Flood Risk Report

Chaffee County: City of Salida, Town of Buena Vista, Town of Poncha Springs

Colorado

Version 001

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FEMA

RiskMAP
Increasing Resilience Together

Preface

The Department of Homeland Security (DHS), Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding and better protect their citizens. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP has transformed traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

Flood risk is always changing, and there may be other studies, reports, or sources of information available that provide more comprehensive information. The Flood Risk Report is not intended to be regulatory or the final authoritative source of all flood risk data in the project area. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

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1 Introduction

1.1 Report Overview

This Flood Risk Report (FRR) provides non-regulatory information on flood risk in Chaffee County, Colorado, and the following incorporated jurisdictions: City of Salida; Towns of Buena Vista, Town of Poncha Springs; and Chaffee County. Non-regulatory information is intended to help communities better understand their flood risks, takes steps to mitigate those risks, and communicate those risks among their citizens and local businesses. The report provides flood risk data for the entire study area as well as for each individual community.

1.2 About Flood Risk

A flood is an accumulation of water over normally dry areas. Floods become hazards to people and property by inundating developed areas. Flood losses range from damage to landscaping and debris generation to building damage and injury or death. The following factors contribute to flood risk:

- **Probability**, or likelihood, is the chance of different size floods occurring.
- **Impacts** are the consequences of flood to the natural and built environment and to human related activities.
- **Vulnerabilities** are the structures and population subject to flooding that may experience impacts because of location, age, or other characteristics.

1.3 Risk MAP Products

Through the Risk MAP program, FEMA provides communities with updated Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) that describe the probability and location of floods. In Chaffee County, this includes an updated floodplain of three separate river reaches: Cottonwood Creek, Poncha Creek and South Arkansas River. FEMA also provides the following products for further understanding, visualization, and data analysis:

- The **Flood Risk Database** (FRD) contains floodplain boundaries and flood risk data as Geographic Information System (GIS) data in a geodatabase to be used and updated by the community.
- The **Flood Risk Report**, this document, presents key risk analysis data for the project area and discusses areas of mitigation interest in Chaffee County.
- The **Flood Risk Map** is a detailed map delivered as a PDF that shows all features in Chaffee County related to flooding, flood risk, and areas of mitigation interest.

The Flood Risk Report, Flood Risk Database and Flood Risk MAP are “non-regulatory” products. They are available and intended for community use, but are neither mandatory nor tied to the regulatory floodplain management and insurance requirements of the National Flood Insurance Program (NFIP). They may be used as regulatory products by communities if authorized by state and local enabling authorities.

1.4 Uses of the Flood Risk Report

The goal of this report is to help inform and enable communities to take action to reduce flood risk. Possible users of this report include the following:

- Local elected officials
- Floodplain managers
- Community planners
- Emergency managers
- Public works officials
- Special interest groups (e.g., watershed groups, environmental awareness organizations, etc.)

State, tribal, and local officials can use the summary information provided in this report, in conjunction with the data in the Flood Risk Database, to:

Update state, tribal, or local hazard mitigation plans and community comprehensive plans. Planners can use flood risk information in the development and/or update of local risk assessments, hazard mitigation plans, comprehensive plans, future land use maps, and zoning regulations.

Update emergency operations and response plans. Risk assessment results may reveal vulnerable areas, facilities, and infrastructure for continuity of operations plans, continuity of government plans, and emergency operations plans. Emergency managers can identify low-risk areas for potential evacuation and sheltering and can help first responders avoid areas of high risk.

Develop hazard mitigation projects. Local officials (e.g., planners and public works officials) can use flood risk information to re-evaluate and prioritize mitigation actions in local hazard mitigation plans.

Communicate flood risk. Local officials can use the information in this report to communicate with property owners, business owners, and other citizens about flood risks, changes since the last FIRM (Flood Insurance Rate Map), and areas of mitigation interest

Inform development standards. Floodplain managers, planners, and public works officials can use information in this report to support development standards, including building and land use regulation, in certain locations.

Hazards U.S. Multi-Hazard (Hazus-MH) is a loss estimation software developed by FEMA for flood, wind, and earthquake hazards.

1.5 Sources of Data Used

To assess potential community losses, the following data were collected for analysis and inclusion in the Flood Risk Report:

- GIS inventory data from the Preliminary Chaffee County Flood Insurance Study, U.S. Census Bureau, Colorado Department of Transportation Online Information System, and Hazus.
- Information on community participation in FEMA programs, such as the NFIP, the Public Assistance (PA) Program, and Hazard Mitigation Assistance (HMA) Programs.

- Local hazard mitigation plans, which include risk assessments containing flood risk information and mitigation strategies that identify community priorities and actions to reduce flood risk.
- Loss estimates for the 0.2%, 1%, 2%, 4%, and 10% annual chance flood event generated by Hazus.

2 Flood Risk Analysis

2.1 Overview

The interaction of community assets with the flood hazard in Chaffee County creates flood risk. The flood depth analysis grids, risk assessment elements and areas of mitigation interest all aid in describing the potential for property damage, population displacement, and economic loss resulting from floods. These products are meant to help identify overall vulnerability, potential impacts, and can be used to create mitigation actions and strategies to reduce risk.

Section 2.2 Flood Risk Datasets describes the flood hazard with the FIRM and 'Changes Since Last FIRM' datasets. Section 2.3 Project Area Flood Risk then summarizes additional conditions that affect flooding in the project area including community involvement with FEMA Programs, flood control structures, and any specific vulnerabilities or conditions related to flood risk.

2.1.1 Project Area Assets

Community assets include anything that is important to the character and function of a community. Table 1 *Project Area Assets* and Table 4 *Community Assets* use data from the following sources:

- **Population** is Census 2010 census data.
- **Land Area** was calculated using GIS.
- **Building Replacement Value** is Hazus v2.1.
- **Critical facilities** include dams, schools, police stations, hospitals and fire stations and are part of the national datasets available with Hazus inventory data.

Table 1. Project Area Assets

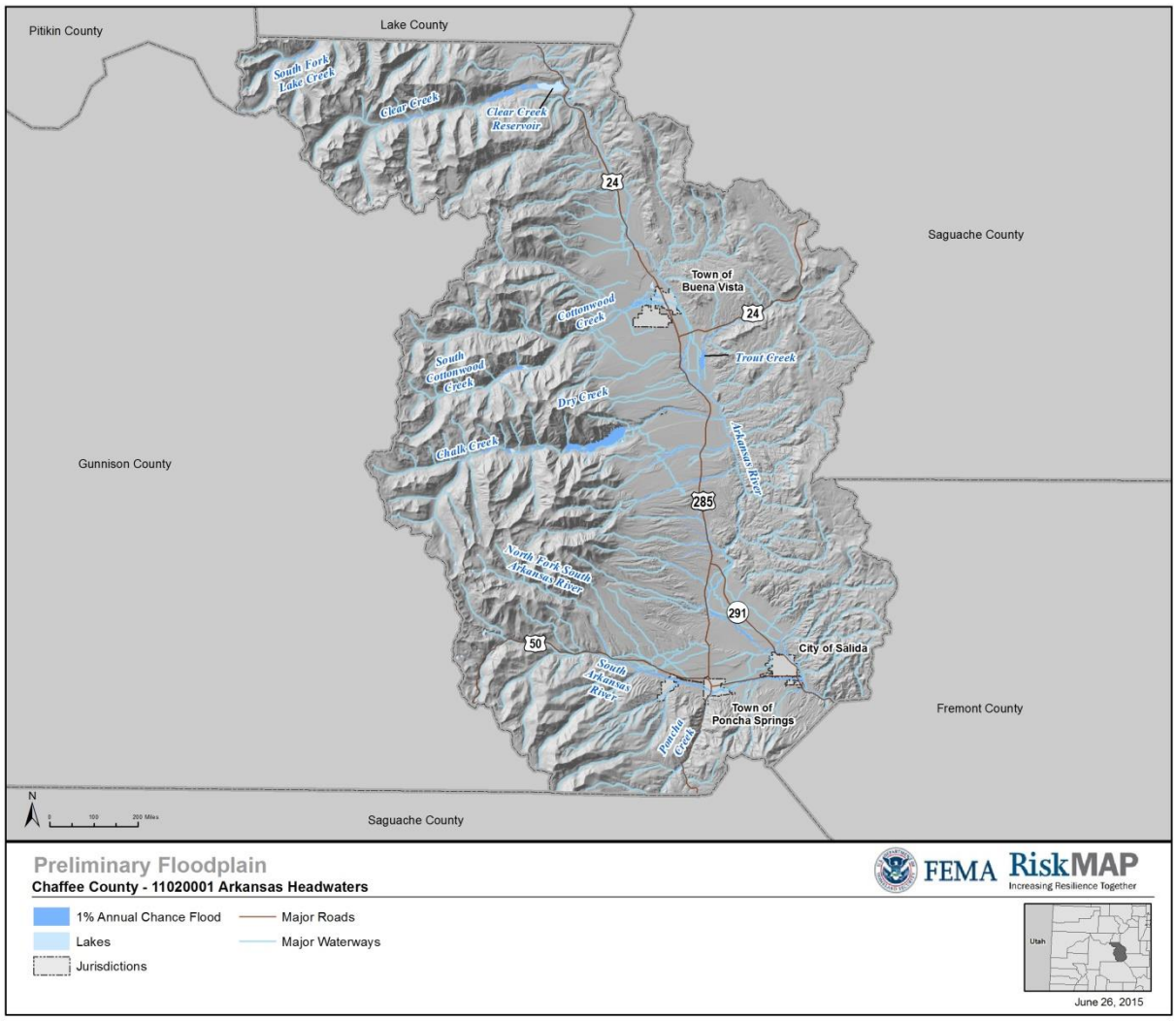
	Community Population	Land Area (square miles)	Building Replacement Value	Critical Facility Count
Project Area	17,809	1013	$2,032,100,000	18

2.2 Flood Risk Datasets

2.2.1 Floodplain Map

The analysis presented in this report is based on the 1-percent-annual-chance (100-year flood) floodplain boundary as delineated on the updated preliminary FIRM. Figure 1 shows the overall project area including incorporated communities and the 1-percent-annual-chance flood. The FIRM dataset also includes the 0.2-percent-annual-chance flood (500-year flood) data.

