Learning from Disasters: Colorado's Extreme Floods of 2013

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We would also like to thank the University of Colorado Denver School of Public Affairs, the Center for Science Technology and Policy Research at University of Colorado Boulder, and the Nicholas School of the Environment at Duke University for their administrative support of the project.

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Learning from Disasters: Colorado's Extreme Floods of 2013

Communities, households, and individuals are ever more vulnerable to floods due to increasing development and changing weather patterns, as well as other social, political, and environmental factors. Local governments focus much of their preparedness attention on emergency response, such as evacuation and restoration of utilities, and may assume that those skills can translate into longer-term disaster recovery. However, during disaster recovery, local governments are faced with a myriad of policy challenges, from repairing and replacing infrastructure to broader questions of reducing vulnerability to future hazards, which must be dealt with over months and years with no clear path toward 'success'. Understanding how local governments respond to a disaster and plan for the future is critical to consider in order to determine whether experiencing a disaster results in safer and more resilient communities.

Credit: Staff Sgt. Dixie Manzanares

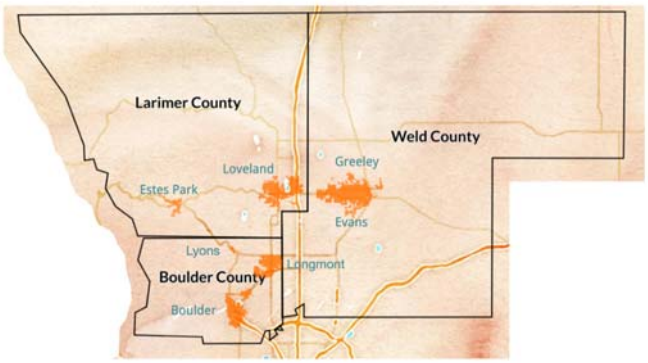
The lessons from our research can be applied in government settings at the local, state, and national levels, as well as by the individuals who are involved in and affected by disasters in their communities.

In September 2013, a stationary rain storm settled on Colorado's Front Range foothills, dropping more than 16 inches of rain over 72 hours. Flash flooding along foothills communities (Boulder, Lyons, Longmont, Estes Park, Loveland, among others) occurred within hours. As the flood moved east, Colorado's plains communities (Evans and Greeley, among others) were impacted. This report explores policy planning, lessons, and changes made in the aftermath of the 2013 floods in these seven affected communities.

Our work is focused on what leads to increased community resilience to future disasters. We want to understand how communities, the public, and governments can learn from disasters. Resilience, as we imagine it, is seen when communities learn to adapt to hazards they face, encourage feedback and learning among and from residents, and make decisions with future risks and goals in mind. **The goal of our study of Colorado's 2013 floods is to help communities learn how to improve recovery decisions that decrease their vulnerability to a wide variety of hazards and prepare for future disasters that may strike.** Hazards in this case include flood risk, but can also include natural, human-made, accidental, economic, or other risks that communities face. The difference between ongoing vulnerability to hazards and long-term resilience may, in part, depend on learning from and adaptation to disaster risks in local communities. Residents and decision makers who understand the factors that increase the likelihood of successful resilience policy may be more likely to develop long-term local-level adaptability and resilience. While communities learn most dramatically from their own experience with disasters, we believe our research can help communities that face myriad hazards establish processes that can mitigate their risk for future disasters.

COMMUNITIES

To understand disaster recovery across different types of local governments and communities, we selected seven communities in the three hardest-hit Colorado counties, based on FEMA data. Within the three counties we explicitly chose communities that vary based on the type and extent of damage they incurred from the floods, as well as the population size and capacity of the local government. From this research we are therefore able to generate findings and lessons for various types of communities.



Map created in Carto®

LARIMER COUNTY

Population 324,124

	Population	Race	Ethnicity	Income	Education
	Total	*White*	*Hispanic/Latino*	*Median Household*	*No college degree*
Estes Park	6,000	83.1%	14%	$56,236	65.3%
Loveland	67,039	84.8%	11.7%	$55,580	66%

WELD COUNTY

Population 277,670

	Population	Race	Ethnicity	Income	Education
	Total	*White*	*Hispanic/Latino*	*Median Household*	*No college degree*
Evans	19,500	53.1%	43.1%	$47,798	84%
Greeley	95,300	59.3%	36%	$47,342	74.4%

BOULDER COUNTY

Population 331,333

	Population	Race	Ethnicity	Income	Education
	Total	*White*	*Hispanic/Latino*	*Median Household*	*No college degree*
Boulder	101,800	83%	8.7%	$58,062	28.5%
Longmont	88,600	69.3%	24.6%	$60,218	62.9%
Lyons	2,000	90.9%	5.7%	$93,844	42.2%

Population: Pre-flood, 2010, US Census
Income: Median Household Income, 2010-2014, American Community Survey, US Census
Education: Education level, US Census

HOW WE LEARNED

INTERVIEWS

2013 – 2014

24 Local government flood recovery staff

2016

23 Local government flood recovery staff

7 Local government flood recovery finance professionals

7 Watershed coalition coordinators

2017

24 Local government flood recovery staff

10 Colorado state government staff

SURVEYS

2014, 2015 and 2016

248

Local government staff, board members, and elected officials

2016 and 2017

905

Residents from flooded and non-flooded areas

DOCUMENTS

2013 – 2017

1,825

Reviewed community planning and recovery documents including:

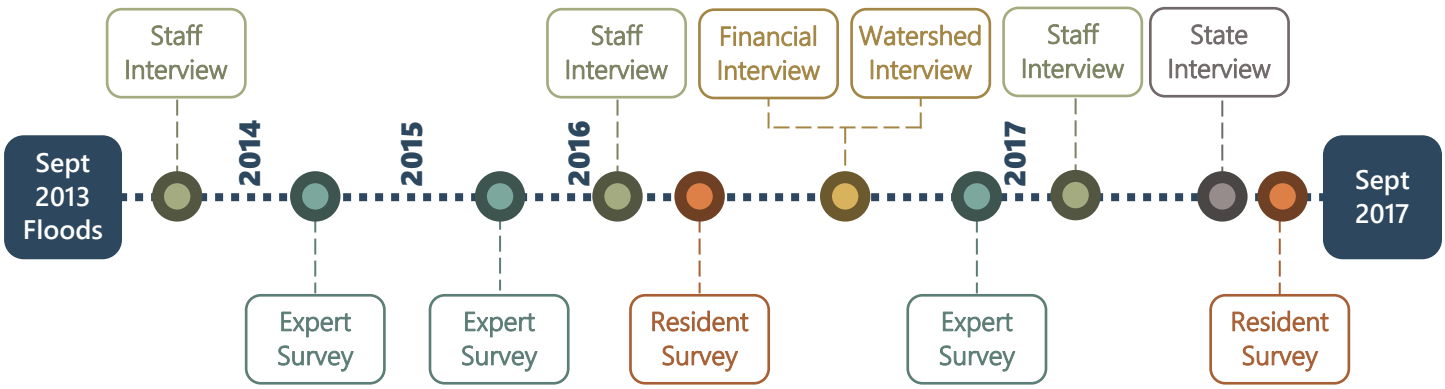
- public or media outreach
- city council minutes and memos
- minutes from boards and commissions that discussed flood recovery
- planning session documents

SURVEY QUESTIONS

- Past flood experiences and perceived future flood risks
- Perceived damages resulting from the floods
- Preferred policy alternatives for managing future flood risks
- Values, beliefs, and policy preferences on flood policy, management, and emergency response
- How local government has involved the public in recovery
- Community resource availability, including financial, professional/ leadership, and networks/relationships
- Perceived level of preparedness for future flooding

(See Appendix B for more detail)

PROJECT TIMELINE



WHAT WE LEARNED

Our initial research lead to lessons in four primary areas: **risk perceptions, public participation, vulnerable populations, and finance and budgeting.** The following sections of this report review lessons in each area, first summarizing our findings and then considering barriers to recovery. The final section of this report discusses ongoing and future work from this same study. As we observe how communities and local governments learn during disaster response and recovery, we use concepts of learning within organizations based on previous research.

