service is a wireless network, with several repeaters spaced throughout the Valley. Occasional outages from several minutes to hours do occur, these outages are usually corrected fairly quickly. Frontier Communications provides internet service through DSL over telephone lines. A number of residents who continue to use Frontier and live further away from the distribution station in the center of the valley have noted a fall-off in both reliability and speed of internet connections. Also, it is not uncommon for customers to have to reboot their modems once, twice, or several times per day, thus disrupting service. When electrical outages occur, there is no internet coverage.

River Canyon Wireless and Frontier's internet system is connected in Moab to a transmission system operated by Emery Telcom. Emery reports that there is sufficient bandwidth to handle all of the areas internet traffic. At the same time, Frontier reports that bandwidth is sufficient to handle all of Castle Valley's traffic.

An estimate of the cost of disruptions to the internet will parallel those of electricity outage costs, although the actual cost is likely to be somewhat lower.

Starting in early 2020 Emery Telecom was installing fiber optic cable within Castle Valley. Fiber optic internet offers the benefits of fewer disruptions, less dependency on existing internet providers, ~~and~~ faster internet connections and phone service.

Since internet service is considered non-essential the providers do not maintain back-up systems of the same quality and back-up time as for telephone service. The back-up time is usually a few minutes if any at all.

Electronic Communication Summary

For a small, relatively remote rural community, Castle Valley has reasonable communications systems. However, Castle Valley is very vulnerable to electricity, telephone and internet outages, especially if those outages coincide with other emergency situations. Providers of both electricity and telephone/internet services report improvements in their ability to reliably meet the needs of Castle Valley residents, but the vulnerability of the lengthy electrical power line to storms and technical problems continues to place the town at risk of break downs in effective communications. The Town and the Fire District have taken steps to mitigate potential utility outages.

Mitigation Initiatives

The Town of Castle Valley, the Castle Valley Fire District, and Grand County emergency services have made several improvements to help mitigate communications issues in Castle Valley. Both the Town and the Fire District have met with electricity and telephone providers to voice concerns and seek solutions to existing problems. On several occasions in recent years, the Town has sought to open communication with cell phone providers, but is regularly told that cell phone infrastructure investments are not in those companies' interests.

The Town and the Fire District are in constant contact with the Grand County Sherriff's Office through handheld radios and the Town Office base station. In addition, the Fire District has acquired one satellite phone for use in emergencies when the handheld radios do not function. The Sherriff's Office has been very responsive to the potential emergency needs of the town. In the past it has brought in portable communication equipment. Finally, the Fire District and town have collaborated to set up an emergency communication system available to residents during prolonged electrical or telephone outages. Notices have been posted to inform residents how they can access that assistance.

Furthermore, emergency communications via two way radios and a wireless mesh communication system are planned. There could also be potential radio station broadcasts (KZMU/ KCYN).

Communications Probability Analysis

Potential		**Negligible**	**Less than 10%**
Magnitude		**Limited**	**10-15%**
(area involved)	**X**	**Critical**	**25-50%**

		Catastrophic	**More than 50%**
Probability (of occurrence)		**Highly likely**	**More than 50%**
	x	**Likely**	**25-50%**
		Possible	**10-15%**
		Unlikely	**Less than 10%**
Location	**Valley Wide**		
Seasonal Pattern or Conditions	**Generally occurs along with severe weather events**		
Duration	**Seconds to days**		
Town Departments and/or Agencies involved			
Analysis Used	**History of occurrence, service providers and antidotal.**		

Mitigation Goal

The goal is to assure that ~~all~~ Castle Valley residents ~~are aware~~ have some access to ~~of~~ communication options during emergency conditions.

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100%
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Develop protocol for reporting problems with communication.
   Potential benefit=5h
   Potential Cost= 1

Comment [PH11]: This is a key endeavor — every time we have a problem in the valley with phones, internet, power etc. it seems that each resident must contact their respective providers. This is efficient and not helpful community wide. I know the Jocelyn, Jazmine and Dorje sometimes do this for the community at large but a good protocol would serve every one. There is the CV Community FB Page and the recently set up one for Emergencies via HMCommitte - both are FB though and not everyone is on FB…. Some of the added strategies in this section may be addressing this. The Neighborhood Radio Watch program I noted above may be helpful here….

Political viability= 4

2. Develop MOUs with surrounding communities and agencies for appropriate support during emergencies.
   Potential benefit = 5
   Potential Cost = 2
   Political viability= 4

3 Upgrade Town Radios to increase Town radio capabilities.
   Potential benefit = 5
   Potential Cost = 2
   Political viability=4

4. Update internal Emergency Operations Communications.
   Potential benefit = 5
   Potential Cost = 1
   Political viability= 4

5. Develop a Town wide Emergency Communications Plan
   Potential benefit =5
   Potential Cost = 2
   Political viability=4

6. Develop and implement emergency messaging system (like LoRa mesh network). And to explore radio station broadcast options.
   Potential benefit = 5
   Potential Cost = 2
   Political viability=4

7. Continue to develop the Rapid Disaster Assessment Plan (RDAP) team
   Potential benefit = 5
   Potential Cost = 2
   Political viability=4

ROCKFALL

BACKGROUND

The study, GEOLOGIC HAZARDS OF CASTLE VALLEY, GRAND COUNTY, UTAH by William E. Mulvey of the Utah Geological Survey, states the following regarding rockfalls:

> "Rockfalls occur along cliffs in Castle Valley. As development advances higher on alluvial fans and slopes below cliffs, the risk from falling rocks will increase.
>
> Rockfalls originate when erosion and gravity dislodge rocks from cliffs or slopes. The most susceptible unit in Castle Valley is the Wingate Sandstone where outcrops are disrupted by bedding surfaces, joints, or other discontinuities that break rock into loose fragments, clasts, or slabs. Rocks in talus and cliffs may dislodge, fall onto steep slopes, and travel great distances by rolling, bouncing, and sliding.
>
> Primary causes of rock falls are weathering, freeze-thaw of water in outcrop discontinuities, and ground shaking during earthquakes. Keefer (1984) indicates that rockfalls may occur in earthquakes as small as magnitude 4.0.
>
> Rock falls present a hazard to structures and personal safety. Homes built on slopes below Porcupine Rim are particularly vulnerable."

A rockfall hazard map is available to the public at the Town Building and their website.

IMPACT ON COMMUNITY

The impacts of Rockfall on the Community would depend on the location and severity of the event. Rockfalls can cause damage to structures, roads, and can alter drainages which could negatively impact other properties and roads. Rockfalls will mostly happen higher up on the rim side of the valley. (See Appendix A4)

HISTORY

Although rockfalls occur often few are documented or cause damage below is a list of witnessed rock falls:

July 8, 1985 - 48,000 cubic yards of rock fell from Porcupine Rim barely missing a home at the top of Rim Shadow Lane. No damage was reported but an inch of dust covered the surfaces inside the house due to open windows.