Figure 1. Chaffee County Floodplain



2.2.2 Floodplain Changes Since Last FIRM

The Changes Since Last Firm (CSLF) shown in this section, illustrates where changes to flood risk may have occurred since the last FIRM was published from the subject area. The updated FIRM was created with higher quality topography data and more accurate modeling software. The CSLF dataset was created by identifying areas that differ between the previous FIRM to the updated FIRM floodplain. An area modeled to be part of the floodplain in the FIRM update that was not considered floodplain in the previous FIRM is called an 'increase'. An area modeled to be out of the floodplain in the FIRM updated that was considered floodplain in the previous FIRM is called a 'decrease'. Figure 2 and Figure 3 show the changes in the area where the National Flood Hazard Layer (NFHL), used as data for the previous FIRM, was available. Floodplain increases are shown in green and floodplain decreases in orange.

Figure 2. Changes Since Last FIRM for Areas Near Town of Buena Vista

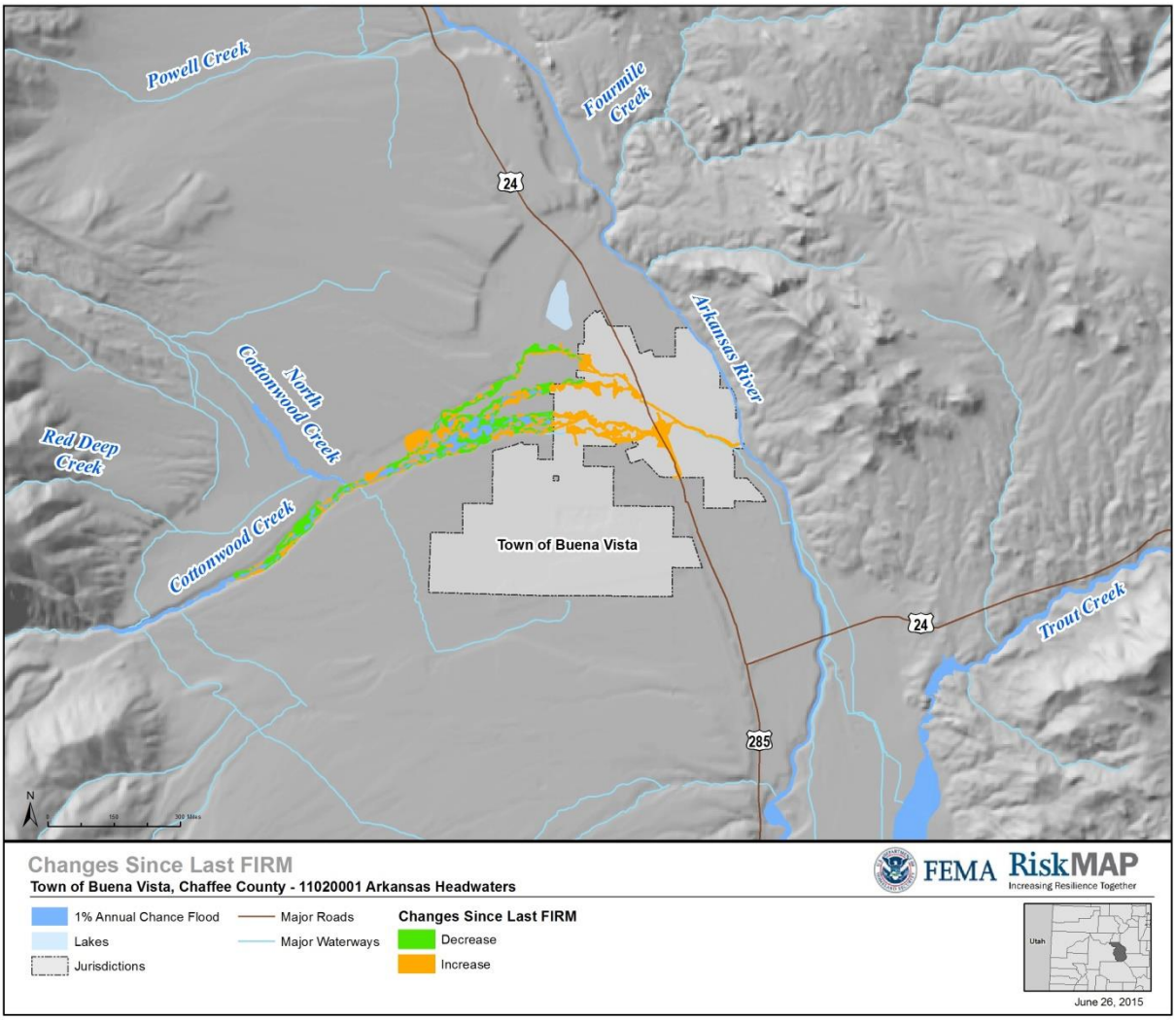


Figure 3. Changes Since Last FIRM for Areas Near Town of Poncha Springs and City of Salida

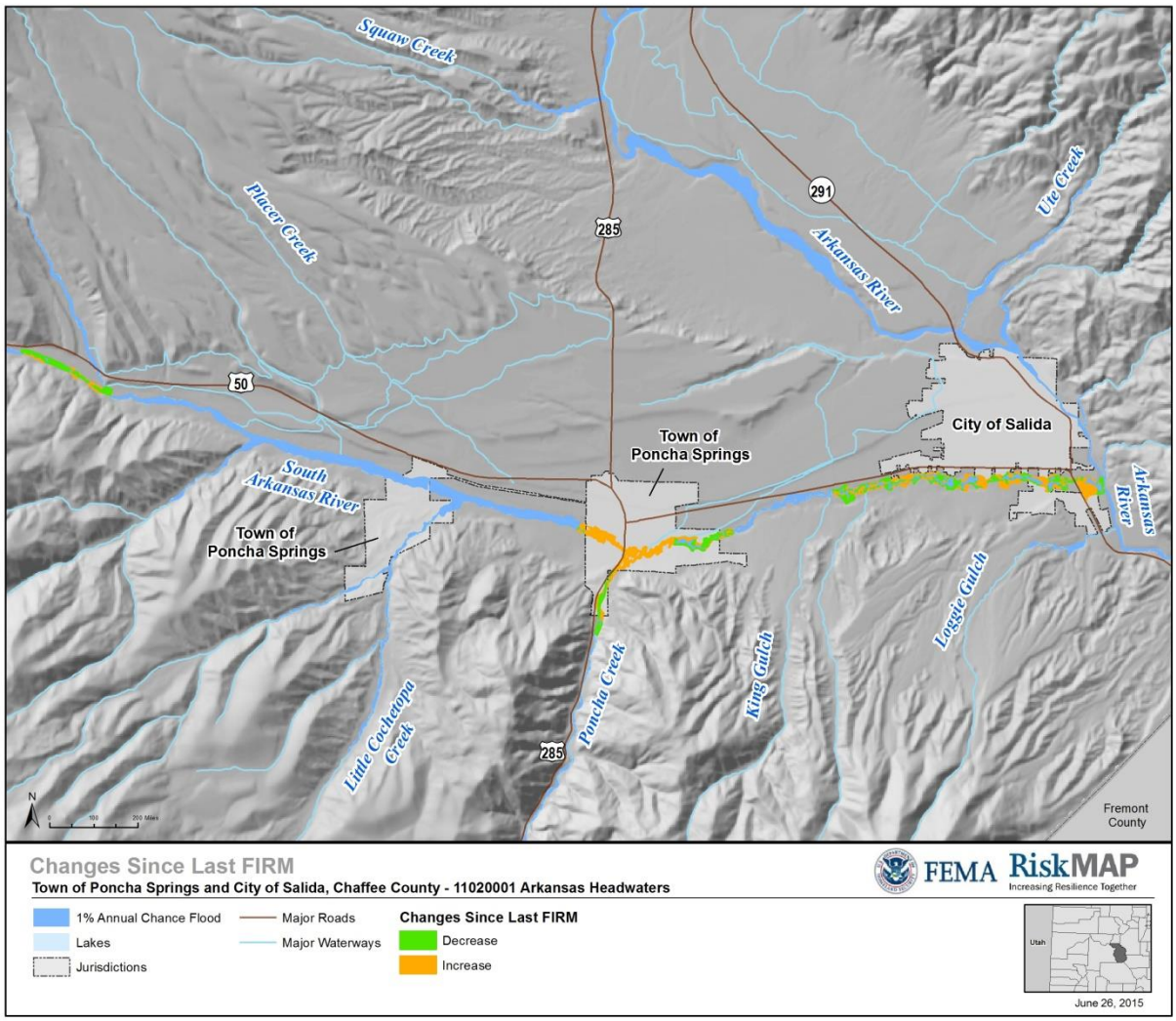


Table 2 shows the changes in area associated with the CSLF increase and decrease. This analysis describes how the updated FIRM has affected the risk summary in Chaffee County. Table 2 and Figure 2 and Figure 3 are provided for planning purposes only. Contact a local or state NFIP representative to determine a particular structure's location in relation to the updated FIRM.