POLITICAL LEARNING	INSTRUMENTAL LEARNING	GOVERNMENTAL LEARNING	SOCIAL LEARNING
Learning about strategies and tactics	**Learning about new policy instruments**	**Learning about governmental organization**	**Learning about problems and long-term solutions**
• Adoption of new approaches • Adoption of intergovernmental strategies	• Changes in specific policy tools • Changes in internal governmental processes	• Formation of new departments or divisions • Development of new venues to discuss policy	• Statement of new goals • Change in long-term policies or community plans • Changes in defined scope of problem

RISK PERCEPTIONS: Understanding and Planning for Hazard Risk

Perceptions of future risk can influence how much a community progresses toward resilience. How local government officials and stakeholders perceive the severity of flooding is linked to past flood experience and professional expertise. Overall, local officials believe the risk of flooding is more severe than the public. These varying risk perceptions may prove to be barriers to successful recovery and are important to consider as communities develop public engagement and planning processes. The differences in risk perceptions may also be barriers to communication and agreement on policy changes during disaster recovery.

I think there's a great resistance to recognizing risk. You know, 'that it hasn't happened before', or 'it's not going to happen here', 'or it's not going to be as bad', or 'we've had this before'.

Local Official

PREVIOUS RESEARCH TELLS US

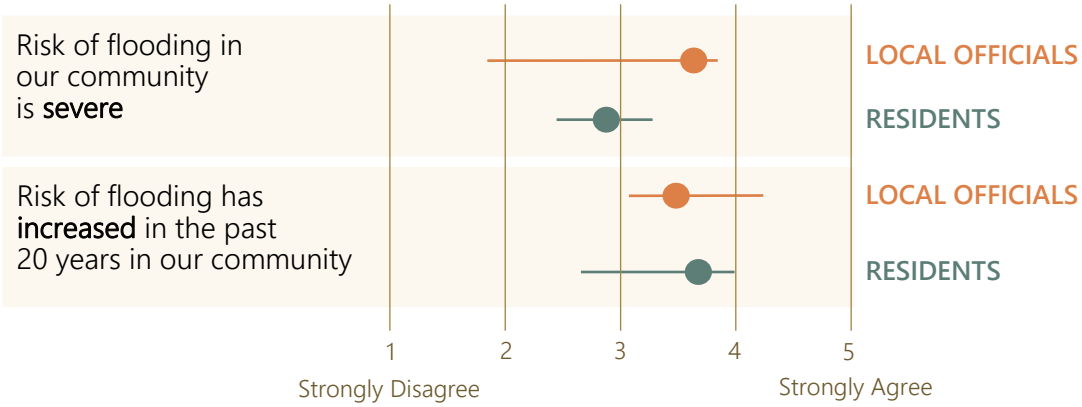
RISK PERCEPTION = Perceived likelihood of event X expected damage. Risk perceptions differ based on characteristics of the person, social processes, past disaster experiences, level of knowledge and expertise, and worldview.[17,18]

Experts and the general public view disaster risk differently. Experts perceive risk more narrowly – using probabilities and severity of consequences. Experts may have a higher sense of control over risks.[19,20] General public perceive risk more broadly – using their social, psychological and cultural lenses. The public may focus more on consequence of the event (expected damage).

Past disaster experience influences perceived risk. With no direct flood experience, people tend to underestimate the future risk. With direct flood experience, people tend to overestimate future risk.[21,22]

RISK PERCEPTIONS

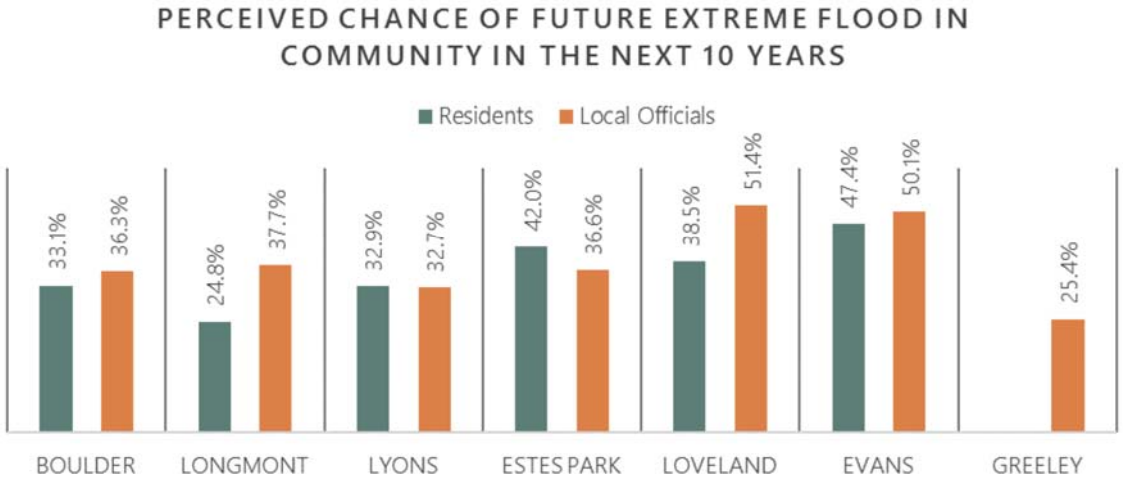
Among local officials, our results suggest that professional expertise, particularly in community infrastructure management, tends to reduce an individual's perception of future flood risk. In this study, local officials include personnel tasked with flood recovery for local governments and members of boards and commissions dealing with flood recovery,



There is nuance to professional expertise: staff, broadly defined, viewed flood severity as greater than those on tasks forces and elected officials. Personal experience with flood events, however, has the opposite effect; local officials who experienced flooding within their own neighborhoods were more likely to perceive an increased risk of future flood events.

The pull of personal experience may outweigh professional expertise as flood managers who experienced flooding personally were more likely to perceive heightened risk compared with their non-effected coworkers. There was also a significant gender component to perception of the likelihood of a high-impact flood event in the next 100 years. In the surveys of local officials, females and those who work in an infrastructure-focused department (versus a social or environmental department) predicted lower risks of a future extreme flood event.

Our findings suggest that, on average, local officials perceive greater levels of risk of future flooding and see flooding as a more severe problem than the general public. Among the public, individuals with lower socio-economic status view flooding as a more severe risk and problem than individuals with higher socio-economic status.



BARRIERS TO UNDERSTANDING RISK PERCEPTION

- Among disaster recovery personnel, disaster risks are often discussed in technical terms, while the public views risk more broadly. These different understandings and interpretations of risks may lead to confusion and perhaps even disagreements between experts and the public.
- Individuals who live in a floodplain may perceive greater risk of future floods, which is important for local governments to consider when reaching out to different neighborhoods or groups of residents.

