

# **Map Modernization Implementation Plan for Colorado**



**Prepared by:**

Colorado Water Conservation Board  
Denver, Colorado



**In cooperation with:  
Urban Drainage and Flood Control District**

**Submitted to:  
FEMA, Region 8  
August 2002  
Revised October 2002**

# Mapping Plan for Colorado

---

## *Table of Contents*

Executive Summary .....	iii
<b>1.0 Introduction.....</b>	<b>2</b>
1.1 Background and Purpose of Plan .....	2
1.2 State Role in the Flood Hazard Mapping Program .....	2
1.3 Mapping Needs Assessment and Priority Setting Approach .....	2
1.4 Underlying Principles of Colorado’s Map Modernization Implementation Plan .....	2
<b>2.0 Overview of CWCB Analysis.....</b>	<b>2</b>
<b>3.0 Meeting FEMA’s Map Modernization Implementation Goals.....</b>	<b>2</b>
3.1 Reducing the Average Age of the Maps .....	2
3.2 Preparing Maps for Unmapped Communities.....	2
3.3 Preparing Digital Maps for the Top-Ranked Counties .....	2
<b>4.0 Meeting Colorado’s Goals for Floodplain Mapping.....</b>	<b>2</b>
4.1 Likelihood of Mapping Success.....	2
4.2 CWCB Rating of Flood Risk .....	2
4.3 Wildfire Impacts .....	2
<b>5.0 Collection of Community Data .....</b>	<b>2</b>
<b>6.0 Prioritization of Community Mapping Needs Statewide .....</b>	<b>2</b>
6.1 Population in 2000 .....	2
6.2 Likelihood of Floodplain Mapping Success .....	2
6.3 Population Growth from 1990 to 2000 .....	2
6.4 CWCB Evaluation of Flood Hazard Risk .....	2
6.5 Age of Maps.....	2
6.6 Unmapped Communities.....	2
6.7 Wildfire Impacts .....	2
6.8 Assigning Weights to Individual Parameters.....	2
<b>7.0 Results of CWCB Prioritization Process.....</b>	<b>2</b>
<b>8.0 Cooperation With the Urban Drainage &amp; Flood Control District .....</b>	<b>2</b>
<b>9.0 Overall Colorado Recommendations .....</b>	<b>2</b>
9.1 First Priority Counties.....	2
9.2 Second Priority Counties .....	2
9.3 Third Priority Counties .....	2
9.4 Fourth Priority Counties.....	2
<b>10.0 Implementing the Plan.....</b>	<b>2</b>
10.1 Proposed Approach To Addressing Mapping Needs .....	2
10.2 Proposed Approach To Map Production.....	2
10.3 Estimated Costs To Complete Proposed Mapping Activities .....	2

## *List of Figures*

1	Age of Effective Map Panels .....	1
2	Population Ranking.....	16
3	Readiness and Likelihood of Success .....	17
4	Population Growth.....	19
5	Flood Hazard Risks.....	20
6	Panel Age.....	22
7	Unmapped Counties.....	24

# Mapping Plan for Colorado

---

8	Wildfire Impacted Counties.....	25
9	Total Scores .....	26
10	Top Ranked Counties.....	30

## *List of Tables*

5.1	Community Participation.....	14
6.1	Population Ranking .....	15
6.2	Likelihood of Success Ranking .....	17
6.3	Population Growth Ranking .....	18
6.4	Summarization of Composite Scores.....	20
6.5	Age of Maps Ranking .....	21
6.6	Unmapped Communities Ranking (Communities).....	23
6.6b	Unmapped Communities Ranking (Counties).....	23
6.7	Weighting Factors for Prioritization Parameters .....	26
7.1	CWCB Prioritization Score Ranges.....	27
7.2	Top Ranked County Scores .....	27
9.1	1 <sup>st</sup> Priority Counties (25% of Total).....	30
9.2	2 <sup>nd</sup> Priority Counties (25% of Total).....	31
9.3	3 <sup>rd</sup> Priority Counties (25% of Total) .....	32
9.4	4 <sup>th</sup> Priority Counties (25% of Total) .....	32
10.1	Map Production Summary for FY 2003 Funding .....	34
10.2	State-Managed Map Production Activities Using FY 2003 Funds.....	35
10.3	Estimated Costs of Planned Production.....	38

## **APPENDICES**

<b>A-1</b>	Questionnaire & Worksheet Transmittal Blank Community Questionnaire Instructions for Community Worksheet Blank Community Worksheet Sample Community Worksheet Workshop Participation Summary
<b>A-2</b>	Questionnaire Response Summary Mapping Needs Worksheet Summary
<b>B-1</b>	Final County Ranking (weighted) Overall County Ranking (non-weighted)
<b>B-2</b>	Ranking Parameter Data & Scoring
<b>B-3</b>	Summary of Prioritization Data
<b>B-4</b>	FEMA Cost & Prioritization Spreadsheet
<b>C</b>	Summary of Mapping Costs
<b>D</b>	Floodplain Mapping Needs Related Data

# Mapping Plan for Colorado

---

## ***Executive Summary***

The Colorado Map Modernization Implementation Plan (MMIP) has been prepared by the Colorado Water Conservation Board (CWCB), with assistance from Moser and Associates and PBS&J. A statewide plan is being prepared for all of the 50 States as part of the development of a comprehensive national strategy for modernizing FEMA's inventory of Flood Insurance Rate Maps (FIRMs). The Colorado MMIP identifies mapping priorities for the State of Colorado and outline an approach and estimated costs for addressing these mapping needs.

In accordance with Government Performance Results Act (GPRA) performance measures suggested by the Office of Management and Budget (OMB), this plan is designed to accomplish the following:

- Reduce the average age of the State's FIRMs from over 13.6 years to 6 years or less;
- Produce digital flood hazard maps with up-to-date flood hazard data for the 15% highest priority areas; and
- Develop flood hazard maps for half of the unmapped, flood prone communities.

The program identified in this plan identifies estimated costs for updating floodplain mapping needs and establishes priorities for study updates by County. In addition, it will identify State resources and the potential for a cost-share with State and local partners.

This plan provides a general profile of mapping needs for Colorado utilizing statistical data, some of which is specific to the National Flood Insurance Program (NFIP). The plan focuses on the highest priority counties in Colorado, including the municipalities within those counties, and the floodplain mapping need of those counties. 25% of the counties in Colorado (16 counties), have been identified as "high priority". CWCB proposes to initiate work in at least 10 of those 16 counties in FY 2003. The remainder of this plan will outline the roles the State and FEMA Region VIII will play in addressing the needs of the remaining 48 Colorado Counties in future years.

## **Acknowledgements**

The Colorado MMIP was completed by the consulting team of Moser & Associates and the Denver office of PBS&J, under contract with the Colorado Water Conservation Board. The team also received invaluable assistance from the Urban Drainage & Flood Control District. FEMA Region VIII staff participated in the process and provided guidance to the team as needed during the development of the plan. Special thanks to the following individuals for their hard work and dedication to the Colorado MMIP:

- Brian Hyde (CWCB)
- Tom Browning (CWCB)
- Bill DeGroot (UD&FCD)
- Dan Carlson (FEMA Region VIII)
- Rick Moser (Moser & Assoc.)
- Steve Smith (PBS&J)
- Karen Ahmrein (PBS&J)

This effort was made possible by a one-time grant from FEMA that the CWCB applied for and received through the Community Assistance Program State Support Services Element (CAP-SSSE). The \$50,000 grant required a 75/25 percent (federal/non-federal) cost share that the CWCB provided through in-kind services.

# Mapping Plan for Colorado

## 1.0 Introduction

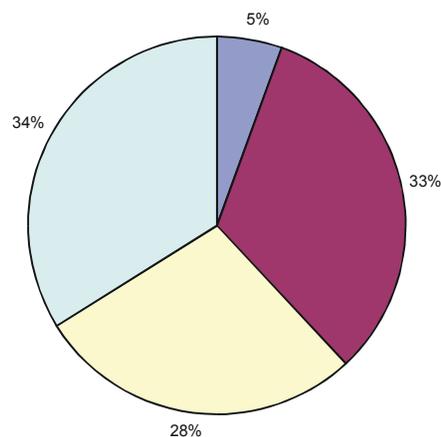
The Colorado Water Conservation Board (CWCB) has been serving Colorado’s floodplain management needs since its creation 65 years ago in 1937. Since 1966 the CWCB has been participating in the preparation of and state regulatory approval of floodplain maps for Colorado’s watercourses. When the National Flood Insurance Program (NFIP) was created, the CWCB was designated as the State of Colorado’s NFIP state coordination agency. CWCB is proud of its long tradition of serving Colorado’s floodplain management needs, including the preparation and approval of floodplain maps. With that tradition in mind, we are pleased to present the Colorado Map Modernization Implementation Plan (MMIP).

The Colorado MMIP incorporates features common to the plans of the other 49 states, as called for by FEMA, and features unique to Colorado. The purpose of this plan is to guide the improvement of Flood Insurance Studies and other Floodplain Information Reports in Colorado during the next decade and beyond. While it is anticipated that many of the floodplain mapping projects in Colorado in the next decade will be supported by substantial funding from FEMA, that will not be the only source of funding of floodplain studies for Colorado’s communities. This plan has attempted to consider the important objectives of FEMA’s Map Modernization program while simultaneously considering the objectives of the CWCB’s ongoing floodplain mapping program and the possibility of funding other than FEMA funding for accomplishing floodplain mapping, including objectives not directly related to the NFIP.

### 1.1 Background and Purpose of Plan

The Federal Emergency Management Agency’s (FEMA’s) flood hazard maps are one of the fundamental tools for flood hazard mitigation in Colorado and in the United States in general. In Colorado, many flood hazard maps have been prepared by entities other than the Federal Emergency Management Agency (FEMA). However, more of these maps have been prepared by FEMA than by any other entity, so FEMA’s maps are very important to current and future flood hazard mitigation activities in Colorado. Unfortunately, as shown in the figure below, most of the FEMA flood hazard maps in Colorado have become outdated.

**Figure 1 - Age of Effective Map Panels**



**Age of Effective Map Panels**

< 5 year old (5%) (102 panels)
5 to 10 years old (33%) (610 panels)
10-15 years old (28%) ( 528 panels)
> 15 years old (34%) (632 panels)

# Mapping Plan for Colorado

---

In many cases, the older maps reflect outdated flood hazard information that limits their utility for insurance and floodplain management purposes. Additionally, most of the maps were prepared using now outdated road network information and manual cartographic techniques, which make the maps difficult for State and local customers to use and expensive for FEMA and the Colorado Water Conservation Board to maintain. In addition, FEMA has not produced flood maps for many communities in Colorado.

To address this problem, the President's budget for Fiscal Year (FY) 2003 (which starts on October 1, 2002) includes \$351 million for initiating FEMA's national Map Modernization Program. Similar funding levels are proposed for subsequent fiscal years.

This MMIP was prepared by the State of Colorado to assist FEMA in the development of regional and national plans for implementing the FEMA Map Modernization Program. This Plan summarizes the role that Colorado will play in completing the required mapping activities and how these activities will be managed and performed. This MMIP identifies mapping priorities, explains how mapping priorities were established for each county in Colorado, and outlines an approach for addressing these mapping priorities.

Government Performance Results Act (GPRA) performance measures were suggested for the Map Modernization Program by the Office of Management and Budget, largely in the basis of the work of the Technical Mapping Advisory Council established by Congress and Council's five years of work and on the basis of work by FEMA's staff in cooperation with the Council during that time. In accordance with the GPRA performance measures, the details of the Plan have been developed with consideration given to FEMA accomplishing the following:

- Reducing the average age of the flood maps nationwide from over 13.6 years to 6 years or less;
- Producing digital flood hazard maps with up-to-date flood hazard data for the 15-percent highest priority areas in the state; and
- Developing flood hazard maps for one-half of the unmapped, flood prone communities in Colorado.

