Resilient Design Performance Standard for Infrastructure and Dependent Facilities

VOLUME I: Report

BOULDER COUNTY CDBG-DR COLLABORATIVE

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PREPARED FOR
Boulder County CDBG-DR Collaborative

BOULDER COUNTY COLLABORATIVE
CDBG Disaster Recovery Funding
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Resilient Design Performance Standard for Infrastructure and Dependent Facilities

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VOLUME I: REPORT
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Volume I: Report

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Executive Summary

The Boulder County Collaborative ("the Collaborative") is a partnership of Boulder County communities that was formed in response to the catastrophic floods of September 11th through September 15th, 2013. The Collaborative includes Boulder County; the cities of Boulder, Lafayette, Longmont, and Louisville; and the towns of Jamestown, Lyons, and Nederland. It was formed to spearhead a regional, community-appropriate plan for successful recovery from these floods and to serve as a guide for the acquisition and implementation of Community Development Block Grant - Disaster Recovery (CDBG-DR) funds.

The Collaborative received a sub-allocation of the CDBG-DR funding from the U.S. Department of Housing and Urban Development (HUD) to address long-term disaster recovery needs related to the federally-declared 2012 wildfires and 2013 floods. The June 3, 2014 Federal Register requires that grantees "identify and implement resilience performance standards that can be applied to each infrastructure project," creating the impetus for the development of the Resilient Design Performance Standard for Boulder County described in this document[1].

Resiliency is quickly rising as a priority for government and nonprofit entities because the ability to bounce "forward" instead of "back" after natural hazard events and other shocks and stresses is imperative in the face of increased variability associated with the impacts of climate change. In May 2015, the State of Colorado put forth its own commitment to resilience through the Colorado Resiliency Framework, a statewide plan to outline guiding principles and tools for community stakeholders to identify and implement strategies to increase resiliency. The Resilient Design Performance Standard builds upon burgeoning state and local planning efforts to develop a tool for building resilience on a project-by-project basis. Application of the Resilient Design Performance Standard helps design teams to broaden the design process for infrastructure projects with the intent to increase the capacity of the whole community to address this increasing variability.

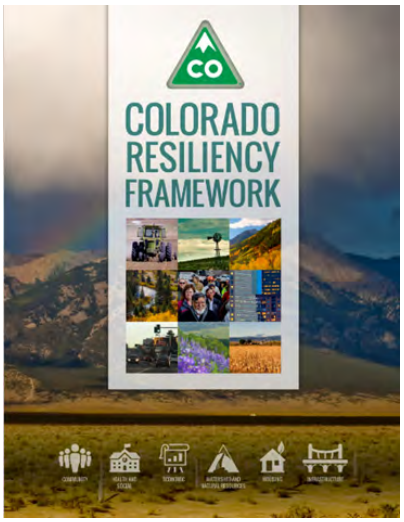

Figure 1: Colorado Resiliency Framework

Over the winter of 2015-16, members of the Collaborative and additional stakeholders worked with the CollinsWoerman consulting team to develop resilience performance goals and a new resilience performance standard for community facilities and infrastructure in Boulder County. Following the National Institute of Science and Technology (NIST) Community Resilience Planning Guide for Buildings and Infrastructure Systems, a set of time-to-recovery goals for all hazards was developed for a the county's building clusters and the infrastructure systems that support them. The goals were formulated over the course of several workshops in December 2015 and January 2016 with the Collaborative, a broad group of stakeholders, and focus groups including regional utility and service providers. The active participation of the Collaborative, as well as the input provided by various stakeholders, defined the expectations for time-to-recovery goals for each cluster of facilities and

[1] Federal Register Volume 79, Number 106 (Tuesday, June 3, 2014), Notices, Pages 31964-31973

infrastructure identified in the County. These goals reflect Boulder County as a whole to establish the combined expectations of each of the individual communities in the County.

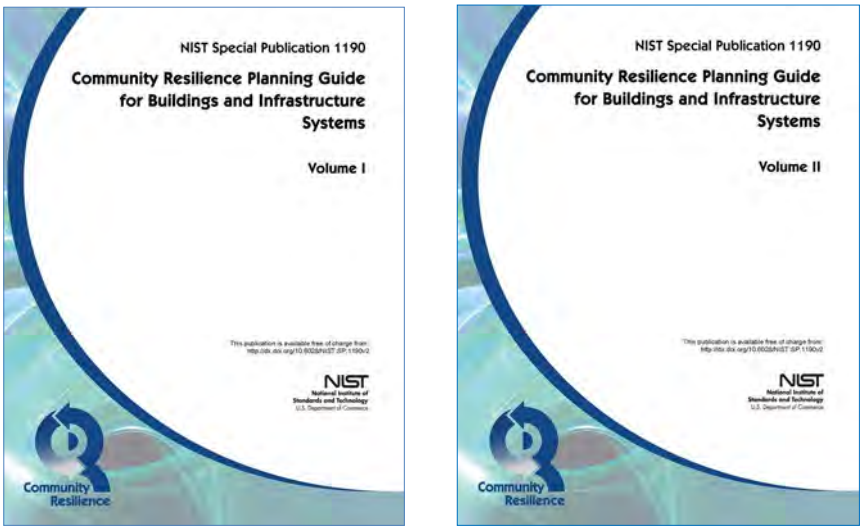

Figure 2: NIST Community Resilience Planning Guides

In February and March, 2016, the Resilient Design Performance Standard was developed as the implementation step to achieve the time-to-recovery goals. Projects developed using the standard must exceed a threshold score that is calculated using the Resilient Design Performance Standard score sheet. The score sheet is based on Colorado Resiliency Prioritization Criteria[2] and uses resiliency indicators, integrated with sustainability principles, to assess projects. Project teams will document how the project meets the standard in a business case developed for each project. The goals and standard are intended to be applied to applicable projects funded by CDBG-DR initially, but to be scalable for use on any future project in Boulder County, as desired by each jurisdiction. Communities will be able to refine the time-to-recovery goals to be more specific to their own conditions and needs if they choose to adopt a focused, community-specific version of this plan.

Based on the input received from the Collaborative, the performance goals and standards were refined and developed into a straightforward, three-step process as outlined below and described in detail in the following chapters of this document:

Step 1: Determine applicable recovery time goals based on the performance matrices for the project to determine the desired recovery time after natural hazard events:

- Determine design hazard level for project (e.g., 100 year flood);
- Determine applicable local/state/federal design standards;
- Identify the applicable building cluster or infrastructure system component and select an appropriate performance level: Minimum (does it impact facilities and infrastructures needed to initiate a *minimal* level of service?), *Functional* (does it impact facilities and infrastructure needed for a *functional* level of service?), or *Operational* (does it impact facilities or infrastructure needed for normal operations?)

Step 2: Complete the Resilient Design Performance Standard matrix to measure progress toward resilient design; score project.

Step 3: Select a preferred alternative that best aligns policy and budget requirements and meets the established recovery goals.

[2] Colorado Resiliency Framework, 2015

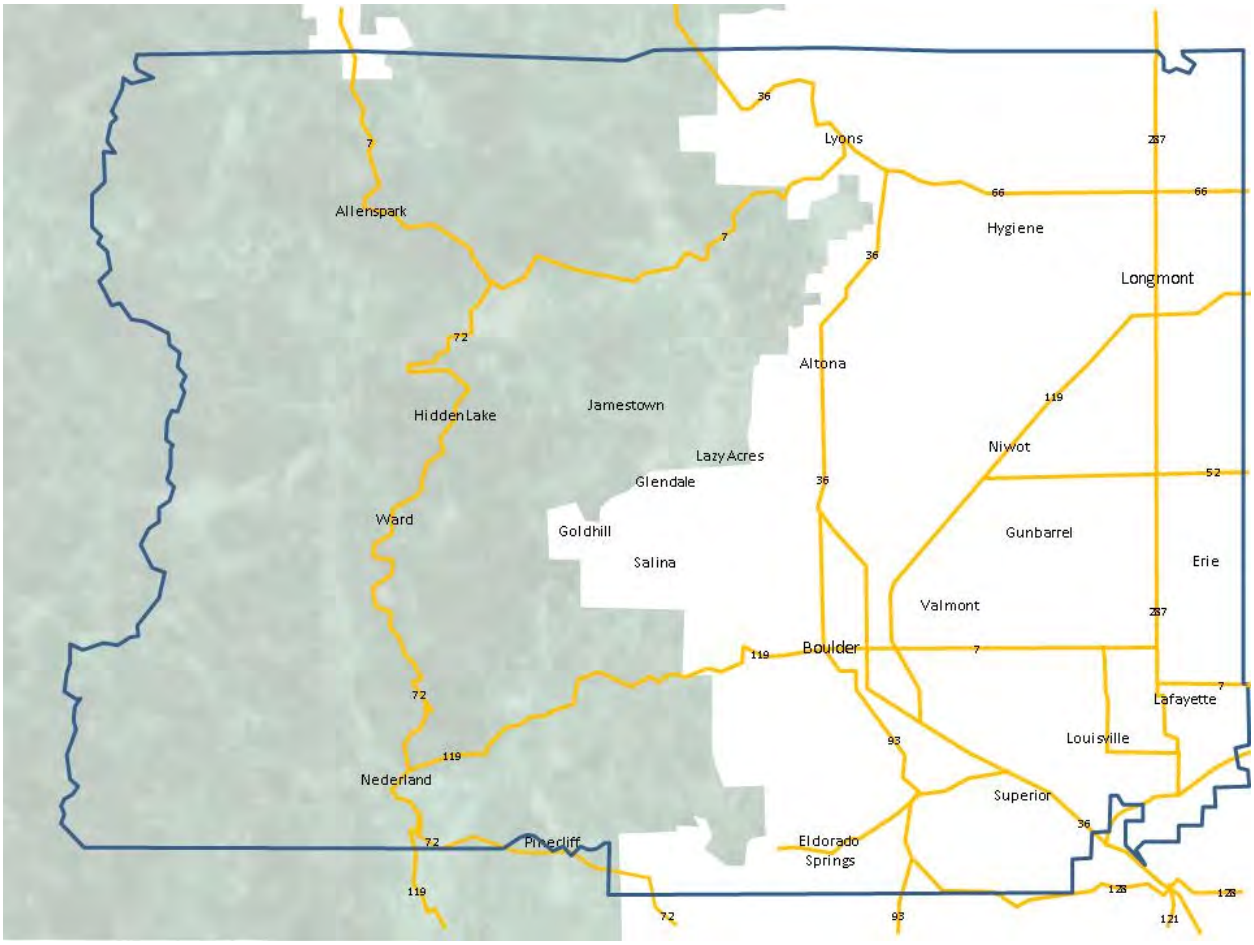

Figure 3: Boulder County Communities in Colorado, USA

Chapter One: Time-to-Recovery Goals

In developing the Resilient Design Performance Standard, the Collaborative adopted the time-to-recovery metric as a measurable goal of resilience for infrastructure projects.

Applying the NIST Approach

The Collaborative followed the guidelines prepared by NIST in the Community Resilience Guide for Buildings and Infrastructure to determine locally-appropriate, long-term time-to-recovery goals for buildings and infrastructure systems in the County. The time-to-recovery metric establishes the desired performance in terms of resilience to stresses, shocks, and natural hazard events in the 50-year horizon.

The power of the NIST approach to community resilience is that these time-to-recovery goals for facilities are not considered in isolation. The infrastructure that supports the facilities must also meet the goal. The NIST process addresses these dependencies between facilities and infrastructure and includes a step that evaluates if the infrastructure (energy, water, bridges, culverts, and roadway sections, etc.) that serve essential facilities is also able to meet the facility's time-to-recovery goals.

***Time-to-Recovery Goals**: The time-to-recovery goals are long-term, all-hazards recovery time goals for building clusters and supporting infrastructure in Boulder County and are the foundation for determining baseline design performance for specific projects. The goals were developed using a method outlined in the National Institute of Standards and Technology's Community Resilience Planning Guide for Buildings and Infrastructure Systems.*

***Resilient Design Performance Standard**: The Resilient Design Performance Standard implements the time-to-recovery goals. Projects developed using the standard must exceed a threshold score that is calculated using the Resilient Design Performance Standard score sheet. The score sheet is based on Colorado Resiliency Prioritization Criteria. Indicators of resilience are included in the standard. Project teams will document how the project meets the standard in a business case developed for each project.*

Categorizing Community Institutions, Buildings, and Infrastructure

The NIST process begins with understanding the social institutions that support the community. These institutions may be services, businesses, and the economy. These institutions in turn are supported by the built environment.

Groups →

Functional Categories →

Clusters →

BUILDINGS	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1 to 7	1-4	4-8	8-12	4	4-24	24+
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals	Minimal				Functional		Operational		
Assisted Living Facilities	Minimal				Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								

Figure 4: Organizational Concept for Clusters

The NIST performance matrices are assembled into "groups". One group represents buildings and additional groups represent each of the urban infrastructure systems such as transportation, potable water, wastewater, storm water, energy, and communications.

Within each of these groups are "functional categories" that support various community needs, including basic needs such as the provision of life safety, medical care, and shelter; economic needs such as critical retail, major employment centers, and basic economic functions such as manufacturing or commercial centers; and social needs, such as community centers, schools, and religious/spiritual centers.

Within the functional categories the NIST process focuses on "clusters" of buildings that provide similar functions for their communities. Clusters are defined by NIST as "a set of buildings and supporting infrastructure systems, not necessarily geographically co-located, that serve a common function such as housing, healthcare, retail, etc."[3] Organizing the built environment into clusters provides a basis for developing an estimate of how to prioritize systems for recovery and sets a workable timeline goal for recovery after a disaster.

For example, in **Figure 4** above, the Buildings group identifies different types of buildings that support the social institutions of the county. The buildings are subdivided into the functional category of Critical Facilities. There are several "clusters" of critical facilities such as Emergency Operations Centers, First Responder Facilities (fire and police stations), and Hospitals, etc. Each cluster is then assigned time-to-recovery goals by local officials to facilitate resilience.

[3] National Institute of Standards and Technology Special Publication 1190, 114 pages (October 2015), CODEN: NSPUE2

Determining Levels of Performance

Setting time-to-recovery goals requires determining the acceptable level of damage to the built environment and the corresponding time needed to restore varying levels of functionality. When a major hazard event occurs, not all buildings and systems are immediately needed to support response and recovery. As in the National Disaster Recovery Framework (NDRF)[4], the time-to-recovery goals are considered in three phases: short-term, mid-term, and long-term. The *short-term* phase focuses on rescue, stabilization, and preparing for recovery and is expected to occur over a period of days. The *mid-term* phase focuses on restoring neighborhoods, workforce, and caring for vulnerable populations and extends for weeks to months. The *long-term* phase relates to restoring the community's economy, social institutions and physical infrastructure and may continue for years after the initial event.