RECOMMENDATIONS FOR ACTION

In order to overcome the barriers described above regarding understanding risk perception, we recommend that local governments take the following actions:

1. Maintain an on-going dialogue between local officials and community members to facilitate an in-depth understanding of local hazard risks and risk reduction strategies.
2. Capitalize on residents' direct experiences with hazards to learn more about potential high-risk areas; incorporate these residents into the process of developing risk reduction tools such as hazard maps.
3. Create a dialogue using multiple methods of communication and education, including methods targeted at specific segments of the community (e.g., children, older adults, immigrants) as well as coordinated efforts throughout the year and during seasonal times when risk increases.
4. Make risk maps available to the public, using simple color-coding or other systems, so that individuals can clearly see their own risk as well as their neighborhood and community risks.

WHAT WE LEARNED

PUBLIC PARTICIPATION: Engagement and Planning for Successful Disaster Recovery

Engaging the public is important for successful disaster recovery in order for governments to consider multiple perspectives, increase support for community-wide decisions, and inform the public about changes being made in their community.

There were significant differences among different types of stakeholder or public engagement processes across communities. We found that there was a tendency for new processes or opportunities for participation in communities that were most severely impacted. These processes include those designed to elicit feedback and input from residents and other stakeholders during government decision-making processes, as well as communication and outreach from governments to stakeholders.

PREVIOUS RESEARCH TELLS US

- Public participation can increase buy-in for government decisions and policies.[1,2,3]
- Public participation in government decisions is difficult, expensive, and often avoided due to limited capacity in government agencies.[4,5,6,7,8,9]
- Participatory processes can increase social capital and trust among the people who participate.[10,11,12]
- Social capital is important to successful disaster recovery .[13,14,15,16]

There was more public input in communities that were relatively wealthier and that had a tradition of community engagement outside of the disaster context. For example, Lyons and Evans both experienced significant damage from the floods and have limited resources, but Lyons developed a highly deliberative process while Evans used a mostly top-down government-led process including staff as well as other city council-nominated stakeholders.

Types of Public Participation Used in Flood Recovery

	Task Force/ stakeholder process	City council/ commission participation	Public meeting participation	Survey of residents	On-line information dissemination or collection
Boulder	⊘	✓	✓	✓	✓
Longmont	✓	✓	✓	✓	✓
Lyons	✓	✓	✓	✓	✓
Loveland	⊘	⊘	⊘	⊘	✓
Estes Park	✓	✓	✓	⊘	✓
Evans	✓	⊘	⊘	⊘	⊘
Greeley	⊘	⊘	✓	⊘	⊘

PUBLIC PARTICIPATION

Boulder, a relatively wealthy community with less damage, chose to structure recovery through staff expertise and public outreach through large public meetings and smaller neighborhood-focused meetings on floodplain management. In Longmont, where the local government would potentially struggle with communicating the significant flood impacts to non-affected residents, they developed an outreach campaign designed to communicate progress, connectedness of various damage and rebuilding efforts, and promote support for the local recovery efforts.

Credit: U.S. Army National Guard photo by Sgt. Joseph K. VonNida

In many communities, concerned stakeholders, such as residents, experts, and non-profit organizations, formed coalition – groups of individuals working together with a common purpose or goal – that motivated and led recovery and rebuilding efforts. Because of the potential impact of these coalitions on recovery, communities should consider who is or is not represented in these coalitions as this is important for successful outcomes.

Our results suggest that the damages experienced and resources available to a community have led communities to select differing participatory processes to guide flood recovery. Communities' past experiences and practices with participatory processes also influence post-disaster stakeholder and public engagement processes.

> **We've done a series of open houses to make sure we had a clear understanding of how things played out across the community and more than anything to let people tell their stories and be heard, but we've accumulated a massive amount of data from [those meetings] and probably more long-term, that will feed into our master planning.**
>
> *Local Official*

PUBLIC PARTICIPATION

BARRIERS TO PUBLIC PARTICIPATION

Public participation is an important aspect of disaster recovery and future resilience planning. However, we identified issues that can create barriers to public participation.

- Some individuals may not have prior experience participating in government processes and may not know how to engage or access information in the ways commonly offered by government.
- Residents may not have access to technology or the skills required to participate.
  - For example, meetings requiring RSVP through online forms and meetings primarily publicized through social media, such as Facebook or NextDoor, will exclude those without access.
- Meetings held locally may be run by state officials who are not aware of community demographics, resulting in some residents not being reached.
- Community members displaced by natural disasters may not have resources to return and participate.
- Segments of the community may be less likely to participate. For example, undocumented immigrants who were affected may fear communicating with government officials.
- Recovery and resilience decisions may be political or controversial in some communities, which further complicates public support or opposition to specific recovery decisions.

RECOMMENDATIONS FOR ACTION

In order to overcome the barriers described above regarding public participation, we recommend that local governments take the following actions:

1. Conduct a disaster *recovery* planning process similar to existing disaster preparedness processes including the processes and personnel that will guide recovery.
2. Develop a forum to bring together leaders of existing neighborhood and community groups to facilitate conversations about including a diversity of residents in planning and advocacy, identifying important mitigation/recovery resources, and partnering with the local government and other organizations on recovery goals.
3. Coordinate with groups of diverse stakeholders, such as watershed coalitions, to identify and engage additional community members from flood-affected areas that may be interested in participating in broader planning processes.
4. Develop an outreach plan that uses multiple forms of communication (digital, traditional, face-to-face, etc.) to create government-to-citizen and citizen-to-citizen networks so that even the most isolated individuals can be reached during disasters.

WHAT WE LEARNED

DEMOGRAPHICS AND LOWER-RESOURCED COMMUNITIES: Responding to the Needs of Diverse Communities

Disadvantaged populations, such as individuals with relatively lower access to financial and political resources, often bear a disproportionate burden of disaster, frequently worsening pre-existing inequities. For example, several communities discussed concerns about the availability of affordable housing prior to the flood, which was only made worse after the flood. Therefore, communities must carefully consider how they can prepare for and recover from disasters, specifically regarding politically- and socioeconomically-marginalized groups. Social resources can be defined as an individual's local support network and access to and knowledge regarding government programs and procedures. Working to engage these individuals, who have fewer resources and are less likely to participate in government decisions during non-disaster times, is important to promoting successful recovery. Consideration of social equity and inequities that exist within communities is a central element of building community-level resilience. If individuals do not have the capacity to be resilient themselves, communities will not be able to successfully build resilience either.

PREVIOUS RESEARCH TELLS US

- Under-resourced communities are often exposed to greater risk of disaster events. [23]
- Socioeconomic differences may lead to different perceptions of risk and ability to recover from disasters.[24,25,26,27]
- Disaster damages frequently worsen pre-existing inequities.[28,29]
- Already disadvantaged populations may lack the social network and resources needed to respond to a disaster, which can hinder recovery efforts.[30,31]

More socio-economically homogenous communities in this study saw more coalitions form during the recovery process, indicating that in more diverse communities, some groups may be underrepresented or not represented at all in the recovery process. Census data is used to describe communities, including race, education, and socio-economics. Economic homogeneity is measured with the Gini Index, which measures income inequality among community members. Damages incurred during the flood to a community member's neighborhood, as well as personal attributes such as gender, education level, and economic status appear to also influence how an individual perceives future risk.

