CITY OF BOULDER

RESILIENCE STRATEGY

DRAFT FOR PUBLIC COMMENT
APRIL 2016 www.ResilientBoulder.com

PIONEERED BY THE ROCKEFELLER FOUNDATION
100 RESILIENT CITIES

VISION

Building on a legacy of frontier innovation, Boulder will cultivate a creative spirit to adapt to and thrive in a changing climate, economy, and society.

RESILIENT BOULDER

AND 100 RESILIENT CITIES (100RC)

MICHAEL BERKOWITZ
President of 100 Resilient Cities - Pioneered by The Rockefeller Foundation.

From its early history as a frontier town fueled by the discovery of gold in the middle of the 19th Century, Boulder has consistently served as a destination for individuals defined by their pioneering spirit. Boulder has originated some of the most progressive policies in the United States in a variety of areas. Its long history of preserving open space and its bold climate action plans and programs are just a few examples.

The launch of Boulder's first resilience strategy is a continuation of that legacy -- complementing your history of sustainability work and establishing Boulder at the vanguard of the urban resilience revolution that will define our time. This strategy takes a comprehensive and honest view of Boulder's resilience challenges and opportunities. It outlines a path forward for the city to confront not just its most obvious shocks, like flash flooding or wildfires, but also the chronic stresses, such as the need for affordable housing, integrated regional planning, and strong, cohesive communities, which exacerbate those shocks and impact the city over the long term.

None of this could have been accomplished without the stalwart support and vision of the Mayor, Suzanne Jones, City Manager, Jane Brautigam and the Boulder City Council. We also extend our thanks to Boulder's exceptional Chief Resilience Officer, Greg Guibert. Greg led a tremendous effort over the course of the past year of robust research, extensive community outreach, and thoughtful planning in order to make this strategy come to fruition.

What makes Boulder's strategy a leading example for our international network of member cities is the way in which it integrates world-class solutions from our platform of partners, while also highlighting the various city-to-city connections Boulder has facilitated through the 100RC network. Boulder has hosted resilience delegations from Da Nang, Vietnam around climate change mitigation efforts, and will do so again, with another 100 Resilient Cities partner, Wellington, New Zealand around a community based resilience outreach program, in the coming months.

Going forward, we know that this bold vision will strengthen your work to make Boulder a more resilient city for the entire community. As you begin to implement the various initiatives outlined in this strategy, I am confident that Boulder will continue to honor its history as an urban innovator, and begin to export the lessons we learn together to cities across the 100RC network and beyond. My congratulations to you all, on behalf of the entire 100 Resilient Cities team. We look forward to partnering with Boulder on its resilience journey for many years to come.

Dear neighbors,

We are delighted to present Boulder's Resilience Strategy, a document that reflects approaches our community will be taking as we work to strengthen our preparedness for – and ability to respond to – future challenges. These approaches build on what we already know works in our highly engaged community, as well as best practices we have learned about as one of the inaugural cities participating in the 100 Resilient Cities program. We are so appreciative of the opportunity to work with 100RC and the cohort of other cities in the program, and want to acknowledge their leadership in this crucial endeavor.

You will notice that each of the strategic focus areas in our Resilience Strategy is defined by verbs. This is by design. We know that the best way to make Boulder more resilient in the face of stress is to act – to act now, to act strategically and with appropriate coordination, and to act together. And as you can see, there is an exciting group of initiatives underway under each of these focus areas.

In exploring what it means to be a "resilient" community, this resultant strategy recognizes the importance of broadening our understanding of potential future stresses. We know from recent experiences that wildfires and floods are very real dangers in Boulder. But this plan covers so much more. How can Boulder leverage the emerging risk of the Emerald Ash Borer beetle, for example, to make our forestry systems and practices stronger? How can we strengthen the social fabric of our neighborhoods and provide more support to particularly vulnerable populations so they can withstand potential economic downturns more effectively? How can the city work with the business community to ensure that they have plans in place to recover quickly after disruptions?

As you read through this strategy document, we hope you will feel the same pride we do for our community. Many of you have played a role in the creation of this framework. You've participated in forums and learning opportunities. You've engaged in dialogue with our Chief Resilience Officer Greg Guibert. And you've provided input that has helped us understand our community's priorities. We are so grateful for this kind of support and engagement. Our people and our sense of community continue to be among our greatest assets as we work toward the shared goal of strengthening Boulder and implementing the many terrific programs outlined in this plan. Let's work together to make Boulder the very best – and strongest – it can be!

Sincerely,

Suzanne Jones
Mayor

Jane Brautigam
City Manager

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RESILIENT BOULDER

1 CHALLENGE

BOULDER has a long history of planning today for the challenges of tomorrow, creating innovative solutions, and undertaking successful resilience-building activities and projects. From its 40+ year legacy of open space preservation, to pioneering commitments to climate action goals, the community has supported some of the most progressive resilience activities in the country for decades, even before we saw them as building Boulder's resilience.

In order to mobilize the resources and community support necessary to significantly increase social, economic and ecological resilience, we must have a compelling vision of the future that allows us to adapt and thrive in the face of disruption. Tapping into the community's forward-thinking civic and planning culture, the goal is to weave resilience into the day-to-day life and functions of community and government. This strategy knits those activities together and presents new actions to address gaps and weaknesses discovered through a community-wide assessment to create an integrated, strategic, and intentional approach to building resilience. The actions included here are immediately implementable activities that take advantage of partnerships and resources offered by the 100 Resilient Cities network. They build off of a long and fruitful legacy in Boulder's community and intend to bring new resources and perspectives to existing ones.

An Unpredictable Future

Like many cities and communities across the country and around the world, Boulder is adjusting to a "new normal," where the effects of climate change are becoming increasingly apparent. And like residents of other cities that have recently experienced a severe natural disaster, many of us understandably perceive resilience as preparing for the kinds of events that are magnified by climate change. But shocks are not limited to natural hazards or the effects of climate change. A hyper-connected economy and the ability for pests and diseases to circle the globe with unprecedented speed, for example, mean the community is confronting a host of challenges that can strike at little notice and have severe, unknowable repercussions.

Boulder's complex topography and natural climate variability make it difficult, and sometimes impossible, to predict when and how often extreme events may occur. Flash flooding, for example, does not follow the boundaries of established flood maps, a lesson learned through the adversity of the 2013 floods. Flash floods may inundate neighborhoods and roads with little advance notice, impacting locations that may not have experienced flooding in the past.

At the same time, increasing global temperatures exacerbate many of these hazards. The 2011 National Academies of Science assessment indicates that a one-degree Celsius rise in temperature would increase fire incidence probabilities by over 600 percent. Rising temperatures also increase the length of drought cycles, which intensify flood, fire risks and create additional risks for Boulder's water supply. These dry conditions have in turn exacerbated insect, exotic weed, and disease threats in the flora and fauna communities. These complex climate and ecological connections show the tight linkages between Boulder's risks and complicate solutions to any single problem, necessitating a holistic approach.

Multiple independent measurements confirm widespread warming in the western United States. In Colorado, temperatures increased by approximately 2°F between 1977 and 2006.

- COLORADO CLIMATE PLAN

Interlinked Hazards

Boulder's natural hazards are tightly linked, necessitating a comprehensive and integrated approach to risk mitigation. Droughts stress the city's ecosystems, helping accelerate the damage of pests to forests, thereby increasing the fuel for wildfires, and consequently denuding slopes and increasing flash flooding risk. But this cycle itself is not linear; each event builds on another and sets the stage for even more complex interactions. Therefore, to address these interlinked hazards, activities and programs must be well coordinated, using a systemic approach to reduce multiple risks at the same time and prepare communities to handle disruptions of any kind.

UNDERLYING STRESSES

Resilience is not only about disaster preparedness and extreme events. It is about addressing the chronic stresses on a fundamental level that weaken the fabric of a city on a day-to-day or cyclical basis. By focusing on both shocks and stresses together, Boulder becomes more able to respond to challenging events and is more likely to thrive as a happy, healthy and inclusive community.

Boulder's regional Fire Training Center was completed in mid-2010 and is used across Boulder County by all 26 fire departments. It served as a regional hub and emergency control center during the September 7, 2010 Fourmile Canyon Fire.

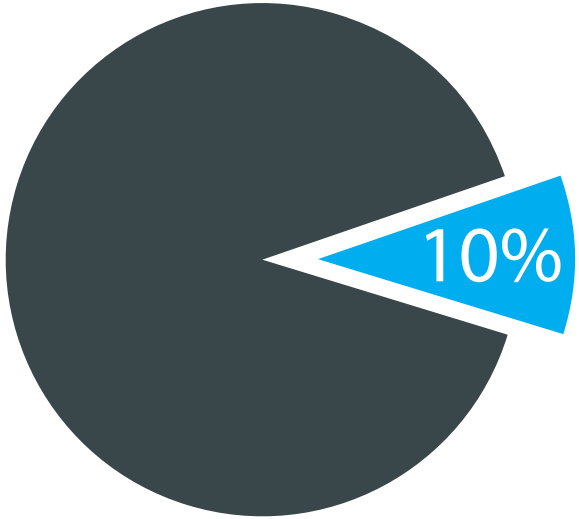
"Lower-income people are among the least able to recover, yet they are often central to the economy and culture of a community."

- ISET INTERNATIONAL

Shocks Expose Stresses

Boulder's social and economic stresses are sometimes harder to see, but can be exposed and exacerbated during a crisis or disaster. The city's vibrant economy and high quality of life often mask latent stresses that strain the community and make it less resilient overall. Natural disasters like floods and fires disproportionately impact low-income residents who already struggle to thrive in a city that is becoming more unaffordable. A Boulderite living on a fixed income, for example, whose home is damaged in a disaster has limited options to find affordably-priced alternatives because the city has a constrained supply of housing.

Stresses can also present a threat to our economic future. Successful, thriving cities need young people to fuel their economic pipeline. However, in Boulder, individuals between the ages of 25 to 44 is a cohort that has declined by 15 percent since 2000. Similarly, increasing real estate prices have also affected the commercial sector. High office rents and limited commercial space hamper the opportunity of growth-stage firms seeking to expand from start-up status, and many of these companies choose to expand in places like Denver and Longmont where there may be more available space.



Boulder families have children under the poverty level.

Boulder's Core Resilience Challenges:

Natural events such as flooding and wildfires will become more frequent and severe as a result of climate change.

Ecological and social stresses are tied to hazards and will negatively impact and exacerbate each other.

Rising housing and commercial real estate costs may limit the diversity of residents and businesses and threaten long-term economic vitality.

Boulder's residents, businesses and government need to work together to be vigilant and prepared for future disruption.

Resilient Communities and Government

At a community level, preparing for an uncertain future means understanding our risks and being vigilant for the unexpected, whether it is a flash flood or global recession. It means that individuals, families and neighborhoods strengthen ties to support each other during times of need. Residents will need to reach out to their neighbors, particularly the most vulnerable and isolated individuals, to support each other when disaster strikes and critical systems fail. Business owners will need to create business continuity plans and understand the available public and private resources to prepare for the economic risks they face.