## **1.2 State Role in the Flood Hazard Mapping Program**

The CWCB has the primary responsibility for floodplain management in Colorado including coordination of the NFIP. CWCB will be the lead agency for the implementation of the MMIP in Colorado, except for the Denver metro area. The CWCB is currently in the process of establishing a joint effort with the Urban Drainage and Flood Control District (UDFCD) in the Denver metro area for MMIP implementation.

The CWCB plans to have a new full-time State Floodplain Mapping Coordinator to implement the plan. CWCB will be requesting a Federal grant to provide funds for an in-house employee or a contracted State Floodplain Mapping Coordinator. The State Floodplain Mapping Coordinator will coordinate all floodplain mapping activities in Colorado between the State and local communities with the involvement of the UDFCD in the Denver metro area. Because the State does not have the resources to fully manage or perform all flood study or map upgrade activities, those activities will be performed by qualified engineering consultants under contract to the CWCB. The State will rely on those consultants for: scoping, outreach and community coordination, digital base map collection and coordination, topographic data collection, field surveys, engineering analyses and floodplain mapping, and report writing. The State Floodplain Mapping Coordinator will be involved in the management of all mapping activities and coordination with State, Federal and local agencies. In the Denver Metropolitan area, the CWCB hopes

# Mapping Plan for Colorado

---

that the State Floodplain Mapping Coordinator will be able to fulfill these responsibilities cooperatively with the Urban Drainage & Flood Control District.

## **1.3 Mapping Needs Assessment and Priority Setting Approach**

To fully evaluate floodplain mapping needs in Colorado, the Colorado Water Conservation Board performed a mapping needs assessment in June, July and August 2002. This mapping needs assessment included the following tasks:

- Soliciting mapping needs information from counties and communities;
- Reviewing available community-specific data;
- Reviewing the information in the FEMA Mapping Needs Update Support System (MNUSS);
- Assigning map upgrade methods and priorities to each county; and
- Assessing whether the proposed map update options would achieve the GPRA performance measures and revise the map update methods accordingly.

The most significant effort in this mapping needs assessment was devoted to the gathering of data and analysis of data to carry out the CWCB's mapping needs prioritization methodology. That methodology is described in detail later in this report. A separate portion of this mapping needs assessment was undertaken in cooperation with, and with the support of FEMA and FEMA's Flood Map Production Coordination Contractor (MCC). The following data was collected and assessed on a county-by-county basis:

- Age of the existing maps;
- Known mapping needs as recorded in the FEMA Mapping Needs Update Support System (MNUSS);
- Status of existing maps (digital, manual, none);
- Existing or potential local mapping partners;
- Number of unmapped, floodprone communities;
- Number of communities;
- Availability of existing base map, topographic data, and/or flood hazard data (including data from other State agencies);
- Number of Letters of Map Change processed during the last 10 years;
- Population and population growth (U.S. Census figures);
- Flood insurance claims and/or repetitive losses;
- Availability of State and/or local funding;
- Format of existing maps (countywide or community-based format); and
- Ongoing map updates, including updates being undertaken by regional agencies or communities under the Cooperating Technical Partners (CTP) Program.

The CWCB believes that the results of its prioritization methodology provides appropriate guidance for vest meeting Colorado's specific floodplain mapping needs.

A complete listing of the data collected for Colorado is provided in the Appendices.

# Mapping Plan for Colorado

---

## **1.4 Underlying Principles of Colorado's Map Modernization Implementation Plan**

The CWCB has identified six underlying principles that provide a philosophical foundation for Colorado's Map Modernization Implementation Plan (MMIP). The six principles are listed below and then each is discussed in detail.

**Principle 1** The State of Colorado plays a major role in prioritizing the floodplain mapping needs of Colorado's communities.

**Principle 2** The local governments in Colorado are the major players in characterizing the floodplain mapping needs of Colorado's communities.

**Principle 3** Due to generalized information and unavailable information and due to a lack of prior experience by FEMA and the CWCB with this magnitude of floodplain mapping, this statewide plan is very much a work in progress.

**Principle 4** It is imperative that FEMA, the State of Colorado, local governments, and all other players in the implementation of this plan pursue all possible strategies that will maximize success in the first two to three years of Colorado's MMIP.

**Principle 5** There are some significant policy decisions, with major budgetary implications, that have yet to be made by FEMA and CWCB.

**Principle 6** Due to Principles 3, 4, 5, the development of a comprehensive Scope of Work for the floodplain mapping improvements to be conducted in the first two years of Colorado's MMIP will be very challenging, and it will be crucial to the long term success of the MMIP.

### **1.4.1 Principle 1 – Major Role for Colorado**

The MMIP provides the CWCB's rankings of the 64 counties in Colorado with regard to floodplain mapping needs. The composite scores for each county consider the floodplain mapping needs of the unincorporated areas of the county and the needs of the municipalities within the county. The county scores were calculated using a prioritization methodology developed by CWCB staff and the MMIP consultants. The CWCB ranking methodology is discussed later in this report. While we understand the need for consistency in ranking throughout the country for equitable allocation of federal funds, we believe that the methodology we have developed best represents the mapping needs of the various communities in Colorado. For that reason, this plan presents the CWCB ranking information first, and then provides the additional information required by FEMA afterward.

# Mapping Plan for Colorado

---

The CWCB's prioritization methodology considers seven (7) ranking factors. Four of those factors are consistent with FEMA's ranking methodology, as indicated by the MMIP report template and spreadsheet provided to each of the states. Those four "FEMA" factors, which are also of concern to the CWCB, are listed below:

- Total population in 2000;
- Population growth from 1990 to 2000, by percentage;
- Age of Flood Insurance Rate Maps (FIRMs); and
- Needs of unmapped communities.

The other three factors were developed by the CWCB to address specific needs in Colorado. Two of those factors ultimately depended on professional evaluations by CWCB staff of the status of each county and the communities within that county. The third factor was simply a "yes" or "no" answer to the question, "did this county experience significant wildfire damage to some of its watersheds in 2002?" In addition to the four factors previously mentioned, the three CWCB ranking factors are:

- CWCB assessment of county readiness to proceed with a floodplain mapping project and the likelihood of success;
- CWCB assessment of overall risk to life and property from flood hazards; and
- Wildfire damage in 2002.

All seven factors will be discussed in detail later in this report. The point in this introductory discussion is to convey the effort made by the CWCB and its consultants to simultaneously meet the assessment needs of the federal government and of the State of Colorado.

## **1.4.2 Principle 2 – Major Role for Local Governments**

The CWCB believes that local governments must be active participants in characterizing the floodplain mapping needs of their communities. For that reason, CWCB and the MMIP consultants developed a questionnaire and a worksheet to be filled out by local officials. In addition, four workshops were held in various locations in Colorado to provide assistance to local officials in filling out the forms. Details about these data gathering efforts are provided in Section 2.

Clearly this effort depended on a sense of commitment to floodplain management by local governments. An important measure of this commitment is the community's participation (or non-participation) in the National Flood Insurance Program (NFIP). It has been the position of the CWCB to encourage all Colorado communities with flood hazards to join the NFIP as part of a comprehensive local program to address local floodplain management needs. CWCB has offered staff and technical assistance to Colorado communities that choose not to participate in the NFIP, but the agency has not funded mapping projects or floods hazard mitigation projects in these communities. Consistent with that historic position, CWCB does not anticipate providing a state match in mapping funds for Colorado communities that do not participate in the NFIP. Within the discussion of CWCB rankings of the 64 counties, specific attention is called to the non-participating communities in Colorado (approximately 1/3 of all Colorado communities).

FEMA has charged the states with identifying the top 15% of counties, so that digital floodplain mapping can be pursued in those counties. Utilizing the CWCB methodology, we have identified the top 25% of the 64 counties in Colorado (16 counties) with regard to map update needs. Clearly the top 15% of

# Mapping Plan for Colorado

---

counties will be included within the top 25%. Within the 16 top-ranked counties in Colorado there are non-participating communities that are floodprone. Despite the high floodplain mapping needs ranking of those counties (and, at least by inference, the individual communities within the counties), the CWCB recommends that no Map Modernization funding be expended for those non-participating communities until they join the NFIP. CWCB recommends that digital map panels could be laid out for those communities, but that no effort should be expended to develop actual cartographic or floodplain information on those blank map panels until the communities choose to join the NFIP. Instead, the funds that would have been spent in those communities should be used to improve floodplain maps in communities with a lower mapping needs rank that actively participate in the NFIP. The CWCB believes that the community's position on participating or not participating in the NFIP is a strong indication of that community's likelihood of making good use of improved maps.

### **1.4.3 Principle 3 – This Plan is a Work In Progress**

Due to the short time frame for preparing this plan, there was a limit to the amount of research that could be conducted. To identify local resources, capabilities and needs, the CWCB and its consultants developed a questionnaire and a needs worksheet. To keep those forms easy to use, a number of questions and the level of detail of those questions were kept simple. Much of the data for Colorado in MNUSS is incomplete. Some data, such as the age of maps, is subject to much more interpretation and even disagreement than might be initially apparent.

Some questions that are important to defining mapping needs and prioritizing them statewide could only be answered through generalizations or assumptions:

- Is the age of a map panel based on the date printed, the age of the oldest floodplain information on the panel, or the age of the newest information on the panel?
- Is population or population growth in a community representative of population or population growth in floodprone portions of that community?
- Given the diversity of communities in Colorado (farming, and ranching communities, mining communities, resort communities, front range urban communities, plains, foothills, mountains, valleys) how well do historic mapping costs from a few locations in Colorado represent costs throughout Colorado?
- How will historic costs from relatively small numbers of individual local mapping studies compare with future costs of studies that are part of a large statewide program?

These kinds of questions can only be answered over time. There are not comprehensive and fully accurate answers available at present. The planning work will have to continue into the implementation period of this program.

### **1.4.4 Principle 4 - Need to Maximize Early Success**

The magnitude of the mapping effort nationwide proposed in the President's budget initiative is far beyond the historic floodplain mapping efforts of FEMA and the states in the past 20 years or so. None of the agency personnel or private consultant personnel who will implement the proposed program have significant experience with such a large mapping effort. It is therefore, critical that strategies be developed immediately to maximize the chances of early success. The "best" counties have to be selected for the first year's mapping projects. Counties with high level GIS resources and capabilities that are ready to use right away must be part of the first year's work. Communities with recent or current

# Mapping Plan for Colorado

---

experience preparing digital floodplain maps compatible with FEMA and CWCB technical requirements must be part of the first year. Consultants who have such experience and expertise must perform some of the first year's work. In the case of Colorado, the advantage must be taken of particular assistance that may be available from the Urban Drainage & Flood Control District to make scarce resources go farther in the heavily populated Denver Metro Area.

These and other strategies will be essential to convincing all parties involved, all the way up to the members of Congress who will fund any future work, that funds are being spent wisely and efficiently from the first day.

## **1.4.5 Principle 5 – Unanswered Policy Questions**

This plan has been developed with the assumption that all identifiable floodplain mapping needs should enter into cost estimates. It is very possible, even likely, that the costs developed in this plan exceed the expectations of the local governments, the State of Colorado, FEMA, the President, and Congress. If the costs are higher than anticipated some of the following policy questions, each of which has budgetary implications, will have to be addressed:

- Do all of Colorado's identified floodplain mapping needs have to be addressed by the MMIP budget?
- How many years should it take to fully implement Colorado's MMIP?
- If there will be only partial funding, should all 64 Colorado counties have some of their needs met?
- Should higher priority counties have a higher proportion of their needs met than lower priority counties?
- Should any state or federal funds be spent on MMIP work for communities that choose not to participate in the NFIP?
- How much effort should be spent converting approximate floodplain information from a paper format to a digital format?
- How should "quality" standards be developed and implemented to minimize expenditures of money on conversion of "mediocre" or "low quality" floodplain or base map information?

These questions and other similar questions have to be addressed by FEMA and the CWCB before money is spent making maps.