Table 2. Changes Since Last FIRM Summary

Jurisdictions	Area Increase (sq mi.)	Area Decrease (sq mi.)	Net Change (sq mi.)
Buena Vista	0.2	0	0.2
Salida	0	1.7	-1.7
Poncha Springs	0.1	1.0	-0.9
Unincorp. Chaffee County	0.6	22.2	-21.6
Project Area Total	0.9	24.9	-24

2.2.3 Flood Depth and Analysis Grids

Grids are FEMA datasets provided in the FRD to better describe the risk of the flood hazard. Much like the pixels in a photo or graphic, a grid is made up of square cells, where each grid cell stores a value representing a particular flood characteristic (elevation, depth, velocity, etc.) While the FIRM and FIS Report describe "what" is at risk by identifying the hazard areas, water surface, flood depth, and other analysis grids can help define "how bad" the risk is within those identified areas. These grids are intended to be used by communities for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management. The Flood Depth and Analysis Grids provide an alternative way to visualize how a particular flood characteristic (depth, velocity, etc.) vary within the floodplain. Since they are derived from the engineering modeling results, they are typically associated with a particular frequency-based flooding event (e.g., 1-percent-annual-chance event). Grids provided in the FRD for this project area include the following:

- **Water Surface Elevation Grids (for the calculated flood frequencies included in the FIS Report):** This dataset represents the flood elevations calculated for each modeled flood frequency.
- **Flood Depth Grids (for the calculated flood frequencies included in the FIS Report):** Flood Depth Grids are created for each flood frequency calculated during the course of a Flood Risk Project. These grids communicate flood depth as a function of the difference between the calculated water surface elevation and the ground. The standard flood frequency grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance) will be delivered for the riverine areas.

  Depth grids form the basis for refined flood risk assessments (as presented in a table in Section 3 of this report) and are used to calculate potential flood losses for display on the FRM and for tabular presentation in this report. Depth grids may also be used for a variety of ad-hoc risk visualization and mitigation initiatives.
- **Percent Annual Chance of Flooding Grid:** This is a grid dataset that represents the percent annual chance of flooding for locations along a flooding source. This grid uses the five standard flood frequencies.
- **Percent Chance of Flooding over a 30-Year Time Period Grid:** This is a grid dataset that represents the estimated likelihood of flooding at least once within a 30-year period, which is the average lifespan for a home mortgage, for all locations within the extent of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplain.

2.2.4 Flood Risk Assessments

Flood risk assessment results reported in the FRR were developed using a FEMA flood loss estimation tool, Hazus. Originally developed for earthquake risk assessment, Hazus has evolved into a multi-hazard tool developed and distributed by FEMA that can provide loss estimates for floods, earthquakes, and hurricane winds. Hazus is a nationally-accepted, consistent flood risk assessment tool to assist individuals and communities to create a more accurate picture of flood risk. Some benefits of using Hazus include the following:

Hazus is a loss estimation methodology developed by FEMA for flood, wind, and earthquake hazards. The methodology and data established by Hazus can also be used to study other hazards.

- Outputs that can enhance state and local mitigation plans and help screen for cost-effectiveness in FEMA mitigation grant programs
- Analysis refinement through updating inventory data and integrating data produced using other flood models
- Widely available support documents and networks (Hazus Users Groups)

Files from the FRD can be imported into Hazus to develop other risk assessment information including:

- Debris generated after a flood event
- Dollar loss of the agricultural products in a study region
- Utility system damages in the region
- Vehicle loss in the study region
- Damages and functionality of lifelines such as highway and rail bridges, potable water, and wastewater facilities

Scenario-Based Flood Loss Estimates:

Scenario-based flood losses have been calculated using Hazus for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events. For areas subject to potential flood loss due to a dam release, flood losses were calculated based on scenarios that take into account the flooding event, release type (e.g., piping or overtopping), and the elevation of the reservoir at the time of the release (e.g., normal pool, full / top of dam, primary spillway). For areas subject to potential flood loss associated with a levee, flood losses were calculated based on scenarios that take into account the flooding event (which may include a historical event) , levee accreditation status (with the appropriate loss analysis procedures), and flooding source. In this report, these losses are expressed in dollar amounts and are provided for the Flood Risk Project area only, even though results are shown for the entire watershed and at the local jurisdiction level.

Loss estimates are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from flood and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics, or economic parameters).

Flood loss estimates in this report are being provided at the project and community levels for multiple flood frequencies, and include the following:

- **Residential Asset Loss**: These include direct building losses (estimated costs to repair or replace the damage caused to the building) for all classes of residential structures including single family, multi-family, manufactured housing, group housing, and nursing homes. This value also includes content losses.

Flood risk assessment data can be used in many ways to support local decision making and explanation of flood risk. For mitigation planning purposes, loss data can be used to help meet requirements to develop loss information for the hazard of flood. Also, the FRM can show where flood risk varies by geographic location. For emergency management, risk assessment data can help forecast losses based on predicted events, and resources can be assigned accordingly. Loss information can support floodplain management efforts, including those to adopt higher regulatory standards. Awareness of at-risk essential facilities and infrastructure also encourages mitigation actions to protect citizens from service disruption should flooding occur.

- **Commercial Asset Loss**: These include direct building losses for all classes of commercial buildings including retail, wholesale, repair, professional services, banks, hospitals, entertainment, and parking facilities. This value also includes content and inventory losses.
- **Other Asset Loss**: This includes losses for facilities categorized as industrial, agricultural, religious, government, and educational. This value also includes content and inventory losses.
- **Business Disruption**: This includes the losses associated with the inability to operate a business due to the damage sustained during the flood. Losses include inventory, income, rental income, wage, and direct output losses, as well as relocation costs.
- **Annualized Losses**: Annualized losses are calculated using Hazus by taking losses from multiple events over different frequencies and expressing the long-term average by year. This factors in historic patterns of frequent smaller floods with infrequent but larger events to provide a balanced presentation of flood damage.
- **Loss Ratio:** The loss ratio expresses the scenario losses divided by the total building value for a local jurisdiction and can be a gage to determine overall community resilience as a result of a scenario event. For example, a loss ratio of 5 percent for a given scenario would indicate that a local jurisdiction would be more resilient and recover more easily from a given event, versus a loss ratio of 75 percent which would indicate widespread losses. An annualized loss ratio uses the annualized loss data as a basis for computing the ratio. Loss ratios are not computed for business disruption. These data are presented in the FRR.

2.2.5 Areas of Mitigation Interest

Many factors contribute to flooding and flood losses. Some are natural, and some are not. In response to these risks, there has been a focus by the federal government, state agencies, and local jurisdictions to mitigate properties against the impacts of flood hazards so that future losses and impacts can be reduced. An area identified as an Area of Mitigation Interest (AoMI) is an important element of defining a more comprehensive picture of flood risk and mitigation activity in a watershed, identifying target areas and potential projects for flood hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce flood risk.

This report and the FRM may include information that focuses on identifying Areas of Mitigation Interest that may be contributing (positively or negatively) to flooding and flood losses in the Flood Risk Project. AoMIs are identified through coordination with local stakeholders; through revised hydrologic and hydraulic and/or coastal analyses; by leveraging other studies or previous flood studies; from community mitigation plans, floodplain management plans, and local surveys; and from the mining of federal government databases (e.g., flood claims, disaster grants, and data from other agencies). Below is a list of the types of Areas of Mitigation Interest that may be identified in this Flood Risk Report, shown on the Flood Risk Map, and stored in the Flood Risk Database:

- **Dams**

  A dam is a barrier built across a waterway for impounding water. Dams vary from impoundments that are hundreds of feet tall and contain thousands of acre-feet of water (e.g., Hoover Dam) to small dams that are a few feet high and contain only a few acre-feet of water (e.g., small residential

pond). “Dry dams,” which are designed to contain water only during floods and do not impound water except for the purposes of flood control, include otherwise dry land behind the dam.

While most modern, large dams are highly engineered structures with components such as impervious cores and emergency spillways, most smaller and older dams are not. State dam safety programs emerged in the 1960s, and the first Federal Guidelines for Dam Safety were not prepared until 1979. By this time, the vast majority of dams in the United States had already been constructed.

