COLORADO RESILIENCY FRAMEWORK

COMMUNITY

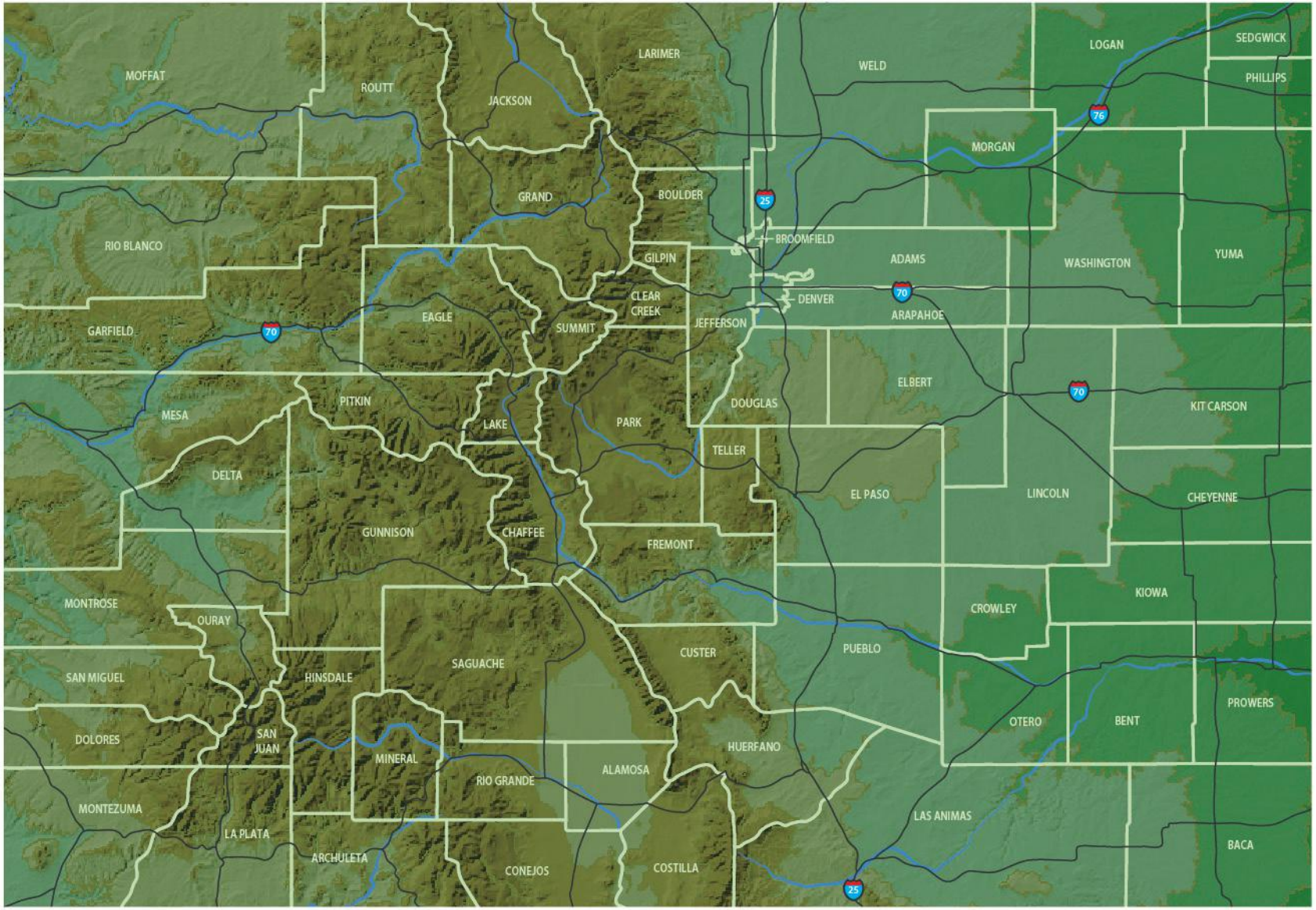
HEALTH AND SOCIAL

ECONOMIC

WATERSHED AND NATURAL RESOURCES

HOUSING

INFRASTRUCTURE



COLORADO

Photo Credit: Evan Semón

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John W. Hickenlooper
Governor

May 28, 2015

Colorado has experienced our fair share of disasters in the past decade. We've seen blizzards, tornadoes, wildfires, floods, and even an earthquake. Each time, Colorado - our communities and our people - have shown a great resolve not simply to bounce back from disaster, but to make ourselves better, stronger, more resilient.

Following our most recent major disaster, the September 2013 floods that impacted communities in 24 Colorado counties, communities and the State of Colorado made clear that resiliency was not simply something we wanted to do. It is something we must do to ensure our safety, vitality and unique way of life into the future. To meet that call, a coalition of agencies came together to discuss how we make resiliency a reality in Colorado, and more than 150 state, federal, stakeholders helped to develop the Colorado Resiliency Framework.

The Framework represents Colorado's long-term commitment and investment into a resilient future. The framework also represents a call to action and partnership, as it will require the efforts of the whole Colorado community to make a resilient future a reality.

I established the Colorado Recovery Office immediately after the 2013 floods to help lead and coordinate the State's long-term recovery efforts and support to local communities, in partnership with departments across State government. With the adoption of this Framework, the office will be re-named as the Colorado Resiliency and Recovery Office and will hold the dual responsibility of continuing its recovery mission, as well as coordinating the long-term implementation of the State's resiliency efforts in partnership with state, federal and local agencies, non-profits and the private sector. With the adoption of this Framework we are also formalizing the Colorado Resiliency Working Group as an ongoing coordination and steering committee for the State's resiliency efforts.

I would like to sincerely thank the many participants who made this Framework a reality. I would also like to thank the many more participants who will implement this Framework and help to make Colorado the most resilient state in the nation.

John W. Hickenlooper
Governor

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Photo Credit: CDPHE

Section 1:

Introduction – Resiliency in Colorado

Coloradans are familiar with the threats and impacts of disasters. Mother Nature has brought droughts, wildfires, floods, tornadoes, and even earthquakes to communities throughout the state. In the past decade, Colorado experienced a nearly $4 billion flood in 2013, wildfires in 2010, 2012, and 2013 that destroyed nearly 1,250 homes, a tornado that left a scar through multiple communities in 2008, and many others. While the disasters have made their mark on Colorado communities, they do not define Colorado. Rather, the strength, determination, leadership, and compassion shown by Coloradans to recover and to ultimately make Colorado better, stronger, and more resilient is the story.

Two years from the September 2013 floods and three years from three of the most destructive wildfires in the state's history, there is a growing consciousness that Colorado must systematically adapt to and prepare for the shocks and stresses of the 21st century. In recognition of this reality, as well as the desire to make Colorado the most resilient state in the nation, Colorado has set out to develop the Colorado Resiliency Framework (Framework). The Framework serves two distinct purposes. First, the Framework demonstrates a commitment from the State to identify and implement strategies to strengthen and increase resiliency throughout Colorado. Second, the Framework outlines guiding principles and tools for community stakeholders and calls for a collective commitment to partnership and action. True resiliency requires coordination and collective action from a broad range of stakeholders. This Framework provides a starting point to guide activities that will be undertaken by state and local government, non-profits, businesses, and community members.

It is Not Enough to Survive… Our Aim is to Thrive

Immediately after the 2013 floods, the Governor established the Colorado Recovery Office (CRO), whose mission is to spearhead the recovery effort and create systems to support long-term resiliency in the State. The Colorado United outreach campaign was initiated to engage the public in the recovery effort. At the Colorado Resiliency Summit on June 4, 2014, state and federal partners formed the Colorado Resiliency Working Group (CRWG) to steer the development of a resiliency Framework and incorporate resiliency strategies and activities into the flood recovery while also establishing a path to integrate resiliency into the fabric of everyday life.

> Resiliency is the ability of communities to rebound, positively adapt to, or thrive amidst changing conditions or challenges – including disasters and climate change – and maintain quality of life, healthy growth, durable systems, and conservation of resources for present and future generations.
>
> — Definition of resiliency adopted by Colorado Resiliency Working Group (CRWG)

Photo Credit:

The Framework provides guiding principles around resiliency for the State. It defines the structure through which the State will support local agencies and community groups as they identify and implement their own resiliency actions. Risks and vulnerabilities are analyzed, and specific strategies are identified that will strengthen the State's capacity to adapt and support local communities on their path toward resiliency. With the adoption of the Framework, the Governor has formalized this commitment to resiliency by renaming the CRO the Colorado Resiliency and Recovery Office (CRRO).

Resiliency is about learning the lessons of disaster events and building back in a way that moves us forward. **Why not survive and thrive? Why not do both?**

Colorado's Resiliency Framework sets this dialogue in motion and creates a structure for the State to do both: to create a vibrant community while overcoming challenges in ways that support Colorado's continued growth, recreation, beauty, and quality of life.

Photo Credit: CDPHE

Photo Credit: CDPHE

Section 2:

The Planning and Engagement Process

The Framework is part of The Colorado Resiliency Project (Project), a larger, holistic effort rooted in a collective drive to preserve, protect, and promote what makes Colorado special to its five million residents, many visitors, and the world at large. Through Project activities, CRRO and its partners are connecting and engaging a diverse cross-section of Coloradans centered around the unifying theme of resiliency, as demonstrated on the Colorado United web site. www.coloradounited.com.

Section 2.1 Context

The role of the Framework is to serve as a road map for making resiliency an everyday practice in Colorado. The philosophy that guided the development process was that the Framework be:

- Locally Driven
- Multi-Disciplinary
- All-Hazards
- Flexible and Adaptable
- Outcome-Based

To achieve these goals, both key stakeholder and general public engagement were instrumental in shaping the Framework. Collaboration and communication with these groups continues to be critical in the successful implementation of the Framework since it depends on these individuals, organizations, and agencies for achieving its goals. Stakeholder and public engagement included:

- **Stakeholder Engagement:** The Colorado Resiliency Working Group (CRWG) was formed by CRRO to better coordinate recovery and resiliency planning among 27 federal, state, local government agencies, and non-governmental organizations. CRWG served as a steering committee for the Framework development process, providing overall leadership and guidance. CRWG's six sector committees were responsible for development of technical content. They provided the background for the risk and vulnerabilities faced by the State, developed adaptive strategies and monitoring metrics for each core resiliency sector, and identified cross-sector strategies to be implemented at the State level.
- **Public Engagement:** A public outreach process was also deployed utilizing multiple methods to reach and consider a broad spectrum of perspectives, including the statewide engagement with Coloradans, experts in resiliency-related fields, and locally based leaders who together informed the overall content of the Framework while simultaneously serving to raise community resiliency awareness.

The development process was further supported and guided by CRRO professional staff and consultants, along with support from FEMA's technical and planning staff.

Section 2.2 Stakeholder Engagement

Development of the Framework began with a Summit held on June 4, 2014, where more than 50 representatives from key state and federal agencies with resiliency/sustainability programs met to begin the State of Colorado's resiliency and sustainability planning process.[i] The attendees were divided into seven groups for facilitated discussion to:

- Define resiliency and sustainability
- Develop a vision for a Resilient Colorado
- Develop guiding principles and goals to incorporate resiliency into recovery

This event was followed by the formation of CRWG in July 2014 to be the steering committee for development of the Framework. CRWG is a multi-disciplinary and collaborative leadership group that is supported by six committees that, combined, include 154 stakeholders from federal and state agencies, local governments, professional associations, non-profits, academic institutions, the faith-based community and the private sector – all of whom will also have direct roles in the ultimate implementation of this Framework, as further referenced in Section 5. A complete list of all agencies that participated in the planning process is provided in Appendix A.

Photo Credit: Thom Rounds FEMA, All-Hands Coordination Meeting February 4, 2014

The committees were aligned with six resiliency sectors (community, economic, infrastructure, watersheds and natural resources, housing, and health and social) and charged with creating sector-specific and integrated cross-sector resiliency strategies. Each sector committee was led by a member of CRWG. The committees developed problem statements, priorities, goals, and strategies and an implementation, collaborators and

partners list as further described in Section 4 and contained in Appendix E. In addition to regularly held CRWG and sector committee meetings, all-sector collaboration meetings were held on December 4, 2014, and February 4, 2014 to identify cross-sector strategies that would provide multiple benefits, as further discussed in Section 5.

An intensive, day-long peer review process was held on April 15, 2015, to provide objective feedback on the draft Framework from a diverse cross-section of 24 participants, a majority of which had not been engaged in the process to date. The peer review meeting included direct dialog on each section of the plan and a segment on how the Framework would be applied by State and other agencies and groups after adoption. This feedback was integrated into the Framework prior to finalization and adoption. The peer review report can be found in Appendix C.

Section 2.3 Public Engagement

CRRO staff (supported by consultants) worked with CRWG to concurrently undertake a robust public outreach process that engaged a diverse cross-section of Coloradans to inform the Framework's content development. The public engagement process included five key components, as depicted in Figure 2-1:

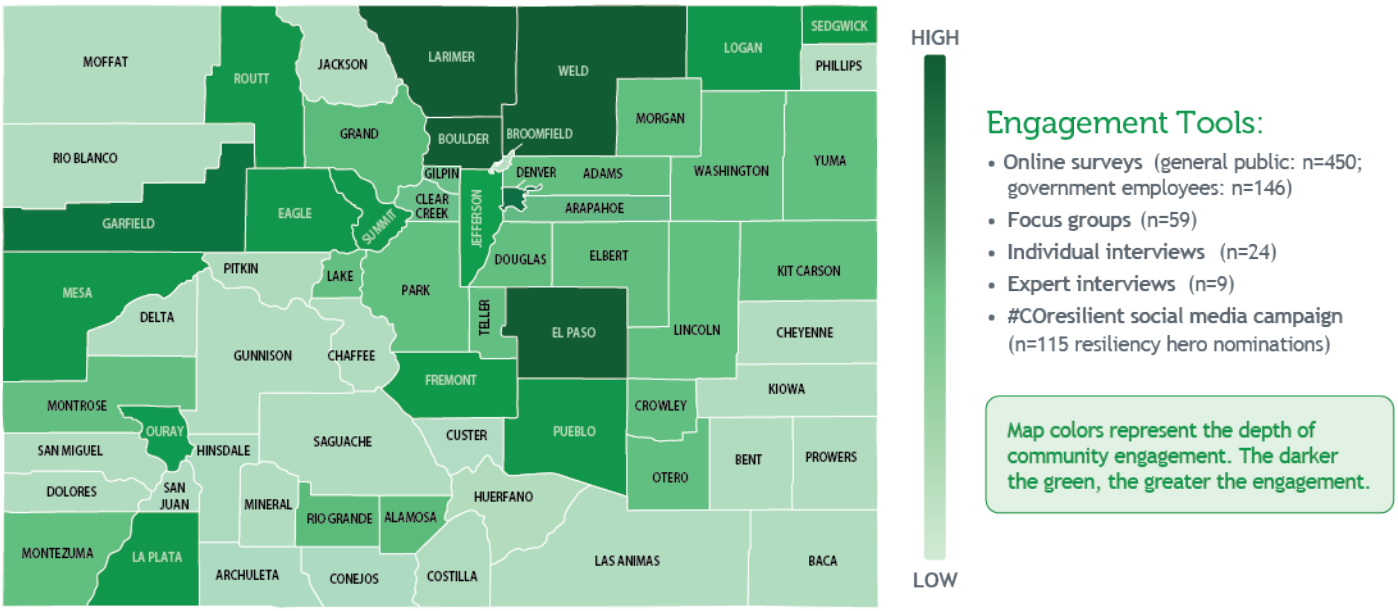
1) Focus Groups – held in seven Colorado communities covering the four counties that have been most directly impacted by a recent disaster
2) Stakeholder and Expert Interviews – held with technical experts and government staff
3) Government and Public Surveys – a broad cross-section of Coloradans were reached through two online surveys, one targeted to local government and one open survey accessible through www.ColoradoUnited.com
4) Social Media – an education and engagement campaign was deployed through the web site with an opportunity for the public to nominate Resiliency Heroes
5) Public Comments – comments were solicited on the draft Framework that was made available prior to finalization and adoption through the ColoradoUnited.com web site.

> Mary is a resident of Drake and is helping to coordinate flood recovery work for her community and the river restoration efforts. She has volunteered countless hours and is a great advocate for her community.
>
> *— Colorado Resiliency Hero Nomination*

Through this process, CRRO directly consulted with 59 different groups as well as thousands of others engaged through social media and the web site. While not a scientifically based research or survey process, these outreach methods provided baseline insights into the perceptions, levels of understanding, strengths, and needs associated with creating a resilient Colorado. These insights and outcomes can be summarized into four areas and have become the guiding principles of the Framework:

- **Expand Knowledge:** Resiliency requires a forward-thinking populace and government that move beyond a reactionary-, hazard- , or disaster-oriented cycle to one that gets out in front of event-driven actions to create systems that continuously educate, improve, and adapt to changing conditions.
- **Build Community:** Connected communities are resilient communities. Well-networked social systems that include opportunities for all populations to connect on a regular basis provide a sense of security and will benefit from collaborative action.
- **Be an Advocate:** Communities need to know the State is their partner – providing a voice for their collective needs and wearing multiple hats to create a better, more resilient future for all of Colorado.
- **Provide Flexibility:** Policies, projects, and programs must be performance-driven with metrics that empower localities to adapt and apply best practices of resiliency that adjust as external forces shift and solutions evolve.

Figure 2-1: Colorado Resiliency Project Engagement Tools[ii]



The above themes and the data derived from surveys, focus groups, and personal interviews have directly influenced the Framework and its strategies. The public engagement process and outcomes have provided valuable input to the Framework regarding public perceptions and needs and advanced community building and knowledge sharing and serve as an important baseline for measuring future success. For more information regarding the public engagement process, go to www.ColoradoUnited.com.

Photo Credit: CRRO

Photo Credit: CRRO

Section 3:

Risk and Vulnerability Assessment

A second pillar to the creation of the Resiliency Framework is the Risk and Vulnerability assessment. The Framework is designed to address resiliency for all hazards, whether natural or man-made. Disease, economic recession, power outages, industrial accidents, and terrorism are all potential hazards in Colorado. Particular emphasis is placed on evaluating natural hazards because of Colorado's recent disasters. Additional hazards will be evaluated as the Framework is updated as its guiding principles are intended to inspire resiliency across the state, regardless of the disaster event.

Colorado experiences a variety of natural hazards inherent to its geographic location, semi-arid climate, and prevailing land use patterns. Comprising both plains and a mountain environment, it also faces systemic vulnerabilities ranging from the location of buildings, roadways, homes, and community assets to underlying economic, social, and environmental conditions. Understanding Colorado's risks and vulnerabilities is a necessary first step in identifying appropriate resiliency strategies. This section describes the changing nature of hazards faced by Colorado and how an analysis of risks and vulnerabilities were incorporated into the Framework.

Section 3.1 Colorado's Exposure to Natural Hazards

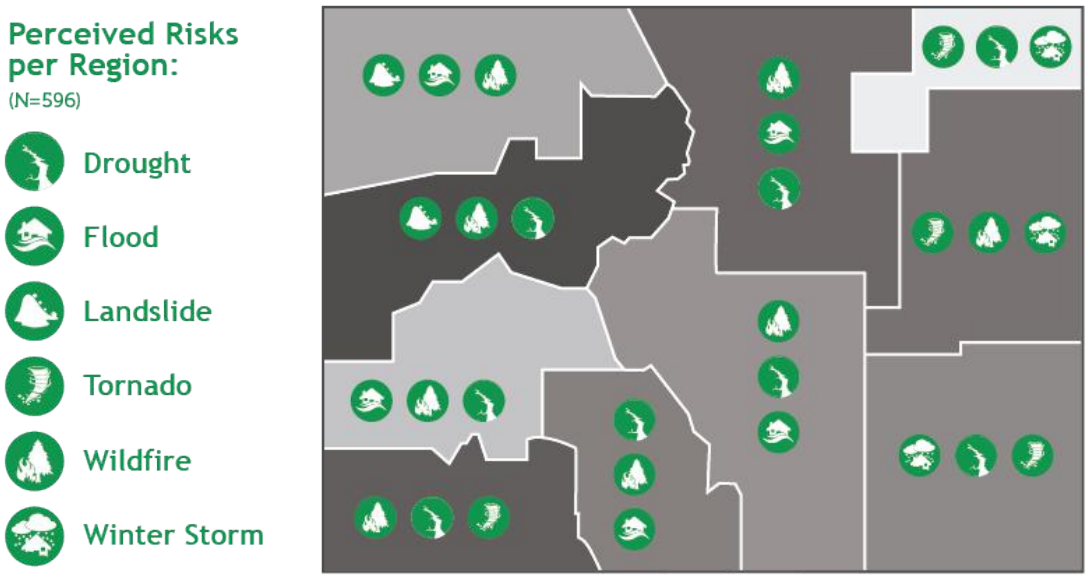
The 2013 Colorado Natural Hazards Mitigation Plan (NHMP)[iii] identifies 16 hazards that cause recurring damage in the State (Table 3-1). Droughts, wildfires, flooding, and winter storms are specifically identified as the four hazards having the most widespread disaster impacts statewide. However, most of the other hazards are directly or indirectly related to these 'top four.'

Table 3-1: Natural Hazards in Colorado as Identified in the State NHMP

Atmospheric Hazards	
■ Drought	■ Lightning
■ Extreme Heat	■ Severe Wind
■ Flood	■ Tornado
■ Hail	■ Winter Storm
Geologic Hazards	
■ Avalanche	■ Expansive Soils
■ Earthquake	■ Landslides, Mud/Debris Flow, Rockfall
■ Erosion / Deposition	■ Subsidence
Other Hazards	
■ Pest Infestation	■ Wildfire

Stakeholder outreach conducted by CRRO determined that respondents as a whole are most concerned about drought and wildfire, followed by flooding, public health threats, and—to a lesser extent—others. However, the perceived risks varied by region, as shown on Figure 3-1 (in which perceived threats have been compiled based on watershed).

Figure 3-1: Perceived Risks per Region[iv]



Section 3.1.1 High Impact Statewide Hazards

Drought

Drought occurs when precipitation is below average levels for a sustained period of time. Short droughts (under three months long) occur somewhere in Colorado nine out of every ten years. Multi-year droughts occur on a longer time cycle and are impacted by the interaction of different components of the atmosphere-ocean climate system. Colorado has been affected by statewide multi-year severe droughts in the 1930s (Dust Bowl), 1950s, and 2000s.[v]

Photo Credit: Colorado Water Conservation Board, Taryn Finnessey

Colorado is uniquely exposed to drought, even compared with other western states: nearly all parts of Colorado have historically experienced severe or extreme drought over 15% of the time.[vi] As of March 2015, nearly 580,000 Coloradans and 68% of the State's land area were impacted by some level of drought,[vii] and the United States Department of Agriculture had designated 26 counties where agricultural producers may be eligible for emergency aid.[viii]

Droughts develop gradually, and their impacts may take months or years to become evident. Although most droughts cause limited direct damage, drought conditions are frequently a contributing cause of other natural hazards such as fires, erosion, pest infestation, and floods. Droughts are linked to economic losses in sectors such as tourism; for example, a low-snow year can result in total revenue losses of over $150 million for ski resorts.[ix] Crops and livestock operations are also impacted by drought due to insufficient water supply, causing losses to agriculture. In 2012, it is estimated that lost revenues resulting from the drought in the agricultural sector alone exceeded $409 million statewide.[x] As droughts continue over several months, levels and flows of water in streams, lakes and reservoirs may decrease. In an extreme drought, reduced water availability may impact human health and aquatic species and cause widespread economic impacts.

Flood

Colorado experiences dozens of floods annually; all counties and nearly all towns and cities (270 of 271) in Colorado contain flood-prone areas.[iii] Major flood disasters (warranting a federal disaster declaration) have occurred every five years on average since 1959. Floods are usually linked to severe weather and high rain; they may also be linked to seasonal conditions such as snowmelt or catastrophic events such as dam failure. As a result, locations vulnerable to flooding are concentrated in floodplains and downstream from dams. Certain parts of Colorado are particularly vulnerable to flash floods following intense storm events; such events develop rapidly following intense localized storms and are intensified by the major elevation changes, steep slopes, and base alluvial fans that characterize mountain river canyons. Because major floods may cause billions of dollars of property and infrastructure damage, they result in significant economic impacts for directly affected communities and for the State as a whole.

Photo Credit: FEMA

Floods pose major risks to property and human life and have caused some of the largest disasters in Colorado history. The South Platte River floods of 1965 and the 2013 floods in the Front Range and Northeast counties caused multiple deaths. The 2013 floods alone had estimated damages at $3.9 billion. The Big Thompson River floods of 1976 caused 144 deaths. However, there is evidence that proper flood mitigation can significantly reduce flood losses. For example, FEMA Region VIII prepared a losses-avoided study associated with the 2013 floods. They calculated $200 million in losses in Boulder, Larimer, and Weld counties paid out through Small Business Assistance, Individual Assistance and the National Flood Insurance Program. However, FEMA was also able to estimate avoided losses from higher floodplain management standards associated with freeboard, floodplain development restrictions, basement restrictions, floodway development restrictions, and no critical facilities in special flood hazard areas. Those estimated avoided losses totaled $395 million.