## **1.4.6 Principle 6 – Scopes of Work for Year 1 and Year 2 Implementation are Important**

Principles 3, 4, and 5 all point to the great importance of the first two years of actually preparing floodplain maps and the importance of developing the Scopes of Work for those two years. The fact that the MMIP is a work in progress, the need for early successes and the need to address unanswered policy questions all mean that the transition from planning to preparing a Scope of Work and implementing it will be a crucial time in this entire program.

FEMA, current CWCB staff and Urban Drainage & Flood Control District staff will all have to assist the future State Floodplain Mapping Coordinator in initiating implementation quickly, thoroughly and efficiently. While there are many parties who have successfully prepared floodplain maps in Colorado before, nobody in Colorado has prepared so many maps in such a short time with such high expectations. Even before the money has been allotted by Congress, it is imperative that all of the parties involved coordinate their efforts. The CWCB proposes to begin coordinating internally, with Urban Drainage &

## Mapping Plan for Colorado

---

Flood Control District staff and with the top ranked 16 counties (and municipalities in those counties) immediately. There is far too much work to do to not start now.

# Mapping Plan for Colorado

---

## 2.0 Overview of CWCB Analysis

The CWCB analysis of Colorado's floodplain mapping needs was based on two data gathering efforts:

- 1) Gathering specific information about the floodplain mapping needs and capabilities of as many of Colorado's 332 communities as possible; and
- 2) Gathering and developing numeric data about each of Colorado's 64 counties, including numeric data about each of the Colorado's 332 communities, to rank the floodplain mapping needs of each county in the state.

CWCB staff and the MMIP consultants, Moser Engineering and PBS&J, developed two forms to gather data about Colorado communities. One form was a survey questionnaire, asking a series of standard questions about each community's map update needs. The other form was a worksheet, asking for specific data regarding the stream reaches within the community and the specific update or new study needs for those stream reaches. Blank copies of these forms were mailed to each of these Colorado's communities. Copies of the mapping needs worksheet and questionnaire are provided in Appendix A-1. In addition, workshops were held in four locations in Colorado to provide direct assistance to attendees in filling out the forms.

The response to the mailings and workshops was as follows:

- 143 of 332 communities responded by filling out at least one of the forms and/or by attending a workshop;
- 34 of 64 counties responded;
- 109 of 268 municipalities responded;
- 141 questionnaires were filled out and entered into the database;
- 130 worksheets were filled out and entered into the database; and
- 83 communities sent officials to attend workshops.

All responses to the questionnaire and the worksheet questions have been entered into a statewide database. A summary of data collected from Colorado Communities is provided in Appendix A-2. This database will be expanded through follow-up efforts by CWCB staff with non-responding communities after the submittal to FEMA of this plan. Using unit costs developed by FEMA, in conjunction with cost data from Colorado floodplain mapping projects, the MMIP consultants estimated the cost of meeting community mapping needs and then aggregated those estimated costs for each of the 64 counties. The estimated total cost of meeting Colorado's identified floodplain mapping needs is \$36 million.

While overall needs and the costs of meeting those needs were being researched, a parallel effort was underway to prioritize the needs of Colorado's 64 counties. The CWCB staff was fully aware of the MNUSS methodology developed by FEMA and its MCC contractors. CWCB recognizes the significant effort that went into developing MNUSS and the value of its ranking capabilities. The CWCB staff felt that it was important to develop a prioritization methodology specific to Colorado and its particular floodplain mapping needs. CWCB staff found that data entered into MNUSS for Colorado was not complete and, therefore, did not provide a fully reliable tool for prioritization in our state. There is clearly overlap between the data analyzed in the CWCB methodology and the data analyzed by MNUSS. Some of the data in the CWCB methodology, however, is unique to Colorado.

# Mapping Plan for Colorado

---

Seven factors were entered into a spreadsheet and analyzed for the prioritization of the Colorado's mapping needs. They are:

1. Population for each county in 2000;
2. A CWCB assessment of overall likelihood of success in floodplain mapping for each county.
3. Population growth for each county from 1990 to 2000, as a percentage;
4. A CWCB assessment of overall flood risk in each county;
5. Average age of current FEMA map panels in each county;
6. Unmapped communities within each county; and
7. Status of each county with regard to wildfire impacts in 2002.

Some of the above factors were based on scores for each separate community, which were then consolidated into county composite scores. Other factors were scored only by county. Weights were assigned to each factor, ranging from the highest weight of 1.75 to the lowest weight of 0.6. Each county was given a total score, with the highest possible score being 40.0 points. The actual county scores ranged from a high score of 35.3 points to a low score of 7.4 points. Details of the county rankings are provided in Section 6.

# Mapping Plan for Colorado

---

## **3.0 Meeting FEMA's Map Modernization Implementation Goals**

In its request to the state for assistance in preparing MMIP documents, FEMA made reference to the three underlying GPRA goals for the Map Modernization effort. Paraphrased, those goals are:

- Reduce the average age of the maps.
- For the highest-ranked 15% counties in each state prepare digital maps.
- Prepare floodplain maps for a significant number of unmapped communities.

CWCB's prioritization methodology has incorporated four parameters (population, population growth, age of maps, and unmapped communities) to address these goals. In addition, CWCB specifically plans to use first-year Map Modernization funding to start preparing digital floodplain information for the top 10 to 16 counties in the state (10 counties = 15% and 16 counties = 25%), based on results of the map need prioritization methodology and dependent on ultimate funding levels and each high priority county's ability to prepare digital maps.

### **3.1 Reducing the Average Age of the Maps**

The oldest FIRMs in Colorado are approximately 25 years old. The CWCB methodology used a scale of 0 to 5 for the priority analysis. New map panels (2002) received 0 points. Map panels from 1 to 5 years old received 1 point, map panels 20 years old and older received 5 points, and so on. Ten of the "top 16" high priority counties in Colorado have an average panel age of 10 years or more. Clearly preparing new digital maps for at least 10 of these counties will greatly reduce the average age of map panels within the state. While the CWCB's primary goal in floodplain mapping is to prepare floodplain maps where they are most needed the goal of reducing map age will inherently be met in the process.

### **3.2 Preparing Maps for Unmapped Communities**

108 communities are deemed "unmapped" by the CWCB. They include communities with flood hazards for which no agency has published floodplain maps (at least to CWCB's knowledge). In addition, they include newly incorporated municipalities for which no specific FIS has ever been prepared but which include areas mapped for the county in which they are located, communities for which have had mapping prepared by other agencies besides FEMA, and communities that the CWCB has deemed not floodprone. Taking all of those factors into account, CWCB developed a methodology that scored communities from 0 to 5 and then provided composite scores for the entire county, including municipalities. Within the top 16 counties there are a total of 18 unmapped communities that are floodprone, out of 108 unmapped and floodprone communities statewide. Ten of the "top 16" counties would make a good initial contribution to the reduction of the backlog of unmapped communities in Colorado.

### **3.3 Preparing Digital Maps for the Top-Ranked Counties**

CWCB specifically plans to use first-year Map Modernization funds to initiate digital mapping in at least 10 of the "top 16 counties". Those 16 counties, as determined by the CWCB prioritization methodology, represent the top 25% of 64 Colorado counties. Within 8 of the 16 counties there are already digital floodplain mapping projects underway. Six of those eight counties are within the Urban Drainage & Flood District and are working cooperatively with the District (and with FEMA) to prepare digital floodplain maps. Communities within several of the other counties have Geographic Information Systems (GIS) in place or under development that would lend themselves to digital floodplain mapping. CWCB will strongly encourage all new floodplain mapping to be prepared digitally from their inception. Counties that do not wish to pursue digital mapping may very well be bypassed by CWCB with counties wanting digital mapping moving up in priority.

# Mapping Plan for Colorado

---

## **4.0 Meeting Colorado's Goals for Floodplain Mapping**

The CWCB staff and the MMIP consultants developed a methodology for prioritizing floodplain mapping needs for the 64 counties, taking account of the factors that are important to Colorado, in addition to the FEMA goals discussed above. Three of the seven prioritization parameters were developed with concerns specific to Colorado in mind.

### **4.1 Likelihood of Mapping Success**

The CWCB believes that it is important to start Colorado's Map Modernization effort in communities where the likelihood of success is the highest. That means working in counties where it is most likely that the maps will be of high quality. The MMIP surveys asked communities to indicate whether they believed there would be local financial support for floodplain mapping. Factors like the answers to that question, filling out the questionnaires and/or attending the MMIP workshops, past history in preparing floodplain maps and using them, and CWCB and Urban Drainage & Flood Control District knowledge of local GIS resources and capabilities all entered into the CWCB rating of each county's likelihood of success. Scores ranged from 1 to 5. Within the "top 16 counties", four received scores of 4 or higher and an additional two, received scores of 3.5. CWCB staff expects those communities to participate actively in ensuring high quality floodplain maps.

### **4.2 CWCB Rating of Flood Risk**

Long-time floodplain managers in Colorado know right away what the years 1921, 1935, 1957, 1965, 1976, 1982, 1984, 1997 and 1999 mean. They refer to flood disasters such as "the '65 flood", the Big Thompson Flood, the Lawn Lake Flood, and the Fort Collins Spring Creek Flood. They mean severe loss of life and great property damage. The CWCB staff developed a risk rating that considers the possibility of property damage and loss of life, due both to existing development and to types of flooding historically experienced in each community. The rating considered past disasters, including those that resulted in Presidential Disaster Declarations. Unique hazards, such as erosion, debris flows, and ice jams, were also considered.

Each community in Colorado (332 total communities) received a score from 0 (not floodprone) to 5 (highest flood hazard risk) from each of three CWCB staff members. Those three scores were averaged for each community. Then, composite scores were developed for each of the 64 counties. The highest composite score for any county was 5 and the lowest composite score was 1.7 (average of 3 scores). Of the "top 16 counties", nine had composite hazard risk ratings of 4 or higher. Utilizing the CWCB methodology will help identify serious flood hazards in Colorado.

### **4.3 Wildfire Impacts**

Coloradans will remember the year 2002 as a year of drought and wildfires. Out of the 64 counties in the state, eleven experienced serious wildfires. Some fires are still burning as this report is completed. As the Buffalo Creek fire and flood of 1996 demonstrated, floods in watersheds that have experienced fires can be far more severe than floods in similar watersheds unaffected by fires. While CWCB staff and the MMIP consultants were preparing the state's mapping plan, professional hydrologists, engineers, and geologists from the USGS had begun preparing flood hazard (and related debris hazard) maps for selected burn area watersheds in Colorado. The USGS has no specific plans to integrate these maps into the county FIS' for those particular counties. The CWCB specifically expects to pursue that integration. Those eleven counties face specific flood hazards that are different from, and in many respects more dangerous than the hazards facing the other 53 counties in Colorado.

## Mapping Plan for Colorado

---

CWCB staff simply assigned 5 points to the eleven fire impacted counties and 0 points to all of the other counties. No scores were assigned to individual communities within those counties. Six of the “top 16 counties” are fire-impacted counties. Three more fire-impacted counties are included within the next 16 (2<sup>nd</sup> Priority tier) counties. Because the threat to life and property of repeating the 1996 Buffalo Creek scenario in any of these eleven counties is so great, this parameter is viewed as essential to the CWCB methodology. It is imperative that all fire-related flood threats be identified as accurately and as quickly as possible.

# Mapping Plan for Colorado

## 5.0 Collection of Community Data

The CWCB felt that it was important for Colorado communities to participate directly in identifying their own floodplain mapping needs rather than simply relying on data available at the state or federal level. To accomplish local participation, CWCB staff and the MMIP consultants developed the Community Questionnaire and the Mapping Needs Worksheet. A blank version of each is provided in Appendix A-1. In addition, the instructions that were given to community officials and the sample information to help in filling out the worksheets are included in the Appendix. A detailed transmittal memorandum also included in the Appendix, accompanied the mailing to each of Colorado's 332 communities.