July, 2003 A medium sized rock fall was sited between Rim Shadow and Lazaris lanes. No damage to properties was reported.
February, 2004 A small rock fall was sited southeast of Lazaris lane. No damage to properties was reported.

August, 2010 A medium sized rock fall was seen above Holyoak lane. No damage to properties was reported.
December 31, 2014 A rock fall on rim side of Bailey Lane. No damage to properties was reported.
November 2015 A large rock fall was seen above Holyoak lane. No damage to properties was reported.
March 2 2019 A large rock fall came down on Highway 128 about mile marker 1. No damage was done although the road was closed for most of the day for blasting and removal of debris.
March 17, 2020 A rock fall was sited at end of Cliffview Lane. No damage to properties was reported.
April 30, 2020 A rock fall was sited between Miller and Pope Lanes on rim side. No damage to properties was reported.

GOALS TO REDUCE VULNERABILITIES
Typical mitigation measures to reduce the impacts from Rockfalls would be cost prohibitive for property owners and the Town. Strategies to decrease vulnerability include continuing to inform property owners of this hazard through the building permit process, and having the road department continue to clear roads after rockfalls. These strategies should be included in a future emergency operations plan.

Rock Fall Probability Analysis

Potential Magnitude (area involved)	**X**	**Negligible (in Town)**	**Less than 10%**
		Limited	**10-15%**
		Critical (on SR 128)	**25-50%**
		Catastrophic	**More than 50%**
Probability (of occurrence)	**X**	**Highly likely**	**More than 50%**
		Likely	**25-50%**
		Possible	**10-15%**
		Unlikely	**Less than 10%**
Location	**Rim sides of Castle Valley, Pace Hill, and Hwy. 128.**		

Seasonal Pattern or Conditions	**Early spring and during rain events, could occur at any time.**
Duration	**Minutes, with cleanup lasting hours to days**
Town Departments and/or Agencies involved	
Analysis Used	**Observations of residents, recorded events, Grand County regional plan, geologic hazard reports, C.V hazard maps.**

ROCKFALL:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benifit
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Develop plans for road closure if rock fall closes roads.
   Potential Benefit= 5
   Potential Cost= 2
   Political viability=4

2. Continue to provide property owners and renters with hazard information.
   Potential benefit=5
   Potential Cost = 2
   Political viability= 1

3. Obtain equipment for stabilization and cribbing.
   Potential benefit= 4
   Potential Cost = 4
   Political viability= 4

4. Build deflection berms, slope benches and rock catch fences.
   Potential benefit=4

Potential Cost = 5
Political viability= 5

5. Continue to identify lots affected by rock fall hazard.
Potential benefit= 5
Potential Cost = 1
Political viability= 3-4

SURFACE AND GROUNDWATER DROUGHT

HISTORY

The Fremont and Ute peoples were in the area of Castle Valley long before white settlers arrived in the region. The Martin brothers were the first white settlers and had the first non-native child in the area in 1886. Farming and ranching was the primary focus of the area with many irrigation ditches coming off of springs along Castle Creek irrigating the lower valley and large irrigation wells in the upper valley. Much more water was used for farming than the current residential use that exists present day. According to local irrigation ditch users the flows from the springs and in the ditch have decreased in the last 30 years mostly due to less annual snowpack.
Sno-Tel Data / resource

Comment [PH12]: This could be verified and enhance this section by consulting Sno-Tel data and other sources.

BACKGROUND

The Town of Castle Valley states the following to be our Goal with regard to water: *To maintain or enhance water quality and quantity in the Castle Valley watershed by improving our knowledge, developing policies, and taking action as needed*. Castle Valley General Plan

Comment [PH13]: cite source.

The source of well water for Town residents, depending on location, is either the valley-fill aquifer or, for those who live closer to Porcupine Rim, the Cutler formation aquifer. The latter tends to have significantly more solids and salts in it, and it impacts the quality of valley-fill aquifer in the lower part of the Valley.

The quality of the water varies in different parts of the Town. The Utah Division of Water Quality has officially classified the water quality based on a classification system focused primarily on total dissolved solids (see **Water Classification Map Appendix A-5**).

IMPACT ON COMMUNITY

The Valley-fill aquifer is fed from a large watershed in the La Sal Mountains whose boundaries were defined by the Federal Environmental Protection Agency in 2001 (see **Watershed Map Appendix A-6**) when it declared the watershed to be a sole source aquifer. Appendix WC-1 This means that the aquifer system is the sole and principle source of drinking water for the residents of the Town and that contamination or depletion of this aquifer system would be detrimental to the health and safety of the town residents.

In 1996, the Town passed a **Watershed Protection Ordinance**. The Town is committed to working with private landowners, agencies and authorities that own property in the Town's watershed to protect water quality and quantity. The Town also tries to use the EPA sole source aquifer designation as much as possible in these interactions.

Comment [PH14]: FYI - As the Water Advisory Commiittee developed the Water Management Plan - it became clear that the Watershed Protection Ordinance needs revision. This will be something for the WAC and PLUC to work on in the near future.

The Town has six monitoring wells for measuring water quality and quantity changes over time. These wells are generally very consistent from year to year in both quality and quantity. A number of publications regarding what we know and don't know about our watershed and its process are gathered in the Town Building and are available to the public on the Town website. Included in the collection is a recent water study, Hydrologic and Environmental Analysis (HESA) and Preliminary Water Budget, (2016), which covered from 1980 to 2000, a wet period which yielded 6,819 ac-ft/yr. At the request of the Division of Water Rights, this analysis was updated a dry period, 2000 to 2016, which resulted in a 19% reduction to 5, 527 ac-ft/yr. The Castle Valley watershed has over 6,900 ac-ft/yr of adjudicated water rights so it is at full appropriation with the Town's surplus water rights taken into consideration. According to a recent scientific study, climate change has contributed 30% to our current drought, and pushed it to mega-drought status, which coincides with the dry period numbers of the study. While our wet period numbers coincide with the wettest 19-year period in at least 1200 years*! So, the Town has a pretty good idea of the high and low yield of the watershed.

Comment [PH15]: John Groo should review these numbers. Also, UT Geological Survey will soon finish the most recent study on CV water issues - one goal is to derive a water budget. The results from this paper will be essential for this section. Stayed tuned!