The time-to-recovery goals are set to indicate the acceptable time allowed to restore community services after a disaster. The goal applies to all the buildings or infrastructure elements in the cluster of similar-functioning facilities, not to the condition of any particular building or infrastructure system. This approach helps communities to gauge how robust any individual element within a cluster must be to meet the time-to-recovery goals. If the cluster as a whole can meet the time-to-recovery performance goal, then the need for any one element within that cluster to meet that goal is not as crucial. Conversely, if the cluster as a whole cannot meet the time-to-recovery goal, then any specific project within that cluster is an opportunity to improve the overall capacity of the cluster to achieve that goal. Over time as more and more projects are built or rebuilt, the resilience of the community will improve as more and more of each cluster increases its capacity to meet the time-to-recovery goal.

Three Levels of Performance

Minimal: *The* ***minimal*** *time-to-recovery goal is the minimum time allowable for the buildings and supporting infrastructure to be unavailable to support immediate relief. Meeting this goal may be accomplished through rapid repairs with temporary, permanent, or programmatic work-arounds.*

Functional: *The* ***functional*** *time-to-recovery goal is the minimum time allowed before the buildings and supporting infrastructure must be able to support routine or non-exceptional operations. Meeting this goal may be accomplished through rapid repairs with temporary, permanent, or programmatic fixes.*

Operational: *The* ***operational*** *time-to-recovery goal is the minimum time allowed before the buildings and infrastructure must be completely repaired and able to meet normal and peak demand operations.*

[4] National Disaster Recovery Framework, FEMA, 2011

Three levels of restoration of function are used to define the time-to-recovery performance goal:

- *Minimal*: Minimum performance required to initiate immediate relief; [5]
- *Functional*: Minimum performance required to support routine or non-exceptional operations during the transitional phase between relief and recovery;
- *Operational*: Performance required to meet normal and peak demand operations.

The following examples are drawn from the performance goals to illustrate this process (See below for Example: Application of Levels of Performance):

- Hospitals. The performance goal for hospitals calls for county-wide capacity for hospitals to meet the performance goal of providing a *minimal* level of service in 0 days after a disaster event, in other words immediately after the event. For example, at least one hospital in Boulder County must be open and servicing minimal needs to support critical relief activities immediately. Other hospitals in the County that may have been damaged will need to be *functional* such that they are able to provide routine provision of services within 4 to 8 weeks after the event. Virtually all hospitals in the County should be *operational* within 4 months of a disaster such that they are all are back in service and be able to provide both normal and peak demand for services.

- Housing. The time-to-recovery goal for housing in Boulder County indicates that all housing needs to provide a *minimal* level of housing for all residents in the County within 1 to 4 weeks. Performance at this level allows residents to have some minimal level of shelter in their homes during relief efforts so that they remain where they can contribute to their own and the overall community recovery. Within 8 to 12 weeks of a disaster all housing in the county should be *functional* such that it is able to provide shelter that can withstand routine events during recovery. Within two years of a disaster virtually all housing in the County must be *operational* where virtually all housing can withstand typical extreme events such as blizzards, high winds, or flooding at the 100-year level.

[5] To avoid confusion, the terms "minimal," "functional," and "operational" replace the NIST designated 30%, 60%, and 90% originally used during the time-to-recovery goal setting workshops in December, 2015-January, 2016.

BUILDINGS	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1 to 7	1-4	4-8	8-12	4	4-24	24+
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals	Minimal				Functional		Operational		
Assisted Living Facilities	Minimal				Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Neighborhood									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Community Recovery									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Example: Application of Levels of Performance

- Businesses – Manufacturing. The performance goal for manufacturing is that a *minimal* level of manufacturing is required to assist with relief and available within 1 to 4 weeks. Within 4 to 8 weeks most manufacturing capacity in Boulder County should be *functional* and able to conduct routine operations during recovery. Virtually all manufacturing should be *operational* within 8 to 12 weeks and capable of normal and peak demand operations.

- Conference and event venues. Conference and event venues should be available at a *minimal* level within 8 to 12 weeks so that community meetings can be held in safe locations during relief. Within 4 months conference and event venues should be *functional* for routine and non-exceptional operations during recovery. Within 4 to 24 months all conference and event venues should be *operational* with the capacity to handle both normal and peak demand operations.

Engaging Boulder County Communities and Stakeholders

The time-to-recovery goals were designed specifically for Boulder County over the course of several workshops in December 2015 and January 2016 with the Collaborative. A number of stakeholders and focus groups including regional utility and service providers were also invited. To be certain that the goals harmonize with broader planning efforts, Collaborative members and stakeholders referred to existing planning documentation including the Boulder County and the City of Boulder multi-hazard mitigation plans' inventories and maps of critical facilities and infrastructure for each community.

The communities and the County in the Boulder County Collaborative reviewed the draft performance goals and provided input that helped shape the time-to-recovery performance goal matrices shown below. The goals represent all-hazards recovery time goals for buildings and supporting infrastructure in Boulder County. These goals then become the foundation for determining baseline design performance for specific projects.

The time-to-recovery goals for Boulder County were set for the County as a whole and serve as planning-level goals to establish the combined expectations of each of the individual communities in the County. Communities may choose to tailor the goals to suit their own needs and performance requirements. Community breakout groups during the workshops developed preliminary community-specific time-to-recovery goals to both inform the county-wide goals and provide a stepping stone for the development of a community-specific plan (preliminary community-specific goals can be found in *Appendix B*).

Applying Time-to-Recovery Performance Goals Before and After Disaster

The time-to-recovery goals set by stakeholders and summarized in the matrices to follow are useful before a hazard event to evaluate level of resiliency of a community's infrastructure system and determine where there are gaps in the capabilities of the built environment for specific hazards. This application requires an inventory of the existing buildings and infrastructure systems, characterization of the hazard under consideration, and determination of the time-to-recovery for each building and system in the community. The existing conditions can then be compared to the ***minimal***, ***functional***, and ***operational*** goals to determine what gaps exist and what temporary measures need to be planned to support recovery when needed. A gap analysis can also result in a prioritized program for improving elements of the built environment to facilitate a quicker recovery. This gap analysis can be used in conjunction with or can be complementary to overall community-wide resiliency assessments that take into account a wide range of systems and institutions.

Hazard mitigation plans and continuity of operations (COOP) plans are existing planning assessments regularly updated by Boulder County communities that work in conjunction with the Resilient Design Performance Standard and specifically help to inform Step 1 of the process.

Boulder County coordinates the development of a multi-hazard mitigation plan in which multiple jurisdictions participate; the City of Boulder has its own hazard mitigation plan. These plans include risk and capabilities assessments helpful in determining the design hazard level for projects (e.g., 100 year flood), the applicable local/state/federal design standards, and the appropriate performance level. Relevant information includes:

- Descriptions of the natural hazards affecting each community, including information characterizing each hazard, such as location, severity, history, and probability of occurrence
- Inventories of existing buildings, critical facilities, and infrastructure as well as estimates of potential losses and types of impacts to the built environment from various hazards
- Assessment of mitigation capabilities in place in each jurisdiction, including applicable plans, policies, codes, and standards.

Mitigation plans also identify and prioritize projects and policy actions to reduce risk, which may include changes to standards as well as planned mitigation measures for buildings and infrastructure. This offers the opportunity to align objectives in preliminary project designs and scoring in Step 2 of the standard. The mitigation strategy is also a good place to document the actions needed to address the gaps between current conditions and desired time-to-recovery performance goals.

Continuity of operations or continuity of governance (COOP/COOG) plans identify an organization's essential functions and ensure that these functions can be continued throughout or resumed rapidly after a disruption of normal activities. Several Boulder County communities have COOP plans in place, which should be used in determining the performance levels needed to support essential functions and coordinated during future updates to avoid conflicts.

The *operational* recovery goal timeframe is the optimal performance standard by which to measure infrastructure resilience. Each building or system added to the cluster should be able to achieve the *operational* performance goal within the 50-year planning horizon as opportunities arise for incorporating resilience on a project-by-project basis through development and redevelopment.

The time-to-recovery goals for Boulder County communities are included in the following tables for all major groups of buildings and supporting infrastructure.

Table 1: Time-to-Recovery Goals Matrix - Building Clusters

BUILDINGS	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1 to 7	1-4	4-8	8-12	4	4-24	24+
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals	Minimal				Functional		Operational		
Assisted Living Facilities	Minimal				Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Neighborhood									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Community Recovery									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Table 2: Time-to-Recovery Goals Matrix - Transportation Infrastructure

TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Ingress (goods, services, disaster relief)									
Freeways and Expressways			Minimal	Functional	Operational				
Other Principal Arterial Highways			Minimal	Functional	Operational				
Minor Arterial Highways			Minimal	Functional	Operational				
Local Roads				Minimal	Functional			Operational	
Bikeways			Minimal	Functional	Operational				
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational				
A Regional Airport						Minimal		Functional	Operational
Egress (emergency egress, evacuation)									
Freeways and Expressways			Minimal	Functional	Operational				
Other Principal Arterial Highways	Minimal		Functional	Operational					
Minor Arterial Highways	Minimal		Functional	Operational					
Local Roads				Minimal	Functional			Operational	
Bikeways			Minimal	Functional	Operational				
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational				
A Regional Airport						Minimal		Functional	Operational
Community Resilience									
Critical Facilities									
Emergency Operational Centers	Functional			Operational					
Police and Fire Stations	Functional				Operational				
Hospitals			Minimal		Functional		Operational		
Assisted Living Facilities				Minimal	Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Neighborhood									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Community Recovery									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	
Non-emergency City Services									

Table 3: Time-to-Recovery Goals Matrix - Water Infrastructure

WATER INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Source Water									
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational	
Raw Water Conveyance				Functional				Operational	
Irrigation Ditches				Minimal			Functional	Operational	
Potable Water Supply (WTP, wells, impoundments)			Minimal			Functional		Operational	
Water for Fire Suppression	Minimal					Functional		Operational	
Transmission (Including Booster Stations)									
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Minimal				Operational			
Control Systems									
SCADA or other		Minimal				Operational			
Distribution									
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals			Minimal		Functional		Operational		
Assisted Living Facilities				Minimal	Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Housing/Neighborhoods									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational				Operational	
Hotels and Motels				Operational					
Drinking Water at community distribution centers	Minimal								
Water for fire suppression at fire hydrants	Minimal								
Community Recovery Infrastructure									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Table 4: Time-to-Recovery Goals Matrix - Waste Water Infrastructure

WASTE WATER INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Treatment Plants									
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational	
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational	
Trunk Lines									
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational	
Control Systems									
SCADA or other				Functional				Operational	
Collection Lines									
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals			Minimal		Functional		Operational		
Assisted Living Facilities				Minimal	Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Housing/Neighborhoods									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public									
Community Recovery Infrastructure									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Table 5: Watersheds and Natural Infrastructure

WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Creek Corridors									
Debris Removal						Minimal	Functional	Operational	
Channel or Levy Repair							Minimal	Functional	Operational
Stream Restoration									Operational
Trail Restoration									Operational
Habitat Restoration									Operational
Parks, Public Open Space									
Debris Removal						Minimal	Functional	Operational	
Levee Repair							Minimal	Functional	Operational
Stream Restoration						Minimal		Functional	Operational
Trail Restoration						Minimal		Functional	Operational
Habitat Restoration						Minimal		Functional	Operational

Table 6: Energy Infrastructure

ENERGY INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Power - Electric Utilities									
Community Owner or Operated Bulk Generation									
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational						
Transmission and Distribution (including Substations)				Operational					
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals			Minimal		Functional		Operational		
Assisted Living Facilities				Minimal	Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Neighborhood									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Community Recovery Infrastructure									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Table 7: Communications Infrastructure

COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Core Communications Buildings									
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational						
Last Mile									
Critical Facilities									
Emergency Operations Centers	Functional			Operational					
First Responder Facilities (Fire- and police-stations)	Functional				Operational				
Hospitals			Minimal		Functional		Operational		
Assisted Living Facilities				Minimal	Functional				Operational
Detention Centers	Operational								
Emergency Housing									
Temporary Emergency Shelters	Operational								
Single and Multi-family Housing (Shelter in place)	Operational								
Neighborhoods									
Critical Retail			Minimal	Functional			Operational		
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational			
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational
Schools				Operational					
Hotels and Motels				Operational					
Community Recovery Infrastructure									
Businesses - Manufacturing				Minimal	Functional	Operational			
Businesses - Retail			Minimal	Functional	Operational				
Businesses - Service Professions				Minimal	Functional	Operational			
Conference and Event Venues						Minimal	Functional	Operational	

Table 8: Urban Stormwater Infrastructure

URBAN STORMWATER INFRASTRUCTURE	Design Hazard Performance								
	Phase 1			Phase 2			Phase 3		
	Days			Weeks			Months		
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+
Above Ground Conveyance Systems: Floodways, Swales, Ditches									
Debris Removal				Minimal			Functional	Operational	
Repair/Reconstruction							Minimal	Functional	Operational
Dam/Dike	**Operational**								
Retention and Detention Basins									
Debris Removal						Minimal	Functional	Operational	
Repair/Reconstruction							Minimal	Functional	Operational
Underground Conveyance Systems: Catch Basins, Curb/Gutter, Curb Inlets, Pipes									
Debris Removal						Minimal	Functional	Operational	
Repair/Reconstruction							Minimal	Functional	Operational

Chapter Two: Resilient Design Performance Standard

The Resilient Design Performance Standard is the implementation method to achieve the time-to-recovery goals. It is a holistic, systematic approach to adapting and preparing infrastructure to better respond to the stresses and shocks of the 21st century. This approach provides new levels of rigor to project design for infrastructure repair and improvements and integrates resilience and sustainability into community disaster recovery.

Resiliency and Sustainability Definitions

The Resilient Design Performance Standard applies the principles and practices of resilience AND sustainability to assist design teams to implement the time-to-recovery goals. Reason being, in the last two decades, design teams have become familiarized with incorporating sustainability strategies into projects. Evolving to include resiliency is an organic extension of the process. The result is an integrated approach where lessons from sustainability are merged with principles of resilience to guide building and infrastructure designers. However, sustainability and resilience are two separate and distinct concepts.