CWCB staff believed that it would be helpful to communities to hold workshops at which staff members and consultant staff would be available to explain the purpose of Colorado's MMIP and the need for the data in the two forms and to provide direct assistance in filling out the forms. The dates and locations of the workshops are listed below:

- Monday, June 10, 2002 - Greeley (Northeastern Colorado)
- Tuesday, June 11, 2002 - Pueblo (Southeastern Colorado)
- Wednesday, June 12, 2002 - Parker (Denver Metro area)
- Monday, June 17, 2002 - Glenwood Springs (Western Colorado)

Appendix A-1 provides a table listing all 332 communities in Colorado, arranged alphabetically by county, and shows whether they were represented at a workshop, whether they filled out a questionnaire, and whether they filled out a worksheet.

The participation rates for the three activities are shown below. 189 communities out of the 332 in the state did not participate at all. Follow-up contacts by the CWCB will continue in an effort to raise the rate of participation.

**Table 5.1 - Community Participation**

Activity	# of Communities Participating	# of Communities Not Participating
Attended Workshop	83	249
Completed Questionnaire	141	191
Completed Worksheet	130	202

*Note: There are 332 total communities in Colorado*

Once the questionnaires and worksheets had been collected by the MMIP consultants, the results were entered into a database. Summaries were prepared for each of the responding communities. Those summaries were aggregated by community and county in Appendix A-2.

# Mapping Plan for Colorado

---

## 6.0 *Prioritization of Community Mapping Needs Statewide*

While the collection of information about mapping needs for individual communities, as described above, is valuable, it does not provide a way to properly allocate the funds to meet those needs over a multi-year program. There is simply not enough money to meet all of Colorado’s floodplain mapping in one year. The total needs of the state have to be prioritized, with the highest priority needs being addressed in the first year, and lower ranked needs being addressed in future years. The methodology developed by CWCB staff and the MMIP consultants was described in general terms earlier in this report. The description below provides technical details of the prioritization methodology, starting first with the seven individual parameters and then describing the procedures for assigning weights to the individual parameters.

### 6.1 *Population in 2000*

Using the website of the Colorado Department of Local Affairs (DOLA), the population of each county in Colorado according to the 2000 US Census was entered into the database. Because of the diversity of counties in Colorado, from small mining and agricultural counties to the City and County of Denver in the heart of the state’s biggest metropolitan area, there was a very large range. The smallest counties had total populations less than 1000. Denver has a population of over 500,000. Table 1 in Appendix B-2 shows populations for the 64 counties.

To simplify the scoring procedure, the population figures for the counties were divided into ranges and assigned values from 1 for the smallest counties to 5 for the largest counties. Table 6.1 below shows those “standardized values” and the population ranges they represent.

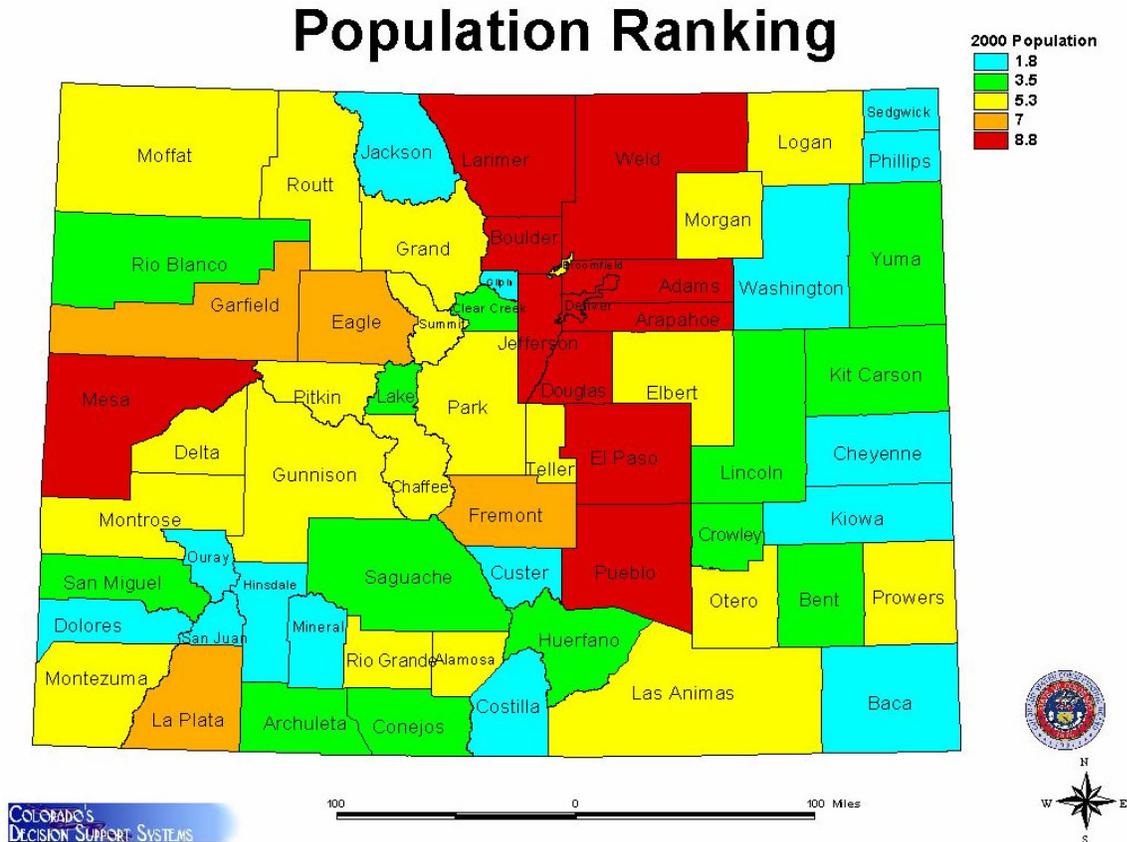
**Table 6.1 – Population Ranking**

Population	Standardized Value	Number of Counties
Less than 5000	1	15
5000 to 9,999	2	13
10,000 to 39,999	3	21
40,000 to 99,999	4	4
Greater than 100,000	5	11

This parameter was deemed to be important assuming that flood risks effect more people and, therefore, more structures, in communities with greater populations. This parameter was viewed by the CWCB and the MMIP consultants as the single most important parameter in determining the need for floodplain mapping. Figure 2 illustrates the population in each county in Colorado.

# Mapping Plan for Colorado

Figure 2



Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.

### 6.2 Likelihood of Floodplain Mapping Success

The CWCB is aware that there are many parties interested in the success that the Map Modernization effort will enjoy once it actually begins. It is important to have the first year or two of the effort be as successful as possible. Much of the “likelihood of success” is dependent on the capabilities and commitment of the involved local governments. Local GIS’ efforts will play a large part in preparing floodplain maps. Local funding will be required. Any pertinent data in the hands of local officials can help. Once the maps have been prepared, local traditions and political support with regard to floodplain management will determine how well the maps are used. CWCB has been working with Colorado communities and their floodplain managers for a very long time. The CWCB staff feels that this experience in working with local governments’ and their cooperation and commitment to the NFIP should be reflected in the prioritization. This parameter was deemed the second most important parameter for prioritizing counties’ floodplain mapping needs.

CWCB staff scored communities individually. Communities that were represented at the workshops and/or filled out questionnaires and/or worksheets were automatically given a score of at least 3 points out of 5. After all communities were scored, countywide composite scores were assigned. Because scores were averaged between two CWCB staff members, scores of 1.5, 2.5, 3.5, or 4.5 were possible. The Table below shows the number of communities receiving various scores.

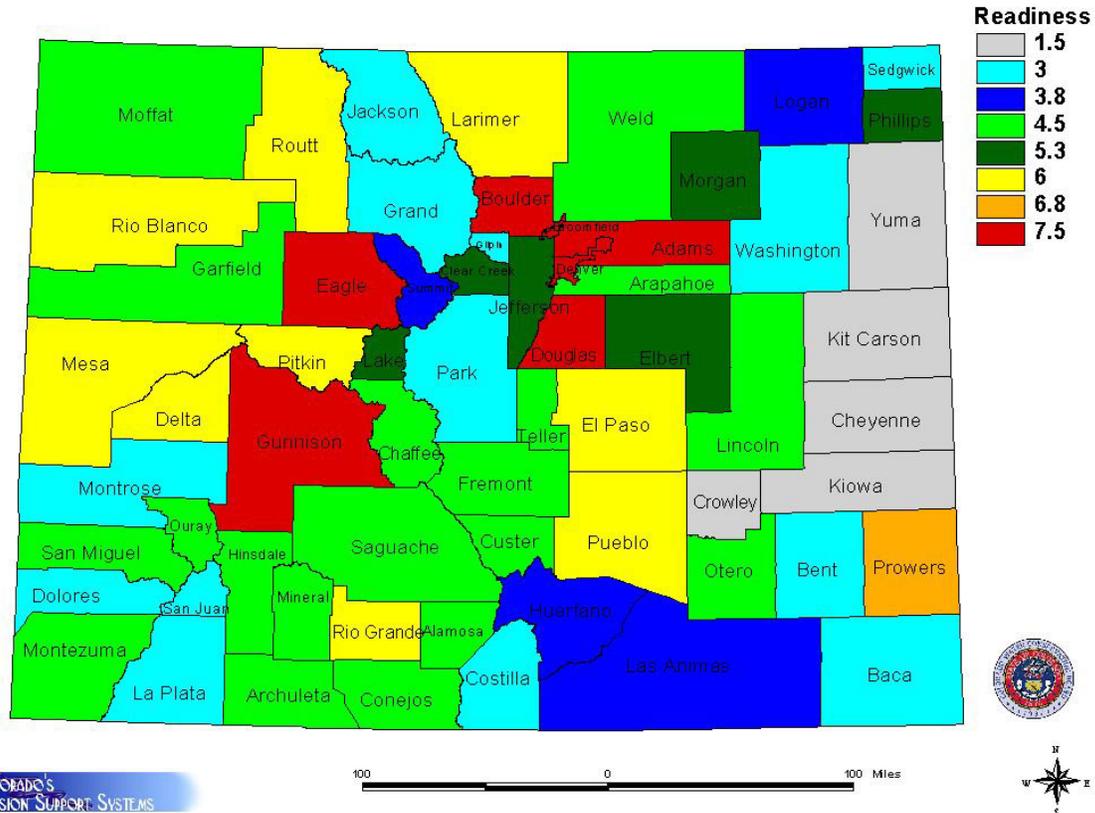
# Mapping Plan for Colorado

**Table 6.2 – Likelihood of Success Ranking**

Standardized Value	Number of Counties
1	5
1.5	-
2	13
2.5	4
3	19
3.5	6
4	9
4.5	1
5	7

Four of the counties in the “top 16” list of counties received scores of 4 or 5 for this parameter. Two or more of the counties received scores of 3.5. For the other four “top 16 counties”, special effort will be expended to ensure the greatest success possible. Figure 3 below, illustrates CWCB’s scoring relative to county readiness and likelihood of success of flooding mapping efforts in each of Colorado’s 64 counties.

**Figure 3  
Readiness and Likelihood of Success**



*Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.*

# Mapping Plan for Colorado

## 6.3 Population Growth from 1990 to 2000

The third most important parameter in terms of determining the need for floodplain mapping was population growth, as measured in terms of percentage growth from the 1990 Census to the 2000 Census. Rapidly growing counties were viewed as facing development pressure, including pressure on their floodprone areas. They were viewed as having already experience pressure on those lands in the 10-year measurement period, and as being likely to continue experiencing such pressure. Several Colorado counties are among the most rapidly growing counties in the country in terms of rate of population growth, with Douglas County sometimes being ranked as the fastest growing county in the entire country. On the other hand, some rural Colorado counties are experiencing declines in their population. The range of growth rates went from -25.1% (a decline) to 191.0%. Table 2 in Appendix B-2 shows the growth rate for all 64 Colorado counties.

Again, CWCB staff felt that standardized scores provided the best way to compare counties to one another. Because some counties have negative values for population growth rate, it was decided to have a range of standardized values from 0 to 5, with 0 representing no growth or negative growth. Table 6.3 shows the “standardized scores” the growth rate ranges they represent and Figure 4 illustrates population growth for Colorado countries.