Photo Credit: FEMA

Wildfire

Wildfires are pervasive across Colorado, with over 2,400 events per year. Fires may occur either in undeveloped areas (wildland fires) or at the interface between undeveloped areas and human settlement (wildland-urban interface fires). Many areas in Colorado experience regular 'natural' wildfires; fire is a part of the regeneration cycle of many forests and grasslands. However, humans cause numerous wildfires that would not otherwise occur, either voluntarily or by accident. Wildfire risks are exacerbated by long-term environmental stresses such as drought, low relative humidity, dry understory fuels, and past suppression of fires, which result in an accumulation of combustible material. Wide-ranging forest insect epidemics may also result in a higher risk of wildfire; as of 2011, the U.S. Forest Service estimated that nearly seven million acres of forest in Colorado had been impacted by bark beetle infestations since 1997.[xi,xii]

Photo Credit: FEMA

Wildfires cause extensive environmental and property damage and occasional deaths and injuries. Wildfires may also affect critical infrastructure lifelines and may impact the ability of local and state government to provide public services. Areas most likely to experience wildfires are on steep slopes and in canyons along the edge of the Front Range and throughout western Colorado. Wildfires may also occur on rangelands, particularly if fire conditions are exacerbated by high winds or highly flammable noxious weeds such as cheatgrass.[xiii] However, the fastest-growing type of firefighting expenditure is the defense of populated areas in the wildland-urban interface. Such areas are especially concentrated in exurban locations along the Front Range, as well as in southwestern Colorado; they represent some of the fastest-growing development areas in the state (e.g. Douglas County).

Winter Storms

Winter storms occur every year in all parts of Colorado, typically between the months of November and April. Winter storms can result in heavy snowfall, blowing snow, and extreme cold. Particularly harsh or persistent winter storms may cause transportation disruptions, power outages, and/or damage to building structures as well as damage to utility lines and domestic water pipes. Winter storms may also result in deaths and injuries from various causes, including transportation incidents and exposure to low temperatures. Damages from winter storms have been recorded in every county in Colorado; the highest historical damages have been recorded in the counties along the Front Range, and in the Colorado and Gunnison river valleys in western Colorado.

Hail

Dozens of hail storms are reported each year in Colorado. The state experiences an average of over 130 events per year, and hail has been recorded in all parts of the state. Nonetheless, most recorded events (and nearly all damages) have occurred in eastern Colorado and along the Front Range. Hail forms in storm clouds that have strong upward drafts; cool rain droplets are pulled upward and come into contact with ice crystals, freezing instantly to form hailstones. Hailstones continue to grow until they are too heavy to be supported by the upward draft, at which point they fall to the ground. Such conditions are typical of spring and summer storms on the eastern Plains of Colorado and are exacerbated by strong updraft potential along the front of the Rocky Mountains. Hailstones as large as 4.5 inches in diameter have been reported in parts of Colorado.

Hailstorms frequently cause injuries and, in certain rare cases, may cause death. However, the primary impact of hail is in property damage. Hail events cause varying amounts of damage, depending on factors such as hailstone diameter, wind speed, and the affected area. Many hail events typically cause a very large number of relatively small distributed impacts. However, the total impact of hailstorms can be very destructive: the twelve most costly recorded hail storms in Colorado each have damages estimated at over $120 million at the time the disaster occurred. From 2003 to 2013, hailstorms caused more than $3 billion in insured damage. Typical damages in populated areas include building. roof, vehicle, and landscape damage. Severe storms can also destroy greenhouses and regularly destroy or severely damage outdoor crops, resulting in agricultural disaster declarations.

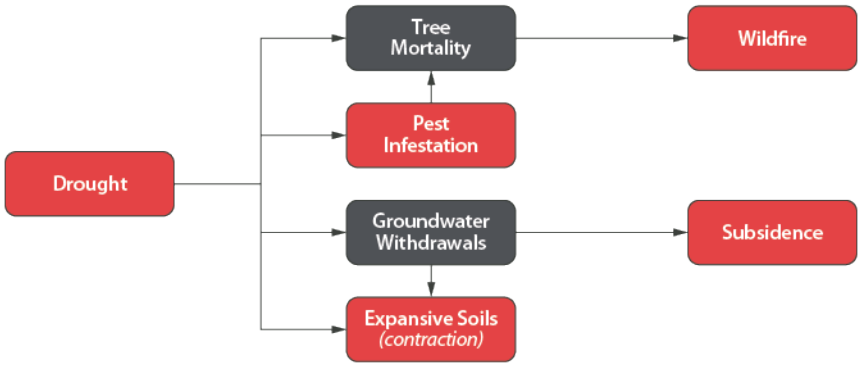
Section 3.1.2 Hazards Are Often Correlated…

Drought, wildfire, and floods are central components of a complex system of interrelated natural hazards that are fundamentally tied to Colorado's continental semi-arid climate. This complex system directly influences risk levels for nearly all of the hazards identified in the State NHMP. Hazards directly or indirectly correlated to those identified in the previous section include extreme heat, severe winds, lightning, earthquakes, erosion/deposition, expansive soil risks, landslides/mudflows/rockfalls, soil subsidence, and pest infestations.

Examples of such relationships include:

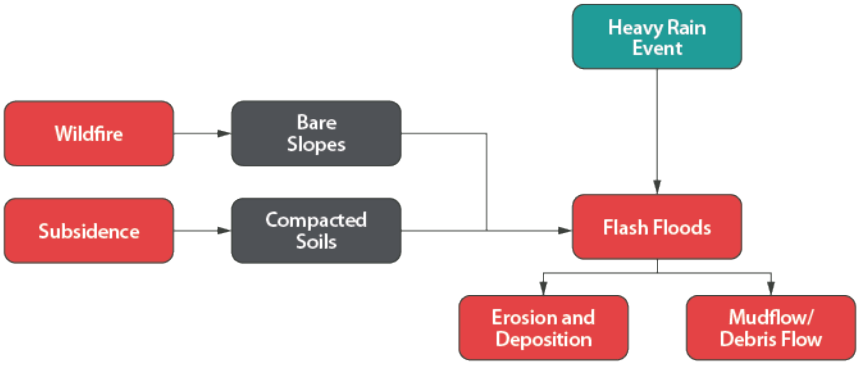
As a controlling environmental condition, reduced water and moisture availability in a **drought** increases risks related to forest **pest infestations** and **wildfire** as well as soil-related hazards, including **subsidence** and contraction of **expansive soils** (Figure 3-2).

Figure 3-2: Potential Hazard Increases Related to Drought



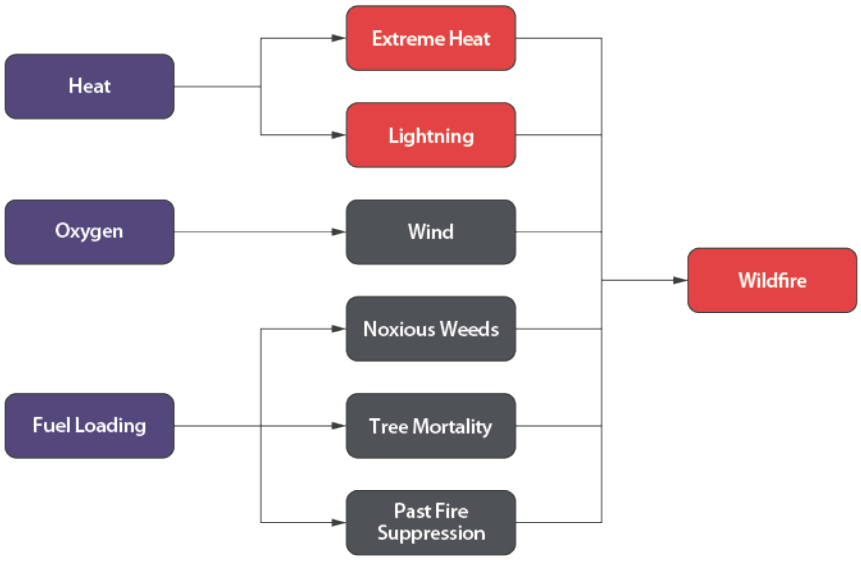
Floods are most frequently caused by high precipitation. However, **drought** conditions may lead to **soil compaction,** and **severe wildfires** may leave slopes denuded and hydrophobic. A single heavy rain event occurring during or following a drought may therefore lead to higher runoff and correspondingly higher **flash-flood**, **erosion**, and **mud/debris flow** risk (Figure 3-3).

Figure 3-3: Increased Flash-Flood Risks of Heavy Rain During or Following Drought



Wildfire spread depends on heat, low relative humidity, and fuel availability. Wildfire risk is therefore directly exacerbated by factors such as **extreme heat** and **strong winds**. **Lightning** can also be a factor in wildfire ignition. Numerous factors can increase fuel load, including tree mortality (caused by **drought** and **pest infestations**), noxious weeds, and suppression of prior fires (leading to denser vegetation) (Figure 3-4).

Figure 3-4: Potential Hazards and Conditions Leading to Wildfire



Section 3.1.3 ... and Sometimes They Are Not

In certain cases, hazards identified in the previous section (such as lightning or pest infestation) may occur independently from other hazards in the system. In addition, certain natural hazards experienced in Colorado are independent of the drought/fire/flood system, although they are linked to Colorado's climate and location. These include such hazards as:

- Some **severe winds** (e.g., Chinook winds) and **hail**, which occur seasonally in eastern Colorado, are related to convective air movements where the Rocky Mountains meet the Great Plains.
- **Tornadoes**, which usually occur in spring and early summer in the eastern half of the State as a result of the interaction of warm, humid winds from the Gulf of Mexico and cold, dry winds from polar regions.
- **Earthquakes** occur independently of atmospheric hazards. They may trigger structural fires in urban areas but are generally not associated with wildfires, floods, or drought-related hazards.
- **Avalanches**, which occur primarily between November and April on steep mountain slopes in Western Colorado.

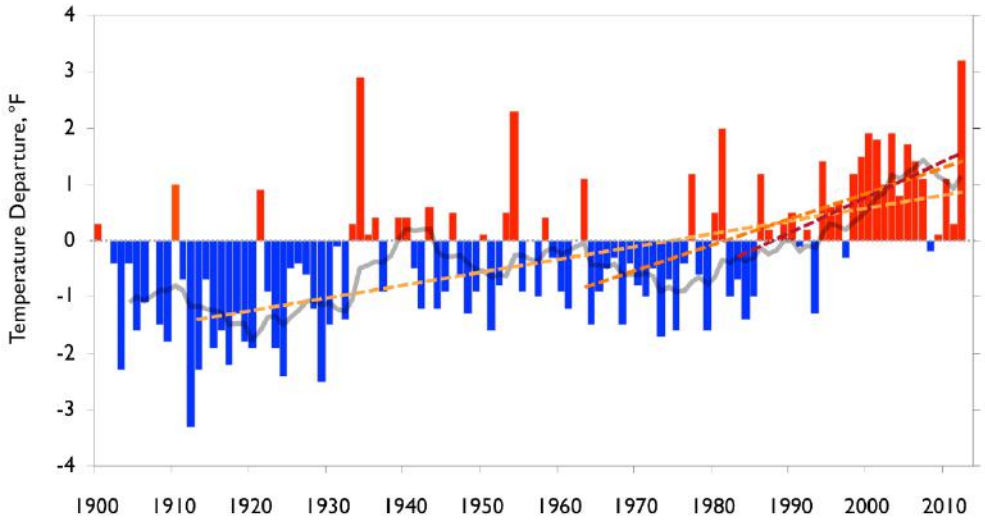
Section 3.2 Climate Variability Affects Hazard Risk

Colorado may be more exposed to natural hazards in the future than it has been in the past. This is related both to seasonal and inter-annual climate variability, which may be much greater than what has been observed in the last century, and to climate changes expected in the 21st century.

Section 3.2.1 Existing Climate Variability

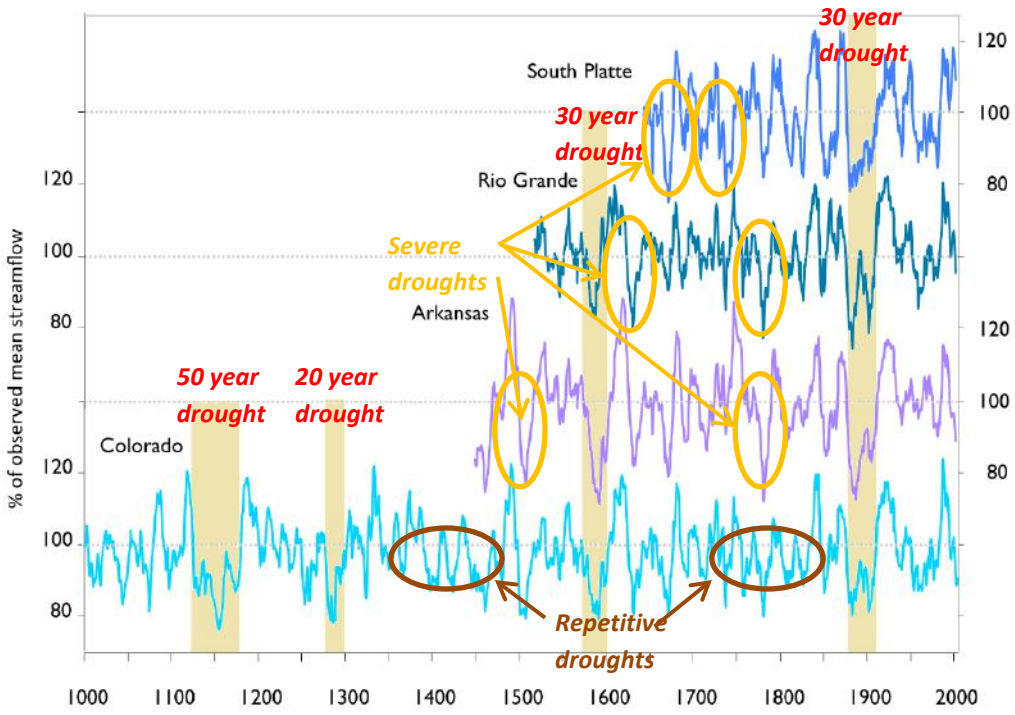
Weather observations show that Colorado is experiencing a long-term warming trend (Figure 3-5). Over the last 30 years, annual average temperatures have increased by 2°F in nearly all parts of the state.[xiv] These increased temperatures, combined with below-average precipitation since 2000, have led to more frequent drought conditions. In addition, snowpack has been mainly below-average since 2000, although the record is not long enough to deduce a clear long-term trend at present.

Figure 3-5: Statewide Annual Temperature, 1900 – 2012[v]



Such trends are complemented by paleoclimate records, which suggest that the length and intensity of droughts in Colorado may be more variable than has been observed since 1900. Tree ring records from the Colorado, Arkansas, Rio Grande, and South Platte basins show that in the last 2,000 years Colorado has experienced multiple droughts that were significantly longer and more severe than anything experienced in the 20th century (Figure 3-6). These droughts were driven by natural variability in precipitation, independent of any human-induced effects on climate. The severity of these droughts may be related to above-average temperatures; the longest and most intense mega-droughts occurred during the Medieval Climate Anomaly, a relatively warm period between 900 and 1350 AD.

Figure 3-6: Tree-Ring Reconstructed Streamflows for Four Major Colorado River Basins[v]



Taken together, both recent trends and prehistoric records suggest that Colorado may be at significant increased risk of drought in future, and therefore communities may be at increased risk of many hazards in the drought/fire/flood system.

Section 3.2.2 Changes in Climate in the 21st Century

In addition to the effects of natural variability, observed climate changes and global climate models have identified changes in the 21st century that are primarily linked to human-induced climate change. The Colorado Energy Office and the Colorado Water Conservation Board have assessed multiple studies of climate change and summarized the results of global climate models and related hydrological models as they apply to Colorado. Based on these assessments, by mid-century:

- All models indicate that Colorado will be warmer on average. Average annual warming estimates range from + 2.5 °F to + 6.5 °F by 2050. Summer temperatures are expected to warm slightly more than winter temperatures. Extreme heat events may become significantly more frequent.
- Nearly all models show an increase in total winter precipitation by 2050. However, overall precipitation trends are inconsistent across models, and total impacts on spring, summer, and fall precipitation are much less clear.
- Most models suggest that spring snowpack will decrease, and peak snowmelt will shift one to three weeks earlier. In addition, the frequency and magnitude of extreme precipitation events could increase, particularly in winter.

Figures 3-7 and 3-8 below show an example of the types of temperature and precipitation changes possible in different parts of Colorado, according to a mid-range scenario.

Figure 3-7: Projected Monthly Temperature Change for Eight Subregions Under RCP 4.5 for 2035-2064[v]

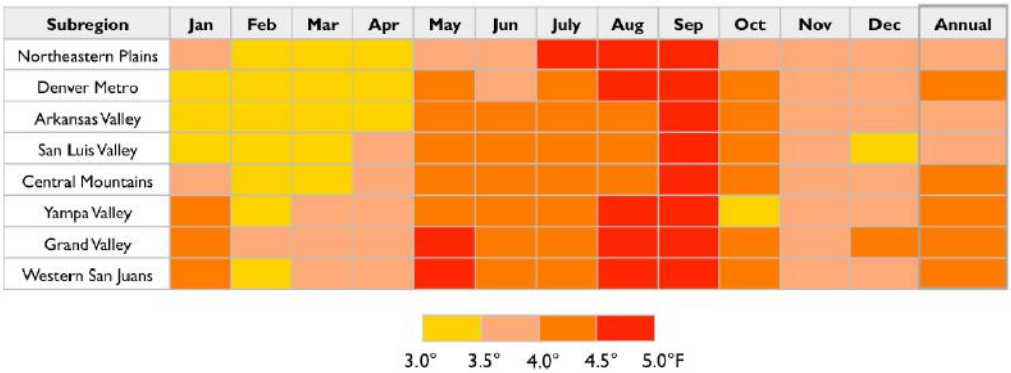
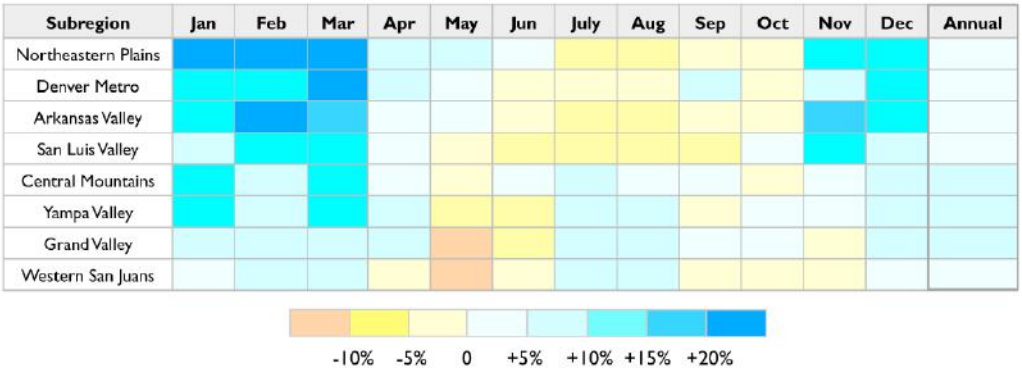


Figure 3-8: Projected Monthly Precipitation Change for Eight Subregions Under RCP 4.5 for 2035-2064[v]



Section 3.2.3 Increased Risks

Both the higher natural variability observed from prehistoric indicators and the trends inferred by climate models suggest that the frequency and severity of disasters in the drought/wildfire/flood cycle may increase in the future, driving the need for increased community resiliency. This is due to:

a) **Changes in temperature**. Climate models reliably predict higher temperatures and suggest more frequent extremes.

b) **Changes in seasonal water availability.** Climate models suggest possible changes in seasonal precipitation, and hydrologic models predict likely changes in snowmelt regime based on temperature changes.

c) **Intensification of drought cycles**. Paleoclimate indicators suggest the possibility of significantly longer and more intense droughts than have been experienced historically.

These changes are likely to have a systemic impact on natural hazards and increase the severity of damages in Colorado. Potentially more frequent and intense hazards include extreme heat days, wildfires, and forest infestations. In turn, these environmental hazards may cause widely felt social and economic impacts such as increased public health risks, property damages, losses to the forestry and tourism industries, and increased cost of maintenance for transportation systems.

The Colorado Water Conservation Board has examined how water resources will be impacted by climate change through a number of studies, including Climate Change in Colorado, The Colorado River Water Availability Study, The Joint Front Range Climate Change Vulnerability Study, the Colorado Drought Mitigation and Response Plan, and the Colorado River Basin Water Supply and Demand Study.[xv, xvi, xvii, xviii, xix]

Based on these studies, the most likely impact of future climate change on water supplies is a shift in the timing of runoff. Projections indicate that runoff timing will shift 1 to 3 weeks earlier by mid-century due to increased temperatures. This may affect flooding; it is also likely to result in decreased late summer streamflow. This is because of both increased temperatures and the projection that precipitation will generally increase in the winter months and decrease in the summer months.[xx]

While precipitation trends are far less clear than temperature trends, some studies have examined what floods and droughts might look like under an altered climate. Colorado's paleoclimate record shows droughts that are longer lasting and more intense than those experienced in the 20th and early 21st centuries.[xxi]

When flood and drought extremes are directly examined under possible future climate conditions, significant variability exists across the state. On the Colorado River at Cameo, the average intensity for future droughts is estimated to be somewhat greater than the historical intensity, while the intensity of future floods is estimated to be considerably lower than the historical surplus. When climate projections are taken into account, droughts occurring in the future are projected to have more intense impacts on streamflow and water supply than historic droughts of comparable length.[xxii]

Photo Credit: Colorado Water Conservation Board, Taryn Finnessey

The frequency and intensity of wildfire may also change under a warmer climate and will continue to affect watersheds and ecosystems.[xxiii] The majority of climate projections indicate that wildfires will likely increase in both frequency and severity by the middle of the century. As temperatures increase and snow

melts earlier, wildfires will also begin earlier in the season. At the same time, those fires will release CO_2, contributing to the ongoing rise in global temperatures. Research shows that these patterns are manifested in measurable ways, with more large wildfires, significantly more area burned, longer seasons, and longer duration of fire events.

While studied less, rock slides and avalanches may also be affected by climate change as permafrost melts and snow becomes less stable. Both of these hazards can seriously hamper transportation and impact road safety. They also hold the potential to isolate small communities that may only have one access road. The Colorado Department of Transportation (CDOT) is currently examining these concerns.

Section 3.3 Vulnerability and Resiliency

Vulnerability is what makes a natural hazard a potential disaster. The more an individual or a community is vulnerable to a hazard, the more likely the impacts will translate into a disaster. However, individuals and communities that are vulnerable to hazards can also be resilient in the face of disaster, particularly if they are empowered to drive their own recovery process. Vulnerability can therefore be addressed in two ways:

- **Direct** vulnerability to acute **shocks**. Shocks include natural events such as wildfire, flood, winter storms and man-made events such as industrial accidents, public health crises, and terrorism events. All individuals and communities are exposed to some degree to the impacts from these acute shocks. This type of vulnerability is often measured as potential **damage** to buildings and infrastructure and as personal risks, including **injuries** and **death**. **Hazard mitigation** focuses on reducing direct vulnerability by reducing communities' exposure to shock.
- **Indirect** vulnerability due to chronic **systemic stresses**. The same event, causing the same amount of immediate damage will cause more or less long-term impacts in a community depending on underlying **economic**, **social**, and **environmental conditions**. In fact, a chronic stress could lead to an acute shock such as over-dependence on single-industry economies leading to an economic bust. A focus on **resiliency planning** seeks to reduce indirect vulnerability by harnessing communities' ability to address those underlying elements and developing adaptive capacity.

Reducing indirect vulnerability from systemic stresses and developing communities' ability to absorb and move forward from disaster events (adaptive capacity) is the foundation of resiliency planning in Colorado, as expressed in this Framework.

Section 3.3.1 Vulnerability to Shocks

A community's direct vulnerability to shocks is equal to the potential damage that may be caused by "shock" hazards (such as fires, floods, earthquakes, man-made events, or others). Potential damage is a function of the likeliness of hazard events and of the exposure of people and property to the likely impacts. This direct vulnerability is often expressed as a dollar figure estimating potential damage from a given natural hazard. The highest dollar damages are usually measured in communities with the highest populations and most valuable facilities. However, this does not necessarily mean that such communities feature a high percentage of individuals at risk. The most vulnerable places may be communities where a substantial portion of development has occurred in hazard areas.

For example, the 2010 Flood Hazard Mitigation Plan for Colorado[xxiv] contains estimates of total potential losses from floods in different counties of the state. In Arapahoe County, potential losses of buildings and building contents were estimated at nearly $2 billion dollars for a population of over 600,000. However, on a per capita basis, this is not the community at most risk. The highest potential per capita losses from flooding were estimated in Phillips County, where total potential building loss is estimated on the order of $30 million for a population of 4,500.

