Chapter 6 BEAVER COUNTY

A PICTURE OF BEAVER COUNTY

DEMOGRAPHICS

Beaver County is approximately halfway between Salt Lake City and Las Vegas. Interstate Highway I-15 passes through the eastern part of the county at Beaver City and is the main traffic route north to Salt Lake City, about 210 miles, and south to Las Vegas, about 220 miles, as well as to major destinations in between. Fillmore, county seat of Millard County, is just 58 miles to the north; Cedar City is 50 miles to the south. The Union Pacific Railroad, running north-south through the center of the county at Milford, is becoming increasingly important as a mover of goods and natural resources to and from Utah.

Recreation importance of the region is increasing, with growing numbers of tourists attracted to the National Parks and Recreation Areas. Beaver County hosts many travelers for short periods as they pass through to the major attractions of the region. The county itself is also a destination for thousands of hunters, fishermen, hikers, bikers, ATV's, and campers looking for a high country outdoor experience. A major attraction in Beaver County is Elk Meadows Ski and Summer Resort, located just 18 miles east of Beaver.

Until recent times the three main sources of income for the County have been agriculture, mining, and the railroad. Agriculture includes high quality grazing land, a variety of crops that are either consumed locally or transported to other areas, and a sizeable dairy industry. More recently Circle Four Farms has brought to Beaver County a modern swine producing operation. The mineral wealth of the county was world renown in the 1880's, at its peak. Though now at a more modest level, mining is experiencing resurgence. Since 1880 the railroad has provided transportation advantages, a steady level of income to a substantial portion of the population, and retirement income for many older residents. Trade and services are increasing in importance, with the development of the tourist potential. The need for outdoor recreation experiences for today's fast paced families is readily available in the Beaver County desert to mountain areas.

Beaver City, the Beaver County seat, is located just south of the I-15 and I-70 Interchange. Beaver City is located 200 miles south of Salt Lake City and 105 miles north of St. George.

DEVELOPMENT TRENDS

Beaver County suffered from three decades of out-migration before it started growing again in the 1980s. During the1990s population grew by 29 percent. Growth in the County slowed to 8.7% from 2000 to 2009; however, according to growth projections provided by the Governor's Office of Planning and Budget, Beaver County can expect significant increases in population over the next 20 years. The projected population increase from 2010 to 2020 is 40.2% and 44.8% from 2020 to 2030. Overall this translates to 103% growth projected over the next 20 years, which will surpass the State of Utah growth projections of 49.9% over the same period.

The projected increase in population is not expected to change the rural nature of the County. If the present population pattern continues, most of the population increase is expected to occur in established developed areas of the County. It is also anticipated that the established trend for population growth in the unincorporated part of the County will continue. Much of this growth in the unincorporated area is expected to occur near Beaver City in the proximity of Beaver Canyon and Elk Meadows.

The Beaver County General Plan (Amended February 1999) stipulates, "As a basis for all land use decisions affecting land within the County's jurisdiction, it is recommended that new development, including residential subdivisions and commercial and industrial activities…be permitted to occur only within the boundaries of incorporated communities or, immediately adjacent to such communities." Growth is further managed through implementation of growth boundaries which specifically state that County land which contains natural constraints, such as critical areas (environmentally-sensitive land) be preserved.

BEAVER COUNTY LANDSCAPE

The County is 90 miles in length from east to west and 30 miles wide from north to south, with an area of 2,568 square miles. It is crossed by a number of short mountain ranges oriented generally on a north-south axis, the highest being the Tushar range in the eastern portion with peaks over 12,000 feet high. The Beaver River originates in this area and flows in a westerly and north-westerly direction to disappear into Millard County at the southern end of the Great Basin drainage area. The elevation of Beaver Valley in the eastern section is 5,970 feet, while the elevation of Milford Valley in the western portion is 4,962 feet. Generally, the climate is temperate and not subject to either extreme heat or cold. There are four well-defined seasons. Precipitation averages 11.65 inches annually in Beaver Valley and 8.5 inches in the Milford area.

Situated on the west side of the Tushar range of the Wasatch Mountains, Beaver County is rich in natural resources. The Beaver River originates in the Tushar range and flows in a westerly and north-westerly direction. The entire eastern portion of the County lies within the Beaver River drainage areas. The remainder of the County is drained by intermittent streams.

A variety of land uses are represented in Beaver County. The major land uses in Beaver County are indicative of the ownership by federal and state governments. The Bureau of Land Management (BLM) areas are used primarily for grazing, mining, recreation, and open space. Most of the forested areas in the county are contained in National Forest boundaries. The National Forest lands have multiple uses which include recreation, timber cultivation and harvest, grazing, wildlife habitat, and watersheds. Privately owned lands, which account for the smallest percentage of the total land are in Beaver County, are given to the most diverse uses.

The majority of urban land uses, including residential, commercial, industrial and public uses are located in or near the three incorporated municipalities in Beaver County: Beaver City, Milford City and the town of Minersville. Beaver City and Milford City are the County's primary centers for commerce and social activity. Beaver City is the County seat and derives a considerable portion of its income from the tourism market. Milford is a railroad and agricultural center. Minersville and the unincorporated communities in Beaver County are primarily agricultural in character.

HAZARD IDENTIFICATION

Requirement §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Requirement §201.6(c)(2)(i): [The risk assessment **shall** include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii)(C): [The plan **should** describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

WILDFIRE

When discussing wildfires it is important to remember that fires are part of a natural process and are needed to maintain a healthy ecosystem. Since its settlement in the mid 1800s, the region and its residents have been subject to the annual threat of wildfire. This is in large part due to the environmental conditions, namely low annual precipitation and high amount of public lands. Lightning is the primary cause of wildfire in the county. However, the potential risk for human caused fires increases as more people move into the wildland urban interface.

Many of Utah's wildland urban interface areas are located in our most fire prone wildland fuels. Generally, these fuels are found on drier, lower elevation sites which are often very desirable for real estate development. To address these issues, a multi-jurisdictional group of agencies, organizations, and individuals collaborated to develop the *Southwest Utah Regional Wildfire Protection Plan* (October 2007). The purpose of this plan is to be a tool in the effort to protect human life and reduce property loss due to catastrophic wildland fires in the communities and surrounding areas located in the southwest Utah counties of Beaver, Garfield, Iron, Kane and Washington.

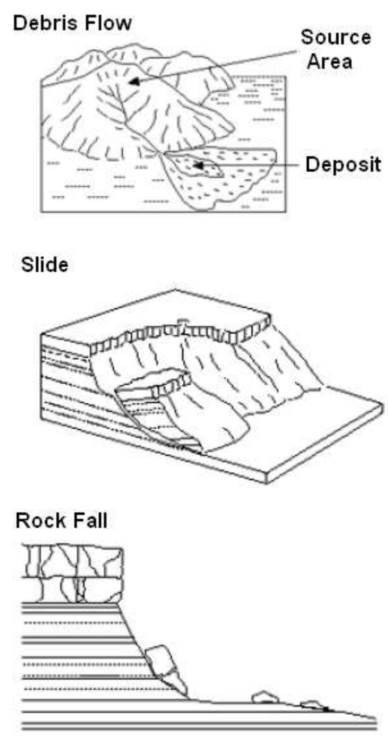
Beaver County is almost exclusively covered in Forest and Shrub/Rangelands with 95% of the land area in that category (1,574,720 acres). Grass/Pasture/Haylands make up 3% of the County's land area (46,463 acres. Water/Wetlands (16,576 acres and Urban/Developed (16,576 acres) each comprise about 1% of the County's land area. Most of the forest and rangeland in

Beaver County is found on federal USFS and BLM lands. Grass/Pasture/Haylands areas in the County may include cheatgrass, fescue, sedges, yucca, wheatgrass and bluegrass. A portion of Beaver County is comprised of Farmland. Grass/Pasture/Haylands includes approximately 7,000 acres of Grass Pasture and/or grass hay in the Beaver City area. Shrub/Rangelands consist of oak savanna, juniper/pinion pine and other open areas.

Using National Fire Plan guidelines, the Utah Division of Forestry, Fire, and State Lands (UDFFSL) has worked with national and local wildland fire officials to create a statewide list of Communities at Risk (CARs). As of 2005, there were over 600 communities listed statewide and 148 are located in the southwestern Utah region. Beginning in 2000, the Color Country Fuels Committee (CCFC) undertook an intensive assessment of the 148 identified CARs in the Color Country fire management response area. These assessments have been the foundation for prioritizing fuels treatments, determining focus areas, and targeting the development of Community Wildfire Protection Plans within the Color Country Interagency Fire Management area.

LANDSLIDE

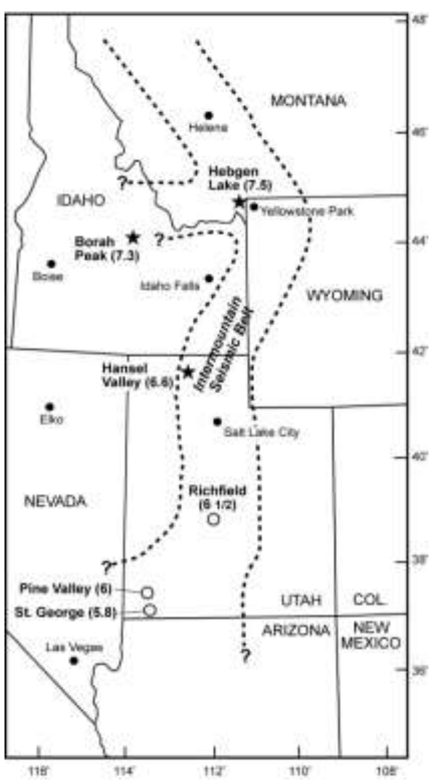
Nationwide, estimated losses from damaging landslides equal $3.5 billion annually (USGS, 2005). In Utah, documented losses from damaging landslides in 2001 exceeded $3 million, including the costs to repair and stabilize hillsides along state and federal highway (Ashland, 2003). Total landslide dollar losses are hard to determine from past events because a standard for documenting them do not exist. Several state and local agencies track landslide losses with inconsistent formats often resulting in several different totals for a single event.



The majority of landslides identified in Beaver County occur in the Tushar Mountains east of Beaver. The U.S. Forest Service identified over 300 landslides in the Beaver, Piute and western Sevier County area. Most of these have occurred in Tertiary volcanic tuffs. Although most of the landslides mapped in this area likely occurred in prehistoric times, a number of landslides in the Tushar Mountains have reactivated as a result of road-building activity. There has been renewed landsliding in ash-flow tuffs in the mountains east of Beaver. Approximately 104 landslides occurred between 1978 and 1981 along a 3-mile stretch of Utah State Route 153 in Beaver Canyon. Highway widening and over steepening of slopes begun in 1962 are cited for the increase in frequency of landsliding and the reactivation of some of these older slope failures. Although major landslide movements in the area have decreased in recent years, rock falls and shallow slope failures continue to impact this road.