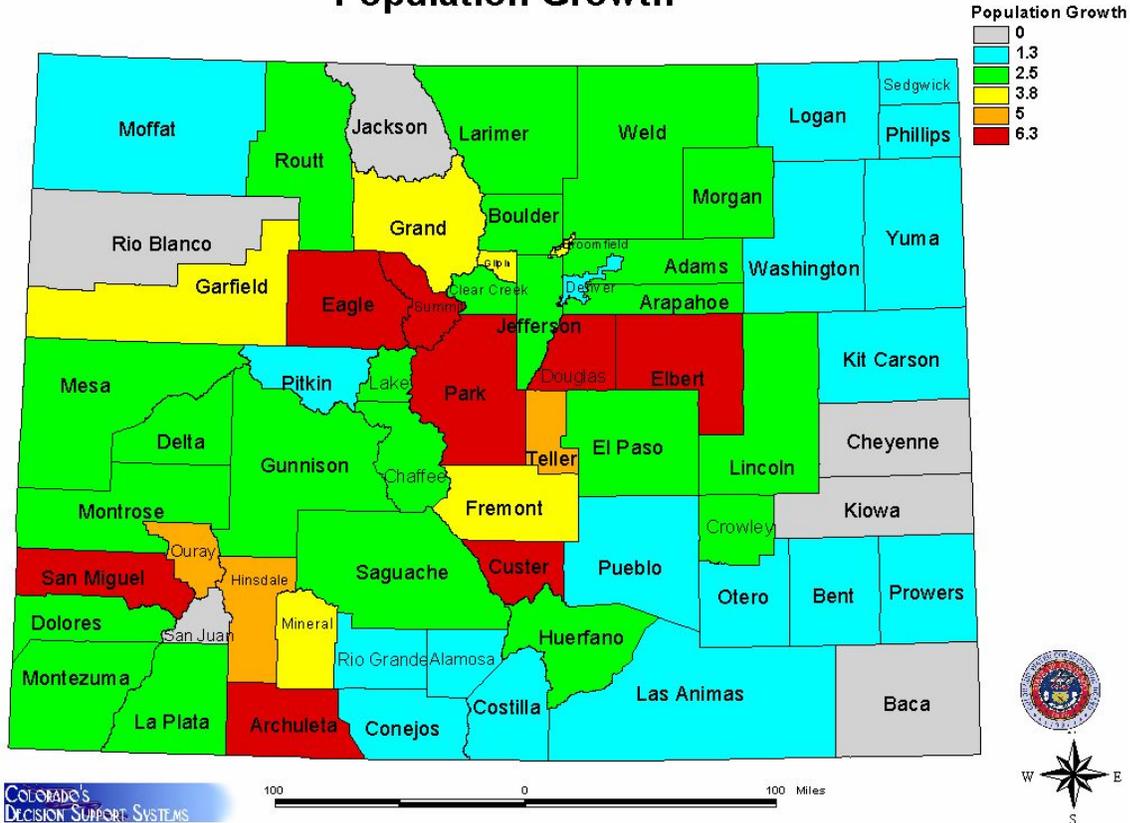
**Table 6.3 – Population Growth Ranking**

Range of Population Growth Rates	Standardized Value	Number of Counties
0% or less	0	6
0.1% to 20.0%	1	18
20.1% to 40.0%	2	23
40.01% to 60.0%	3	6
60.01% to 80.0%	4	3
Greater than 80.0%	5	8

# Mapping Plan for Colorado

Figure 4

## Population Growth



Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.

### 6.4 CWCB Evaluation of Flood Hazard Risk

This parameter attempts to address the question, “Which counties face the greatest likelihood of loss of life and damage to property due to flood hazards?” Two of the three CWCB staff members who scored the 332 individual communities for this parameter have worked for the CWCB for more than 20 years. They have seen Presidential Disaster Declarations in 1982, 1984, 1997 and 1999. The third staff member witnessed the Buffalo Creek flood and the two most recent Presidential Disasters. All three have traveled throughout Colorado and met with officials from many local governments. They have helped develop floodplain maps and flood hazard mitigation plans and projects for numerous communities. They have also witnessed severe erosion and channel migration, debris flows, and ice jam floods. With that experience, staff felt that they were very well qualified to assign scores from 0 to 5 for the flood hazard risk faced by each community in Colorado. Communities deemed by the CWCB to have no flood hazard (not floodprone) were assigned a score of 0. The communities in Colorado facing the greatest danger with regard to flood hazard risk were assigned a score of 5.

# Mapping Plan for Colorado

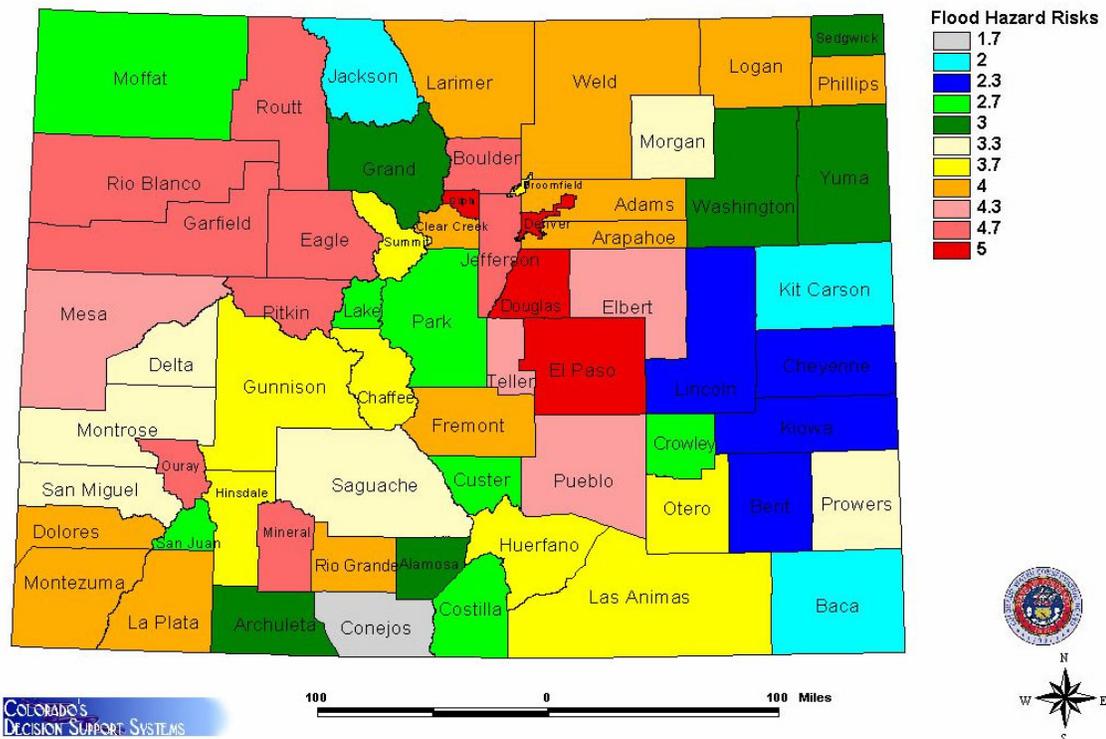
After CWCB staff had assigned scores to all of the individual communities in the state, composite scores were assigned to each of the 64 counties, taking into account the relative significance of the hazard in each community within a county in the big picture for that county. Table 6.4 below summarizes the composite scores assigned to the 64 counties. Figure 5 provides a graphical illustration of flood risks throughout Colorado.

**Table 6.4 – Summarization of Composite Scores**

CWCB Flood Hazard Risk Value (County Composite Score)	No. of Communities
0 to 1.0	-
1.0 to 1.9	1
2.0 to 2.9	14
3.0 to 3.9	21
4.0 to 4.9	24
5.0	4

**Figure 5**

## Flood Hazard Risks



*Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.*

# Mapping Plan for Colorado

## 6.5 Age of Maps

FEMA has made it clear to the states that “reducing the age of the maps” is extremely important. CWCB has taken note of FEMA’s desire. A few comments are in order, however. It is not as easy as it seems to determine the age of every map panel. Some panels include information for many flood sources, some of which were mapped at different times. If Letters of Map Revision (LOMR’s) have been issued but not physically revised, then the information on file is newer than the date the printed map would indicate. FEMA should take due note of the very approximate nature of the map age date in its database and not grant more credibility to these data than is warranted. In addition, the “reduction” in age that might be assigned to a map update project may also misrepresent the magnitude and the value of the project. Knowing that, Congress will be watching all 50 states and FEMA, we understand the reasons for using this parameter. We are concerned that users of the information may misinterpret what has been accomplished. Colorado is committed to making sure the “newer” maps are truly newer than those they will replace.

Because counties include communities that have their own map panels, CWCB directed the MMIP consultants to calculate a weighted average panel age for each county. The number of panels of any age anywhere in the county was multiplied by that age. The numbers were added up and an average countywide age was calculated. Communities with more panels played a more significant part in determining that age than communities with less panels.

The oldest map panels in Colorado are approximately 25 years old (prepared about 1977), according to FEMA’s database. The newest map panels are dated 2002. Again, standardized scores were assigned. Brand new panels (those prepared in 2002) were assigned a score of 0. Communities with no map panels were also assigned a score of 0, with the reasoning that they have no old panels and they are already getting points for being unmapped. The panels prepared in the last five years were assigned a score of 1. Panels prepared over 20 years ago were assigned a score of 5. The results of the scoring are summarized in the table below.

**Table 6.5 – Age of Maps Ranking**

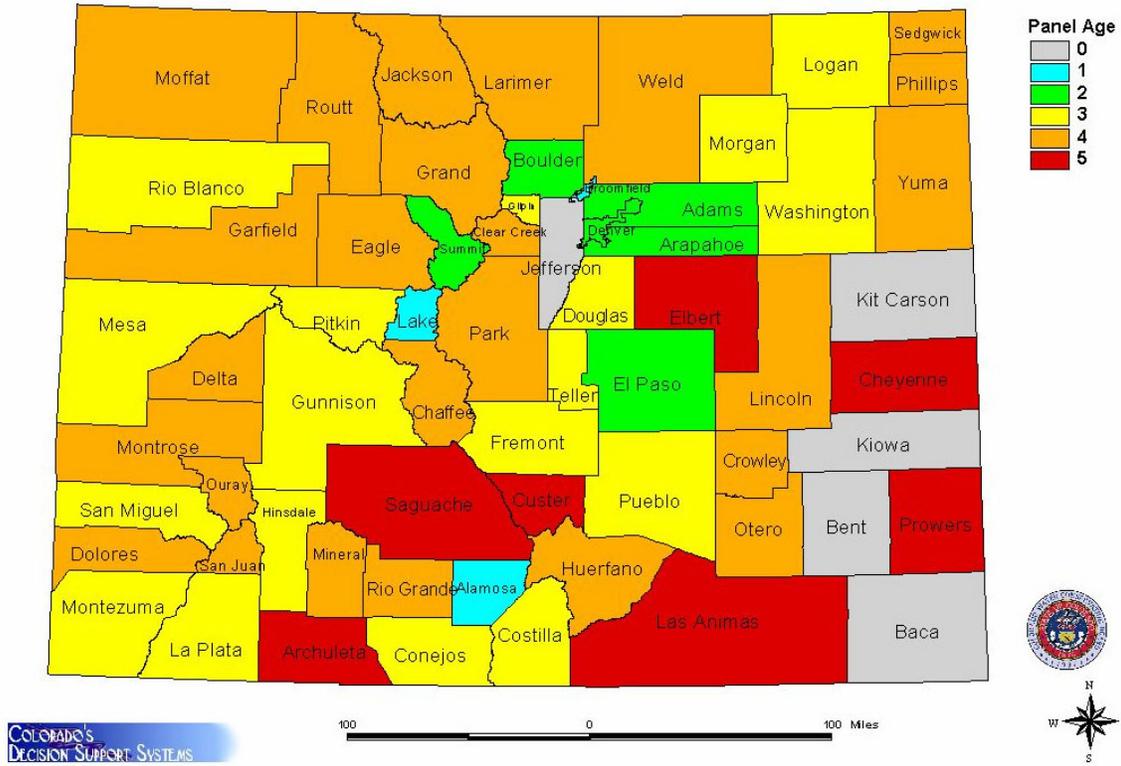
Range of Map Panel Ages	Standardized Value	Number of Counties
Brand new maps or no maps	0	4
1 to 5 years old	1	3
6 to 10 years old	2	6
11 to 15 years old	3	19
16 to 20 years old	4	25
Over 20 years old	5	7

Clearly it will be important to FEMA and to Congress to show progress by updating this parameter in their database as new maps are actually prepared. Figure 6 illustrates average FIRM panel age in Colorado counties.

