



CITY OF BOULDER

COMPREHENSIVE FLOOD AND STORMWATER MASTER PLAN

DRAFT

TECHNICAL MEMORANDUM #9

Flood Preparedness, Warning, Response and Recovery

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1 Introduction

The City of Boulder is one of the highest flash flood risk communities in Colorado. Floods can happen at any time with little or no warning. City floodplains and stormwater infrastructure can safely convey water during storm events in a way that reduces flood risk to the community. Infrastructure cannot eliminate all dangerous flooding conditions, however, and it is important for the city and community members alike to prepare in advance and be able to respond when conditions warrant. This memo summarizes roles, responsibilities, and community resources available for the various phases of a flood, including:

- The city's flood education and outreach efforts
- Flood insurance
- Emergency warning and alert resources
- Emergency operations and associated organizational structure
- Recommendations



2 Roles, Responsibilities and Resources

Most structures within the City of Boulder were constructed prior to the mapping of Boulder's floodplains, the enactment of floodplain regulations and the development of a Flood and Stormwater Utility. Because the city is prone to flash flooding along with various other hazards, flood preparedness, flood warning, and emergency response are all critical for life safety and property protection. National and regional agencies generally identify four levels of flooding as defined below, and the city and community members both have a role to play in each phase.

1. **Normal operations** | *Be aware and prepare*
2. **Heightened readiness or Low Impact Flooding** | *Be aware and prepare – flooding is possible and/or low impact flooding is imminent or occurring.*
3. **Flash Flood Watch** | *life-threatening flash flood may occur later in the day*
4. **Flash Flood Warning** | *life-threatening flash flood is imminent or occurring*

Under **Normal Operating conditions**, city staff review emergency response plans and functions, and participate in emergency preparedness exercises. [Community members should consider buying flood insurance, develop and discuss personal emergency response plans and evacuation routes, sign up for emergency alerts and ensure contact information is up to date, and take floodproofing precautions such as those described by the National Weather Service \(NWS\) in this resource.](#)

When a potential flood scenario is developing, the Boulder City and County Office of Disaster Management (ODM) coordinates with Mile High Flood District (MHFD), Skyview Weather, the NWS and others on weather forecasting, patterns, predictions and probability of impact information. Primary data sources used by these agencies include radar, lightning detection software, rain gauges, streamflow gauges, and topography including drainage boundaries. Key severe storm characteristics of concern include slow moving storms, the presence of lightning indicating convection-based thunderstorms, rain intensity of 2 inches or more per hour, and storm events that cause ground saturation. Additionally, MHFD has developed a [Flash Flood Prediction Program \(F2P2\)](#) which runs April through September in the Denver/Boulder metropolitan area. This program uses information from MHFD's partnership with NOAA National Weather Service and local governments to provide notifications of heavy rain and flood threats.

These agencies may issue a Flood Advisory indicating a **Heightened Readiness** stage, which typically indicates nuisance flooding conditions. Both Boulder and ODM staff monitor conditions and NWS and MHFD activity under these conditions. Additionally, city staff respond to nuisance flooding and issues as they arise and begin flood response preparations, such as referring to flood action plans, ensuring resources and materials are readily available, and identifying critical system components that may be impacted and/or may need to be operated. [Community members should likewise stay aware, review preparedness plans and sign up for notifications.](#)

In a **Flood Watch**, where weather conditions are favorable for flooding and life-threatening flash flooding may occur later in the day, city preparation activities increase. City staff continue to respond to nuisance flooding and additionally prepare to shut valves and headgates, set up barricades, and identify critical system components that may be impacted and/or may need to operate. These activities are largely performed by Utilities Maintenance staff, with support from technical experts as needed. [Community Members should continue to monitor weather, prepare household members including pets for possible](#)



evacuation, and charge electronic devices to stay connected to alerts and other notifications. Community members should also identify potential evacuation routes and be prepared to re-route if flood waters are encountered.