Resilience: *"Resilience is the ability of communities to rebound, positively adapt to, or thrive amidst changing conditions or challenges – including disaster and climate change – and maintain quality of life, healthy growth, durable systems and conservation of resources for present and future generations."*

-Colorado Resilience Working Group

Sustainability: *"The use, development and protection of resources in a way that enables Boulder County residents to meet their needs and maintain a high quality of life, without compromising the ability of future residents to do the same."*

-Boulder County

The Resilient Design Performance Standard uses the Colorado Resilience Working Group's definition of resilience and Boulder County's definition of sustainability, as shown here.

Resilience and sustainability each provide separate important insights into developing project alternatives. However, a project may be resilient, but not sustainable. For example, a resilience strategy that continues to harden facilities via concrete may make a facility robust to an extreme event, but may not incorporate habitat considerations that sustain wildlife populations. Likewise, it might be sustainable but not resilient. For example, just-in-time food delivery is an efficient way to minimize energy use and maximize freshness of food delivery; however, if a vehicle cannot make deliveries during an extreme event, food shortages can occur quickly. Therefore, an integrated approach that incorporates resilience and sustainability attributes into project design is beneficial for two reasons: 1) it allows for greater success due to the piggy-backing on familiarity with complementary sustainability design aspects; and 2) it results in more flexible, adaptable solutions.

An example of integrated resilient and sustainable design is green stormwater infrastructure. Managing stormwater in such a way that incorporates green infrastructure – such as existing floodplain and riparian areas, or designed solutions such as vegetated "green streets", rain gardens, and bio-retention areas – can complement and help reduce reliance on traditional "grey" infrastructure. The diagram in **Figure 5** below illustrates the confluence of resilient and sustainable design.

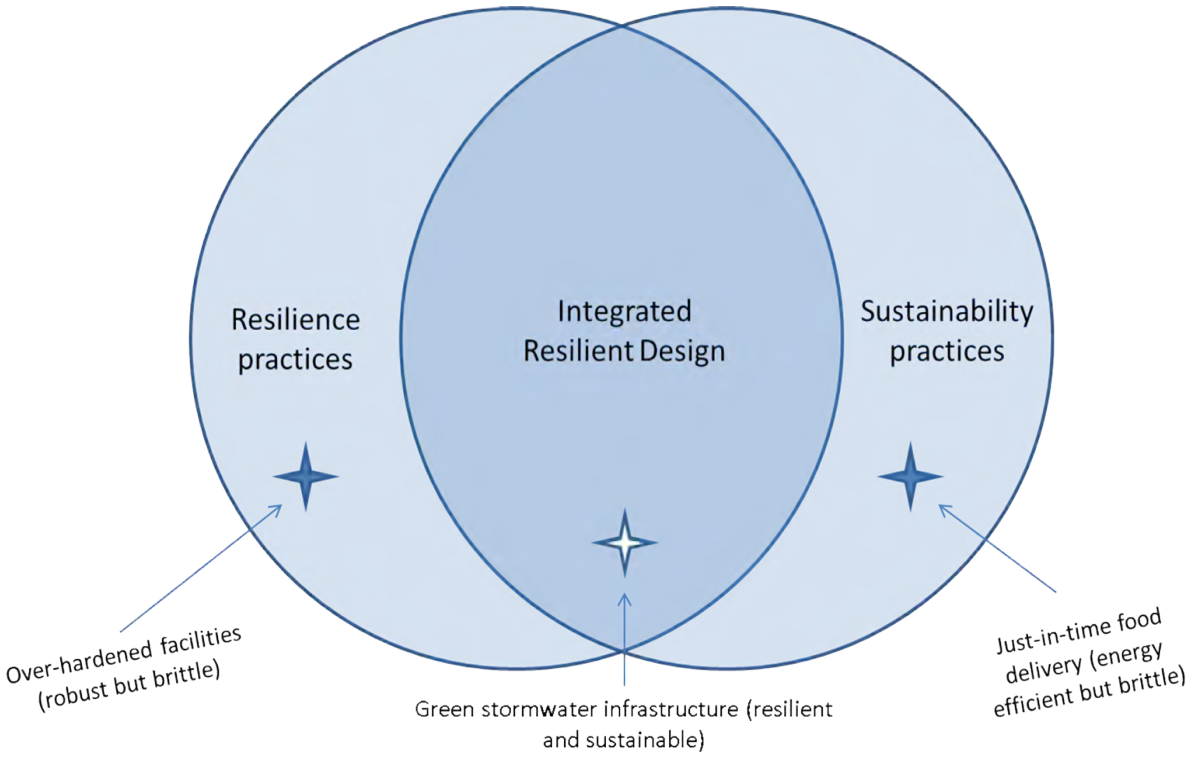

Figure 5: Resilience and Sustainability in Integrated Resilient Design

Integrated Design Teams and Evaluation of Alternative Strategies

The Resilient Design Performance Standard requires teams to look for alternative strategies that offer the most value to the triple bottom line: community, the economy, and the environment. Teams familiar with sustainability certification processes (LEED, BREEAM, Living Building Challenge, SITES, ENVISION, etc.) that use checklists, imperatives, and points will find a similar system in the resilient design performance standard.

Tools such as design charrettes are encouraged where integrated teams of professionals, owners, and users work together to test a range of integrated strategies that provide multiple benefits across the triple bottom line. See *Attachment 2* for a description of a charrette process.

Projects developed using this Resilient Design Performance Standard will be better positioned to perform well economically with greater resilience against stresses, shocks, and hazards while also creating healthier environments for people and the planet.

Resilience Prioritization Criteria

The Resilient Design Performance Standard builds on the Resilience Prioritization Criteria outlined in the Colorado Resiliency Framework. In incorporating these criteria, each infrastructure project designed using the Resilient Design Performance Standard will contribute to achieving the vision and goals for resiliency in the state.

Colorado Resiliency Framework: Resilience Prioritization Criteria

1. **Co-Benefits.** Provide solutions that address problems across multiple sectors creating maximum benefit.
2. **High Risk and Vulnerability**. Ensure that strategies directly address the reduction of risk to human well-being, physical infrastructure, and natural systems.
3. **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
4. **Social Equity**. Provide solutions that includes consideration of populations that are often most fragile and vulnerable to sudden impacts due to the continual state of stress
5. **Technical Soundness**. Identify solutions that reflect best practices that have been tested and proven to work in similar regional contexts
6. **Innovation**. Advance new approaches and techniques that will encourage continual improvement and advancement of best practices serving as models to others in Colorado and beyond.
7. **Adaptive Capacity**. Include flexible and adaptable measures that consider future unknowns of changing climate, economic and social conditions.
8. **Harmonize with existing activity**. Expand, enhance, or leverage work being done to build on existing efforts. Assure outcomes that are environmentally friendly, sustainable, and complementary to the natural setting
9. **Long Term Lasting Impact.** Create long term gains to the community with solutions that are replicable and sustainable, creating benefits for present and future generations.

Chapter Three: How to Apply the Resilient Design Performance Standard

Implementation of the Resilient Design Performance Standard is a three-step process.

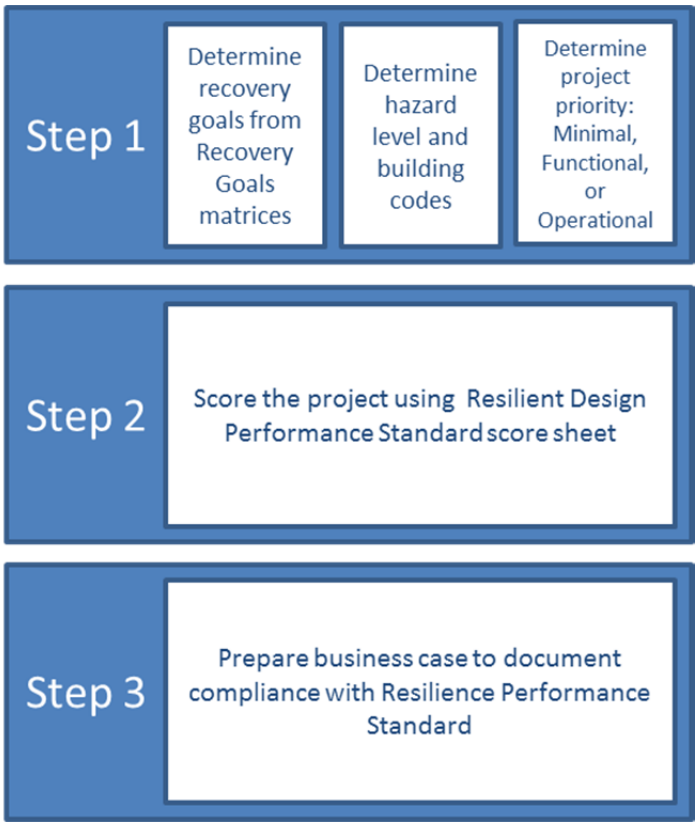

Figure 6: Steps to Implement the Resilient Design Performance Standard to a Project

Step 1: Determine applicable time-to-recovery goals for the project

When preparing to build, repair, or replace infrastructure or community facilities, project teams must determine applicable time-to-recovery goals found in the recovery goals matrices (see **Tables 1** through **8**). The recovery goals identify the desired time-to-recovery after natural hazard events. Once the time-to-recovery goal is determined, project teams will also need to meet existing codes and requirements such as:

- Determine design hazard level for project (e.g., 100-year flood)
- Identify applicable building codes and existing engineering standards to identify the minimum applicable local/state/federal design standards
- Identify the applicable building cluster or infrastructure system component and select an appropriate performance level: *Minimum* (does it impact facilities and infrastructures needed to initiate a *minimal* level of service?), *Functional* (does it impact facilities and infrastructure needed for a *functional* level of service?), or *Operational* (does it impact facilities or infrastructure needed for normal operations?).

Design teams refer to the time-to-recovery goals matrices depending upon the project type. For example, if it is a transportation project, the team will look up the time-to-recovery goal in the Transportation Infrastructure group (Table 2). If the project is for a bikeway for ingress and egress, then the time-to-recovery goal is for the community-wide bikeway system to have a ***minimal*** level of function within 1-7 days. ***Minimal*** function would allow bicycles to navigate down the bikeway within 1-7 days of a disaster. If the bikeway is determined to be critical for supporting ingress and egress, and depending upon the bikeway design and the hazard, the bikeway may suffer little or no damage and be passable, or if it does suffer damage, it must be fixable within 1 to 7 days via temporary repairs or patches. In contrast, some bikeways in Boulder County double as floodways. If the hazard under consideration is a flood, then this particular facility may not be one that contributes to the ***minimal*** function goal, it may be more in line with a later time-to-recovery goal.

Once the time-to-recovery project requirements are established, the design team then uses the Resilient Design Performance Standard checklist to score the project.

Step 2: Complete Resilient Design Performance Standard score sheet

The Resilient Design Performance Standard score sheet lists the nine criteria from the Colorado Resiliency Framework and a number of subsidiary indicators. The indicators are based on attributes of resilient socio-ecological systems, sustainability principles, and the Characteristics of Resilient Communities developed by BOCO Strong, the regional organization intent on building resilient social infrastructure. Use of the indicators helps project teams to incorporate resilience attributes into project design and to leverage infrastructure investments to create additional economic, environmental, and community value to improve the triple bottom line. For additional information on the indicators see *Attachment 1: Indicators of Resilience*.

For all applicable projects funded by CDBG-DR (and if future non-CDBG-DR funded projects use this tool) project teams apply the Resilient Design Performance Standard score sheet to the project design for permanent projects with a budget in excess of $250,000. Some indicators are required for all projects including development of a business case, exploration of alternatives, and avoiding disproportionate impact on vulnerable populations. An additional number of optional indicators are included that are scored as either 1 or 2 points per indicator. Out of a total of 23 possible points, a project team must apply a minimum threshold of 18 or more points to meet the standard. Teams then document use of the indicators in the business case analysis and report.

For temporary or emergency projects designed to initiate immediate relief (e.g., minimal), or for projects with a budget of $250,000 or less, only the indicators that are listed as required on the score sheet are needed. This helps immediate, smaller, and more focused projects to efficiently move forward. Teams for these types of projects are encouraged to use as many of the optional indicators as possible given time and budget constraints.

When a project meets the required indicators and achieves or exceeds the applicable threshold score, that project is furthering progress towards achievement of the long-term, community-wide goals for time-to-recovery and contributing to the improvement of the community's resilience. As more and more projects meet the threshold, and the more those goals are served in the long term, the greater

the likelihood that the recovery goals will be met during future hazard events. Projects that meet or exceed the threshold are serving the long-term time-to-recovery performance goals.
If the project does not meet the threshold, the project team will be required to revisit the indicators and add integrated resilient design features or processes until the project meets or exceeds the minimum required score to meaningfully contribute towards achieving the performance goals.

However, when a project serves the intent of the Resilient Design Performance Standard by assessing the project against the standard and implementing integrated resilient design features or processes as feasible, but through unique circumstances due to timing, project type, or other factors, the project cannot achieve the threshold score, the project can still be considered to be in compliance with the HUD requirements as stated in 79 FR 106, p. 31968.