'*Large contribution from anthropogenic warming to an emerging North American megadrought. A. Park Williams[1]*, Edward R. Cook[1], Jason E. Smerdon[1], Benjamin I. Cook[1,2], John T. Abatzoglou[3,4], Kasey Bolles[1], Seung H. Baek[1,5], Andrew M. Badger[6,7,8], Ben Livneh[6,9] 2020

GOALS TO REDUCE VULNERABILITIES

In 2006, Alice Drogin formed a Watershed Protection Group, since then there have been a series of groups and committees which have looked into how to best protect the quality and availability of Castle Valley's water. Work continues today for watershed protection as the Town Water Advisory Committee is currently taking the information from the recent HESA water studies and creating a Water Management Plan to further protect the Castle Valley aquifer and the Town's water rights. This Plan was approved by the Town Council March, 2025. It is considered to be a 'living document' and will be updated and revised as new information comes to light.

The following are the highlights from two papers, one from the Utah Climate Center, the other from the Colorado College. Using information from instrumental records dating back 60 years, Great Salt Lake shoreline data dating back a century, and tree ring data dating back 900 years, the UCC concludes that:

1) in the context of the past thousand years, 20th-century Utah - and the latter half in particular - has been exceptionally wet. The commonly assumed "30-year average" cycle is misleading, because the year-to-year deviation from the average is high. While dry periods in the late 20th century usually lasted less than a decade, drought lasted during most of the 13th and 17th centuries.

2) they found a clear 12-year pattern for northern Utah (which fades in the south) but also two more strong patterns - a 40-year cycle and a 150-200 year cycle. These appear to be linked to a climate pattern in the Pacific Ocean called the Pacific Quasi-Decadal Oscillation which affects the path of the jet stream and hence the moisture we receive.

The Colorado College study also showed a "Little Ice Age" running from about 1300 A.D. to the early 1800's, preceded by a "Medieval Warm Period" from about 800 A.D. to the mid-1200's.

Looking forward, the study projects
(1) a reduction of 6% and 20% in annual runoff between 2041-2060 for the Colorado River Basin, principally because of markedly lower snowpack.
(2) a slight increase in average annual temperatures.
(3) Increased desertification resulting in an increased number and severity of wildfires: fire risk rising by 30%-60% under current greenhouse emission rates.
(4) the 21st century may "be nasty".

If the floods don't get us, the fires probably will.....

SURFACE AND GROUNDWATER DROUGHT:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Monitor water depths in Castle Valley wells.
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 5

2. Determine the point at which the Town would implement a groundwater drought management plan.
   Potential benefit=5
   Potential Cost =3-4
   Political viability=5

3. Build large retention ponds above the community.
   Potential benefit=4
   Potential Cost = 5
   Political viability= 4

4. Provide information on residential rain water catchment systems.
   Potential benefit=3
   Potential Cost = 1
   Political viability= 4

5. Educate the Community on current water management practices
   Potential benefit=5
   Potential Cost = 1-2
   Political viability= 3

6. Investigate the Water Use Ordinance as is tied to State Drought Declaration
   Potential benefit=4
   Potential Cost = 1
   Political viability=4

Drought Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
		Limited	**10-15%**
		Critical	**25-50%**
	X	**Catastrophic**	**More than 50%**
Probability (of occurrence)		**Highly likely**	**More than 50%**
	X	**Likely**	**25-50%**
		Possible	**10-15%**
		Unlikely	**Less than 10%**
Location	**Everywhere**		

Seasonal Pattern or Conditions	**Long term condition with seasonal breaks**
Duration	**Years to decades**
Town Departments and/or Agencies involved	
Analysis Used	**Utah Climate Center, Colorado College, National Weather service** **Sno-tel**

WATER CONTAMINATION

BACKGROUND

Castle Valley's primary water resources are the aquifer that underlies the valley, Castle Creek and a small number of springs that mostly occur adjacent to Castle Creek. The aquifer is the sole source of drinking water for Castle Valley residents and Castle Creek provides surface water for irrigation, recreation and maintenance of important riparian areas. There is significant interaction between the aquifer and surface sources such as Castle Creek, springs and intermittent sources such as Placer Creek also supplied by springs in its headwaters. Because of that interaction and because the Castle Valley community has very limited sources of water, contamination of any of the sources could be disastrous. The watershed is at or near full appropriation, depending on drought or wet periods with the Town's surplus water rights taken into account. To date there have been no contamination problems, but it is vital that any potential sources of contamination be identified and action taken to prevent or mitigate contamination. Through the years the Town has completed water and septic density studies to identify such things as septic density, the location of a culinary well site, the amount of water moving through the aquifer, water budget, in a wet period (1980 - 2000) and a dry period (2001 – 2016) the storage capacity of the aquifer.
Definite source vs nonpoint source of contamination

See Appendixes:

- WC-1 Sole Source Aquifer Designation
- WC-2 Ground water Quality Classification Map
- WC-3 Aquifer System Map
- WC-4 Septic Density Study by UGS (Lowe, Gibson, & Wallace) during Bruce Keeper time as Mayor
- WC-5 HESA Part 1 Water Budget 1980 – 2000
- WC-6 HESA Part 2 Culinary Well Siting
- WC-7 Updated to HESA / Water Budget 2001 – 2016)
- WC-8 Town of Castle Valley Water Management Plan 2025

CONTAMINATION HAZARDS

Contamination of the Aquifer

Widespread contamination of Castle Valley's aquifer would be a major threat to the Castle Valley community and could be extremely difficult to mitigate or cure, therefore the emphasis should be on prevention. An ongoing water quality monitoring program will help identify potential contamination problems before they become widespread, but at the same time it is important to regulate activities or materials that are known to have caused water contamination issues elsewhere. Possible sources of aquifer contamination are:

1) Airborne Pollutants – There are a variety of airborne pollutants that can bond with or dissolve in surface water and then through seepage make their way into an aquifer. Aquifer contamination from airborne VOCs produced by oil drilling activity has occurred in other parts of Utah.

2) Agricultural Chemical / By-Product Seepage – Most agricultural chemicals and by-products are water soluble and if used in large amounts or high concentrations can migrate into aquifers. This is a common problem in areas with a lot of conventional agricultural activity or feedlots.

3) Septic System Seepage – By design, septic system effluent is leached into the adjacent soil and will be cleaned by microbiological action in the soil. However, if the density of septic systems in an area is too high for the cleaning capacity of the soils and / or the water table is relatively close to the surface then an aquifer can become contaminated by the effluent.

4) Industrial / Chemical Spills – There are many products available for industrial, yard or household use that contains high concentrations of chemicals and compounds that could pose a considerable threat to aquifer water. It is not expected that yard, garage or household use of such products would occur on a level that could contaminate an entire aquifer, but there are commercial or industrial activities that might use hazardous chemicals or compounds in volumes and / or concentrations that could pose such a threat.