# Mapping Plan for Colorado

Figure 6

## Panel Age



Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.

### 6.6 Unmapped Communities

FEMA also made a point of emphasizing the importance of mapping floodplains in unmapped communities that are floodprone. There is some question about what constitutes an unmapped community. In particular, FEMA has decided that communities with D-zone maps (“areas of possible but undetermined flood hazard”) are mapped. The CWCB disagrees with that assessment. A D-zone designation provides absolutely no useful information to anyone trying to assess the nature of the flood hazard, because there is no quantification of flood elevations and no floodplain limits on a map to guide a person reading the map. In addition to the D-zone question, there may be a question in the minds of some whether a community that has been mapped by parties other than FEMA is unmapped. The CWCB’s definition of an unmapped community is a community that has no map published by FEMA that shows either approximate or detailed floodplain delineations.

CWCB used a numerical score to define a community’s unmapped status. Communities with no flood hazard were given a score of 0. Communities with a current published FEMA map showing floodplain delineations were also given a score of 0. Communities evaluated by CWCB as needing a limited detailed study (detailed hydrology, limited topography, and limited hydraulics) were given a score of 2. Communities for which CWCB recommended the use of a FEMA map for another community (e.g. a

## Mapping Plan for Colorado

---

county map for a newly incorporated municipality that has no FIS in its own name) or where CWCB recommended the use of a non-FEMA map were assigned a score of 4. Communities for which a new detailed FEMA study is needed were assigned a score of 5. No scores of 1 or 3 were assigned to any communities. Table 6.6 below shows how many communities fell into each of the scoring categories.

**Table 6.6 – Unmapped Communities Ranking (Communities)**

Characteristics of Mapping Recommended by CWCB	Standardized Value	Number of Communities
No flood hazard or community already mapped	0	248
Recommend limited detailed map	2	59
Recommend use of map from other community or use of non-FEMA map	4	14
Recommend new FEMA detailed study	5	11

Once the individual communities had been scored, composite scores were assigned to each county. Those scores ranged from 0 to 5, including 1 and 3. The results are summarized in Table 6.6b below.

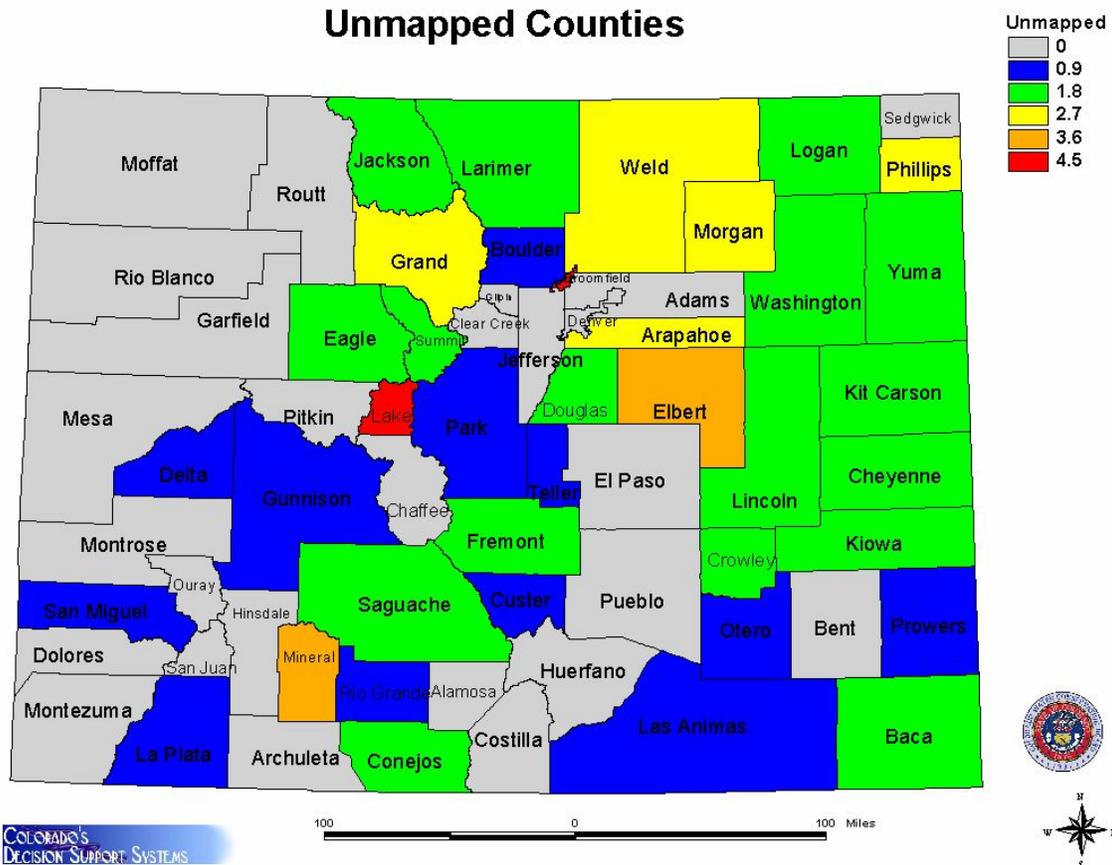
**Table 6.6b – Unmapped Communities Ranking (Counties)**

Standardized Value	Number of Counties
0	26
1	12
2	17
3	5
4	2
5	2

Table 6.6b shows that more than half of the counties in the state are already substantially mapped, and that a limited number of counties have a significant need for new maps. However, a significant number of individual communities need floodplain maps. The ranking scores relative to “unmapped communities” is illustrated in Figure 7.

# Mapping Plan for Colorado

Figure 7



Note: The above scores are weighted. Weighting of individual parameters is explained on pages 25 & 26.

## 6.7 Wildfire Impacts

2002 was a devastating year in Colorado with regard to wildfires, as it was in other western states. Unfortunately, the impacts of wildfires are not over once the fires have been extinguished. In 1996, Jefferson County, Colorado learned that painful lesson with a deadly flood approximately two months after the Buffalo Creek fire was put out. Hydrophobic (water-repelling) soils left behind by intense fire, sticks and stumps instead of green forest, and sterilized growing conditions limiting revegetation success all conspire to make watershed hydrology change radically. The Buffalo Creek watershed experienced flood flows 5 to 30 times the published FEMA 100-year flows from rains on the order of 2 to 5 inches in a few hours. Buildings outside the 100-year mapped floodplain were damaged or destroyed. The fires of 2002 have already produced frightening events in several counties, as a result of rather modest rainstorms in most cases.

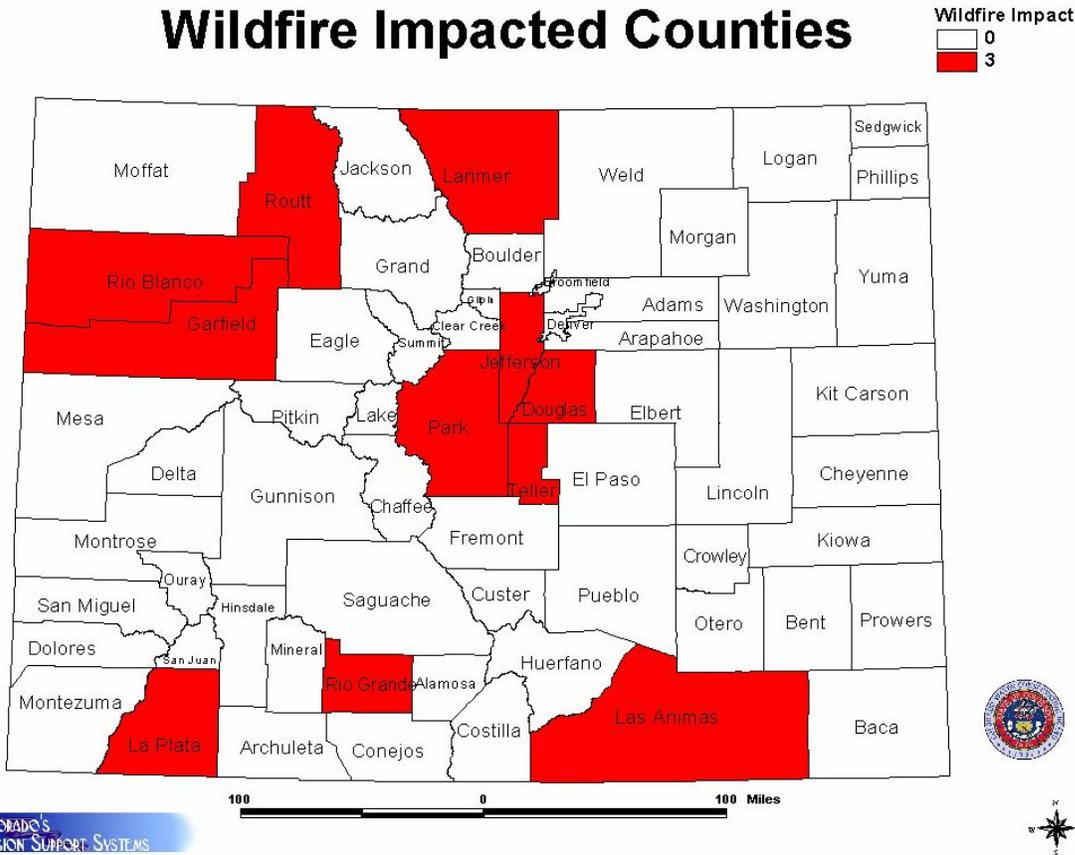
Recognizing the threat, an effort to map flood hazards at selected sites in Colorado has begun. The USGS is preparing these maps in cooperation with the Bureau of Reclamation. While the CWCB is aware of these efforts and speaking with the scientists who are preparing the maps, they are not ready at this point. In addition, the CWCB has been told that these maps will not be integrated into the countywide FIS' for those counties, at least not by the USGS. It is critical that this information be incorporated into the FIS

# Mapping Plan for Colorado

for the fire affected counties. The CWCB has taken note of eleven of the 64 counties in Colorado where fires have severely affected watersheds. This is such a serious matter in the eyes of the CWCB that those counties have been assigned points in the scoring methodology. Counties with fire impacts in 2002 received scores of 5, while those with no fire impacts received scores of 0. Six of the fire-impacted counties are in the “top 16 counties” list, in part as a result of this parameter. Figure 8 shows Colorado Counties impacted by significant fires in 2002.

Figure 8

## Wildfire Impacted Counties



Note: The above scores are weighted. Weighting of individual parameters is explained below.

### 6.8 Assigning Weights to Individual Parameters

For all seven parameters scores of 0 to 5 or of 1 to 5 were assigned to each county. CWCB staff determined that the parameters were not all of equal importance. It was decided that no parameter should have a weight greater than 2.0 or a weight less than 0.5. Three parameters, population, CWCB rating of likelihood of success, and population growth, were deemed from the beginning to be more important than any other parameters. Two parameters, unmapped status and wildfire impacts, were deemed to be less important than any other parameters. That left two parameters in the middle of the weighting scale. Those two parameters are CWCB risk rating and age of maps.