Table 9: Resilient Design Performance Standard Score Sheet

RESILIENT DESIGN PERFORMANCE STANDARD Score Sheet			
BOULDER COUNTY INDICATOR	**POINTS**	**ENTER SCORE**	**DESCRIPTION**
1. Co-Benefits. Provide solutions that address problems across multiple sectors creating maximum benefit.			
Indicator 1.1. Apply a business case format that includes consideration of alternatives and robust analysis of those alternatives across the triple bottom line of economics, community, and the environment.	*Required*	*Required*	Prepare a business case that takes an analytical look at the project element alternatives, the costs, and the return on investment both in terms of the economy and in value creation to the community and the environment.
Indicator 1.2. Use multi-disciplinary design team to develop and consider a range of integrated solutions that provide enhanced value across the triple bottom line.	*2*		Document the project design charrette process, integrated design team in Business Case.
2. High Risk and Vulnerability. Ensure that strategies directly address the reduction of risk to human well-being, physical infrastructure, and natural systems.			
Indicator 2.1. Satisfy the time-to-recovery performance goal.	*Required*	*Required*	Refer to Time-to-Recovery Performance Goals Matrix (Design team estimate the damage from hazard and the time-to-repair.)
Indicator 2.2. Identify gaps and find solutions for moving forward.	*Required*	*Required*	If the project cannot meet the performance goals, then the project team must develop temporary work-arounds or programmatic strategies to meet the required Operational time-to-performance goal.
Indicator 2.3. Consider project alternatives that augment capacity and increase buffers from high risk locations such as floodplains, landslide and urban wildfire interface when applicable.	*Required*	*Required*	Provide business case that documents consideration and analysis of alternatives considered for the project. (Can include temporary repairs to meet the minimal or operational phase.)
3. 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			
Indicator 3.1. Evaluate benefit of programmatic solutions when developing alternatives for capital projects.	*Required*	*Required*	Conduct triple bottom line analysis in the Business Case that quantifies economic, community, and environmental impacts of the project.
Indicator 3.2. Consider if project can increase nearby land and property values and encourage local business opportunities.	*1*		Include in Business Case
Indicator 3.3. Consider if project can create opportunities for local jobs and training	*1*		Include in Business Case
4. Social Equity. Provide solutions that includes consideration of populations that are often most fragile and vulnerable to sudden impacts due to the continual state of stress			
Indicator 4.1. Avoid disproportionate negative impacts to vulnerable populations.	*Required*	*Required*	Identify location-based demographics of populations that might be disproportionately impacted by the project. Provide triple bottom line analysis in the business case that evaluates economic, community, and environmental impacts of the project to vulnerable populations.
Indicator 4.2. Encourage diversity of actors and processes at each scale.	*1*		Document public outreach and consultation process and findings report in Business Case.
Indicator 4.3. Maintain and enhance social connectedness up, down, and between community groups, civic groups, religious and cultural communities, as well as opinion leaders in business and environment to foster understanding of complex adaptive systems and to reinforce the social connections and identity of residents, employers, and employees.	*1*		Document public outreach and consultation process and findings report in Business Case.
Indicator 4.4. Incorporate monitoring and feedback loops to enable project managers to moderate behavior, be accountable, and adapt as conditions change.	*1*		Document public outreach and consultation process and findings report in Business Case.
Indicator 4.5. Create places that foster community identity and that enhance the experience of neighbors and visitors.	*1*		Document public outreach and consultation process and findings report in Business Case.

5. Technical Soundness. Identify solutions that reflect best practices that have been tested and proven to work in similar regional contexts			
Indicator 5.1. Design project to meet existing engineering and building code standards.	*Required*	*Required*	Project must comply with local code and building standards.
Indicator 5.2. Consider how well project will perform in uncertain times.	*2*		Uncertainties from climate change, technological shifts, population growth, and resource scarcity make it difficult-to-impossible to accurately determine the appropriate capacity for a system to absorb an uncertain range of stresses, shocks, and disturbances. Testing how alternative solutions respond across a range of possible future conditions can help the project team to determine which project design performs the best. Apply a sensitivity analysis to project alternatives to determine vulnerability to uncertainties and risks to success. Include the results in the sensitivity analysis in Business Case.
6. Innovation. Advance new approaches and techniques that will encourage continual improvement and advancement of best practices serving as models to others in Colorado and beyond.			
Indicator 6.1. Project teams should consider both traditional and nontraditional alternatives to a proposed project.	*1*		The value of non-traditional approaches is that they tend to be multi-disciplinary and may create benefits and costs sometimes missed in traditional practice. The intent is to compare traditional and non-traditional alternatives that are feasible and provide outcomes with the same or better levels of service. If, however, an alternative has a self-evident fatal flaw or is infeasible, it should be documented as considered and rejected with a rationale for elimination to avoid expending resources on non-competitive alternatives. Document the alternatives consider in the Business Case.
Indicator 6.2. Consider if natural system functions can be included in project design and operations.	*1*		Document the project design charrette process, integrated design team in Business Case.
7. Adaptive Capacity. Include flexible and adaptable measures that consider future unknowns of changing climate, economic and social conditions.			
Indicator 7.1. Consider project solutions at a variety of different scales so that impact at any one scale is less likely to impact similar functioning systems at different scales.	*1*		Design district energy and water systems that nest into larger centralized systems. This adds additional capacity to the system as an impact at any one scale may not impact systems at different scales with different system drivers. Centralized systems continue to provide the backbone levels of service, but district-scale systems can relieve the peak demands on the centralized systems and provide additional buffers against extreme events.
Indicator 7.2. Consider a diversity of sources to add adaptability and flexibility for infrastructure systems during times of stresses, shocks, or loss of access to resources.	*1*		Diversity of sources examples might include water reuse for non-potable uses; multiple water supply sources such as different watersheds and/or groundwater; multiple energy sources such as grid and onsite renewables; more than one critical facility to handle essential functions post-disaster; diversity of food supply from both imported and locally available sources; etc. Apply the consideration of diversity of sources in the project design process and document results in the Business Case.
Indicator 7.3. Consider cost-effective modular, repeatable strategies.	*1*		Use of modularity can provide quick repairs for replaceable parts that can be replicated as needed in similar circumstances. Modular systems provide enhanced multi-scale functionality where different drivers and over-lapping functions can serve to increase the resilience of larger centralized systems. Apply the consideration of modularity in the project design process and document results in the Business Case.
Indicator 7.4. Consider if the project can maintain and enhance connectivity between habitat systems and provide appropriate buffers to allow habitat to serve beneficial functions for plants and wildlife.	*1*		Species have greater options to find required food, shelter, and breeding options within connected habitat systems. Apply the consideration of connectivity of habitat in the project design process and document results in the Business Case.
Indicator 7.5. Consider if the project can enhance the range of mobility connections.	*1*		Choices in modes to increase adaptive capacity of the community during sites of stress, shock, or loss of access to other modes. Apply the consideration of connectivity of modes of mobility in the project design process and document results in the Business Case.

Indicator 7.6. Consider if project can store and restore capacity of reserves at each scale so isolated elements can survive for a period on their own.	*1*		Consider storage in the project design process and document results in the Business Case.
Indicator 7.7. Evaluate potential of creating semi-autonomous systems at the building, neighborhood, and district scale.	*1*		Semi-autonomous systems are self-organizing and have the capacity to self-correct given new insight and information. They do not require extensive command and control and are the source of innovation that can create novel adaptations to variability. This innovation provides increased capability for all systems to adapt to fast and slow change. Apply the consideration of semi-autonomous systems in the project design process and document results in the Business Case.
8. Harmonize with existing activity. Expand, enhance, or leverage work being done to build on existing efforts. Assure outcomes that are environmentally friendly, sustainable, and complementary to the natural setting			
Indicator 8.1. Identify project design solutions that leverage and enhance the function of existing natural, social, and infrastructure systems.	*2*		A project that can provide multiple benefits to community will be more highly ranked than one that only serves a single purpose. Reviewing existing plans can identify opportunities for mutual support. Cost effectiveness can increase if multiple objectives can create synergies.
9. Long Term Lasting Impact. Create long term gains to the community with solutions that are replicable and sustainable, creating benefits for present and future generations.			
Indicator 9.1. Account for value of benefit to future generations when identifying preferred project designs.	*2*		To better reflect the multi-generational investments OMB Circular A-4 recommends applying a 1% discount rate in the economic analysis for future generations, 3% for a consumption perspective, and 7% discount rates to model an investment perspective. Document findings in the Business Case.
Total Possible Points	**23**	**0**	**Project TOTAL**
In meeting or exceeding the resilience performance standard of 18 points the project is contributing towards resilience by meeting the Time-to-Recovery goal			

Step 3: Develop a business case

Prepare a business case that documents how the project complies with the Resilience Performance Standard. A sample business case outline can be found in *Attachment 3: Business Case Report Template*.

The business case takes an analytical look at the project including alternatives, the costs, the return on investment both in terms of the economy and in value creation to the community and the environment. It is designed to enable efficient resource decisions and to appropriately value all relevant direct and indirect impacts, whether financial, environmental or social. With its emphasis on the triple bottom line, the business case helps to add rigor to the inclusion of environmental and social impacts as well as more financially-oriented economic analysis of projects.

Values are calculated both quantitatively and qualitatively. For example, two project alternatives may have similar capital and operations costs, but have a different qualitative impact on the community or the environment. Typical economics tools such as sensitivity analyses, various discount rates, and net present value calculations can help decision-makers make a fair comparison between alternatives.

Use of the business case template can help to create a common structure and toolkit of analytical tools. Use of the tools is intended to be flexible and practical with the expectation that project teams can reject infeasible alternatives to avoid unnecessary analysis.

Attachments

Attachment 1: Indicators of Resilience

Specific indicators have been developed to guide projects towards fulfilling the criteria noted above as part of the Resilient Design Performance Standard Score sheet. These indicators align with the "Resiliency Prioritization Criteria" documented in the *Colorado Resiliency Framework* and BOCO Strong's Characteristics of Resilient Communities, and are intended to help projects to become more resilient across the triple bottom line of economics, community, and the environment. They are based on application of elements of socio-ecological resilience science and sustainability practice. The overall goal of applying these indicators of resilience is to leverage every capital project as an opportunity to incrementally move Boulder County towards a more resilient future.

> ***Indicators of Resilience***
> *The overall goal of applying the indicators of resilience is to leverage every capital project as an opportunity to incrementally move Boulder County towards a more resilient future.*

1. CO-BENEFITS

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

Indicator 1.1. Apply a business case format that includes consideration of alternatives and robust analysis of those alternatives across the triple bottom line of economics, community, and the environment.

By definition, the Co-Benefits Indicator overlaps with other indicators, including High Risk and Vulnerability, Economic Benefit Cost, and Social Equity. The business case pulls all these elements together when analyzing a project across the triple bottom line of community, economy, and the environment.

Projects usually have more than one way to achieve the same basic objective. For some proposals there may be different technologies, different labor-vs.-capital mixes, different centralized-vs.-decentralized solutions, etc. Each of these alternatives may have a different mix of costs and benefits in economic terms and in impacts to the community and environmental systems. The intent is to identify a broad array of alternatives to then select an alternative that provides the same or better levels of service with greater resilience as calculated across the triple bottom line.

"Triple bottom line" evaluations seek to quantify financial, environmental and social impacts. These impacts should be quantified to the extent practicable, while retaining all significant non-quantified impacts in order to promote decision-making based on relevant information from a variety of sources. Some project costs and benefits may have a market price while others may have only non-market or qualitative values. (For example, improving habitat connectivity for a wildlife species may have an ecological value but an uncertain quantifiable monetary value. Noting that the ecological value is "high" or "low" can contribute to understanding the relative benefits of various alternatives under

consideration.) Some projects have externalities that create a positive or negative impact on entities other than the project proponent. Thus it is optimal if decisions are made with consideration of both internal and external impacts. Although they can be difficult to quantify, there are also often intangible perceptual values that are independent of quantifiable resource values. These intangibles often reflect social benefits (or costs) to people whose overall interests should be included in the analysis. Paying attention to the expected life of the project, residual value at the end of project life, and inter-generational equity transfers are often appropriately included on both the benefit and costs side of the evaluation. In preparing the business case, it is important to document consequential benefits and costs across the triple bottom line in quantifiable and qualitative terms.

A business case is prepared to take an analytical look at the project element alternatives, the costs and return on investment both in terms of the economy and in value creation to the community and the environment. See Chapter 3, Step 3 for more information. Also see *Attachment 3: Business Case Report Template* for example topics included in a well-developed business case.

BOCO Strong Characteristics of Resilience alignment: Robust and Able to Fail Safely, Resourceful, Inclusive, Integrated.

Indicator 1.2. Use multi-disciplinary design team to develop and consider a range of integrated solutions that provide enhanced value across the triple bottom line.
Many design teams convene a mix of experts and stakeholders with diverse backgrounds and expertise who can help to generate alternative strategies to achieve the project objective. The most valuable charrette participants are those people who have deep expertise in their chosen field AND a wide-ranging interest across the silos of practice. They have a combination of depth and breadth. Depth is important because it allows the team to have confidence that a novel approach can be accomplished. The breadth is important because it brings in unique insights that create new ways to look at a situation.

Teams should seek out and explore creative synergies in order to generate new alternatives to solve complex problems. Team leaders should seek out individuals with depth in one field and a breadth of appreciation for other fields. See *Attachment 2: The Charrette Process* for more detail.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Resourceful, Inclusive, Integrated.

2. HIGH RISK AND VULNERABILITY

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

Indicator 2.1. Align with the time-to-recovery performance goal.
When preparing to build, repair, or replace infrastructure or community facilities, project teams must determine applicable time-to-recovery goals found in the time-to-recovery goals matrices. The goals identify the desired time-to-recovery after natural hazard events. To calculate if a project design can meet the time-to-recovery goal, project designers estimate the damage from a design hazard event such as a 100 year flood and the time and cost to repair it. This estimate should be included in the

business case report developed for the project. The project satisfies the time-to-recovery goal if the project as designed can be permanently repaired or replaced within the timeframe allotted for the *operational* goal as indicated in the time-to-recovery goal matrix for the specific facility or infrastructure. The project should also be compared to the shorter timeframe performance goals of *minimal* or *functional* time-to-recovery. If the project does not satisfy those goals, then the team needs to indicate in the business case how the structural, temporary, or program-level work-arounds will deliver these shorter timeframe performance goals[6].

BOCO Strong Characteristics of Resilience alignment: Robust and Able to Fail Safely, Redundant, Flexible.

Indicator 2.2. Identify gaps and find solutions for moving forward.

If the project is dependent on the capacity of supporting infrastructure in order to meet the *operational* goal after an extreme event then the project team must develop and document in the business case the gap in performance and mitigate that gap with structural, temporary work-arounds, or programmatic strategies that will be included in order to comply with the required *operational* time-to-recovery performance goal. For example, the community-wide *operational* time-to-recovery goal for detention facilities is zero days, therefore, due to the goal being the most restrictive; it can be assumed that a specific detention facility would have the same expectation. Yet if the wastewater collection system is unable to provide service at that same performance level, then the detention facility must identify how it will work around this issue. The work-around may be to build onsite wastewater treatment, or to work with the wastewater treatment system operators to increase the robustness of the system to meet this standard, or to secure a hauling contract to haul and treat wastewater to an offsite location. Gaps and work-around solutions are included in the business case.

BOCO Strong Characteristics of Resilience alignment: Robust and Able to Fail Safely, Redundant, Flexible. In addition, BOCO Strong's Community Resilience Assessment can be a complementary tool to crosswalk gaps and solutions for infrastructure and community resilience.

Indicator 2.3. Consider project alternatives that augment capacity and increase buffers from high risk locations such as floodplains, landslide and urban wildfire interface when applicable.

A hazard is only a hazard if built systems are vulnerable to it. Projects can be vulnerable due to choices made in location and design. Reducing exposure to risk is a definitive precursor to resilience. Project teams should develop project designs that reduce vulnerability and increase the capacity of natural systems that are subject to catastrophic events such as floodplains, landslide and urban wildfire interface. Project design teams can seek out solutions and partnerships with public and private entities to create projects that reduce exposure and increase buffers from extreme events. Document the alternatives considered in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Robust and Able to Fail Safely, Flexible, Resourceful.