5) Chemicals used for ground source heating and cooling systems (of which there are a few in TCV) are potentially toxic and could enter the aquifer if the system were to leak. [not sure if these systems have leak detection options in place].

Contamination of Individual Wells

There are any number of ways that an individual well can become contaminated and in such cases there are generally better opportunities for mitigation and repair. However, due to the movement of water within the aquifer the contamination of any individual well should be considered a serious matter because a high concentration of contaminants introduced in a specific location could become a widespread problem. Possible sources of individual well contamination are:

1) Surface Water Intrusion – Wells that are inadequately sealed (grouted) at the top can be contaminated by surface water intrusion (i.e. contaminated from the top down). Sources of such intrusion are flooding, irrigation runoff or precipitation pooling near the wellhead. More specific threats from such intrusion are covered in the following paragraphs.

2) Agricultural Chemical / By-Product Seepage – Most agricultural chemicals and by-products are water soluble and if present in large amounts or high concentrations near a well could potentially contaminate an individual well by seeping into the water that the well draws. Spills or runoff containing dissolved agricultural chemicals or feedlot by-products could also be a cause of individual well contamination, particularly if the wellhead is not adequately sealed.

3) Chemical Spills – There are many products available for yard, garage or household use that contain high concentrations of chemicals and compounds that could contaminate an individual well if spilled near the well, particularly if the wellhead is not adequately sealed.

4) Septic System Seepage – Septic system effluent could contaminate an individual well if the septic system and well are not adequately separated, particularly if the water table is close to the surface.

Contamination of Castle Creek

Being a surface water body, Castle Creek is more susceptible to contamination. Castle Creek is not a source of drinking water so its contamination may be viewed as less of a threat to the community than contamination of the aquifer, but because there is significant interaction between surface water and aquifer water and because Castle Creek water is distributed and used for flood irrigation contamination of its water could become a serious problem. Possible sources of Castle Creek contamination are:

1) Airborne Pollutants – There are a variety of airborne pollutants that can bond with or dissolve in surface water. Castle Creek could be contaminated by such pollutants if they are present in large amounts or local high concentrations. Such contamination has occurred in other areas where commercial or industrial activity occurs near surface water.

2) Agricultural Chemical / By-Product Runoff – Most agricultural chemicals and by-products are water soluble could contaminate Castle Creek if present in large amounts or high concentrations in areas where there is a large volume of irrigation or storm water runoff into the creek.

3) Industrial / Chemical Spills – There are many products available for industrial, yard or household use that contain high concentrations of chemicals and compounds that could contaminate Castle Creek if spilled or used in areas where there is a large volume of irrigation or storm water runoff into the creek.

4) Septic System Seepage – It is conceivable that septic system effluent could seep into Castle Creek, particularly in areas where there are springs and a high water table.

5) (Geo) Thermal Wells – Depending on the design and material used (glycol for example) in (geo) thermal wells they potentially cause a major threat to contamination of underground water.

6) Mining – There are several gold deposits and a long history of mining in the La Sal mountains. Placer Creek in Castle Valley was named after the Placer Gold; such an industry also poses a threat water contamination.

7) E. Coli triggers /TDML report

Comment [PH16]: The Div of Water Quality completed a draft report 3/25 addressing non-point source pollution/impairments in Castle Cr due to E. coli. TCV has submitted comments as a stakeholder. Once DEQ addresses these comments and the report is finalized - a summary section could be added here. This report looked at effects on recreational activities eg swimming (not on drinking water)

Water Contamination Probability Analysis

Potential Magnitude (area involved)		**Negligible**	**Less than 10%**
	x	**Limited (nonpoint source)**	**10-15%**
		Critical	**25-50%**
	X	**Catastrophic(source)**	**More than 50%**
Probability (of occurrence)		**Highly likely**	**More than 50%**
	x	**Likely(nonpoint source)**	**25-50%**
	X	**Possible(source)**	**10-15%**
		Unlikely	**Less than 10%**
Location	**Would depend on the source of contamination.**		
Seasonal Pattern or Conditions	**Anytime**		
Duration	**Would depend on where and what type and quantity of contaminate.**		
Town Departments and/or Agencies involved			
Analysis Used	**Utah Geologic Survey (UGS), Bureau of Land Manegemnt, Environmental Protection Agency(Sole Souce Aquifer designation), South East Utah Health Department. Septic Density study, TDML Report**		

Definite source vs nonpoint source of contamination

WATER CONTAMINATION:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Regular water quality monitoring and sampling of selected wells and Castle Creek, to provide an early warning of future issues.
   Potential benefit= 5
   Potential Cost = 2-3
   Political viability= 5

2. Delineate and Protect the Castle Valley Watershed. The Town should take whatever legal action is available to create broad protection for the entire Castle Valley watershed.
   Potential benefit= 5
   Potential Cost = 2-3
   Political viability=5

3. Educate Castle Valley residents, agricultural and livestock operators to help them understand how water source contamination can occur and how to prevent it.
   Potential benefit= 5
   Potential Cost = 1
   Political viability= 4

4. Continue to monitor septic system placement, construction and use done by the State, any indication of water contamination caused by septic systems should trigger action by the Town.
   Potential benefit= 5
   Potential Cost = 1 to 2 (if the Town is involved)
   Political viability= 5-3 (if the Town is involved)

5. Continue to monitor any indication that a well has been contaminated by surface water intrusion.
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 4-5

6. Use appropriate mechanisms to regulate Town business activities limit pollutants used in commercial and industrial activity so sources of VOCs and other concentrated chemical contaminants are prohibited or severely limited.
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 4

7. Use Appropriate Zoning to Limit Septic System Density (i.e. population density).
   Potential benefit= 5
   Potential Cost = 2
   Political viability= 4-5

8. Construct a Community Water System
   Potential benefit= 5
   Potential Cost = 5
   Political viability= 1

9. Construct a Community Sewer System.
   Potential benefit= High
   Potential Cost = 5
   Political viability=1

10. Property owners should consult with the South East Utah Health Department to select the most appropriate human waste disposal system for their property as this varies based on the different geologic conditions found within incorporated Castle Valley.
   Potential benefit=5
   Potential Cost = 1
   Political viability= 5

11. Purchase and maintain above ground water storage for a back-up culinary water source.
   Potential benefit= 5
   Potential Cost = 5
   Political viability= 2

12. Develop an emergency protocol for widespread contamination.

   Potential benefit= 5
   Potential Cost =1
   Political viability=5

SUBSIDENCE

BACKGROUND

Subsidence is the motion of a surface (usually, the Earth's surface) as it shifts downward relative to sea-level. Subsidence is what can create sinkholes, which typically occur naturally as a result of percolating water and the gradual removal of soluble bedrock. This process creates a void that ultimately results in a collapse of the overlying cave roof. Though most often occurring in regions with heavy limestone deposits, sinkholes also appear in areas of chalk, gypsum, basalt, and where there are underlying salt beds, several of which are abundant in Grand County.