In Utah most earthquakes are associated with the Intermountain seismic belt (Smith and Sbar, 1974; Smith and Arabasz, 1991), an approximately 160-kilometer-wide (100 miles), north-south trending zone of earthquake activity that extends from northern Montana to northwestern Arizona. Since 1850, there have been at least 16 earthquakes of magnitude 6.0 or greater within this belt (Eldredge and Christenson, 1992). Included among those 16 events are Utah's two largest historical earthquakes, the 1901 Richfield earthquake with an estimated magnitude of 6.5, and the 1934 Hansel Valley magnitude 6.6 earthquake, which produced Utah's only historical surface fault rupture. In an average year Utah experiences more than 700 earthquakes, but most are too small to be felt. Moderate magnitude (5.5 – 6.5) earthquakes happen every several years on average, the most recent being the magnitude 5.8 St. George earthquake on September 2, 1992. Large magnitude earthquakes (6.5 – 7.5) occur much less frequently in Utah, but geologic evidence shows that most areas of the state within the Intermountain seismic belt, including southwestern Utah, have experienced large surface-faulting earthquakes in the recent geologic past.

Fault-related surface rupture has not occurred in southwestern Utah historically, but the area does have a pronounced record of seismicity. At least 20 earthquakes greater than magnitude 4 have occurred in southwestern Utah over the past century (Christenson and Nava, 1992); the largest events were the estimated magnitude 6 Pine Valley earthquake in 1902 (Williams and Trapper, 1953) and the magnitude 5.8 St. George earthquakes in 1992 (Christenson, 1995). The Pine Valley earthquake is pre-instrumental and poorly located, and therefore, is not associated with a recognized fault. However, the epicenter is west of the surface trace of the Hurricane fault, so the event may have occurred on that structure. Pechmann and others (1995) have tentatively assigned the St. George earthquake to the Hurricane fault. The largest historical earthquake in nearby northwestern Arizona is the 1959 Fredonia, Arizona, earthquake (approximate magnitude 5.7; DuBois and others, 1982). Since 1987 the northwest part of Arizona has been quite seismically active (Pearthree and others, 1998), experiencing more than 40 events with magnitudes >2.5.

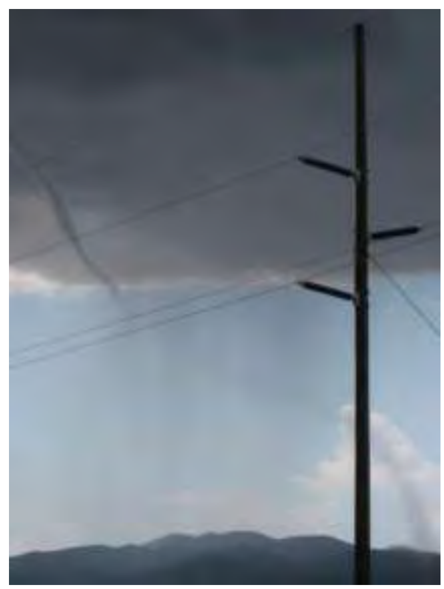


Despite the lack of an historical surface-faulting earthquake in southern Utah, available geologic data for faults in the region indicate a moderate rate of long-term Quaternary activity. Mid-Quaternary basalt flows are displaced hundreds of meters at several locations and alluvial and colluvial deposits are displaced meters to tens of meters in late Quaternary time.

Because earthquakes result from slippage on faults, from an earthquake-hazard standpoint, faults are commonly classified as active, capable of generating damaging earthquakes, or inactive, not capable of generating earthquakes. The term "active fault" is frequently incorporated into regulations pertaining to earthquake hazards, and over time the term has been defined differently for different regulatory and legal purposes. In fact, faults possess a wide range of activity levels. Some, such as the San Andreas Fault in California, produce repeated large earthquakes and associated surface faulting every few hundred years, while others, like Utah's Wasatch fault and many of the faults in the Basin and Range Province, generate large earthquakes and surface faulting every few thousand to tens of thousands of years. Therefore, depending on the area of interest or the intended purpose, the definition of "active fault" may change. The time period over which faulting activity is assessed is critical because it determines which faults are ultimately classified as hazardous and therefore in need of regulatory mitigation (National Research Council, 1986).

SEVERE WEATHER

The term severe weather, as it pertains to this plan, is used to represent a broad range of weather phenomena which affect southwestern Utah, namely; downburst, lightning, heavy snowstorms, avalanches, and tornados. Severe weather events are the most deadly type of natural hazard in Utah. Interestingly, more people have died in avalanches in Utah than by any other natural hazard. Between 1958 and 2006 avalanches killed 85 people.



Since 1950, lightning has killed 60 people statewide and injured another 144. In southwestern Utah the most common type of severe weather activity is related to lightning. Since 1950 a total of 5 lightning deaths and 10 lightning injuries have been recorded within the region.

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Most tornados have winds less than 112 miles per hour and zones of damage less than 100 feet wide. According to the National Weather Service, a total of 12 tornados have been observed in southwestern Utah. Of this amount, Iron and Beaver counties contain the highest amounts at 5 and 4 respectively.

Climate- Most of the moisture in the winter comes from fronts that develop in the Gulf of Alaska and move from west to east across the State. Tropical air from the Gulf of Mexico enters the state from the south and west during July through September and is the source of severe thunderstorms. Tropical Pacific air masses from the southwest at times have caused extreme floods in the southwest part of the State. The mountains form barriers to the flow of moisture-laden air, and orographic precipitation may occur any time during the year. Rain shadows, which are areas of reduced precipitation, on the leeward side of the mountains account for the low normal annual rainfall in many of the interior valleys in the region.

Cloudburst storms and resultant floods occur principally during the summer. All parts of the State are subject to these storms, even the flat desert areas of the western portion. However, they occur more frequently along the west slope of the Wasatch Range, the Colorado Plateaus, and the southwest part of the State.

Tornados- Generally speaking, atmospheric conditions are rarely favorable for the development of tornadoes in Utah due to its dry climate and mountainous terrain. In fact, Utah ranks as having one of the lowest incidences of tornadoes in the nation, averaging only about two tornadoes per year, with only one F2 or stronger tornado once every seven years.

In the central U.S., tornadoes are commonly one-fourth of a mile wide and often cause considerable destruction and death. However, Utah tornadoes are usually smaller in size, often no more than 60 feet wide (at the base), with a path length usually less than a mile and a life span of only a few seconds to a few minutes. They normally follow a path from a southwesterly to a northeasterly direction and usually precede the passage of a cold front. About 73% of all Utah tornadoes have occurred in May, June, July and August, when severe thunderstorms occasionally frequent Utah.

Avalanches occur when a cohesive slab of snow fractures as a unit and slides on top of weaker snow, breaking apart as it slides. Slab avalanches occur when additional weight is added quickly to the snow pack, overloading a buried weaker layer. Dry snow avalanches usually travel between 60-80 miles per hour, reaching this speed within 5 seconds of the fracture, resulting in the deadliest form of snow avalanche.

Wet avalanches occur when percolating water dissolves the bonds between the snow grains in a pre-existing snow pack, this decreases the strength of the buried weak layer. Strong sun or warm temperatures can melt the snow and create wet avalanches. Wet avalanches usually travel about 20 miles per hour.

According to the Colorado Avalanche Information Center (CAIC), over the last 10 winters in the United States an average of 25 people died in avalanches every year. In Utah, this translates to approximately 4 avalanche related fatalities every year. Generally speaking, the lion share of avalanche fatalities have occurred in northern Utah. Since every fatal accident is investigated and reported, the numbers can be reported with some certainty. However, there is no way to determine the number of people caught or buried in avalanches each year, because non-fatal avalanche incidents are increasingly under reported. Unfortunately, statistical data pertaining to avalanche related fatalities in southern Utah is underprovided.

PROBLEM SOILS

There are six types of problem soils and rocks that are found in southwestern Utah; namely, Expansive Soil, Collapsible Soil, Limestone (Karsts Terrain), Gypsiferous Soil/Rock, Soils subject to Piping, and Sand Dunes.

Expansive soil and rock is the most common type of problem deposit in southwestern Utah. In particular, the Jurassic-age Arapien and Cretaceous-age Tropic Shale's, and the Triassic-age Chinle and Moenkopi Formations are sources for expansive materials. Expansive deposits contain clay minerals that expand and contract with changes in moisture content. Clays absorb water when wetted, causing the soil or rock to expand. Conversely, as the material dries, the loss of water between clay crystals or grains causes the deposit to shrink. Expansive deposits are extensive around St. George, Washington, and Santa Clara. In these areas expansive clays in the Chinle Formation have been most damaging to structures. Common problems are cracked formations, heaving and cracking of floor slabs and walls, and failure of wastewater disposal systems. Sidewalks and roads are particularly susceptible to damage.

Collapsible Soil- Subsidence of the ground surface due to collapsible soil has caused extensive damage in and around Cedar City and the Hurricane cliffs, where it is most prevalent. Collapsible soil is common in Holocene alluvial-fan and debris-flow deposits in southwestern Utah. Soil and rock containing gypsum are also susceptible to subsidence. Collapse occurs when susceptible soils are wetted to a depth below that normally reached by rainfall, destroying the clay-bonds between bands. Collapsible soil is present in geologically young materials such as Holocene-age alluvial-fan and debris-flow sediments, and in some wind-blown silts.

Limestone (Karst Terrains) susceptible to dissolution and subsidence occurs throughout mountains west of Sevier Lake, west of Richfield, and south of St. George. Karsts terrain is characterized by closed depressions (sinkholes), caverns, and streams that abruptly disappear underground. Most karsts terrain in southwestern Utah is relict and relates to moisture climates during the Pleistocene, or may have been created by ground water prior to the rock being uplifted and tilted during basin and range faulting. No known damage has occurred to structures from ground collapsing or subsidence related to limestone karsts, but because karsts ground-water systems have little filtering capacity, contamination of ground water is a major concern.

Gypsiferous Soil/ Rock deposits are subject to settlement caused by the dissolution of gypsum, which creates a loss of internal structure and volume within the deposit. Gypsiferous soil and rock deposits are common in southwestern Utah, particularly along the base of the Hurricane cliffs. Gypsum in these deposits can cause damage to foundations, and induce land subsidence and sinkholes similar to those seen in limestone terrain.