At the same time, local government must plan for and respond to shocks that affect the city and stresses by working collaboratively across departments and jurisdictional boundaries, as well as with private and institutional stakeholders. This collaborative approach will facilitate more robust information sharing and analysis, development of cross-cutting solutions and strategic private-public partnerships.

Leveraging Boulder's History of Planning Innovation

Boulder's pioneering spirit and commitment to advancing critical initiatives such as open space preservation, climate mitigation and inclusive affordable housing happened decades before the rest of the country adopted similar efforts. Through this strategy, and as reflected by the process leading up to the preparation of this document, the Boulder community will prepare and adapt to existing and future challenges by infusing resilience into the day-to-day operations and activities of residents, businesses and government.

City Highlight

FISCAL LEADERSHIP

Leadership in fiscal resilience is making Boulder better equipped to respond to and recover from economic shocks, whether this is withstanding a global recession or responding to a major event.

- For many Front Range cities, nearly 75 percent of revenues come from sales taxes; in Boulder, less than 45 percent of sales taxes comprise the city's general fund.
- One of the city's primary financial policies is that one-time revenues shall only be used to cover one-time expenses and that ongoing costs should not be greater than ongoing revenues.

City Highlight

HOUSING AFFORDABILITY INITIATIVES

We recognize that housing affordability is a key issue for the community. It ensures that Boulder remains a place for residents of different backgrounds, incomes and household sizes.

- Boulder's mandatory inclusionary housing ordinance requires 20 percent of housing in new developments to be priced affordably for low-income households.
- As of August 2015, there are 3,586 units in Boulder's affordable housing program. This represents 8 percent of the total units in the city, which puts Boulder 2 percent away from the city's goal of making 10 percent of all housing units affordable.

City Highlight

OPEN SPACE CONSERVATION

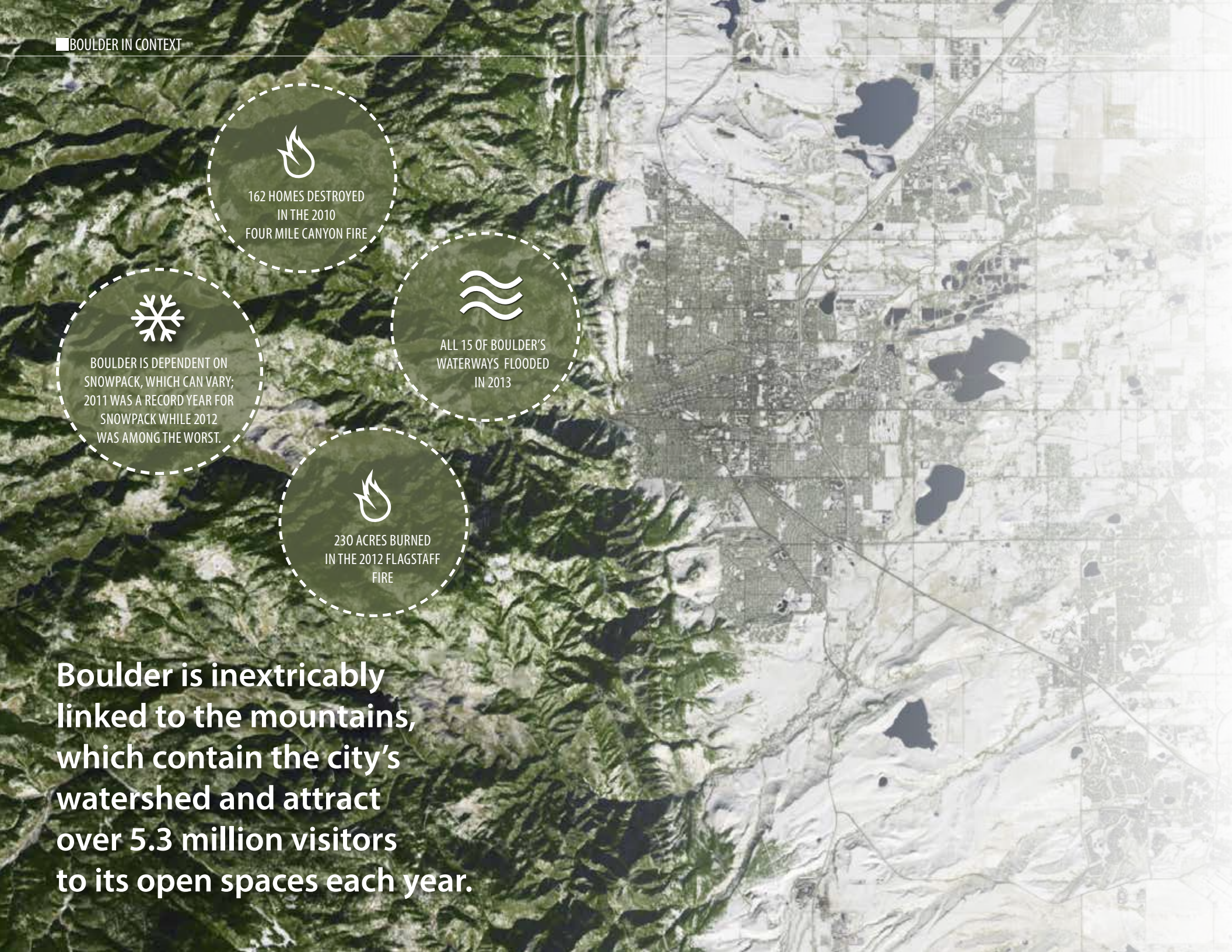
Nearly 50 years ago, Boulder voters enacted an open space initiative where residents taxed themselves to purchase and preserve und eveloped land surrounding the city, an unprecedented feat at the time and even today still rarely emulated.

- The roots of Boulder's robust open space system date back to 1875 to 1929 when the city acquired over 5,000 acres, including Chautauqua, Buckingham Park (in Left Hand Canyon) and much of the mountain backdrop.
- There are more than 102,000 acres of land in Boulder County's parks and open space system. Of these, approximately 62,000 acres (60 percent) are either publicly owned, leased from the State Land Board, or held in the form of access or trail easements. The remaining 40,000 acres in the system (40 percent of the total) are privately-owned lands with county conservation easements.

2 CONTEXT

Boulder has a long history of planning today for the challenges of tomorrow, creating innovative solutions and undertaking many successful resilience-building activities and projects.

Located at the base of the foothills of the Rocky Mountains, Boulder is a small city with a high quality of life, a diverse and vibrant economic base and tremendous open space resources. The community enjoys the natural and recreational amenities resulting from decades of progressive land use planning which preserves a vast rural and undeveloped landscape that encircles the city. Boulder is truly a city whose identity and future is inextricably linked with the natural environment, and environmental sustainability has been a long-standing and primary guiding principle in planning and policies. A strong commitment to sustainability is regularly reinforced through voter-initiated ballot measures to increase taxation for additional open space preservation or carbon reduction measures.



Boulder is inextricably linked to the mountains, which contain the city's watershed and attract over 5.3 million visitors to its open spaces each year.

BOULDER'S natural terrain and location at the mouth of numerous canyons creates a constant flood risk for the city. Fifteen major creeks pass through town, including Boulder Creek, which flows right through downtown. The Front Range is also susceptible to wildfires and drought, which create dry, less vegetated conditions and contribute to increased flood risk. In addition, Boulder's propensity for sudden bursts of isolated and severe storms contributes to flash flooding risk. Flooding and wildfires demonstrate the connections between Boulder's natural environment, climate change-related conditions and the interconnections between major hazards.

BOULDER'S WATER RESOURCES

Like most western communities, Boulder depends on stored water most of the year. High streamflows from melting snowpack occur for only a few spring and summer months. Natural streamflows in late summer and the winter are not sufficient to meet customer demands and must be supplemented with previously stored water supplies. The amount of water available also changes from year to year depending on how much snow falls in the mountains. Therefore, Boulder must store water in reservoirs during wetter years to carry over for use in dry years.

The city stores water in seven reservoirs and several natural lakes in the headwaters of the North Boulder Creek basin within the Silver Lake Watershed. In addition, the city stores water in the Barker Reservoir facilities on Middle Boulder Creek and the Boulder Reservoir northeast of Boulder. The latter is supplied through Western Slope water diversions that come from miles away.

Investing in both source water protection and enhancing water infrastructure continue to be of chief importance to the city. This has included investments that secure additional capacity and redundancy at the city's water treatement facilities which help reduce risk from drought and other concerns. It also includes a long history of investing in the city's stormwater and wastewater systems which help mitigate flooding and sewer back-ups.

INVASIVE SPECIES ARE A MAJOR CONCERN FOR BOULDER

Boulder's urban forest provides nearly $5.2 million in annual environmental, economic and social services benefits to the community. These services include air quality improvements, energy savings, stormwater runoff reduction, atmospheric CO2 reduction and aesthetic contributions to the social and economic health of the community. One of the largest threats faced by urban forests across the U.S. is from invasive insects and disease pests such as the Emerald Ash Borer (EAB). EAB will cause mortality of all untreated ash trees in Boulder and destroy a significant portion of urban tree canopy.

EAB is a green jewel beetle that feeds on ash tree species. The beetle originated from Asia and is thought to have been introduced to North America in the 1990s on solid wood packing material. In the U.S., EAB is a federally quarantined, invasive tree pest responsible for the death or decline of more than 50 million ash trees to date.

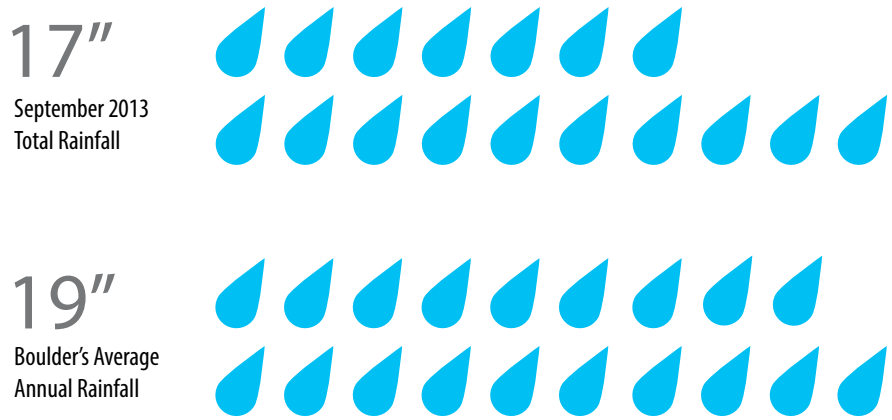
Percentage of Boulder's ash trees infested with EAB in 2013.

Percentage of Boulder's ash trees infested with EAB in 2016.

Expected percentage of Boulder's untreated ash trees that will be infested with EAB in 2020.

Putting It In Perspective

COMPARING HISTORICAL RAINFALL TO 2013 FLOOD



From Fire to Drought to Flood

Changing weather in Colorado is nothing new, but the arc of shocks from 2012 to 2013 offers a glimpse of the types of extreme events and swings that will only be exacerbated by the impacts of a warming climate. A dry summer with little rainfall set up conditions for Boulder's 2012 Flagstaff Fire. Drought concerns loomed larger in Boulder and across the state moving into 2013, only to have the year end with flooding and record rainfall.