FINDING

Community socio-economic diversity ↑ = ↓ Number of recovery-focused coalitions

CONCERN

With less representation through coalitions, some groups may be underrepresented or not represented at all in the recovery process.

DEMOGRAPHICS AND LOWER-RESOURCED COMMUNITIES

While racial diversity across survey respondents was too low to make statements about differences in individual risk perception and resource levels, interviews show that local governments were acutely aware of the need to pay attention to residents who may not have economic stability, language skills, networks, or other resources needed to recover. Trust building is essential with many of these individuals who may not encounter government personnel often or in positive situations.

Credit: Staff Sgt. Dixie Manzanares

Our findings underscore the need for shorter- and medium-term goals focused on developing community capacity for disaster recovery and resilience. These goals are a) important for building resilience within communities towards environmental, economic, and hazards-related risks, and b) may be mechanisms through which non-profit and aid organizations can help communities in the short-term while local governments plan for and work towards longer-term community resilience goals.

Governments in some communities demonstrated a focus on community resilience and capacity-building by working with disadvantaged groups explicitly and over many months to assess needs and build trust.

> **One of the issues we found is, being a resort community with a lot of hospitality, is these are a lot of folks that are undocumented. And they have a hard time getting help because they're not eligible for it and they're afraid to come to the officials because they're afraid of being reported and getting deported, losing their family or their jobs.**
>
> *Local Official*

BARRIERS TO RESPONDING TO THE NEEDS OF DIVERSE COMMUNITIES

- The distribution of resources, political authority, and social resources may limit a community's ability to learn from a disaster and adapt to hazards.
- Disaster damages may worsen pre-existing inequities such as access to information, economic resources, and access to decision makers.
- Socioeconomic factors may also influence how individuals perceive the risks of and their ability to recover from disasters.
- Immigrants – both documented and undocumented – may be faced with increased risk after a disaster and may not attempt to, or know how to, access government resources, based on prior experiences or lack of trust in government.
- Governments that are not representative of their populations may struggle with building trust or engaging diverse segments of their communities in disaster recovery.

RECOMMENDATIONS FOR ACTION

In order to overcome the barriers described above regarding responding to the needs of diverse communities, we recommend that local governments take the following actions:

1. Work to develop a strategic and specific plan to identify and work with diverse segments of the community during disaster planning and recovery.
2. Seek assistance from faith-based organizations and community non-profits that are already working with residents who face severe barriers to accessing government aid programs and decision-making processes.
3. Where appropriate, work across governmental departments, such as human services, health, animal control, and code enforcement, to find points of positive engagement with residents regarding risk and resilience.
4. Government departments should have both an emergency plan and a recovery plan in place prior to a disaster to work with their constituents and identify segments that may be most affected by a disaster.
5. Identify existing relationships in the community – both organizations and individuals – who will be important points-of-contact after a disaster to access and communicate with various segments of the population.
6. Work with trusted leaders within neighborhoods and segments of the community rather than relying only on government-run or established leadership.

WHAT WE LEARNED

FINANCE AND BUDGET: Financial Planning for Disaster Recovery

There are many types of lessons and degrees of learning that can be observed during disaster recovery, from small-scale incremental learning to broader types of learning that may lead to resilience. Across the study communities, researchers heard that disaster recovery finance lessons were among the most important.

As local governments face numerous policy decisions related to disaster recovery, their actions may be constrained by federal and state policies, particularly those related to disaster recovery finance. These constraints may also influence a community's future fiscal planning decisions, such as their target level of budget reserves, borrowing, categories of spending, and mechanisms to generate revenue. Budget reserves and cash flow may be particularly crucial during disaster response and recovery as communities navigate reimbursement-based state and federal aid programs.

PREVIOUS RESEARCH TELLS US

- FEMA knows that finances are important and included finance personnel in the Incident Command System structure.[32,33]
- Training on procurement and processes may come very late after a disaster.[34]
- TABOR and government professional organizations suggest having a budget reserve policy that is robust enough to cope with a disaster event.[35]
- There is very little research on the financial policy lessons that communities learn after a disaster.[36,37]

LARIMER COUNTY

	Damage	Fiscal Capacity
Estes Park	Significant	Within town capacity after FEMA, insurance and state cost-sharing
Loveland	Moderate	Within town capacity after FEMA, insurance and state cost-sharing

WELD COUNTY

	Damage	Fiscal Capacity
Evans	Significant	Beyond town capacity
Greeley	No lasting damage	Within town capacity

BOULDER COUNTY

	Damage	Fiscal Capacity
Boulder	Moderate	Within town capacity after FEMA, insurance and state cost-sharing
Longmont	Significant	Within town capacity after FEMA, insurance and state cost-sharing
Lyons	Catastrophic	Beyond town capacity

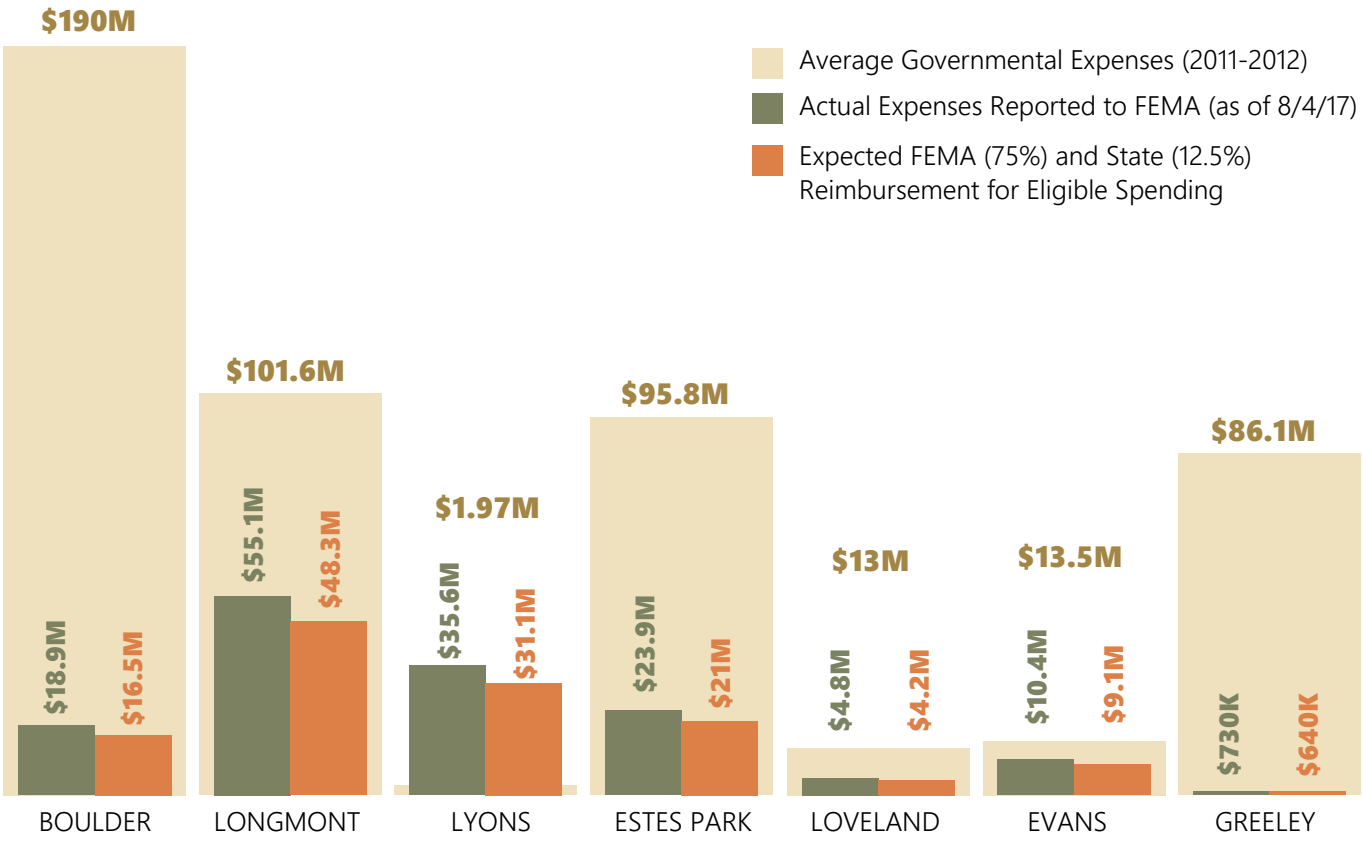
Damage and Capacity: Descriptions and capacity to respond compiled from interview data and local government documents.