Human activities such as mining, groundwater over-extraction, extraction of natural gas, earthquake, overly dry expansive soils, drainage diversion and failing infrastructure – such as water main leaks, or the collapse of sewer systems and other buried pipes – can also create sinkholes.

1. **HISTORY**

Castle Valley is part of a large, regional, collapsed salt anticline that includes Paradox Valley to the Southeast. It is surrounded by Permian to Tertiary sedimentary and igneous rocks. Beneath the Valley is the Pennsylvanian Paradox Formation that contains thick salt layers deposited in a shallow sea. As these salt layers were buried, they became mobile and formed diapir (A geological structure formed when a mass of material of high plasticity and low density, such as salt, gypsum, or magma, pushes upward into overlying strata.) in what is now Castle Valley. The uplift of the Colorado Plateau in the late Tertiary increased erosion rates and allowed ground water to dissolve the salt layers from the core of the anticline. As a result, the overlying rock collapsed and eroded, leaving Castle Valley in the core of the anticline. In 1992 Mulvey mapped a suspected Quaternary fault parallel to Porcupine Rim northwest of Round Mountain. Several sinkholes along this fault are attributed to localized dissolution or piping. Mulvey, W.E., 1992, Geologic hazards of Castle Valley, Grand County, Utah: Utah Geological Survey Open-File Report 238, 31 p., scale 1:24,000.

Comment [PH17]: Cite the reference.

IMPACT ON COMMUNITY

Present day subsidence and sinkholes have yet to make a big impact on the Castle Valley community however the larger concern could be directed at the reason why they appear or increase in size. Many of the activities that are responsible for creating sinkholes could be very detrimental to the holistic health of Castle Valley. Over-mining water in the valley could lead to drought and seriously impact the community. Other activities such as mining in the region could affect Castle Valley's Sole Source Aquifer if sinkholes begin to appear from mining practices.

GOALS TO REDUCE VULNERABILITIES

The Town of Castle Valley has had many geologic and hydrologic studies done in the past which have helped the valley understand more about the local aquifer and the effects the geology plays on the valley as a whole. Continuing to monitor local subsidence and draw conclusions as to why they have formed will protect the community by forecasting possible future problems. The knowledge gained from continual water monitoring and a general understanding of Castle Valley's watershed will help the community create a water budget that will not over mine the valley's water and create sinkholes. Add link to USGS Expansion Map

Subsidense Probability Analysis

Potential Magnitude (area involved)	**x**	**Negligible**	**Less than 10%**
		Limited	**10-15%**
		Critical	**25-50%**
		Catastrophic	**More than 50%**

Probability **(of occurrence)**		**Highly likely**	**More than 50%**
		Likely	**25-50%**
	x	**Possible**	**10-15%**
		Unlikely	**Less than 10%**
Location	**Localized**		
Seasonal Pattern or Conditions	**Seasonal, increased with excessive rainfall**		
Duration	**ongoing**		
Town Departments and/or Agencies involved			
Analysis Used	**USGS,DWRi, Town Page information.**		

SUBSIDENCE:

Risk Assessments & Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit

Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.

Political Viability/ Public Support: 1= 100% resistance 2=25% 3=50 % 4= 75% 5= 100% support/no resistance

1. Monitor water depths in Castle Valley wells.
   Potential benefit= 5
   Potential Cost = 2
   Political viability=5

2. Determine the point at which the Town would implement a groundwater drought management plan.
   Potential benefit=5
   Potential Cost = 2
   Political viability= 4

3. Create log of current sinkholes and monitor their changes.
    Potential benefit= 5
    Potential Cost = 2
    Political viability= 4

4. Prevent any kind of mining in the local region that may create subsidence.
    Potential benefit= 5
    Potential Cost = 2
    Political viability= 4

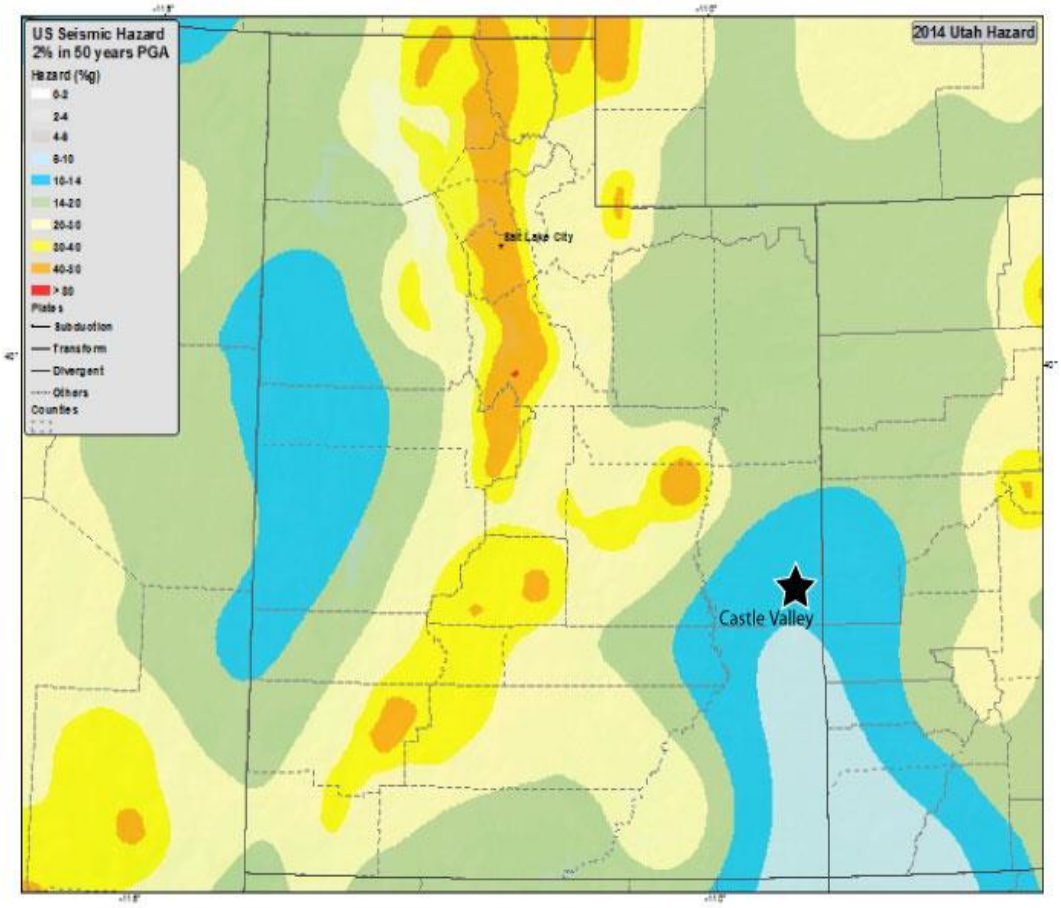
5. Bring awareness and education about subsidence to the community.
    Potential benefit= 5
    Potential Cost = 1
    Political viability= 5