Soils subject to Piping- Piping is subsurface erosion by ground water that moves along permeable, non-cohesive layers in unconsolidated materials and exists at a free face, usually along a stream bank or cliff that intersects the layer. Deposits susceptible to piping are common in the southwestern part of the state. Holocene-age alluvial fill in canyon bottoms is the most common material susceptible to piping in Utah. Collapse of soil pipes and subsequent erosion has damaged roads and agricultural land. Piping can cause damage to roads, bridges, culverts, and any structure built over soils subject to piping. Earth-fill structures such as dams may also be susceptible to piping.

Sand Dunes are common surficial deposits in arid areas where sand derived from weathering of rock or unconsolidated deposits is blown by the wind into mounds or ridges. In areas where development encroaches on dunes, inactive or vegetated dunes may be reactivated, allowing them to migrate over roads and bury structures. Sand Dunes occur in the Escalante Desert and west of Kanab. Migration of dunes across roads and burial structures are common problems in areas where active dunes are present. Avoidance of dunes is the best way to prevent damage to structures. However, active dunes usually are a maintenance problem only and do not preclude development.

FLOOD

In the southwest, as elsewhere, flooding, erosion, and sediment discharge are responsible for loss of life, land, and infrastructure, along with damage to reservoirs and natural habitats. Stream flooding is the most prevalent and destructive (annually) of the geologic hazards that affect Utah. This destructive trend is nowhere more evident than in the southwest part of the state.

The two types of stream flooding events which typically occur in southwestern Utah are riverine floods and flash floods. Riverine floods are usually regional in nature, last for several hours or days, and have recurrence intervals of 25 to more than 100 years. They commonly result from the rapid melt of a winter snow pack or from periods of prolonged heavy rainfall. Flash floods result from thunderstorm cloudbursts. They are localized, quickly reach a maximum flow, and then quickly diminish. Recurrence intervals for flash floods are erratic, ranging from a few hours to decades or longer for a given drainage. Both types of flooding have caused extensive damage in southwestern Utah.

Four major riverine floods have affected southwestern Utah since the area was settled. They occurred in 1966, 1983, 1984 and 2005. The 1966 flood on the Santa Clara River near Pine Valley resulted from an intense three-day rainstorm that produced record peak flows on the Virgin River. This three-day storm produced between 1 and 12 inches of rain and resulted in total damage of approximately $1.4 billion (Butler and Mundorff, 1970). The 1983 and 1984 floods occurred in response to the rapid melting of maximum-of-record and greater-than-average snow packs respectively. The 1983 and 1984 floods caused several landslides and a dam failure. Total damage was in excess of $640 million and the President issued a disaster declaration for 22 Utah counties. Lastly, a stalled storm-system containing abundant moisture caused significant flooding in Washington and Kane Counties between January 8-12, 2005. It is estimated that $300 million dollars in damages was sustained along the Santa Clara and Virgin Rivers in Washington County. 30 homes were destroyed in the flood and another 20 homes were significantly damaged (NCDC, 2005). A Presidential Disaster Declaration was declared February 1, 2005.

According to statistics provided by SHELDUS, Beaver County has experienced a total of 7 major flooding events; the first event occurring August 20, 1971 and the most recent occurring

May 21, 2005. The total property damage (not adjusted for inflation) for these flood events was $ 2,423,633.

By nature flash floods are sudden, intense, and localized. Many undoubtedly occur every summer along isolated drainages in southwestern Utah and are never recorded. Flash floods have damaged every major town in southwestern Utah. Many communities have implemented flood-control measures to reduce flash flood hazard; however, as communities expand into unprotected areas, new development is again subject to flash flooding. As a whole, any new development in southwestern Utah must consider the potential for stream flooding, and mitigate any flood hazard that may exist.

VULNERABILITY ASSESSMENT

Requirement §201.6(c)(2)(ii): [The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A): The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Requirement §201.6(c)(2)(ii)(B): [The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph *(c)(2)(ii)(A)* of this section and a description of the methodology used to prepare the estimate.

WILDFIRE

One of the core elements of providing a wildfire vulnerability assessment is developing an understanding of the risk of potential losses during a wildfire. The Healthy Forests Restoration Act, the National Fire Plan, and the National Association of State Foresters all provide guidance on conducting a wildfire hazard and risk assessment. As illustrated in the *Southwest Utah Regional Wildfire Protection Plan,* the Color Country Fuels Committee Risk Assessment Teams approached the wildfire risk assessment with a comprehensive review of potential risk from the Communities at Risk (CARs) list. These risk assessments have been reviewed and are presented in this section.

As illustrated in the *Southwest Utah Regional Wildfire Protection Plan* the Color Country Fuels Committee (CCFC) compiled data that included standardized internal and external risk assessments, digital photos, maps, and other information to prioritize hazardous fuels target areas and to aid in suppression efforts. Each CARs was given a score ranging from 0 (no risk) to 12 (extreme risk) based on the sum of multiple risk factors (e.g., fire history, local vegetation, firefighting capabilities) analyzed in every area. The scoring system allows Utah's fire prevention program officials to assess the relative risk in a given area of the state and open communication channels with these communities to help them better prepare for wildfire.

Beaver County- Communities at Risk and Risk Score (2005)	
Elk Meadow	12
Baker Canyon	11
Sulpherdale	11
North Creek	10
Puffer Lake	9
High-Low	9
Greenville	8
Adamsville	7
Minersville	7
Eagle Estates	7
Source: Southwest Utah Regional Wildfire Protection Plan (October 2007)	

In addition to the above analysis, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) structures located within a respective hazard area. This analysis was based upon the most recent (2009) County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the market value for structures in each defined hazard area. Where applicable, if a critical facility was located within a defined hazard area, this valuation was included within the commercial structure category. The GIS software then quantified the number of units and total market value for all structures located within each defined hazard area.

Beaver County - Wildfire			
Type of Structure	Market Value of Structures		Number of Structures
	Wildfire Risk Area-High	Wildfire Risk Area-Medium	
Residential	$7,363,141		107
Commercial	$144,274		2
Residential		$36,428,012	435
Commercial		$1,661,115	9
Total	**$7,507,415**	**$38,089,127**	**553**
Overall Total		**$45,596,542**	**553**

In addition to structures located within a defined hazard area, there is also an overwhelming amount (in terms of quantity and value) of infrastructure that is not captured by the GIS analysis. This is in large part due to the fact that compilation of this data would be exhaustive; nevertheless, the following provides a summarization of infrastructure at risk from wildfire.

Infrastructure at Risk from Wildfire			
Location	Miles of Major Roadways	Miles of Railroad Track	Miles of Utility Powerlines
Beaver County	60	5	87
Garfield County	104	0	154

Iron County	110	117	180
Kane County	59	0	50
Washington County	80	0	155
Paiute Indian Lands	10	0	0
Region Totals	**423**	**122**	**626**

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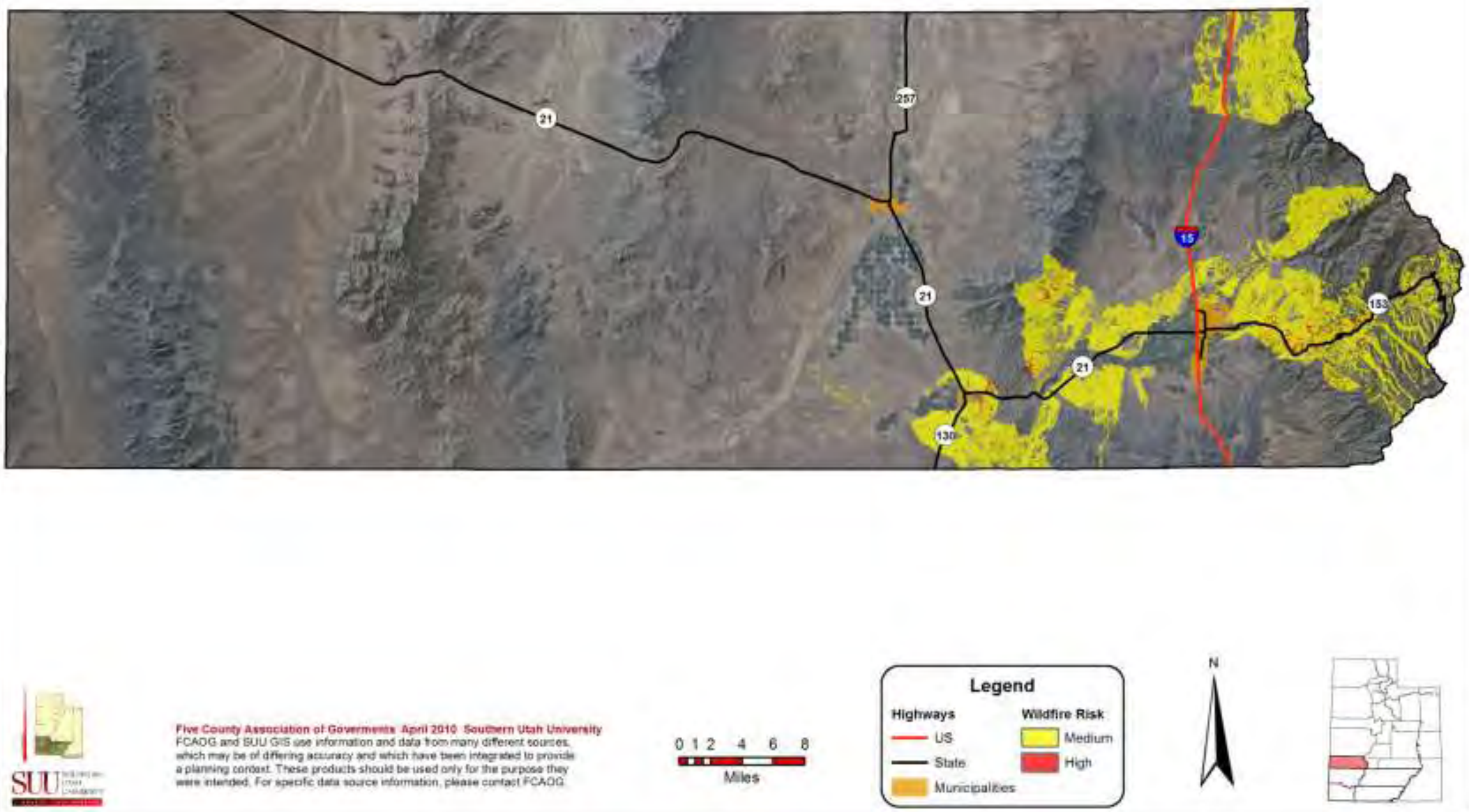
Five County Natural Hazard Mitigation Plan

Beaver County

Wildfire Risk Map



Five County Association of Goverments April 2010 Southern Utah University
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LANDSLIDE

According to the USGS, landslides are a widespread geologic hazard that can occur in all 50 states. On average, landslides cause $1-2 billion annually in damages and claim 25 lives per year. Urban development in and along hillside areas increase the number of people threatened by landslide events each year (USGS, 2007). Many factors contribute to overall landslide vulnerability; including local weather, soil moisture, duration and intensity of precipitation, wildfire history, and development pressure. Typically, landslides result from other natural disasters such as earthquakes, volcanoes, wildfires and floods (USGS, 2007). The table below illustrates landslide susceptibility by hazard category.