FINANCE AND BUDGET

Our findings across flood-affected communities in Colorado suggest that financial considerations are critical during disaster recovery. When local governments have the capacity – due largely to financial health and staff expertise – to respond quickly, understand proper procedures, and make recovery decisions divorced from financial limits faced by communities with less healthy budgets, they have a greater degree of local control over their recovery process and may be able to take actions that focus on longer-term resiliency. When absent, these factors may create meaningful barriers to disaster recovery for local governments.

Despite consistent findings regarding frustrations experienced by local governments in disaster recovery finance and procurement, few governments made significant changes that will aid in future disasters. Most local governments added personnel to work on disaster recovery finance and procurement, but these positions were generally temporary. Some local governments made policy changes to increase the requirement for budget reserves. However, budget data suggest that these budget reserves were not significant for recovery from the 2013 floods either because expenses so far exceeded reserves that they were relatively unimportant, or because intergovernmental sources of funding and borrowing were the primary ways that local governments paid for recovery with outside funding. Internally, the most common approach to financing disaster recovery was through increasing fees for water, wastewater, and park services. **There was very little evidence of long-term organizational changes or lessons learned related to disaster recovery finance and procurement.**

Overall Fiscal Flood Impact: Flood Related Costs and Reimbursements



Note: Not all response and recovery expenses are eligible for state and FEMA reimbursement. In some cases, reimbursement rates were 100% when federal grant funds from the Department of Housing and Urban Development were used as the local match of 12.5%. Expected FEMA and state reimbursement rate is a current estimate. Final rates will not be known for several years as recovery projects are completed. Various other issues can affect reimbursement rate including requests for a higher rate.

FINANCE AND BUDGET

BARRIERS TO FINANCIAL AND BUDGETARY PLANNING

- The fiscal capacity that the local government has (or gains from external sources) and the slow pace of the reimbursement-based system may force smaller communities to complete projects one-by-one while larger communities with more resources can fund simultaneous recovery projects.
- The disaster reimbursement process through the Federal Emergency Management Agency (FEMA) and the many other federal agencies involved in disaster relief and recovery such as Housing and Urban Development (HUD) require strict documentation and technical skills, as does state financial compliance.
- The complexity of financial issues associated with recovery and resilience planning mean that the level of professionalization and capacity of local staff may be a barrier, reinforcing the need for internal local government expertise and resources.
- There is need for many communities to go beyond Federal government grants and relief funds, including budget reserves and external grants in order to complete their recovery.

Despite these challenges, it is important to emphasize that the barriers encountered and the experiences of the local government during a disaster may provide an opportunity for decision makers to change policy.

RECOMMENDATIONS FOR ACTION

In order to overcome the barriers described above regarding financial and budgetary planning, we recommend that local governments take the following actions:

1. Incorporate disaster finance planning in all government departments rather than sequestering the skills only within a single department. Consider requiring an existing training module (or developing a more robust module for communities within a single state) for emergency managers and financial and procurement staff, to train them in the requirements for response and recovery documentation.
2. Determine an appropriate level of budget reserves and clearly document the justification for this level so future government staff and elected officials have insight into past budgetary decisions.
3. Connect with non-profits or other non-governmental groups (such as watershed coalitions) with access to funding beyond that which is available to local governments to investigate opportunities for collaboration on recovery projects, especially those that span jurisdictions or fall outside local government priority areas.
4. Invest in modern software that syncs with federal procurement processes to save time and resources during disaster response and recovery.
5. In non-disaster hiring considerations, include disaster-related skills in personnel decisions such as experience with CDBG applications and management, project management skills, etc.
6. Develop pre-disaster relationships and formal partnerships (e.g., MOUs) between larger and smaller capacity governments to aid smaller communities, including with fiscal management, during disasters.

The findings summarized here focus on several major areas of lessons learned by researchers and communities faced with disaster recovery in the aftermath of Colorado's floods of 2013. First, risk perceptions among community members and professionals vary. Second, past experience has a significant impact on disaster recovery. Communities that have a tradition of participatory approaches are more likely to create participatory approaches to disaster recovery as well. In addition, bureaucratic procedures can be a sizeable barrier for residents and local government personnel in achieving a successful recovery. Third, lower-resourced populations tend to experience a disproportionate amount of harm in natural disasters and are less likely to be included in recovery planning. Finally, financial resources are paramount in disaster recovery and community resilience planning, but acquiring and managing these resources require high levels of expertise and government capacity. The findings from this project indicate that developing recovery planning prior to a disaster is essential to building towards successful recovery after a disaster. This planning should include education and communication about risks, as well as engagement processes that reach many segments of the community and help increase capacity among the community and individuals.

FUTURE DIRECTIONS

In the coming years, we will also be analyzing data from newspapers and social media, interviews with state agency personnel, and interviews with watershed coalition personnel, as well as conducting further analysis of the data sources discussed above. From these various data sources, we hope to answer questions such as:

1. Are traditional and social media equally discussing disasters and disaster recovery? What content is present in each source? Are media sources adding to the policy discussion within communities?
2. Do residents in Colorado communities trust the information their local and state government agencies are providing? How can various communication modes be better used to inform and engage residents about disasters in their communities?
3. What lessons were learned by state and local government actors regarding intergovernmental relations and processes that can be applied to improving post-disaster recovery in Colorado in future disasters?
4. Are watershed coalitions achieving their goals, and does state intervention that helps to organize and fund such organizations lead to longer-term success?
5. Are communities moving towards community resilience in the aftermath of the floods?

SUMMARY OF RECOMMENDATIONS

Through research during the initial recovery phases of the September 2013 flooding in Colorado, between 2013-2017, we have discovered lessons learned that allow us to make the following recommendations to local governments working on disaster recovery planning.

UNDERSTANDING RISK PERCEPTION

1. Maintain an on-going dialogue between local officials and community members to facilitate an in-depth understanding of local hazard risks and risk reduction strategies.
2. Capitalize on residents' direct experiences with hazards to learn more about potential high-risk areas; incorporate these residents into the process of developing risk reduction tools such as hazard maps.
3. Create a dialogue using multiple methods of communication and education, including methods targeted at specific segments of the community (e.g., children, older adults, immigrants) as well as coordinated efforts throughout the year and during seasonal times when risk increases.
4. Make risk maps available to the public, using simple color-coding or other systems, so that individuals can clearly see their own risk as well as their neighborhood and community risks.