A complete summary of estimated direct vulnerability to natural hazards in Colorado is contained in the 2013 State NHMP.

Section 3.3.2 Vulnerability to Systemic Stresses

Direct vulnerability is a function of likely shocks; if a portion of a community is located in a floodplain, it is directly vulnerable to flooding. However, two communities with identical exposure to floods may have very different experiences responding to, recovering from, and reorganizing following the same disaster.

The most resilient communities typically feature strong leadership and governance, social connectedness and healthy community networks, land use plans that integrate hazard considerations, a prosperous and diversified economy, a focus on individual health and well-

being, and well-developed, maintained, and protected infrastructure.[xxv] By contrast, communities that suffer from significant systemic socioeconomic stresses (such as high poverty, poor governance, limited land use plans, or weak infrastructure) are usually less resilient following a disaster event.

In the Colorado context, environmental stresses such as drought also inflict long-term damage that may increase vulnerability to shock events or even result in shock events. For example, in an area experiencing long-term drought, windstorms can become dust storms, leading to massive erosion, structural damage, agricultural losses, and public health impacts from dust inhalation. This is the 'Dust Bowl' scenario that played out in the Great Plains, including eastern Colorado, in the 1930s. Likewise, the long-term stresses can become shocks themselves. For example, mounting agricultural losses can mean that agricultural businesses sell off their livestock or even close their businesses.

Current land use patterns and socio-economic conditions (i.e., the choices we make with how we live) may also affect community resiliency. Living in the mountains is an important part of living in Colorado. However, many communities in the Rockies are served by a limited number of roads – some of which are privately owned and maintained - that run through narrow valleys or canyons and can easily be cut off in a major disaster. This has the potential to severely limit the community's access to outside resources following a flood, avalanche, wildfire, or landslide. For example, in the 2013 floods, the town of Lyons was cut off when flood waters and debris blocked emergency response personnel from entering the town after the St. Vrain Creek spilled over its banks.[xxvi] During the same floods, the town of Estes Park was impacted by the destruction of the main road, causing substantially longer trip times from Denver or Fort Collins.[xxvii] Many small, unincorporated communities suffered similar or worse impacts when private roads and bridges were wiped away and landowners did not have the resources to quickly make repairs and get home. As another example, when a rock slide closed U.S. 550 in January 2014, business owners in Silverton lost as much as 90%of their customers during the three-week closure.[xxviii]

Expanding population at the fringes of the Front Range and extensive second home and other development in mountain communities have caused a boom in development in or near wildlands. In 2010, an estimated 313,000 housing units existed in the wildland-urban interface (WUI). Colorado State University researchers predict that by the year 2030, the number of homes in Colorado's WUI will have increased to 720,000 homes. As this boom occurs, communities are facing increasing difficulty providing adequate fire protection and in ensuring the safety and redundancy of utility systems serving an increasing number of outlying and isolated homes. Colorado has the second-highest level of development in the wildland-urban interface in the western United States, after the state of Washington. The problem is especially acute in Boulder, Jefferson, and La Plata counties, where over 50% of interface land has already been developed.[xxix]

Although resort areas and areas with strong tourism-based economies have achieved economic success, these areas remain very vulnerable to the impacts of years with below-normal precipitation and snow pack, as well as the real and perceived effects of other disasters such as floods and wildfires. As winter temperatures are forecast to rise in the 21st century, years with lower snowpack will occur more frequently. If the frequency and severity of floods and wildfires increases in the future, tourists may also decide to stay away in larger numbers, even in areas that have not been impacted by recent disasters.

Section 3.4 Analysis of Impact from Acute Shocks and Chronic Stresses

Vulnerability is what elevates a hazard's potential to cause damage. The more an individual or a community is vulnerable, the greater the impacts from a disaster. As a method to develop resiliency strategies that reduce the State's overall vulnerability and prepares it to recover in a way that makes it stronger, the CRWG evaluated the impact of acute shocks and identified existing chronic stresses within six sectors. The CRWG looked at the impacts from recent flood and wildfire events and extrapolated the understanding of those impacts to evaluate vulnerability to other hazards. They also identified and discussed chronic stresses such as economic boom and busts, widening educational attainment gaps among certain populations, and underfunded and strained transportation infrastructure. The ultimate goal of the analysis was to identify resiliency strategies that reduce our short- and long-term vulnerabilities and find ways to learn lessons from disasters and build towards a more resilient future.

Photo Credit: CRRO

Photo Credit: Denver Housing Authority

Section 4:

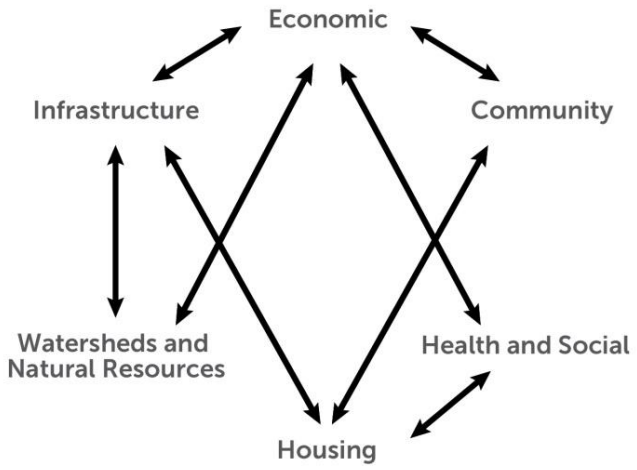
Resiliency Sectors and Adaptive Capacity

Resiliency can only be achieved when underlying, chronic challenges and susceptibility to acute external shocks are both considered and addressed. To identify strategies and actions Colorado can take to foster resiliency, the CRWG organized committees around six core resiliency sectors: Community, Economic, Health and Social, Housing, Infrastructure, and Watersheds and Natural Resources. Each sector represents a fundamental building block that supports the State's overall resiliency. Sector committees were asked to develop a vision for resiliency in their sector, examine impacts from acute shocks, and identify chronic stresses that may lead to an acute shock, affect Colorado's ability to rebound quickly, or impact daily quality of life.

Each sector identified critical problems that inhibit Colorado's ability to realize resiliency in that sector. Sector committee members then developed a list of strategies to address these problem statements. Although organized by sector, the CRWG and the planning process recognized the interdependency among sectors. The key to achieving the CRWG's vision of a "resilient state of sustainable communities" is to consider the six resiliency planning sectors together as an integrated framework. Each sector addressed in Section 4 is an integral part of a larger, resilient whole. Hazards that affect one sector are likely to have direct and indirect effects on other sectors and, likewise, strategies will have a cross-sector impact.

There are many instances where the strategies identified in Chapter 4 intersect. For example:

- A primary strategy for community and watersheds and natural resources is locating housing outside of floodplains, which involves co-locating adequate infrastructure and aligning housing and land use policies to encourage development outside of floodplains. In this context, the success of community development and watershed management are co-dependent and, furthermore, will rely on recommendations in the housing and infrastructure sectors.
- There is an equally strong connection between housing and infrastructure. Housing (and land use) policy needs to align with planned infrastructure investments to achieve an outcome where homes and neighborhoods are adequately served by infrastructure (such as utilities, broadband, public facilities, transportation, etc.) at a cost that can be reasonably borne by the involved stakeholders. Stronger collaborations are needed between actors in the housing and infrastructure sectors in order to implement strategies and recommendations that will achieve resiliency goals.



- The economic resiliency sector intersects with both infrastructure and watersheds and natural resources. For example, Colorado has experienced significant population and economic growth related to the state's world-class scenic and recreational resources. On the one hand, infrastructure must keep up with current and forecasted population growth in order to support economic growth. Incorrectly sized or inadequate infrastructure will hinder economic activity. At the same time, preservation and maintenance of scenic and recreational resources is essential to sustaining the state's natural beauty and economic growth and depends on proper stewardship over watersheds and natural resources. Economic and infrastructure policy and projects should therefore be conceived such that they do not undermine the scenic beauty, water quality, and ecological function that also underlie Colorado's success. Unified design and review of watersheds and infrastructure projects has been a focal point of the 2013 flood recovery effort and the continued practice of unified review is listed as a State resiliency success indicator.
- A primary focus in the health and social sector is concern for the physical and mental health of impacted residents. While such considerations are often viewed as 'social,' there is a real economic cost associated with a lack of access to a healthy workforce and losses of personal income following disaster shocks. Healthy, supportive work environments contribute to an individual's resiliency, such as in the aftermath of a shock when personal or sick time is a necessity. Avoiding disruptions to income in the aftermath of a disaster keeps money circulating, helping sustain the local economy. Policies or mechanisms that help ensure continuity of employment and income through a disaster recovery period therefore add value to both the health and social sector and the economic sector.

As new challenges emerge, Colorado's communities will require innovative thinking that emphasizes an integrated cross-cutting approach to adapt to emerging threats. Local stakeholders, communities, and the State of Colorado should take into consideration the holistic nature of the resiliency sectors while adhering to five overarching resiliency goals.

Framework Resiliency Goals

Risk. Reduce risk to Colorado communities.

Planning. Enhance resiliency planning capacity in Colorado communities.

Policy. Develop, align, and streamline policies to empower resiliency.

Culture. Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.

Investment. Ingrain resiliency into investments in Colorado.

Colorado Resiliency Framework Sectors

Section 4.1 Community

A resilient community is one in which community members are involved and have the information necessary and tools available to make resilient decisions. There is an underlying culture of resiliency that drives local decision making. Changing hazards and risks are understood by decision makers and incorporated into local plans. Tools such as land use planning, smart growth, effective floodplain management, comprehensive emergency management, hazard mitigation, and governance work in concert with each other and reinforce mutual goals. Resilient communities share lessons learned and know how to access resources to supplement local capacity when necessary.

Photo Credit:
American Red Cross Jamestown Art Project

Colorado communities are diverse and include mountain and plain, urban and rural, and incorporated and un-incorporated communities. As a home-rule state, the strength of Colorado resides in the right to local self-governance. Colorado's approach helps to define communities' self-reliant attitudes. It provides communities more opportunities to foster collaboration among diverse stakeholders and find unique and customized solutions. A top-down approach is not appropriate in most instances and ongoing multi-disciplinary conversations are locally driven. For example, current stream recovery processes included the creation of a multi-disciplinary, multi-sector engagement strategy. Private landowners, non-profits, businesses, technical experts, and local, state, and federal governments have all participated in the process.

Section 4.1.1 Shock Impacts and Chronic Stresses – Community

The September 2013 floods damaged or destroyed long-standing businesses and homes. Not only did the physical landscapes change as a direct impact from the shock, but aspects of the community, such as social and economic structures, were also altered. Progress has been made since the floods to address assistance to the whole community. Local governments have benefited from financial and technical assistance to form long-term recovery teams and planning projects in more than 20 local governments. The Community Sector Committee observed that after the floods of September 2013, there was an improvement in cross-government relationships and an increased willingness and ability to work together within agencies. They anticipate opportunities to incentivize and increase regional coordination and are planning ways to support implementation of local resiliency measures.

Chronic stresses exist in all sectors of this Framework. The Community Sector Committee discussed changing risks and hazards from shifting climate patterns, existing development in floodplains, the wildland-urban interface and other hazard areas, and overall resource constraints. The Committee recognized that although there is a large body of work on changing climate patterns in Colorado, the level of granularity of the information is not detailed enough for communities to apply to local plans.

The Committee also highlighted the current lack of integration between hazard mitigation plans and land use plans and historic development in floodplains exposing residents to flood risk. The Committee recognized that local governments try to operate as leanly as possible while providing maximum service. The result can be that resources are stretched thin during an acute shock. This includes resources such as local budgets, tax bases, and staffing levels. This presents challenges to Colorado's communities. New partnerships in the public, non-profit, and private sectors are helping tackle these challenges. Staffing levels have increased in the last couple of years as a response to the floods through training, staffing grants, and deployment of needed staff to ensure disaster recovery and routine business moves forward simultaneously. In many instances, the State and local governments loaned staff to impacted communities and assisted with the management of disaster assistance centers, and regional partnerships have been encouraged.

Community Sector Mission: *To build state and local capabilities and resources that facilitate holistic pre- and post-disaster recovery planning, effective implementation, and community resiliency and sustainability.*

Section 4.1.2 Problem Statement – Community

The Community Sector integrates the concerns of risk management, preparedness, and smart growth into land use planning and community engagement. Both immediate priorities and long-term needs for community planning are interdependent. The challenges we face are not just about protection and mitigation but are also about smart growth and future quality of life. The adaptive capacity problem statements the Committee identified include:

Preparedness

Local governments and citizens could benefit from information and specific data regarding their potential risks so that they can adequately plan for and protect themselves against those risks. Building resiliency first requires an understanding of risk and vulnerability that can then be addressed through mitigation actions and policies.

A collaborative, cross-sector approach to planning would enhance integrated planning and community involvement, while fostering awareness and education. It would enable the sharing of best practices in environmental sustainability and smart development and would increase the number of plans that truly reflect the unique characteristics of and potential risks to Colorado. A focus on integrated planning would reduce instances of missing critical community information and plans that become inert after they are adopted.

Awareness

In order for communities to prioritize and invest resources into resiliency efforts, they need to understand what resources exist, what opportunities there are to integrate into their current planning, and what it means to plan for resiliency in the long-term. This will enable local communities to prioritize and invest in resiliency.

Local communities need support to incorporate resiliency into their regular planning and thinking (not just following a disaster). Supporting their efforts to adopt resilient processes and standards before an event or disaster occurs helps to reduce non-resilient outcomes that sometimes come from the very natural human tendency to simply rebuild as quickly as possible.

Local Resources and Capacity

Local governments could benefit from knowing their current capacity to manage potential risk events that threaten their communities. Knowing their capacity and capabilities would enable them to identify areas that can be supplemented through private/public partnerships or federal and state support. This would help strengthen the continuity of government operations during acute shocks.

Guidance to communities regarding best practices in resiliency policy and practices could enable communities to establish greater community resiliency.

Culture

Colorado quality of life and its recovery after a shock are critical criteria for resilient, sustainable systems. Emergency and other “risk and vulnerability” assessments often focus on hazards and infrastructure impact without considering the demographic and functional characteristics of the people in the community, such as vulnerable populations, youth, and others. Systems for emergency response, disaster recovery, and smart growth will be more resilient when they reflect not just hazard profiles but also the changing profiles of community populations and characteristics in Colorado. Additionally, it is important for the state to support communities’ efforts to preserve unique markers of culture and identify community assets such as historic resources and artistic venues.

Section 4.1.3 Strategies and Goals – Community

Strategies determined by the CRWG Community Sector committee are flexible by nature and focus on providing information and education to local government and local planning processes on incorporating resiliency through toolkits and other resources. They are detailed below in Table 4-1. Additional strategies will be developed to support community partners such as non-profits and civic groups upon adoption of the Framework.

Table 4-1: Community			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
Guide and online resource	Develop a statewide guide and online resource on how to assess, analyze, and integrate all hazards information into local government land use planning efforts.	Cross-sector with Watersheds and Natural Resources: Develop guidance to encourage land use review/decision-making coordination with overlapping sector considerations at a local and regional level.	DOLA
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Proactive planning	Encourage and educate government staff and community leadership to develop pre-disaster, continuity, and recovery plans using an inclusive process. Develop an educational training program on various plans for local governments.	Offer professional education and guidance to local and regional governments that focuses on cross-training and sharing of best practices to create a better understanding of planning and emergency management and associated plans (e.g., continuity of government and operations plans, pre-disaster plans, emergency operations plans, recovery plans, hazard mitigation plans).	CDPS, DOLA, FEMA CPCB, SHPO, local communities
Cross-sector coordination	Support academic and nonprofit community in developing literature on resiliency and an accreditation program.	Cross-sector with all: Use relationships and networks to increase government capacity through partnerships with universities, business groups, etc. Through higher education and other training programs, grow the next generation of leaders who are knowledgeable on resiliency across the state. Leverage partnerships with state colleges and universities to provide technical expertise for planning and community development. Hold workshops/work sessions for local governments on integrated resiliency planning approaches and best practices.	Universities, FEMA CPCB, CDPS, CCI, CML, SDA, DOLA, VOADs, other nonprofits
Best practices for policies and planning	Develop guidance and share best practices to help communities plan for changing risks and hazards (climate variability) and incorporate this information into policies and actions in comprehensive and other plans.	Provide best practices, along with incentives, regarding the incorporation of changing risks and hazards into comprehensive and other plans.	CML, CCI, DOLA, FEMA CPCB, DNR, CEO, SHPO, Partnership for Sustainable Communities (EPA, HUD, DOT), APA Colorado
Institutional capacity	Educate and orient officials and staff on how to build institutional capacity to promote resiliency (e.g., identify back-up or temporary staff; cross-train existing staff; identify access to HR resources such as employee assistance program resources)	Identify and develop best practices for collecting, preserving, and sharing institutional knowledge when key players leave positions, agencies, or communities. Offer ongoing trainings, webinars.	CDPHE, CDPS, DOLA, CML, CCI, SDA

Table 4-1: Community			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 3: Policy - Develop, align, and streamline policies to promote resiliency.			
Local policy	Foster resources to support local policy alignment to address resiliency. Evaluate policy alignment and consistency across state plans and policies.	State and communities should establish policies in advance of a disaster to ensure optimal rebuilding practices. Develop state agency policies that are evidence-based and forward-looking with input from local stakeholders.	CDPS, DOLA, CCI, CML, SDA, CDPHE, DNR, SHPO, CRRO
Policies on growth	Promote a dialogue about the role of policies and regulations to promote safe, resilient, and sustainable development, including sustainable housing patterns, that avoids growth in high-hazard areas.	Leverage existing conferences, academic institutions, and urban planners to meet with partners/stakeholders and present needs.	RMLUI, ULI, CML, CCI, universities, Partnership for Sustainable Communities (HUD-DOT-EPA), APA Colorado, SDA
Codes Toolkit	Develop a "Resiliency in Codes" Toolkit.	Provide guidance and best practices for green building, fire, water conservation, and building codes in Colorado.	CEO, DOLA, Colorado State Forest Service
Policy evaluation and improvement	State agencies should, with partner support, prepare after-action reports that include recovery and develop lessons learned (post-event) and make recommendations for private, foundation, and government policy changes.	This should apply to the floods of Sept 2013 but also to future major events. A framework could be established to assess the impact of policies on disaster response and recovery and incorporate lessons learned.	CRRO, CDPS, other state agencies and key partners
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Education of public	A state-hosted social media public education and input campaign called "I am resilient."	With state coordination, find opportunities to showcase messages that highlight local jurisdictions' response to a disaster/community need as a way of increasing relevance and enhancing the opportunity to share and reiterate the need for resilient activities. SDA, CCI, CML to promote social media campaign.	CRRO, DOLA, SDA, CCI, CML, local communities
Cultural resources	Develop guidance for pre-disaster mitigation for the protection and preservation of cultural resources and facilities (e.g., historic buildings and other cultural assets, community gathering centers, etc.).	Encourage community surveys of cultural resources. Encourage disaster management plans for cultural resources.	History Colorado (SHPO and SHF), CDPS, FEMA CPCB, DOLA
Goal 5: Investment - Ingrain resiliency into investments in Colorado.			
Local government financial sustainability	Develop guidance for local governments to plan for revenue disruption and recover from disasters and other stressors (guidance documents, training, best practices, funding).	Guidance materials available to local governments. Educate local communities about the benefits of setting up a Revolving Loan Fund (RLF). Plan for administrative needs. Identify and promote existing funding sources that support risk assessment, information management, and overall mitigation activities at the local level.	DOLA, SDA, CML, CCI, universities
Incentivize action toward resiliency and maximize investments	Maximize investments by incentivizing resiliency through state discretionary grants. Encourage foundations to do the same.	Cross-sector with Infrastructure and Watersheds and Natural Resources: Incorporate resiliency criteria in state discretionary grant programs (e.g., green infrastructure, storm water, smart development, and sustainability.)	CRRO, state agencies

Table 4-1: Community			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Incentivize action and maximize investments	Maximize investments by incentivizing integrated planning in local government comprehensive plans.	Incentivize comprehensive planning that integrates hazard mitigation, sustainability, and resiliency.	DOLA
Incentivize action and maximize investments	Support and encourage community actions that will result in cost savings for residents/business owners through insurance costs. Continue to partner with insurance companies to reduce risk and vulnerability of communities.	Cross-sector with Economic: Support communities' goals (through education, training, research, technical expertise/assistance, and funding) to reduce risk and insurance rates, especially through the Community Rating System and FireWise Communities programs.	DNR, DOLA, FEMA CPCB, CSFS

Section 4.2 Economic

Economic resiliency is the ability of a system or market to maintain function and absorb and rebound from immediate stress or shock. A diversified base of industries, with free-flowing and accessible capital, is one key feature of a resilient economy. A healthy, mobile, and trained workforce also enables an economy to re-engage after an initial disruption. Business continuity plans, back-up electronic files, and telecommunications redundancies reduce the time needed to get back to business. The long-term benefits of building a resilient economy include reducing the booms and busts of single-industry economies and full absorption and employment of the varying skills offered through the existing workforce.

Colorado's current economic success is being driven by its Colorado Advantage—that it is one of the nation's best places to live, explore, work, and conduct business. The State also has important natural resources and one of the most highly educated workforces in the world. People are moving to Colorado not for jobs but because they want to live here and are creating jobs as a result.

However, throughout its history, the State has experienced extreme boom and bust economic cycles related to its concentration in extractive industries. According to the Center of the American West at the University of Colorado in Boulder, historically, "in many towns, communities, settlements, and sub-regions of the West, everyone's fortune depended on the production and marketing of one commodity. Dependence on one commodity brought a particular kind of precariousness, instability, and vulnerability to external changes, whether of markets or climate."[xxx] To address and reduce the impact of boom and bust cycles, the state has identified key industries to direct State Resources through the Colorado Blueprint and Regional Blueprints to create a diverse economy, capitalize on demographic trends, and drive job growth. These industries are Advanced Manufacturing, Information and Technology, Electronics, Energy and Natural Resources, Bioscience, Food and Agriculture, Aerospace, Defense and Homeland Security, Health and Wellness, Creative Industries, Tourism and Outdoor Recreation, Transportation and Logistics, Infrastructure Engineering, and Financial Services.[xxxi]

Colorado Advantage: Colorado is one of the premier places to live, explore, work and conduct business. It is a state where the best and the brightest from around the world come to work hard and play hard. Colorado's economy and dynamic institutions of higher education are matched by diverse urban, suburban, and rural communities.

This is the Colorado Advantage.

From 2000 to 2013, **Colorado's population increased by 19%** versus the 10.7% U.S. average. The median age remained consistent with the national average but education levels far surpassed the U.S. average.

Voted number one (1) economy in U.S. by Business Insider

1.2% growth in its working age population from 2012 to 2013.

2.8% growth in non-farm payroll jobs, adding 66,300 jobs between June 2013 and June 2014.

GDP growth of **3.8%** year over year in 2013

Section 4.2.1 Shock Impacts and Chronic Stresses – Economic

Despite its diversification, Colorado's economic success is not immune to acute shocks such as natural disasters. Economic impacts from shocks are felt intensely. According to an EDA study[xxxii] conducted immediately after the 2013 floods, small businesses were particularly impacted by disaster events and are uniquely vulnerable due to a lack of financial capacity, small private capital savings, and lack of business continuity plans. The economic impact from the 2013 floods was widespread, with the concentration being felt in Boulder, El Paso, Larimer, and Weld Counties. On the Western Slope, the closure of U.S. highway 550 for three weeks in January 2014 due to rockslides led to significant loss of revenue to businesses in Silverton that rely on ski tourism. Business owners reported that they lost 90 percent of their customers during the closure.[xxxiii] Wildfires create a similar effect on small businesses by isolating them from their client base. The Rio-Grande Watershed Emergency Action Coordination Team (RWEACT) started a forum to develop short- and long-term solutions to assist businesses affected by a disaster.

> The majority of businesses impacted by this disaster (2013 Flood) are considered small businesses. As such, the capacity for small businesses to recover is a key factor in Colorado's economic recovery. Economic development stakeholders indicate that many affected businesses lack overall business and financial management capacity. Many small businesses had relatively small private capital savings prior to the floods, and few had disaster preparedness or business continuity plans in place.
>
> — EDA Oct, 2014

In addition to the impacts of a shock, the state's economy experiences chronic stresses as well. Single-industry local economies are unable to rebound after business closures or long, drawn-out downturns. Colorado's oil economy, for example, is subject to the roller coaster of oil prices. Declining oil prices lead to layoffs and production cutbacks. In the 1980s there was a significant oil bust that resulted in Exxon terminating its Colony Shale Oil project, laying off 2,000 workers in Parachute, Colorado. Because of these trends, Colorado has been moving away from single-industry economies and is recruiting and growing new industries. These industries have their own needs to maintain resiliency. Advanced Manufacturing, Information and Technology, Electronics, Energy and Natural Resources, Bioscience, Food and Agriculture, Aerospace, Defense and Homeland Security, and Biosciences are dependent on reliable access to their corporate assets and resources. Health and Wellness, Creative Industries, Tourism and Outdoor Recreation, and Transportation and Logistics need resilient infrastructure to access bases and work forces.