Beaver County- Landslide susceptibility by hazard category				
County	High Hazard (square miles)	Moderate Hazard (square miles)	Low Hazard (square miles)	**Total (square miles)**
Beaver	46.6	579	236.1	**861.7**
Garfield	3.7	193.8	223.5	**421**
Iron	20.5	738.2	333	**1,091.7**
Kane	42	1,638.5	672.9	**2,353.4**
Washington	28.1	1,079.9	423.2	**1,531.2**
Source: State of Utah, Natural Hazard Mitigation Plan, November 2007.				

In addition to the above analysis, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) buildings located with a respective hazard area. This analysis was based upon the most recent County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the ***market value*** for structures in each defined hazard area. The GIS software then quantified the number of units and total market value for all structures located within each defined hazard area.

Beaver County - Landslide			
Type of Structure	Market Value of Structures		Number of Structures
	Landslide Risk Area- High	Landslide Risk Area- Medium	
Residential			
Commercial			
Residential		$22,177,201	279
Commercial		$177,032	6
Total		**$22,354,233**	**285**
Overall Total		**$22,354,233**	**285**

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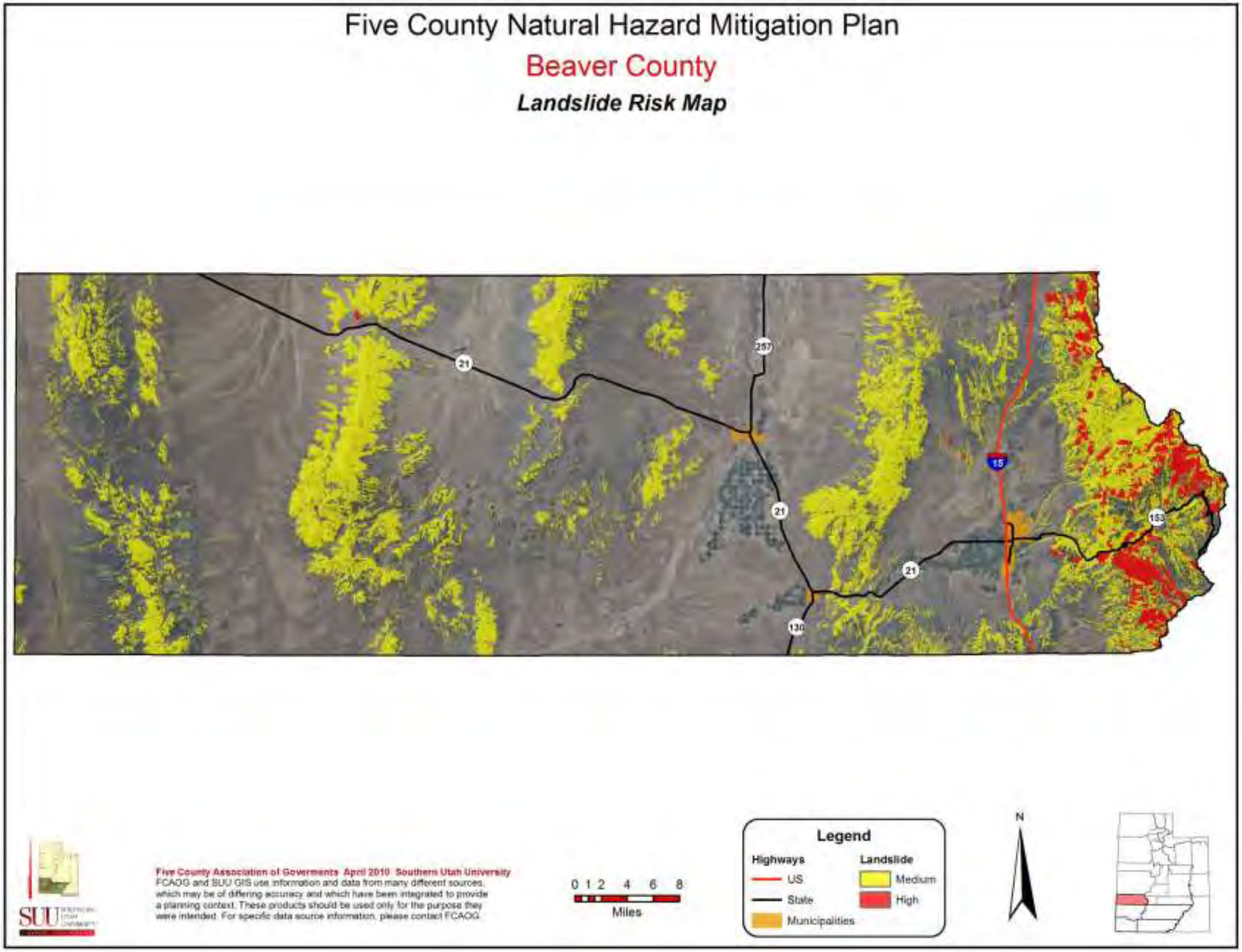
Five County Natural Hazard Mitigation Plan
Beaver County
Landslide Risk Map
21
257
15
153
130
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Miles
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Highways
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Landslide
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EARTHQUAKE

When assessing the vulnerability of structures as a result of an earthquake, an understanding of the building code, to which the structure was designed, is of extreme importance. Utah building codes began to address seismic design as early as 1976; although, the state did not adopt building codes fully addressing seismic safety until 1989. It is fairly safe to assume that structures constructed prior to 1976 will not perform in an earthquake as well as structures built following 1976. This is to say that an increased understanding of seismic events coupled with advances in building design has greatly increased our ability to design and construct buildings which perform better in earthquakes.

Earthquakes are regional hazards affecting multi-county areas, and because almost the entire state could experience a seismic event, all communities contain some degree of risk. The degree of risk is determined by several factors; however, the paramount factor is naturally the likelihood and magnitude of the earthquake. This being said, building design is a key factor when discussing potential structural damage. Vulnerability of structures was determined through age of construction with those structures built before 1976 considered to possess a higher risk.

Age of Housing Stock			
County	Structures built before 1976	Total Structures	**% of Structures built before 1976**
Beaver	1,559	2,660	**59%**
Garfield	1,497	2,767	**54%**
Iron	5,336	13,618	**39%**
Kane	1,398	3,767	**37%**
Washington	6,777	36,478	**19%**
Source: U.S. Census, November 2000.			

In addition to the above analysis, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) buildings located with a respective hazard area. This analysis was based upon the most recent County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the *market value* for structures in each defined hazard area. The GIS software then quantified the number of units and total market value for all structures located within each defined hazard area. The quantitative earthquake data provided below includes all structures which are: 1) on a fault line, or 2) within a 500' to 1,000' fault line buffer area. The range provided for the fault line buffer area is a determination made by Utah Geological Survey as it relates to the fault being studied or unstudied.

Beaver County - Earthquake		
Type of Structure	Market Value of Structures	Number of Structures
Residential	$5,209,071	61
Commercial	$2,008,147	11
Total	**$7,217,218.00**	**72**

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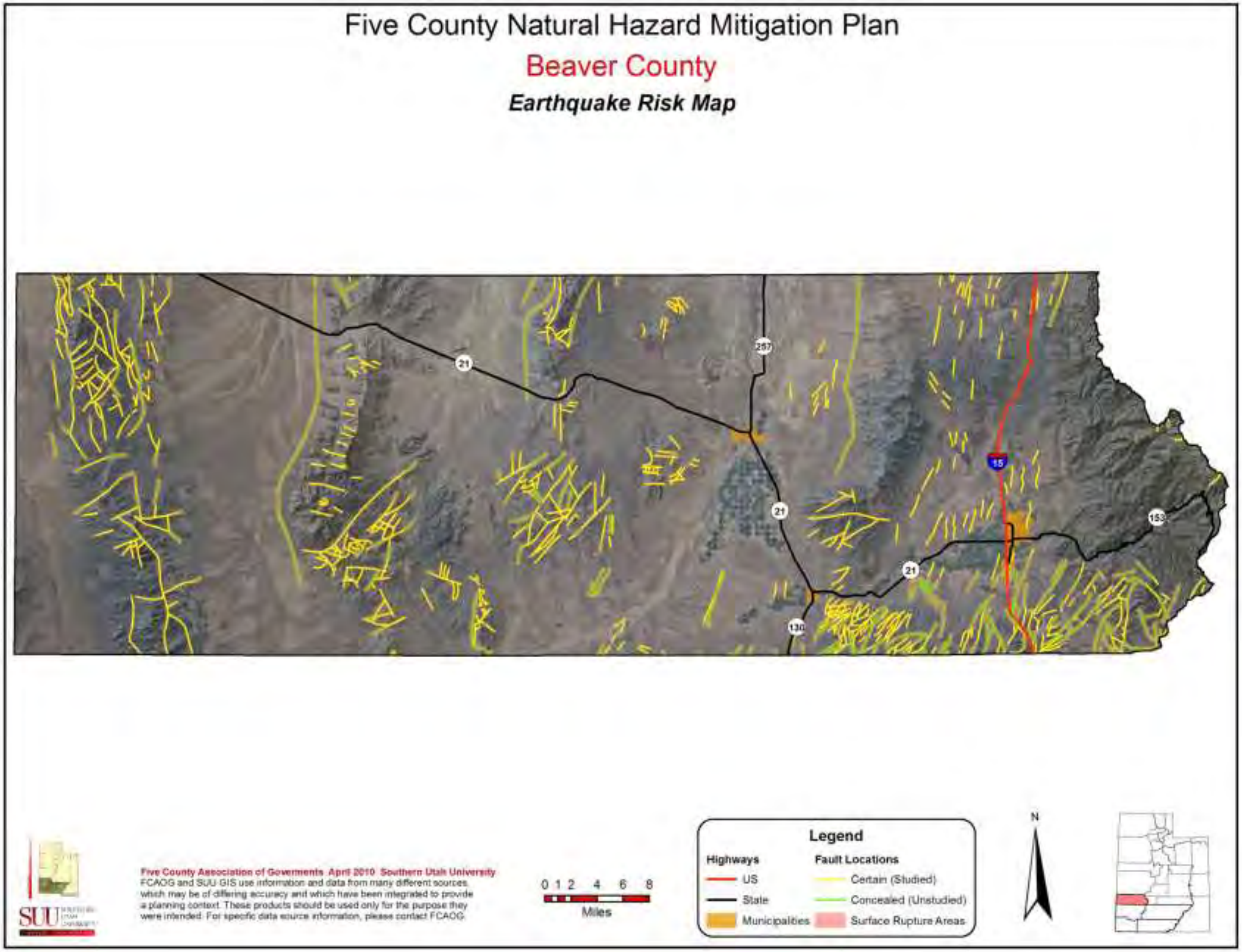
Five County Natural Hazard Mitigation Plan
Beaver County
Earthquake Risk Map
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257
21
15
21
153
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Five County Association of Goverments April 2010 Southern Utah University
FCAOG and SUU GIS use information and data from many different sources which may be of differing accuracy and which have been integrated to provide a planning context. These products should be used only for the purpose they were intended. For specific data source information, please contact FCAOG.
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Miles
Legend
Highways
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Municipalities
Fault Locations
Certain (Studied)
Concealed (Unstudied)
Surface Rupture Areas
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SEVERE WEATHER