EARTHQUAKE

BACKGROUND

Earthquakes are not a major threat or hazard to Castle Valley. The underlying geology is stable. However, north of Castle Valley, along the Wasatch Front (see map), a number of faults exist and have produced earthquakes within recorded history. This is the most recent 2% in 50 year probability map from 2014

data.



Source: http://earthquake.usgs.gov/earthquakes/states/utah/hazards.php

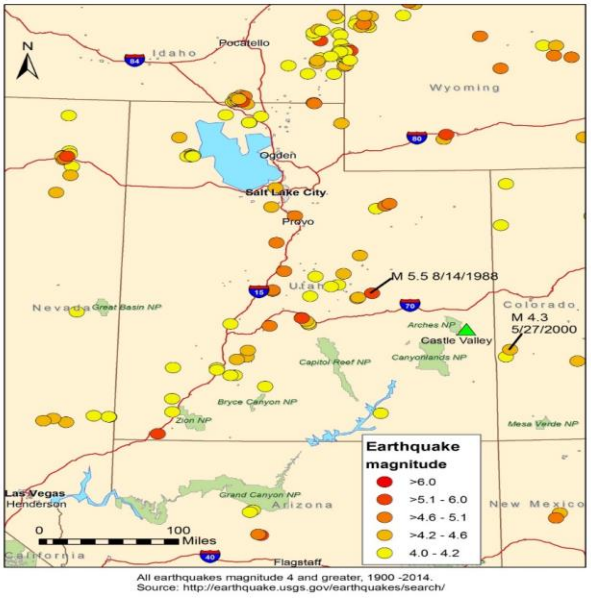
Available at http://earthquake.usgs.gov/earthquakes/states/utah/hazards.php

IMPACT ON COMMUNITY

The map illustrates that Castle Valley has a 2% probability that it will shake harder than 0.10 to 0.14g's every 50 years. It also means that there is a 98% probability that it will not shake harder than 10 -14%g every 50 years.
The probability of exceeding those acceleration values in the next ~2500 years is ~100%.

The table below will help translate the expected acceleration for Castle Valley into relative terms should an event of that size occur.

Instrumental Intensity	Acceleration (g)	Velocity (cm/s)	Perceived Shaking	Potential Damage
I	**< 0.0017**	< 0.1	Not felt	None
II-III	**0.0017 - 0.014**	0.1 - 1.1	Weak	None
IV	**0.014 - 0.039**	1.1 - 3.4	Light	None
V	**0.039 - 0.092**	3.4 - 8.1	Moderate	Very light
VI	**0.092 - 0.18**	**8.1 - 16**	Strong	Light
VII	0.18 - 0.34	**16 - 31**	Very strong	Moderate
VIII	0.34 - 0.65	**31 - 60**	Severe	Moderate to heavy
IX	0.65 - 1.24	**60 - 116**	Violent	Heavy
X+	> 1.24	**> 116**	Extreme	Very heavy



All earthquakes magnitude 4 and greater, 1900 -2014.
Source: http://earthquake.usgs.gov/earthquakes/search/

Earthquakes and Rock Falls

The August 14, 1988 magnitude 5.3 San Rafael Swell earthquake caused numerous rockfalls on the edge of Lockhart Basin.

Source: http://www.seis.utah.edu/lqthreat/nehrp_htm/1988sanr/1988sanr.shtml

Given the rock fall hazard from Porcupine Rim, it is reasonable to say that the rock fall hazard is increased by the seismic potential beyond what would be expected in an aseismic environment. Further, rockfalls can occur by seismic occurrences outside of Castle Valley, including occurrences over 50 miles away.

It is known that landslides have been initiated by earthquakes as low as magnitude 4.
Source: Keefer, D. K, 1984, Landslides caused by earthquakes: Geological Society of America Bulletin, v. 95, p. 402-421.

Induced Earthquakes

The M4.3 Paradox, Colorado, earthquake in 2000 was caused by deep well brine injection and has been the source of over 4,500 small earthquakes since the well was put into operation in 1991. Only 22 earthquakes, about 0.5% of the induced events, have magnitudes greater than or equal to M2.5. It is possible that larger earthquakes could be generated from this known source but well operators have reduced the injection rate since the M4.3 event in 2004 however, a M3.9 earthquake occurred in 2004.

Only 4 induced earthquakes with magnitude greater than or equal to M 3.0 have occurred.
All but one of these occurred prior to the mid-2000 decrease in injection rate, including the largest induced event – the M4.3 event which occurred on May 27th, 2000 (after ~4 years of continuous injection). On March 4, 2019 a M4.5 earthquake occurred 7 miles southeast of Paradox, largest ever in the area, leading to a temporary shut-down of operations and likely leading to the drilling of a new injection well.

Source: http://www.usbr.gov/uc/wcao/progact/paradox/annualRep/PVSN-2008Annual-Rep.pdf

Another source for information on this project see:
http://www.coloradoriversalinity.org/docs/PVU%20Briefing%20Document%202015-04-30.pdf\

GOALS TO REDUCE VULNERABILITIES

Discourage deep well brine injections that have been known to cause small earthquakes.
Create awareness for the community to a have 72- hour kit with ample food and water storage if roads and passes are shut down due to the effects of an earthquake.

Earthquake Probability Analysis

(area involved)		**Negligible**	**Less than 10%**
	X	**Limited**	**10-15%**
		Critical	**25-50%**
		Catastrophic	**More than 50%**
Probability		**Highly likely**	**More than 50%**

(of occurrence)		
		Likely 25-50%
		Possible 10-15%
	X	**Unlikely Less than 10%**
Location	**River corridor and along steep slopes and cliffs.**	
Seasonal Pattern or Conditions	**Potential from fracking or injection wells.**	
Duration	**Seconds to minutes with clean-up lasting hours to days.**	
Town Departments and/or Agencies involved		
Analysis Used	**USGS and government records**	

EARTHQUAKE:

Risk Assessments and Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit

Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.