Another core theme associated with economic stresses in Colorado is the varying levels of educational attainment across regions and between residents born outside of Colorado and those born in Colorado. Providing for and developing a healthy, educated, and well cared for workforce is imperative to building a resilient economy. The 2014 Talent Pipeline report produced by the Colorado Workforce Development Council asserted that as Colorado continues to use the career pathways model to align education, training, and work-based learning, it is crucial that we provide accessible information that increases Coloradans' understanding of good career opportunities and the multiple pathways into them.[xxxiv] A thriving workforce will further the State's goal of business retention and encourage businesses to consider employee health as part of business health during disasters.

The Economic Sector also evaluated business mobility. Although not a stress, business retention and continued opportunities for growth are critical for mitigating the economic impacts from a disaster. The sector reviewed and discussed a webinar produced by the International Economic Development Council (IEDC) entitled "Using Business Retention and Expansion to Mitigate the Effects of Disaster,"[xxxv] then considered strategies for how to continue to attract a diversified base of business, develop stronger relationships with businesses, and help them prepare for and overcome disaster events.

> **Economic Sector Mission:** *To sustain and/or rebuild businesses, preserve or create jobs, and develop economic opportunities that result in sustainable and economically resilient communities that meet local needs.*

Section 4.2.2 Problem Statement – Economic

The Economic Sector's vision for economic resiliency in Colorado is to have diverse industries, strong partnerships, effective preparedness, and a healthy workforce that responds to economic changes and disruptions, and to support sustainable growth for all of Colorado's communities. Based on this vision, the committee evaluated the adaptive capacity concerns associated with economic resiliency in Colorado.

Workforce Development and Support

Few communities have engaged the workforce support system to assess workforce vulnerabilities and develop plans to address those vulnerabilities and assist displaced workers. Support of displaced workers is important for overall business retention.

Much of Colorado's educated workforce comes from outside the state. While importing a talented workforce is advantageous, it could be a future vulnerability as an educated workforce is typically fairly mobile and does not mitigate the need for community workforce planning. Furthermore, we as a state have an obligation to address the educational attainment gap among Coloradans in order to grow and maintain a talented workforce in the future.

> The Town of Holly Colorado was hit hard by a strong tornado a few years ago and bounced back with a top-notch school system and businesses there for its people.
>
> *— Colorado Resiliency Hero Nomination*

Business Recovery

There are challenges with obtaining financial assistance or deploying financing to the local economy following a disaster, and many businesses do not have various forms of hazard insurance. To address these challenges, businesses should develop business continuity plans, and communities should be actively engaged and support business continuity planning in their local economies.

Communications

Disasters can cause local businesses to lose revenue and the ability to pay employees, thus impacting the economic health of the larger community. Outreach plans to local businesses such as "Open for business" campaigns can be useful for driving commercial activity back to a community after its immediate recovery. Few communities currently have such plans in place.

Long-Term Resources

The Economic Sector identified two significant resource issues: 1) There are insufficient resources being allocated to fostering local education, and Colorado's minority populations are being underserved. According to the 2014 Colorado Talent Pipeline Report, 54 percent of all top entry-level job openings require a Bachelors, Masters, or PhD degree. Colorado's local workforce is not being groomed for Colorado's new job types. 2) Investments in maintaining and developing critical infrastructure in Colorado—ranging from expanding broadband to rural areas to fixing roads and bridges to replacing outdated water and sewer systems—are not keeping up with needs, which can adversely impact economic health and diversity.

Section 4.2.3 Strategies and Goals – Economic

The Economic Sector committee focused strategies on education, developing workers, and emphasizing implementation of Colorado's Economic Blueprint. Details are provided in Table 4-2.

Table 4-2: Economic			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
Education	Strengthen the understanding of risks and vulnerabilities to communities, people, assets, and institutions.	Integrate the results of the CRRO-led risk and vulnerability assessment tool into the regional economic blueprints.	CRRO, OEDIT, DOLA, DHSEM
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Best practice toolkit	Strengthen State and local capacity to make resiliency a standard planning practice through guidance and resources. Identify and engage resources to develop best practice toolkit based on examples such as the Colorado Springs Together organization, created after the Waldo Canyon Fire. Consider making the toolkit available through a virtual business emergency operations center (VBEOC).	Communities should receive support and guidance on launching "open for business" campaigns after their immediate recovery. The toolkit should include examples of business continuity plans, funding sources, and how-to guides to access funds. Specific support should be provided to at-risk businesses and ensuring that business recovery plans and insurance policies are in place.	OEDIT
Economic planning & mapping	Provide support to communities for economic mapping. Encourage economic diversification in the local communities.	Economic mapping includes identifying key organizations and business and community leaders who will play a role in community business recovery. The mapping should also include understanding of workforce characteristics, critical infrastructure, and key industry.	OEDIT, DOLA, OIT, CDLE
Goal 3: Policy - Develop, align and streamline policies to empower resiliency.			
Utilization of Economic Blueprint	Utilize Colorado's Regional Economic Blueprint plans to provide a pathway to achieving economic success specific to each region.	Cross-sector with Infrastructure: The Regional Blueprints identify existing core economic strengths and industries that will be targeted for growth and development. It will be important to integrate the strategies from the Resiliency Framework in order to create a vibrant economy across all of Colorado's regions.	OEDIT
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Education of stakeholders	Create campaign to engage businesses in resiliency. Inform community stakeholders about resiliency policies, programs, initiatives, and progress.	Work with community stakeholders to continually determine resiliency needs and priorities.	CRRO
Workforce development	Promote regional industry-led initiatives for workforce development, specifically through sector partnerships and the development of career pathways.		CWDC, CDE, CCCS, CDHE
Goal 5: Investment - Ingrain resiliency into investments in Colorado.			
Public/private partnerships	Establish public/private partnerships to invest in a resilient Colorado.	Provide capacity-building grants in rural areas. Support and promote loans and grants through lending organizations	CRRO, OEDIT, DOLA, CDFIs

Section 4.3 Health and Social

A resilient health and social service system is one in which the health and well-being of a community is a shared responsibility among all levels of society. Mental and physical health, preventive care, access to care, environmental health, and managing the impact of the built environment play equally important roles. Federal, state, non-profit, and private organizations work together in a coordinated fashion to care for all members of society. Extremes in social inequity are addressed, and health and social service programs are tailored to specific population needs, including those of vulnerable populations. Overall healthier lifestyles; better physical and mental health; preventative care; improved recovery from illness; fewer limitations in daily living; better relationships with adults and with children; more social cohesion and engagement and improved quality of life are all dimensions of a resilient health and social system.

> Phamaly Theater Company has been a life changer for all of us actors with disabilities. We are each other's safety nets. When one of us falls (either literally or figuratively) the rest are there to help get us back on our wheels, feet, etc. Phamaly empowers people with disabilities to become more than their diagnoses.
>
> *— Colorado Resiliency Hero Nomination*

According to Healthy People 2020, the U.S. Department of Health and Social Services' 10-year agenda for health promotion and disease prevention, health equity is achieving the highest level of health for all people. "Health equity entails focused societal efforts to address avoidable inequalities by equalizing the conditions for health for all groups, especially for those who have experienced socioeconomic disadvantage or historical injustices."

Colorado is one of the healthiest and fastest growing states in the U.S. with people relocating to Colorado for its lifestyle, career, and world-class recreational opportunities. The State has actively engaged its citizens and local community partners in protecting environmental quality and improving public health. In 2008, Colorado established the Public Health Act, which calls upon the Colorado Department of Public Health and Environment (CDPHE) to produce a comprehensive, statewide public health improvement plan every five years. The State established its Winnable Battles program in 2011, which sets the priorities for improving public health and the environment. Clean air, obesity, disease prevention, mental health, and substance abuse are a few of the winnable battles with which Colorado has engaged. More recently in May 2013, the State released the Governor's report entitled "The State of Health: Colorado's Commitment to Become the Healthiest State." Local public health agencies with support from community partners have also created community health assessments and are implementing their local health improvement plans.

As part of the statewide public health and environment plan and corresponding statewide Health and Environmental Assessment, CDPHE produced a Health Equity model. As stated in Shaping a State of Health: Colorado's Plan for Improving Public Health and the Environment,[xxxvi] "The conditions in which people live, work and play have an enormous impact on health." There are many determinants throughout a person's life that influence their well-being. Colorado, recognizing the importance of its residents' health, created its own health-equity model and is evaluating how to achieve health equity, namely the highest level of health for all people in Colorado.

Section 4.3.1 Shock Impacts and Chronic Stresses – Health and Social

When acute shocks occur, there are physical health implications, disruptions of the social service system, and mental health impacts. The 2013 September flood created unprecedented damage with 10 lives lost, 18,000 people evacuated from their homes, 1,852 homes destroyed, and 28,363 dwellings impacted. CDPHE's Colorado Spirit FEMA Crisis Counseling Program Final Report (FEMA Crisis Counseling Report) reported 131,000 primary (counseling) service encounters and 107,000 secondary (counseling) contacts associated with the September 2013 floods. Although mental health impacts have not been aggregated across the collective disaster events, the FEMA Crisis Counseling

Report (FEMA 4067 DR-CO) for the High Park, Woodland Heights, and Waldo Canyon fires identified a long-term effect on mental health. Survivors sought services well after the first three months from when the disaster ended.

Chronic stresses also exist in the health and social system. The committee discussed lack of access to health care services, high staff turnover, mission fatigue for social service agencies, and the alarmingly high and growing suicide rate as chronic stresses. They considered that within vulnerable populations there may be unique chronic stresses. As an example, the committee cited low-income populations, which in Colorado have persistent unmet behavioral health needs.[xxxvii]

Health & Social Committee's Mission: *To integrate the efforts of public health, healthcare providers and facilities, and social service networks to promote the health and wellness needs of the whole community and create more resilient and sustainable systems for the residents of Colorado.*

Section 4.3.2 Problem Statement – Health and Social

The Health and Social Committee identified specific problem statements associated with the State's ability to reduce the impact from acute shocks and its ability to address chronic stresses. Key concerns include enabling access to care; incorporating socially vulnerable populations into preparedness and recovery activities; the sharing of resources across jurisdictional boundaries; and limited service capacity.

Communication

Local communities are most knowledgeable about themselves. They require support in enhancing their ability and capacity to communicate and educate populations that are unable to access information on social services, preventive health measures, medical, behavioral health, preparedness, and emergency/recovery messaging.

Planning

Socially vulnerable populations such as low-income, the elderly, individuals with access and functional needs, and/or linguistically isolated populations are not always included within emergency management, recovery and other community planning efforts. Additional resources and tools would benefit local governments and community partners to ensure equitable services are available to meet the unique needs of every community.

Networks

A disconnect exists between rural, suburban, frontier, and urban communities, creating a vulnerability wherein health and social capabilities and resources cannot be easily shared. Communities could benefit from State-sponsored support to foster community connectedness and the sharing of resources across town boundaries.

Resources/Capacity

Increasing demand for health and social services aimed at achieving ideal penetration rates is already apparent. Additional unforeseen increases in demand stemming from disaster events will threaten existing resources. This is of particular concern as resources are currently strained by the daily needs of Colorado's providers of health care, behavioral health, and social services.

Section 4.3.3 Strategies and Goals – Health and Social

Health and social strategies, goals, and initial project concepts include items focused on information, counseling, and education, among others. Specific strategies were developed to address disadvantaged and underrepresented populations. Over the course of the planning process, heavy emphasis was placed on the effective roll-out and use of Colorado Community Inclusion program (CCIP) maps. This program has created detailed map books on demographic indicators such as population, language, poverty, and special needs and disabilities and resource maps on aging, special needs and disabilities, income, and mobility. Further use of the CCIP maps would enable State, local, and community partners to better design resiliency activities with the unique characteristics of a population in mind. Further detail can be found in Table 4-3.

Table 4-3: Health and Social			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
Low-income populations	Reduce unmet needs and increase service penetration rates in low-income populations as identified in the Colorado Population in Need 2009 study.		CDHS
Information sharing	Promote and facilitate information sharing between local, state and non-profit crisis counseling, case management, and social service providers.	Best practices can be shared to reduce risk. Information sharing can also lead to partnerships to expand capacity during disasters.	CDHS
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Community inclusion mapping	Promote and educate decision makers and program managers about the value of and the opportunities for using the Community Inclusion mapping project. Develop guidance and resources to help local governments access data on vulnerable populations.	Community Inclusion mapping helps to identify strengths and vulnerabilities within Colorado pertaining to health and social services, including resources, assets, and populations. The Community Inclusion maps can also be used to support the assessment of needed community programs and resources and encourage population analysis to ensure outreach materials about health and social services are available in all appropriate languages within each community. Community Inclusion mapping is also useful to identify and prepare for community-unique vulnerabilities, allowing communities to incorporate vulnerable populations into risk mapping, including the homeless population.	CDPHE
Gap analysis	Conduct a gap analysis to examine the potential triggers (outside of the known hazards) that would cause an increase in demand of health and social services in order to foster more effective planning for providers.	As an example, work with agencies to determine potential triggers that would cause an increase in health and social services such as flu season, potential for Ebola, contamination of drinking water, recession, and an increasing income disparity. The gap analysis would be used to predict future mid- to long-term spikes in health and social service demands.	CDPHE
Inclusion	Develop a forum / guidance for the inclusion of populations and non-governmental stakeholder groups (religious groups, nonprofits, people with access and functional needs, ethnic support networks) into planning efforts.	Ensure outreach is conducted and members of traditionally underrepresented populations are included in all community emergency planning efforts.	Local Communities
Goal 3: Policy - Develop, align, and streamline policies to empower resiliency.			
Built environments	Support built environments that encourage community connectedness and increased physical & mental health.	Cross-sector with Community: The village/community inclusion concept decreases mental health consequences of western culture. As an example in Colorado, depression and suicide occur at a greater frequency than in other States.	CDPHE, Local Communities

Table 4-3: Health and Social			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Colorado 2-11	Expand and promote a system Colorado 2-11 as the one-stop-shop tool for referral services within the State.	Invest in system Colorado 2-11 to ensure consistent, equitable, and vital information resources services to ALL communities throughout Colorado.	CDHS, CDPHE, non-profits
Lessons learned	Utilize and publicize lessons learned from disaster.	This may include sharing of after-action reports or identifying local initiatives such as disaster assistance centers as best practices.	Local Communities
Education of community partners	Increase reach of existing preparedness campaigns that target youth, businesses, communities, schools, access and functional needs populations and families by educating community partners and existing community networks about existing campaigns.	For example, Fire Readiness http://www.readyforwildfire.org/	CDHS, CDPHE, Local Communities, Non-Profits
Goal 5: Investment - Ingrain resiliency into investments in Colorado.			
Mental health and counseling services	Advocate for larger percentage of disaster-recovery funds to be allocated to mental health and post-disaster counseling services.	Identify a funding stream that will ensure crisis counseling programs continue to serve the community even when the disaster recovery funding ceases.	CDPHE, CDHS
Grant funding	Encourage Colorado to apply for Climate-Ready States and Cities Initiative cooperative grant program that promotes and facilitates CDC's BRACE Program (Building Resilience Against Climate Effects).	Funds can be used to anticipate climate impacts and health vulnerabilities and to develop a climate and health adaptation plan.	CDC

Section 4.4 Housing

Resilient housing includes durable construction materials and design features that limit the impacts of natural disasters while also allowing for short-term sheltering in place. In addition, housing is more resilient when located outside of high-risk areas such as flood zones and when it allows access to multiple transportation options. Housing developments or neighborhoods that include access to community support systems and on-site renewable energy sources increase resiliency by fostering residents' self-reliance. Beyond hazard considerations, housing resiliency also encompasses issues of affordability and access to community assets. These resiliency features are not only beneficial in the event of a disaster, they also create quality homes that can be more affordable to operate, use fewer resources, and provide longer-lasting value to the home or building owner and the broader community.

Fast growth, increasing diversity, an aging population, and other Colorado demographic indicators are also important factors in creating a resilient housing stock. Housing that is adaptable to changing market conditions provides residents with the ability to age in a place surrounded by a familiar community, includes diverse building types and sizes for a mix of household needs, and is also resilient during economic and demographic shifts.

As the above factors indicate, housing intertwines with all other sectors included in this framework: location and density of housing development directly correspond to land use mapping and pressures on natural resources; transportation options and proximity of workforce housing to job locations impact household commuting costs and economic growth; and the design and materials used in housing directly impact human health and accessibility. These are just a few of the connections that inform housing choices. The Housing Sector committee narrowed its focus to the following areas for development of problem statements and strategies:

- Affordable Housing
- Range of Housing Options
- Energy Efficiency
- Repair, Rehabilitation & Reconstruction
- Accessibility and Special Needs Housing
- Durable Materials
- Insurance, Finance, and Legal
- Housing Stock Surveys and Needs Assessments

Colorado's growth rate is ranked fourth in the country, at 1.59%, and is double the national average at 0.75. 60% of the state's population gains in 2013 came from net migration. Colorado's immigrant population (both legal and undocumented) grew by 34% between 2000 and 2010—over 21% higher than the U.S. average rate. The North Front Range – Larimer and Weld Counties could see their population double by 2040.

Section 4.4.1 Shock Impacts and Chronic Stresses – Housing

Resilient housing allows individuals, households, and entire communities to bounce back more quickly and with less impact from sudden shocks when families are able to safely shelter in place and return to normal daily activity sooner, which in turn helps the entire community recover faster. The urgent need for resilient housing in Colorado became even more apparent when 18,000 people were forced to evacuate their homes due to flooding in 2013 and when more than 1,000 homes were lost to wildfires in 2012. In the aftermath of these recent natural disasters, an already inadequate supply of affordable housing became an even larger stress factor for many communities.

Housing Sector Mission: *To implement sustainable and resilient housing solutions that improve community resiliency by addressing pre- and post-disaster housing issues and the needs of the whole community.*

Colorado ranks among the top five states in the country when it comes to creating jobs and attracting new residents. However, construction has not kept pace with this population growth. Home prices and rents are rising sharply, while new jobs and the incomes needed to pay them are not rising in proportion. "If you scratch under the surface, there are plenty of folks coming out of the recession with flat or very minimal wage growth," according to Phyllis Resnick, lead economist for the Colorado Future Center at Colorado State University.[xxxviii] Speaking at the University of Colorado Boulder's 2015 Business Economic Outlook forum, Jeff Handlin, president of Oread Capital & Development, noted: "We are really supply-constrained in this market."[xxxix] A shortage of affordable housing in many parts of Colorado has created ongoing stress for households and is expected to hinder continued economic growth. Adding to the affordable housing shortage is the high cost of commuting, which creates an overall housing and transportation index in some areas of Colorado to well over 50 percent of household income.[xl] This housing stress has a direct relationship to the resiliency of many communities. As the recent flood and wildfire events illustrated, many people lost their homes and had few options for temporary or permanent replacement residences, thus delaying the overall recovery process for families, communities, and the local economy.

> On the morning of September 12, 2013, 20% of our kids lost their homes and another 60% were displaced for 3 months. We started school in a borrowed building and stayed there for 3 months. With all the adversity and suffering at many levels they persevered. The Children of Lyons taught the adults the meaning of resiliency. They ROSE ABOVE.
>
> *— Colorado Resiliency Hero Nomination*

On the positive side, new construction of housing to meet the current demand has the opportunity to be designed and built in a smart and safe manner for generations to come. Retrofit of existing affordable housing stock is possible as well, but it presents ongoing challenges due its massive scale, age, and, in some cases, vulnerable locations. For houses that are located in vulnerable areas such as floodplains, relocation may be a better option than retrofitting. However, this tactic is not always feasible given the current inadequate housing supply. For existing homes that are well located, actions need to be taken by homeowners and landlords to phase in resiliency measures that provide added safety, ability to shelter in place for several days, and ongoing durability to better withstand natural disasters. Sudden shocks such as flooding and wildfires are now at the forefront of many policy actions; however, slower developing issues such as drought and climate volatility that require adaptation should also be considered through energy and water efficiency retrofits and other measures.

Photo Credit:CRRO

Section 4.4.2 Problem Statement – Housing

Housing in Colorado requires a variety of resiliency solutions. Affluent homeowners and long-time homesteaders who prefer remote, often difficult-to-access, single-family homes in rural areas should all take personal responsibility for making their property defensible and self-sustaining if they are cut off from services. Denser housing developed within towns and urban areas requires personal responsibility, community-wide support, and local government action to create broader, holistic solutions. Resiliency solutions in housing should not be viewed as addressing a "what if" disaster scenario but, rather, as an ongoing improved quality of life for all occupants. Shortages and mild disruptions of energy, water, and other infrastructure-supported resources should be planned for through the installation of redundant, decentralized, and/or renewable systems to meet ongoing societal needs, not just as crisis-mitigation measures. Growing demands on our natural resources require that communities be more sustainable to reduce impacts and provide lasting solutions, such as using durable and resource-efficient products in housing construction that serve the dual purposes of sustainability and resiliency. Planning and designing for resiliency in housing should be viewed not as an option available to only a few but as the new standard that is built into all housing, both existing and new, including market-rate and affordable housing for rent or for sale.

While the needs are many, the following problem statements were considered by the Housing Sector committee to be of highest priority in creating a resilient housing stock throughout Colorado.

Affordable housing renovation and new construction located in vulnerable areas.

Existing affordable housing built in locations that offer lowest land prices is also often susceptible to environmental justice issues, including those resulting from natural disasters such as flooding. Additionally, renters seldom have control over the exterior defensibility of their residence. Many living in these communities also do not have adequate access to affordable alternative transportation or energy options. New construction continues to follow this pattern in localities where resiliency has not been included in land use, zoning, and building codes and regulations.

Market rate housing renovation and new construction located in vulnerable areas.

Existing market-rate houses have been built in remote areas, often with private infrastructure such as bridges that further limit access during times of stress. Local codes and regulations may not cover these areas, and insurance markets have limited influence on creating defensible and resilient spaces that impact individual properties and the adjacent environment.

Public infrastructure located in vulnerable locations and without redundant systems to maintain occupancy of habitable homes.

Severe infrastructure damage exacerbates the number of homeowners needing temporary housing. Disruption of water and waste treatment infrastructure has been known to prevent homeowners from returning to an undamaged homes.

Community centers without adequate capacity to support temporary housing and shelter needs.

Many communities designate schools as emergency shelters. This selection of shelters does not always take into account the vulnerability of the location or redundancy of systems to operate in limited capacity for a period of time.

Accommodations and systems for persons with mobility challenges that are inadequate to allow sheltering in place when transportation systems are not available.

When the floods of 2013 hit, several transportation corridors were either partially or fully washed away, leaving both residents and emergency responders with limited access to and from the affected communities. Persons with physical mobility challenges were disproportionately impacted, with no access to evacuation means and in need of extended sheltering in place capacity.

Residents without an adequate connection to community systems and information.

A fast growing population is often transient and has various cultural and language differences that make it difficult to connect these new residents to existing community networks that provide support services and resiliency education. A large segment of this in-migrating population has a low-to-moderate income, living in affordable housing in some of the most vulnerable areas.

Lack of affordable housing creates added stress when existing housing is removed through disaster or relocation.

With a current shortage of affordable housing in many areas of the State, the loss of existing units through recent disasters made relocation even more challenging, increasing homelessness and other economic and societal issues that create ongoing stress.

Section 4.4.3 Strategies and Goals – Housing

Housing Sector strategies focus on market resiliency, energy, hazard areas, and temporary housing. Many are related to other sectors, however, and are included due to a specific housing problem that was identified above, which would be alleviated through the recommended strategy. Ultimately, all housing strategies should strive to create safe and affordable housing that contributes to and preserves the fabric of the greater community.

The strategies and goals listed below in Table 4-4 also address temporary housing needs to accomplish resiliency. Temporary housing needs include emergency housing (utilized within two weeks of the disaster), medium-term housing (used up to six months after the disaster), and long-term temporary housing (used up to two years following the disaster).