There are many qualitative factors that point to potential vulnerability. Severe weather can cause power outages, transportation and economic disruptions, significant property damage, and pose a high risk for injuries and loss of life. The event can also be typified by a need to shelter and care for individuals impacted by the event. On numerous occasions, severe weather have brought economic hardship and affected the life of the residents of southwestern Utah. Higher elevations in the Five County region have greater exposure to snow and ice, but may be less economically vulnerable because they are sparsely populated. Quantitative assessment of severe weather vulnerability and determining which counties are more vulnerable is very challenging. However, using the principle of the past being the key to the future is effective. For example, one would assume that an area that has exhibited a large number of occurrences would continue to exhibit the same.

A quantitative vulnerability assessment is difficult based upon the simple fact that severe weather occurrences are random and difficult to predict. Several factors limit a determination of potential losses, they include:

- Limited GIS data availability;
- Lack of research on location;
- The entire state of Utah shares similar, if not identical risks; and
- Most hazards are tied to weather and cannot be predicted with location.

This being said, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) buildings located with an area that has exhibited severe weather occurrences. This analysis was based upon the most recent County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the *market value* for structures in each defined severe weather hazard area. The GIS software then quantified the number of units and total market value for all structures located within each defined severe weather hazard area.

Beaver County – Severe Weather		
Type of Structure	Market Value of Structures	Number of Structures
Residential	$391,848	5
Commercial	$210,288	1
Total	**$602,136.00**	**6**

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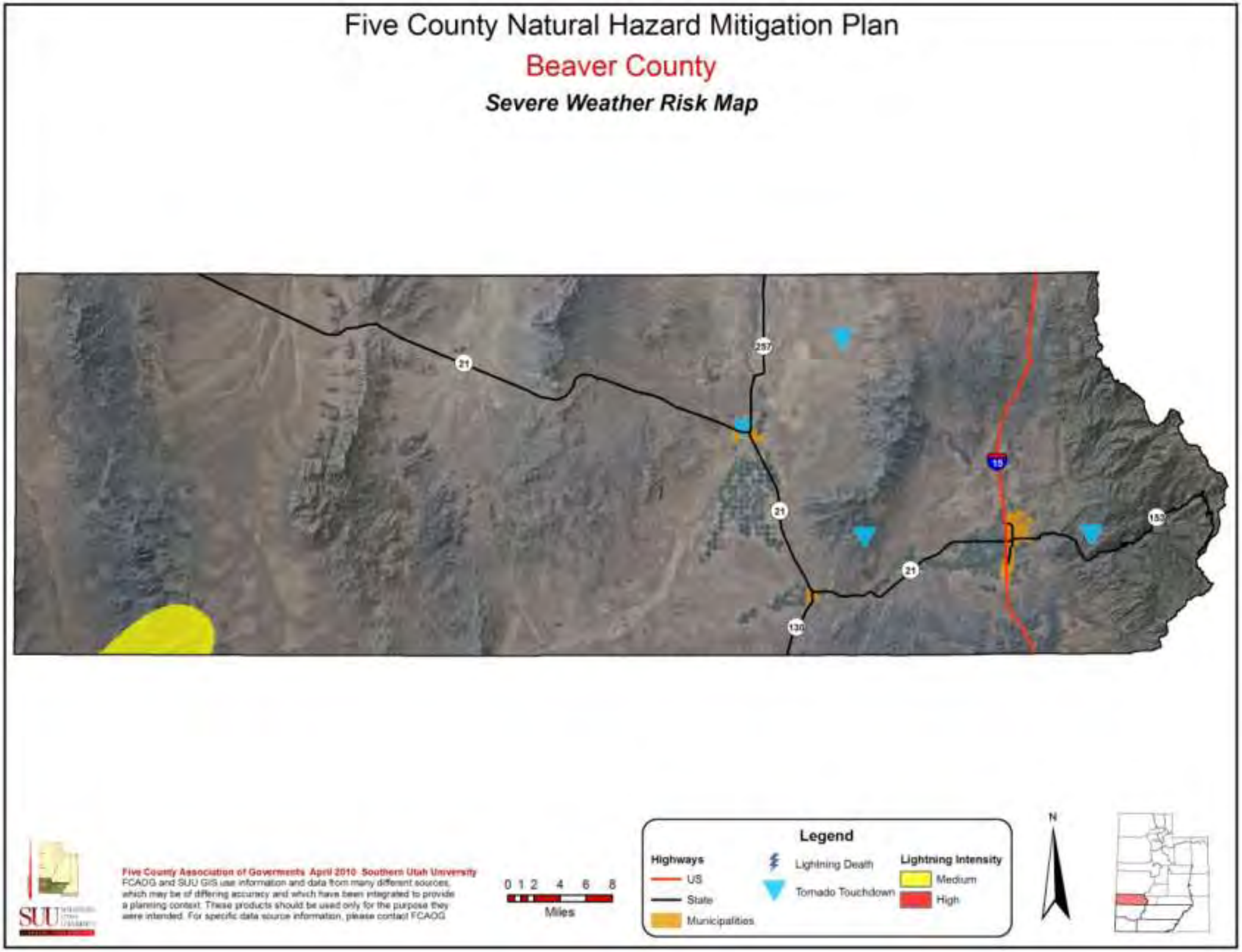
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Tornado Touchdown
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PROBLEM SOILS

Geologic materials with characteristics that make them susceptible to volumetric changes, collapse, subsidence, or other engineering-geologic problems are referred to as problem soils. Geologic and climatic conditions in southwestern Utah provide a variety of both localized and widespread occurrences of these materials. Soil and rock related geologic problems occur in a variety of geologic settings and are some of the most widespread and costly geologic hazards. Six types of problem soil and rock are present in southwestern Utah. Six types of problem soil and rock are found in southwestern Utah: (1) expansive soil and rock with high shrink/swell potential, (2) collapsible soil, (3) limestone (Karsts Terrain) susceptible to dissolution under some hydro geologic conditions, (4) gypsiferous soil/rock susceptible to dissolution, (5) soil subject to piping (localized subsurface erosion), and (6) active dunes. Some materials, such as expansive soil and limestone, cover large areas, whereas others, like active dunes, are of limited extent. The most extensive problem soils found in the region are expansive soil and rock.

Expansive Soils and rock are the most common type of problem soils in southwestern Utah. Expansive deposits contain clay minerals that expand and contract with changes in moisture content. Clays absorb water when wetted, causing the soil or rock to expand. Conversely, as the material dries, the loss of water between clay crystals or grains causes the deposit to shrink.

Expansive deposits are extensive around St. George, Washington, and Santa Clara in Washington County. In these areas expansive clays in the Chinle Formation have been most damaging to structures. In Santa Clara, many homes and a church were damaged by expansive clays in the Chinle Formation. Common problems are cracked foundations, heaving and cracking of floor slabs and walls, and failure of wastewater disposal systems. Sidewalks and roads are particularly susceptible to damage. The majority of expansive soil problems are found in Washington and Iron Counties.

Collapsible Soil- The phenomenon of hydrocompaction, which causes subsidence in collapse prone soil, occurs in loose, dry, low density deposits that decrease in volume or collapse when saturated for the first time following deposition. Collapse occurs when susceptible soils are wetted to a depth below that normally reached by rainfall, destroying the clay bonds between grains. Collapsible soil is present in geologically young materials such as Holocene age alluvial fan and debris flow sediments. When saturated, the soil collapses and the ground surface subsides, damaging property and structures. Human activities that involve some form of water application such as irrigation, water impoundment, lawn watering, and alterations to natural drainage or wastewater disposal commonly initiate hydrocompaction.

Collapsible soil is present particularly near Cedar City (Iron County) and the Hurricane Cliffs (Washington County). In Cedar City approximately $3 million in damage to public and private structures has been attributed to collapsible soil. Other areas in southwestern Utah with a potential collapsible soil problem are along mountain fronts where young alluvial fan deposits containing fine-grained sediments are present. Climate also plays a role in the distribution of collapsible soils. Drier areas, such as the Basin and Range and Colorado Plateau provinces, provide the best conditions for development of collapsible soil. Soil and rock containing gypsum are also susceptible to subsidence. Ground water and introduced waters from irrigation dissolve gypsum causing subsidence.

Limestone (Karsts Terrain) is characterized by sinkholes, caverns, and streams that abruptly disappear underground. Karsts features are caused by ground and surface water dissolution of calcareous rocks, such as limestone. Cavernous subterranean openings in karst terrain often collapse, leaving sinkholes at the surface.

Limestone susceptible to dissolution and subsidence occurs throughout mountains west of Sevier Lake, west of Richfield, and south of St. George. No known damage to structures has occurred from ground collapse or subsidence related to limestone karsts; however, the potential for damage exists where susceptible units are present. In addition, because karsts ground-water systems have little filtering capacity, contamination of ground water is a major concern.

Gypsiferous soil/rock are subject to settlement caused by the dissolution of gypsum, which creates a loss of internal structure and volume within the deposit. Gypsum in soil can also form in other ways - including as a secondary mineral deposit leached from surficial layers and concentrated lower in the soil profile or wind-blown dust, and in the St. George area (Washington County) by the evaporation of ground water.

Gypsiferous soil and rock deposits are common in southwestern Utah, particularly along the base of the Hurricane Cliffs. Much of the gypsum is derived from erosion of gypsum rich rock units. Gypsum in these deposits can cause damage to foundations, and induce land subsidence and sinkholes similar to those seen in limestone terrain. Water introduced into the subsurface for irrigation and landscaping or into wastewater disposal systems, can cause underground solution cavities to develop, which may ultimately cause surface collapse. Gypsum is also a weak material with low bearing strength, which can cause problems when loaded with the weight of a structure. In addition, gypsum dissolved in water forms sulfuric acid and sulphate, which react with certain types of cement and weaken foundations.