Political Viability/ Public Support: 1= 100% resistance 2=75% 3=50 % 4= 25% 5= 100% support/no resistance.

1. Culinary water backup- cistern research.
   Potential benefit = 5
   Potential Cost =1
   Political viability= 4

2. Include information about earthquakes in public awareness publications.
   Potential benefit=4
   Potential Cost =1
   Political viability=4

3. Work with Grand County to keep Loop Road open year around as Hwy 128 is likely to experience excessive rock fall. Look into alternative routes i.e. Loop road.
   Potential benefit= 5
   Potential Cost =1-2

Political viability=5

4. Utilize Rapid Disaster Assessment team to ensure no one is left behind.
   Potential benefit=5
   Potential Cost = 1
   Political viability=5

5. Encourage residents to maintain 72 hour Kits. And stock the Town Building with 72 hour kit provisions for staff.
   Potential benefit= 5
   Potential Cost = 1
   Political viability= 5

BIOLOGICAL HAZARDS

BACKGROUND

Biological hazards include virus, infectious diseases of all kinds, toxic substances, and can include animal and plant diseases. Some biological hazards that have occurred, that have been present in Castle Valley include chronic wasting disease, COVID-19, West Nile virus, and E.coli. There is potential for many other types of biological hazards to occur.

Chronic wasting disease (CWD) is common among the mule deer population in this region and specifically inside of the Town of Castle Valley where mule deer congregate and spend the entire year. CWD has not yet been identified in humans but research is incomplete and we don't know enough at this time to rule out potential issues from the deer living in close proximity to humans and water sources.

COVID-19 is a novel virus became a global pandemic. Castle Valley was impacted by global shut downs to combat the virus have impacting people's lives and our economy.

West Nile virus is transmitted by Culex mosquitoes that bite at night , the peak flight time for the vector Culex mosquitoes is in the two hours after the first stars become visible at sunset. West Nile Virus has occurred in Grand County and happens seasonally with the mosquito populations; in 2019 the county had its first two confirmed human West Nile case. No cases in Castle Valley have been identified.

E-coli has been found in surface water in Castle Creek in the past and the potential for it to occur is present with livestock operations and grazing in the area, this would be included in the Water Contamination Hazard section of this plan.

Comment [PH18]: I noted DEQ E. coli Study (Total Maximum Daily Load) above. The study also noted that S Pot Potential Cost ential Cost eptic system failure is a possible source of E. coli.

IMPACTS ON THE COMMUNITY

Biological hazards can occur without warning and in varying degrees of severity. Biological hazards could potentially threaten our air quality, and water supply. We currently have no back up source for

our sole source aquifer and no storage for community use should the need arise. Residents who do not have adequate storage of water would need to find a way to have it delivered.

GOALS TO REDUCE IMPACTS AND VULNERABLITIES

Improving community resilience is a goal for reducing the long term impacts of biological hazards. Educating residents on the importance of food and water storage for at least 2 weeks' worth of household needs, and encouraging home gardens and back up means to run well pumps would also help reduce some vulnerability to biological hazards. Water management plans with long term goals of protecting our water quality and availability given the drought hazard is also a community goal. Educating residents on efficient crop watering methods to ensure long term sustainability of home food production as well as encouraging sustainable methods of animal husbandry would improve resilience as well. Neighbor helping neighbor has been a very important for the community getting through the recent pandemic, and will remain one of the ways we build resilience.

Biological Hazards Probability Analysis

Potential Magnitude (area involved)	**X**	**Negligible**	**Less than 10%**
	X	**Limited**	**10-15%**
		Critical	**25-50%**
		Catastrophic	**More than 50%**
Probability (of occurrence)		**Highly likely**	**More than 50%**
	X	**Likely**	**25-50%**
		Possible	**10=-15%**
		Unlikely	**Less than10%**
Location	**Town wide**		
Seasonal Pattern or	**Some Biological Hazards could be seasonal, others less often.**		

Conditions	
Duration	**Variable event to ongoing**
Town Departments and/or Agencies involved	
Analysis Used	**Division of Water Quality , DWR , CDC , Southeast Health Department**

BIOLOGICAL HAZARDS:

Risk Assessments & Mitigation Strategies:

Scale:

Potential Benefit to the Town population; 1= No benefit 2=25% 3=50% 4=75% 5=100% benefit
Potential Cost: 1= less than $600 2= up to $5000 3= $5000-$20,000 4= $20,000-$75,000 5= over $100,000.00 grant(s) required.
Political Viability/ Public Support: 1= 100% resistance 2=75% 3=50 % 4= 25% 5= 100% support/no resistance

1. Bring awareness and education of the biological hazard to the community through communications with the Southeastern Utah Health Department, Grand County and the State of Utah.
   Potential benefit= 5
   Potential Cost = 1
   Political viability= 5

2. Have a supply Personal protection Equipment (PPE) for employees, Town officials and residents.
   Potential benefit= 5
   Potential Cost = 3
   Political viability= 4

4. Encourage and support Community based initiatives to provide groceries, pharmaceuticals and other essential / critical supplies to higher risk residents.
   Potential benefit=5
   Potential Cost = 1
   Political viability= 5

5. Develop a Community Fund to help citizen initiatives provide groceries, pharmaceuticals and other essential/critical supplies to higher risk residents.

Potential benefit= 5
Potential Cost = 2
Political viability= 4

6. Create a pandemic protocol for the Town lot facilities such as the Pavilion and Playground.
Potential benefit=5
Potential Cost = 1
Political viability= 5

7. Bring awareness and education of Chronic Wasting Disease to avoid resident's interaction/contact with infected deer.
Potential benefit= 5
Potential Cost = 1
Political viability=3

8. Reconsider Fencing Ordinance in order to reduce possible interaction with deer.
Potential benefit=5
Potential Cost = 1
Political viability=3

9. Depending on the nature of the biological hazard, consider protocols for partial or total evacuation of the Town.
Potential benefit= High
Potential Cost = 1
Political viability=3

10. Encourage home orchards, gardens and livestock to supply locally sourced food.
Potential benefit=5
Potential Cost= 1
Political viability=4

11. Encourage residents to maintain 72 Hour Kits. And stock the Town Building with 72 hour kit provisions for staff.
Potential benefit= 5
Potential Cost = 6
Political viability= 5

2025 - UPDATED
RECOMMENDED PRIORITY PROJECTS

Goal	Priority - 1
Objective	Secure permission to work on BLM lands
Action Project:	Develop Right of Ways and/or MOUs to get permission to work on Town ingress and egress routes on BLM land and to work on drainages on BLM land adjacent to the Town on BLM land.
Time Frame:	1-3 years
Funding:	
Estimated Cost:	
Jurisdictions Involved:	Bureau of Land Management

Goal	Priority -2
Objective	Plan to help educate property owners along the green belt on fire vulnerability and defensive space.
Action Project:	Annual - quarterly public awareness publications. To include the Mayor's Annual Letter ,Castle Valley Fire District Newsletters and outreach a Community Events
Time Frame:	On going
Funding:	Town of Castle Valley Tax Base
Estimated Cost:	Current rate of postage and printing supplies plus Town Clerks regular salary.
Jurisdictions Involved:	Town of Castle Valley Town Clerk will be responsible for the mailing with info from the CV Fire District. and CV Hazard Mitigation Committee.