- **Reasons dams are considered AoMIs:**
  - Many older dams were not built to any particular standard and thus may not withstand extreme rainfall events. Older dams in some parts of the country are made out of an assortment of materials. These structures may not have any capacity to release water and could be overtopped, which could result in catastrophic failure.
  - Dams may not always be regulated, given that the downstream risk may have changed since the dam was constructed or since the hazard classification was determined. Years after a dam is built, a house, subdivision, or other development may be constructed in the dam failure inundation zone downstream of the dam. Thus, a subsequent dam failure could result in downstream consequences, including property damage and the potential loss of life. Since these dams are not regulated, it is impossible to predict how safe they are.
  - A significant dam failure risk is structural deficiencies associated with older dams that are not being adequately addressed today through needed inspection/maintenance practices.
  - For larger dams a flood easement may have been obtained on a property upstream or downstream of the dam. However, there may have been buildings constructed in violation of the flood easement.
  - When a new dam is constructed, the placement of such a large volume of material in a floodplain area (if that is the dam location) will displace flood waters and can alter how the watercourse flows. This can result in flooding upstream, downstream, or both.
  - For many dams, the dam failure inundation zone is not known. Not having knowledge of these risk areas could lead to unprotected development in these zones.

- **Stream Flow Constrictions**

A stream flow constriction occurs when a human-made structure, such as a culvert or bridge, constricts the flow of a river or stream. The results of this constriction can be increased damage potential to the structure, an increase in velocity of flow through the structure, and the creation of significant ponding or backwater upstream of the structure. Regulatory standards regarding the proper opening size for a structure spanning a river or stream are not consistent and may be non-existent. Some local regulations require structures to pass a volume of water that corresponds to a certain size rain event; however, under sizing, these openings can result in flood damage to the structure itself. After a large flood event, it is not uncommon to have numerous bridges and culverts “washed out.”

- **Reasons stream flow constrictions are considered AoMIs:**
  - Stream flow constrictions can back water up on property upstream of the structure if not designed properly.

- These structures can accelerate the flow through the structure causing downstream erosion if not properly mitigated. This erosion can affect the structure itself, causing undermining and failure.
- If the constriction is a bridge or culvert, it can get washed out causing an area to become isolated and potentially more difficult to evacuate.
- Washed-out culverts and associated debris can wash downstream and cause additional constrictions.

- **At-Risk Essential Facilities**

  Essential facilities, sometimes called "critical facilities," are those whose impairment during a flood could cause significant problems to individuals or communities. For example, when a community's wastewater treatment is flooded and shut down, not only do contaminants escape and flow into the floodwaters, but backflows of sewage can contaminate basements or other areas of the community. Similarly, when a facility such as a hospital is flooded, it can result in a significant hardship on the community not only during the event but long afterwards as well.

  - **Reasons at-risk essential facilities are considered AoMIs:**
    - Costly and specialized equipment may be damaged and need to be replaced.
    - Impairments to facilities such as fire stations may result in lengthy delays in responding and a focus on evacuating the facility itself.
    - Critical records and information stored at these facilities may be lost.

- **Drainage or Stormwater-Based Flood Hazard Areas, or Areas Not Identified as Floodprone on the FIRM But Known to Be Inundated**

  Flood hazard areas exist everywhere. While FEMA maps many of these, others are not identified. Many of these areas may be located in communities with existing, older, and often inadequate stormwater management systems or in very rural areas. Other similar areas could be a result of complex or unique drainage characteristics. Even though they are not mapped, awareness of these areas is important so adequate planning and mitigation actions can be performed.

  - **Reasons drainage or stormwater-based flood hazard areas or unidentified floodprone locations are considered AoMIs:**
    - So further investigation of such areas can occur and, based on scientific data, appropriate mitigation actions can result (i.e., land use and building standards).
    - To create viable mitigation project applications in order to reduce flood losses.

- **Other**

  Other types of flood risk areas include drainage or stormwater-based flood hazard areas, or areas known to be inundated during storm events.

2.3 Project Area Flood Risk

This section describes the areas of mitigation interest for the overall project area. Section 3 Community Risk Summaries provides a detailed breakdown of the data and information by community.

2.3.1 At Risk Critical Facilities

At risk critical facilities are counts of assets located in the 1% annual chance floodplain. GIS was used to quantify the critical facilities that intersect the floodplain.

Total dollar losses for a 1% annual chance event scenario were generated using Hazus. Loss Ratio is calculated by dividing the total building inventory in a community by the total building loss in that community. Loss ratios highlight relative risk in the county and can help with resource allocation and targeting mitigation efforts.

Table 2 describes flood risk interest in Chaffee County and incorporated areas.

Table 2. Project Area Risk Assessment Summary Table

	Critical Facilities in Floodplain	Total Dollar Losses	Loss Ratio
Project Area	5	$38,200,000	0

2.3.2 FEMA Programs and History

2.3.2.1 Hazard Mitigation Plan

Chaffee County, the City of Salida, the Town of Buena Vista, and the Town of Poncha Springs are covered by the current, FEMA approved Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for Upper Arkansas Area. The plan expired in 2008. To maintain eligibility for HMA grant program funding, Chaffee County and the communities must each participate in a plan update.

2.3.2.2 National Flood Insurance Program

Chaffee County, the City of Salida, and Town of Buena Vista and Poncha Springs participate in the NFIP. Chaffee County and its communities did not participate in the Community Rating System (CRS). There are a total of 144 policies. There are no repetitive loss properties.

2.3.2.3 Mitigation Project Successes

Mitigation projects for Chaffee County were not found.

2.3.2.4 Declared Disaster History

There have been three federally declared disasters in Chaffee County. Table 3 shows the disaster type, year, and program funding granted. Each of the flooding disasters received both Individual Assistance (IA) and Public Assistance (PA) from the federal government.

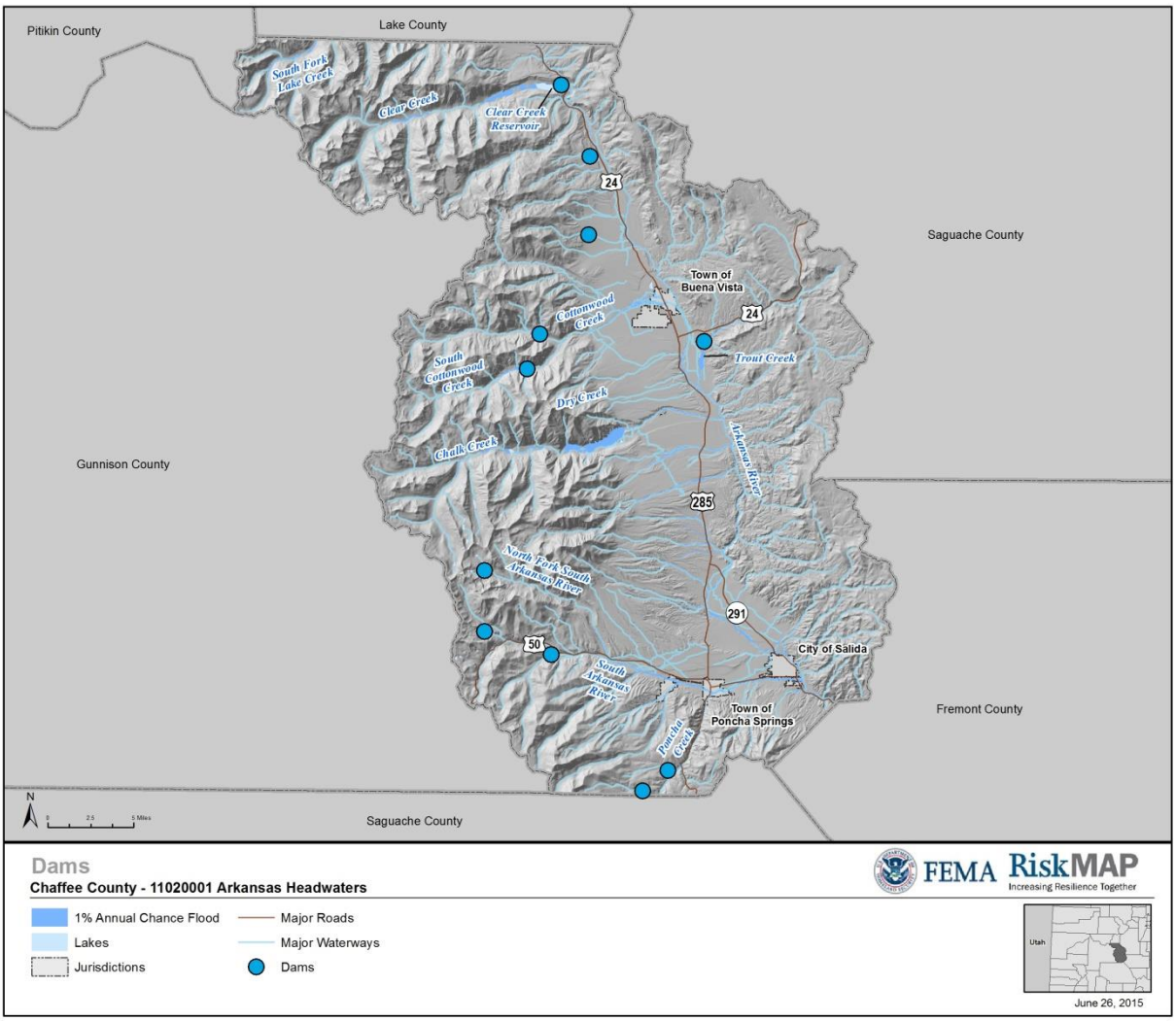
Table 3. Presidentially Declared Disasters in Chaffee County

Year	Hazard	IA	PA
2002	Wildfires	X	
2003	Snow		X
2005	Hurricane Katrina Evacuation		X

2.3.3 Dams and Levees

Dams data were obtained from the National Inventory of Dams. Figure 4 shows the fourteen dams in Chaffee County. Each dam with either a significant or high hazard potential is required to have an Emergency Action Plan. All dams in the State fall under the regulatory authority of the Colorado Division of Water Resources Dam Safety Branch. There are no official levees in Chaffee County.