Soils Subject to Piping- Piping is subsurface erosion by ground water that moves along permeable, non-cohesive layers in unconsolidated materials and exits at a free face, usually along a stream bank or cliff that intersects the layer. Removal of fine-grained particles by this process creates voids within the material that act as minute channels which direct the movement of water. As channels enlarge, water moving through the conduit increases velocity and removes more material, forming a "pipe." The pipe becomes a preferred avenue for ground-water drainage and enlarges as more water is intercepted. Increasing the size of the pipe removes support from the walls and roof, causing eventual collapse.

Deposits susceptible to piping are common in southwestern Utah. Piping can cause damage to roads, bridges, culverts, and any structure built over soils subject to piping. In areas where piping is common, roads are frequently damaged where they parallel stream drainages and cross-cut pipes. Road construction can contribute to the piping problem by disturbing natural runoff and concentrating water along paved surfaces, allowing greater infiltration and potential for pipes to develop.

Sand Dunes are common surficial deposits in arid areas where sand derived from weathering of rock or unconsolidated deposits is blown by the wind into mounds or ridges. In areas where development encroaches on dunes, inactive or vegetated dunes may be reactivated, allowing them to migrate over roads and bury structures. Another problem is the contamination of local ground water from wastewater disposal in dunes. The uniform size of the sand grains comprising dunes makes them highly permeable. Dunes are present in many areas of southwestern Utah, especially in the Escalante Desert (Iron County) and west of Kanab (Kane County). Avoidance of dunes is the best way to prevent damage to structures. (Excerpted from Lund, UGS unpublished information).

Conclusions- In addition to the above analysis, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) buildings located with a respective hazard area. This analysis was based upon the most recent County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the *market value* for structures in each defined hazard area. The GIS software then quantified the number of units and total market value for all structures located within each defined hazard area.

Beaver County – Problem Soils		
Type of Structure	Market Value of Structures	Number of Structures
Residential	$24,142	2
Commercial		
Total	**$24,142.00**	**2**

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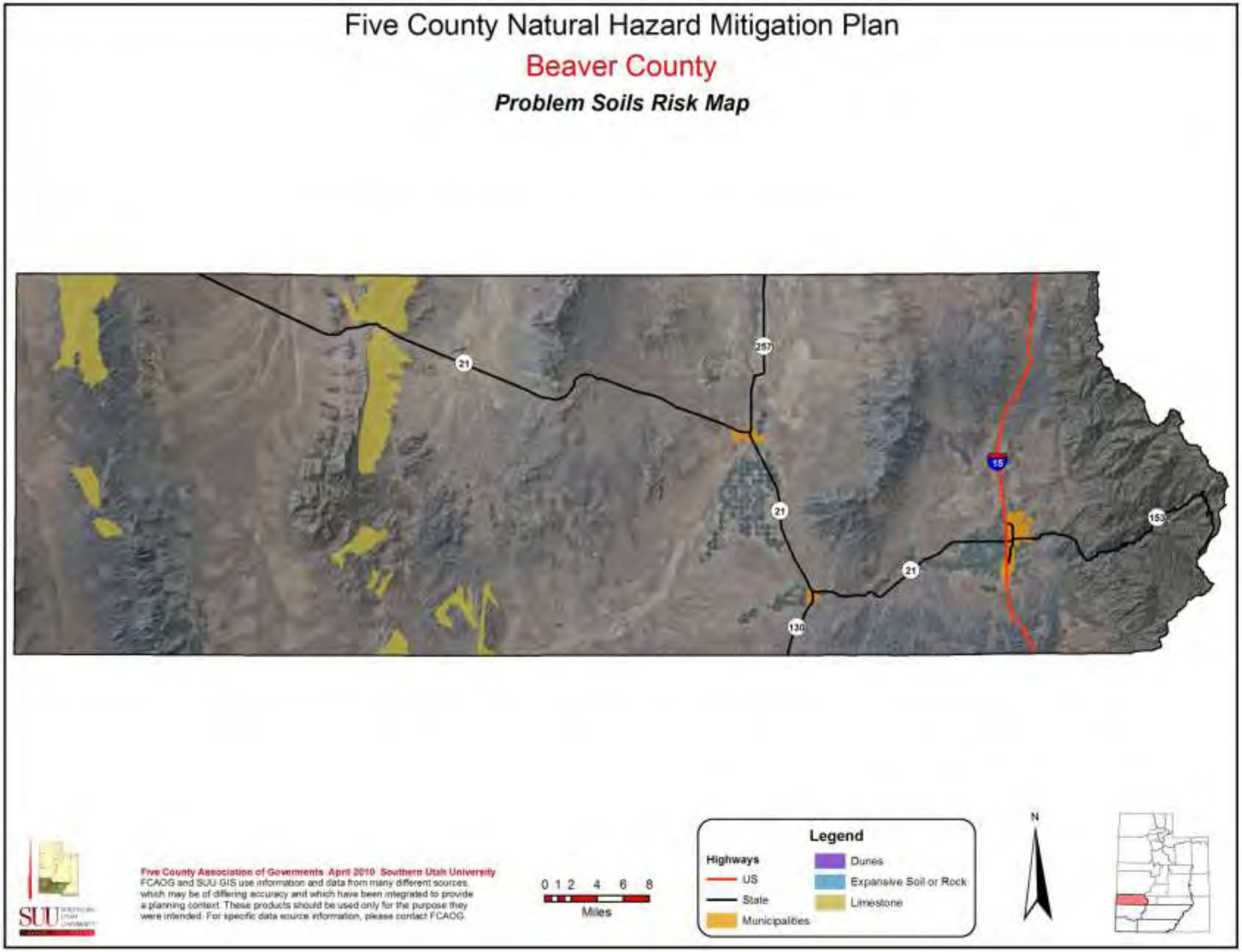

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Expansive Soil or Rock
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FLOOD

The Army Corps of Engineers conducted a *Flood Hazard Identification Study* for the Five County region in August, 2003. The intent of this study is to aid in detailing natural hazards associated with fluvial process for entities within the region. The study evaluates and identifies areas with a flood hazard and identifies potential mitigation solutions. Municipalities within the region were studied if they met the following criteria: 1) Jurisdiction has not been mapped by FEMA; and 2) Jurisdiction mapped by FEMA as a Zone D, area of undetermined flood hazard. The following information is provided from the Study.

Dams are a critical support function for water managers in the State, and also can act as a flood control measure. If a dam remains stable, does not get overtopped, or is not impaired as the result of an earthquake, then at a minimum, they do provide incidental flood control. If not then they can add to the flood threat. There are 145 dams within the Five County region, of those 33 have received a high hazard rating by Utah Division of Water Right Dam Safety Section. The State Dam Safety Section has developed a hazard rating system for all non-federal dams in Utah. Downstream uses, size height, volume, and incremental risk/damage assessments are a variable used to assign dam safety classification. High hazard dams would cause a possible loss of life in the event of a rupture. The following are high hazard dams in Beaver County: Manderfield, Three Creeks, Kents Lake-Middle, Kents Lake-Upper, and Rocky Ford.

Only about 20% of Beaver County residents live in the unincorporated county. The County does participate in the National Flood Insurance Program (NFIP). However, FEMA 100yr. flood plain mapping is generally non-existent; with the exception of one small flood plain mapped on the south end of Main Street in Beaver City. No major rivers threaten existing urban development. Potential flood sources include the Beaver River and its tributaries, and other potential flood sources such as the reservoirs and lakes. Vulnerability assessment as it relates to specific developed area in unincorporated Beaver County includes the following:

- Adamsville: Little threat as Indian creek runs quite a ways east of the community.
- Greenville: At some risk due to Dry Creek running through town.
- Manderfield: A large channel just east of the main street appears to pose a moderate flood threat.

Vulnerability assessment as it relates to specific developed area in incorporated Beaver County includes the following:

- Beaver: The town is susceptible to flooding primarily on the very south end of town from Beaver Creek and on the very north end of town from North Creek.
- Milford: An existing, large Corps of Engineers project, Big Wash Diversion Dam and Channel, provide adequate flood protection resulting in this community's NSFHA designation.
- Minersville: Relatively protected from flood threat due to the Minersville Dam being just a few miles upstream (to the east) and due to the long and relatively large interceptor levee that extends for close to 2 miles along the foothills southeast of town.

In addition to the above analysis, the vulnerability assessment was conducted using GIS software to join: 1) County Property Tax data as it relates to 2) buildings located with a respective hazard area. This analysis was based upon the most recent County Property Tax data provided by each County Assessor's office. The values shown are based upon utilizing the *market value* for structures in each defined hazard area. The GIS software then quantified the number of units and total market value for all structures located within each defined hazard area. Unfortunately, Beaver County FEMA 100yr. flood plain mapping is generally non-existent; with the exception of one small flood plain mapped on the south end of Main Street in Beaver City. Based upon this fact, the aforementioned GIS analysis could not be performed.

MITIGATION STRATEGY

The following table provides a brief synopsis of the Beaver County mitigation strategies. Additional information for each specific hazard, including specific mitigation strategies and associated information, are found following this table.