The Greenways Program

The Greenways Program divides each of the city's 15 tributaries into reaches to facilitate a manageable implementation approach for improvements. The greenways system is maintained by the city and funded by the city's Transportation Fund, Stormwater and Flood Control Utility Fund and the state's Lottery Fund. Each of these funding sources provides $150,000 annually to 1) protect and restore riparian, floodplain and wetland habitat; 2) enhance water quality; 3) mitigate storm drainage and floods; 4) provide alternative modes of transportation routes or trails for pedestrians and bicyclists; 5) provide recreation opportunities and 6) protect cultural resources

Boulder has a history of floods including the "Big Flood" of 1894 - the largest flood on record. Other major floods in 1938, 1969,1995 and 2013 all reinforce the need to educate the public about flood safety. Each year, city staff coordinate with multiple groups to maximize the impact and reach of ongoing community engagement around flood outreach.

City Highlight

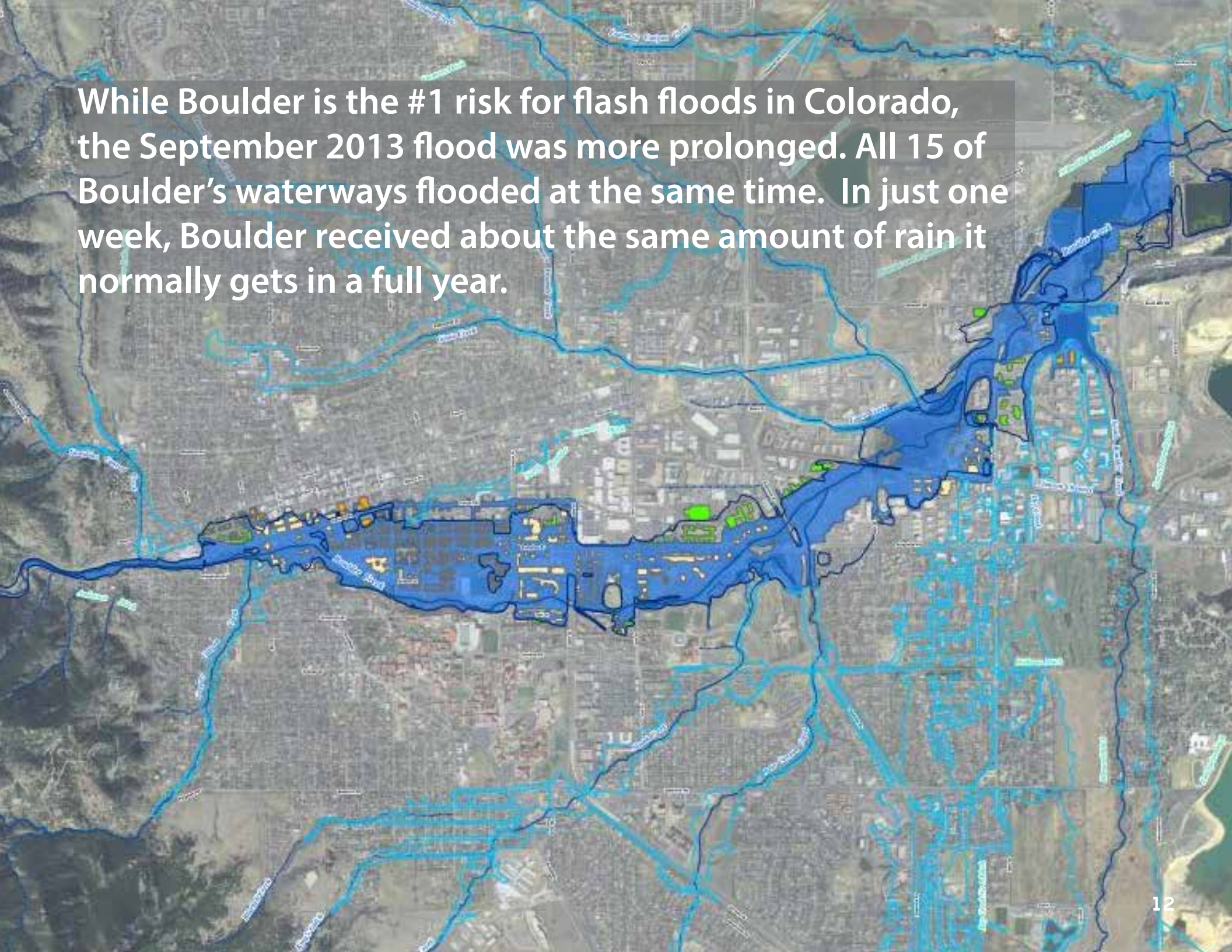
COMMUNITY RATING SYSTEM (CRS)

The federal Community Rating System provides flood insurance discounts to communities that exceed the minimum requirements to prevent and reduce flood damage to insurable property. The city's efforts have earned discounted flood insurance rates for Boulder property owners.

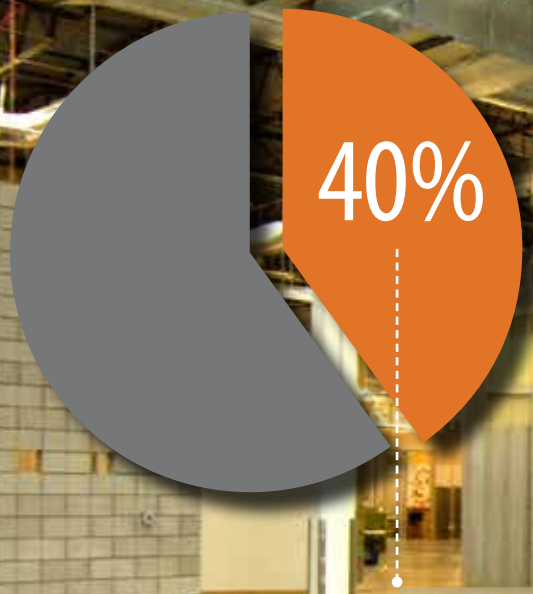
City Highlight

CIVIC CENTER FLOOD MEMORIAL

Gilbert F. White arguably did more to advance flood policy than anyone. While his efforts had broad impacts advancing natural hazard research, White was a tour de force in Boulder. The Gilbert F. White Memorial dedication monument marks the level of the 50-year, 100-year, 500-year and the Big Thompson floods (one of the biggest in Colorado).



While Boulder is the #1 risk for flash floods in Colorado, the September 2013 flood was more prolonged. All 15 of Boulder's waterways flooded at the same time. In just one week, Boulder received about the same amount of rain it normally gets in a full year.



OF 1,000 TECH COMPANIES STARTED IN COLORADO SINCE 2000, NEARLY HALF HAVE BEEN IN BOULDER COUNTY

Boulder is nationally-recognized for its quality of life, thriving tech- and research-based economy and booming real estate market. In addition, Boulder has become a hub of entrepreneurship in the U.S., particularly for businesses that value the lifestyle that is rooted in a love of the outdoors, healthy living and access to tech resources. We have a robust and diverse economy defined by the research and institutional sector. Over the past 10 to 15 years, the tech industry has experienced pronounced growth throughout Boulder County.

"If you look at a lot of the green technology and the systems we're implementing, they're coming from Boulder."

- Robert F. Kennedy Jr.
Speaking at the June 12, 2013
BizWest, *Boulder Earth Conference*

Owing to the presence of the University of Colorado's (CU) flagship campus in Boulder, the city maintains a relatively high proportion of young people. With a current enrollment of just under 30,000 students, CU accounts for approximately 29 percent of the total population. Boulder is also one of the most educated metropolitan areas in the country. The presence of the university and 17 federally-funded research labs support many of the jobs for this demographic including those that focus on weather, climate and geophysical research. Furthermore, this segment of the workforce is supported by the presence of tech jobs that draw from and attract scientists and engineers.

Regional Resilience

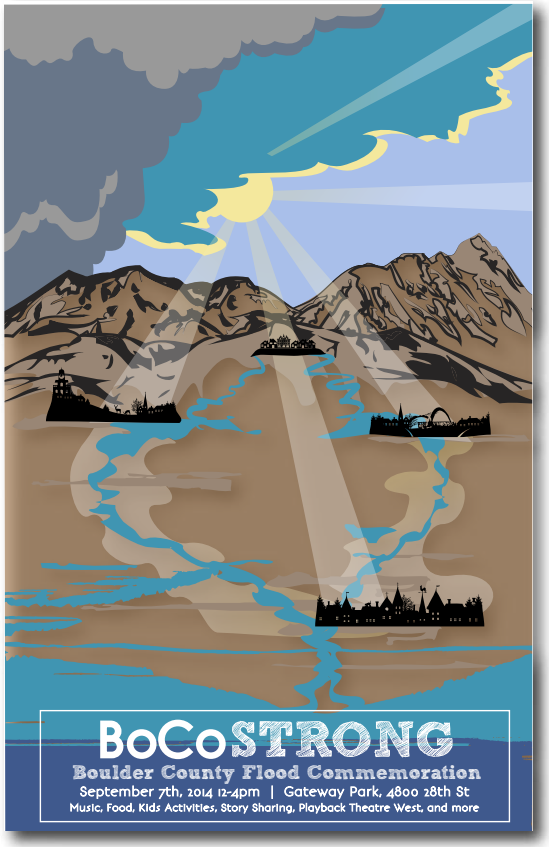
Boulder is part of a larger community and region, and, just as the shocks and stresses we face do not simply start at the borders, neither do the actions and partnerships necessary to address them. Even as recent disasters have motivated Boulder's own resilience building efforts, they have also spurred action at the county, state and national levels. Boulder has developed a strong network of partnerships that have helped inform activities and strategies, and it regularly participates in the collaborative development of this emerging field.

BoCo Strong

BoCo Strong is a countywide resilience hub that creates and supports collaborative relationships between individuals, communities, nonprofits, governments and businesses. BoCo Strong increases the web of connections among individuals, organizations and governments across Boulder County to foster inclusivity, increase disaster resilience and build vibrant and prosperous communities. Its vision is that all Boulder communities will have access to the resources and connections needed to allow all residents to adapt and thrive in the face of community stressors. From the outset, Boulder has recognized that the challenges we face do not start or stop at the city's edge. Building a sustaining effort requires close collaboration, learning from a broad base of experience and building enduring partnerships.

Colorado Resilience Framework

Governor John Hickenlooper adopted the Colorado Resiliency Framework in May of 2015, a first-of-its-kind statewide framework in the nation. The framework was developed under the leadership of the Colorado Resiliency and Recovery Office (CRRO) through a collaborative and inclusive process that engaged local, state, federal, non-profit and private sector partners, as well as individual Coloradans. The framework provides guiding principles for Colorado communities and concrete actions that the state commits to implement. One of the first priority strategies implemented under the framework was a pilot regional resiliency planning process to build and strengthen collaborative relationships locally, establish a unified regional vision for resilience, and put in place a coordinating framework for long-term regional resilience action. Starting in the summer of 2015, the CRRO partnered with some of the most heavily disaster-impacted communities to conduct the pilot process which utilized the state framework's guiding principles to help facilitate a vision and identify strategies unique to each participating region. The Boulder County region was one of three communities to participate.