# Mapping Plan for Colorado

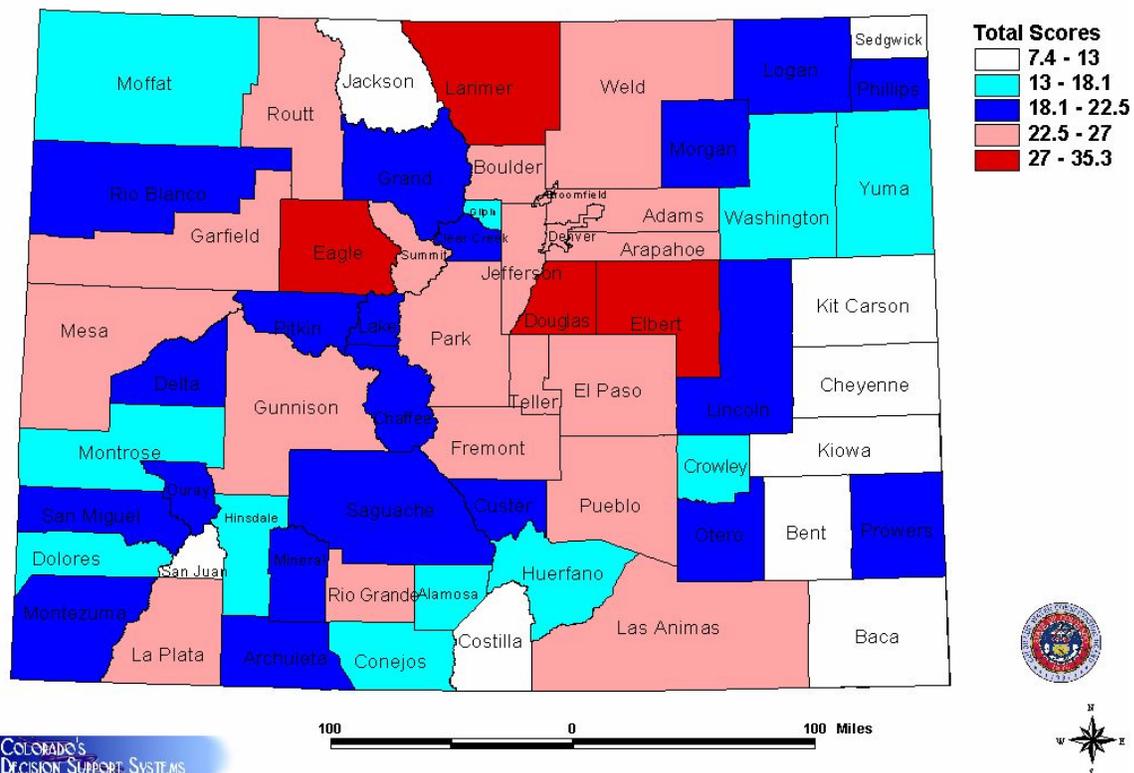
The weights ultimately selected by CWCB staff are listed in Table 6.7 below. Composite priority scores for each of Colorado's 64 counties are illustrated in Figure 9.

**Table 6.7 – Weighting Factors for Prioritization Parameters**

Parameter	Weight
Population in 2000	1.75
CWCB rating of likelihood of success	1.5
% Population growth from 1990 to 2000	1.25
CWCB rating of flood hazard risk	1.0
Age of map panels	1.0
Unmapped communities	0.9
Wildfire Impacts	0.6

**Figure 9**

## Total Scores



# Mapping Plan for Colorado

---

## 7.0 Results of CWCB Prioritization Process

The lowest possible total score for a county was 3.3 and the highest possible score was 40.0. The lowest actual score was 7.4 and the highest actual score 35.3. The scores are broken down in the table below in ranges of approximately 5 points (10 points or less, 10 to 15 points, 15 to 20 points, and so on).

**Table 7.1 – CWCB Prioritization Score Ranges**

Range of Total Scores	Number of Counties
Less than 10.0	2
10.0 to 14.9	8
15.0 to 19.9	17
20.0 to 24.9	26
25.0 to 29.9	8
30.0 or more	3

The top ranked 16 counties, representing 25% of the total, are listed below, along with the total number of points awarded.

**Table 7.2 – Top Ranked County Scores**

Rank	County Name	Total Points
1	Douglas	35.3
2	Eagle	31.3
3	Larimer	30.1
4	Elbert	29.7
5	Garfield	27.0
6	Weld	26.5
7	Boulder	26.4
8	Teller	26.0
9	Broomfield (City & County)	25.7
10	Routt	25.5
11	Park	25.1
12	Adams	24.8
13*	Denver (City and County)	24.5
13*	Arapahoe	24.5
13*	Mesa	24.5
16	Rio Grande	24.4

\* Tied

Results for all 64 counties, including scores for each individual parameter are presented in Appendix B-1.

# Mapping Plan for Colorado

---

## **8.0 Cooperation With the Urban Drainage & Flood Control District**

Of the “top 16 counties” in the CWCB rankings, 7 are within the Urban Drainage & Flood Control District. The District is already a Cooperating Technical Partner (CTP) with FEMA, party to an agreement that has facilitated the processing of LOMCs in the Denver metropolitan area. The District and some of its member communities have also initiated pilot projects to prepare updated FIRMS in the City and County of Broomfield and Douglas County. The District provides equipment (computers and software), staff expertise, and funds that greatly enhance the ability of those local governments to prepare first-rate floodplain mapping.

The seven counties in the District include two counties that are entirely within its jurisdiction (Broomfield and Denver) and five counties that are partially within its jurisdiction (Adams, Arapahoe, Boulder, Douglas, and Jefferson). CWCB staff has already proposed to UD&FCD staff that the District might manage the preparation of DFIRMS for the entire county of those five counties, not just the portions within the District. The UD&FCD staff expressed interest in serving that study manager function. The District is an experienced CTP entity and the staff at the District already has a working relationship with local floodplain managers for the five counties (in addition to Broomfield and Denver). Those factors put Colorado in an enviable position of having a state agency that is a CTP and another entity that is a CTP, both of which are interested in participating actively in the preparation of high quality floodplain mapping that serves local, regional, state and federal needs. In fact, the District is already doing some of this work. District staff and consultants have perhaps the greatest degree of experience in Colorado (and some of the greatest degree of experience in the country) in doing precisely what the Map Modernization program developed by FEMA calls for.

With District participation, the CWCB is confident that the first year Map Modernization effort in Colorado will have a significantly greater chance of success. All of the counties in the District’s boundaries have high quality GIS and staff. Two counties are actively preparing new GIS floodplain maps in cooperation with the District, before the Map Modernization effort has even begun. Approximately half of the population of Colorado lives within the District’s boundaries and would benefit directly from this proposed partnership. In addition, if the District is willing to take on the management function for the non-District portions of the five counties mentioned above, a very large part of the management of Colorado Map Modernization effort could be undertaken by an entity other than CWCB. That partnership would greatly enhance CWCB capabilities.

# Mapping Plan for Colorado

---

## 9.0 Overall Colorado Recommendations

The CWCB believes that addressing all of the mapping needs identified in this plan will take at least 6 years. The number of years it takes to meet Colorado's floodplain mapping needs will depend on the following factors:

- The difference between the estimated costs of mapping contained in this report and the actual costs;
- The policy decisions made about which stream reaches to map, which map panels to update, and which stream reaches and map panels to leave alone within any given county (how complete does the mapping for any county have to be);
- The policy decisions made about mapping every county in Colorado vs. mapping only higher priority counties; and
- The policy decisions made about mapping floodplains for communities not participating in the NFIP.

This report presents a complete picture of floodplain mapping needs in Colorado, assuming that all identified needs would be addressed. The following overall recommendations are made with that assumption in mind, while recognizing that some very important budgetary and policy questions are still to be resolved.

CWCB staff has set a tentative goal of beginning to prepare FIS' for 10 counties out of the top 16 in the first year of Map Modernization funding. The "top 16 counties" would all be equal candidates for first-year work. The CWCB and the Urban Drainage & Flood Control District would select the 10 counties out of that pool of potential candidates with the greatest likelihood of success, based on funding, GIS base map and topographic map availability, staff commitment and similar factors. Those counties out of that pool of 16 counties for which mapping was not started in the first year would become part of the pool of 16 candidates for the second year and so on.

With that kind of management strategy in mind, the overall recommendations presented below are divided into four groups of 16 counties. This does not mean that the CWCB proposes a four-year program. In fact we believe it will take longer than four years to meet Colorado's mapping needs. Instead, the recommendations provided below simply provide four distinct pools of candidate counties, ranging from the highest priority counties to the lowest priority counties, as measured by the CWCB methodology.

### 9.1 First Priority Counties

The 16 "first priority" counties are those counties that received the highest scores from the CWCB prioritization methodology. Some characteristics that many of these counties share in common are:

- Large population
- Rapid growth
- A history of severe floods
- Impacts to watersheds due to the wildfires of 2002

The CWCB is confident that from this pool of 16 counties, a group of 10 counties can be selected that will provide Colorado with a good first-year start to Map Modernization. First priority counties are listed in Table 9.1 and shown in Top Ranked Counties, Figure 10.

# Mapping Plan for Colorado

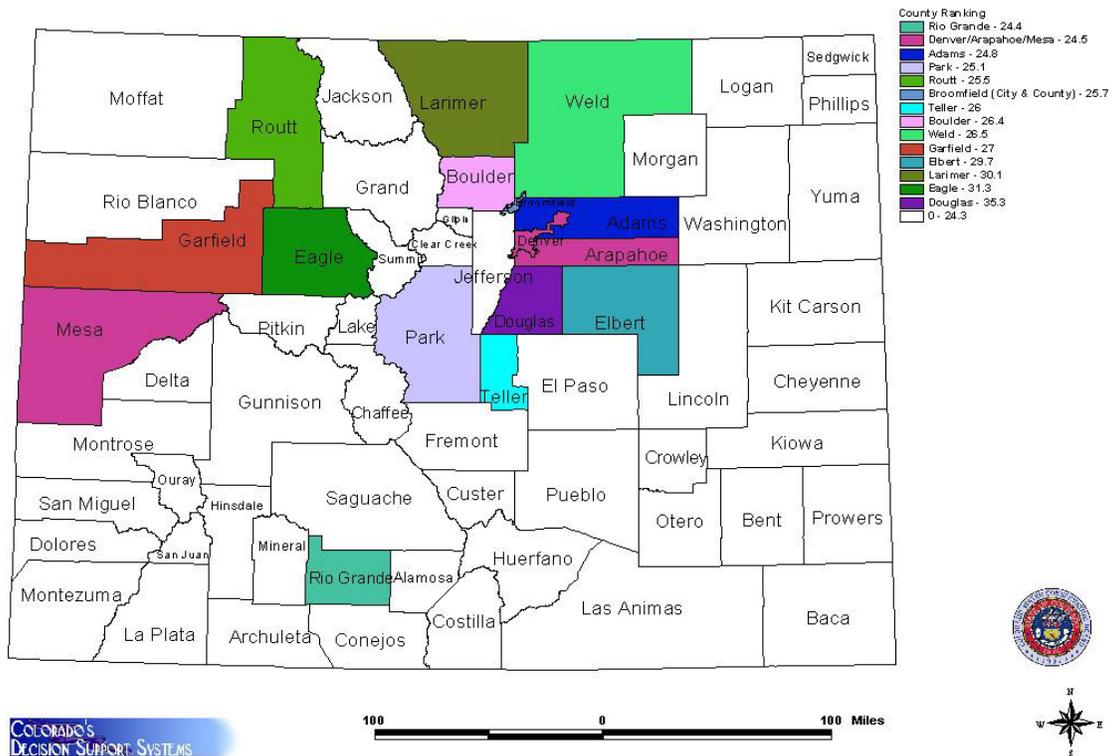
**Table 9.1 - 1<sup>st</sup> Priority Counties  
(25% of total)**

Rank	County Name
1	Douglas
2	Eagle
3	Larimer
4	Elbert
5	Garfield
6	Weld
7	Boulder
8	Teller
9	Broomfield (City & County)
10	Routt
11	Park
12	Adams
13*	Denver (City and County)
13*	Arapahoe
13*	Mesa
16	Rio Grande

\* Tied

**Figure 10**

## Top Ranked Counties



# Mapping Plan for Colorado

---

## 9.2 Second Priority Counties

The 16 “second priority” counties received scores from the CWCB prioritization methodology that ranged from 23.8 to 21.1 out of a possible total of 40.0. The list includes some large population counties, some rapid growth counties, some counties that have experienced flood disasters, and some counties that have been impacted by wildfires in 2002. However, they do not share these attributes to as high a degree as the first priority counties. The CWCB proposes to continue working with these counties after this plan has been submitted to FEMA, in order to prepare for the mapping work of the second and third years. Some of these counties have floodplain mapping projects underway that should be ready in the next two or three years for incorporation into a countywide FIS.