Under a **Flood Warning** where life-threatening flash flood is imminent or occurring, a more comprehensive response and event management structure is needed. In this situation, Boulder ODM activates the Emergency Operations Center (EOC) to coordinate flood response efforts with the support of Emergency Support Functions (ESF) described below. During such an event, city public works personnel staff the *ESF 3 – Public Works*. Utilities staff responsibilities and involvement are largely situationally dependent, as no two events are the same. As a guide, Utilities has established high-level actions and duties for various departmental workgroups including the Engineering / Flood and Stormwater team for different flood threat levels. This guide and set of actions are summarized under the All-Hazard Alert (AHA) framework as defined by the city in conjunction with Boulder ODM. Specific actions and tasks in the Flood AHA Response Guide should be annually reviewed and updated as needed to stay current and practiced.

When either **Flood Watch** or **Flood Warning** conditions are issued by the weather agencies, or demonstrated conditions warrant, Boulder ODM will send a message to the Boulder Fire Department and Boulder Police to indicate flood status. Boulder Police and Fire Communications (BPFC) issue emergency notifications to the public and activate the sirens. Depending on the scale of the flooding, alerts may be issued city-wide or to a specific area. BPFC has pre-planned polygon maps in Everbridge associated with flooding in areas. Additionally, Wireless Emergency Alerts (WEA) may also be broadcast to anyone with a cell phone within a geographic radius of a specific area. The alerting systems described in Table 1 below can be tied to polygons if alerts are issued to a particular area and not citywide.

As noted above, one important distinction once active flooding is occurring is that the response management structure varies depending on the magnitude of the storm. City staff takes the lead in small to medium-scale flood events involving low impact, localized flooding. For such events Boulder's Utilities staff response includes providing engineering expertise, construction management, technical support and maintenance services to alleviate the impacts of flooding.

Utilities also has a key supporting role in larger flood emergencies. In such events, Boulder ODM leads disaster response and recovery efforts in coordination with the State Emergency Management Agency. During a large-scale event, ODM activates the EOC with support from various ESFs. City of Boulder Utilities staff supports *Emergency Response Function 3: Public Works and Engineering Annex* during EOC activation, including providing flood modeling information upon request during an emergency as well as all the other roles described for a small to medium event. **Table 9-1** below summarizes the various roles and responsibilities described in this section.



Table 9-1 | Flood Preparation and Response Roles and Responsibilities

Flooding Phase	City Utilities Staff Responsibilities*	Community Member Responsibilities	Other Key Agency Contributions	Available Community Resources
Normal operations <i>Be aware and prepare</i>	<ol style="list-style-type: none"> 1. Update and Maintain Emergency Response Plans, including updating contact lists and confirming /clarifying roles 2. Perform Emergency Response Exercises 3. Update and Maintain public education and outreach materials 4. Maintain equipment and supplies needed for emergency response 5. Perform routine maintenance on flood and storm systems 	<ol style="list-style-type: none"> 1. <u>Prepare</u> and <u>know your risk</u> 2. <u>Obtain Flood insurance</u> 3. <u>Sign up for alerts</u> 4. Have an <u>emergency preparedness kit</u> ready to go 5. Ensure your sump pump is functioning properly 	<p>ODM supports emergency response training and planning. Monitors for developing situations.</p> <p>MHFD manages stream gages and related data, provides flood preparedness and response materials, coordinates with municipalities on flood maintenance projects</p> <p>NWS monitors weather and provides weather-related information, provides flood preparedness and response materials</p>	<ul style="list-style-type: none"> • Boulderfloodinfo.net • Community Guide to Flood Safety • Flood Awareness Flash Drive (handed out at various city events) • City of Boulder and related flood preparedness information • NWS Before a flood actions
Heightened readiness or Low Impact Flooding <i>Be aware and prepare - flooding is possible and/or low impact flooding is imminent or occurring</i>	<ol style="list-style-type: none"> 1. Respond to nuisance flooding and issues 2. Alert work groups of potential needs and EOC staffing assignments 3. Identify critical system components that may be impacted 	<ol style="list-style-type: none"> 1. Account for all members of your household (including pets) 2. Stay tuned to local weather networks 3. Be prepared to evacuate or seek higher ground 	<p>ODM, MHFD, and NWS monitor weather and provide weather-related alerts and notifications as situation warrants</p> <p>ODM staff monitor conditions and NWS and MHFD activity under these conditions.</p>	<ul style="list-style-type: none"> • Report non-emergency flooding on Inquire Boulder • NWS radio weather reports
Flash Flood Watch <i>Life-threatening flash flood may occur later in the day</i>	<p>Oversee resource acquisition for Utilities Maintenance</p> <p>Oversee damage/repairs to water distribution and wastewater collection systems.</p> <p>Assess immediate and residual field damages; assists and prioritize crews as needed.</p>	<ol style="list-style-type: none"> 1. Account for all members of your household (including pets) 2. Stay tuned to local weather networks 3. Be prepared to evacuate or seek higher ground (there may be only moments to react) 	<p>ODM coordinates with Bolder Police and Fire to indicate flood status and issue emergency notifications to the public and activate the sirens as situation warrants</p> <p>ODM activates the EOC as needed to</p>	<ul style="list-style-type: none"> • NWS radio weather reports • City communication networks, including social media accounts