PUBLIC PARTICIPATION

1. Conduct a disaster *recovery* planning process similar to existing disaster preparedness processes including the processes and personnel that will guide recovery.
2. Develop a forum to bring together leaders of existing neighborhood and community groups to facilitate conversations about including a diversity of residents in planning and advocacy, identifying important mitigation/recovery resources, and partnering with the local government and other organizations on recovery goals.
3. Coordinate with groups of diverse stakeholders, such as watershed coalitions, to identify and engage additional community members from flood-affected areas that may be interested in participating in broader planning processes.
4. Develop an outreach plan that uses multiple forms of communication (digital, traditional, face-to-face, etc.) to create government-to-citizen and citizen-to-citizen networks so that even the most isolated individuals can be reached during disasters.

SUMMARY OF RECOMMENDATIONS

NEEDS OF DIVERSE COMMUNITIES

1. Work to develop a strategic and specific plan to identify and work with diverse segments of the community during disaster planning and recovery.
2. Seek assistance from faith-based organizations and community non-profits that are already working with residents who face severe barriers to accessing government aid programs and decision-making processes.
3. Where appropriate, work across governmental departments, such as human services, health, animal control, and code enforcement, to find points of positive engagement with residents regarding risk and resilience.
4. Government departments should have both an emergency plan and a recovery plan in place prior to a disaster to work with their constituents and identify segments that may be most affected by a disaster.
5. Identify existing relationships in the community – both organizations and individuals – who will be important points-of-contact after a disaster to access and communicate with various segments of the population.
6. Work with trusted leaders within neighborhoods and segments of the community rather than relying only on government-run or established leadership.

FINANCIAL AND BUDGETARY PLANNING

1. Incorporate disaster finance planning in all government departments rather than sequestering the skills only within a single department. Consider requiring an existing training module (or developing a more robust module for communities within a single state) for emergency managers and financial and procurement staff, to train them in the requirements for response and recovery documentation.
2. Determine an appropriate level of budget reserves and clearly document the justification for this level so future government staff and elected officials have insight into past budgetary decisions.
3. Connect with non-profits or other non-governmental groups (such as watershed coalitions) with access to funding beyond that which is available to local governments to investigate opportunities for collaboration on recovery projects, especially those that span jurisdictions or fall outside local government priority areas.
4. Invest in modern software that syncs with federal procurement processes to save time and resources during disaster response and recovery.
5. In non-disaster hiring considerations, include disaster-related skills in personnel decisions such as experience with CDBG applications and management, project management skills, etc.
6. Develop pre-disaster relationships and formal partnerships (e.g., MOUs) between larger and smaller capacity governments to aid smaller communities, including with fiscal management, during disasters.

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APPENDIX A - Public and Local Official Survey Responses

All data are from the public survey unless otherwise noted.

Table 1. Civic engagement: Measures of transparency, openness, fairness and community participation in flood recovery process. Measured on a five-point scale from Strongly disagree (1) to Strongly agree (5).

	N	(a) Transparent	(b) Open	(c) Fair	(d) High-level of Participation
Boulder	171	3.3	3.5	3.3	3.4
Longmont	113	3.6	3.6	3.5	3.5
Lyons	184	3.3	3.7	3.1	4.0
Estes Park	134	3.7	3.8	3.6	3.9
Loveland	106	3.5	3.7	3.4	3.6
Evans	89	3.3	3.3	3.1	3.2
Overall	**802**	**3.4**	**3.6**	**3.3**	**3.7**

a. Our community's flood recovery process has been transparent, in that anyone can know what happens during the process.
b. Our community's flood recovery process has been open, in that anyone is welcome to participate
c. Our community's flood recovery process has been fair
d. We have had a high-level of community participation in the flood recovery process.

Table 2. Risk perceptions: Average of responses of public and stakeholders across seven communities about the chances of extreme flooding, future flood risk, and severity of the problem. Measured on a five-point scale from Strongly disagree (1) to Strongly agree (5).

		(a) Percent Chance Extreme Flood in Community (%)	(b) Percent Chance Extreme Flood in Colorado (%)	(c) Risk of Flooding in Community Increased over Past 20 years (Scale: 1-5)	(d) Risk of Flooding in Colorado Increased Past 20 years (Scale: 1-5)	(e) Flooding in Community is a Severe Problem (Scale: 1-5)
Boulder	Public (n=172)	33.1	53.0	3.5	3.5	2.8
	Local officials (n=28)	36.3	61.8	3.7	3.7	3.9
Longmont	Public (n=107)	24.8	42.3	3.1	3.2	2.4
	Local officials n=15)	37.7	65.8	3.8	3.8	3.4
Lyons	Public (n=176)	32.9	55.6	3.5	3.6	3.3
	Local officials n=28)	32.7	53.8	3.8	3.9	3.9
Estes Park	Public (n=134)	42.0	57.1	3.5	3.5	3.0
	Local officials (n=12)	36.6	68.2	3.6	3.8	3.8
Loveland	Public (n=106)	38.5	57.6	4.3	3.4	2.6
	Local officials (n=7)	51.4	77.6	3.4	3.4	3.0
Evans	Public (n=85)	47.4	67.1	3.6	3.6	3.0
	Local officials (n=8)	50.1	70.4	4.0	4.1	3.4
Greeley	Local officials (n=9)	25.4	40.8	2.6	2.6	1.9
Overall	**Public (n=787)**	**35.9**	**55.1**	**3.4**	**3.5**	**2.9**
	Stakeholders (n=111)	**36.9**	**61.2**	**3.6**	**3.7**	**3.6**

APPENDIX A - Public and Local Official Survey Results - continued

Table 3a. Demographics: Percent of respondents that reported at least some flood damage to their personal property across home value ranges.

	N	Overall	Home value <$100,000	Home value between $100,000 and $249,999	Home value between $250,000 and $499,999	Home value greater than $500,000
Boulder	165	54.5%	50.0%	20.0%	55.4%	60.5%
Longmont	111	27.0%	-	20.9%	33.3%	12.5%
Lyons	181	42.3%	-	72.2%	44.3%	26.5%
Estes Park	138	42.5%	-	35.1%	52.7%	35.7%
Loveland	110	8.6%	-	6.8%	13.0%	0%
Evans	91	13.3%	25.0%	10.4%	-	-
Overall	**783**	**35.0%**	**38.1%**	**21.2%**	**40.8%**	**40.5%**

Table 3b. Demographics: Percent of respondents that reported at least some flood damage to their neighborhood across ranges of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and $249,999	Home value between $250,000 and $499,999	Home value greater than $500,000
Boulder	165	94.5%	75.0%	93.3%	94.5%	96.5%
Longmont	111	48.6%	-	44.2%	48.3%	75.0%
Lyons	181	76.2%	-	88.3%	82.5%	58.3%
Estes Park	138	73.3%	-	72.7%	73.4%	73.8%
Loveland	110	45.7%	-	38.6%	41.3%	85.7%
Evans	91	44.3%	72.7%	40.6%	-	-
Overall	**774**	**68.0%**	**73.7%**	**52.7%**	**70.5%**	**80.4%**