Uniquely Boulder

GROWING UP BOULDER

In collaboration with Resilient Boulder, Growing Up Boulder (GUB) worked with approximately 120 children and youth to develop their perceptions of resilience within the city. Overall, access to nature and family, friends and supportive networks (from school and community) help support resilience, as do activities that help young people develop skills and confidence (including music, arts and skateboarding). Aspects of the community that do not support resilience include social, environmental and economic concerns (including the need for greater care of homeless residents, fracking and the cost of living). Children spoke about bullying and youth spoke about cultural exclusion as aspects of their community that need to be addressed in the city. High school students also participated in a poetry project in which they described a personal moment of resilience. Many of these stories included surviving the flood, family losses and coping with poor family health, and the challenges of immigration/immigration status. Access to nature in relatively close walking space could help some of the children and youth we worked with access greater opportunities for restoration and resilience.

3 APPROACH

Resilience and Sustainability

Resilience and sustainability are sometimes confused with one another. Resilience is a new way of thinking about the community in a holistic way that adds to and deepens the way we already plan for a sustainable future. Resilience and sustainability represent complementary values and ways of managing urban systems. Where sustainability is about actively and thoughtfully managing resources to achieve environmental, social and economic goals that preserve or enhance Boulder's quality of life, resilience is about anticipating the inevitable events that cause disruption and then developing the strategies to reduce their impacts to the greatest extent possible. While resilience itself is not new, 100 Resilient Cities is the first organization to use resilience as a systematic framework, on a global scale, for actively managing and prioritizing city operations and activities.

Sometimes metaphors can help explain complex topics. For some, the reasons for planting street trees help illustrate the relationship between resilience and sustainability.

SUSTAINABILITY:
- Urban heat island mitigation
- Carbon sequestration
- Cleaner air
- Community character
- Aesthetic value

RESILIENCE
- Summer cooling
- Reduced storm runoff
- Species diversification
- Neighborhood identity

re·sil·ience

/rə ' zilyəns/

Boulder defines resilience as the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt and thrive no matter what kinds of chronic stresses and acute shocks that may be experienced.

CITY RESILIENCE FRAMEWORK

The City Resilience Framework (CRF) provides a lens to understand the complexity of cities and the drivers that contribute to their resilience, and a common language that enables cities to share knowledge and experiences. The framework is built on four essential dimensions of urban resilience: Leadership & Strategy, Health & Wellbeing, Economy & Society, and Infrastructure & Environment. Each dimension contains three "drivers," which reflect the actions cities can take to improve their resilience.

Leadership & Strategy

The processes that promote effective leadership, inclusive decision-making, empowered stakeholders and integrated planning.

Health & Wellbeing

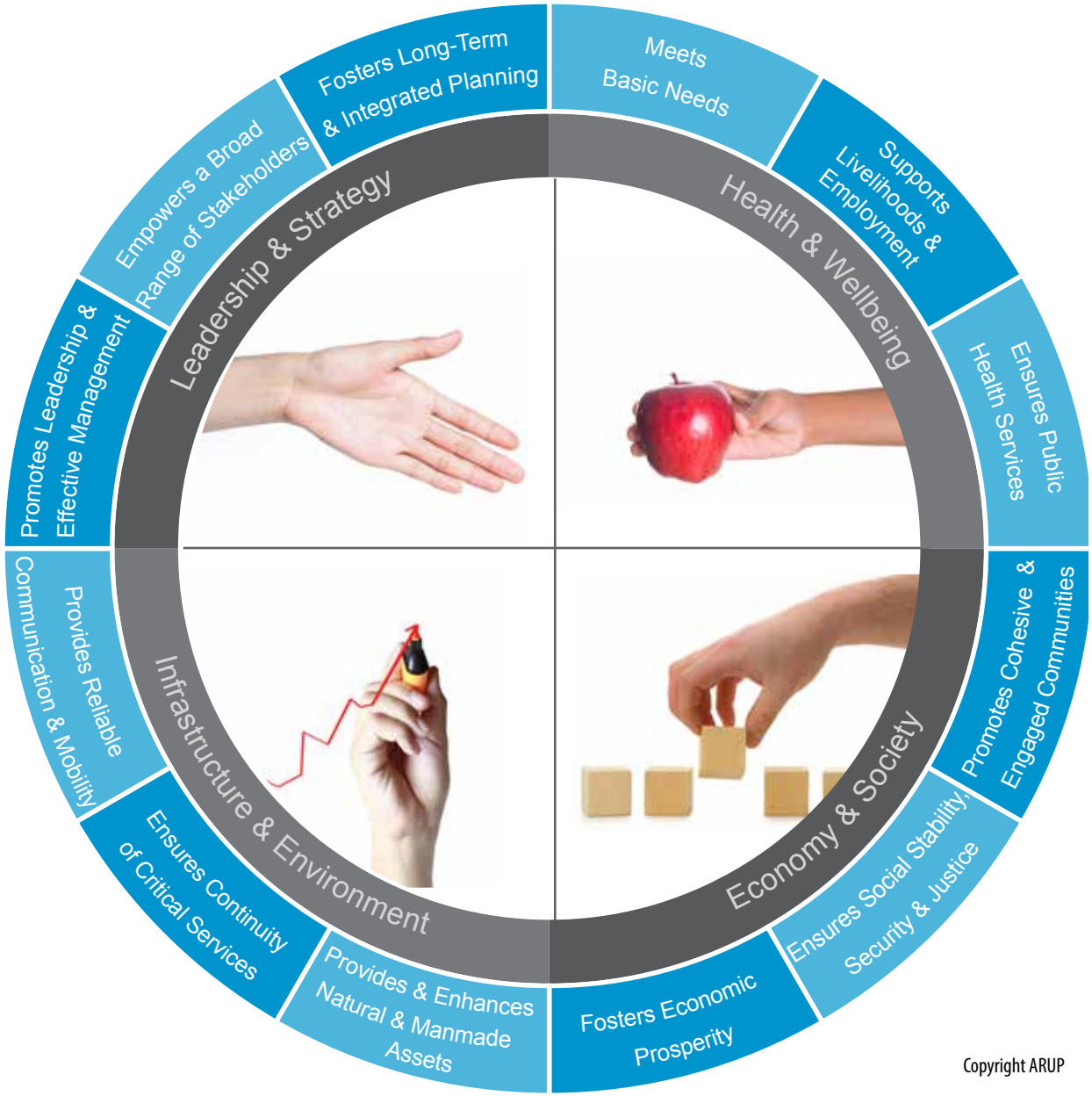
Everyone living and working in the city has access to what they need to survive and thrive.

Economy & Society

The social and financial systems that enable urban populations to live peacefully and act collectively.

Infrastructure & Environment

The physical and natural systems that provide critical services and protect and connect urban assets, enabling the flow of goods, services and knowledge.



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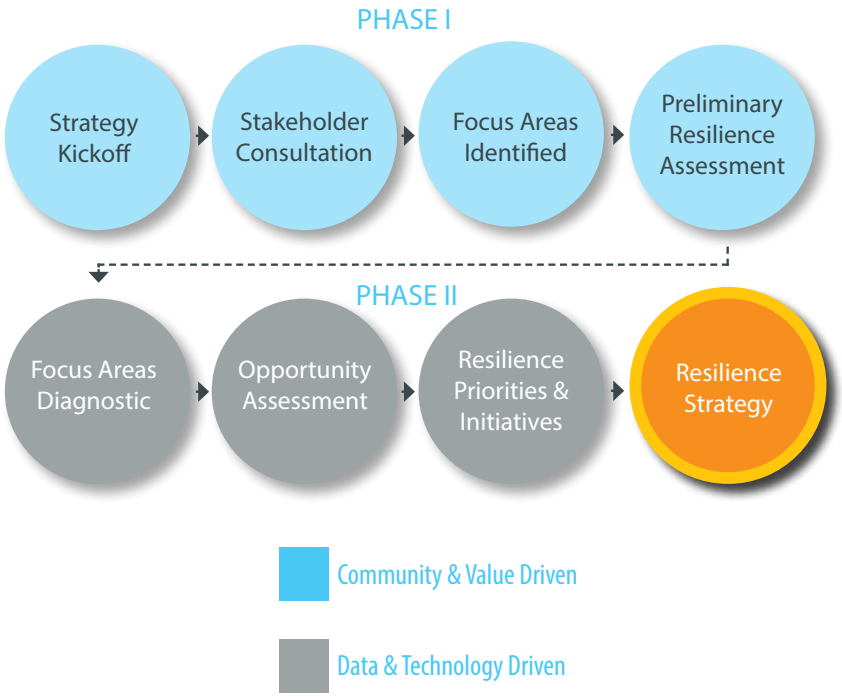
The Process

Building resilience is as much a process as it is a set of outcomes. The process itself must also embody the characteristics of resilient systems and be iterative, inclusive, integrated, adaptive and flexible. It must allow for the constant infusion of new information and accommodate often unpredictable change in the community, creating the ability for reassessment and reprioritization of activity to address new risks and opportunities.

From the outset, Boulder's goal has been to do things differently. The city set off to build on existing efforts, but recognized the opportunity to tap into the new energy around the 100 Resilient Cities network. For example, the city has explored new methods for community engagement and ownership through the MIT Climate CoLab, harnessing the creative potential of the whole community, and Growing Up Boulder (GUB), giving voice to youth in the process. This approach has given us the chance to position Boulder as a resilience testbed for new technologies, innovative partnerships and creative thinking.

In 2014, the city initiated its first resilience assessment, ultimately leading to the creation of this strategy. The assessment methodology was an analysis of current efforts that support resilience and identified important gaps in knowledge, capacity and activity. However, this initial assessment process itself highlighted areas where the existing methodology could be augmented by new diagnostics to be incorporated in future resilience assessments. New elements being developed as part of Boulder's resilience efforts will bring insights and depth of analysis for the continuous process of reflection and assessment.



Learning with 100 Resilient Cities

WHAT ARE THE PLATFORM PARTNERS?

The 100RC Platform of Partners provides member cities with a curated suite of donated tools and services, supplied by partners from the private, public, academic, and non-profit sectors, to support cities in their resilience-building activities. Boulder has already partnered with a number of these service providers, including Trimble, a company that provides geospatial technical solutions and domains to capture, measure, analyze, monitor and share built and environmental information.

From Boulder's 40+ year legacy of open space preservation, to pioneering commitments to climate action goals, the Boulder community has supported some of the most progressive resilience activities in the country for decades.