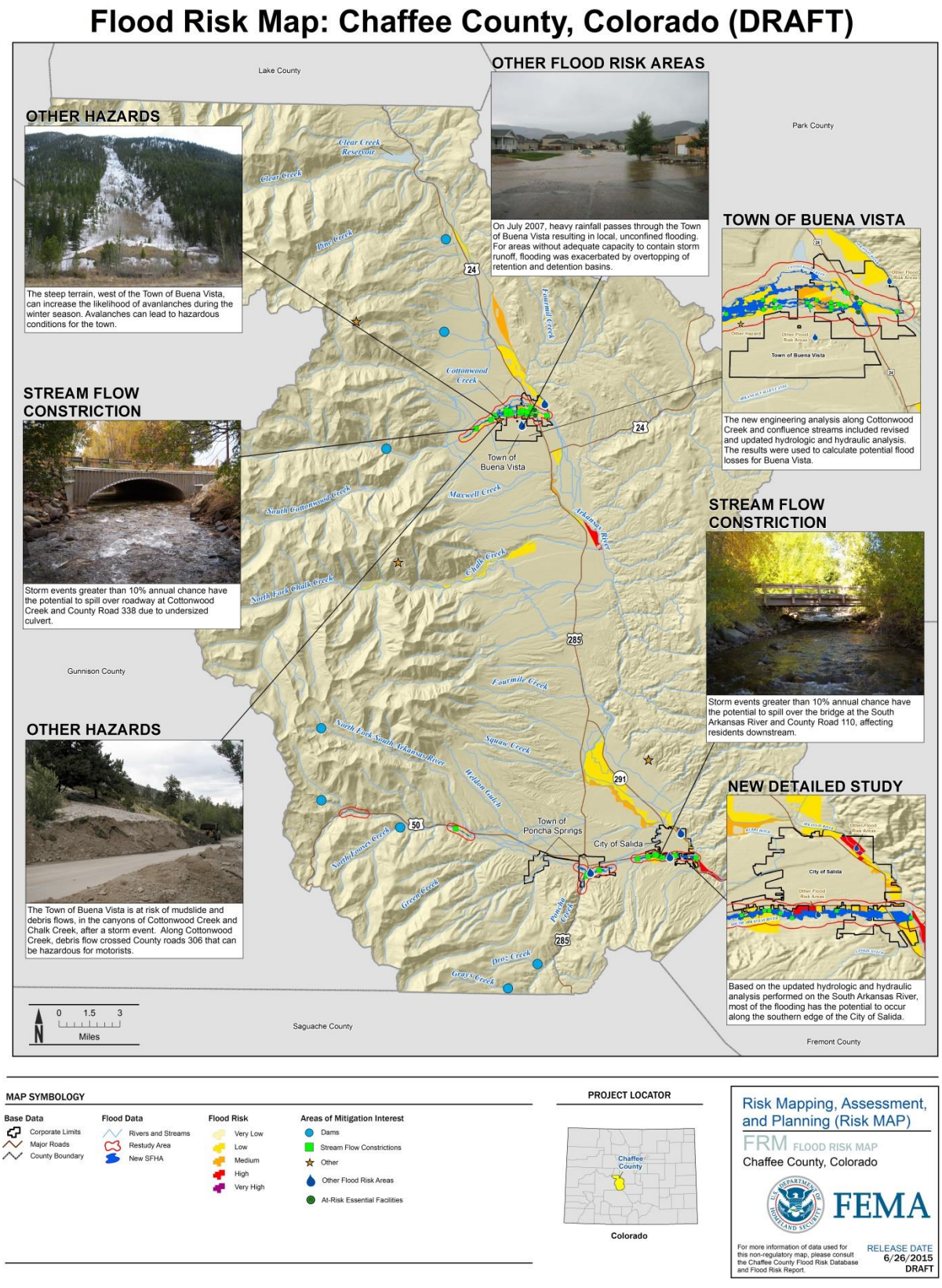
Figure 4. Chaffee County Dams



2.3.4 Flood Risk Map

The Flood Risk Map is intended to communicate specific areas of flood risk to communities and their decision makers. The Flood Risk Map depicts flood risk datasets and the areas of mitigation interest in the project area and is included as a separate non-regulatory product (file type PDF). Figure 5 shows a thumbnail version of the Flood Risk Map.

Figure 5. Flood Risk Map



3 Community Risk Summaries

This section provides more detail on the risk assessment elements and areas of mitigation interest summarized in Section 2 for each incorporated city and town in Chaffee County. Section 3.1 presents an asset inventory by community and Sections 3.1.1 through 3.1.4 describe flood risk by community.

3.1 Communities Overview

All jurisdictions of the area of Chaffee County are in the Arkansas Headwaters Watershed [11020001]. Unincorporated Chaffee County is included in Section 3.1.4 as a separate community.

Table 4 provides information about the project area, sorted by community.

Table 4. Community Assets

Jurisdictions	CID	Community Population	Land Area (sq mi.)	Building Replacement Value	Critical Facility Count
Buena Vista	080030	2,617	3.4	$290,900,000	2
Salida	080031	5,236	2.6	$647,600,000	0
Poncha Springs	080220	737	2.7	$58,000,000	0
Unincorporated Chaffee County	080287	17,809	1,013	$1,035,600,000	3
Total	-	26,399	1,023.7	$2,032,100,000	5

3.1.1 Town of Buena Vista (080030)

Table 5 and Figure 6 help describe flood risk and areas of mitigation interest in the Town of Buena Vista. The Arkansas River runs on the eastern edge of the town, while Cottonwood Creek runs across the northern portion of the town. On July 2007, the Town of Buena Vista experienced a small, high intensity rain storm that resulted in flooding in parts of the town.

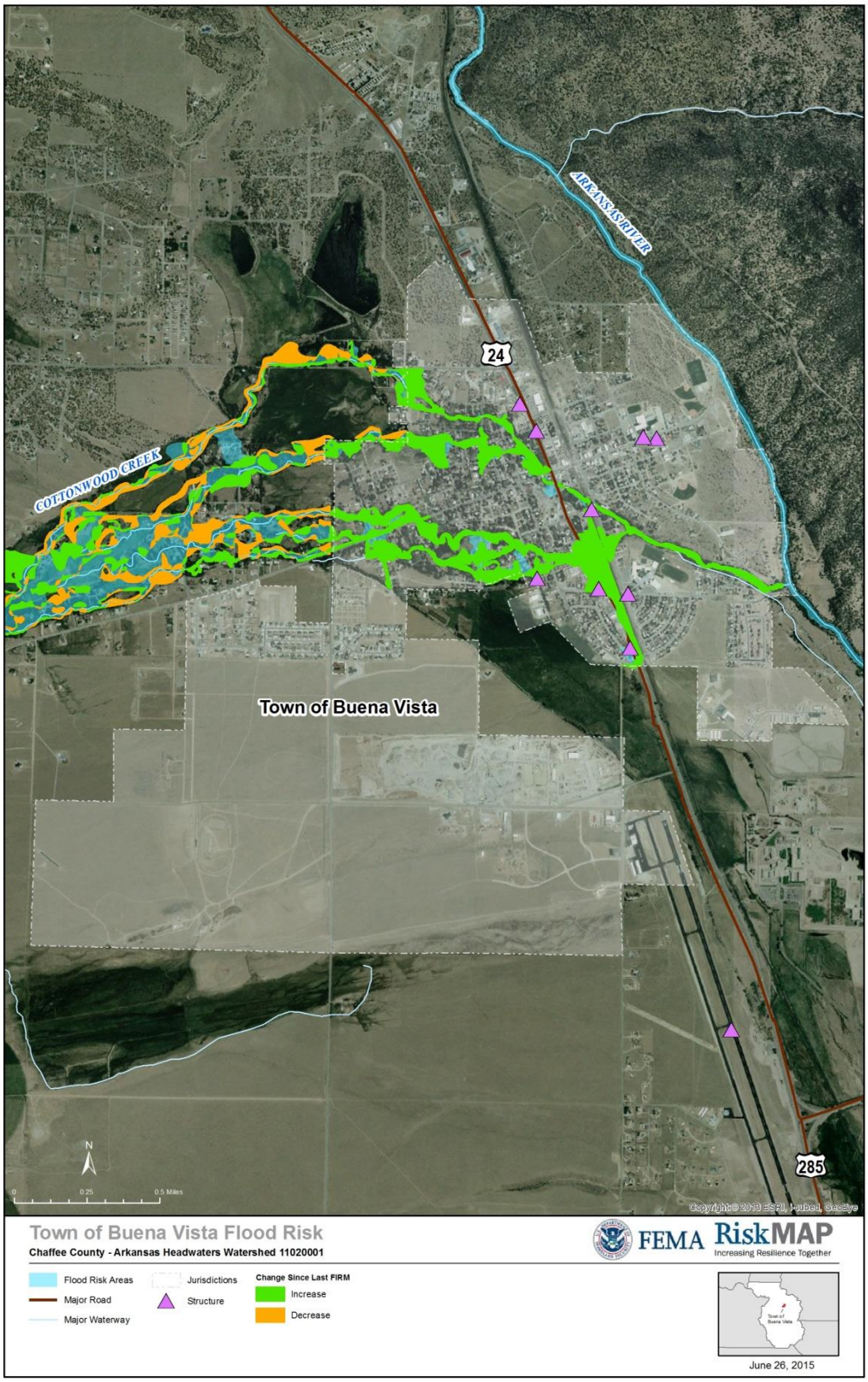
Vulnerabilities and potential mitigation actions were identified for the Town of Buena Vista in the State of Colorado 2007 Flood Document Report.