[6] Some projects may not be able to satisfy the operational goal, but would still be considered in compliance with the resilient design performance standard if the design team assesses the project in Step 2 and incorporates resilient design features and processes as feasible.

3. 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.

3.1. Evaluate benefit of programmatic solutions when developing alternatives for capital projects.

Some projects can meet their objectives either with major capital facilities that require little operational effort and expense, or alternatively with smaller or less costly capital facilities that require greater ongoing operating or maintenance efforts. Without proper consideration, project teams may generally assume that a capital project is always superior on the assumption that maintenance costs will always overwhelm capital and debt service costs. However, many asset managers have discovered that levels of service may at times be more cost-effectively met with a rapid repair program rather than a large and expensive capital improvement program. This has the added benefit of creating jobs local to the area with that capital circulating in the local economy rather than being exported to manufacturers outside of the community. A programmatic solutions analysis helps teams to find out which approach best serves the objectives. Complications can arise if the funding source is for capital only or for operations only even if cost savings and triple bottom line benefits would otherwise be available. This indicator must be documented in the business case.

BOCO Strong Characteristics of Resilience alignment: Redundant, Resourceful.

3.2. Consider if project can increase nearby land and property values and encourage local business opportunities.

In evaluating project alternatives, some alternatives may be able to be configured in ways that increase the benefits they provide to local residents, landowners, and business owners. The capacity of the community to be resilient in the face of disaster is increased when the community has a greater economic baseline to tap in times of stress, shock, and disruption. If project teams do not consider these options, then the potential to enhance the value to the community and the local economy is a lost opportunity. The intent of this indicator is to encourage project teams to seek to maximize the community values across the triple bottom line. Consideration does not imply that the project *must* increase nearby land and property values – only determine if it is a possibility. When the project team applies this indicator during their analysis they must document their findings in the business case.

BOCO Strong Characteristics of Resilience alignment: Redundant, Integrated.

3.3. Consider if project can create opportunities for local jobs and training

Project teams should seek to develop alternatives that can augment building the capacity of residents to improve their skills and increase their job prospects. As in the Indicator G. above, the capacity of the community to be resilient in the face of disaster is increased when employees have a greater skills base and earning power to tap in times of recovery. If the project team applies this indicator during their analysis, they must document their findings in the business case.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Diverse, Inclusive.

4. SOCIAL EQUITY

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

4.1. Avoid disproportionate negative impacts to vulnerable populations.
Use the Community Inclusion in Colorado mapping project to identify location-based demographics of populations that might be disproportionately impacted by the project. Seek to avoid or mitigate negative impacts. Look for solutions that engage affected populations as experts to help the project to align with their needs. Use these findings in preparing the triple bottom line analysis in the business case that evaluates economic, community, and environmental benefits and costs of the project.

BOCO Strong Characteristics of Resilience alignment: Inclusive.

4.2. Encourage diversity of actors and processes at each scale.
Systems can increase adaptive capacity with multi-scale diversity. Broad diversity of race, culture, gender, skills, income, and history helps a community to have increased capacity to understand change, innovate in the face of change, and provide perspective to change or disruption. Reaching out to local experts and staff with different backgrounds, cultures, and life experience can open up a broader range of alternatives to be considered. Broader alternatives consideration, especially across the silos of expertise can often provide the most value and adaptability for urban systems facing novel challenges from a variable climate. Encourage a diversity of viewpoints and document the public outreach and consultation process and findings in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Diverse.

4.3. Maintain and enhance social connectedness up, down, and between community groups, civic groups, religious and cultural communities, as well as opinion leaders in business and environment to foster understanding of complex adaptive systems and to reinforce the social connections and identity of residents, employers, and employees..
During times of stress, communities that are connected are better able to adapt to changing conditions. For example, if a tornado or flood destroys a business district or neighborhood, the local people who know each other in advance of the event have increased capacity to work together to address the needs of the moment. Thus a key strategy for social resilience is to connect the highly-connected nodes in a community before an event. A thorough and inclusive outreach process connected to projects can reach out to government officials, community leaders, cultural leaders, and opinion leaders in the project area. A goal is to connect highly connected leaders in business, environment, and social equity so they are well-acquainted with each other and can then leverage each other's network of trusted contacts and advisors.

Understanding that we are in a complex continually adapting world can become a framework for how we give meaning to shocks, shifts, and gradual change. In sharing stories we reinforce social connections and help people to understand intuitively that we are in a world where coping with change and uncertainty is understood as an appropriate management approach. Civic leaders and project teams can frame their messages during project outreach and consultation in terms of "who we are": we are people who are survivors, who help each other, who build back better for ourselves and

for future generations. The stories create expectations about the challenges faced and the lessons learned. Document the public outreach process in the business case.

BOCO Strong Characteristics of Resilience alignment: Flexible.

4.4. Incorporate monitoring and feedback loops to enable project managers to moderate behavior, be accountable, and adapt as conditions change.

Resilience of a system is enhanced if accountability measures and verification provide metrics that create assurances that projects and processes will tend to perform as expected. Monitoring and understanding signals of impending change can provide feedback that helps to maintain stability in the face of shocks or surprise or long term underlying variables. Managing well in the face of change includes having the ability to sense and understand changes underway. A robust outreach and consultation strategy reaches out early and often to monitor project impacts and make adjustments as needed. Being clear and transparent on accountability systems also builds trust for the project, the process, and the proponent. Document the ongoing public outreach, monitoring, and accountability measures in the business case.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Flexible, Inclusive, Integrated.

4.5. Create places that foster community identity and that enhance the experience of neighbors and visitors.

People take care of things that they cherish. While every project gets designed, too often functionality is the only consideration when a project could create a broad range of additional values for the community. Excellent design demonstrates empathy for the community it serves and creates an emotional resonance that people value. A single project can integrate intimately with people's lives, and this provides an opportunity to contribute to quality of life that can have a domino effect on improving other aspects of a community. Encourage project design teams to consider alternatives that create beauty, aesthetics, and appreciation on behalf of those that take ownership, real or symbolic. Document the value of the design excellence via monetary quantification or qualitative descriptions in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Integrated.

5. TECHNICAL SOUNDNESS

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

5.1. Design project to meet existing engineering and building code standards

All projects must meet existing codes and legal requirements as a baseline condition. Safety standards for buildings and infrastructure are set via building codes or existing engineering standards based on design hazard levels (e.g., 100 year flood). Projects must meet other existing minimum requirements where required, such as those for energy and water conservation. Project teams demonstrate compliance by securing permits as needed.

BOCO Strong Characteristics of Resilience alignment: Not applicable. This is a minimum requirement intended as a baseline step from which to build upon for resilience.

5.2. Consider how well project will perform in uncertain times.

Uncertainties from climate change, technological shifts, population growth, and resource scarcity make it difficult-to-impossible to accurately determine the appropriate capacity for a system to absorb an uncertain range of stresses, shocks, and disturbances. Testing how alternative solutions respond across a range of possible future conditions can help the project team to determine which project design performs the best. For a flood project, the team would evaluate how the system would perform under a 500-year or a 1,000-year flood. Apply a sensitivity analysis to project alternatives under consideration to determine vulnerability to uncertainties and risks to success. Consider if there are non-capital mitigation strategies that might enhance the project to mitigate this small probability high impact events. Include the results in the sensitivity analysis in Business Case.

BOCO Strong Characteristics of Resilience alignment: Robust and Able to Fail Safely.

6. INNOVATION

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

6.1. Project teams should consider both traditional and nontraditional alternatives to a proposed project.

The value of non-traditional approaches is that they tend to be multidisciplinary and may create benefits and costs sometimes missed in traditional practice. The intent is to compare traditional and nontraditional alternatives that are feasible and provide outcomes with the same or better levels of service. The definition of traditional can change over time. For example, some sustainability project elements such as energy conservation were considered non-traditional two decades ago. Now, they are considered the norm. This indicator encourages project designers to consider cutting edge technologies and methods when defining the non-traditional alternative. If, however, an alternative has a self-evident fatal flaw or is infeasible, it should be documented as considered and rejected with a rationale for elimination to avoid expending resources on non-competitive alternatives. Document the alternatives considered in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Flexible, Resourceful.

6.2. Consider if natural system functions can be included in project design and operations.

Use nature as a partner and metaphor in project design. Retain, enhance, reintroduce, or mimic natural processes and habitats. Salvage and reuse native topsoil according to habitat type to improve survival rates of revegetated areas. Use deep friable soils to retain rain and seek to extend green networks of natural infrastructure throughout urban areas. In buildings create natural ventilation and flood indoor areas with natural daylight. Use transportation corridors to increase native vegetation, grow food, or grow habitat for pollinators. Encourage greening of neighborhoods and green stormwater infrastructure to enhance vegetated cover in urban areas to control runoff, improve air quality, reduce the urban heat island effect, and improve property values.

BOCO Strong Characteristics of Resilience alignment: Flexible, Resourceful.

7. ADAPTIVE CAPACITY

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

7.1. Consider project solutions at a variety of different scales so that impact at any one scale is less likely to impact similar functioning systems at different scales.
Infrastructure systems such as district energy and water systems can add adaptive capacity to the whole system as an impact at any one scale may not impact similar functions at different scales with different system drivers. Legacy centralized systems continue to provide the backbone levels of service, but district-scale systems can relieve the peak demands on the centralized systems and provide additional buffers against extreme events.

BOCO Strong Characteristics of Resilience alignment: Redundant, Integrated.

7.2. Consider a diversity of sources to add adaptability and flexibility for infrastructure systems during times of stresses, shocks, or loss of access to resources.
In water supply, systems are more reliable when they have a variety of sources with different functional profiles. Water diverted from two watersheds increases reliability over just one as the rain and snowfall in each watershed may differ year upon year. Similarly, groundwater wells provide a third source of reliability. Many utilities are turning to reclaiming wastewater for nonpotable purposes as a drought-proof water supply augmentation. Diversity of sources applies just as well in other contexts such as use of multiple sources of electrical energy such as energy grids plus onsite renewables plus batteries plus wind; diversity of thermal sources such as solar hot water plus sewer heat recovery plus geoexchange to tap the thermal energy of the earth; and, diversity of food supply from both imported and locally available sources. Apply the consideration of diversity of sources in the project design charrette process and document results in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Redundant, Flexible, Diverse.

7.3. Consider cost-effective modular, repeatable strategies.
Use of modularity can provide quick repairs for replaceable parts that can be replicated as needed in similar circumstances. In nature, assemblages of smaller modular systems can be built into larger multi-functional systems with capacity to adapt to stress, shock, and rebuild. The modular approach can be repeated across urban service areas to increase adaptive capacity. Apply the consideration of modularity in the project design charrette process and document results in the Business Case.

7.4. Consider if the project can maintain and enhance connectivity between habitat systems and provide appropriate buffers to allow habitat to serve beneficial functions for plants and wildlife.
Species have greater options to find required food, shelter, and breeding options within connected habitat systems. Buffers and setbacks allow for an appropriate transition between habitat and developed areas to decrease plant mortality and provide shelter and separation for wildlife from human activities and associated noise. Apply the consideration of connectivity and buffering of habitat in the project design process and document results in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Flexible, Diverse, Integrated.

7.5. Consider if the project can enhance the range of mobility connections.
Choices in mobility modes increase the adaptive capacity of the community during times of stress, shock, or loss of access to other modes. Bicycle trails and walkways are energy efficient and reliable methods of mobility that provide connectivity when roads are damaged or fuel supplies are low. Helicopters and drones can supply resources and information to isolated areas. Apply the consideration of connectivity of modes of mobility in the project design process and document results in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Redundant, Diverse, Integrated.

7.6. Consider if project can store and restore capacity of reserves at each scale so isolated elements can survive for a period on their own.
The overall ability of a system to absorb shocks or disruption is increased if essential reserves of energy, food and water are stored at each scale. Energy storage at the building and neighborhood scale can moderate and avoid costly peak demand energy supplies and soften the impact of centralized outages. Storage of food and water at the neighborhood level can greatly increase the capacity of communities to handle extreme events. Apply the consideration storage in the project design process and document results in the Business Case.

7.7. Evaluate potential of creating semi-autonomous systems at the building, neighborhood, and district scale.
Semi-autonomous systems are self-organizing and have the capacity to self-correct given new insight and information. They do not require extensive command and control and are the source of innovation that can create novel adaptations to variability. This innovation provides increased capability for all systems to adapt to fast and slow change. Apply the consideration of semi-autonomous systems in the project design process and document results in the Business Case.

BOCO Strong Characteristics of Resilience alignment: Redundant, Resourceful.

8. HARMONIZE WITH EXISTING ACTIVITY

Expand, enhance, or leverage work being done to build on existing efforts. Assure outcomes that are environmentally friendly, sustainable, and complementary to the natural setting

8.1. Identify project design solutions that leverage and enhance the function of existing natural, social, and infrastructure systems.

A project that can provide multiple benefits provides more value to a community than one that only serves a single purpose. Stormwater management can create new open spaces. Transportation projects can provide habitat. Green stormwater infrastructure can increase nearby property values, cool hot summer weather, and increase habitat. Reviewing existing plans and information sources can identify opportunities for mutual support. Additionally, a project does not stand alone; it interacts with other projects or activities that are underway and can create a cumulative effect. Cost effectiveness increases if multiple objectives create synergistic benefits. Document multiple benefits in business case report.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Flexible, Integrated.

9. LONG-TERM LASTING IMPACT

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

9.1. Account for value of benefit to future generations when identifying preferred project designs.

We are trustees of the natural environment for future generations who have an equal claim to use and benefit from it. Similarly, we are the trustees of the built environment, since some infrastructure is built to last for decades or longer. Yet all too often, decision-making is predominately made from the perspective of the present generation. Every generation experiences the impact of imperfect decision-making from previous generations. Likewise, future generations will face challenges presented by our design decisions today. There is value in accounting for the multi-generational trustee role and imperfect knowledge in today's decision-making.

This challenge can be addressed in part during economic analyses through the use of discount rates selected to better balance long-term benefits and costs. For multi-generational investments the Office of Management and Budget recommends use of a real 1% discount rate in determining the benefit cost ratio. This real discount rate (above inflation) is calculated in addition to the more typical 3% discount rate used by many government entities and the 7% discount rates (often used to reflect a private investment perspective). Use all three discount rates in the analysis. Use of the 1% discount rate creates a more attractive benefit:cost ratio than might otherwise be the case if only using the 3% or 7% discount rates. Decision-makers can select which discount rate is most appropriate when selecting the preferred alternative project design.