Beaver County- Mitigation Strategies									
Mitigation Strategy	**Action**	**Timeline**	**Estimated Cost**	**Plan Goals Addressed**					
				Education/ Outreach	**Emergency Services**	**Environmental Protection**	**Partnership/ Coordination**	**Prevention**	**Property Protection**
Wildfire-Mitigation Strategy #1	Promote public awareness campaign for property owners living in wildland urban interface areas.	Ongoing	Unknown	●			●	●	●
Wildfire-Mitigation Strategy #2	1-Voluntary site visits (to CARS) by fire crews to consult with landowners about specific ways to reduce risk to their property.	Ongoing	Unknown	●	●		●	●	●
	2-Develop local code enhancements that require utilization of defensible space tactics.	Ongoing	Unknown					●	●
Wildfire-Mitigation Strategy #3	Enhance existing wildfire training programs, equipment procurement, and fire fighting resources for wildfire suppression.	Ongoing	Unknown		●		●	●	●

Landslide-Mitigation Strategy #1	Increase public education related to landslide hazards by distributing UGS landslide informational brochures to local municipality level emergency mgmt., engineering, and planning departments.	Ongoing	Very minimal	●	●		●	●	
Landslide-Mitigation Strategy #2	Drafting/updating zoning and/or landslide ordinances to prevent development of structures near debris flows, landslides, and rock fall areas.	Ongoing	Minimal					●	●
Landslide-Mitigation Strategy #3	1-Address landslide risk at the building/construction level by requiring all subdivision proposals to have a geotechnical report.	Ongoing	Minimal					●	●
	2-If jurisdiction does not have trained staff to review the geotechnical report, the jurisdiction can, upon request, have UGS perform a review of the report.	Ongoing	Minimal				●	●	●
Earthquake-Mitigation Strategy #1	Increase public education related to earthquake hazards by distributing Utah Seismic Safety Commission informational brochures to County and City emergency management agencies.	Ongoing	Very minimal	●			●		
Earthquake-Mitigation Strategy #2	Continued dedication/vigilance in enforcing the seismic standards established in the International Building Code.	Ongoing	Minimal					●	●

Earthquake-Mitigation Strategy #3	1-Utilize the Earthquake Risk Map provided in this plan as a tool to assess earthquake risks as it relates to any building/subdivision proposals. If deemed necessary, jurisdiction should require the builder/developer to conduct a site-specific earthquake hazard identification/mapping study.	Ongoing	$1,000-$5,000					●	●
	2- At the County level, contract with UGS to formally study/map earthquake hazard areas.	3-5 years	$7,109-$14,218 per jurisdiction				●	●	●
Severe Weather-Mitigation Strategy #1	Continued dedication/vigilance in enforcing the standards established in the International Building Code as it relates to wind-loading, electrical grounding, snow-loading, and other weather-related hazards.	Ongoing	Minimal					●	●
Severe Weather-Mitigation Strategy #2	1-Enhance the Emergency Alert System (tv & radio)	Ongoing	Unknown	●	●		●		
	2-Enhance NOAA Weather Radio All Hazard coverage.	Ongoing	Unknown	●	●		●		
Severe Weather-Mitigation Strategy #3	At the county Local Emergency Planning Committee (LEPC) level, meet the program guidelines then apply to the National Weather Service StormReady Program.	3-5 years	Minimal		●		●	●	●

Problem Soils-Mitigation Strategy #1	1-Address problem soils at the building/construction level by requiring all subdivision proposals to have a geotechnical report.	Ongoing	$1,000-$5,000					●	●
	2- If jurisdiction does not have trained staff to review the geotechnical report, the jurisdiction can, upon request, have UGS perform a review of the report.	Ongoing	Minimal				●	●	●
Problem Soils-Mitigation Strategy #2	Utilize the Problem Soils Risk Map provided in this plan as a tool to assess problem soils risks as it relates to any building/subdivision proposals. If deemed necessary, jurisdiction should require the builder/developer to conduct a site-specific geotechnical (soils) report.	Ongoing	$1,000-$5,000					●	●
Problem Soils-Mitigation Strategy #3	Through mapping, identify areas which contain collapsible and expansive soils. Require soils testing at the building/construction level and ensure that engineer's recommendations are followed.	Ongoing	$1,000-$5,000					●	●
Flood-Mitigation Strategy #1	Work with Army Corps of Engineers to map potential flood areas.	2.5 years	Unknown		●	●	●	●	●

Flood-Mitigation Strategy #2	Nonstructural measures appear to be the most prudent option for the county to implement. Zoning to prevent development of structures near all rivers, creeks, and lakes (100’ min. setback).	Ongoing	Minimal		●		●		●
Flood-Mitigation Strategy #3	Address flood control at the building/construction level by requiring all subdivision proposals to have a storm water drainage system.	Ongoing	Minimal			●		●	●
Flood-Mitigation Strategy #4	Clear debris and other material from all waterways	Ongoing	Minimal			●		●	●
Flood-Mitigation Strategy #5	Identify areas of inundation from possible failure of the Rocky Flood Irrigation Dam (Minersville Reservoir).	2-5 years	Minimal		●			●	●
Flood-Mitigation Strategy #6	Indian Peaks Band of Paiute Indians-Prevent future roadway erosion of the road which leads to the water tank.	1-5 years	Unknown					●	●
Flood-Mitigation Strategy #7	Officially recognize Minersville as a NSFHA. Draft and adopt a NSFHA ordinance.	1-5 years	Minimal	●			●	●	●
Drought-Mitigation Strategy #1	1-County-level distribution of water conservation information via newsletter and/or website to affiliated constituents.	Ongoing	Minimal	●		●	●	●	
	2- Water purveyors distribute water conservation information to affiliated constituents.	Ongoing	Minimal	●		●	●	●	

Drought-Mitigation Strategy #2	Develop/demonstrate water conservation practices for agricultural use.	Ongoing	Minimal	●		●	●	●	●
Drought-Mitigation Strategy #3	County-level implementation of mitigation strategies identified in *"Drought in Utah-Learning from the Past-Preparing for the Future."*	3-5 years	Unknown			●	●	●	●
Radon Gas-Mitigation Strategy #1	Increase public education related to radon gas hazards by distributing Utah Dept. of Environmental Quality informational brochures to County and City planning and engineering departments.	Ongoing	Very minimal	●		●	●	●	●
Radon Gas-Mitigation Strategy #2	Utilize the Radon Risk Map provided in this plan as a tool to assess radon gas risks as it relates to any building/ subdivision proposals. If deemed necessary, jurisdiction should require the builder/ developer to conduct a site-specific radon hazard identification study and implement applicable control techniques.	Ongoing	$25- $1,200	●		●		●	●

Requirement §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

The following mitigation strategies, listed in accordance to their respective natural hazard, are presented in an effort to provide macro-level risk reduction. Although each mitigation measure is important and achievable, they have been prioritized and listed in order of:

1) Respective amount of potential loss of life/property value as a result of a natural hazard occurrence (as quantified through GIS analysis) ; and

2) Implementation priority through utilization of the STAPLEE process (as explained in Chapter 3 of this Plan and in FEMA 386-3).

WILDFIRE

The Color Country Interagency Fire Center Fuels Committee has identified the general location of ten "Focus Areas" within the southwest Utah region. The selection of these specific areas was based on the need for fuels reductions as understood by fuels specialists and fire wardens, risk levels in the Regional Wildfire Protection Plan risk assessment, values at risk in the area, firefighting concerns including access and evacuation routes, the presence of Communities At Risk (CARs), and local interest in the community documented by having a Community Wildfire Protection Plan in place.

The Color Country Interagency Fire Center Fuels Committee has not prioritized these ten focus areas. The Committee determined that to do so would have the effect of minimizing the fact that every one of these areas is in need of treatment and all are of concern. Each focus area also includes a list of general goals resulting from activities and treatments for the area.

Goals common to all treatment areas include fuels reduction, public education, and increases in equipment and training available to firefighting personnel. Goals that are generally applicable to all of the focus areas include the following:

- Protection of human life, firefighter and public safety as the highest priority.
- Public education and partnerships with citizens or community-centered approaches to manage fire risks and hazards in WUI areas located in the focus area, including effort aimed towards the implementation and maintenance of defensible space projects to reduce risk to homes and personal property.
- Protection of high value resources and watersheds through fuels reduction treatments as determined locally.
- Restoration and maintenance of ecosystems consistent with land uses and historic fire regimes. Restoration of vegetation to the appropriate Condition Classes and Fire Regimes.
- Maintenance and/or improvement of fire prevention and road/structure identification signage. Dissemination of fire restriction information through appropriate signage and/or visitor contacts when necessary.
- Improvement of wildland firefighting equipment, training and information for volunteer fire departments located in the focus area, including the improvement of GIS and road data.

The ten Focus Areas developed by the Color Country Interagency Fire Center Fuels Committee do not include areas within Beaver County. This being said, the Communities at Risk within Beaver County (from high to medium risk) include: Elk Meadow, Baker Canyon, Sulpherdale, North Creek, Puffer Lake, High-Low, Greenville, Adamsville, Minersville, and Eagle Estates.

Wildfire Mitigation Strategy #1	
Objective:	Promote public awareness campaign for property owners living in wildland urban interface areas.
Action:	Mailings; Printed Information; Public Service Announcements;
Timeline:	Ongoing
Estimated Cost:	Unknown
Possible Funding:	State and Federal wildfire grant programs
Responsible Agencies:	State and Federal government

Wildfire Mitigation Strategy #2	
Objective:	To encourage and assist local governments to require property owners and developers to utilize defensible space tactics.
Action:	1-Voluntary site visits (to CARs) by fire crews to consult with landowners about specific ways to reduce risk to their property. 2-Develop local code enhancements that require utilization of defensible space tactics.
Timeline:	Ongoing
Estimated Cost:	Unknown
Possible Funding:	Local government operating budget; Special Service District operating budget
Responsible Agencies:	Community & local government entities

Wildfire Mitigation Strategy #3	
Objective:	Provide training, equipment, and resources for fire departments to fight wildfires.
Action:	Enhance existing wildfire training programs, equipment procurement, and fire fighting resources for wildfire suppression.
Timeline:	Ongoing
Estimated Cost:	Unknown
Possible Funding:	State CIB funding; Federal wildfire grant programs
Responsible Agencies:	Federal Government

LANDSLIDE

Factors included in assessing landslide risk include built property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, and soil characteristics. This type of analysis generates estimates of the damages to the county due to a landslide or debris flow event on the current built environment. The mitigation strategies listed below identify cost effective measures that will yield measurable benefits toward reducing the risk of landslide hazards.

Landslide Mitigation Strategy #1	
Objective:	Increase the level of knowledge related to landslides.
Action:	Increase public education related to landslide hazards by distributing Utah Geological Survey (UGS) landslide informational brochures to local municipality level emergency management, engineering and planning departments.
Timeline:	Ongoing
Estimated Cost:	Very Minimal: request UGS to deliver brochures; and/or download brochures directly from: http://geology.utah.gov
Possible Funding:	Local, jurisdictional level.
Responsible Agencies:	Local, jurisdictional level.

Landslide Mitigation Strategy #2	
Objective:	Minimize future landslide damage in the unincorporated County.
Action:	Drafting/updating zoning and/or landslide ordinances to prevent development of structures near debris flows, landslides, and rock fall areas.
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	Local government operating budget; State and Federal planning grant programs.
Responsible Agencies:	Local government

Landslide Mitigation Strategy #3	
Objective:	To reduce landslide risk as it relates to the built environment.
Action:	1-Address landslide risk at the building/construction level by requiring all subdivision proposals to have a geotechnical report. 2-If jurisdiction does not have trained staff to review the geotechnical report, the jurisdiction can, upon request, have Utah Geological Survey (UGS) perform a review of the report.
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	Private funds/ developer; Local government operating budget; Utah Geologic Survey operating budget.
Responsible Agencies:	Local, jurisdictional level; Utah Geological Survey

EARTHQUAKE

Earthquake mitigation strategies include general mitigation actions that agencies are capable of implementing during the next five years, given their existing resources and authorities. In addition to the earthquake mitigation strategies provided herewith, this Natural Hazard Mitigation Plan endorses any seismic mitigation proffered by the Utah Seismic Safety Commission. In particular, numerous and varied earthquake mitigation strategies are provided in

A Strategic Plan for Earthquake Safety in Utah (January, 1995) completed by the Utah Seismic Safety Commission. It is highly recommended that jurisdictions whom desire to provide more specific earthquake mitigation strategies consult the aforementioned plan, which can be accessed at: http://ussc.utah.gov/.