- Assess and define potential areas of flooding;
- If necessary, re-define level of protections;
- Improve or implement new drainage structures for areas that are identified most need or have none currently existing;
- Enhance new drainage requirement for new development areas.

Table 5. Town of Buena Vista Flood Risk

Critical Facilities in Floodplain	2, Fire Department and Medical Center
Total Dollar Losses	$6,700.000
Loss Ratio	0
FEMA Approved Hazard Mitigation Plan	Yes
NFIP Participation	Yes
CRS Participation	10
NFIP Policies and Claims	44 policies

Figure 6. Town of Buena Vista Flood Risk



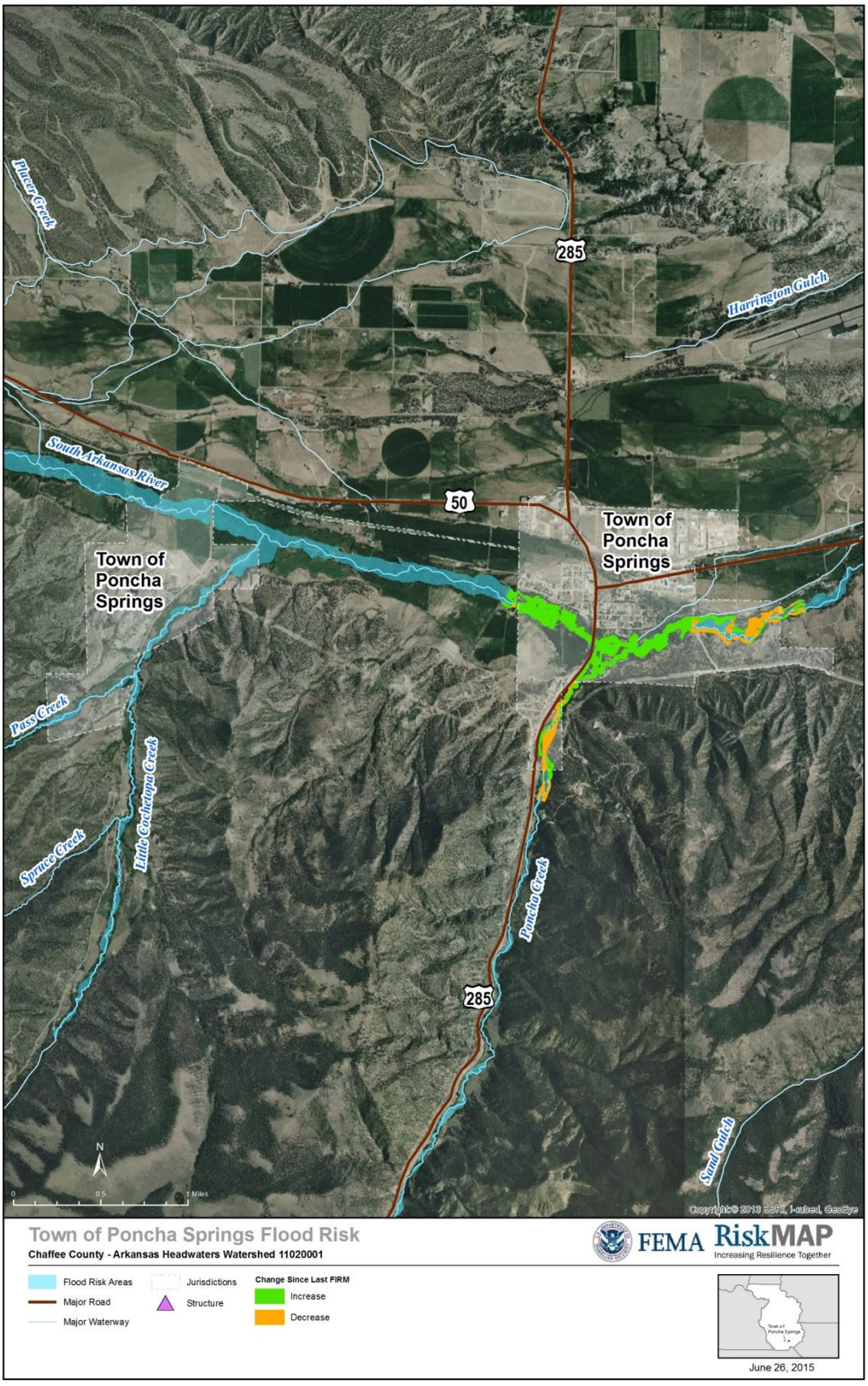
3.1.2 Town of Poncha Springs (080220)

Table 6 and Figure 7 help describe flood risk and areas of mitigation interest in Town of Poncha Springs. The potential flooding sources within the Town of Poncha Spring are the South Arkansas River and Poncha Creek. Other potential flooding sources are Pass Creek, Spruce Creek, and Little Cochetopa Creek. South Arkansas River runs across both eastern and western corporate limits, while Poncha Creek intersects with South Arkansas River in the eastern corporate limits.

Table 6. Town of Poncha Springs Flood Risk

Critical Facilities in Floodplain	0
Total Dollar Losses	$500,000
Loss Ratio	0
FEMA Approved Hazard Mitigation Plan	Yes
NFIP Participation	Yes
CRS Participation	10
NFIP Policies and Claims	1 policy

Figure 7. Town of Poncha Springs Flood Risk



3.1.3 City of Salida (080031)

Table 7 and Figure 8 help describe flood risk and areas of mitigation interest in the City of Salida. Arkansas River and South Arkansas River along the eastern portion and southern of the city boundary, create a natural barrier limits development from the city.

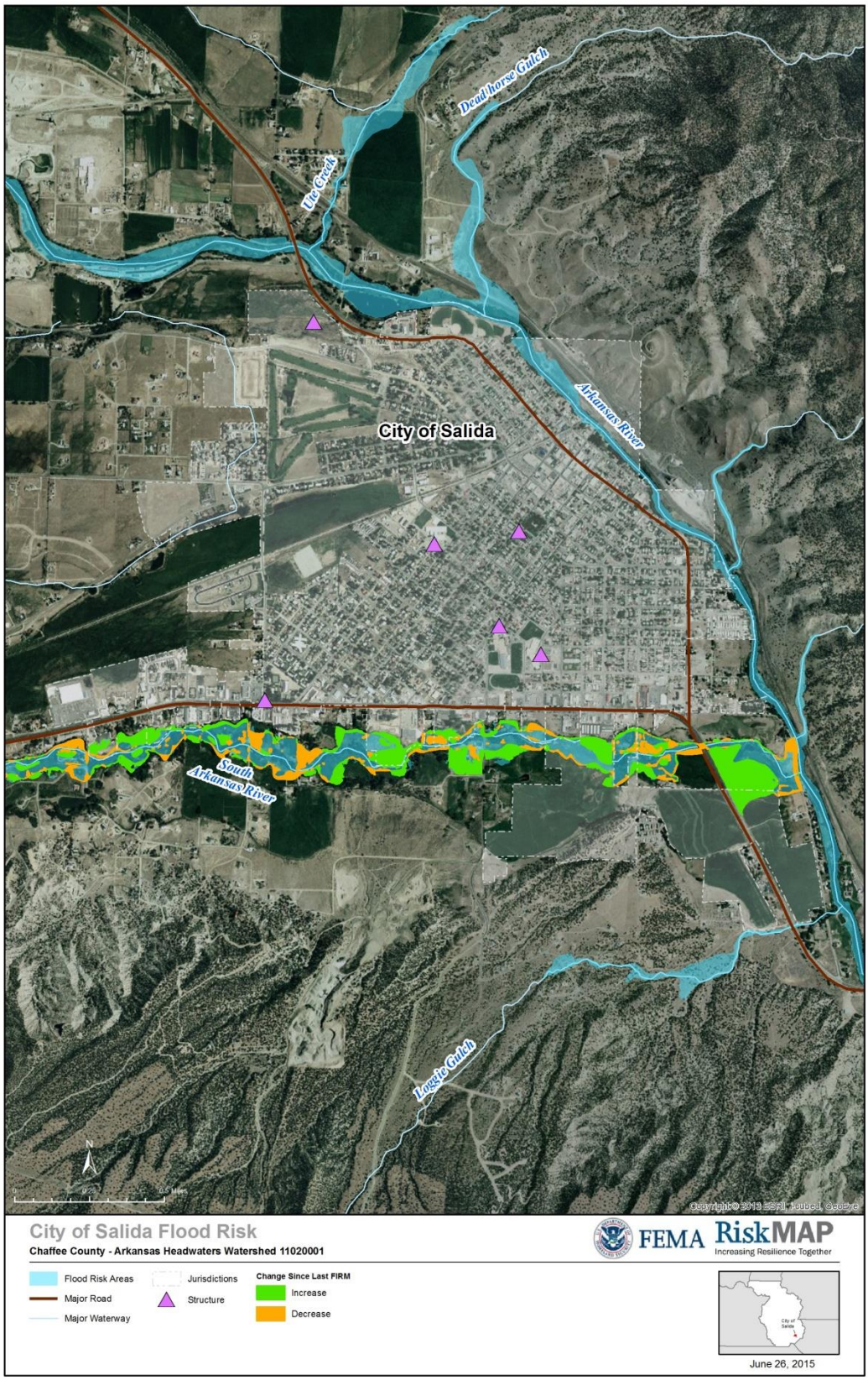
The following were identified as the most significant risks and vulnerabilities in the city:

- Older structures with in the city boundary may be subject to damage during wintery conditions.