BOCO Strong Characteristics of Resilience alignment: Able to Learn, Inclusive.

Attachment 2: The Charrette Process

1. Convene multi-disciplinary teams for intense pre-design session to identify possible alternative solutions.
2. Assemble maps, background materials, project purpose, and resilience performance standards.
3. Develop wide-ranging possible solutions.
4. Capture charrette outputs via drawings, sketches, maps, and written reports.
5. Refine best solutions for further evaluation in normal project development processes.

Preparation for a charrette requires maps, background information, connectivity to the web and GIS, white boards, work areas, printers, food, and facilitation. Typically, charrettes are small with a dozen or two participants, although some charrettes can include hundreds of participants. Length of time for a charrette is from half a day up to five days for larger efforts. Teams of participants, perhaps 5-10 per team, are given assignments and short periods of time to generate ideas, assemble them into plausible solution sets, and then to do quick troubleshooting and refinement.

There are regular times when teams assemble to update each other. It is quite helpful to invite regulators to the charrette to become "barrier busters." Their job is to help the teams identify if there are regulatory challenges of a particular approach and to help the team understand what it would take to adjust the approach or to adjust the regulations to achieve the creative outcome.

The outputs of the charrette are captured via drawings, written reports, and sometimes video or audio recordings. Design teams that continue forward after the charrette then vet and refine the generated alternatives to determine which may be most resilient, sustainable, plausible, affordable, or add the most value to the community and the environment. Lastly, the design teams provide a business case that documents consideration and analysis of alternatives considered for the project.

Attachment 3: Business Case Report Template

A business case should be commensurate with project size and complexity. Simple projects could be 2 to 3 pages, but more complex projects may require substantial documentation.

1) Background
2) Project History
3) Project Description (Use measurable terms if possible)
    i) Objectives
    ii) Why is project needed?
    iii) What resources are needed?
    iv) What service level will the project meet?
    v) What functional purpose will the project accomplish?
    vi) What outcomes will the project produce?
    vii) How will success be measured?
    viii) How does the project serve the needs of the community?
    ix) What are project risks?
    x) What are positive and negative effects on ongoing O&M practice?
4) Timetable
    i) What is the project timeline?
    ii) What are the key milestones?
    iii) Will project be developed in phases?
    iv) Where are go/no-go decisions made?
5) Map
    i) Include map
    ii) Provide concept plan or sketch
6) Public Outreach and Consultation Process
    i) Avoidance of impacts to vulnerable populations?
    ii) Diversity of outreach?
    iii) Enhance social connectedness?
    iv) Incorporate monitoring and feedback?
    v) Tell the story of the project?
    vi) Build trust?
    vii) Create places that enhance the experience of neighbors and visitors?
7) Outline and evaluate alternatives
    i) Did project team use an integrated design charrette?
    ii) What are the alternatives identified to achieve the project objectives?
    iii) What resilience indicators were included and what was the result of applying each indicator?
    iv) Were creative or unconventional options considered?
    v) What is the outcome of doing nothing?
    vi) Pros and cons of each alternative
    vii) What are the potential uncertainties?
    viii) What are the risks to success?
    ix) Any institutional barriers that exclude certain options?

8) Metrics for success and accountability measures
   i) How will project success be quantified?
   ii) What is the plan to measure success?

9) Other Agency Issues
   i) Does project success require actions from other agencies?
   ii) What are their issues?

10) Triple Bottom Line Analysis

11) Show capital and O&M cost for alternatives

12) Multi-year costs
   i) Use Present Value @ 1, 3, and 7% discount rate
   ii) Include total capital cost
   iii) Include long-term O&M
   iv) Include any other lifecycle costs
   v) Include indirect community costs

13) Benefits
   i) Quantify if possible: direct, indirect and monetary
   ii) Highlight intangible (difficult to quantify) benefits including:
      - Co-benefits
      - High risk and vulnerability
      - Economic benefit cost
      - Social equity
      - Technical soundness
      - Innovation
      - Adaptive capacity
      - Harmonize with existing activity
      - Long term lasting impact.

14) Net Present Value (NPV)
   iii) Calculate NPV for costs and benefits that are quantifiable in dollar values
   iv) Alternatively, show project cost-effectiveness when benefits are non-monetary

15) Recommendation
   v) Why is it recommended?
   vi) What is capital expenditure timing?
   vii) What is overall project timeline?

Appendices (Included in Volume II)

Appendix A: Stakeholder Engagement Summary and Notes
Appendix B: Community-Specific Time-to-Recovery Performance Goals Matrices
Appendix C: Workshop Sign-in Sheets

Resilient Design Performance Standard for Infrastructure and Dependent Facilities

VOLUME II: Appendices

BOULDER COUNTY CDBG-DR COLLABORATIVE

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PREPARED FOR
Boulder County CDBG-DR Collaborative

BOULDER COUNTY COLLABORATIVE
CDBG Disaster Recovery Funding
Your Dollars in Action

Resilient Design Performance Standard for Infrastructure and Dependent Facilities

Boulder County CDBG-DR Collaborative

VOLUME II – APPENDICES

March, 2016

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Volume II

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Appendix A: Stakeholder Engagement Summary and Notes

To create and refine the time-to-recovery goals matrices for Boulder County and each community, Collaborative members and stakeholders participated in a series of meetings:

- Project Kickoff Meeting, November 20, 2015. The purpose of this meeting in Longmont was to set the stage for the project by identifying existing best practices and similar frameworks to help guide the project, presenting the recent work of the National Institute for Standards and Technology (NIST) in the area of community resilience planning and the NIST community resilience concepts, and to present the project in the larger context of the recently completed Colorado Resiliency Framework. In addition to the consultant team, the meeting included representatives from the Cities of Longmont, Boulder, and Louisville, the Towns of Nederland and Jamestown, Boulder County, the State of Colorado Department of Local Affairs (DOLA) and Resiliency and Recovery Office (CRRO), and the United States Department of Housing and Urban Development (HUD) Region 8 Office, for a total of 21 people.

- Resilience Performance Goals Meeting, December 11, 2015. The purpose of this meeting in Boulder of the Collaborative was to develop the draft resilience performance goals for Boulder County by filling the time-to-recovery matrix for the region and defining acceptable levels of recovery time and *functionality* for elements of each cluster. In addition to the consultant team, the meeting included representatives from the Cities of Longmont, Boulder, and Louisville, the Towns of Nederland and Lyons, Boulder County, DOLA and CRRO, and the Science and Technology Policy Institute, for a total of 22 people.

- Utility Provider Workshop, January 11, 2016. This workshop in Boulder was with utility or service providers to introduce the project to and collect their input on the draft time-to-recovery matrices that had been developed by the Collaborative. In addition to the consultant team, the utility providers meeting included representatives from the Cities of Longmont, Boulder, and Louisville, the Town of Lyons, Boulder County, HUD, and Western Disposal, for a total of 22 people.

- Stakeholder Workshop, January 11, 2016. Each community in the Collaborative identified stakeholders to invite to this workshop based on expertise and responsibility as related to building and infrastructure categories and community services in the matrices. The purpose of the workshop was to introduce the project and collect input on the draft time-to-recovery matrices. Each community of the Collaborative was given opportunity to tailor matrices to better reflect their circumstances and priorities. In addition to the consultant team, the stakeholders meeting included representatives from the Cities of Longmont, Boulder, and Louisville, the Towns of Lyons, Jamestown, and Nederland, Boulder County, the Fourmile Watershed Coalition, the State of Colorado Division of Homeland Security and Emergency Management, CRRO, HUD, the National Renewable Energy Laboratory, BOCO Strong,

Boulder Small Business Development Center, GP HomeOwners Association, Hill Petroleum, Via, and Western Disposal, for a total of 36 people.

- Resilient Design Performance Standard Implementation Training, March 17, 2016. Representatives of communities in the Boulder County Collaborative and other stakeholders participated in a three-hour training on how to apply the Resilient Design Performance Standard to projects, how to provide guidance to others to do the same, and to give feedback on finalizing the standard. The team walked through two examples of applying the standard to existing CDBG-DR projects.

Appendix B: Community-Specific Time-to-Recovery Performance Goals Matrices (Following Pages)

Local community representatives developed specific comments on the time-to-recovery matrices which are included here. These comments are provided as additional input and are meant to be advisory to project design teams. The decision to use the overall time-to-recovery matrix included in Volume 1 or these advisory performance goals is the choice of the local jurisdiction.

City of Boulder

CITY OF BOULDER: BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										**Should waste-water facilities be in the critical facilities cluster?**
Emergency Operations Centers	Operational									
First Responder Facilities (Fire- and police-stations)	Operational									
Hospitals	Minimal				Functional		Operational			Talk to Boulder County Health and Medical Response (HAMR) group and get them to validate: Mary Pancheri, 303-994-4352, Mpancheri@luhcares.org
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional	Operational					Changed to march row 24: Businesses - retail
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools			Operational							Kids need to be in school for parents to resume their activities.
Daycare centers, incl. home-base centers										Is this the responsilbility of the local governments?
Hotels and Motels				Functional%	Operational					
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				Comment from Mark Gittes (Boulder SBDC): I looked through the "business" categories listed under "community recovery" and I think the percentages look pretty good. As stated, critical retail businesses would be high priority and there might be different opinions on that category. Obviously businesses depend very much on transportation (to receive and ship product and for employees to get to work!), energy, and communication. At the time of the 2013 floods I owned a manufacturing company and we were shut down for about a week. Our power came on after 3 days but Arapahoe was still closed so we couldn't ship product and the employees couldn't come to work. I was able to check emails and get calls on my phone so communication wasn't really affected that much. We didn't have damage but the business right next to us was flooded and some of his computer equipment got ruined. Anyway, if you have any specific questions feel free to ask. Thanks.
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues					Minimal	Functional	Operational			

City of Boulder

CITY OF BOULDER: TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster relief)										
Freeways and Expressways	Minimal			Functional	Operational					
Other Principal Arterial Highways			Minimal	Functional	Operational					
Minor Arterial Highways			Minimal	Functional	Operational					
Local Roads				Minimal	Functional			Operational		
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Egress (emergency egress, evacuation)										
Freeways and Expressways	Minimal			Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Community Resilience										
Critical Facilities										
Emergency Operational Centers	Operational									Match the building cluster matrix.
Police and Fire Stations	Operational				Operational					Match the building cluster matrix.
Hospitals	Operational									You can only access to BMC via Arapahoe Avenue, so this road should be accessible at all times.
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									

City of Boulder (Transportation, Cont.)

Neighborhood										
Critical Retail			Minimal	Functional	Operational					Modified to mirror building cluster matrix
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools			Operational							
Daycare centers, incl. home-base centers										
Hotels and Motels				**Functional**	Operational					
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues					Minimal	Functional	Operational			
Non-emergency City Services										

City of Boulder

CITY OF BOULDER: WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		
Raw Water Conveyance				Functional				Operational		
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Operational				
Water for Fire Suppression	Minimal					Operational				
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)	Minimal			Functional		Operational				
Control Systems										
SCADA or other	Minimal			Functional		Operational				
Distribution										
Critical Facilities										
Emergency Operations Centers	Operational									
First Responder Facilities (Fire- and police-stations)	Operational				Operational					
Hospitals	Operational									
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional	Operational		Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools			Operational							
Daycare centers, incl. home-base centers										
Hotels and Motels				Functional%	Operational					Modified to mirror building cluster matrix
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues					Minimal	Functional	Operational			

City of Boulder

CITY OF BOULDER: WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection		Minimal		Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional			Operational			
Control Systems										
SCADA or other			Minimal	Functional				Operational		
Collection Lines										
Collection Liness			Minimal		**Functional**			Operational		
Critical Facilities										
Emergency Operations Centers	Operational									Modified to mirror building cluster matrix Additional revision after that with input from input from the head of the wastewater treatment facility here in Boulder (Chris Douville) on the: - Collection Lines row - Assisted Living Facilities row: moved the Minimal - Daycare centers: added percentages - Hotels and Motels row: added Minimal
First Responder Facilities (Fire- and police-stations)	Operational				Operational					
Hospitals	Operational									
Assisted Living Facilities			Minimal		Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									

City of Boulder

WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levy Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	Contigent on local, state, federal permitting processes
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration									Operational	
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	Contigent on local, state, federal permitting processes
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

City of Boulder

ENERGY INFRASTRUCTURE	Design Hazard Performance									CHANGE NEEDED
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Transmission and Distribution (including Substations)				Operational						
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

City of Boulder

CITY OF BOULDER: COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Boulder County Unincorporated Areas

BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										**Most County facilities in larger towns, not in unicorporated areas**
Emergency Operations Centers	Functional			Operational						Smaller towns each need some public facility to be available to serve as emergency coordination center on day 0
First Responder Facilities (Fire- and police-stations)	Functional				Operational					Labor and access to equipment more important than building functionality
Hospitals	Minimal				Functional		Operational			Critical facilities may not need to be immediately available in small town if functioning in region. Transportation access is critical.
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									Most/many will shelter in place in mountain towns
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Boulder County Unincorporated Areas

TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster relief)										**90% by 8-12 Weeks is more appropriate for most; Some transportation access critical in phase 1 for county services**
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways				Minimal	Functional	Operational				Peak to Peak Highway is critical for mountain towns; if one canyon is closed can get to another. For Lyons, highways 36 and 66 are critical
				Minimal	Functional	Operational				
Local Roads				Minimal	Functional			Operational		Provided there are other access routes, this can be managed.
Bikeways					Minimal	Functional	Operational			Looser standards, not critical in phase 1 - roads can be biked upon if bike routes closed
Transit, Bus, Light Rail, Transit Lanes				Minimal	Functional	Operational				Bus route critical for Nederland
A Regional Airport						Minimal		Functional	Operational	
Private bridges and culverts [added]					Minimal			Functional	Operational	
Egress (emergency egress, evacuation)										**What is reasoning for differences between ingress and egress infrastructure capacity? Consider making recovery times for roads used for ingress and egress the same (they are the same roads)**
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						Peak to Peak Highway is critical for mountain towns; if one canyon is closed can get to another
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		Provided there are other access routes, this can be managed.
Bikeways			Minimal	Functional	Operational					Not critical for evacuation; can bike on roads.
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	Bus route critical for Nederland
Community Resilience										
Critical Facilities										
Emergency Operational Centers	Functional			Operational						
Police and Fire Stations	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									

Boulder County Unincorporated Areas (Transportation, Cont.)

Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		
Non-emergency City Services										

Boulder County Unincorporated Areas

WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		Critical in mountain towns
Raw Water Conveyance				Functional				Operational		
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Operational				
Water for Fire Suppression	Minimal					Operational				Critical to have some availability of water for fire suppression day 0 in each town/community
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Minimal				Operational				
Control Systems										
SCADA or other		Minimal				Operational				
Distribution										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Boulder County Unincorporated Areas

WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short Term			Phase 2 Intermediate			Phase 3 Long Term			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational		
Control Systems										
SCADA or other				Functional				Operational		
Collection Lines										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public										
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Boulder County Unincorporated Areas

WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levee Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	Reality from 2013 much different. Season dependent, fire area revegetation. Exigent protection measures
Trail Restoration									Operational	
Habitat Restoration									Operational	Several years of ongoing restoration
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

Boulder County Unincorporated Areas

ENERGY INFRASTRUCTURE	Design Hazard Performance									CHANGE NEEDED
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Transmission and Distribution (including Substations)				Operational						Add new row - containment of oil and gas wells
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Boulder County Unincorporated Areas

COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

City of Longmont

BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals	Minimal				Functional		Operational			Fed. Joint commission governs recovery
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels	Minimal		Functional			Operational				In Longmont, hotels/motels all clustered in floodplain...County's 1-4 week fully operational goals may not be realistic.
Community Recovery										
Businesses - Manufacturing				Minimal	Functional			Operational		
Businesses - Retail			Minimal	Functional	Operational			Operational		Which businesses are considered critical? Where to draw the line? Need to define.
Businesses - Service Professions				Minimal	Functional	Operational		Operational		Medical / dental included in this category?
Conference and Event Venues						Minimal	Functional	Operational		
										All "community recovery" categories thought to be ambitious

City of Longmont

TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster relief)										
Freeways and Expressways			Minimal	Functional	Operational					For all in this category -- consider if getting to 90% in 4-8 wks is possible
Other Principal Arterial Highways			Minimal	Functional	Operational					
Minor Arterial Highways			Minimal	Functional	Operational					
Local Roads				Minimal	Functional			Operational		
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Egress (emergency egress, evacuation)										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		Referred to as collector roads, residential roads
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Community Resilience										
Critical Facilities										
Emergency Operational Centers	Functional			Operational						
Police and Fire Stations	Functional				Operational					
Hospitals	Minimal				Functional		Operational			Align with timelines on 1st page
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									

City of Longmont (Transportation, Cont.)

Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions			Minimal		Functional	Operational				Many of these are home-based -- consider this when looking at recovery times
Conference and Event Venues						Minimal	Functional	Operational		
Non-emergency City Services										
										General comments: --Spacing between recovery times may need to be increased (e.g., ingress/egress)

City of Longmont

WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		
Raw Water Conveyance				Functional				Operational		
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Operational				
Water for Fire Suppression	Minimal					Operational				
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Minimal				Operational				
Control Systems										
SCADA or other		Minimal		Operational						SCADA should be resilient, recovery of systems should be fast
Distribution										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

City of Longmont

WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational		
Control Systems										
SCADA or other				Functional				Operational		
Collection Lines										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public										
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

City of Longmont

WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levy Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	
Trail Restoration									Operational	
Habitat Restoration									Operational	
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

City of Longmont

ENERGY INFRASTRUCTURE	Design Hazard Performance									CHANGE NEEDED
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Transmission and Distribution (including Substations)				Operational						
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals	Minimal				Functional		Operational			
Assisted Living Facilities	Minimal				Functional				Functional	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

City of Longmont

COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Lyons

Lyons: BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										
Emergency Operations Centers	Functional			Operational						Elementary school becomes emergency center
First Responder Facilities (Fire- and police-stations)	Functional				Operational					Volunteer firefighter ability to access equipment even if building is compromised. At least Minimal of resources on line by day zero
Hospitals	Minimal				Functional		Operational			Critical facilities goals are ok for region but are dependent on transportation access
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									Later recovery time
Single and Multi-family Housing (Shelter in place)	Operational									Later recovery time
Neighborhood										
Critical Retail			Minimal	Functional			Operational			Market
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				School
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						Elementary school becomes emergency center
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Lyons

Lyons: TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster relief)										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways			Minimal	Functional	Operational					Highways 36 and 66 critical
Minor Arterial Highways			Minimal	Functional	Operational					
Local Roads			Minimal		Functional	Operational				Operational 8-12 weeks
Bikeways			Minimal	Functional				Operational		Bikeways 4-24 months
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Egress (emergency egress, evacuation)										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Community Resilience										
Critical Facilities										
Emergency Operational Centers	Functional			Operational						
Police and Fire Stations	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		
Non-emergency City Services										

Town of Lyons

Lyons: WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		
Raw Water Conveyance				Functional				Operational		
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Operational				
Water for Fire Suppression	Minimal					Operational				
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Minimal				Operational				
Control Systems										
SCADA or other		Minimal				Operational				
Distribution										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Lyons

Lyons: WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational		
Control Systems										
SCADA or other				Functional				Operational		
Collection Lines										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public										
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Lyons

Lyons: WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levy Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	
Trail Restoration									Operational	
Habitat Restoration									Operational	
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

Town of Lyons

Lyons: ENERGY INFRASTRUCTURE	Design Hazard Performance									COMMENTS/NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Transmission and Distribution (including Substations)				Operational						
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Lyons

Lyons: COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Jamestown

JAMESTOWN: BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										
Emergency Operations Centers	Functional			Operational						Town Hall -- Yes, reasonable (Essential facility)
First Responder Facilities (Fire- and police-stations)	Functional				Operational					Yes, reasonable
Hospitals	Minimal				Functional		Operational			
Assisted Living Facilities	Minimal				Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									Jamestown Elementary
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Jamestown

JAMESTOWN: TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways			Minimal	Functional	Operational					James Canyon -- Sufficient for Minimal; may be unrealistic for Operational
Minor Arterial Highways			Minimal	Functional	Operational					
Local Roads				Minimal	Functional			Operational		If Functional, allows everyone to access homes
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Egress (emergency egress,										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		
Bikeways			Minimal	Functional	Operational					
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	
Community Resilience										
Critical Facilities										
Emergency Operational Centers	Functional			Operational						
Police and Fire Stations	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		
Non-emergency City Services										

Town of Jamestown

WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		Would be great. May be unrealistic.
Raw Water Conveyance				Functional				Operational		
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Functional		Operational		See changes
Water for Fire Suppression	Minimal					Functional		Operational		See changes
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Minimal				Operational				
Control Systems										
SCADA or other		Minimal				Operational				
Distribution										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									Consider alternative solutions to FEMS's TRA, such as water cisterns to all people to shelter-in-place
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			90%	This is realistic. Needs to include private access, such as private bridges and culverts.
Schools				Minimal				Operational		See change -- [Initial target of "operational" in 1-4 weeks] not realistic. Maybe 30% ["minimal"]. May also be that once students are displaced, it may be good for them to finish school year there if family housing is displaced.
Hotels and Motels				Operational						
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Jamestown

JAMESTOWN: WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational		
Control Systems										
SCADA or other				Functional				Operational		
Collection Lines										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public										
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Jamestown

JAMESTOWN: WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levy Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	
Trail Restoration									Operational	
Habitat Restoration									Operational	
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

Town of Jamestown

JAMESTOWN: ENERGY INFRASTRUCTURE	Design Hazard Performance									CHANGE NEEDED
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Transmission and Distribution (including Substations)				Operational						
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Jamestown

JAMESTOWN: COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Nederland

Nederland: BUILDING CLUSTERS	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities										
Emergency Operations Centers	Minimal			Operational						
First Responder Facilities (Fire- and police-stations)		Minimal			Operational					Huge aspect- required to be on line. 30% is minimum
Hospitals	Minimal				Functional		Operational			No hospital. Need access to regional hospitals
Assisted Living Facilities	Minimal				Functional				Operational	8 units
Detention Centers	Operational									Only inmates are at Police Department to be moved to County facilities
Emergency Housing										
Temporary Emergency Shelters	Operational									Nederland Community Center as countywide (mountain) evacuation
Single and Multi-family Housing (Shelter in place)	Operational									Most/many will shelter in place
Neighborhood										
Critical Retail			Minimal	Functional			Operational			Hinges upon access and supply and power supply. Road access is primary.
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				Consider social media access and outreach for congregation members. Also, affects external church
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	Many folks will want to shelter in place, resume life asap.
Schools				Operational						If school resumes, otehrwise evacuation /mtg. potential
Hotels and Motels				Operational						Tourism would be limited. Hotel/motel serves as extra housing
Community Recovery										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					Limitation of local mountain services. Nederland is hub for many mountain communities.
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Nederland

Nederland: TRANSPORTATION INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Ingress (goods, services, disaster relief)										
Freeways and Expressways			Minimal	Functional	Operational					None close to Ned
Other Principal Arterial Highways			Minimal	Functional	Operational					Peak to Peak Highway is critical as is Canyon Road
Minor Arterial Highways			Minimal	Functional	Operational					
Local Roads				**Minmimal**	Functional					Provided there are other access routes, this can be managed.
Bikeways			Minimal	Functional	Operational					Looser standards - roads can be biked upon if bike routes closed
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					Only bus route - critical to reduce infrastructure load
A Regional Airport						Minimal		Functional	Operational	
Egress (emergency egress, evacuation)										
Freeways and Expressways			Minimal	Functional	Operational					
Other Principal Arterial Highways	Minimal		Functional	Operational						Peak to Peak highway is critical; Canyon Road
Minor Arterial Highways	Minimal		Functional	Operational						
Local Roads				Minimal	Functional			Operational		Can be managed if other access routes available
Bikeways			Minimal	Functional	Operational					Not as critical - roads can be biked upon as alternative
Transit, Bus, Light Rail, Transit Lanes			Minimal	Functional	Operational					
A Regional Airport						Minimal		Functional	Operational	Bus availability is critical for infrastructure load

Town of Nederland (Transportation, Cont.)

Community Resilience											
Critical Facilities											
Emergency Operational Centers	Functional			Operational							Priority
Police and Fire Stations	Functional				Operational						Priority
Hospitals			Minimal		Functional		Operational				
Assisted Living Facilities				Minimal	Functional				Operational		
Detention Centers	Operational										
Emergency Housing											
Temporary Emergency Shelters	Operational										
Single and Multi-family Housing (Shelter in place)	Operational										
Neighborhood											
Critical Retail			Minimal	Functional			Operational				
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational					
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational		
Schools				Operational							
Hotels and Motels				Operational							
Community Recovery											
Businesses - Manufacturing				Minimal	Functional	Operational					
Businesses - Retail			Minimal	Functional	Operational						
Businesses - Service Professions				Minimal	Functional	Operational					
Conference and Event Venues						Minimal	Functional	Operational			
Non-emergency City Services											

Town of Nederland

Nederland: WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Source Water										
Raw Water, Source Water, Terminal Reservoirs				Functional				Operational		Critical in mountain towns
Raw Water Conveyance				Functional				Operational		Prioritization
Irrigation Ditches				Minimal			Functional	Operational		
Potable Water Supply (WTP, wells, impoundments)			Minimal			Operational				
Water for Fire Suppression	Functional (60%)					Operational				Immediately available as water is critical - at least Functional (60%) on Day zero
Transmission (Including Booster Stations)										
Backbone Transmission Facilities (pipelines, pump stations, tanks)		Functional (60%)				Operational				Functional (60%) is vital
Control Systems										
SCADA or other		Minimal				Operational				
Distribution										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									

Town of Nederland (Water Infrastructure, Cont.)

Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Drinking Water at community distribution centers	Minimal									
Water for fire suppression at fire hydrants	Minimal									
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Nederland

Nederland: WASTE WATER INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Treatment Plants										
Treatment plants operating with primary treatment and disinfection			Minimal	Functional				Operational		
Treatment plants operating to meet regulatory requirements			Minimal		Functional			Operational		
Trunk Lines										
Backbone Transmission Facilities (major trunk lines, lift stations, siphons, relief mains, aerial crossings) pump stations, tanks)			Minimal	Functional				Operational		
Control Systems										
SCADA or other				Functional				Operational		
Collection Lines										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Housing/Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Threats to Public Health and Safety are controlled by containing and routing raw sewage away from public										
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Nederland

WATERSHEDS AND NATURAL INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1			Phase 2			Phase 3			
	Days			Weeks			Months			
	0	1	1-7	1-4	4-8	8-12	4	4-24	24+	
Creek Corridors										
Debris Removal						Minimal	Functional	Operational		
Channel or Levy Repair							Minimal	Functional	Operational	
Stream Restoration									Operational	30% in 4-24 months, season dependent, fire area revegetation
Trail Restoration									Operational	
Habitat Restoration									Operational	Several years of ongoing restoration
Parks, Public Open Space										
Debris Removal						Minimal	Functional	Operational		
Levee Repair							Minimal	Functional	Operational	
Stream Restoration						Minimal		Functional	Operational	
Trail Restoration						Minimal		Functional	Operational	
Habitat Restoration						Minimal		Functional	Operational	

Town of Nederland

Nederland: ENERGY INFRASTRUCTURE	Design Hazard Performance									COMMENTS/NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Power - Electric Utilities										
Community Owner or Operated Bulk Generation										
In Place Fueled Generation (Hydro, Solar, Wind, Wave, Compressed Air)		Functional	Operational							
Oil and gas wells				Operational						New row added: containment of oil and gas wells
Transmission and Distribution (including Substations)				Operational						
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhood										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Town of Nederland

Nederland: COMMUNICATIONS INFRASTRUCTURE	Design Hazard Performance									COMMENTS / NOTES
	Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term			
	Days			Weeks			Months			
	0	1	2-7	1-4	4-8	8-12	4	4-24	24+	
Core Communications Buildings										
Communications Hub (e.g., Central Office, IXP, Data Centers, etc.)		Functional	Operational							
Last Mile										
Critical Facilities										
Emergency Operations Centers	Functional			Operational						
First Responder Facilities (Fire- and police-stations)	Functional				Operational					
Hospitals			Minimal		Functional		Operational			
Assisted Living Facilities				Minimal	Functional				Operational	
Detention Centers	Operational									
Emergency Housing										
Temporary Emergency Shelters	Operational									
Single and Multi-family Housing (Shelter in place)	Operational									
Neighborhoods										
Critical Retail			Minimal	Functional			Operational			
Religious and Spiritual Centers Community Centers				Minimal	Functional	Operational				
Single and Multi-family Housing (Full-Function)				Minimal		Functional			Operational	
Schools				Operational						
Hotels and Motels				Operational						
Community Recovery Infrastructure										
Businesses - Manufacturing				Minimal	Functional	Operational				
Businesses - Retail			Minimal	Functional	Operational					
Businesses - Service Professions				Minimal	Functional	Operational				
Conference and Event Venues						Minimal	Functional	Operational		

Community-Specific Feedback on Time-to-Recovery Goals

City of Boulder

Representatives from the City of Boulder generally agreed with the County performance goals set by the Collaborative. When discussing the City of Boulder's time-to-recovery matrix, they decided on shorter timeframes for quite a few buildings and infrastructures than what had been set on the county-wide matrix. Boulder, along with Longmont, is in fact one of the biggest cities in the County, and there is recognition that the smaller communities rely on the services it provides. In addition, it should be highlighted that the City of Boulder's matrix sets a goal for 90% of school capacity to be *operational* within 1 to 7 days after a disaster; the reasoning behind this indicator is that schools provide a safe place for kids, and enable parents to go back to their activities, thus improving the economic recovery of the community. Finally, it was noted that there is only one access road (Arapahoe Avenue at Foothills) to the main hospital in Boulder (Boulder Medical Center), where all Emergency Room services for the City and beyond have been regrouped. It was therefore decided – under the Transportation Infrastructure cluster – that this access road's capacity should always remain at 90%, even on the day of the disaster.