Table 4-4: Housing			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
High risk housing locations.	Conduct an inventory of housing that is currently located in hazardous zones to prioritize mitigation needs.	This may be done with the assistance of geographic information system (GIS) and risk assessment tools.	DOLA administered 3rd Party, local governments
Remote housing locations.	Conduct an inventory of housing located in areas accessed only by private bridges and roads.	Understanding where these settlements are located will assist in reaching these populations during times of need and provide education about alternative access solutions.	DOLA administered 3rd Party, local governments
Fuel diversification	Investigate the installation of diverse fuel supplies to maintain critical infrastructure, including wastewater treatment plants, during a disaster.	This should be done in collaboration with local governments, special districts, and the National Renewable Energy Laboratory (NREL).	NREL, local government, special districts
Biogas as energy for housing	Explore the use of captured biogas produced in the natural wastewater treatment process from wastewater treatment plants as a continual (though limited) and emergency back-up energy supply.	A hybrid system of biogas paired with solar photovoltaic (PV) systems could help to keep wastewater treatment plants operating on a limited basis.	NREL
Protection of collector systems	To ensure continuity of wastewater systems to housing units, develop a plan that protects the collector systems, especially systems that include pumps to get waste to the plant.	Energy is just one component, but an important one in keeping a wastewater treatment plant up and running. The end result will be fewer short-term displacements, which will limit inventory vacancy issues and allow resources (time and money) to focus on severely damaged homes, businesses, infrastructure, and families in the first week of response.	NREL
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Improvement in resiliency of existing and new housing.	Work with local planners, residents, and builders (and other stakeholders) to incorporate resilient housing modification practices and water and energy efficiency measures into existing and new homes.	Tie into existing programs (for example weatherization, rehabilitation, etc.).	NREL, DOLA, DOH, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers
Location of local renewable generation	To ensure reliable power supplies to housing units, locate renewable energy supply systems on sites outside of vulnerable areas such as floodplains and within defensible spaces.	Some renewable generating facilities (e.g., geothermal projects) could be located within floodplains if appropriately sited.	NREL, DOLA, DOH, local governments, CEO, CHFA, CML, CCI, Utilities
Resource information on resilient housing	Compile a list of resources and best practices and provide support in understanding and navigating their application to help communities add resilient building stock and universally designed communities (i.e., adhering to the Universal Design Guidelines).	Housing best practices can be included in the overall resiliency toolkit. This is a cross-sector strategy with multiple other sectors.	NREL, DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers

Table 4-4: Housing			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Requirements for new affordable housing	New affordable housing development funded by state or federal dollars should incorporate location of and access to escape corridors in their plans in addition to hazard risk mitigation criteria, including but not limited to flood plain elevations, fire zones, and erosion hazards.	Cross-sector with Infrastructure and Community: work with local communities to develop a transportation plan that provides two routes in and out of every community, where feasible. Designated roads should receive extra funding to incorporate resiliency measures.	NREL,DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers, Colorado Chapter of the International Code Council
Housing market to accommodate disaster victims	Encourage a stable housing market with a 5% vacancy rate, which would allow for absorption of disaster victims. Evaluate temporary housing needs for people with access and functional needs.	Promote a focus on regional planning to encourage resilient housing across political boundaries.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Developers, Colorado Chapter of the International Code Council
Goal 3: Policy – Develop, align, and streamline policies to empower resiliency.			
Floodplain standards to accommodate resilient housing	Encourage local governments to develop floodplain standards that find appropriate uses for future housing development in floodplains through a public/private partnership between state agencies and associated private or non-profit partners.	Cross-sector strategy with Community, Infrastructure, and Watershed and Natural Resources.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers
Building standards	Develop a resiliency and housing codes tool kit to encourage resilient, fortified housing.		DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers, Colorado Chapter of the International Code Council
Land use planning	Encourage local government to develop land use master planning that encourages construction of resilient housing.	Master planning should encourage development of housing in less risk-prone areas. This could include annexing open space or other land when necessary.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Developers
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Additional temporary housing	Identify appropriate medium-term facilities such as local motels/hotels outside of floodplains and other vulnerable areas and work with the property owners and local officials to designate these locations as temporary housing locations. Create networks across jurisdictions to meet temporary housing needs within adjacent areas whenever possible. Qualify the identified temporary housing facilities for access to additional resources for installation of renewable energy sources and other resources that may provide ongoing benefits to the property owner and improve capacity during emergencies.	This would remove the longer-term burden of community service buildings such as schools and the associated disruption of their primary purpose. This may also reduce the need to transfer students to new schools and allow organizations to help displaced individuals as well as provide information or resources to affected citizens in a central place closer to the citizens' community. Work with local entities to develop resources that would adapt these temporary housing locations to make them resilient.	DOLA administered 3rd Party, local governments, Utilities, Colorado Chapter of the International Code Council, CEO

Table 4-4: Housing			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
	Work with local governments to identify future sites for additional temporary housing that could also serve multiple purposes.		
Retrofit of facilities for temporary housing	Prepare case studies of resiliency retrofits of existing buildings such as schools to serve as short-term shelters and other facilities identified for mid-term housing needs. Develop criteria for the retrofit of facilities to provide for short-term shelter and mid-term temporary housing.	Collaborate with NREL and Emergency Management to understand needs and develop adaptive solutions.	NREL DOLA, local governments, Colorado Chapter of the International Code Council, CEO
Housing insurance	Work with the insurance industry to expand community-wide education and volunteer inspection programs that support personal and community-wide responsibility. Engage the insurance industry to include best practices (materials, elevation, clear zones, etc.) in high-risk areas of the state.		NREL, DOLA, local governments, Colorado Chapter of the International Code Council
Multi-family housing	Encourage local government to identify resilient locations (to minimize impacts of potential fire, flooding, or other disasters) for multi-family development to meet local housing needs. Stable market identified by a 5% vacancy rate to ensure long-term temporary housing options in case of disaster.	Multi-family housing will be appropriately scaled to the local community.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Developers, Colorado Chapter of the International Code Council
Goal 5: Investment - Ingrain resiliency into investments in Colorado			
Incorporate resiliency requirements for public funding of housing	Incorporate resiliency design requirements into all affordable housing projects, including manufactured housing, that receive public funding. Encourage housing that is mixed-income and located near community amenities and recreation areas to advance connected and healthy communities.	At a minimum, measures should include water and energy efficiency, renewable energy systems, and design features that elevate mechanical and living spaces in areas prone to flooding, and the use of fire-resistant materials and/or built to be defensible in areas prone to wildfire hazards. These units should also be (re)built to accommodate the needs of aging persons and persons with disabilities.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers
Public private partnerships	Develop public/private partnerships to ensure a comprehensive approach and access to resources for the retrofit and creation of affordable and resilient housing.		DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers
New affordable single family home creation	Identify/develop investment/funding model to create new, affordable single-family and townhome products in response to future catastrophes.		DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers
Community resiliency partnership fund	Incorporate resilient new housing development and retrofit funding as an activity covered under the community resiliency partnership fund.	Cross strategy with infrastructure.	DOLA, local governments, CEO, CHFA, CML, CCI, Housing Authorities, Housing Developers

Section 4.5 Infrastructure

Our State's infrastructure mission is to design, maintain, and manage infrastructure that not only answers some of the world's most difficult engineering challenges but creates a network of resilient infrastructure that resists - and bounces back quickly - from acute shock events, including man-made threats, accidents, extreme weather events, and climate change, and that minimizes disruptions to critical infrastructure such as roads, power, clean drinking water, and waste management, and that allows critical services to remain active such as police, fire and rescue, and hospitals. This requires meeting community needs in the context of the hazards Colorado faces such as keeping infrastructure out of high-hazard areas – e.g., floodplains – and providing back-up infrastructure and systems – such as multiple roadways and clean water access into and out of canyon communities - wherever economically feasible. It requires us to act more boldly to deliver infrastructure that strengthens our State by providing multiple benefits for people and communities, environmental stewardship, and economic stability and growth.

Balancing stewardship with growth in complex, unique, and diverse engineering environments has always defined Colorado's infrastructure. Colorado is home to the world's highest suspension bridge over Royal Gorge; the bridge rises 1,053 feet above the Arkansas River. Climbing 14,258 feet above sea level, Interstate 70 from Idaho Springs to Mount Evans is the highest paved road in America and is a federal-aid road. Colorado is also home to the world's highest auto tunnel, the Dwight Eisenhower Memorial Tunnel between Clear Creek and Summit counties. It was bored at an elevation of 11,000 feet under the Continental Divide and is over 1.5 miles long, has an average daily traffic of 26,000 vehicles, and is an economic driver as a gateway to some of Colorado's best ski country.

Photo Credit: CRRO

Coloradans cherish their relationship with the natural environment, and Katherine Lee Bates penned *America the Beautiful* after being inspired by the view from Pikes Peak. There are nearly 20 rivers whose headwaters begin in Colorado, with the Continental Divide directing each river's course, and the North American Cordillera (the mountain chain runs through Colorado) has 52 dramatic peaks over 14,000 feet or "Fourteeners," as they are affectionately known, in Colorado. Balancing stewardship with growth in complex, unique and diverse engineering environments has always defined Colorado's infrastructure. Additional detail regarding infrastructure assets throughout Colorado can found in Appendix D.

Infrastructure involves supporting the essential facilities, equipment, and structures operated and owned by public and private entities needed for society to function safely and to support the continued growth of our communities. Throughout the past year, the Infrastructure Working Group has been focusing on identifying the needs and opportunities for resilient infrastructure in Colorado. The primary focus areas include transportation, water, wastewater, solid waste, energy, telecommunications, information technology, and essential public facilities.

Section 4.5.1 Shock Impacts and Chronic Stresses – Infrastructure

In recent years, four fires wrought unprecedented destruction in Colorado. In 2012, fueled by extremely hot and dry conditions, the Waldo Canyon Fire ravaged 28 square miles in and around Colorado Springs, consuming public lands, suburban and rural communities, and U.S. Defense lands. Colorado Springs is an essential U.S. defense community housing both Army and Air Force bases, including the North American Aerospace Defense Command (NORAD) and the nearby Cheyenne Mountain Nuclear Bunker. The Waldo Canyon Fire caused the evacuation of 30,000 people, including the partial evacuation of the U.S. Air Force Air Force Academy, and it took 1,500 firefighters to control the blaze, which caused over half a billion dollars in damages.

Earlier that same year, the High Park fire engulfed 138 square miles of land in Larimer County next to Fort Collins, home of Colorado State University. The local evacuation lasted 21 days. Within days, the Black Forest Fire started three hours south, in an unrelated event, adjacent to State Highway 83, located near Colorado Springs, decimating over 22 square miles. It took

457 firefighters working the fireline to control the blaze, including the Colorado Air National Guard and fire suppression teams from Fort Carson and the nearby United States Air Force Academy. In that same week, the Royal Gorge fire impacted five square miles in the county that supports the Colorado State Penitentiary.

Infrastructure Sector Mission: *To improve the resiliency and sustainability of infrastructure in Colorado by integrating investment and planning efforts of infrastructure owners across jurisdictions; to prioritize resilient infrastructure enhancements based on risk and a hierarchy of need before and after a disaster to improve recovery time. To integrate the efforts of infrastructure owners, operators, and authorities across jurisdictions to efficiently restore and enhance infrastructure systems and services while incorporating risk reduction measures to improve resiliency and sustainability.*

A few months after the Black Forest Fire, Colorado experienced the largest flood in its history, beginning on September 11th. The flood events and consequent landslides and mudslides lasted through September 30th and caused over a billion dollars in infrastructure damages and cut off land evacuation and supply routes to canyon communities for weeks. At the direction of Governor Hickenlooper, the Colorado Department of Transportation restored serviceable roadways in 60 days within a disaster impact zone that measured 200 by 50 miles. Colorado is in the middle of a multi-year recovery from the flood event.

These fires and flood occurred on a frequency and scale that had not previously been experienced in Colorado. At the same time that the natural disasters ravaged the State, technology crimes – such as cyberattacks – have become a persistent and pernicious threat.

These threats and events inspired a shift away from how we have traditionally thought about infrastructure, how threats affect the design, maintenance and management of assets, and how we think of chronic stresses and acute shocks. Stresses are the long-term conditions that weaken the overall infrastructure system.

Examples of stresses include:

- Aging infrastructure that requires upgrading or replacement.
- Increasing population adds stress to the existing capacity of many of the State's highways and puts a toll on an already over-allocated water supply (Colorado's Water Plan is one way the State is working to address this concern).
- Energy generation and distribution systems that are reaching their carrying capacity.
- Colorado's climate, including severe freeze/thaw cycles.
- Changing climate trends also stress the infrastructure sector.

Stresses and shocks are not mutually exclusive, and the September 2013 floods illustrated how pre-existing stresses can weaken a system that is then undermined by a shock such as a major disaster.

Colorado's recent disasters have created new opportunities to build back better. It has encouraged stakeholders to come together to meaningfully discuss what resilient infrastructure means and what it should look like. These events have given Coloradans the opportunity and energy to think holistically about infrastructure resiliency that crosses assets and organizational and geographic boundaries.

> Gray Currier is an engineer for CDOT and was responsible for a large portion of the emergency repairs of US 34 in the Big Thompson Canyon. Gray worked tirelessly throughout the initial response to the flooding of September 2013. I worked with him on the ER project. Gray worked 16-22 hr days without a day off for the first 58 days of the disaster response. He worked as hard as humanly possible...
>
> *— Colorado Resiliency Hero Nomination*

Section 4.5.2 Problem Statement – Infrastructure

Colorado's multiple challenges to infrastructure manifest themselves in the infrastructure management arena as deficiencies of knowledge, tools and skills, funding, monitoring, and communication. In many cases, those who manage and own infrastructure do not have a complete inventory, condition assessment, and risk evaluation of their facilities. Financial limitations are present across all sectors, limiting needed improvements and required maintenance. The necessary technical resources to design, construct, and manage resilient assets are not always available. The complexity of project risks and project requirements makes it difficult for newly constructed projects to properly deal with and comply with these risks and requirements. The lack of a common language regarding resiliency

creates problems in communication between stakeholders.

In order to transform existing and build new resilient infrastructure, Colorado needs to bring together and support diverse stakeholders and establish a statewide-understanding of the threats and vulnerabilities of critical infrastructure assets. By understanding threats and vulnerabilities and accessing a diverse set of stakeholders, the State will be able to prioritize the best and most financially prudent ways to make existing assets resilient.

Rebuilding with a focus on leveraging multiple benefits will be another strategy of the State. That means not only considering new and improved infrastructure with its primary function in mind (such as storm water management), but considering how assets can be planned, designed, built, operated, and maintained to deliver benefits to people and communities, promote environmental stewardship and support economic stability and growth so that investments in resilient infrastructure pay long-term dividends.

As the State moves forward with this framework, it will look to fill gaps in technical resources and will support the design, construction, and management of resilient assets by advancing current thinking about project complexity and risks and changing how we understand the threats posed by acute shocks and chronic stresses and promoting multiple returns in infrastructure investments.

The Infrastructure Sector Committee summarized these challenges with the four problem statements below.

Asset risk assessments and management tools.

Communities across Colorado lack comprehensive information about the threats and vulnerabilities of the assets they control and need support in identifying and prioritizing opportunities to reduce asset vulnerabilities in line with asset criticality and consequence management. Colorado infrastructure stakeholders do not universally have the technical assistance and tools needed to effectively plan, design, construct, and manage resilient assets that leverage multiple benefits for people, for environmental stewardship, and for the economy and that incorporate best practices in green infrastructure.

Common definitions and lack of design standards.

There is no shared definition of resiliency, which causes communication gaps amongst stakeholders, including State and local governments, regional planning authorities, residents and community-based organizations, and business and industry. In addition, Colorado's "home state rule" makes aligning standards for resiliency consistent for assets across jurisdictional boundaries difficult, time consuming, and complex.

Funding limitations.

The limited amount of funding, competing interests, and program restrictions do not currently allow for the development of criteria to evaluate projects for resiliency or to financially prioritize and ultimately implement improvements. The work ahead requires us to create a shared definition and vision for resiliency, statewide. Policy and program requirements need to be aligned to encourage multiple funding streams that consider infrastructure investments as part of a larger system rather than for a single function. If this shift can be made, the State will be better positioned to deliver resilient assets that yield significant returns on investments for people, environmental stewardship, and economic stability and growth.

Stakeholder Engagement.

Home Rule has the benefit of bringing multiple stakeholders to the table, and collaboration is something Colorado communities and residents do best on a project-by-project or asset-by-asset basis. However, local communities are not structured, encouraged, or incentivized to align resources and assets across jurisdictional or geographic boundaries. Infrastructure should be seen as a web of interconnected assets; only then will the State be able to transform its infrastructure assets to be truly resilient.

Section 4.5.3 Strategies and Goals – Infrastructure

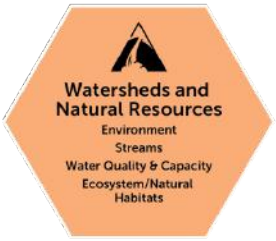
Strategies developed by the Infrastructure Sector committee, listed in detail in Table 4-5, focused on scenario planning and adaptive planning; utilizing best practices in developing, operating, and maintaining resiliency,; green infrastructure; educating and influencing stakeholders; incorporating risk and resiliency into funding decisions; and developing mechanisms that allow increased investments in infrastructure to enhance resiliency that systematically reduce impact from acute shocks and chronic stresses and eliminate or reduce downtime.

Table 4-5: Infrastructure			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
Central database	Compile existing hazard data into a single database. Identify information gaps in the hazard database.	This could be part of the risk and vulnerability assessment tool being developed by the CRRO.	CRWG, CDOT, DNR, CWCB, DHSEM, OEM, CDPHE
Evaluate risks	Evaluate Infrastructure risks to determine comprehensive approach to hazards.	When evaluating risks and all threats and hazards we need to be sure to include climate change and the potential implications.	CRWG, CDOT, DNR, CDPS, CDPHE
Infrastructure asset inventories	Conduct Infrastructure asset inventory and/or make technical assistance and tools available for the local communities.	Collect all statewide asset data and compile in a single location. Then work with the local communities to have them "report up" asset information including but not limited to; water, wastewater, stormwater, water quality, energy, communication, transportation, and rail. Develop a comprehensive database.	CRWG, CDOT, DNR, CDPS, CDPHE
Planning decisions	Incorporate the use of risk and vulnerability into infrastructure planning and development decisions.	The main strategy to achieve this objective is to prioritize risks in alignment with individual, community, and organizational needs and align resource allocation to systematically reduce risks.	CRWG, CDOT, DNR, CDPS, CDPHE Local Governments
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Centralized mapping tools	Develop and distribute integrated (sectors / hazards) mapping tools statewide.	Cross-sector with Community: Web-based GIS tools or otherwise that provide the communities a resource to understand their hazards and risks.	CRWG, CDOT, DNR, CDPS, CDPHE Local Governments
Resiliency guide	Develop a resource guide for incorporating resiliency into local communities' planning & land use planning processes.	Create a "how to" document that provides definitions, examples, metrics, and incentives as a planning tool for local governments. The document should also provide guidance on how communities can incorporate resiliency into their existing planning documents, including comprehensive plans and capital improvement plans. A separate guide could be created for resiliency for the private sector.	CRWG, DOLA, DNR, CDPS, CDOT, DOLA, Local Governments
Recognition/ accreditation	Create/incorporate a statewide resiliency recognition/accreditation program.	Either develop a new program or work with existing programs to come up with a LEED Certification type opportunity for communities to show off their resiliency efforts.	CRWG
Tie metrics and funding	Tie resiliency metrics and funding sources to planning efforts.	Find a way to incentivize communities to develop or update planning documents that incorporate resiliency concepts. This incentive could be through the development of new funding sources or the leveraging of existing planning funds.	CWRG, DOLA, CDPS, NRCS, FEMA, FHWA

Table 4-5: Infrastructure			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Triple bottom line	Identify tools and educate stakeholders on the durable benefits of using a triple bottom-line approach in project planning to increase the return on investment.		
Redundancy	Incorporate redundancy into infrastructure planning.	Expand upon existing ideas of building redundancy into infrastructures systems in order to decrease vulnerabil-ities.	CDPS, CDOT, CDPHE, DNR, Local Governments
Goal 3: Policy - Develop, align, and streamline policies to empower resiliency.			
Holistic standards/ policies	Have agencies work together for a holistic approach (standards/policies) to resiliency measures.	Cross-sector with Watersheds and Natural Resources: For example, bridges and embankments need to planned for together. As an example, roadway and river restoration can be jointly planned and designed, resulting in added benefits such as bike trails and other recreation. Overcome barriers by identifying threats and vulnerabilities, providing education and infor-mation sharing; attempting to make the conversation positive and forward thinking; developing tools for the local level; attempting to include flexibility in planning and policies; identifying projects that provide multiple benefits; and realizing that projects exist within "si-los," but can still be in accordance with larger goals.	CGS, DOLA, DNR, USGS, Local Governments, FEMA, FHWA, NRCS, CDOT, USFS, CDPHE, CDPS,
Interagency coordina-tion	Develop policies that a stakeholder / interagency ap-proach should be taken for infrastructure design and construction projects to ensure that all interested par-ties are involved.	Formalize DURT process for disaster and non-disaster infrastructure design.	FEMA, FHWA, NRCS, CDOT, DNR, USFS, CDPHE, CDPS, DOLA, Local Governments
Design standards	Create consistency and incorporate resiliency within de-sign standards for use in all State-funded investments in infrastructure.	These design standards should incorporate the latest scientific information regarding flood magnitude and frequency, temperature extremes, wind hazards, ge-otechnical hazards, fire vulnerability, and all other relevant hazards, make design standards publicly available for adoption by local governments. Identify necessary partnerships such as APA or ASCE to establish standards.	CRWG
Cost/benefit analyses	Identify costs of projects and benefits of incorporating resiliency into projects (cost/benefit analysis).	Incorporate the use of financial reporting into infra-structure costing. For example, use benefit-to-cost ratios and return on investment to justify improve-ments.	CDOT, CDPHE, DNR, DOLA, Local Govern-ments

Table 4-5: Infrastructure			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Stakeholder engagement	Proactively identify opportunities to educate communities.	Instead of responding to speaking requests, the CRRO and other State agencies should proactively seek out good opportunities to present resiliency and communicate the need for resiliency to those communities and people that can implement the thought process.	CRWG
Inform stakeholders about resiliency policies, programs, initiatives, and progress	Communicate project progress and success stories for infrastructure and put on Colorado United web site.		CRWG
Advocate community resiliency action	Create a Friends of Resiliency Program to promote resiliency awareness and actions.		CRWG
Advocate for resources, tools, and support for resiliency in Colorado	Create or leverage resiliency officers at either the State or local level.		CRWG
Goal 5: Investment - Ingrain resiliency into investments in Colorado			
Grant funding	Create funding flexibility to support resiliency.	Modify existing funding pots to adapt to new resiliency objectives. Possible re-structuring of impact fees to fund resilient infrastructure objectives.	CRWG, FEMA, FHWA, NRCS, CDOT, DNR, USFS, CDPHE, CDPS, DOLA, Local Governments
Grant funding	Incorporate resilient infrastructure funding as an activity covered within the Community Resiliency Partnership Fund.		CRWG

Section 4.6 Watersheds and Natural Resources



In the context of the Framework, resilient watersheds and the natural resources within them are able to withstand disturbances over time by retaining their structure, functions, and support services. Resilient and properly functioning watersheds and natural habitat cost-effectively protect valuable infrastructure, economies, recreational opportunities, and human health. Communities would exist in harmony with natural systems and be resilient to the environmental hazards they pose. As an example, communities in the wildland-urban interface would have fire-wise development standards.

Colorado is home to the Continental Divide, making Colorado the headwaters of four major river systems: the Arkansas, Colorado, Platte, and Rio Grande. Those systems originate in the mountainous areas of Colorado and flow to 18 downstream states and the country of Mexico. All of Colorado's landscapes reside above 3,300 feet with an average elevation of 6,800 feet (CWP, 2014).[xli] This geographic phenomenon carries significant natural resource stewardship responsibilities for Coloradans. In combination with this increased awareness of natural disasters and hazard mitigation, individuals and communities would also be preparing plans and taking actions to manage the efficient use of resources and address long-term stresses, such as drought.

Watersheds and the natural resources within them – including streams, lakes, wildlife, forests, grasslands, minerals and mineral fuels, wetlands, and soils – provide the foundation and sustenance for our communities and livelihoods. Communities can only thrive when supported by healthy watersheds that have intact natural functions. In addition to our drinking water, watersheds provide building materials, grazing and agricultural lands, and recreation opportunities, to name just a few fundamental support services. Healthy floodplains and riparian areas improve water quality, provide flood protection, and recharge aquifers. Coloradans are connected emotionally as well as functionally to the state's natural resources: the natural setting provides a sense of place, beauty, pride, and rejuvenation.

Much significant work in natural resource planning and management has been accomplished and is ongoing. In May 2013, the Governor issued an executive order directing the CWCB to develop a Colorado Water Plan.[xlii], [xliii] This planning effort is identifying future water needs as a whole and planning for how those needs will be addressed. The water plan is addressing the gap between water supply and demand, while considering drought and climate change.

> "Colorado's Water Plan offers a strategic vision for a productive economy that supports vibrant and sustainable cities, productive agriculture, a strong environment, and a robust recreational industry. It provides the strategies, policies, and actions by which Colorado can address its projected future water needs in a manner consistent with this vision. This plan will be accomplished through collaboration within basin roundtables, local governments, water providers, and other stakeholders.[xliii]"

Within the Colorado Department of Natural Resources, the CWCB supports watershed planning for stream restoration, flood mitigation, water quality protection, habitat protection, and improvement of recreation and accessibility. Watershed organizations in areas affected by the 2013 floods have prepared long-term plans to restore and protect local watersheds.