Flooding Phase	City Utilities Staff Responsibilities*	Community Member Responsibilities	Other Key Agency Contributions	Available Community Resources
Flash Flood Warning <i>Life-threatening flash flood is imminent or occurring</i>	<p>Employ specific plan of action: i.e., bridges to monitor, water valves to shut down, evaluate conditions of water resources, monitor dam safety and implement dam emergency action plans as needed.</p> <p>Coordinate with Ditch Companies for head gate closures and/or emergency operations by ditch company personnel.</p> <p>Monitor water quality and quantity issues</p> <p>Staff ESF3 if EOC is activated</p>	<ol style="list-style-type: none"> 1. Stay tuned to local weather networks 2. Follow any evacuation orders 3. Seek higher ground (never walk or drive through floodwaters) 4. Practice electrical/gas safety 	<p>coordinate flood response and recovery activities, including coordination with local, State, and Federal agencies.</p> <p>MHFD and NWS continue to monitor weather and provide weather-related alerts and notifications as situation warrants</p>	<ul style="list-style-type: none"> • City communication networks, including social media accounts • Emergency services, such as ODM • NWS during a flood actions

*This table primarily focuses on City Utilities staff responsibilities. Numerous other city departments also have significant roles in natural disasters

Public Outreach and Education

In the preparedness phase of flooding, the Utility engages in extensive public outreach and education efforts to educate the community about flood risks. However, demographics change and the need is ongoing. The Be Heard Boulder survey launched at the beginning of the master plan update process identified the following concerns and perceptions about flooding:

- Who is at risk?
- How big is the risk?
- Preparation is key
- Warn the community earlier

The CFS Community Working Group echoed these same themes by noting the importance of focusing on equity and in reaching traditionally hard to reach populations. To do this, the Utility should routinely use the racial equity tool and continue to investigate effective and creative outreach strategies and develop a mechanism to understand the efficacy of outreach and education efforts currently being conducted.

The public outreach and education strategy should be updated to provide structure and process for aligning activities with the overall CFS Master Plan goals. The city's approach currently aligns with CRS Activity 330. The city should maintain this approach and continue to identify and evaluate additional applications that could result in broader public awareness and involvement.

As part of a public outreach and education strategy, the following actions should be considered for inclusion:

1. Identify goal and objective evaluation metrics, including outputs (i.e., administrative, and programmatic activities) and anticipated outcomes (i.e., changes in awareness and behavior).
2. Conduct a target audience characterization to identify subgroups of the community that have shared characteristics and communication needs/preferences/capabilities. These audiences exist within different



geographic areas of the community that require targeted messaging based on flood risk, vulnerability, and neighborhood. The use of existing or new survey tools could be used to determine awareness and communication preferences.

3. Align with city's Racial Equity Plan.
4. Identify communication channels, stakeholders, and partners that can help tailor and disseminate messaging.
5. Develop key messaging which can be tailored by theme (i.e., preparedness, response, and recovery) and by the key target and sub-target audiences. Identify messaging gaps.
6. Organize existing messaging by format and distribution channel (i.e., print, electronic, in person events, virtual events, innovative formats) by phase and also by sub-target audiences to identify messaging gaps or an oversaturation in one or more areas.

Additionally, the city should update its annual flood communications plan and schedule to include lessons learned during the COVID pandemic, including effective distribution methods, guidance and guidelines on hosting in person versus virtual events, evaluation methods and associated costs.