Table 3c. Demographics: Measure of agreement with the statement that flooding in the respondent's community is a severe problem. Five point scale from Strongly disagree (1) to Strongly agree (5). Average rating reported for each range of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and $249,999	Home value between $250,000 and $499,999	Home value greater than $500,000
Boulder	175	2.8	3.9	2.7	2.7	2.8
Longmont	111	2.4	-	2.5	2.4	2.5
Lyons	181	3.3	-	3.0	3.2	3.4
Estes Park	137	3.0	-	3.3	2.9	2.8
Loveland	110	2.6	-	2.7	2.5	2.5
Evans	87	3.0	3.8	2.8	-	-
Overall	**803**	**2.9**	**3.8**	**2.8**	**2.9**	**2.9**

APPENDIX A - Public and Local Official Survey Results - continued

Table 3d. Demographics: Measure of respondents' perceived levels of flood preparedness. Five point scale from Not at all prepared (1) to Very prepared (5). Average rating reported for each range of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and $249,999	Home value between $250,000 and $499,999	Home value greater than $500,000
Boulder	178	3.2	3.3	3.3	3.1	3.3
Longmont	117	3.2	-	3.2	3.2	3.1
Lyons	187	3.7	-	3.8	3.7	3.9
Estes Park	138	3.6	-	3.5	3.6	3.6
Loveland	110	3.1	-	3.1	3.2	3.2
Evans	91	2.9	2.7	2.9	-	-
Overall	**824**	**3.3**	**3.0**	**3.2**	**3.4**	**3.5**

Table 3e. Demographics: Perceived levels of how informed respondents believe they are about flood risks. Five point scale from Not at all informed (1) to Very informed (5). Average rating reported for each range of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and	Home value between $250,000 and	Home value greater than $500,000
Boulder	178	3.6	2.9	3.6	3.6	3.7
Longmont	117	3.5	-	3.5	3.5	3.9
Lyons	185	4.0	-	4.0	4.0	4.1
Estes Park	139	3.8	-	3.6	3.8	3.8
Loveland	110	3.5	-	3.5	3.4	3.6
Evans	91	3.1	3.0	3.2	-	-
Overall	**825**	**3.6**	**3.1**	**3.5**	**3.8**	**3.8**

Table 3f. Demographics: Measure of respondent's confidence that they personally will recover from the flood. Five-point scale (1-5) with five representing the highest level of confidence that respondent will recover. Average rating reported for each range of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and	Home value between $250,000 and	Home value greater than $500,000
Boulder	176	4.2	3.6	4.3	4.2	4.3
Longmont	114	4.1	-	4.1	4.1	4.3
Lyons	186	4.4	-	4.3	4.4	4.5
Estes Park	138	4.3	-	4.1	4.4	4.5
Loveland	111	4.0	-	3.9	4.0	4.6
Evans	91	4.1	4.0	4.2	-	-
Overall	**815**	**4.2**	**3.9**	**4.1**	**4.2**	**4.4**

APPENDIX A - Public and Local Official Survey Results - continued

Table 3g. Demographics: Measure of respondent's confidence that their community will recover from the flood. Five-point scale (1-5) with five representing the highest level of confidence that respondent's community will recover. Average rating reported for each range of home values.

	N	Overall	Home value <$100,000	Home value between $100,000 and	Home value between $250,000 and	Home value greater than $500,000
Boulder	178	4.1	3.7	4.3	4.3	4.1
Longmont	116	4.0	-	4.0	4.0	4.1
Lyons	185	3.5	-	3.7	3.5	3.4
Estes Park	137	4.1	-	4.1	4.2	4.1
Loveland	110	4.1	-	4.1	4.1	4.4
Evans	91	3.6	3.8	3.6	-	-
Overall	**818**	**3.9**	**3.8**	**3.9**	**3.9**	**3.9**

Table 4. Adequacy of resources from local official survey. Measures of adequacy of resources based on a five-point scale of strongly disagree (1) to Strongly agree (5) to statements listed below. Average of responses reported across communities.

	N	(a) Adequate community financial resources	(b) Adequate community technical resources	(c) Adequate community human resources	(d) FEMA financial resources adequate	(e) State of CO financial resources adequate
Boulder	28	3.6	4.0	3.9	2.8	3.0
Longmont	19	1.7	3.0	2.6	3.1	3.1
Lyons	41	1.2	1.9	1.8	3.2	3.2
Estes Park	16	1.9	2.3	2.1	3.2	3.8
Loveland	16	2.7	4.1	3.6	2.9	2.9
Evans	14	2.0	2.4	2.9	2.5	3.2
Greeley	8	3.5	4.0	3.6	3.0	3.0
Overall	**142**	**2.2**	**2.9**	**2.8**	**3.0**	**3.2**

a. Our community had adequate pre-existing financial resources to recover from the flood
b. Our community had adequate pre-existing technical resources to recover from the flood
c. Our community had adequate pre-existing human resources to recover from the flood
d. FEMA has provided adequate financial resources to our community for recovery
e. The State of Colorado has provided adequate financial resources to our community for recovery

APPENDIX A - Public and Local Official Survey Results - continued

Table 5. Recovery process: The public's satisfaction in post-flood recovery across a number of sectors. Responses were measured on a five-point scale, from Very dissatisfied (1) to Very satisfied (5).

	N	Road infrastructure	Drinking water	Wastewater	Electricity	Parks and open space	Floodplain management/ regulation
Boulder	150	3.2	3.5	3.3	2.5	3.8	3.2
Longmont	106	3.4	3.4	3.4	2.6	3.7	3.4
Lyons	175	2.9	3.7	3.7	2.6	3.2	3.1
Estes Park	129	3.0	4.0	3.7	3.4	3.5	3.0
Loveland	103	3.6	3.6	3.6	3.1	3.9	3.3
Evans	83	3.0	3.3	3.0	2.8	2.8	2.8
Overall	**746**	**3.2**	**3.6**	**3.5**	**3.0**	**3.5**	**3.1**

Table 6. Policy preferences of the public: Measures capture agreement with the five statements below, on a scale of Strongly disagree (1) to Strongly agree (5).

	N	(a) Damaged homes should be removed from the 100-year floodplain.	(b) No new development on 100-year floodplain	(c) Our community should place ore parks and trails in floodplain	(d) New building codes should be established for buildings in floodplain	(e) Regulations to decrease amount of impervious surface (paved areas) should be adopted
Boulder	95	2.9	3.5	4.1	4.1	3.4
Longmont	50	3.4	3.5	3.8	3.8	3.2
Lyons	106	3.1	3.6	3.8	4.1	2.9
Estes Park	93	3.5	3.4	3.7	3.9	3.0
Loveland	63	3.4	3.7	3.3	4.0	2.6
Evans	65	3.6	3.6	3.5	4.1	3.0
Overall	**466**	**3.3**	**3.6**	**3.7**	**4.0**	**3.0**

Table 7: Overall Fiscal Flood Impact: Flood-Related Costs and Reimbursements

	Actual Reported Expenses to FEMA (as of 8/4/2017) [A]	Average Governmental Expenditures (2011-2012) [B]	Financial Flood Impact Ratio [A/B]	Expected FEMA (75%) and State (12.5%) Reimbursement Rate for Eligible Spending [C]	Estimated After-Reimbursement Financial Flood Impact Ratio [(A-(A*C)/B]
Boulder	$18,893,203	$190,530,000	9.9%	87.5%	1.2%
Longmont	$55,148,929	$101,593,561	54.3%	87.5%	6.8%
Lyons	$35,593,324	$1,974,433	1802.7%	87.5%	225.3%
Loveland	$23,946,596	$95,833,592	25.0%	87.5%	3.1%
Estes Park	$4,770,798	$13,024,982	36.6%	87.5%	4.6%
Evans	$10,456,691	$13,547,280	77.2%	87.5%	9.7%
Greeley	$731,574	$86,097,858	0.9%	87.5%	0.1%
Average:			**286.7%**		**35.8%**
Average without Lyons			**34.0%**		**4.3%**

Note: Not all response and recovery expenses are eligible for state and FEMA reimbursement. In some cases, reimbursement rates were 100% when federal grant funds from the Department of Housing and Urban Development were used as the local match of 12.5%. Expected FEMA and state reimbursement rate is a current estimate. Final rates will not be known for several years as recovery projects are completed. Various other issues can affect reimbursement rate including requests for a higher rate.