In the aftermath of the 2013 flood, cooperative and productive relationships between different agencies have increased, laying the groundwork for future coordination of resiliency strategies across sectors. Local, state, and federal resource agencies have standing programs in place to specifically deal with pre-flood mitigation and post-flood response and recovery.

In 2009, the state legislature passed a bill that requires all Colorado counties with a wildfire risk to develop a county-wide Community Wildfire Protection Plan.[xliv] These collaboratively developed plans analyze fuel hazards and risks of wildfire occurrence, in balance and consideration with community values.

Photo Credit: Denver Post

Photo Credit: Colorado Water Conservation Board, Taryn Finnessey

In 2011, the CWCB adopted statewide higher standards for floodplain management, including freeboard and added flood protection for critical facilities. The higher standards provide for increased public safety and reduced flood losses across the state. The CWCB has participated in FEMA's Cooperating Technical Partners Program since 2000 and has collaborated with FEMA to maintain updated flood hazard maps.

Section 4.6.1 Shock Impacts and Chronic Stresses – Watersheds and Natural Resources

Dramatic topography, forested mountainsides, narrow rocky canyons, and expansive plains define Colorado's geographically varied landscapes; they also create unique natural hazards. The shocks of recent severe drought, wildfires, and flooding have heightened awareness of our interdependencies with watersheds and natural resources and of our direct vulnerability to such shocks. Colorado's communities are exposed to many unique natural hazards, including flooding, erosion, landslides, and inundation. During the September 2013 flooding, more than 18,000 people were evacuated from their communities and 10 people lost their lives. Homes and some towns were isolated as a result of flood damage to roads and bridges. In numerous places, floodwaters carved new river channels and altered existing channels. Miles of high-functioning aquatic habitat were destroyed. The following spring, a massive landslide in Mesa County killed three people and destroyed irrigation and oil and gas infrastructure.

Wildfires are recurring events in Colorado. Recently, combinations of drought, forest beetle infestations, and urban growth have contributed to three of the most destructive wildfires in Colorado state history, which occurred in 2012 and 2013. After the wildfires, dramatic flash floods, debris slides, and erosion continue to disrupt commerce and infrastructure along U.S. Hwy 24 near Manitou Springs and State Hwy 14 along the Cache la Poudre River, resulting in recurring damages to homes, businesses, and the traveling public. Flood risk increases after a wildfire in mountainous terrain, when the loss of vegetation makes the soil more prone to erosion and, in some cases, water-repellant. In May 1996, the Buffalo Creek fire in Jefferson County burned an area of forested land 10 miles long and 2 miles wide. Two months later, a short-duration, high-intensity thunderstorm poured down on the burned area. Unable to soak into the ground, the runoff created vast overland flows of ash, logs, and boulders that clogged the South Platte River and some of its tributaries, destroying wildlife habitat, causing extensive damage to the village of Buffalo Creek, and taking two lives. The mud and debris that poured into nearby Strontia Springs Reservoir, which stores drinking water for Denver and Aurora, filled the reservoir to within seven percent of its capacity.[xlv] Dredging the sediment was a two-year project that cost $30 million.[xlvi]

Photo Credit: CRRO

The shocks of natural hazards are potentially compounded by mid- and long-term stresses to Colorado's watersheds and natural resources.

- Watershed protection is increasingly important as economic growth and changing land use and development practices place pressure on already scarce water resources, ecosystems, and watershed health.
- Development practices and population growth lead to incremental expansion of residential areas into agricultural and forested lands, causing paving of once-permeable land surfaces; intrusion into the wildland-urban interface; and conversion of water rights from agricultural to municipal use.
- Changing climate conditions are potentially contributing to the drought-fire-flood cycle. Climate change will bring challenges to watershed and natural resource management. Climate models predict that Colorado average temperatures will increase, causing more variable weather patterns with the possibility of warmer summer temperatures, extreme heat events, decreased spring snowpack, and earlier snowmelt.[xlvii] Inter-related issues could include increased water demands for agriculture, domestic, and commercial use; higher summer energy demands; effects on native plant and wildlife habitats; and impacts on outdoor recreation.
- Water is a heavily regulated, controlled, and monitored asset. Colorado water right laws must be used in all water-use decisions and solutions.

Section 4.6.2 Problem Statement – Watersheds and Natural Resources

The watersheds and natural resources sector identified the resiliency challenges, based on their analysis of adaptive capacity and existing strengths and weaknesses. These are described below as problem statements, and fall into the general categories of:

- Hazard identification and hazard area management.
- Flood-affected watersheds and floodplain management.
- Watersheds and natural systems, from the statewide scale down to discreet reaches of stream channel.

Watersheds & Natural Resources Sector Mission: *Approach the challenges of sustainability, adaptation, and climate change holistically to protect Colorado's natural resources, consistent with community priorities and environmental laws.*

Risk Assessment

Almost half the geographic area of the State still lacks updated floodplain mapping and much of the State lacks erosion zone and geological hazard mapping due to limited dollars and resources.

There is an urgent need for communities to map their existing floodplains in order to make informed land use decisions.

The correlation between droughts, forest health, and resilient watersheds needs to be further explored and strategies identified specific to protection of natural resources and their connection with reducing the vulnerability to known hazards.

Resources/Capacity

Staff turnover, multiple responsibilities and priorities, limited training, insufficient financial resources, lack of hands-on disaster experience, insufficient jurisdictional coordination, and inadequate understanding of recovery grants are just some of the typical challenges that become apparent when disasters strike. Support should be provided to communities to supplement and expand existing capacity as required by the specific circumstances.

Single-Focus Planning

Resiliency planning requires a multi-objective approach, incorporating social, environmental, and economic assets; public transportation and utility infrastructure; healthy stream corridors; and accessible recreational amenities. All aspects are heavily affected by the impacts of a changing climate. Land use planning and master planning decisions must be managed collectively in a triple-bottom-line (e.g., social, ecological, and financial) framework to protect these assets against natural hazards.

Often, multi-stakeholder watershed restoration and protection approaches at the local level are driven by specific issues or concerns in the watershed. This sometimes leads to multiple watershed groups or organizations operating in the watershed without cross-coordinating to maximize resources.

> Staying with and guiding his community, Big Elk Meadows, through the recovery process. Giving countless hours of his time and skill to help. Advocating for his community. Always maintains a positive outlook in the face overwhelming odds.
>
> *— Colorado Resiliency Hero Nomination*

Specifically, watershed groups that focus on water quality improvements operate by guidelines established by Clean Water Act (CWA) water quality programs. These processes and directions are often different from those of watershed organizations or local governments specifically addressing resiliency in disaster-affected areas. This reality can sometimes prevent each separate process from sharing valuable information and leveraging resources in a complementary manner.

In addition, hazards are often correlated. As an example, plans considering wildfire should also evaluate the potential for increased flooding and debris flow and the need for re-forestation as a part of public safety. Landslides and expansive soils are other geologic hazards that may be subject to single-focus planning.

Assessing Watershed Resiliency

Communities across Colorado would benefit from understanding the resiliency of the watersheds in which they live. Watershed resiliency can be measured by evaluating the health of the active river area, which includes monitoring the landscape condition, flow regimes, geomorphology, habitat, biota, and water chemistry. A healthy water assessment combines several key indicators within the watershed to help determine the level of watershed health and, thus, resiliency. Assessing the health and resiliency of watersheds across the state will help prioritize areas for resource spending and enable local entities to maintain or improve resiliency within their own watersheds.

Section 4.6.3 Strategies and Goals – Watersheds and Natural Resources

The Watersheds and Natural Resources Sector committee had both broad strategies that included educating stakeholders and providing tools to watershed groups and local governments as well as specific strategies related to floodplain and watershed planning. Watersheds and natural resources strategies are presented in Table 4-6.

Table 4-6: Watersheds and Natural Resources			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 1: Risk - Reduce risk to Colorado communities.			
Understanding risks and vulnerabilities	Strengthen the understanding of risks and vulnerabilities to communities, people, assets, and institutions. Gather and develop maps for natural hazards, including updated floodplain maps, erosion zones, wildfire risk, debris flows, and other geologic hazards and make accessible to local government and general public.	Cross-sector with Community: Gather natural hazard data and make it available to local governments and to other planning entities. Provide incentives to communities to conduct risk assessments using existing programs that are currently available.	local govt., DOLA, CDPS, CDPHE , CGS, DNR, USFS, FEMA, USGS, CASFM
Incorporate risk and vulnerability issues into planning and development decisions	Develop legislation to require State-funded comprehensive plans to include risks and vulnerabilities to natural hazards. Develop legislation to develop state minimum building codes.	Cross-sector with Community and Infrastructure: Provide State technical assistance and funding to include natural hazards as a required element in local comprehensive and emergency operations plans. Provide all-hazard plans and natural hazard elements in existing infrastructure planning. For example, in regional transportation improvement plans, ensure that higher priority is given to projects or communities that implement resiliency programs and policies.	local govt., DOLA, CDPS, CDPHE , CGS, DNR, USFS, FEMA, CDOT, Councils of Governments
High-risk land management	Create a funding source for statewide programs to encourage new approaches to development of risky areas, including mitigation of existing properties within these hazard-prone areas.	Cross-sector with Community: Examples may include conversion to open space, expansion of greenways and recreational space, transfer of development rights to exchange development in high-risk areas to areas of lower risk, easements, voluntary acquisitions, and new approaches to development and conservation.	CRRO
Goal 2: Planning - Enhance resiliency planning capacity in Colorado communities.			
Local planning	Through guidance and resources, strengthen the ability of local communities to incorporate resiliency into various programs, plans, and land use policies.	Cross-sector with Community: Incorporate resiliency into the State's various programs that support local planning (e.g., provide model regulations, comprehensive plans, technical assistance, and template documents).	DNR, DOLA, CDOT, Local Govt, FHWA, USFS, FEMA, Watershed Coalitions, CGS, CASFM, CML,
State programs	Incorporate watershed and natural resources resiliency objectives into current State programs and planning documents.	Coordinate the approach for river and stream planning at the State level and include local stakeholders (e.g., rules and regulations, policies, and technical assistance) in natural hazard planning.	DNR, CGS, CDOT, DOLA, CDPS, CDPHE, Forest Service, CGS,

Table 4-6: Watersheds and Natural Resources			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Goal 3: Policy - Develop, align, and streamline policies to empower resiliency.			
State policy	Inventory and analyze current resiliency policy.	Identify and develop methods for addressing gaps in floodplain management policy.	CRWG, DNR
Metrics	Develop metrics to evaluate progress and success, and to continue to improve resiliency planning, policies, and actions.	Develop a procedure or central database to track projects, gather data, and measure the positive and negative environmental impacts of State-funded watershed projects.	DNR, CRWG
Follow up	Require follow-up reporting on resiliency-related projects.	Identify and incorporate lessons learned from disaster recovery into a recurring resiliency framework update.	CRWG
Water conservation	Implement a holistic statewide approach for water conservation and water reuse activities by encouraging programmatic consistency from the local level up to the State level.	Provide technical and financial assistance to plan and implement long-term water efficiency strategies to meet local and statewide water needs. Coordinate and enhance land use and water planning through financial incentives, best practices, partnerships, and technical resources.	DNR, EPA, DOLA
Master plan updates	Review relevant watershed and natural resource plans and update as needed on a periodic basis.	Tie grant funding to completion of this review. For example, plans may include source water protection plans, wild fire protection plans, community wild fire protection plans, and watershed plans.	Watershed Coalitions, CRRO
Goal 4: Culture - Create a culture that fosters resiliency, instilling an inherent sense of responsibility among all.			
Stakeholder engagement	Continually engage community stakeholders to determine resiliency needs and priorities in the watersheds.	There are currently over 75 watershed groups in Colorado. This presents an opportunity to expand the current watershed-wide collaboration for flood resiliency to include all hazards. Create public-private partnerships as appropriate.	Watershed Coalitions, DNR, DOLA
Education	Identify opportunities (such as trainings and educational events) where resiliency awareness could be incorporated.	Incorporate resiliency education into existing workshops, conferences, and events on relevant topics in order to embed resiliency into best practices in that particular field.	CRRO with state agency support, CASFM, CML, UDFCD, Universities, local non-profit, GOCO strong, Community based organizations
Build relationships	Build relationships with community stakeholders to determine their resiliency needs and priorities and to help them stay informed about resiliency policies, programs, initiatives, and progress.	Identify issues that are important to key stakeholders and incorporate resiliency into the solutions.	CRRO

Table 4-6: Watersheds and Natural Resources			
Topic	**Strategy**	**Additional Information**	**Implementing Agencies**
Education	Advocate for resources, tools, and support for resiliency in Colorado, including resiliency policy and resources to empower whole community resiliency action.	Develop outreach and educational materials and practical, real-world resiliency materials. An example is slope stability information for land developers that the Colorado Geologic Survey could prepare. Use other media, including YouTube, FAQ documents, fact sheets, case studies, and presentations.	CRRO
Goal 5: Investment - Ingrain resiliency into investments in Colorado.			
Risk and resiliency funding	Incorporate risk and resiliency analysis into funding decisions, including State grant programs, and incentivize the use of resiliency in grants and funding opportunities.	Direct State investments in open space and recreational opportunities to provide improvements to watersheds and natural resource resiliency, perhaps leveraging public/private partnerships. Tie grant funding to support resiliency objectives, for example. Require periodic review of development plans.	CRWG, CDPS, DOLA, DNR, CDPHE, CDOT-every agency has their own lead role
Public/private partnerships	Establish public/private partnerships to invest in a resilient Colorado.	Extend the public/private partnership ideas presented in the Colorado Water Plan into natural hazard management and watershed health. Develop a resiliency bank for investors.	CRWG, DNR, DOLA, CML, CCI, Watershed Coalitions,
Financing tools	Develop a financing toolkit for communities to use to increase resiliency.	Examples could include providing tax incentives to purchase open space in hazard-prone areas or facilitating alternative funding mechanisms such as tax incentives, tax increment financing (TIF), and public improvement fees (PIF).	CRRO, CRWG

Photo Credit: CDPHE

Section 5:

Resiliency Roadmap – A Call to Action

This Framework, and in particular Section 5, represents the State of Colorado's commitment to a more resilient future. The Framework is informed by engagement with Coloradans, identification and analysis of risks and vulnerabilities, an examination of priorities and capabilities and, ultimately, the identification of concrete activities that are within the purview of the State to implement. Resiliency also requires participation from the whole community – federal, State, local, non-profit, private, and community members – to play their part. As such, this Framework represents a call to action and partnership and seeks to empower those with a stake in resiliency to participate in making it an ongoing priority and reality.

Section 5.1 Leadership, Roles and Responsibilities

Development of the Framework is just the beginning. Implementation requires leadership to make decisions and empower others to act. The following provides a summary of roles of each key entity responsible for implementation of the Framework.

Section 5.1.1 State's Role in Resiliency

Governor's Office and Cabinet Level Leadership: Immediately after the onset of the 2013 floods, Governor Hickenlooper made clear that Colorado would not simply recover from the floods and restore Colorado to its pre-disaster condition. Rather, Colorado would build back stronger, better - more resiliently. With the adoption of this Framework, Colorado also seeks to demonstrate that resiliency does not simply apply when a disaster occurs. It applies in the everyday business of Colorado and Colorado communities. The Framework will benefit from leadership and a continued commitment to resiliency at the highest level of state government through its adoption.

Colorado Resiliency and Recovery Office: Governor Hickenlooper established the Colorado Recovery Office (CRO) in the days after the 2013 floods to convene, coordinate, and facilitate long-term recovery activities for the State of Colorado in partnership with agencies across State government. With the adoption of this Framework, the CRO has been renamed the Colorado Resiliency and Recovery Office. Central to the CRRO mission is the incorporation of resilient practices into long-term recovery processes – current and future - wherever feasible. While critical recovery activities from the 2013 floods and 2012 and 2013 wildfires continue, the CRRO's mission has evolved to incorporate resiliency into the everyday business of the State and of communities. The CRRO will continue to chair the CRWG and, in partnership with member agencies, will set priorities, track progress, report on outcomes, and work with stakeholders throughout the State of Colorado to support resiliency activities. In particular, CRRO will:

- **Convene:** Bring together a diverse range of stakeholders from State and federal agencies, local communities, the private sector, and non-profits to collectively identify, coordinate, and implement resiliency activities.
- **Facilitate:** Create opportunities to implement resiliency strategies through education and technical assistance and leveraging of resources.
- **Communicate:** Share stories, best practices, and lessons learned and priorities, with a sense of urgency and with an eye to the long term.
- **Empower:** Inspire and enable local governments, businesses, non-profits, and community members to integrate resiliency into their daily lives and business.

Colorado Resiliency Working Group (CRWG): Adoption of the Framework formalizes the ongoing existence and role of CRWG. The decision to continue the work of the CRWG was based on public-outreach surveys that indicated local communities are looking to the State to be a resiliency advocate and on the need to provide a continued voice and center for resiliency knowledge and coordination. The direct benefits of cross-sector planning experienced during the Framework planning process further reinforced the ongoing value of the CRWG. The CRWG will be chaired by the CRRO and serve as a leadership team that oversees and coordinates resiliency activity across State agencies. Specific roles and responsibilities of the CRWG include:

- Enhancing cross-agency collaboration & communication
- Integrating resiliency into agency polices and plans
- Developing sector specific action plans
- Monitoring progress
- Identifying resources
- Educating partners and constituents

The composition of the CRWG will be reviewed by the CRRO annually to accommodate updates to the Framework and to address the priorities identified in the annual operating plan. Initially, the CRWG will comprise the Executive Director or the designated representative from each of the following agencies:

- Colorado Department of Local Affairs
- Colorado Department of Natural Resources
- Colorado Department of Public Safety
- Colorado Department of Transportation
- Colorado Department of Public Health & Environment

- Colorado Department of Human Services
- Office of Economic Development & International Trade

Subject matter experts or other specialists may be added or temporarily invited as priorities shift and targeted topics require additional expertise that is available through universities, agencies, and professionals. The CRRO will also establish an advisory committee comprising local resiliency leaders and champions to contribute input and assess progress of Framework activities.

Section 5.1.2 Role of Communities

Communities exist in many forms with an ability to greatly influence local action at the personal, government, business, and organizational levels. Each type of community has the power to effect change within their sphere of influence and beyond by providing local leadership and playing a role in the implementation of resiliency actions. Communities of all types are invited to play a role in the Framework's implementation through the following actions:

- Inform the CRWG and CRRO of local perspectives
- Provide lessons learned and examples
- Utilize the framework in the development of their own resiliency strategies
- Serve as ambassadors to expand the resiliency knowledge base

Section 5.2 Informed Implementation

The implementation of the Framework starts with the identification of priority actions. The selection of actions included in Section 5.3 was informed through three key elements in the Framework that are now utilized for implementation: the engagement process, risk and vulnerability assessment, and the expertise of the CRWG and its sector committees. Additionally, criteria have been established to further assess potential impact and assist with prioritization. Each of these areas informed the selection of initial State actions and will continue to provide guidance in the prioritization and use of resources in further implementation of the Framework and its strategies.

Section 5.2.1 Engagement

As discussed in Section 2, the engagement process for the development of this Framework utilized multiple methods to reach a broad range of Coloradans, business and community leaders, and government officials and organizations. Engagement will expand through the implementation of this framework and continue to inform the State of Colorado's resiliency efforts. Four consistent themes surfaced through the engagement process that the CRRO and CRWG will utilize as **guiding principles**. One or more of these guiding principles will be an expected outcome of all actions.

- **Expand Knowledge:** Resiliency requires a forward-thinking populace and government that moves beyond a reaction-, hazard-, or disaster-oriented cycle to one that gets out in front of event-driven actions to create systems that continuously educate, improve, and adapt to changing conditions.
- **Build Community:** Connected communities are resilient communities. Well-networked social systems that include opportunities for all populations to connect on a regular basis provide a sense of security and will benefit from collaborative action.
- **Be an Advocate:** Communities need to know the State is their partner – providing a voice for their collective needs and wearing multiple hats to create a better, more resilient future for all of Colorado.
- **Provide Flexibility:** Policies, projects, and program must be performance-driven with metrics that empower localities to adapt and apply best practices of resiliency that adjust as external forces shift and solutions evolve.

Section 5.2.2 Risk and Vulnerability

As described in Section 3, communities and individuals in Colorado are at risk from natural and man-made hazards. Actions will be informed by the understanding of risks and vulnerabilities and how those risks and vulnerabilities would impact and interact with people, property, and infrastructure. Efforts that make existing tools and data more usable, accessible and understandable will assist the public and policy- and decision-makers in making good decisions.

Section 5.2.3 Colorado Resiliency Working Group (CRWG)

As a formalized coordinating body, the CRWG will provide guidance and oversight to development, implementation, and tracking of strategies. The CRWG will establish community feedback loops and track progress to ensure actions are meeting their intended goals and outcomes.

Section 5.2.4 Resiliency Prioritization Criteria

Moving forward, resiliency can be applied in two primary contexts. First, Colorado is in the midst of recovery processes and will have future disasters to recover from. Resiliency was integrated through this experience and future emphasis will be placed on integrating and ingraining resiliency into response and recovery operations following shocks. This helps Colorado and Colorado communities to rebound as quickly as possible and build back stronger and better than before. Additionally, it is imperative that resiliency be integrated into daily business in order to proactively address shocks and stresses and to enable Colorado to further thrive amidst changing conditions. The problem statements and proposed strategies defined in Section 4 require a prioritization process that will aid all decision making. A first step in prioritization is to determine those strategies that will provide multiple benefits resulting in a higher return on the investment of human and financial capital resources. CRWG took this step by hosting two All-Sector Coordination Meetings during the Framework development process. The first was held on December 10, 2014, and brought together more than 20 different agencies for cross-sector-facilitated discussions about resiliency issues, general goals, and cross-sector integration challenges. A follow-on meeting was held February 4, 2015, to define interdependencies between sectors and identify cross-cutting strategies. During these events, facilitated group discussions resulted in a broad spectrum of potential strategies that the State can pursue to promote resiliency. These recommended strategies focused both on what the State can do directly (e.g., in its operations and capital investments) and on what the State can do to empower other actors such as local government, businesses, public/private partnerships, and households and individuals. The cross-cutting strategies that were identified are highlighted in each relevant sector strategy table provided in Section 4. This section builds on that first step taken by CRWG and provides prioritization criteria for consideration in the implementation of strategies.

State resiliency strategies and, ultimately, projects will be prioritized to ensure limited resources are leveraged for multiple, triple-bottom-line returns. Prioritization requires the application of criteria that consider critical areas of impact and are then weighted to match the local context and urgency or level of stress. With so much need, it is easy to become overwhelmed and not optimally streamline investment decisions that will touch everyone; however, a focused approach is needed to ensure that limited resources are used wisely to maximize multiple areas of return that benefit the entire community. The following criteria comprise a set of critical areas in which to utilize strategy and project prioritization. An example strategy is associated with each criterion that is drawn from the list of strategies in Section 4, and a sample project is aligned with each to demonstrate in practical terms how prioritization criteria relate to resiliency activities undertaken by the State. These criteria and associated strategies and project examples illustrate how prioritization criteria can be used to provide guidance in the selection of specific programs and projects during Framework implementation. Likewise, these criteria can help to inform local and regional resiliency efforts.

Section 5.3 Taking Action

Implementation of the Framework requires taking a collective step forward to create tangible results informed by resiliency indicators. Activities will be driven by identification and leveraging of both existing and new resources in creative and collaborative ways to gain the highest returns for all of Colorado. This section demonstrates the State's commitment to action and also provides guidance on what communities can do at the local level to integrate resiliency into every day practice.

Section 5.3.1 State Actions

The Framework will be measured in part by the number of times it is picked up and read, how wide an audience it reaches, and the actions it sets in motion. The State has committed to actions, each of which was identified as a priority based on significant need and support demonstrated through the engagement process, ability to reduce risk and vulnerability, references in the sector committee strategies, and the application of the prioritization criteria above. The following actions will be initiated by CRRO within the first year following the adoption of the Framework.

Resiliency Prioritization Criteria

Co-Benefits:

Provide solutions that address problems across multiple sectors creating maximum benefit.

Cross-sector Strategy: Develop a statewide guide and online resource on how to assess, analyze, and integrate all hazards data into local government land use planning.

Project Example: Develop model codes.

High Risk and Vulnerability:

Ensure that strategies directly address the reduction of risk to human well-being, physical infrastructure, and natural systems.

Cross-sector Strategy: Encourage local governments to develop floodplain standards that prohibit future development in flood plains through a public/private partnership between state agencies and associated private or non-profit partners.

Project Example: Create a statewide risk and vulnerability assessment tool.

Economic Benefit-Cost:

Make good financial investments that have the potential for economic benefit to the investor and the broader community both through direct and indirect returns.

Cross-sector Strategy: Incorporate risk and resiliency analyses into funding decisions, including state grant programs.

Project Example: Develop resiliency design standards and incentivize their application in projects utilizing public funds.