Flood Insurance and the Community Rating System

Another preparedness activity involves flood insurance. The City of Boulder participates in the National Flood Insurance Program (NFIP) by adopting and enforcing floodplain management ordinances and providing public education to reduce future flood damage. In exchange, the NFIP makes federal government-backed flood insurance available to homeowners, renters, and business owners regardless of whether they are in the floodplain. The NFIP also has a voluntary incentive-based program called the Community Rating System (CRS), which ranks communities on a 1-10 scale and allows communities to obtain discounts on flood insurance premiums if community floodplain management activities exceed minimum NFIP standards. Participation in the CRS Program generally involves receiving points for performing flood management activities that reduce and avoid flood damage to insurable property and that foster comprehensive floodplain management in exchange for insurance discounts. Boulder first entered the CRS Program in 1992 as a Class 9 community which provided a 5% discount on flood insurance premiums. Since then, the city has maintained an active floodplain management program, and now holds a CRS Class 5 rating, providing NFIP flood insurance policy holders with a 25% discount.

In addition to providing communities with discounts on flood insurance rates, FEMA's CRS program is nationally recognized as being a comprehensive guide for best management practices related to floodplain management, stormwater drainage, and stormwater quality. The city's commitment to implementing diverse and comprehensive programs in this arena is recognized through its current Class 5 rating under the CRS program. However, the community has expressed the desire to move to a lower class, which would increase reductions by approximately 5% to a total of 30% on NFIP flood insurance premiums for community members. A significant hurdle for communities in achieving the Class 4 rating is the prerequisite requirement for Watershed Master Planning (WMP) under CRS Activity 450, which entails completing a unified plan that addresses both storm and flood management. Approval of the CFS Master Plan update would likely meet this "CRS Activity 450 WMP" criteria, but additional prerequisites and 500 additional CRS points would be needed to achieve a Class 4 rating. Significant additional staff and financial resources would be needed to refine existing programs or implement new programs that would garner the necessary Class 4 credit points. Therefore, these improvements should be considered when implementing priority flood and storm projects and programs based on staff capacity and in comparison to community benefits associated with other work plan priorities.



Emergency Warning Dissemination

Early warning systems are a critical life-safety aspect of flood management, some of which require community member sign-up, which ideally would occur in the preparedness phase of a flood. Boulder Police and Fire use the following Emergency Warning alerts in coordination with Boulder ODM when forecasted or actual current conditions warrant.

Table 9-2 | Emergency Alert Systems

Mechanism	Audience	Benefits	Drawbacks
Everbridge (Auto)	Landline phones	The communications centers/dispatch centers receive quarterly updates on landlines from Century Link and Comcast to ensure landline numbers are current	Few residents have landlines; if solicitor-block features are present, the emergency telephone notification will not go through to warn the resident
Everbridge (Opt-In)	Residents and commuters	Notifications received by cell, home, and work phones, text messaging, and email. Can sign up for multiple locations (i.e., work and home)	Requires action from the public to sign up <u>online</u> ; those wary of providing personal information, may not be inclined to opt-in; if cell phone numbers or locations registered in the system change, then the residents may not get the notifications as expected
Integrated Public Alert Warning System (IPAWS)/Wireless Emergency Alerts (Auto)	Anyone with a cell phone	Broadcasts messages to anyone located in the city or a specified polygon with a cell phone	A cell phone tower must be within the polygon, therefore, the locations of all cell phone towers should be linked into the Everbridge system.
Sirens (Auto)	People outdoors or in cars	Notifies people recreating in or near waterways, and commuters	May not be heard indoors (particularly in apartment buildings); can be difficult to decipher audio message associated with the alert; depending on location relative to the siren, the sound may not be heard and/or the message can sound distorted
Door-to-Door Notifications (Auto)	Local residents	Experience demonstrates that during an emergency, residents may not get the warning even if all systems are used. First responders will need to deploy to the hazard area to set up roadblocks and go door to door if possible to warn and assist residents	There will be areas inaccessible to first responders and door-to-door notifications will not be made
Note: (Auto) indicates no community member action is needed to receive an alert; (Opt-In) requires <u>community member registration</u>.			