2010-2011
City's Affordable Housing Task Force Report; Comprehensive Housing Strategy first approved in 2000

2010
Fourmile Canyon Fire; utilizes staff from the Wildland Fire Program, which began in 1990

2011
EnergySmart Program launches; provides home and business advice and incentives to reduce energy use

2012
Flagstaff Fire

2013
Earth Conference held in Boulder hosts Robert F. Kennedy Jr. and is dedicated to the sharing of knowledge, bold ideas and technologies to advance sustainable business practices regionally, nationally and globally

2012 -2013
Drought Concerns; Water Conservation Program began in 1992

2013
Major flooding causes significant damage

2013
City launches a significant planning effort to define priorities and goals for the expansion and preservation of diverse, affordable housing

2013
Open Space Tax extended by voters; an initiative started in 1967

2013
Boulder provides $20k to fund Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, to support low-income purchases of local food, doubling the value of purchases at the Boulder Farmer's Market

2013
City Council adopted the Economic Sustainability Strategy

2014 Public supports 75% increase in Stormwater/Flood Utility rates to more quickly address flood-related work; utility efforts began in 1973

2014
City of Boulder announced as one of the 100 Resilient Cities

2014
100 Resilient Cities Boulder Kick-off Workshop

2014
National Disaster Resilience Competition Kick Off

2014
Chief Resilience Officer Annual Summit

2015
Growing Up Boulder elementary students present to City Council

2015
Citywide Perceptions Survey

2015
National Institutes for Standards and Technology Community Resilience Workshop

2015
Resilience Assessment Expert Workshops

2015
100 Resilient Cities Network Exchange: Resilient Land Use Workshop

Since joining 100RC, the City of Boulder has increasingly leveraged opportunities, participated in events and utilitized the Chief Resilience Officer to drive community engagement.

- 2015 City Council Study Sessions
- 2015 Resilience Advisors Spontaneous Volunteers Training
- 2015 Natural Hazards Mitigation Association Symposium
- 2015 MIT Climate CoLab Community Challenge
- 2015 Understanding Risk Boulder
- 2015 Climate Action Plan Tax extended by voters; an initiative started in 2007
- 2015 National Renewable Energy Lab Resilience Workshop
- 2016 Colorado Recovery and Resilience Office Stakeholder Planning Workshop
- 2016 Boulder Talks: Deliberative Inquiry
- 2016 Human Services Strategy (Master Plan) update begins

- 2015 Update to Boulder Valley Comprehensive Plan begins
- 2015 State of Colorado releases Resiliency Framework
- 2015 National Disaster Resilience Competition Academy
- 2015 BoCoStrong Annual Summit
- 2015 100 Resilient Cities City Leaders Urban Resilience Summit
- 2015 Resilience Tech Challenge
- 2015 Chief Resilience Officer Annual Summit
- 2015 Boulder sends delegates to Paris COP Convening
- 2016 City launches Climate Commitment Framework draft
- 2016 Resilience by Design University Prototype Workshop
- 2016 USAID/ICMA Shimla City-Links Exchange
- 2016 City launches Resilience Strategy document draft

RESILIENT

4 STRATEGIES

THROUGH THE RESILIENCE assessment and community discussions, Boulder has identified three major resilience strategies. Working collaboratively to create actions that achieve these interconnected strategies will help build a resilient and adaptive community that is better able to address the unpredictable impacts of environmental, social and economic shocks and stresses.

Building community resilience is a never-ending process and requires constant adjustment to new conditions and opportunities. Through the actions identified here, we take steps towards meeting these goals, but as noted earlier, these are not the first steps. These new actions add to ongoing and historic efforts in a way that brings intentional direction toward catalyzing change across all sectors of the community.

Strategies

The following three strategies represent the main action areas for the city.

- **CONNECT AND PREPARE** - Prepare all segments of the community for uncertainty and disruption by encouraging community preparedness, creating a culture of risk awareness and personalizing resilience.
- **PARTNER AND INNOVATE** - Capitalize on the collective problem-solving and creativity of our community by leveraging advances in data, research and observations to address emerging resilience challenges.
- **TRANSFORM AND INTEGRATE** - Embed resilience into city operations and systems by transforming our approach to community resilience.

Actions

These are immediate priority activities to be implemented over the next two to three years that take advantage of partnerships and resources catalyzed by the 100RC network and program. The actions being proposed are intended to be responsive to existing city priorities and bring a resilience lens and added value to projects and initiatives that are already underway. A summary table of all the proposed activities is provided at the end of this document.

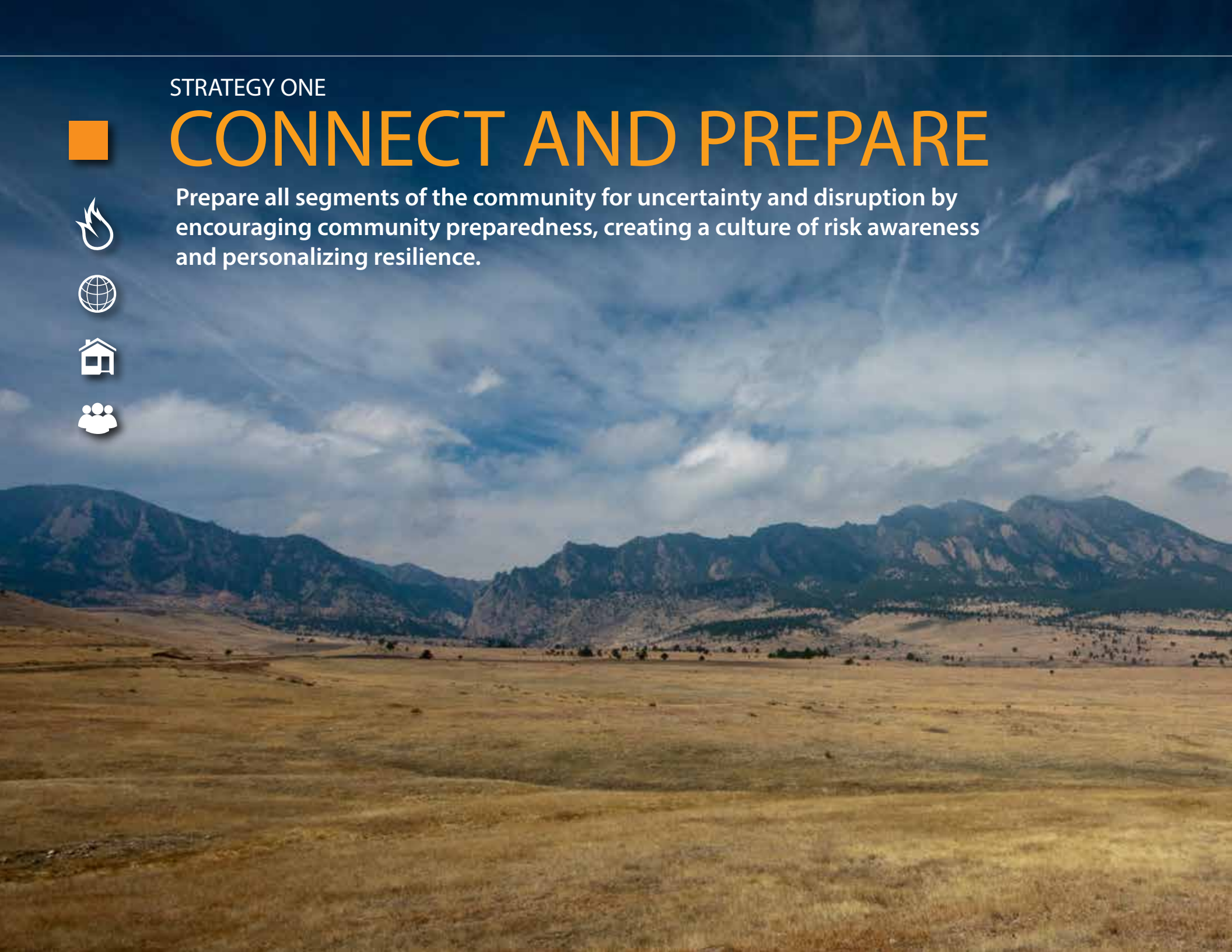
Frontiers

Transformative investments in community resilience that currently have no models to emulate, represent extremely complex areas for action and/or require an extensive community conversation to be successful.

STRATEGY ONE

CONNECT AND PREPARE

Prepare all segments of the community for uncertainty and disruption by encouraging community preparedness, creating a culture of risk awareness and personalizing resilience.



ACTIONS:

1.1 Make Resilience Accessible

Deploy a community driven, interactive "Mobile Resilience Lab."

1.2 Activate Volunteerism

Develop a volunteer community preparedness training program.

1.3 Assess Economic Strength

Identify risks to future economic vitality.

1.4 Prepare Businesses

Facilitate the use of continuity planning strategies with local businesses.

1.5 Connect for Rapid Recovery

Develop rapid post-disaster impact assessment capacity in partnership with the local business community.

1.6 Foster Artistic Engagement

Engage the creative power of the arts to convey and involve people in complex risk and resilience themes.

PURPOSE:

Despite several severe natural disasters over the last decade, most Boulder community members remain unprepared for future events. Many of the potential shocks the city faces require constant vigilance, a deeply personalized understanding of individual exposure and community risk, and an ability to act quickly in case of an emergency. Fundamental to preparedness is community connectivity and the ability for all members of the community to contribute to response and recovery when disaster strikes. Community connection can be as simple as knowing your neighbors, but it can also mean building new relationships and capacities between the city and local businesses. By enhancing preparedness and connection now, before the next disaster, the city can empower everyone to take quick action, while also deepening the city's overall sense of community.

RESILIENCE VALUE:

Preparing for future disruption is a core aspect of building community resilience. To address gaps in the city's response to the 2013 flood, the city is preparing for future uncertainty by building robust and flexible local capacity, inclusive plans and new opportunities for community collaboration.

Action 1.1 Make Resilience Accessible

Deploy a community driven, interactive "Mobile Resilience Lab."

In partnership with BoCo Strong, the collaborative countywide resilience building organization, the City of Boulder will bring resilience and preparedness activities directly into neighborhoods and communities through a "Mobile Resilience Lab." The lab will be a highly interactive space that accommodates programming as varied as developing your own bee-safe garden to creating personalized blueprints for individual resilience to building disaster "go kits." Deploying a mobile lab recognizes that true resilience building occurs first and foremost at home and in your own neighborhood, with the people and places you know best. The lab will provide a fun and dynamic platform for building relationships around preparedness and will, literally, be a vehicle for the community to share challenges and solutions. By meeting people where they are, the city will deepen public ownership of resiliency and seek to address community concerns about the responsiveness and transparency of government.

Action 1.2 Activate Volunteerism

Develop a volunteer community preparedness program.

A key to effective and successful disaster response is community and individual preparedness. Boulder's formal emergency response capabilities are well-resourced and effective; however, local neighborhoods and communities need to be better prepared and possess a deeper capacity to be first responders while formal systems gear up for relief operations. Developing a more robust and flexible capacity to respond to crisis when it occurs is a direct outcome of lessons learned from recent disasters.

In August 2015, Boulder was selected as one of 10 cities to host the inaugural class of Resilience AmeriCorps VISTA members. The program was created as a response to the recommendations made by President Barack Obama's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience. The AmeriCorps VISTAs will assist Boulder in developing and piloting a citizen corps disaster preparedness training initiative by partnering with 100RC network city, Wellington, New Zealand, and aligning these emerging efforts with deliberate ties to community volunteerism and civic ownership opportunities that already exist.

Action 1.3 Assess Economic Strength

Identify risks to future economic vitality.

Ensuring the continuing vitality of the local economy is an essential component of long-term community resilience. The City of Boulder will incorporate an analysis of the local business community's vulnerability to disruptions in core infrastructure provision, workforce availability and financial services into an update to the Economic Sustainability Strategy. Boulder will also explore whether there are latent vulnerabilities to larger macro-economic trends that the city can plan for proactively. Cyclical swings in the economy are normal and are predictable stresses whose effects can be minimized through thoughtful preparation.