Social Equity:

Provide solutions that are inclusive with consideration to populations that are often most fragile and vulnerable to sudden impacts due to their continual state of stress.

Cross-sector Strategy: Promote and educate decision makers and program managers about the value of and the opportunities for using the Community Inclusion mapping project.

Project Example: Integrate Community Inclusion map analysis into planning and funding decisions.

Technical Soundness:

Identify solutions that reflect best practices that have been tested and proven to work in similar regional context.

Cross-sector Strategy: Develop guidance and share best practices to help communities plan for the potential impacts of changing risks and hazards and incorporate this information into policies and actions in comprehensive and other plans.

Project Example: Develop resiliency design and policy guides and a case study database.

Innovation:

Advance new approaches and techniques that will encourage continual improvement and advancement of best practices serving as models for others in Colorado and beyond.

Cross-sector Strategy: Explore the use of captured biogas produced in the natural wastewater treatment process from wastewater treatment plants as a continual (though limited) and emergency backup energy supply.

Project Example: Conduct research, then design and build a model plant using biogas as an alternative fuel and backup.

Adaptive Capacity:

Include flexible and adaptable measures that consider future unknowns of changing climate, economic, and social conditions.

Cross-sector Strategy: Work with local planners, residents, and builders to incorporate water and energy-efficiency measures into existing and new homes.

Project Example: Adopt performance-based energy and water building codes for all new housing, and provide labeling for all existing housing for renters and buyers.

Harmonize with Existing Activity:

Expand, enhance, or leverage work being done to build on existing efforts.

Cross-sector Strategy: Continue to engage community stakeholders to determine resiliency needs and priorities in watersheds.

Project Example: Expand on the current watershed-wide collaborative focus of 75 watershed groups to include a focus on all hazards.

Long-Term and Lasting Impact:

Create long-term gains to the community with solutions that are replicable and sustainable, creating benefit for present and future generations.

Cross-sector Strategy: Establish a new resiliency funding bank to support lapses in current funding opportunities.

Project Example: Create the Colorado Community Resiliency Partnership Fund.

Action 1: Educate and Engage

Resiliency is a topic that will require an ongoing sharing of best practices and infusion of new knowledge as markets, climate, hazards, and solutions continue to evolve. The State is committed to continuing to use the Colorado United website as a central location for posting information and engaging community feedback. More extensive education programs will also be developed in partnership with learning institutions and professional associations that have the capacity and infrastructure to create platforms for training and knowledge exchange. Lessons learned, case studies, and best practice examples will be gathered, documented, and shared through training, presentations, and online forums to expand the understanding of resiliency and the application of solutions in planning, policy, and practice. An ongoing dialog with the public through forums, online tools, and advisory panels will also be utilized to gather on-the-ground experiences and the real-life issues facing Coloradans that will be continuously factored into resiliency strategies and solutions.

Action 2: Risk and Vulnerability Assessment Tools

Being informed about future risk and vulnerabilities is instrumental to planning for growth and reducing the damage caused by future disasters. Over the next two years, the State will create a geospatially based tool that identifies hazards, critical assets, and demographic trends. The tool and underlying data will be made available to local jurisdictions to support risk management and development decisions. CRRO will work with technical experts to design the tool so that it is useful and user friendly to local hazard mitigation and land-use planning staff and is compatible with the data and outputs contained in the Community Inclusion maps.

Action 3: Local Resiliency Strategies

No single community has all the resources they need to create a resilient future. The State can build strong connections across communities by sharing best practices and supporting local resiliency strategies; the Framework provides a starting point for these local strategies. CRRO will provide a toolkit and resources for local resiliency planning processes. The toolkit will include local and nationwide best practices, a risk assessment tool, and the four to five communities most impacted by recent disasters to implement a pilot resiliency strategy development process. The pilot will be offered to areas with the highest level of need and a proven capacity to manage the process and its outcomes. The intent will be to learn from the pilot experience and then create a model process and toolkit that will, over time, be utilized by all localities across the state to develop local resiliency strategies. The initial pilot process will pave the way for the development of resiliency strategies throughout Colorado.

Action 4: Colorado Community Resiliency Partnership Fund

Resiliency solutions are not one-size-fits-all. Colorado must maintain flexibility and adaptability to reflect the changing needs and unique character of its many communities. In order to create this flexibility, the State of Colorado has committed to create a Colorado Community Resiliency Partnership Fund (Fund). The Fund, which will initially be seeded with $1 million in Community Development Block Grant – Disaster Recovery funds, will be used to finance innovative resiliency projects that support the five goals of the Resiliency Framework presented in Section 4 in the coming years.

Action 5: Mapping and Land Use Tools

Recovery and resiliency begins and ends locally. The State can play an important role in informing and supporting local priorities through the development of tools and resources to advance local best practices. Currently the State is moving forward with two such initiatives, the development of model ordinances and land use code language and tools that integrate potential hazards (e.g., flood, wildfire, geologic). Additionally, the State is committed to the implementation of Senate Bill 245 (SB 245), which provides funding for updating floodplain maps in areas impacted by the 2013 floods as well as for the development of methodologies and maps for erosion zones. SB 245 will be implemented starting in July 2015 and will be completed within three years.

Action 6: Statewide Resiliency Indicators

The CRRO and CRWG are developing a set of statewide and local indicators to assess progress in Colorado. The statewide resiliency indicator list will be further refined by integrating the sector-specific indicators identified by the CRWG sector committees. A baseline indicator report will be issued along with the first annual report on resiliency activities.

Action 7: Prepare an Annual Operating Plan Resiliency Report

The strategies identified in this Framework provide a roadmap for the CRRO's and CRWG's operating plans for future years. The CRRO will review these strategies with CRWG and prepare one-year and five-year operating plans upon Framework adoption. The process for selecting these operating plan strategies includes further refinement and identification of responsible parties and measures to evaluate success, development of a community resiliency scorecard, prioritization based on cross-sector benefits and other criteria above, and the timeframe to implement. Upon adoption of the Framework, the CRRO will convene the CRWG and review the planning process and Framework components and agree to a process and timeframe for the update cycle. In addition to the scheduled update, any major disaster will trigger an automatic review of the Framework within one year. Finally, the CRRO and CRWG will be responsible for an annual report describing the outcomes of the Framework and other State resiliency activities.

Action 8: Develop and Refine Resiliency Metrics

Utilizing statewide resiliency indicators, a baseline dataset of metrics will be collected to determine where Colorado is now and then use this data to set targets for where Colorado would like to be in five, ten, or 20 years. Understanding the current condition and defining the desired future state in a quantitative manner allows for the continual evaluation of progress and determination of whether programs are having the intended impact. A small set of key indicators with associated metrics that are manageable to collect and have a meaningful relationship to community values will provide the State with a clear method for monitoring progress and making adjustments, as needed, to meet the targeted future state.

> Watching Mary and her family have their home devastated in Lyons was troubling, but also inspiring. They pulled together with their friends, family and neighbors. They cleaned up, rebuilt, got the kids back in school and got back to business. It was a great show of resiliency in action!
>
> *— Colorado Resiliency Hero Nomination*

Section 5.3.2 Actions Communities Can Take

State actions alone will not create a resilient Colorado. The Framework is intended to serve as a mechanism that will empower communities to take actions that will create safe, healthy, and thriving places for their residents and businesses. Priority actions that communities can take to expand the impact of the Framework include:

- Plan and coordinate regionally
- Dedicate staff to resiliency
- Engage leadership
- Develop local resiliency strategies
- Prioritize and implement projects
- Invest in resiliency
- Evaluate and update local land use practices and codes
- Educate and engage organizations and community members
- Establish new or support existing networks
- Establish peer to peer relationships

Section 5.3.3 Leveraging Other Resources

Actionable plans identify and leverage a range of resources to make the vision a reality. Implementation requires the creation of a portfolio of resources that is appropriately leveraged to realize the high possible returns from human, natural, and financial capital. Financial capital includes private investment and public sources through loans or grant programs. Human capital comes in the form of community volunteers and individuals and paid staff. All human resources are finite and need to be carefully invested in the right strategies and projects. Natural capital in Colorado is an investment that also has limited carrying capacity. Whether it is demands on fresh water supplies or tree roots, nature's role in creating solutions should also be considered as capital that is precious and to be used efficiently.

There is a multitude of potential partners that reflect a network of agencies and organizations with resources of all kinds to be leveraged with enhanced collaboration. State and community actions listed above along with the sector strategies in Section 4 suggest the need for joint efforts to remove barriers and develop solutions. Appendix E provides a complete summary of all entities identified by CRWG and subsector committees

that play a role in resiliency. The Framework also identifies a broad range of partners from the whole of community that are essential to its success. Many entities are active in several sectors and vary in their role, as is illustrated in the table. The implementation of strategies should leverage these players and identify areas of efficiency and ability to serve multiple purposes.

Section 5.4 Defining and Measuring Success

The Framework sets in motion a series of actions that will move Colorado toward a more resilient future. Through the engagement process, several success indicators were defined that create a picture of what the State will strive to accomplish through the Framework, its strategies, and actions. This is what success will look like in five years.

Success Indicators

- Model projects are built and replicated by others.
- Resiliency is incorporated into local plans and resiliency officers are on local government staffs.
- Long-term local and state budgets incorporate resiliency investments.
- The Colorado Resiliency Partnership Fund is established and functioning.
- Neighborhoods and networks utilize resiliency practices.
- Regional economic blueprints include a hazard and vulnerability assessment.
- Risk and vulnerability mapping, community inclusion mapping, and model land use codes are adopted and utilized by communities.
- Transportation and watersheds plan and design together and repair jointly.
- Design and implementation of natural and built systems is integrated.
- Impacted residents and businesses are able to continue to live and operate in their communities after a disaster event.
- Colorado is a national model for statewide resiliency.

Section 5.5 Adaptive Management

The Framework and its implementing entities must build in flexibility that allows for unanticipated change and leveraging of new opportunities. The application of feedback loops will create a system of continuous improvement and evolution of strategies and actions. Feedback loops will be created through continued engagement with community partners, the application of ongoing education, and outreach methods. This ongoing commitment to adaptive management practices will ensure that the Framework does not become stagnant or obsolete but, rather, is in a constant state of seeking integration, best practices, and advancing knowledge that will place Colorado at the forefront of resiliency planning and implementation.

Section 5.6 Recommendations for Future Consideration

This is Colorado's FIRST resiliency framework and the first of its kind in the nation. Creating a template and moving forward with action is a critical step that should not be encumbered by seeking perfection. It is acknowledged that many ideas and adjustments will continue to surface as the commitment to transparency and engagement remains a priority for the CRRO and CRWG. The peer review and public comment process leading up to the finalization and adoption of the Framework surfaced many more ideas than could be incorporated in this first Framework. These inputs are valued and documented in Appendix C and will be referenced for the next update and in the development of the Year One operation plan.

Section 5.7 Conclusion

The State seeks to use the Colorado Resiliency Framework and its associated public engagement processes as a catalyst for institutional change at the state and local levels. Working together, Colorado's planning processes and tools will be leveraged along with the Fund to empower communities and facilitate an investment in long-term, systemic solutions for a resilient Colorado.

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Photo Credit: CRRO

Photo Credit: CRRO

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Appendix A:

Acknowledgements

The Colorado Resiliency Framework is the result of collective commitment, dedication, perseverance and hard work across multiple organizations, jurisdictions and communities. It takes courage to initiate a plan that has not been done before and is the first of its kind in the nation. Through this collaborative effort, Colorado has placed a stake in the ground declaring its commitment to a resilient Colorado. The Framework could not have been possible without the leadership of the Colorado Resiliency Working Group and the Colorado Resiliency and Recovery Office, the hard work and dedication of the Colorado Resiliency Framework Sector working groups, the expertise garnered from the Peer Review or the facilitation and collaboration of the extended project team.

Special thanks and recognition go to:

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Ecology and Environment, Inc.: Janet Brick, Julie Chang, Daniel Costantino, Amy DiCarlantonio, Rebecca Flora, John Jankousky, Eric Lenderman, Kevin Magner, Jon McClurg, Richard Morse, Susan Nordstrom, Scott Severs, Michael Wironen

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Appendix B:

Abbreviations and Acronyms

ACEC	American Council of Engineering Companies
APA	American Planning Association
B/C	Benefit Cost
BIA	United States Bureau of Indian Affairs
BLM	United States Bureau of Land Management
BRACE	Building Resiliency Against Climate Effects
APWA	American Public Works Association
CAF	Colorado Association of Funders
Campaign	I/We are Resilient Campaign
CASFM	Colorado Association of Stormwater and Floodplain Managers
CCA	Colorado Contractors Association
CCI	Colorado Counties
CCCS	Colorado Community College System
CDC	Centers for Disease Control
CDE	Colorado Department of Education - Colorado State Library
CDFI	Community Development Financial Institutions
CDOA	Colorado Department of Agriculture
CDOT	Colorado Department of Transportation
CDE	Colorado Department of Education
CDHS	Colorado Department of Human Services
CDLE	Colorado Department of Labor and Employment
CDPHE	Colorado Department of Public Health and Environment
CERT	Community Emergency Response Teams
CEO	Colorado Energy Office
CEPP	Colorado Emergency Preparedness Partnership
CGS	Colorado Geologic Survey
CHFA	Colorado Housing and Finance Authority
CIRES	Cooperative Institute for Research in Environmental Sciences
CML	Colorado Municipal League
CO DHSEM	Colorado Division of Homeland Security and Emergency Management
COG	Continuation of Governance
Colorado 211	Colorado Call-in help center
COOP	Continuation of Operations plans
CO VOAD	Colorado Voluntary Organizations Active in Disaster
CPW	Colorado Parks and Wildlife
CRDC	Colorado Rural Development Council
CRO	Colorado Recovery Office
CRRO	Colorado Resiliency and Recovery Office
CRP	Colorado Resiliency Project
CRS	Community Rating System
CRWG	Colorado Resiliency Working Group

CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
CWDC	Colorado Workforce Development Council
DHS	U.S. Department of Homeland Security
DLG	Colorado Division of Local Government
DNR	Colorado Department of Natural Resources
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DOLA	Colorado Department of Local Affairs
DOT	Colorado Department of Transportation
DRC	Disaster Recovery Center
DWR	Colorado Division of Water Resources
EAP	Employee Assistance Program
EDA	Colorado Economic Development Administration
EHP	Environmental Planning and Historic Preservation
EM	Emergency Management
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EPHT	Environmental Public Health Tracking
EPS	Economic Profile System
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FDIC	Federal Deposit Insurance Corporation
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
Framework	Colorado Resiliency Framework
FTA	Federal Transit Administration
Fund	Colorado Community Resiliency Partnership Fund
GDP	Gross Domestic Product
GED	General Educational Development
GIS	Geographic Information System
GOCO	Great Outdoors Colorado
H & S	Health and Safety
HDT	Human Dimensions Toolkit
HED	Colorado Department of Higher Education
HERS	Home Energy Rating System
HHS	U.S. Department of Health and Human Services
HR	Human Resources
HUC	Hydrologic Unit Code
HUD	U.S. Department of Housing and Urban Development
ICC	Colorado Chapter of the International Code Council

IECC	International Energy Conservation Code
IEDC	International Economic Development Council
LTRG	Long-Term Recovery Group
MPO	Metropolitan Planning Organization
MW	Megawatt
NCA	National Climate Assessment
NFIP	National Flood Insurance Program
NGO	Non-governmental Organization
NHMP	Natural Hazards Mitigation Plan
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NDRC	National Disaster Resiliency Competition
NREL	National Renewable Energy Laboratory
NVOAD	National Voluntary Organizations Active in Disaster
OEDIT	Colorado Office of Economic Development and International Trade
OEM	Colorado Emergency Management
OEPR	Colorado Office of Emergency Preparedness and Response
OIT	Colorado Governor's Office of Information Technology
PIF	Public Improvement Fees
PTAC	Colorado Procurement Technical Assistance Center
PUC	Colorado Public Utilities Commission
RE/EE	Renewable Energy/Energy Efficiencies
RLF	Revolving Loan Fund
RMLUI	Rocky Mountain Land Institute, Denver University
RTD	Regional Transportation District
SBA	Small Business Administration
SBDC	Small Business Development Center
SDA	Colorado Special District Association
SHPO	State Historic Preservation Office
SOVI	Social Vulnerability Index
TIF	Tax Increment Financing
UCD	University of Colorado – Denver
UDFCD	Urban Drainage and Flood Control District
ULI	Urban Land Institute
USACE	U.S. Army Corp of Engineers
USDA	U.S. Department of Agriculture
USDA - RD	U.S. Department of Agriculture - Rural Development
USFS	U.S. Forest Service
USGS	United States Geological Survey
VA	U.S. Department of Veterans Affairs

VBEOC	Virtual Business Emergency Operations Center
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children
WUI	Wildland Urban Interface

Photo Credit: Denver Housing Authority

Appendix C:

Peer Review and Public Comment

Peer Review Meeting Summary
April 15, 2015

An intensive, day-long peer review meeting was convened by the Colorado Resiliency and Recovery Office (CRRO) to provide objective feedback on the draft Colorado Resiliency Framework (Framework) from a diverse cross-section of 24 participants from 20 organizations representing government, non-government and private sector perspectives. A majority of the participants had not been engaged in the process to-date. The peer review meeting included presentation and direct dialog on each section of the plan and a breakout segment on how the Framework would be applied by State and other agencies and groups after adoption.

The Peer Group was generally very positive about the Framework and applauded the CRRO's effort. However, they were specifically asked to bring a critical eye to the draft Framework which is reflected in the constructive feedback that was provided with the intent of further enhancing the final product and its implementation. The feedback provided by the Peer Review Group was highly valued and resulted in revisions to content and structure prior to release of the draft Framework for public comment on April 23, 2015. These high level revisions included:

- Strengthened the introduction by clarifying the intent of the Framework to both present guiding principles on resiliency for the State and specific strategies for the State and local communities to implement.
- Expanded the discussion of risk to make clear that the Framework addresses all hazards both natural and man-made
- Clarified the connections between vulnerability and risk in Section 3.
- Modified the discussion around acute shocks and chronic stresses.
- Included a description of the interconnectedness of each Framework sector and the need to think of systems holistically.
- Filled gaps and strengthened Section 4, Resiliency Sectors in coordination with the Sector Committees that met concurrently the week of April 13th to finalize each sector section.
- Consolidated and expanded Sections 5 and 6 to provide a clear path forward.
- Developed a series of success indicators resulting from the peer review
- Incorporated the concept of adaptive management as a way to manage resiliency planning moving forward.

The following reflects a few common themes heard throughout the day from the group:

- Include a purpose statement in the beginning
- Define the audience
- Emphasize cross-cutting strategies
- Observe that the document is heavily disaster focused
- Improve the linkage between strategies/vulnerabilities/risk/problem statements
- Clarify and further define shocks and stresses
- Emphasize the need for a culture shift
- Reflect the community need for a "safety net" – financial and social
- Share lessons learned
- Formalize network(s) for coordination and communication
- Identified need for data collection and management
- State why resiliency is being advanced
- Add CO Resiliency Project brochure graphic(s) to the front of document

A more detailed summary is provided below for each segment of the Peer Review meeting. Comments have been synthesized where possible into key concepts and edited for clarity. All comments were documented and carefully considered in the revisions to the draft Framework prior to release for public comment. Many of the comments are related to the operating plan that will be prepared following Framework adoption or will provide important direction in the development of the next version of the Framework during future updates. The CRRO greatly appreciates the time and knowledge given to this effort by the participants.

Section 1: Introduction

Colorado Resiliency Framework

The Framework was presented as just the beginning of the Resiliency efforts in Colorado and not intended to be a comprehensive operations plan detailing everything that needs to be accomplished. The intent of the framework is aimed at accomplishing a culture of resilience throughout the state of Colorado as well as to empower communities with the guidance to embed resilience into their local plans and policies. Overall, the Framework focuses on creating a THRIVING Colorado.

Section 2: The Planning and Engagement Process

Colorado Resiliency Project – Purpose and Process

Background information was provided to the peer review group on the development of the Colorado Resiliency Working Group, NDRC application, the resiliency public engagement campaign and local focus groups. It was also discussed how this process has been both bottom up and top down confirming the framework's importance and capacity to be flexible throughout all levels of the state.

Section 3: Risk and Vulnerability

The full group observed a few key areas in this section that are summarized below. Actual comments have been synthesized and edited for clarity.

- Perceptions of risk are very different:
  - How people perceive them?
  - How they are feeling when looking at the data?
  - What are they basing risk on?
- Linkage of risks to impacts are needed within this section:
  - Can risk be quantified in regards to each section? (E.g. what is the impact of a flood to the Economic sector/impact of a wildfire to infrastructure?)
  - Ensure a true connection between strategies and vulnerabilities
  - Ensure risks are forward looking
- Lacks information on how Colorado's risks relate to adjacent states. e.g., water issues with other states and how it relates
- There are four categories of disasters: The risk section only addresses natural:
  - Natural (Expand drought understanding; ensure root causes are also taken into consideration i.e. unhealthy forests; social disjunction with water shortage)
  - Political (Civil Unrest, War)
  - Economic
  - Technological

- Consider man-made disasters, i.e. oil/gas/forestry and engage them in discussions surrounding this plan
- Section is not very consumable for local communities as written
  - May need a separate document for residents
  - Need an executive summary to assist local government in conveying plan/framework to local communities (written in the risk and vulnerability section)
  - Lacks a strong case for the ultimate impact and the consequences of those impacts to communities
- Key question that need to be addressed: How do vulnerabilities translate to impacts on communities?
- Take away from the section should be that "resiliency is an investment"
  - Show how knowledge of risks and vulnerabilities drive local investment in resiliency
- In regards to wildfire risk: Insect outbreaks have been shown NOT to be correlated. "Area burned in W. US is unaffected by recent Murray Darling Basin(MDB) infestation" (Hart et al., 2015) PHAS
- Shocks and Stresses
  - Stresses can exacerbate shocks and shocks create and exacerbate stresses
  - Stresses are listed as things that exacerbate shocks, and not as issues in themselves. (Declining education funding, dependence on boom and bust industries, increased temperature, effects on agriculture all have effects on their own independent of sudden shocks.)
  - Link stresses to risks - provide examples of shocks and stresses within this section
  - Relate to health world – make readable and understandable to policy makers and communities
- Source information would help improve the validity of the documents.
- The background science is not adequately cited and a major resource is not mentioned: "Colorado Climate Change Vulnerability Study" –Western Water Assessment commissioned by CO Energy Office in accordance with HB13-1293
- Front Range is heavily represented – Suggest including a few more examples from mountain region and western slope.
  - e.g. Beetle kill a result from winds near steamboat impacted entire western part of state and Wyoming.
- Lack of Climate variability/risk information to inform local planning is noted. The State can address that gap through additional analysis of climate risks on a regional basis way better and more efficiently than local government action on their own. (Cross-cutting issues impact across sectors)
- Climate – risk to vegetation sustainability – should this be further emphasized in the Framework?
- Section 3.2.3: Impacts of climate change on water supplies… paragraph
  - Use "increase risk of" in place of "affect" flooding.
  - Need to mention loss of snowpack as a key water supply reservoir has increased vulnerability
  - Need to consider/address timing, availabilities, quantity, and quality of water supply
- Section 3.3.2: Third Paragraph repeats "Dust Bowl" example from earlier in the section. Delete.
- Figures and Graphics:
  - Figure 3-2, ask FEMA or NREL GIS departments for assistance if the state doesn't have the capacity to develop this image.
  - Figure 3-7 arrives at a urban heat island issue but it is not mentioned in the text
  - Figures 3-9 and 3-10 need discussion and integration into the section
  - There is no description of social resiliency (Figure 3-10)
  - Need an additional figure (3-11) to capture "Environmental Resiliency"

Section 4: Resiliency Sectors and Adaptive Capacity – Review & Discussion

An overview presentation was provided on Section 4 to the full group and then two breakout groups were formed to allow for more in-depth discussions on 3 sector areas per group. Each group of 10-15 people was provided with a facilitator and recorder. The following provides a summary of comments from each group that has been edited to provide clarity and consistency.