Everbridge

Currently, the city has access to and uses the Everbridge platform, which is recognized as a top platform across the country. The redundancy and speed are currently unmatched by competitors, as the total number of activations “pushed out” by phone, email, text from the community far exceeds any other platform. Additionally, when an alert message is acknowledged by the intended recipient, the system does not continue to send same message. This keeps the system from duplicating unwanted messages to an inbox, phone or text. Although this system is currently the most successful at sending targeted



alerts, the “opt-in” feature can be a challenge as it requires community member action to register. The city should keep apprised of technological improvements to all alert systems and consider upgrades as they become available.

Wireless Emergency Alerts (WEA)

In early 2022, Boulder gained new emergency alert capability that allows police and fire departments to send Integrated Public Alert Warnings (IPAWS), including Wireless Emergency Alerts (WEA), to the public. These messages activate all enabled cell phones in a specific geographic area with sounds and text, similar to Amber Alerts and National Weather Service emergency notices, without requiring users to opt-in or subscribe to the service in advance. When possible, these alerts include direction from emergency responders on what steps to take. While the city still strongly encourages individuals to [register through Everbridge](#) opt-in notifications for the most targeted emergency messaging, the use of WEA will allow officials to reach out-of-town visitors, unhoused individuals, and people outside of their opt-in addresses during a life-threatening emergency. ODM holds the administrative responsibility for the WEA service, which can be activated by individual jurisdictions that are part of sender groups. In Boulder, the sender group is led by the 911 Communications manager with input from Public Safety PIOs and other communications staff.

Outdoor Warning Sirens

The ODM coordinates with BPFC for activating the outdoor warning sirens in the event of an outdoor emergency. These sirens are owned and maintained by the City of Boulder. Boulder’s current sirens are aging and some are approaching the end of their useful life. The city should investigate potential upgrades to newer outdoor warning systems, as well as available federal funding sources which can be used to help offset purchase costs if new sirens are warranted. Additionally, siren coverage is currently determined using a proximity function that sets a fixed distance surrounding each siren. Since these sirens are intended to warn people who are outdoors at the time of an emergency, variables such as weather conditions, prevailing wind directions, and building and terrain heights should all be incorporated into an updated coverage analysis. Furthermore, socially vulnerable individuals may be less likely to receive warning messages through other means. This should also be investigated and incorporated as necessary to ensure coverage in areas where most needed.

Flood Response Operations

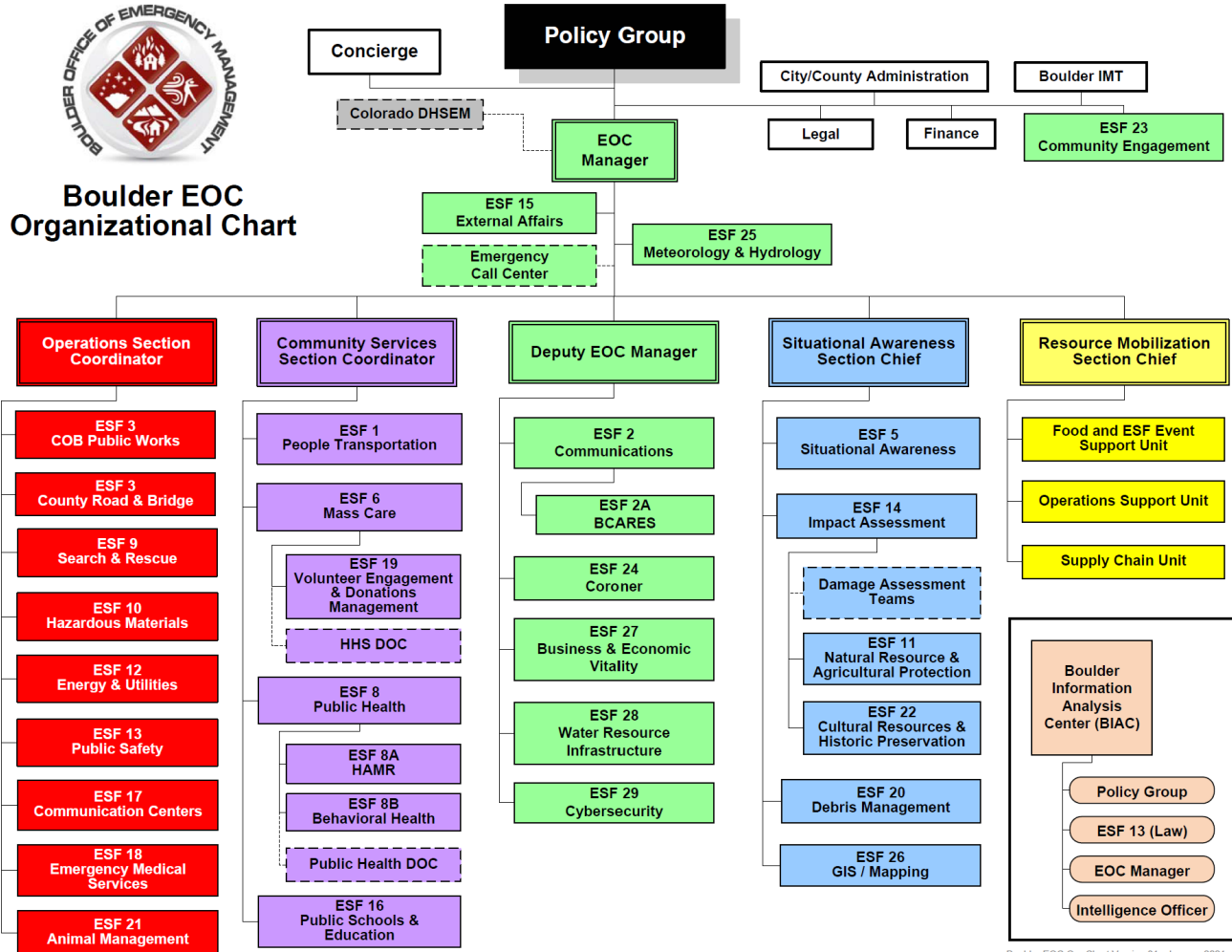
As noted previously, once an emergency event reaches a certain threshold, a more formal and comprehensive incident management structure is necessary and requires an activation of the EOC. The overarching EOC framework and comprehensive set of ESFs are shown in the figure below. For the Utilities Department, main duties and responsibilities fall under ESF 3 – Public Works, and are described as:

ESF 3 is structured to provide public works and road and bridge related support for the changing requirements of incident management, to include preparedness, prevention, response, recovery and mitigation actions. Activities within the scope of this function include conducting pre-and post-incident assessments of public works and infrastructure and reporting damage; executing emergency contract support for life-saving and life-sustaining services; providing technical assistance to include engineering expertise, construction management, contracting and real estate services; providing emergency repair of damaged infrastructure and critical facilities; recovery programs including coordinating the restoration and recovery of the transportation infrastructure; and coordinating and supporting prevention, preparedness and mitigation among transportation infrastructure stakeholders at the local and State levels.



COMPREHENSIVE FLOOD AND STORMWATER

Master Plan



Boulder EOC Org Chart Version 31-- January 2021



3 Recommendations

To proactively address Boulder’s flood risk, the following recommendations for emergency preparedness and response activities should be considered:

- **Emergency Response and Roles** - Review and update existing city emergency response plans. Confirm and clarify city Utilities staff response roles internally and with partnering agencies for small to medium events (no EOC activation) and for large events (full EOC activation) and update accordingly in the All-Hazard Alert (AHA) Response Guide.
- **Education and Outreach** – City staff should periodically review and update city resources available to the community. Consider education and outreach goals and objectives; target audiences (especially vulnerable audiences); communication channels, stakeholders, and partners that can help tailor and disseminate messaging.
- **Emergency Alert Systems** – City staff should periodically review and update emergency alert systems and references available to the community and should investigate potential upgrades to newer outdoor warning systems.
- **Equity** – City staff should apply the city’s racial equity plan and instrument to emergency preparedness and response plans and activities.
- **Community Members** - consider buying flood insurance, develop and discuss personal emergency response plans and evacuation routes, sign up for emergency alerts and ensure contact information is up to date, and take floodproofing precautions such as those described by the National Weather Service (NWS) [in this resource](#).



4 References

Federal Emergency Management Agency (FEMA), 2003. Homeland Security Presidential Directive-5, To enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system.

FEMA's Community Rating System (CRS) 2017 Manual and 2021 Addendum. [The CRS Coordinator's Manual - CRSresources](#)

Boulder County CO use of alert notification system. [Emergency Mass Notification System - Boulder County](#)