Learning with 100 Resilient Cities

RESILIENCY ADVISORS

During the 2013 flood, even before the rain had stopped falling, thousands of volunteers were out helping neighbors, friends and strangers protect their homes and clean up debris. This outpouring of assistance reflected the best of Boulder's spirit and was a vital unplanned resource during the flood recovery. However, without the coordination to direct, equip and support these activities, volunteers can place themselves in danger and unintentionally hamper or overwhelm formal responses. Recognizing the need to create the capacity to welcome this energetic community support, the City of Boulder, the newly-formed Boulder County Volunteers Active in Disaster (VOAD) and 100 Resilient Cities Platform Partner, Resiliency Advisors, partnered to deliver the "Leading and Managing Community Volunteers in Disaster" workshop. During this best practices workshop to manage and marshal spontaneous volunteerism, participants engaged in sharing lessons learned, assessing future risks and resourcing mapping, as well as applying proven disaster management concepts to manage spontaneous volunteers. Post session, the group was provided an after action report that outlined next steps including a strong focus on Volunteer Reception Center training. The session was delivered by Lisa Orloff, president of Resiliency Advisors.

Learning with 100 Resilient Cities

PARTNERSHIP WITH WELLINGTON, NEW ZEALAND

Wellington, New Zealand is a 100 Resilient Cities network city that is recognized globally for its community disaster preparedness program. Wellington's approach integrates volunteerism, community-based trainings and a network of district disaster hubs to create a multi-tiered preparedness and response capability across their region. Wellington's success rests largely on the accessibility of training courses to a wide range of community members, as well as an innovative approach to regularly scheduled activities that create new opportunities for community interaction with the program. In May 2016, experts from Wellington, NZ will visit with city staff and community organizations in a weeklong workshop to design and implement activities that will prepare the community for the next disaster.

Action 1.4 Prepare Businesses

Facilitate the use of continuity planning strategies with local businesses.

The sooner local businesses return to normal operations after a disaster, the faster the surrounding neighborhoods and city recover. We will collaborate with public and private institutions and organizations to identify best practices; facilitate the use of continuity plan templates and other resources; develop policies and procedures for improved situational awareness; coordinate between business support organizations; and communicate with businesses after a disaster. Ultimately it is in each organization's interest to proactively plan for uncertainty and disruption, but our community at large has a clear stake in helping all businesses weather the inevitable crises and bounce back faster and better.

Action 1.5 Connect for Rapid Recovery

Develop rapid post-disaster impact assessment capacity in partnership with the local business community.

The ability for businesses to rapidly access resources and financial assistance after a disaster is essential for the successful return to operations. Each day that businesses remains idle represents lost revenue, wages and taxes, eliminating vital infusions of financial capital just when a community needs it most. Boulder will partner with local businesses and associations to develop the necessary capacity, relationships and systems to quickly and efficiently collect impact information and data, access recovery funds and return businesses to operation after a disaster with minimal disruption. The city will also explore the creation of a Business Disaster Assistance Center that would become operational when needed. By developing a user-friendly process to address gaps in our response to the 2013 flood, we are preparing for future uncertainty.

Action 1.6 Foster Artistic Engagement

Engage the creative power of the arts to convey and involve people in complex risk and resilience themes.

Mobilizing action at a broad scale also requires varied ways of communicating complex topics so that they are relatable and actionable to the diverse residents that make up our community. Breaking from the traditional model of community engagement, we will invest in the creative talent of our visual artists, filmmakers, poets, theatre-makers, dancers and musicians to broaden our vision, discussion and experience of risk and resilience. By enhancing our collective thinking about resilience and exploring creative ways to communicate it, we will broaden the circle of community ownership, action and perspective. This effort will lead to creative insights and solutions from community members who might not otherwise participate.

Uniquely Boulder

YOUTH "SHINE" IN PERFORMANCE FOR RESILIENCE

Performance can be a dynamic tool for including youth participation in authoring our city's plan for resilience. Shine is a musical performance that weaves climate science and artist expression into a funny and powerful story that spans 300 million years of geological time to convey how humanity and climate are interrelated. Performed at NCAR in Boulder in June 2015 as a collaboration between NCAR scientists, Beth Osnes at CU and Boulder's youth, rehearsing each part of the musical led participants through different aspects of climate science, from dancing the various phases of photosynthesis to creating flags to representing the ways in which our city utilizes fossil fuels. This show has gone on to engage youth in other 100 Resilient Cities, including New York City and London, with Durban, South Africa and New Orleans to come.

FRONTIER

INVEST IN THE FUTURE

Prioritize city investments to promote community resilience and proactively address future risks.

The capital budgeting process is the critical intersection between public policy and program implementation. Given limited resources, city officials must choose among competing priorities. These choices are often significantly determined by the criteria that are used to prioritize and rank public expenditures. Given the relatively recent emergence of resilience capacity-building as a public policy priority, there are few formal evaluation criteria built into the capital planning process that provide guidance on how to weigh the costs of proposed actions against potential benefits. This is essential to enable systematic consideration of proposed resilience actions and measures against other priorities.

Currently, for example, city investments and budgets do not specifically consider likely climate impact on city systems, nor are there mechanisms for internalizing the cost implications of the city's commitment to a zero-carbon energy policy. It is important to have valuation mechanisms that evaluate the potential cost of carbon and the potential for future constraints on carbon emissions. Implementing climate risk screening mechanisms in the Capital Improvement Program or internalizing the carbon cost of projects will reprioritize budgets and drive new conversations about risk and resilience tradeoffs across the entire city organization.

STRATEGY TWO

PARTNER AND INNOVATE

Capitalize on the collective problem solving and creativity of Boulder's community by leveraging advances in data, research and observations to address emerging resilience challenges.

ACTIONS:

2.1 Put Science in the Hands of the Community

Create a "citizen science" program to foster the co-creation of knowledge.

2.2 Ensure Food Security

Design and conduct a local food security assessment.

2.3 Make Data Accessible to All

Spur creative representation of data through investments in artistic visualization and knowledge display.

2.4 Crowd Source Solutions

Drive the creative use of community data through competitive challenges and hackathons.

PURPOSE:

In order to make the most informed decisions about the future, Boulder needs a better understanding of the changes taking place around us. The city must develop the ability to anticipate changes to proactively address emerging challenges. Rapid evolutions in remote sensing, data architecture and mobile technology now allow us to design integrated monitoring and observations systems to create new insights into the world and community. By using the power of people and place, tapping into vast research and educational resources, the city will develop the data, observation systems and partnerships necessary to understand and predict forces of change across social, economic and environmental factors, as well as create new opportunities for engagement from a wide range of stakeholders.

RESILIENCE VALUE:

The complex issues which the Boulder community faces lack easy or obvious solutions. By developing mechanisms and partnerships for inclusive and collective problem-solving, Boulder can elicit novel and innovative answers from a broad pool of expertise, creativity and talent.

Action 2.1 Put Science in the Hands of the Community

Create a "citizen science" program to foster the co-creation of knowledge.

Citizen science can take many forms, but as technologies have advanced over the last decade, each member of the community can now serve as independent, mobile data-collecting participants. To harness this potential, the city will develop the information architecture necessary to support community-driven mobile science applications and translate that data into information and metrics to inform city decision-making. The aggregation of information from so many data points can create new insights into changes in the community, collective behavior or climate, as examples. By relying on community members to play a role in the creation of data and shared knowledge, Boulder will foster co-ownership in understanding the factors of change affecting us all. The underlying architecture will be openly available to the public to creatively develop applications to support data collection from sources as diverse as the Boulder Valley School District to Boulder's active and enthusiastic outdoor community.

Action 2.2 Ensure Food Security

Design and conduct a local food security assessment.

Boulder's passion for safe, local and ethical food has made the community a global hub for natural foods. As a leader in the natural and organic industry, Boulder has world-class, locally sourced restaurants and has made revolutionary contributions to natural food packaging and labeling. However, Boulder needs a better understanding of what role locally produced food can play in buffering the community from a disruption in national or global food or transportation systems. The city will conduct an entirely new food security assessment, deviating from traditional scales of analysis and definitions of "security." An assessment of this type will require a broad range of partnerships from the business, agricultural, transportation and water sectors, among others, to understand how changes in the complex dynamics of the food production, delivery and consumption system can both be impacted by disruption, but also meaningfully mitigated by local action.

Action 2.3 Make Data Accessible to All

Spur creative representation of data through artistic visualization and knowledge display.

New capabilities created by the integration of enhanced computational power, big data and visual representation systems provide the opportunity to bring many previously complex and abstract concepts into stunning visual relief for the first time. The city will convene some of the world's great artists and media professionals to work with scientists, librarians and city officials to develop and refine some of these data visualization systems to create a compelling community education and communication approach. Boulder will work with partners to put the vast amount of collected scientific and citizen science data in the hands of artists and hackers, giving them the tools they need to interpret and represent the data in a clear, resonant message. Through these creative partnerships, the city will unleash untapped knowledge to inform decisions and mobilize collective action.

Action 2.4 Crowd Source Solutions

Drive the creative use of community data through competitive challenges and hackathons.

As part of an ongoing effort to democratize the city's data through community dashboarding and a more accessible open-data portal, Boulder will create data and technology challenges to encourage the use of city and community data. These challenges are dynamic competitions intended to focus the creative and entrepreneurial talent of the city to help identify and solve collective problems. Similarly, the city will partner with the local coding and tech community to host hackathons—events that focus intense programming attention toward a collaborative solution to a single, discrete issue. Taken together, this approach taps into two powerful behavioral motivators—competition and collaboration—to find solutions to particularly complex resilience issues.

Uniquely Boulder

UNDERSTANDING RISK: BOULDER

In October 2015, the City of Boulder, in partnership with Ushahidi, a 100 Resilient Cities Platform Partner, the University of Colorado, the World Bank's Global Facility for Disaster Risk Reduction (GFDRR) and several local technology companies, hosted a two-day event called Understanding Risk Boulder (URBoulder). URBoulder convened the talent and expertise of the region's communities, scientists, technologists and government to develop a shared understanding of the challenges faced in building long-term resilience to natural hazards; understand the impacts of climate change; and develop innovative solutions to meet them.

In conjunction with UR Boulder, Ushahidi hosted a Tech Challenge that sought to use open-source technology to improve resilience in Boulder and strengthen community engagement. The UR Boulder Tech Challenge was designed to identify technological gaps in the resilience landscape of Boulder and provide seed funding for innovate solutions to them. The challenge was funded by The Rockefeller Foundation.

"With an estimated 2.8 million visitor nights in 2013, the tourism industry contributed to an estimated $420 million total economic impact on the City of Boulder. The industry is supported by the area's scenic beauty and recreational opportunities, variety of entertainment and attractions, support for arts and culture, and broad range of dining, shopping and lodging options."

- BOULDER ECONOMIC COUNCIL

"We are working on a wide array of policies, programs and projects to reduce emissions and realize other important community outcomes. We know that long-term success will require better feedback loops, honest assessment, persistence and collective action."

- City of Boulder's 2016
Climate Commitment Framework

FRONTIER

ENVISION THE FUTURE OF ENERGY

Develop a sustainable, secure and equitable energy system.