Group 1: Economic, Infrastructure, Watershed & Natural Resources

Section 4.2 - Economic

- State and local government's key role is to support economic resiliency through developing and maintaining the public infrastructure in a resilient manner
- Provide more detail and link economics to all sectors
- Economic strategies are primarily directed towards recovery
- Define the role of state and local government
- Provide grants to rural areas to mitigate and/or assess annual drought patterns

Section 4.5 - Infrastructure

- Focus on resilient design standards and incorporate green infrastructure criteria
- Is there a standard of the optimal level/amount of infrastructure needed?
- Implementing agencies for infrastructure should include local, municipal government & special districts
- Clarify education efforts and needs of implementing agencies responsible for response to disaster or resiliency
- Incorporate the need for electric and gas redundancies and determine the level needed to maintain systems and allow for growth (note: All utilities are required to prepare and implement vulnerability assessments post 9-11)
- Cost-avoidance was not addressed as a key resilient element in maintaining infrastructure
- How can the Framework help current conditions? Determine what is needed to sustain and determine cost to rebuild to current conditions
- Broaden definition of resiliency in infrastructure
- Oil and gas industry impact on infrastructure is not mentioned
- Lack of clarity on what the table within the Infrastructure section is trying to achieve. What are the goals, outcomes, objectives? How will this be operationalized?
- Success story: City of Fort Collins – water infrastructure interactions between different sectors

Section 4.6 Watershed & Natural Resources

- Define relationships between implementing agencies. How do they interact?
- Long-term resiliency can conflict with immediate impact/needs.
- Include a strategy to integrate and influence watershed protection plans and strategies at federal level, esp. in CO where federal agencies own and manage huge areas of the state
- Provide graph of fed/state ownership (ex: federal land, state land, etc.)
- Include wildfire risk assessment to natural resources and critical infrastructure
- Link problem statements to benefit

- What are the stresses (short and long-term) that can exacerbate the shocks of hazard events (not just disasters)?
- Lack of integration between water areas – resiliency in isolation and overall growth of the state – could be digging a deeper whole for the future

Group 2: Community, Health & Social, Housing (Rebecca)

Section 4.1 - Community

- Provide staff liaisons from granting agencies and "Community to Community Ambassador" type program for communities with limited resources;
- Leverage relationships and expertise by utilizing surrounding county staff
- Consider neighborhood vulnerability – fragility issues, resources, preparedness plans
- Include in the Community section (or elsewhere in the document):
  - Cultural differences
  - Unique interconnectedness of communities
  - Define community
- What is a "statewide guide/resource"?
  - Localized guides would be most valuable
  - Who will maintain these?
- Consider new strategy – Communications strategy
  - Urban vs rural – incorporated vs unincorporated
  - Age differences

Section 4.3 - Health & Social

- Include existing governance structures (comp plans, zoning, etc.) that determine land use
- Hazard appropriate codes have a cost that may be a heavy financial burden
- Section is narrowly focused – very heavy on behavioral health
- Safety nets within community should be discussed (considering financial and social)
- Where are the existing strengths regarding local social service agencies?
- Not enough focus on NGOs, VOADs capabilities and opportunities
- Document has a very specific focus on low-income – balance this with other moderate and middle income needs
- Undocumented populations not mentioned
- Volunteerism is not mentioned
- Engaging educational institution – consider all levels – primary through higher education

Section 4.4 - Housing

- Interface between homeowners vs mortgage vs insurance
  - Need insurance education
  - Guidance on replacement housing plan
  - State advocacy for insurance, finance, permitting intersection
- Provide a clearer picture of housing

  - Affordable housing is not the same thing as housing affordability – very different causes, issues and solutions
  - Rebuilding housing is different from temporary housing – regulations on rebuilding are essential.
  - Incorporate market aspects into Housing section
- Educate public about the process of receiving government assistance
- HUD suggested to ensure the housing builders, contractors and mortgage industry was engaged
- Housing strategy – expand beyond identifying temporary housing options to offering some incentive/s (i.e. tax credit) to those that help or "don't take advantage" of the disaster (e.g. raising rent, being flexible)
- Political buy-in differs when considering energy diversity and efficiency
- Lack of consistency exists in the Federal Registry making it hard to prepare applications since criteria is always different

Section 5: State Implementation

Implementation of the Framework was presented in regards to the prioritization methods that could be used for the tremendous amount of strategies and how to leverage additional resources.

Section 6: Putting the Framework to Work

The State's initial action items that have stemmed from the resiliency were presented as:

- Local Resiliency Plans
- Risk and Vulnerability Assessment Tool
- Community Resiliency Partnership Fund
- CRWG – Governance

Framework Implementation (Groups consolidated)

Following a presentation of Sections 5 and 6 related to Framework implementation, two new breakout groups were formed to facilitate a deeper discussion on how to best leverage the Framework and create impact. Each group discussion followed a similar facilitation approach and a consolidated summary is provided below with edits made for clarity and consistency.

Evaluation - What Does Success Look Like: *The breakout groups were asked, "What would indicate success as the Framework is implemented?"*

- More Resiliency Managers – not just Recovery Managers
- Case studies with local jurisdictions that have resiliency plans
- 6 year budget reflects elements of resiliency
- Cost benefits are assessed and understood
- Resiliency is "household language"
- Resiliency is part of strategic plans across multiple organizations and agencies
- Programs are implemented and projects created
- Modules in schools – courses and service learning projects
- Local funding is available
- Examples of neighborhoods using resiliency system – define a resilient community
- Governor's award for most resilient town, county, leadership, etc.
- Other states adopting CO model of best practices

- Technology – Resiliency Apps exist and are being used
- Provide Resiliency Plan training
- Identify metrics and measure success, i.e., 95% retention during an event and building functionality
- Create highly visible projects and initiatives that stimulate culture change and advance public understanding of the importance of investment
- Demonstrate government buy-in
- Create long-term monitoring mechanisms
- Evaluate and re-evaluate the structure
- Improved communication
  - e.g. Breaking down barriers between response and recovery agencies
- The State has $320m in CDBG-DR funds. What are the metrics for measuring successful implementation?
  - A database to track projects, funds, and impact for reporting, as well as serving as examples of what works well and serve as a feedback loop to learn valuable lessons.
- Success can be measured by increase/decrease in operations and maintenance budget as opposed to changes in capital budget
- Improved social/economic statistics in lower income neighborhoods (rates of heart attack, homicide, obesity, etc.)
- Preparedness Guides
  - More detailed plans drawn to neighborhood level
  - Business preparedness planning
  - Funding for volunteer fire departments to engage rural residents
  - Recovery planning
- Build on understanding of resilience principles into all existing planning processes through training, set criteria, technical assistance.
- For indicators, build in adaptive management indicators like relationships we want to build, things we want to learn and when, and who needs to be included, etc. Utilize Adaptive management.
  - Learning moments
  - Inclusions
  - Relationships
  - Adaptability

Overall Tone & Intent: *The breakout groups were asked to assess whether they felt the Framework would inspire and empower local action? Will it inform and motivate decision makers? Does it strike a balance of identifying real problems while considering future action and what a resilient Colorado could look like? Does the Framework meet its mission?*

- Strategies seem to be misplaced, what are the expected outcome and goals?
- Tie to risks throughout the document
- Hazard and vulnerability are not the same thing
- It gets you thinking!
- Establishes shared strategies
- Provides a feedback loop
- Reiterates the importance of incorporating resiliency into common practice

- Creates a system (framework)
- Gets people/companies thinking about what's necessary – creates reality check
- Gets the private sector thinking about how the resiliency framework affects them? What are the financial benefits?
- "The Framework frames the narrative"
- No one is afraid of the word "resiliency" – bi-partisan, something in it for everyone
- Reiterative individual resiliency responsibilities
  - Vertical integration
  - Preparedness
- Shifts setbacks/challenges to opportunities (cultural shift)
- Creates deliverables to give space for process
- Remove and call out overlapping strategies across sectors…needs to be a starting point for the state
- What does it take to get from the definition of resilience to actual resilience? Need broader thinking at the intro of each section
- Use best practices/examples of resilient action throughout, e.g., acquire property in hazard areas
- Need to work at a landscape level – need to streamline organization/jurisdictions
- The Framework helps inform upward (Feds)
- Report structure is unclear. Suggestion:
  - Problem – Vulnerability to hazards (e.g., what are they? How do they limit resilience?)
  - Strategy - Identify why particular vulnerabilities diminish resilience, identify opportunities to build
  - Outcomes - Benefit provided to state and/or communities as a result of strategy implementation (provide examples)
- When "selling" resiliency, we should acknowledge that it needs to speak to potential disasters but also that it improves life today
- How is this going to get from the government to communities?
- The document displays great leadership within the State

Gaps or Barriers: *The breakout groups were asked if there was anything of significance missing that should be considered in this Framework plan, or future framework updates.*

- Need to take into consideration that some communities may never see a shock but will have consistent stresses that weigh on their community
- An evaluation tool is needed for the local level
- Provide a Call-to-Action statement
- Needs a visual, a mind-map to show interrelations/ interconnectedness of issues/cross sector strategies in summary
- Reorient community and health & social – rename community to governance
- Barrier – continuity (how to assure it will last through political changes)
- There needs to be a convener in the State
- Transparency on rollout
- Communication importance to local communities to gain acceptance

- Bipartisan challenges
- Ensure all regions and municipalities, and NGO partners are engaged
- There has been limited private sector engagement – banks, builders, etc.
- Needs to be a Plan B, what happens if state leadership and direction changes? e.g., Implement at the local level and create grassroots support
- A chart or graphic, such as the one in the CRP brochure, would help understand how to choose between two policies or projects – which one would build more resilience? Or, use the list in 4.1, local policies, good governance, social connectivity, emergency preparedness, flexibility, diversification
- Being structured by sector, the framework is in danger of losing much of the silo-busting sentiment that went into it. The final version could have a section on strategies that cut across
- What is the state's intermediary role?
- Ensure social equity – public engagement throughout the process

Priorities: *The breakout groups were asked what a priority was to them as their respective agency representatives.*

- Projects that touch on more than one sector should be considered a priority
- Create a "State Resiliency Day" to show importance and involve politicians, schools, and whole community.
- Disaster preparedness activities/dust plans off the shelf
- Strategies need to be in harmony with existing efforts/plans
- Emphasize future cost avoidance
- Mapping Tool – great as the first action listed in section 6, in regards to the identified issues
  - Clarify the type of vulnerabilities that will be identified
  - Inventory as well as identify gaps
- Data collection needs to be a strategy - show importance of data collection both pre- and post- disaster. (Engage VisionLink **-** helps nonprofits and government organizations work together on a single software system, the Community Operating System® or CommunityOS®.– Boulder based company)
- Provide flexibility regarding projects
- Mitigation priorities and projects
- Clear process, road map to follow of what we need to do to access support
- Clear about engaging communities in planning
- Clear to pilots ability to include lessons learned
- Allow for local customization
- Strong launch of pilots –Create Champions
- State agency buy-in
- Broader definition of resiliency
- Diversify participation

Leveraging: *The breakout group was asked to consider existing opportunities that could be leveraged to inform and engage Coloradoans about the Resiliency Framework.*

- Have standing meeting – formalize informal networks
- Utilize existing networks to message resiliency, obtain buy-in and to implement strategies.
  - BoCo – turning lessons learned into actions
  - Public-private partnerships

  - Private sector: return on investment, foundations, banking community reinvestment act, smaller or mid-level backs-tie back to participation
  - Intermountain alliance groups
- Resiliency vs recovery - > shift to longer range thinking
- Ensure elected officials are informed and resiliency remains a topic of advocacy.
- Deploy a team that has "been there" to help communities plan and recover
- Develop county resiliency plans in support of CDBG_DR funded projects complimentary to the Framework
- Continue (and if possible expand) Colorado Recovery Office!!

Closing Comments

- Formalize Peer/Focus Groups to help implement the framework
- Appreciate speed of the process
- Include Economic Risks to Risks and Vulnerability Section to be more comprehensive
- Build Resiliency into Recovery
- Resiliency efforts can combat community complacency/burnout after disaster
- Very timely and a great start!
- Participants should bring this back to the local community
- Peer Review was a great way to include local groups
- Colorado is a leader among states
- The potential is huge
- There is a disconnect with the western slope
- This is just the start of the conversation

Next step – Development of operational coordination plan for the implementation of the Framework

Public Comment Summary
April 24 - May 12, 2015

Summary

The Colorado Resiliency Framework was released for public comment from April 24 – May 12, 2015. Comments received through the public comment period included;

- The discussion of wildfire and potential triggers through relative humidity
- The need to incorporate people with access and functional needs into resiliency planning
- Colorado's unique and diverse engineering environments

Comments were assembled and changes made to better describe the factors leading to wildfire. Strategies in the Housing and Health and Social Sector include a discussion of people with access and functional needs and the description of Infrastructure in Section 4 was enhanced to express the unique engineering environment in Colorado.

Photo Credit: Denver Housing Authority

Photo Credit: CRRO

Appendix D:

Infrastructure Statistics

Critical Infrastructure and Key Resources	
System	**Description**
Transportation	
Roads	■ 23,021 lane miles Statewide *excluding* county and city roads – Interstate: 4142 miles – Principal Arterial Freeways and expressways: 1373 – Principal Arterial (other): 8051 – Minor Arterial: 6358 – Major Collector: 2816 – Minor Collector: 240 – Local: 43 ■ 8,628 bridges – On System: 3,611 – Off System: 5,017 – Backlog of $875 million per year over the next 25 years
Bus	■ The State maintained 125 bus routes with more than 10,000 bus stops across eight counties in the Denver metro area
Transit	■ Existing: RTD's six light rail lines stop at 46 stations ■ In Development: FasTrack is Colorado's voter-approved expansion program – the largest in the Nation – transforming transportation through the Denver Metro Area. This includes: – 122 miles of new rail service – 18 miles of bus rapid transit – 57 new stations – 31 new Park-N-Rides – 21,000 new parking stations – Redevelopment of historic Union Station
Airports	■ Commercial Service – Primary Airports: 9 airports with 27,143,000 passenger boardings (enplanements) in 2013 ■ Commercial Service – Non-Primary Airports: 9 ■ Military Airports: 3 ■ Reliever Airports: 4 ■ General Aviation Airports: 31 ■ Other Public Airports: 25 ■ Notable Private Use Airport: 1
Freight Rail	■ Colorado has 3,041.84 miles of freight rail line ■ More than 90% of the coal BNSF hauls comes from the Powder River Basin in Wyoming and Montana ■ Lines: Atchison, Topka & SantaFe, Burlington Northern & Santa Fe, Colorado Kansas & Pacific, Cumbres and Toltec Scenic, Denver and Rio Grande Western, Denver Rock Island Railroad, Durango & Silverton Narrow Gauge, Great Western, Kansas and Oklahoma Railroad, Kyle Railroad, Nebraska, Kansas Colorado Railway, Plate Valley Trolley, Rock and Rail LLC, San Luis and Rio Grande, San Luis Central, Southern Pacific, Trinidad Railway, Union Pacific, US Army Spur
Water	
Drinking/Potable	■ CO Water Quality Control Division (WQCD) – There are 2100 public drinking water systems in Colorado – Our 3 largest systems (Denver, Aurora, and CO Springs) have approximately 6,000 miles of pipe – Estimate somewhere between 10,000 and 15,000 miles of distribution pipe in the ground for Colorado
Wastewater	■ There are 509 permits that have 4,952 as the primary SIC code (municipal and private domestic wastewater treatment). Of those, 113 are non-NPDES permits discharging to ground water.

Critical Infrastructure and Key Resources	
System	**Description**
Electric Utility Capacity	
Hydroelectric	■ There are 42 hydroelectric power plants in Colorado, and 3 more that have been proposed. Together, Colorado's hydroelectric power plants can produce a total capacity of 1,136 Megawatts of electricity. Colorado has 5 major hydroelectric plants that together produce over 850 MW of electricity.
Power Generation Facilities	■ There are 106 power plant generation facilities in Colorado producing a total capacity of 15,553 MW ■ 8 power plants together produce 7,014 MW; 44 of the power plants are renewable, consisting of biomass, solar, waste, and wind.
Nuclear Reactors, Materials, and Waste Sector	■ 1 nuclear facility, an Independent spent fuel storage installation. ■ Colorado also has other sites related to the healthcare industry.
Renewable Energy	■ Colorado is the home of the US Department of Energy's National Renewable Energy Lab in Golden, CO – *Wind* - According to the American Wind Energy Association, published results for the fourth quarter 2014 market report, Colorado ranked tenth for wind power capacity with 2,593 megawatts (MW) installed. Colorado generated 13.8% of its power from 1,530 wind turbines in 2013. – *Solar* - In 2014, 398 MW of solar energy is currently installed in Colorado ranks the state 8th in the country in installed solar capacity. There is enough solar energy installed in the state to power 76,000 homes (from SEIA) – *Hydropower* - As of 2013, installed capacity of 650MW – *Biomass* - As of 2013, installed capacity of 18MW
Telecom	
	■ 28 Telecom Broadband Colocation facilities/Carrier hotels in Colorado ■ 2,726 Cellular Towers in Colorado ■ Radio: The legislature mandated a statewide needs assessment and business plan for public safety communications. The purpose of the System-Wide Needs Assessment is to determine current and future public safety communications needs and how they impact the Digital Trunked Radio network, interoperability, and other non-DTRS systems operating in Colorado. Those reports are due to the legislature in June 2015 and will make recommendations on maintenance, sustainability, funding, policy and governance.
Emergency Services	
	■ County emergency management offices: 39 ■ City Emergency Management and Homeland Security Offices: 8 ■ County sheriff's offices: 75 ■ Local police departments: 125
Healthcare	
	■ Hospitals: 96 – 67 hospitals report having an emergency department ■ Regional Trauma Centers: 5 ■ Rural trauma hospitals: 24 ■ Community trauma centers: 5 ■ Bonfils Blood Center serves as one of two national centers (key supplier to DoD worldwide)

Critical Infrastructure and Key Resources	
System	**Description**
Government Facilities	
	■ There are ~ 176 federal government facilities throughout Colorado to include office buildings and law enforcement. ■ Denver Federal Center (623-acre campus, 55 federal buildings, totaling 4 million square feet of rentable space)
Defense Industrial Base	
	■ There are 18 key defense contractors interspersed along the Front Range in Colorado to include Lockheed Martin (world's largest defense contractor). Their Space Systems Company is critical for communication satellites and launch vehicles. Ball Aerospace (Fortune 500)
Cultural Icons	
	■ Royal Gorge Bridge and Park ■ Rocky Mountain National Park
Higher Education	
	■ There are 118 colleges, universities, and trade schools. Three of which surfaced in the top 100 of undergraduate rankings and one of which has earned top 100 in graduate rankings.
Industry	
Information Technology	■ There are 33 datacenters located in Colorado to include colocation, dedicated servers, cloud servers, managed hosting, IP transit and many other hosting services.
Chemical Facilities	■ CO is home to one of the 10 Chemical Depots (approximately 2,611 tons of mustard agent - 7% of the nation's original chemical material stockpile) ■ 325 companies file an EPA Risk Management Plan (RMP)
Commercial Facilities	■ There are ~ 158 significant commercial facilities to include malls, shopping centers, retail outlets, theme parks, race tracks, fairgrounds, zoos, concert halls, stadiums and arenas, casinos and tall buildings. ■ Major sporting venues include: Sports Authority Field at Mile High (Denver Broncos – NFL; Denver Outlaws - MLL), Coors Field (Colorado Rockies – MLB), Pepsi Center (Colorado Avalanche – NHL; Denver Nuggets – NBA; Colorado Mammoth – NLL; Colorado Crush – AFL), and Dick's Sporting Goods Park (Colorado Rapids – MLS) ■ Colorado Convention Center (1.2 million square feet total area)
Critical Manufacturing	■ There are approx. 2000 manufacturing facilities throughout Colorado. ■ Colorado is considered to have the third largest uranium reserves of any state
Financial Services	■ Colorado is home to one of the four U.S. Mints ■ First Data (Fortune 500) credit card and data processing center
Food and Agriculture	■ There are approximately 862 food and agricultural sites (distribution, packaging, processing, production, storage, supply, and transportation) in Colorado.
Dams	
	■ Colorado has 1,737 dams – 386 are high hazard; 372 high hazard dams have an emergency action plan

Photo Credit: CRRO

Photo Credit: CDPHE

Appendix E:

Implementation Collaborators and Partners

Agency or Group	Acronym	Community	Economic	Health and Social	Housing	Infrastructure	Watersheds and Natural Resources
State of Colorado							
Colorado Recovery Office	CRO		IM			DV	DV
Department of Local Affairs	DOLA	DV, IM	DV, IM	DV	DV	DV	DV
Division of Homeland Security and Emergency Management	DHSEM	DV, IM	IM		IM	DV	DV
Department of Agriculture	CDA				IM		PA
Department of Education	CDE		DV, IM		IM		
Department of Human Services	CDHS			DV, IM	IM		
Department of Labor and Employment	CDLE		DV, IM				
Department of Natural Resources	DNR				IM	DV	DV
Department of Public Health and Environment	CDPHE	DV, IM		DV, IM	IM	DV	DV
Department of Regulatory Agencies	DORA				DV	DV	
Department of Transportation	CDOT	DV				DV	DV
CDOT – Division of Aeronautics	DOT-DOA					DV	
Office of the Attorney General	AG				IM		
Office of Economic Development and International Trade	OEDIT		DV, IM				
Office of Information Technology	OIT		DV, IM				
Office of the State Architect	OSA				IM		
Energy Office	CEO				DV	DV	
Oil and Gas Conservation Commission	COGCC					EU	
Water Conservation Board	CWCB	DV, IM			IM	DV	DV
Geologic Survey	CGS						DV
State Forest Service	CSFS						DV
Parks and Wildlife	CPW						DV
Water Resources and Power Development Authority	CWRPDA				IM	IM	
Division of Water Resources	DWR				IM		
Colorado Department of Higher Education	HED					IM	
Office of Archeology & Historic Preservation	SHPO	DV, IM				IM	
Workforce Development Council	CWDC		DV, IM			IM	IM
Community College System	CCCS		IM				
Housing Finance Authority	CHFA				DV		
Advisory Council for Persons with Disabilities					DV, IM		

Agency or Group	Acronym	Community	Economic	Health and Social	Housing	Infrastructure	Watersheds and Natural Resources
Local Government							
County and Municipal Governments		IM, EU	EU	DV, IM, EU	IM	IM	EU
Councils of Government			EU				PA
Regional Planning Commissions			EU				
Public Utility Commissions						DV	
Special Districts (RTD, water, fire protection, sanitation, stormwater, conservation, others)		EU				IM (fire) DV (RTD)	PA DV (UDFCD)
School Districts					IM		
Housing Authorities					IM		
Federal Government							
Emergency Management Agency	FEMA	DV, IM	DV	DV	DV	DV	DV
Environmental Protection Agency	EPA	DV, IM			DV	IM	DV
Aviation Administration	FAA					IM	
Economic Development Administration	EDA		DV				
Highway Administration	FHWA					DV	
Transit Administration	FTA					DV	
National Oceanic and Atmospheric Administration	NOAA						PA
Department of Agriculture (Rural Development)	USDA	DV			DV		
Department of Education	ED			DV			
Department of Energy/National Renewable Energy Laboratory	DOE/NREL	DV			DV	DV	
Department of Health and Human Services	HHS				IM		
Department of Housing and Urban Development	HUD				DV		
U.S. Forest Service	USFS					IM	PA
Bureau of Land Management	BLM					IM	PA
Natural Resource Conservation Service	NRCS						PA
U.S. Army Corps of Engineers	USACE					IM	PA
U.S. Geological Survey	USGS						PA
U.S. Centers for Disease Control and Prevention	CDC			DV, IM			
Federal Deposit Insurance Corporation	FDIC		DV		IM		
Small Business Administration	SBA				IM		

Agency or Group	Acronym	Community	Economic	Health and Social	Housing	Infrastructure	Watersheds and Natural Resources
Others							
Colorado Citizens		EU		EU			EU
Citizens' Coalitions						IM	
Colorado Businesses		EU	EU	EU		EU	
Colorado Association of Stormwater and Floodplain Managers	CASFM						DV
Watershed coalitions							PA
NGOs, not-for profits, faith-based organizations, and subject matter experts		IM	EU			EU	PA
Rocky Mountain Climate Organization (local resiliency project)	RMCO					IM	
Colorado Municipal League	CML	DV, IM					PA
Colorado Counties Inc.	CCI	DV, IM					
Colorado Special District Association	SDACO	DV, IM					
Colorado Coalition for the Homeless					EU		
Colorado Legal Services	CLS				EU		
Colorado Community Action Association	CCAA				EU		
Ditch Companies							PA
Colleges and Universities		DV, IM		DV	EU		PA
Schools				IM			
Insurance Industry							EU
Homeowner's Authorities/Micro-communities						IM	
Chambers of Commerce/Main Street Associations			EU			EU	
Trade and Professional Associations			IM		EU	EU	
Foundations						EU	
Public utility companies (power, communications, other)					IM	EU	
Colorado Hospital Association	CHA			DV			
Hospitals				IM			
American Red Cross	ARC	DV, IM		DV			
Health care coalitions				IM			
Voluntary Organizations Active in Disaster	VOADs	IM		IM	IM		
Health and social service delivery organizations				IM, EU			
Colorado Procurement Technical Assistance Center	PTAC		DV				
Colorado Rural Development Council	CRDC		DV				
Federal Reserve Bank of Kansas City	FRB		DV				

Agency or Group	Acronym	Community	Economic	Health and Social	Housing	Infrastructure	Watersheds and Natural Resources
Community development financial institutions			IM				
Workforce boards			EU				
History Colorado		DV, IM					

Key:
DV = Developers/Decision Makers
EU = End Users/Beneficiaries
M = Implementers
PA = Process Advisors (Watersheds and Natural Resources only)

COLORADO

Resiliency & Recovery Office

Governor John W. Hickenlooper

www.ColoradoUnited.com