Table 7. City of Salida Flood Risk

Critical Facilities in Floodplain	0
Total Dollar Losses	$15,800,000
Loss Ratio	0
FEMA Approved Hazard Mitigation Plan	Yes
NFIP Participation	Yes
CRS Participation	10
NFIP Policies and Claims	3 policies

Figure 8. City of Salida Flood Risk



3.1.4 Chaffee County, Unincorporated (080269)

Table 8 helps describe flood risk and areas of mitigation interest in unincorporated Chaffee County. The following were identified as the most significant risks and vulnerabilities in unincorporated Chaffee County:

- Landslide for areas along Arkansas River and Chalk Creek during a rainstorm event;
- Vulnerable to seasonal floods along the Arkansas River.

Table 8. Unincorporated Chaffee County Flood Risk

Critical Facilities in Floodplain	3, Dams
Total Dollar Losses	$15,200,000
Loss Ratio	0
FEMA Approved Hazard Mitigation Plan	Yes
NFIP Participation	Yes
CRS Participation	10
NFIP Policies and Claims	196 policies

Vulnerabilities were identified in the Natural Hazard Risk Analysis and Pre-Disaster Mitigation Plan for Upper Arkansas Area and potential mitigation action were recognized in the Colorado Natural Hazards Mitigation Plan for the Chaffee County and Unincorporated:

- Establish a stormwater management plan;
- Improve alert and notification capability for winter storm events;
- Reduce vulnerability of community assets to flash floods by improving design guidelines of flood prone areas.

4 Actions to Reduce Flood Risk

Mitigation reduces or eliminates the impacts of hazard events and provides a critical foundation for creating safer, more disaster resilient communities. As a community better understands its flood risk, it can identify mitigation actions to reduce future losses and protect people and property. This section provides a comprehensive range of flood risk reductions actions as well as various mitigation programs and assistance to consider for addressing key vulnerabilities in the project area.

Local hazard mitigation plans identify and prioritize mitigation actions developed by communities through a comprehensive planning process that involves the public and a wide range of stakeholders. The risk analysis information and areas of mitigation interest developed through the Risk MAP project and in the Flood Risk Report can be used to inform and update local mitigation plans.

4.1 Types of Mitigation Actions

Mitigation actions generally fall into the following four categories:

Local Plans and Regulations | These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built. Examples include:

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- NFIP Community Rating System (CRS)
- Capital improvement programs
- Open space preservation
- Stormwater management regulations
- Master plans

NFIP's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from community actions meeting the three goals of the CRS: to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance.

Structure and Infrastructure Projects | These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures, as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards. Examples include:

- Acquisitions and elevations of structures in flood-prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts
- Safe rooms

Natural System Protection | These are actions that minimize damage and losses and also preserve or restore the functions of natural systems. Examples include:

- Sediment and erosion control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Education and Awareness Programs | These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. Examples include:

- Radio or television advertisements
- Community websites with maps and information
- Real estate disclosures
- Presentations to school groups or neighborhood organizations
- Mailings to residents in hazard-prone areas.
- StormReady , http://www.stormready.noaa.gov/
- Firewise, http://www.firewise.org/

Emergency Services Measures | Although not considered a mitigation technique, emergency service measures can minimize the impacts of flooding on people and property. Actions commonly taken immediately prior to, during, or in response to a hazard event include:

- Hazard warning system
- Emergency response plan
- Continuity of operations or continuity of governance planning
- Critical facilities protection
- Health and safety maintenance
- Post-flood recovery planning

4.2 Identifying Specific Actions for Your Community

Communities may consider the following factors to help identify the mitigation actions most appropriate to lessen the impact of floods:

Site characteristics | Does the site present unique challenges (e.g., significant slopes or erosion potential)?

Flood characteristics | Are the flood waters fast or slow -moving? Does the flooding generate debris? How deep is the flooding?

Social acceptance | Will the mitigation action be acceptable to the public? Does it cause social or cultural problems?

Technical feasibility | Is the mitigation action technically feasible (e.g., making a building watertight to a reasonable depth)?

Administrative feasibility | Is there administrative capability to implement and maintain the mitigation action?

Legal | Does the mitigation action meet all applicable codes, regulations, and laws? Public officials may have a legal responsibility to act and inform citizens if a known hazard has been identified.

Economic | Is the mitigation action affordable? Is it eligible for grant or other funding programs? Can it be completed within existing budgets?

Environmental | Does the mitigation action cause adverse impacts on the environment or can they be mitigated? Is it the most appropriate action among the possible alternatives?

4.3 Mitigation Programs and Assistance

For those mitigation actions that require assistance through funding or technical expertise, several state and federal agencies have hazard mitigation grant programs and offer technical assistance. These programs may be funded at different levels over time or may be activated under special circumstances such as after a presidential disaster declaration.

4.3.1 FEMA Mitigation Programs and Assistance

FEMA awards many mitigation grants each year to states and communities to undertake mitigation projects to prevent future loss of life and property resulting from hazard impacts. The FEMA Hazard Mitigation Assistance (HMA) programs provide grants for mitigation through the programs listed in Table 9.

Table 9. FEMA Hazard Mitigation Assistance Programs

Grant Program	Authority	Purpose
Hazard Mitigation Grant Program (HMGP)	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Activated after a presidential disaster declaration; provides funds for long-term mitigation measures to reduce vulnerability to natural hazards.
Pre-Disaster Mitigation (PDM)	Disaster Mitigation Act	National competitive program focused on funding mitigation project and planning activities that address multiple natural hazards.
Flood Mitigation Assistance (FMA)	National Flood Insurance Reform Act	Provides funds for projects to reduce or eliminate claims against the NFIP.

The HMGP and PDM Programs offer funding for mitigation planning and project activities that address multiple natural hazard events. The FMA Program focuses funding efforts on reducing claims against the NFIP. Funding under HMA Programs is subject to availability of annual appropriations. HMGP funding is also subject to the amount of FEMA disaster recovery assistance provided under a presidential major disaster declaration.

FEMA's HMA grants are awarded to eligible states, tribes, and territories (applicant) that, in turn, provide sub-grants to local governments and communities (sub-applicant). The applicant selects and prioritizes sub-applications submitted to them and submits them to FEMA for funding consideration. Prospective sub-applicants should consult the office designated as their applicant for further

information regarding specific program and application requirements. Contact information for the FEMA Region VIII Office and State Offices of Emergency Management is available on the FEMA website at http://www.fema.gov/region-viii-co-mt-nd-sd-ut-wy.

Each year, FEMA partners with the State on training courses designed to help communities be more successful in mitigation planning and projects, including the Local Hazard Mitigation Planning Workshop, Hazard Mitigation Grant Assistance Application Development Course, and the Benefit Cost Analysis (BCA) course. Contact your State Hazard Mitigation Officer for course schedules.

4.3.2 Additional Mitigation Programs and Assistance

Several additional agencies including the U.S. Army Corps of Engineers (USACE), Natural Resource Conservation Service, U.S. Geological Survey, and others have specialists on staff and can offer further information on hazard mitigation. Your State NFIP Coordinator and State Hazard Mitigation Officer are state-level sources of information and assistance.

5 Appendix A: Related Resources

For a more comprehensive picture of flood risk, FEMA recommends that state and local officials use the information provided in this report in conjunction with other sources of flood risk data, such as those listed below.

FIRMs and FISs. This information indicates areas with specific flood hazard by identifying the limit and extent of the 1 percent annual chance (100-year) floodplain and the 0.2 percent annual chance (500-year) floodplain. FIS reports include summary information regarding other frequencies of flooding, as well as flood profiles for riverine sources of flooding.

Hazus-MH Flood Loss Estimation Reports. Hazus can be used to generate reports, maps and tables showing loss estimation from potential flood events. Hazus can run specialized risk assessments to model new/proposed mitigation projects or future development patterns and dam or levee failures.

Flood or multi-hazard mitigation plans. Local hazard mitigation plans include risk assessments that contain flood risk information and mitigation strategies that identify community priorities and actions to reduce flood risk.

Dam Emergency Action Plans. Emergency Action Plans contain downstream inundation maps and identify actions to minimize property damage and loss of life in the case of an emergency.

FEMA Map Service Center (MSC). The MSC is an online resource for floodplain mapping related data and information. FIRM and FIRM databases and the National Flood Hazard Layer (NFHL) Database are available at the MSC.

ASCE 7 – National design standard issued by the ASCE, *Minimum Design Loads for Buildings and Other Structures*, which gives current requirements for dead, live, soil, flood, wind, snow, rain, ice, and earthquake loads, and their combinations, suitable for inclusion in building codes and other documents.

ASCE 24-05 – National design standard issued by the ASCE, *Flood Resistant Design and Construction*, which outlines the requirements for flood resistant design and construction of structures in flood hazard areas.