Extreme weather events have created a call to action for deploying more resilient power systems. Communities face a growing number of stresses that pose risks to their energy systems and economies. These include aging infrastructure in need of costly maintenance upgrades and severe weather events. Energy efficiency and local power generation are strategies that enhance the resilience of energy systems and the communities they serve.

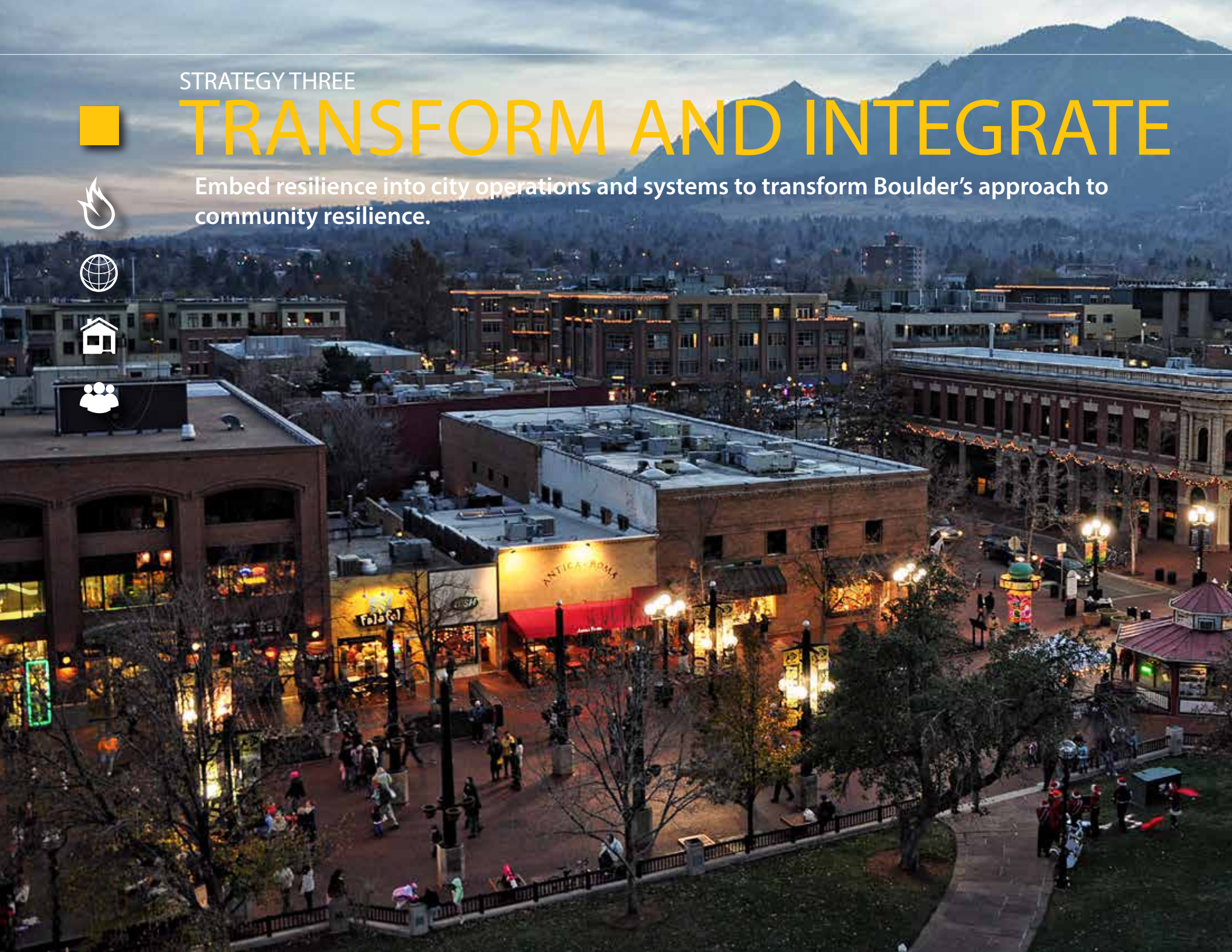
Boulder is committed to transitioning to a no-carbon energy system as part of its climate action plan. This wholesale transformation will fundamentally alter the landscape of energy production, storage, distribution and use in ways that are only now being fully explored. With this transition comes an additional opportunity—a chance to apply core resilience principles, such as flexibility, redundancy and robustness, as additional drivers of the system design. Many of the renewable energy sources we rely on as part of our strategies for reducing carbon are well suited to serve as the backbone for a resilient energy system.

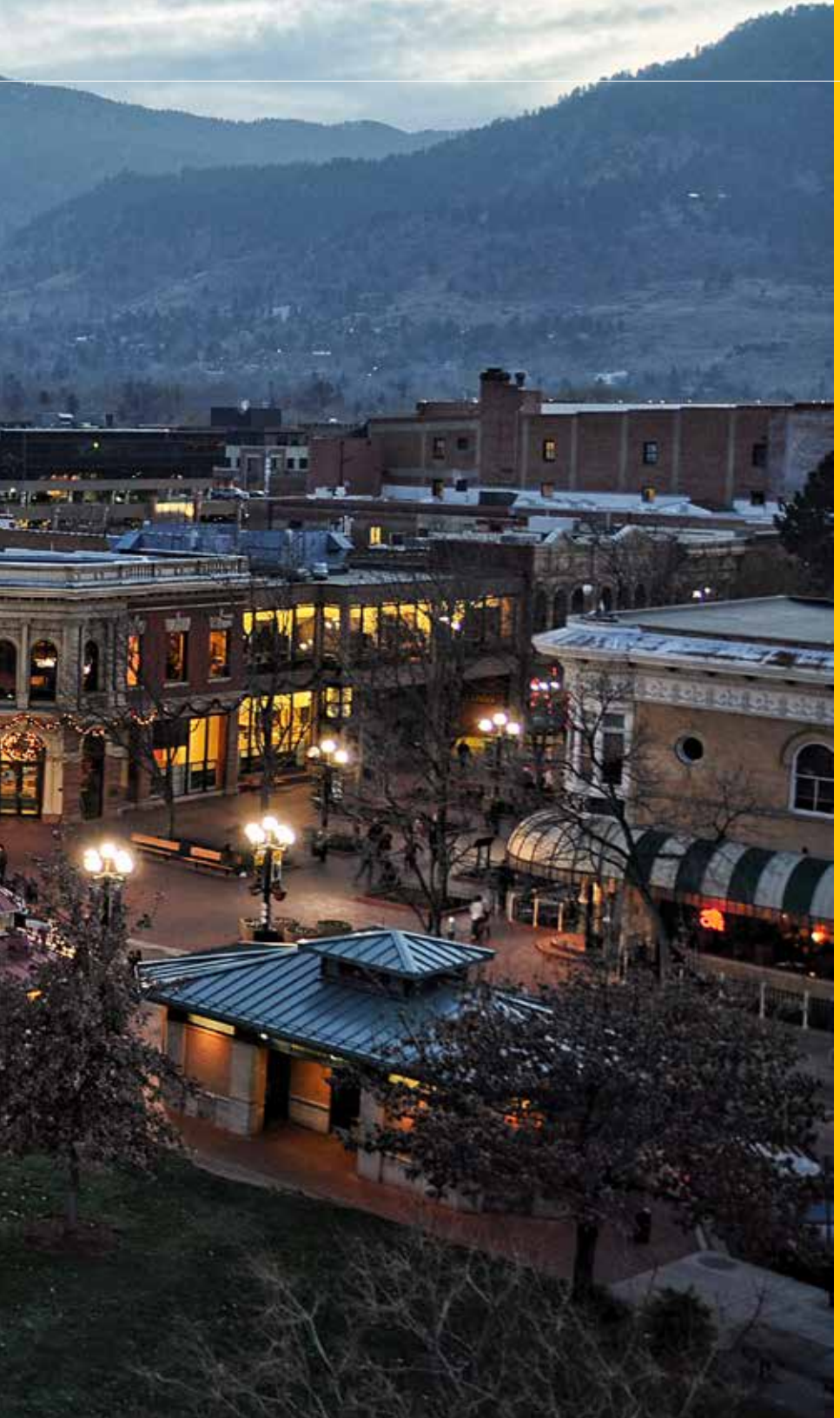
The city aims to improve resiliency and address economic and environmental concerns by prioritizing a local, clean energy system that combines Boulder-based generation, integrated storage and other distributed energy resources, increasing clean energy opportunities to low-income communities and protecting vulnerable populations by serving critical power needs. It will require careful consideration and extensive design, partnerships that span the entire community, and, ultimately, a collective leap of faith and the willingness to embrace change, even when the outcome is not yet entirely clear.

STRATEGY THREE

TRANSFORM AND INTEGRATE

Embed resilience into city operations and systems to transform Boulder's approach to community resilience.





ACTIONS:

3.1 Create Community Resilience Centers

Ensure the continuity of all critical life-safety services at a network of community resilience centers.

3.2 Foster Climate Readiness

Build climate preparedness capacity across the city organization.

3.3 Advance Sustainability with Resilience

Integrate resilience principles into Boulder's Sustainability Framework.

3.4 Embed Resilience in the Comprehensive Plan

Integrate resilience into the Boulder Valley Comprehensive Plan.

3.5 Manage Thriving Ecosystems

Develop an integrated urban ecosystem management plan.

PURPOSE:

The city's infrastructure, design and neighborhoods are driven by public investments and land use decisions. Choices made today will last for generations. These choices also must be considered on multiple scales and across issues and systems. Facing a future with so much uncertainty will ultimately require flexible and adaptive systems that do not lock the Boulder community into a single pathway.

RESILIENCE VALUE:

Embedding resilience into long-held sustainability values creates systemic change for both the city and the larger community that allows us to better address a wide range of climate, economic and social challenges.

Action 3.1 Create Community Resilience Centers

Ensure the continuity of all critical life-safety services at a network of community resilience centers.

Recent events have highlighted the extreme vulnerabilities and interdependencies of core life-safety infrastructure and utilities (e.g. energy, water and sanitation) and the need for their combined secure, continuous operation during crisis. Advance planning for large-scale, high-impact events is critical to ensuring that these incidents do not overwhelm either immediate response capabilities or the long-term well-being of highly vulnerable segments of Boulder's community. The city will design and implement a communitywide network of resilience centers that ensures continuity of critical community services, protection for high-risk populations and infrastructure, and an enhanced capacity to provide and maintain basic services at a neighborhood scale, and develop the capacity to 'island' critical infrastructure provision without jeopardizing core life-safety functions. These resilience centers will contain small-scale or compartmentalized infrastructure systems that can operate independent of the larger utility system to sustain a sheltering facility during wide-scale disruption.

Boulder will also create place-based platforms for assembly, cooperation and education. By basing and delivering community outreach, activities and other functions (e.g., mobile farmers markets, food trucks, fix it clinics, recycling support, etc.) from these locations, these centers can be integrated into the new focus on neighborhood- based engagement during good times as well as crisis. The likely integration of significant renewable energy assets at these locations can also provide foundational elements for a distributed energy system that could include neighborhood-based load balancing through on-site battery storage, neighborhood microgrid development or other emerging decentralized energy utility models.