Earthquake Mitigation Strategy #1	
Objective:	Promote building safety through non-structural improvements.
Action:	Increase public education related to earthquake hazards by distributing Utah Seismic Safety Commission informational brochures to County and City emergency management agencies.
Timeline:	Ongoing
Estimated Cost:	Very Minimal: request Utah Seismic Safety Commission to deliver brochures; and/or download brochures directly from: http://ussc.utah.gov/
Possible Funding:	County and City operating budget; Utah Seismic Safety Commission operating budget.
Responsible Agencies:	Local, jurisdictional level.

Earthquake Mitigation Strategy #2	
Objective:	To reduce earthquake risk as it relates to the built environment.
Action:	Continued dedication/vigilance in enforcing the seismic standards established in the International Building Code (IBC).
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	County or City government operating budget (where applicable).
Responsible Agencies:	County or City government (where applicable).

Earthquake Mitigation Strategy #3	
Objective:	To reduce earthquake losses by mapping and identifying earthquake hazard areas.
Action:	1-Utilize the Earthquake Risk Map provided in this plan as a tool to assess earthquake risks as it relates to any building/subdivision proposals. If deemed necessary, jurisdiction should require the builder/developer to conduct a site-specific earthquake hazard identification/mapping study. 2-At the County level, contract with Utah Geological Survey (UGS) to formally study/map earthquake hazard areas.
Timeline:	Action 1-Ongoing Action 2- 3 to 5 years
Estimated Cost:	Action 1-$1,000 to $5,000 Action 2- $7,109 to $14,218 per jurisdiction (1995 cost as reflected in *A Strategic Plan for Earthquake Safety in Utah* adjusted for inflation)

Possible Funding:	Action 1-Private funds/ developer. Action 2- Local government operating budget; Utah Geologic Survey operating budget.
Responsible Agencies:	Local, jurisdictional level; Private property owner; Utah Geological Survey

SEVERE WEATHER

Quantitative assessment of severe weather vulnerability and determining which specific areas of the county are more vulnerable is very challenging. This being said, the vulnerability assessment quantified the number of units and total market value for all structures located within a defined severe weather hazard area; said area includes: known lightning deaths, lightning intensity (based upon actual lighting strike data), and tornado touchdowns. The following severe weather hazard mitigation strategies are specific to the aforementioned severe weather hazards.

Severe Weather Mitigation Strategy #1	
Objective:	To reduce severe weather risk as it relates to the built environment.
Action:	Continued dedication/vigilance in enforcing the standards established in the International Building Code (IBC) as it relates to wind-loading, electrical grounding, snow-loading, and other weather-related hazards.
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	County or City government operating budget (where applicable).
Responsible Agencies:	County or City government (where applicable).

Severe Weather Mitigation Strategy #2	
Objective:	Ensure that the general public is warned of severe weather occurrences via broadcast media.
Action:	1-Enhance the Emergency Alert System (television and radio). 2-Enhance NOAA Weather Radio All Hazard coverage.
Timeline:	Ongoing
Estimated Cost:	Unknown
Possible Funding:	Federal and State government operating budget.
Responsible Agencies:	Federal and State government.

Nearly 90% of all presidentially declared disasters are weather related. In an effort to guard against the negative effects of severe weather, the National Weather Service has designed the StormReady program. This program is a nationwide community preparedness program that uses an approach which helps communities develop plans to handle all types of severe weather. To be classified as a StormReady community several criteria must be met; however, the county Local Emergency Planning Committee (LEPC) is positioned well to satisfy the StormReady application/program guidelines. Ultimately the benefit of becoming formally recognized as a

StormReady community lies in the additional planning/preparation/preparedness for severe weather occurrences; however, some grant opportunities are available through the National Weather Service as well as possible adjustment to insurance rates through the Insurance Services Organization (ISO).

Severe Weather Mitigation Strategy #3	
Objective:	Guard against the negative effects of severe weather by becoming a StormReady community.
Action:	At the county Local Emergency Planning Committee (LEPC) level, meet the program guidelines then apply to the National Weather Service StormReady program.
Timeline:	3 to 5 years
Estimated Cost:	Minimal
Possible Funding:	County and City operating budget.
Responsible Agencies:	County and City government.

PROBLEM SOILS

Problem soils pose a significant hazard to the current/future built environment. This being said, many of these problems can be dramatically reduced through proper assessment of the risk and adherence to applicable mitigation measures. Factors included in assessing problem soils risk include built property distribution in the hazard area. This type of analysis generates estimates of the damages in the county due to problem soils occurrences in the current built environment. The mitigation strategies listed below identify cost effective measures that will yield measurable benefits toward reducing the risk of problem soils as they relate to the built environment. Further, these mitigation strategies include general actions that agencies are capable of implementing during the next five years, given their existing resources and authorities.

Problem Soils Mitigation Strategy #1	
Objective:	Lessen the risk to buildings from problem soils.
Action:	1-Address problem soils at the building/construction level by requiring all subdivision proposals to have a geotechnical report. 2-If jurisdiction does not have trained staff to review the geotechnical report, the jurisdiction can, upon request, have Utah Geological Survey (UGS) perform a review of the report.
Timeline:	Ongoing
Estimated Cost:	$1,000 to $5,000
Possible Funding:	Private funds/ developer; Local government operating budget; Utah Geologic Survey operating budget.
Responsible Agencies:	Local, jurisdictional level; Utah Geological Survey

Problem Soils Mitigation Strategy #2	
Objective:	To reduce problem soils related losses by mapping and identifying problem soils hazard areas.
Action:	Utilize the Problem Soils Risk Map provided in this plan as a tool to assess problem soils risks as it relates to any building/subdivision proposals. If deemed necessary, jurisdiction should require the builder/developer to conduct a site-specific geotechnical (soils) report.
Timeline:	Ongoing
Estimated Cost:	$1,000 to $5,000
Possible Funding:	Private funds/ developer; Local government operating budget
Responsible Agencies:	Local, jurisdictional level; Private property owner.

Problem Soils Mitigation Strategy #3	
Objective:	Lessen the risk to buildings from collapsible and expansive soils.
Action:	Through mapping, identify areas which contain collapsible and expansive soils. Require soils testing at the building/construction level and ensure that engineer's recommendations are followed.
Timeline:	Ongoing
Estimated Cost:	$1,000 to $5,000
Possible Funding:	Private funds/ developer; Local government operating budget.
Responsible Agencies:	Local, jurisdictional level.

FLOOD

The Army Corps of Engineers *Flood Hazard Identification Study* (August, 2003), identifies areas with a high flood hazard and identifies potential mitigation solutions. The following prioritized mitigation strategies are provided from this Study as well as from the Five County *Natural Hazard Mitigation Plan (2004).*

Beaver County FEMA 100yr. flood plain mapping is generally non-existent; with the exception of one small flood plain mapped on the south end of Main Street in Beaver City. Based upon this fact, the #1 Priority flood mitigation strategy is to provide much needed mapping in flood prone areas of the County. Additionally, local zoning regulations need to be drafted/implemented (where applicable) to ensure that development is adequately setback from areas which pose risk due to flooding.

Flood Mitigation Strategy #1	
Objective:	Identify flood prone areas in the County.
Action:	Work with State Floodplain Coordinator & FEMA.
Timeline:	2-5 years
Estimated Cost:	Unknown
Possible Funding:	Federal flood programs
Responsible Agencies:	Federal (FEMA)

Flood Mitigation Strategy #2	
Objective:	Minimize future flood damage in the unincorporated County.
Action:	Nonstructural measures appear to be the most prudent option for the county to implement. Zoning to prevent development of structures near all rivers, creeks, and lakes (100' min. setback).
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	Local government operating budget; State and Federal flood and planning grant programs
Responsible Agencies:	Local government.

Flood Mitigation Strategy #3	
Objective:	To reduce flooding risk as it relates to the built environment.
Action:	Address flood control at the building/construction level by requiring all subdivision proposals to have a storm water drainage system.
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	Private funds/ developer.
Responsible Agencies:	Local (Beaver County, Beaver City, Milford City, Minersville town)., jurisdictional level.

Flood Mitigation Strategy #4	
Objective:	To reduce flooding risk at the community level.
Action:	Clear debris and other material from all waterways.
Timeline:	Ongoing
Estimated Cost:	Minimal
Possible Funding:	Related public/private property owners.
Responsible Agencies:	Private property owners, irrigation companies, local jurisdictions.

As illustrated in the vulnerability assessment, the Rocky Ford Irrigation Dam (Minersville Reservoir) poses a high risk to dam failure due to a seismic event. As such, the following mitigation strategy is provided:

Flood Mitigation Strategy #5	
Objective:	To reduce flooding impact of Rocky Ford Irrigation Dam (Minersville Reservoir) failure due to a seismic event.
Action:	Identify areas of inundation from possible failure of the Rocky Flood Irrigation Dam (Minersville Reservoir).
Timeline:	2-5 years
Estimated Cost:	Minimal
Possible Funding:	Local government operating budget; State and Federal flood programs

Responsible Agencies:	State, Local, and Five County AOG

The Indian Peaks Band of Paiute Indians has indicated that there are several areas of the "water tank" roadway that experience drainage problems as a result of rain and/or snow melt.

Flood Mitigation Strategy #6	
Objective:	Indian Peaks Band of Paiute Indians- Prevent future roadway erosion of the road which leads to the water tank.
Action:	Add culverts to keep water off of the road.
Timeline:	1-5 years
Estimated Cost:	Unknown
Possible Funding:	Federal flood grant programs
Responsible Agencies:	Indian Peaks Band of Paiute Indians

As a result of the Army Corps of Engineers *Flood Hazard Identification Study* (August, 2003), the following mitigation strategy is provided.

Flood Mitigation Strategy #7	
Objective:	Officially recognize Minersville as a NSFHA.
Action:	Draft and adopt a Non-Special Flood Hazard Area (NSFHA) ordinance.
Timeline:	1-5 years
Estimated Cost:	Minimal
Possible Funding:	Local government operating budget; State and Federal flood grant programs
Responsible Agencies:	Local government, State Floodplain Coordinator, FEMA