ASCE, 2010 - *So, You Live Behind a Levee!* Reston, VA. to help individuals and communities better protect themselves against future flood threats. Written for both the engineering and non-engineering public, it covers issues such as flood size and risk, signs of trouble, ways to reduce risk, and how to prepare for and respond to emergencies.

FEMA Publications. Check the FEMA library (http://www.fema.gov/library/) and FEMA Building Science website (http://www.fema.gov/building-science#3) for publication updates.

- FEMA, 1985. *Manufactured Home Installation in Flood Hazard Areas*, FEMA 85. Washington, DC, September 1985.

- FEMA and the American Red Cross, 1992. *Repairing Your Flooded Home*, FEMA 234/ARC 4476. Washington, DC, August 1992.
- FEMA, 1996. *Addressing Your Community's Flood Problems*, FEMA 309. Washington, DC, June 1996.
- FEMA, 1998. *Homeowner's Guide to Retrofitting*, FEMA 312. Washington, DC, June 1998.
- FEMA, 1999. *Protecting Building Utilities from Flood Damage*, FEMA 348. Washington, DC, November 1999.
- FEMA, 1999. Riverine Erosion Hazard Areas Mapping Feasibility Study. Washington, DC, September 1999.
- FEMA, 2003. *Interim Guidance for State and Local Officials - Increased Cost of Compliance Coverage*, FEMA 301. Washington, DC, September 2003.
- FEMA, 2000. *Above the Flood: Elevating Your Floodprone House,* FEMA 347. Washington, DC, May 2000.
- FEMA, 2001. *Understanding Your Risks: Identifying Hazards and Estimating Losses*, FEMA 386-2. Washington, DC, August 2001.
- FEMA, 2002a. *Getting Started: Building Support for Mitigation Planning*, FEMA 386-1. Washington, DC, September 2002.
- FEMA, 2003a. *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies*, FEMA 386-3. Washington, DC, April 2003.
- FEMA, 2003b. *Bringing the Plan to Life: Implementing the Hazard Mitigation Plan*, FEMA 386-4. Washington, DC, August 2003.
- FEMA, 2004a. *Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds*, FEMA 424. Washington, DC, January 2004.
- FEMA, 2004b. *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, FEMA 64. Washington, DC, April 2004.
- FEMA, 2005. *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*, FEMA 386-6. Washington, DC, May 2005.
- FEMA, 2006a. *Multi-Jurisdictional Mitigation Planning*, FEMA 386-8. Washington, DC, August 2006.
- FEMA, 2006b. *Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects*, FEMA 386-9. Washington, DC, August 2008.
- FEMA, 2006c. "*Designing for Flood Levels Above the BFE," Hurricane Katrina Recovery Advisory 8, Hurricane Katrina in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance*, FEMA 549, Appendix E. Washington, DC, July 2006.
- FEMA, 2007a. *Property Acquisition Handbook for Local Communities*, FEMA 317. Washington, DC, September 2007.
- FEMA, 2007b. *Public Assistance Guide*, FEMA 322. Washington, DC, June 2007.
- FEMA, 2007c. *Using Benefit-Cost Review in Mitigation Planning*, FEMA 386-5. Washington, DC, May 2007.
- FEMA, 2007d. *Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings*, FEMA 543. Washington, DC, January 2007.

- FEMA, 2007e. *Selecting Appropriate Mitigation Measures for Floodprone Structures*, FEMA 551. Washington, DC, March 2007.
- FEMA, 2007f. *Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds: Providing Protection to People and Buildings,* FEMA 577. Washington, DC, June 2007.
- FEMA, 2008. *Reducing Flood Losses Through the International Codes: Meeting the Requirements of the National Flood Insurance Program,* FEMA 9-0372, Third Edition. Washington, DC, December 2007.

6 Appendix B: Acronyms and Definitions

B.1 Acronyms

A

AAL	Average Annualized Loss
ALR	Annualized Loss Ratio
AOMI	Areas of Mitigation Interest
ASCE	American Society of Civil Engineers

B

BCA	Benefit-Cost Analysis
BFE	Base Flood Elevation
BMP	Best Management Practices

C

CFR	Code of Federal Regulations
CHHA	Coastal High Hazard Areas
COG	Continuity of Government Plan
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSLF	Changes Since Last FIRM

D

DFIRM	Digital Flood Insurance Rate Map
DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000

E

EAP	Emergency Action Plan
EOP	Emergency Operations Plan

F

FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRD	Flood Risk Database
FRM	Flood Risk Map
FRR	Flood Risk Report
FY	Fiscal Year

G

GIS	Geographic Information System

H

HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program

I

IA	Individual Assistance

M

MSC	FEMA Map Service Center

N

NFHL	National Flood Hazard Layer
NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NRCS	Natural Resource Conservation Service

P

PA	Public Assistance
PAL	Provisionally Accredited Levee
PDM	Pre-Disaster Mitigation
PFD	Primary Frontal Dune
PMF	Probable Maximum Flood

R

RFC	Repetitive Flood Claims
Risk MAP	Mapping, Assessment, and Planning

S

SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SRL	Severe Repetitive Loss

U

USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

B.2 Definitions

0.2-percent-annual-chance flood – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

1-percent-annual-chance flood – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

Annualized Loss Ratio (ALR) – Expresses the annualized loss as a fraction of the value of the local inventory (total value/annualized loss).

Areas of Mitigation Interest (AoMI) - The dataset is intended to be used as a communication tool to direct users to areas and issues that warrant further investigation or research for possible mitigation, as well as to highlight prior mitigation successes.

Average Annualized Loss (AAL) – The estimated long-term weighted average value of losses to property in any single year in a specified geographic area.

Base Flood Elevation (BFE) – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

Berm – A small levee, typically built from earth.

Cfs – Cubic feet per second, the unit by which discharges are measured (a cubic foot of water is about 7.5 gallons).

Coastal High Hazard Area (CHHA)—Portion of the SFHA extending from offshore to the inland limit of a primary frontal dune along an open coast or any other area subject to high velocity wave action from storms or seismic sources.

Consequence (of flood) – The estimated damages associated with a given flood occurrence.

Crest – The peak stage or elevation reached or expected to be reached by the floodwaters of a specific flood at a given location.

Dam – An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water.

Design flood event – The greater of the following two flood events: (1) the base flood, affecting those areas identified as SFHAs on a community's FIRM; or (2) the flood corresponding to the area designated as a flood hazard area on a community's flood hazard map or otherwise legally designated.

Digital Flood Insurance Rate Map (DFIRM) – The official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zone applicable to the community.

Erosion – Process by which floodwaters lower the ground surface in an area by removing upper layers of soil.

Essential facilities – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in Hazus, essential facilities include hospitals, emergency operations centers, police stations, fire stations, and schools.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters or (2) the unusual and rapid accumulation or runoff of surface waters from any source.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community. See also Digital Flood Insurance Rate Map.

Flood Insurance Study (FIS) Report – Contains an examination, evaluation, and determination of the flood hazards of a community, and if appropriate, the corresponding water-surface elevations.

Flood risk – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. This is sometimes referred to as flood vulnerability.

Flood vulnerability – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. This is sometimes referred to as flood risk.

Flood-borne debris impact – Floodwater moving at a moderate or high velocity can carry flood-borne debris that can impact buildings and damage walls and foundations.

Floodwall – A long, narrow concrete or masonry wall built to protect land from flooding.

Floodway (regulatory) – The channel of a river or other watercourse and that portion of the adjacent floodplain that must remain unobstructed to permit passage of the base flood without cumulatively increasing the water surface elevation more than a designated height (usually 1 foot).

Floodway fringe – The portion of the SFHA that is outside of the floodway.

Freeboard – A factor of safety usually expressed in feet above a flood level for purposes of flood plain management. “Freeboard” tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed (44CFR§59.1).

Hazus – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds and storm surge, and earthquakes.

High velocity flow – Typically comprised of floodwaters moving faster than 5 feet per second.

Levee – A human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding. (44CFR§59.1)

Loss ratio – Expresses loss as a fraction of the value of the local inventory (total value/loss).

Mudflow – Mudslide (i.e., mudflow) describes a condition where there is a river, flow or inundation of liquid mud down a hillside usually as a result of a dual condition of loss of brush cover, and the subsequent accumulation of water on the ground preceded by a period of unusually heavy or sustained rain. A mudslide (i.e., mudflow) may occur as a distinct phenomenon while a landslide is in progress, and will be recognized as such by the Administrator only if the mudflow, and not the landslide, is the proximate cause of damage that occurs. (44CFR§59.1)

Primary frontal dune (PFD)—A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

Probability (of flood) – The likelihood that a flood will occur in a given area.

Risk MAP – Risk Mapping, Assessment, and Planning, a FEMA strategy to work collaboratively with state, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

Riverine – Of or produced by a river. Riverine floodplains have readily identifiable channels.

Special Flood Hazard Area (SFHA) – Portion of the floodplain subject to inundation by the 1-percent-annual or base flood.

Stafford Act – Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. This Act constitutes the statutory authority for most federal disaster response activities especially as they pertain to FEMA and FEMA programs.

Stillwater – Projected elevation that flood waters would assume, referenced to National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or other datum, in the absence of waves resulting from wind or seismic effects.

Stream Flow Constrictions – A point where a human-made structure constricts the flow of a river or stream.