City of Longmont

Representatives from the City of Longmont generally agreed with the time-to-recovery goals set by the Boulder County Collaborative. It was noted that some recovery goals in the building cluster -- particularly in the "community recovery" category -- were probably too ambitious, with the 90% recovery pushed out further on the timeline. Also noted were some community-specific conditions that could hamper quick recovery for some clusters, such as hotels and motels. It was noted that most of the City's hotels and motels are located in a floodplain area, which could disproportionately affect this cluster's recovery time.

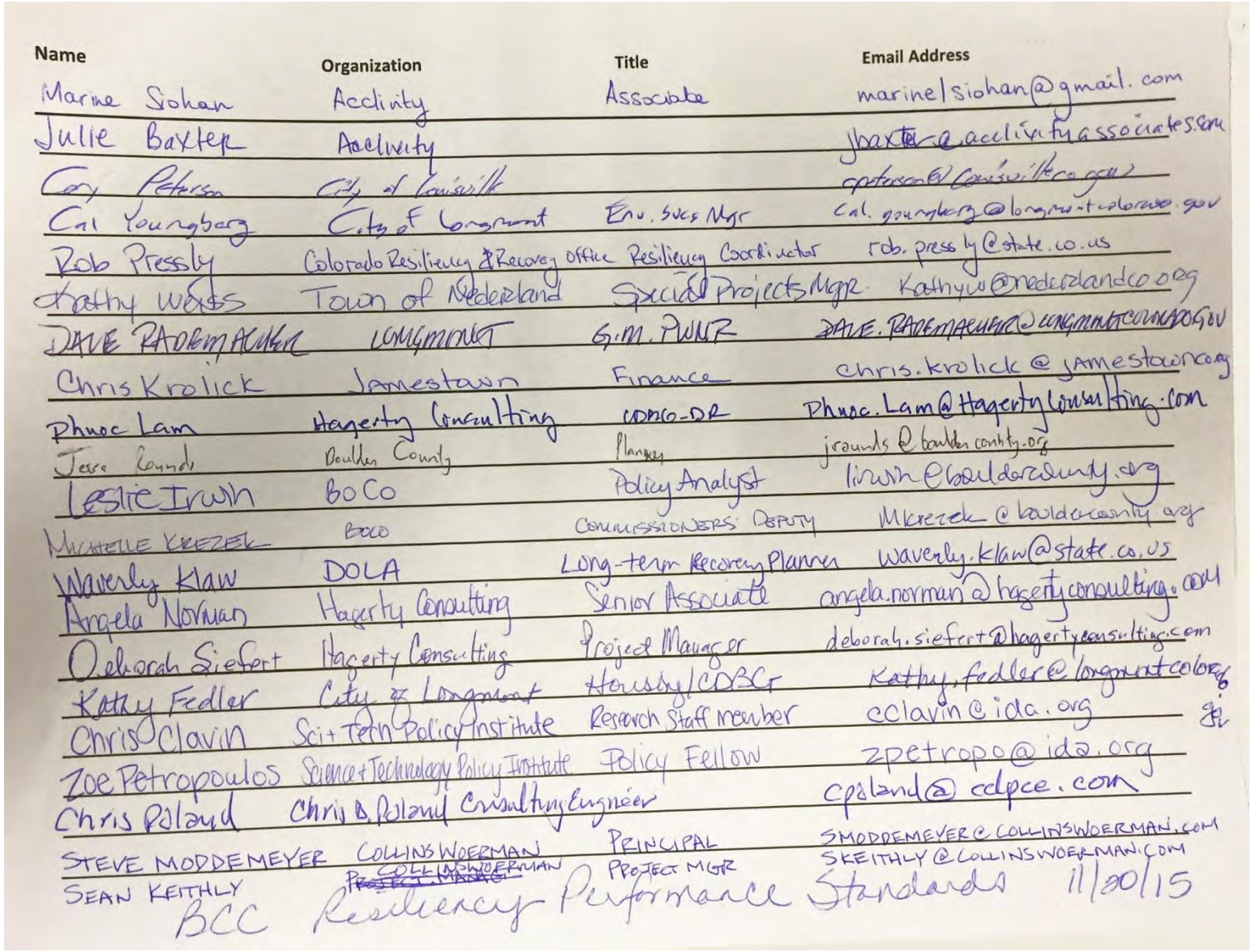
Some participants noted some organizational changes that could be made with respect to the clusters and *functional* categories. For example, hotels and motels might be more appropriately considered "emergency housing," and some businesses, being home-based (for example, many of those in the construction trade), would rely on quick recovery of transportation infrastructure in order to provide critical services to those in need. Therefore, recovery times for transportation infrastructure serving community recovery functions may need to be adjusted forward for faster expected recovery.

Appendix C: Workshop Attendee Sign-In Sheets

The following sign-in sheets include the following workshops that were hosted as part of this project in order to develop and gather input for the Resilient Design Performance Standard:

- 11/20/2015 Project Kickoff Meeting
- 12/11/2015 Project Oversight Committee Workshop
- 1/11/2016 Stakeholder Workshop
- 1/11/2016 Utility / Infrastructure Provider Workshop
- 3/17/2016 Implementation Training Workshop

Project Kick-Off Meeting – 11/20/2015



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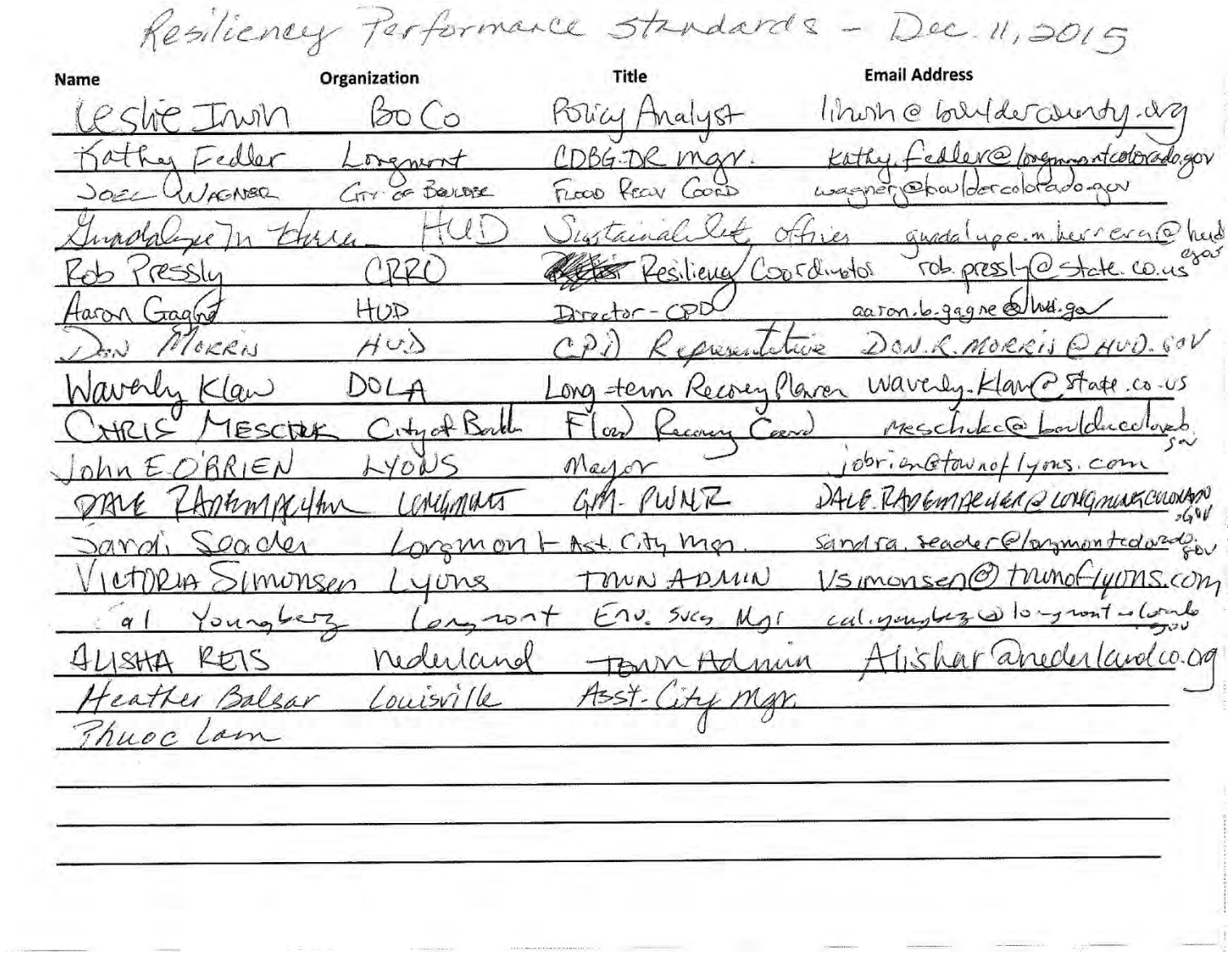
BCC Resiliency Performance Standards 11/20/15

Oversight Committee Workshop – 12/11/2015



Resiliency Performance Standards – Dec. 11, 2015

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Heather Balsar	Louisville	Asst. City Mgr.	
Thuoc Lam			

Stakeholder Workshop– 1/11/2016

Resilience Performance Standards Meeting: Community/Stakeholder 1/11/16

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11/1/16

Resilience Performance Standards Meeting: Community/Stakeholder

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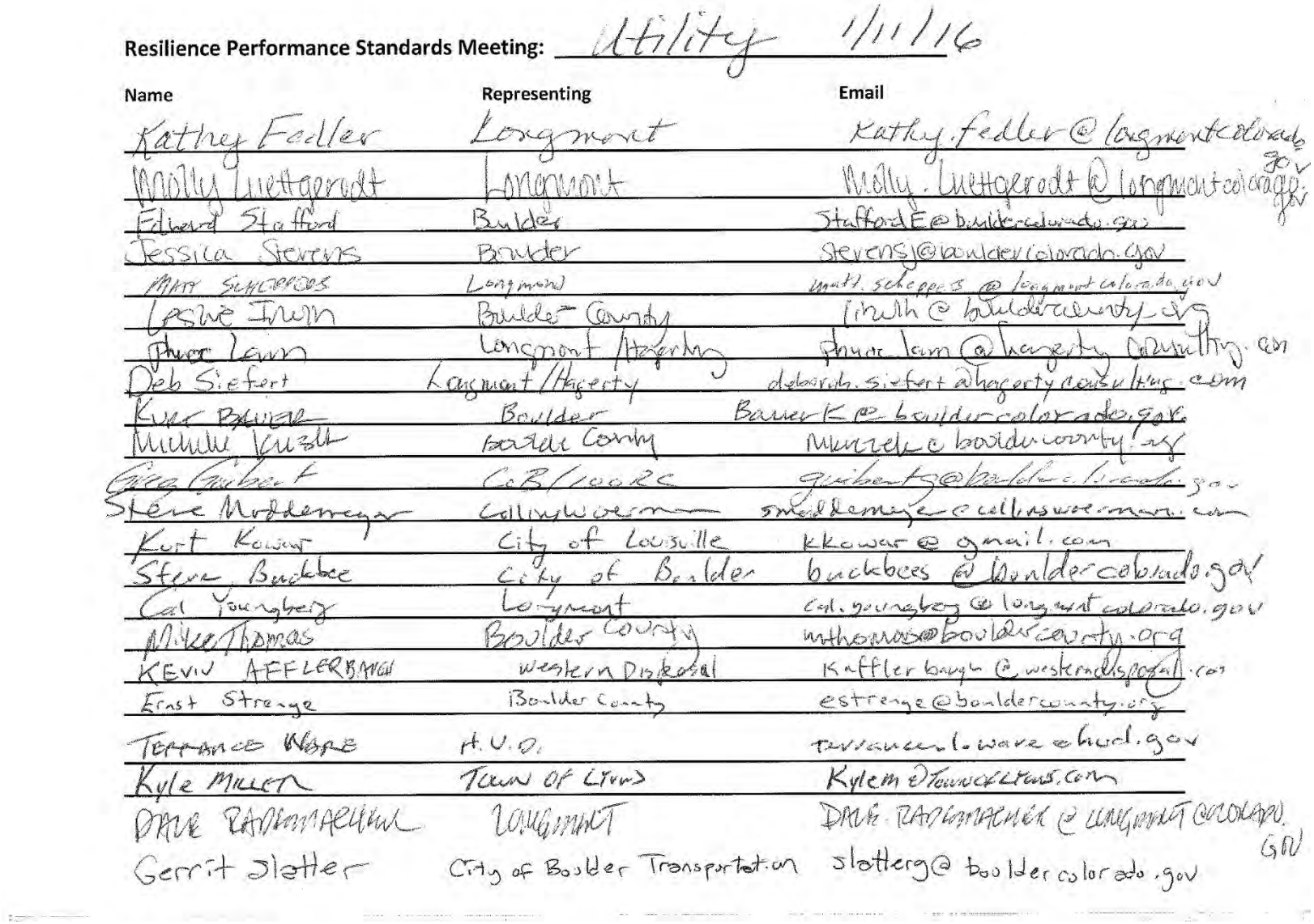
Infrastructure / Utility Providers Workshop – 1/11/2016



Resilience Performance Standards Meeting: Utility 1/11/16

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Implementation Training Workshop – 3/17/2016

Resilience Performance Standards Meeting: Implementation Workshop 3/17/16

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