By thoughtfully investing in public safety infrastructure as a response to lessons learned in previous events, the city can weave in multiple additional community benefits such as neighborhood development and energy transition.

Action 3.2 Foster Climate Readiness

Build climate preparedness capacity across the city organization.

Most of the city's climate risk is tied to larger scale changes in the global and regional climate, and the community's understanding of those impacts at the local scale is inconsistent. This is in part because of the complexities of Boulder's local topography, but also because the city currently uses a wide variety of models, methods and analysis to characterize potential "futures." In order to efficiently and effectively plan for Boulder's future climate impacts, the city will systematize the use of climate information across all departments and city functions in a way that is scientifically robust yet retains appropriate flexibility.

CLIMATE LEADERS PROGRAM

The City of Boulder will pilot a program to train department leaders, from Human Resources and Finance to Utilities and Parks and Recreation, in the science of climate change so that everyday decisions across the organization can be informed by a consistent foundation of knowledge and understanding.

SCENARIO PLANNING

We must prepare to accommodate a much wider range of possible future conditions than in the past. Part of the solution is to design a scenario-based process for planning that allows us to test programs, actions and investments against different plausible potential future conditions and prioritize actions that represent "no or low regrets" strategies. "No or low regrets" strategies are those that are sound investments and adaptations regardless of the severity of future change.

By investing in the core capacity of city staff to understand climate science and impacts, and by developing flexible mechanisms to plan for a range of potential climate impacts, Boulder is creating the adaptive governance structures necessary to address the wide-ranging effects that climate change will have on all functions of government.

Action 3.3 Advance Sustainability with Resilience

Integrate resilience principles into Boulder's Sustainability Framework.

Boulder's Sustainability Framework is the unifying mechanism that connects all of the city's policies and programs, and therefore represents the best point for integrating the resilience principles that will have the greatest impact across all of Boulder's departments and functions. The Sustainability Framework has been used successfully in practice for several years, informing the city's policies, budget prioritization and program design. The Boulder community has a deeply embedded sense of sustainability as a core value system, manifested through the well-established framework, among many other community-driven initiatives. Resilience, however, is a relatively new and emerging concept being systematically applied as a practice in cities for the first time. By thoughtfully integrating resilience into a familiar and operational framework, resilience activity will be placed in a relatable and immediately actionable context.

The city is continuously working to provide service excellence for an inspired future and moving towards the vision of One City, One Boulder.

Action 3.4 Embed Resilience in the Comprehensive Plan

Integrate resilience into the Boulder Valley Comprehensive Plan.

The Boulder Valley Comprehensive Plan (BVCP) serves as the city's highest level policy document, articulating the community's vision and core values. The BVCP contains sustainability principles and policies and chapters that convey discrete topics such as land use, transportation, housing and economy. By integrating new resilience policies and strategies into the BVCP, the plan can address key elements of a healthy, stable and adaptive community, reflect and address Boulder's highest risks so the community can be adaptive, underscore connectively between systems and vulnerabilities, and illustrate ways that the BVCP can address Boulder's resilience, not only in times of disruption and crisis, but also on a day-to-day basis and over the long term. Integrating resilience into the BVCP will leverage interdisciplinary expertise and generate strategies that are responsive to Boulder's challenges, as well as align activities and priorities across city departments.

Action 3.5 Manage Thriving Ecosystems

Develop an integrated urban ecosystem management plan.

By creating an integrated ecosystem management plan, Boulder will support its complex local ecosystem and plan for the systemic stresses and changes anticipated with climate change impacts. As part of Boulder's long history of progressive planning, the city actively manages many aspects of the urban ecosystem, including monitoring wildlife-human interactions, maintaining a healthy forest canopy and conducting regular riparian renewal and restoration efforts. The success of these programs contributes to the city's rich quality of life and sense of community. These programs also add to the ongoing success of Boulder's signature planning achievement—the vast greenbelt of open space that encircles the city. Building on these efforts, Boulder will develop an integrated strategy that aims to knit disparate efforts to create a single ecosystem management plan.

Learning with 100 Resilient Cities

TRIMBLE AND DIGITALGLOBE

Boulder's urban forest faces unique challenges due to both the higher stresses already caused by geographic conditions and the onset of diseases and exotic pests such as the recently arrived Emerald Ash Borer (EAB). Given these factors and the need to develop a more robust set of urban forest management tools, the City of Boulder partnered with 100RC Platform Partners Trimble and DigitalGlobe to map the urban tree canopy.

DigitalGlobe was able to provide Boulder with the high-resolution multi-spectral satellite imagery needed to extract, map, and measure the trees throughout the city. Trimble presented an initial citywide urban tree canopy analysis, as well as provided free training to city staff on the use of the eCognition software necessary to map changes to the urban tree canopy over time.

The result provided the city with a baseline to prioritize future management plans and track green infrastructure changes whether through loss due to EAB infestation or gain through green infrastructure improvements. The urban tree canopy analysis will be published in Boulder's Open Data Catalog. In addition to working with Boulder, Trimble and DigitalGlobe are assessing how to replicate and offer similar outcomes to other municipalities based on the work done and lessons learned with Boulder.

The 18-month "Tree Debris to Opportunity" project (see pg 42) aims to transform Emerald Ash Borer infested wood debris into items area residents can use. In partnership with the Bridge House Ready to Work program, participants will receive expert training to turn milled wood into practical items and artistic expressions at the new Building 61 Makerspace at the Boulder Main Library.

Uniquely Boulder

TRAINING THE HOMELESS TO TURN "TREE DEBRIS TO OPPORTUNITY"

The City of Boulder has won a prestigious Knight Cities Challenge grant to develop an innovative program that will train homeless community members to turn trees impacted by Emerald Ash Borer into beautiful products. This 18-month project addresses a variety of community challenges, including Emerald Ash Borer infestation and homelessness. The program, called Tree Debris to Opportunity, was one of 37 recipients chosen by the Knight Cities Challenge for support and funding. The city's application was submitted in partnership with the Bridge House and Library Maker Space.

The goal is to engage the Boulder community in repurposing Ash tree debris to usable products to be sold back to the community. The program will hire participants of the Bridge House Ready to Work program. These individuals will complete a multi-month apprenticeship at the Maker Space, located in the Main Library, to learn how to become woodworkers. The group will make products that will then be sold at the Farmers Market and other locations. Public classes will also be offered for free. The Bridge House participants will help teach and facilitate the classes, encouraging collaboration between all members of the community. The project is expected to begin in mid- to late summer and is made possible through the generous support of the Knight Cities Challenge. The grant amount totals $200,000.

FRONTIER

CREATE ADAPTIVE SOCIAL SERVICES

Reduce homelessness by designing an adaptive and predictive social service network.

Human Services provides vital support for large segments of the Boulder community through grants to community agencies, direct services and community capacity-building partnerships. These programs provide a range of community services for vulnerable residents—from access to mental and physical health, child care and family support to emergency services. The 2016 revision to the Human Services Strategy seeks to shift how Human Services conducts business, away from primarily tracking program-based success metrics, such as the number of shelter beds filled or meals served, to a predictive and adaptive service provision based on achieving social outcomes. This shift will allow us to identify "tipping points" in the social safety net that cause individuals and families to move from relative stability into homelessness. It will allow us to monitor for those changes and preemptively adjust resources to avoid them.

Homelessness represents a profound threshold for the most vulnerable in our society and once crossed, individuals and families encounter significantly more social, economic and health barriers. Reducing homelessness not only brings obvious and important benefits for the individuals and families involved, but ultimately saves substantial resources in the social safety net that can be redirected toward additional positive investments. Boulder is a prosperous and innovative city, and it has pioneered many important cultural and environmental issues. Thus, developing new ways to assist residents with the greatest needs, so that no one falls into homelessness, is a resilience frontier.

A RUNNING START

The actions listed to the right showcase many of the resilience activities the city is currently undertaking across the community. Boulder has taken inspiration and learned from its successes in the design of the new actions proposed earlier in this strategy. However, the list is not comprehensive – Boulder is doing much more. Let us know what you, your organization or company is already doing to build community resilience at www.resilientboulder.com Add to the ever-growing list of resilience building projects, programs and activities!

2016-2017 Resilience Actions	Resilience Challenge Area	Boulder's Running Start
Strategy 1: **CONNECT AND PREPARE** Prepare all segments of the community for uncertainty and disruption by encouraging community preparedness, creating a culture of risk awareness, and personalizing resilience.		
1.1 Make Resilience Accessible: Deploy a community driven, interactive "Mobile Resilience Lab."		NEW!
1.2 Activate Volunteerism: Develop a volunteer community preparedness training program.		City of Boulder Fire Rescue's Citizen's Fire Academy
1.3 Assess Economic Strength: Identify risks to future economic vitality.		City of Boulder's Economic Sustainability Strategy
1.4 Prepare Businesses: Incentivize the use of continuity planning strategies with local businesses.		Boulder Office of Emergency Management
1.5 Connect for Rapid Recovery: Develop rapid post-disaster impact assessment capacity in partnership with the local business community.		NEW!
1.6 Foster Artistic Engagement: Engage the creative power of the arts to convey and involve people in complex risk and resilience themes.		Boulder's Community Cultural Plan
FRONTIER 1: Invest in the Future: Prioritize city investments to promote community resilience and proactively address future risks.		City of Boulder Capital Improvements Program
Strategy 2: **PARTNER AND INNOVATE** Capitalize on the collective problem solving and creativity of Boulder's community by leveraging advances in data, research and observations to address emerging resilience challenges.		
2.1 Put Science in the Hands of the Community: Create a "citizen science" program to foster the co-creation of knowledge.		NEW!
2.2 Ensure Food Security: Design and conduct a local food security assessment.		City of Boulder's Local Foods Initiative
2.3 Make Data Accessible to All: Spur creative representation of data through investments in artistic visualization and knowledge display.		Bold Measures, Boulder's Community Dashboard (Coming Soon!)
2.4 Crowd Source Solutions: Drive the creative use of community data through competitive challenges and hackathons.		Understanding Risk Boulder
FRONTIER 2: Envision the Future of Energy: Develop a sustainable, secure, and equitable energy system.		City of Boulder's Energy Future
Strategy 3: **TRANSFORM AND INTEGRATE** Embed resilience into city operations and systems to transform Boulder's approach to community resilience.		
3.1 Create Community Resilience Centers: Ensure the continuity of all critical life-safety services at a network of community resilience centers.		City of Boulder's Climate Commitment
3.2 Foster Climate Readiness: Build climate preparedness capacity across the city organization.		Colorado's Water Plan - Chapter 6, Water Supply Management for the Future
3.3 Advance Sustainability with Resilience: Integrate resilience principles into Boulder's Sustainability Framework.		Boulder's Sustainability Framework
3.4 Embed Resilience in the Comprehensive Plan: Integrate resilience into the Boulder Valley Comprehensive Plan (BVCP).		Our Legacy. Our Future. BVCP 2015 Update
3.5 Manage Thriving Ecosystems: Develop an integrated urban ecosystem management plan.		City of Boulder's Urban Forest Strategic Plan
FRONTIER 3: Create Adaptive Social Services: Reduce homelessness by designing an adaptive and predictive social service network.		City of Boulder's Human Services Strategy

5 CREDITS

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