APPENDIX B - Public Survey Questions

Statements in bold are currently summarized in the Appendix A

A. Flood Experiences

- Have you moved to a different community since the floods of September 2013?
- Have you moved homes within the same community since the floods of September 2013?
- Please select the community where you lived during the floods of September 2013
- At the time of the September 2013 floods, in what type of home did you live?
- At the time of the September 2013 floods, did you own or rent your home?
- What was the approximate market value of your home before the September 2013 floods?
- About how much damage to your personal property did you experience in the 2013 flood (including home, car, personal belongings)? Please provide total costs, including amount you paid directly, as well as costs covered by insurance or other sources, such as FEMA.
- If your home was damaged, about what percentage of the damage costs did you have to cover yourself (beyond what FEMA, insurance and other sources paid)?
- Did you have flood insurance for your home at the time of the September 2013 floods?
- If you did have flood insurance for your home, were you required to have flood insurance (check all that apply)?
- While you were living in your home BEFORE September 2013 had you experienced any flood damage…
- How bad was the damage from the September 2013 floods…

B. Views on Flooding

Please indicate your level of agreement with each of the following statements.

- Extreme rainfall contributed to the 2013 flood in my community.
- Inadequate water infrastructure (e.g., dams, levees) contributed to the 2013 flood in my community.
- Poor maintenance of water infrastructure contributed to the 2013 flood in my community.
- Inadequate floodplain regulations contributed to the 2013 flood in my community.
- Development in the floodplain contributed to the 2013 flood in my community.
- Upstream deforestation contributed to the 2013 flood in my community.
- Land use changes contributed to the 2013 flood in my community.
- Global climate change contributed to the 2013 flood in my community.

Place an X on the line for each location to represent the percent chance that an extreme flood event (greater than a 100-year flood) will occur in the next TEN years. A 0 means there is NO chance that an extreme flood event will occur. A 100 means that an extreme flood event will definitely occur.

In my community 0 ---------- 100
In Colorado 0 ---------- 100

Place an X on the line for each location to represent the percent chance that an extreme flood event (greater than a 100-year flood) will occur in the next FIFTY years. A 0 means there is NO chance that an extreme flood event will occur. A 100 means that an extreme flood event will definitely occur.

In my community 0 ---------- 100
In Colorado 0 ---------- 100

Please indicate your level of agreement with each of the following statements.

- The risk of flooding in Colorado has increased over the past 20 years.
- The risk of flooding in my community has increased over the past 20 years.
- Flooding in my community is a severe problem.
- The risk of drought in Colorado has increased over the past 20 years.
- The risk of drought in my community has increased over the past 20 years.
- Drought in my community is a severe problem.

Please check all that apply since the September 2013 flood.

- I have read flood-related material on my community's website.
- I have read flood-related material on the State of Colorado's website.
- I have read flood-related material on the FEMA website.
- I have read flood-related material that my community posted to Facebook.
- I have followed flood-related tweets on Twitter.
- I have tweeted about flood recovery.

APPENDIX B - Public Survey Questions - continued

C. Flood Preparation and Recovery

Please indicate your level of agreement with each of the following statements.
BEFORE/CURRENTLY the September 2013 flood….

- I was well-informed about flood risks in my community.
- I was well-prepared for flooding.
- I was worried about flooding in my community.

Please indicate your level of agreement with the following statements regarding the September 2013 flood.

- I am confident that I can personally recover from this flood.
- I am confident that my neighborhood can recover from this flood.
- I am confident that my community can recover from this flood.

What kinds of changes have you personally made in response to the September 2013 floods? Check all that apply.

- Put together an emergency kit for the home (e.g., food, water, flashlight, etc.)
- Elevated my house
- Waterproofed my basement
- Replaced gutters
- Repaired roof of home
- Repaired foundation of home
- Moved footprint of the house while staying on the same property
- Listed home for sale
- Sold home
- Purchased flood insurance
- Increased flood insurance coverage

If you haven't yet purchased or increased flood insurance for the property on which you lived in September 2013, please indicate why.

D. Community Flood Recovery

Please check the appropriate answer for events BEFORE/AFTER the September 2013 flood. A flood-related public meeting as a meeting in which information is collected from or disseminated to the public about a flood-related issue.

- I attended a flood-related public meeting.
- I organized a flood-related public meeting.
- My community organized a flood-related public meeting.

For each of the following statements regarding recovery, please check your level of agreement.

- Damaged homes should be removed from the 100-year floodplain.
- Damaged commercial buildings should be removed from the 100-year floodplain.
- New building codes should be established for buildings in the floodplain.
- No new developments should occur in the 100-year floodplain.
- New emergency rescue procedures should be developed.
- Regulations to decrease paved areas in our communities should be adopted.
- Our community should place more parks and trails in the floodplain.

On a scale of no trust to trust, how strongly do you trust the following when dealing with flood issues? (staff, mayor, county staff, federal staff, academics, community members, etc.)

Please indicate how strongly you agree or disagree with the following statements regarding the community's flood recovery process (transparency, openness, fairness).

Please indicate how strongly you agree or disagree with the following statements regarding access to resources for the flood recovery process.

- My community had adequate resources to recover from the flood (not including resources from outside my community).
- FEMA provided adequate resources to our community for recovery.
- The State of Colorado provided adequate resources to our community for recovery.

APPENDIX B - Public Survey Questions - continued

Please indicate how strongly you agree or disagree with the following statements regarding leadership in the flood recovery process.

- Leaders in my community (e.g., city council, boards & commissions) have sought the opinion of the public in flood recovery processes.
- Leaders in my community (e.g., city council, boards & commissions) have sought the opinion of the business community in flood recovery processes.
- Leaders in my community (e.g., city council, boards & commissions) have had frequent communication with the public on flood recovery issues.

Please indicate how satisfied you are with post-flood recovery in the following areas:

- Our water infrastructure (e.g., dams, levees, ditches)
- Our road infrastructure
- Our drinking water infrastructure
- Our wastewater infrastructure
- Our parks and open space
- Floodplain regulations/management

E. Perceptions of the Environment

For each of the following statements, please check your level of agreement.

- Humans have the right to modify the natural environment to suit their needs.
- When humans interfere with nature it often produces disastrous consequences.
- Humans will eventually learn enough about how nature works to be able to control it.
- Plants and animals have as much right as humans to exist.
- Global climate change does not exist.
- Global climate change is a very serious problem.
- Global climate change is harming people around the world right now.
- Global climate change will harm people around the world in the future.
- Global climate change will harm me personally at some point in my lifetime.

F. Demographics

- Education
- Gender
- Income
- Race/Ethnicity
- Age
- Political affiliation