Goal	Priority - 3
Objective	Develop and implement emergency messaging system (like LoRa mesh network). And to explore radio station broadcast options.
Action Project:	
Time Frame:	
Funding:	Town of Castle Valley Tax Base
Estimated Cost:	
Jurisdictions Involved:	

Goal	Priority - 4
Objective	Have back-up generators and/or battery backups tied into public buildings for prolonged power outages.
Action Project:	Install back-up power for municipal buildings. Propane generator , battery backups and investigate Solar Options
Time Frame:	Two years for all buildings, Town and Fire Department.
Funding:	Possible Grants or from the Town's Tax Base for capital improvements.
Estimated Cost:	Thousands of dollars
Jurisdictions Involved:	Town of C.V and C.V.F.D

2020 - PLAN
PRIORITY PROJECTS AND RESULTS

Goal	**Priority - 1**
Objective	Have an Emergency Operations Plan in place to be prepared for major disasters.
Action Project:	Develop an Emergency Operations Plan. To include budgeting, emergency evacuation planning and post event "neighborhood rapid assessment planning (NRAP)" (FEMA FA-197 Appendix B)
Time Frame:	6 months
Funding:	Volunteers based, with support from the Town Clerk under the salary position.
Estimated Cost:	Depends on number of people and time involved, unknown. An estimate from Rick Bailey, the Grand County Emergency Manager, would to take a trained individual 15 hours to complete the plan.
Jurisdictions Involved:	Town of C.V staff, C.V.F.D, volunteers, County emergency manager, Sheriffs' Department staff. Representatives from Daystar Academy and the Castle Valley branch of the Church Jesus Christ of Latter-day Saints.
Results:	Formation of R-DAP Team. Town wide mapping and teams. Supplies for R-DAP vests, white boards, maps and name tags purchased with a donation from the Castle Valley Gourd Festival. First R-DAP volunteer orientation and shakeout scenario completed.

Goal	**Priority - 2**
Objective	Maintain the ingress and egress roads open for the community in case of an emergency.

Action Project:	A -Finish Upper 80 easements to Green Gate to access BLM land. B- Finish four-season surface on Shafer Lane extension to Fire Station. C- Continue to maintain ingress and egress for community. D- Repair/ Armor Castle Creek Culvert at Castle Valley Dr.
Time Frame:	Present and Ongoing
Funding:	Town of C.V. annual Roads budget. Town Capital Fund , Community Development Block Grant
Estimated Cost:	Placer Creek Low water Crossing Engineering $36,000.00 Placer Creek Low water Crossing Construction $188,888.00
Jurisdictions Involved:	Town of Castle Valley Road Department and MOU with Grand County Road Department.
Results:	Placer Creek low water crossing to Upper Eighty residences and BLM ingress/ egress completed

Goal	**Priority -3**
Objective	Bring awareness to the community about how to be prepared for and mitigate possible hazards.
Action Project:	Annual - quarterly public awareness publications. To include the Mayor's Annual Letter ,Castle Valley Fire District Newsletters and outreach a Community Events
Time Frame:	On going
Funding:	Town of Castle Valley Tax Base
Estimated Cost:	Current rate of postage and printing supplies plus Town Clerks regular salary.

Jurisdictions Involved:	Town of Castle Valley Town Clerk will be responsible for the mailing with info from the CV Fire District. and CV Hazard Mitigation Committee.
Results:	

Goal	**Priority - 4**
Objective	Identify in detail issues in the major drainages in Castle Valley Town boundaries to prevent or mitigate major events that may occur.
Action Project:	Annual and interim inspections and reports of Placer and Castle Creek drainages.
Time Frame:	Annual Inspections and after every major flooding event events, beginning immediately.
Funding:	Town of Castle Valley Tax Base
Estimated Cost:	8 hours each inspection at current per hour for staff labor.
Jurisdictions Involved:	Town of C.V. Road Department staff and the Bureau of Land Management.
Results:	

Goal	**Priority - 5**

Objective	Have back-up generators and/or battery backups tied into public buildings for prolonged power outages.
Action Project:	Install back-up power for municipal buildings. Propane generator , battery backups and investigate Solar Options
Time Frame:	Two years for all buildings, Town and Fire Department.
Funding:	Possible Grants or from the Town's Tax Base for capital improvements.
Estimated Cost:	Thousands of dollars
Jurisdictions Involved:	Town of C.V and C.V.F.D
Results:	Castle Valley Fire Protection District installed a propane generator to their well on Lot 13

Goal	**Priority - 6**
Objective	Mitigate Fire Hazard Fuels in Town Greenbelt by reducing biomass.
Action Project:	Finish riparian plan, build stakeholder support with Utah Forestry, Fire and State Land, Daystar Academy and County and Town property owners along Castle Creek.
Time Frame:	1 year.
Funding:	Town of Castle Valley Tax Base and possible grant funding
Estimated Cost:	At Current FEMA rate
Jurisdictions Involved:	Town of C.V. Road Department staff, Grand County, State and Private property owners.
Results:	

Goal	**Priority - 7**
Objective	Create Interlocal agreements to efficiently handle mitigation and disaster recovery efforts.
Action Project:	Advise and seek agreements with other organizations in the community, Interagency and government. Create an updated resources list of Interlocal agreements and Memorandums of Understanding.
Time Frame:	Immediately and ongoing.
Funding:	Town of Castle Valley Tax Base.
Estimated Cost:	Will depend on time of people involved at the current FEMA rate.
Jurisdictions Involved:	
Results:	

PLAN MAINTENANCE PROCESS

The Hazard Mitigation Committee will update the plan every four years or as determined by events. The plan will be updated by November of 2025.
Public hearings will be held prior to updating the plan.

Appendices will be added as information becomes available and as events occur.

Because the majority of committee members involved in the process are, members of the Fire District or of the Town of Castle Valley Public Body, updating the plan every four years will also help maintain continuity in local government.