**Table 9.2 - 2<sup>nd</sup> Priority Counties  
(25% of total)**

Rank	County Name
17	El Paso
17	Jefferson
19	Fremont
20	La Plata
21	Pueblo
22	Gunnison
22	Las Animas
24	Summit
25	Prowers
26	Mineral
26	Archuleta
28	Morgan
28	Delta
30	Grand
31	San Miguel
32	Custer

## 9.3 Third Priority Counties

The 16 “third priority” counties received scores from the CWCB prioritization methodology that ranged from 20.6 to 17.5 out of a possible total of 40.0. The list includes some large population counties, some rapid growth counties, some counties that have experienced flood disasters, and some counties that have been impacted by wildfires in 2002. However, they do not share these attributes to as high a degree as the first and second priority counties. The CWCB proposes to continue working with these counties after this plan has been submitted to FEMA, in order to prepare for the mapping work of the third and fourth years. Some of these counties have floodplain mapping projects underway that should be ready in subsequent years for incorporation into a countywide FIS.

# Mapping Plan for Colorado

---

**Table 9.3 - 3<sup>rd</sup> Priority Counties  
(25% of total)**

Rank	County Name
33	Saguache
34	Rio Blanco
34	Pitkin
36	Ouray
36	Chaffee
38	Otero
39	Lake
40	Clear Creek
40	Montezuma
42	Logan
43	Phillips
44	Lincoln
45	Montrose
46	Hinsdale
47	Moffat
48	Huerfano

## **9.4 Fourth Priority Counties**

The 16 “fourth priority” counties received scores from the CWCB prioritization methodology that ranged from 16.5 to 7.4 out of a possible total of 40.0. This list includes mostly low population and low population growth counties. There are also counties that do not have any existing floodplain panels. The CWCB proposed to work with these counties, after this plan has been submitted to FEMA, to prepare for mapping work in the fourth year.

**Table 9.4 – 4<sup>th</sup> Priority Counties  
(25% of total)**

Rank	County Name
49	Gilpin
50	Crowley
51	Conejos
52	Dolores
53	Yuma
54	Alamosa
55	Washington
56	Sedgwick
57	Jackson
58	Cheyenne
59	Costilla
60	San Juan
61	Kit Carson
61	Bent
63	Baca
64	Kiowa

# Mapping Plan for Colorado

---

## 10.0 Implementing the Plan

### 10.1 Proposed Approach To Addressing Mapping Needs

To address the prioritized mapping needs, the Colorado Water Conservation Board evaluated the map production options that are available. For the purposes of this Plan, the options have been categorized as Level 1 Map Upgrades and Level 2 Map Upgrades. A brief description of each is provided below.

- Level 1 Map Upgrades: Level 1 Map Upgrades are improvements to existing flood maps that are not based on the development of new detailed flood hazard information. These improvements may include converting the flood maps to a GIS-based digital format, incorporating an improved base map (such as digital orthophoto quarter quadrangles), redelineating existing floodplain boundaries based on updated topographic data, refinement or addition of Zone A, and/or incorporating existing flood hazard data developed by Federal, State, or local agencies for purposes other than the FEMA Flood Hazard Mapping Program.
- Level 2 Map Upgrades: Level 2 Map Upgrades are improvements involving the development of new detailed flood hazard information. These upgrades typically require updated topographic data, structure and cross-section surveys, hydrologic and hydraulic engineering analyses, and floodway and floodplain boundary delineation.

The costs associated with Level 2 Map Upgrades typically will be significantly higher than the costs associated with Level 1 Map Upgrades.

The Colorado Water Conservation Board then evaluated various scenarios to determine the best combination of the above activities to achieve the GPRA performance measures. Based on this evaluation, the Colorado Water Conservation Board is submitting the highest priority recommendations shown in Table 10.1 to FEMA. A complete, county-by-county listing is provided in Appendix C.

The CWCB identified 16 counties out of the 64 counties in Colorado in the “highest priority group”, using its prioritization methodology. Those counties are included in Table 10.1. Some communities that do not currently have any FEMA map panels, did not provide any needs information to the CWCB. For those communities, no needs are taken into account in Table 10.1. If the interest of those communities changes in the future, CWCB will update Table 10.1 accordingly.

# Mapping Plan for Colorado

**Table 10.1 – Map Production Summary for FY 2003 Funding**

County	Planned	Community	Upgrades	Reduction in Average Age of Maps by FY 2006	Unmapped Communities To Be Mapped by FY 2006
	Level of Upgrade	No. of Communities	No. of Panels		
Douglas	1	5	32		
	2	5	34		
	Total	5	66		1
Eagle	1	-	0		
	2	7	43		
	Total	7	43		0
Larimer	1	7	42		
	2	7	54		
	Total	7	96		2
Elbert	1	-	-		
	2	2	3		
	Total	2	3		(a)
Garfield	1	7	33		
	2	7	13		
	Total	7	46		0
Weld	1	14	27		
	2	14	42		
	Total	14	69		7
Boulder	1	10	77		
	2	10	29		
	Total	10	106		0
Teller	1	4	9		
	2	4	14		
	Total	4	23		0
Broomfield	1	1	5		
	2	1	1		
	Total	1	6		1 (b)
Routt	1	-	-		
	2	4	19		
	Total	4	19		1
Park	1	2	23		
	2	2	5		
	Total	2	28		0
Adams	1	8	25		
	2	8	84		
	Total	8	109		0
Denver	1	1	20		
	2	1	4		
	Total	1	24		0
Arapahoe	1	10	27		
	2	10	49		
	Total	10	76		1(c)
Rio Grande	1	-	-		
	2	4	35		
	Total	4	35		1
Jefferson	1	-	-		
	2	7	74		
	Total	7	74		0

(a) Elbert County will be contacted to join the NFIP (b) Not Yet mapped as a City & County

(c) Newly created city. Map panels from unincorporated Arapahoe County.

# Mapping Plan for Colorado

## 10.2 Proposed Approach To Map Production

As discussed above, a primary role for the State and its partners will be the management of mapping activities. The map production activities that the Colorado Water Conservation Board plans to manage using FY 2003 funds are summarized in Table 10.2. As shown in the table, these activities may be spread over multiple Fiscal Years. At this time the Map Modernization funding that Colorado will receive in FY 2003 is unknown. Likewise funding for subsequent years is unknown. Because the number of map panels addressed by Colorado is dependent on that funding, CWCB has chosen to fill out only the FY 2003 column in Table 10.2. We will fill out the remainder of the table once we have an estimate of annual funding levels.

**Table 10.2 – State-Managed Map Production Activities Using FY 2003 Funds**

Mapping Activities	Number of Counties (Estimated Number of Panels)			
	FY 2003	FY 2004	FY 2005	FY 2006
Scoping	16 (823)			
Outreach and community coordination	16 (823)			
Digital base map collection/coordination	16 (823)			
Digital base map development	16 (823)			
Field surveys	16 (823)			
Hydrologic and hydraulic analyses	16 (823)			
Floodplain mapping	16 (823)			
Digital FIRM production	16 (823)			
Post-Preliminary processing	16 (823)			

The estimated number of panels in Table 10.2 was arrived at by adding up all of the needs identified for the 16 top priority counties. The CWCB does not anticipate that all of those counties will actually see their mapping work completed in FY 2003. Some of them will not even see their work initiated in FY 2003. Nevertheless, Table 10.2 shows all of those map update activities as FY 2003 activities.

The CWCB has the primary responsibility for floodplain management in Colorado including coordination of the NFIP. CWCB will be the lead agency for the implementation of the MMIP in Colorado, except for the Denver metro area. The CWCB is currently in the process of establishing a joint effort with the Urban Drainage and Flood Control District (UDFCD) in the Denver metro area for MMIP implementation.

The CWCB plans to have a new full-time State Floodplain Mapping Coordinator to implement the plan. CWCB will be requesting a Federal grant to provide funds for an in-house employee or a contracted State Floodplain Mapping Coordinator. The State Floodplain Mapping Coordinator will coordinate all floodplain-mapping activities in Colorado between the State and local communities with the involvement of the UDFCD in the Denver metro area. Because the State does not have the resources to fully manage or perform all flood study or map upgrade activities, those activities will be performed by qualified engineering consultants under contract to the CWCB. The State will rely on those consultants for: scoping, outreach and community coordination, digital base map collection and coordination, topographic data collection, field surveys, engineering analyses and floodplain mapping, and report writing. The State Floodplain Mapping Coordinator will be involved in the management of all mapping activities and coordination with State, Federal and local agencies.

# Mapping Plan for Colorado

---

Mapping Needs Assessment in Colorado will be an ongoing process after the development of our initial MMIP. However, for each fiscal year there will be a pre-designated date upon which certain activities will be halted in order to provide a current assessment to update each County's mapping needs. This process includes:

- Collecting up-to-date mapping needs information from communities
- Reviewing, updating and entering the community needs into the Mapping Needs Update Support System (MNUSS)
- Collecting available community technical and historical data
- Assessing map update methods and ranking system to prioritize communities
- Ensuring GPRA performance measures are being met and updating mapping needs accordingly

To evaluate the State's mapping needs, the following data is being collected and assessed on a community and county basis. The information will be maintained in a database so that the data can be updated and analyzed on an ongoing basis.

- Age of the existing FIRMs
- Known mapping needs
- Status of existing maps
- Existing or potential local mapping partners
- Existing flood hazard data
- Number of Letters of Map Change (LOMCs)
- Population and population growth
- Flood insurance claims and/or repetitive losses
- Format of existing maps

In addition, data needed to update the results of CWCB prioritization methodology on an annual basis will be collected each year.

### **10.3 Estimated Costs To Complete Proposed Mapping Activities**

The activities to be performed by the State in updating "First Priority" Community maps are estimated to cost approximately \$15,471,933. Approximately \$11,603,950 of this amount will be provided by FEMA to the State, and the State will provide a minimum match of 25 percent, or about \$3,867,983, through both in-kind and cash contributions.

The costs for each county are listed in Table 10.3.

- All existing panels will require a Level 1 or Level 2 Update
- DFIRM production will be completed by the CTPAC and its consultants, not by MCC.
- The number of stream miles assumed per panel is based on an average of 3 miles/panel (based on approximating the average stream miles per panel for Larimer (2.8 mile/panel), Adams (5.4 miles/panel) and Weld (3.4 miles/panel) counties.

## Mapping Plan for Colorado

---

- Level 1 unit costs for UD&FCD counties is based on recent cost estimates to update Adams County maps. Based on the Adams County estimate (excluding the South Platte River FHAD costs) an approximate cost of \$1,300 per mile is assumed.
- There is an average of 5.4 miles per panel in Adams County. Estimated cost per panel is 5.4 miles x \$1,300 per mile or \$7,000 per panel.
- Level 1 unit prices for non UD&FCD counties is based on assuming 2/3 of each county is rural and is similar to UD&FCD estimated cost to update non-UD&FCD parts of Adams County and 1/3 of county is urban and is similar to UD&FCD cost to update the part of Adams County within the UD&FCD. The average cost per mile is 1,000 per mile. Assuming that there is 3 miles per panel the estimated cost per panel is 3 miles x \$1,000 per mile or \$3,000 per panel.
- The number of stream miles for Level 2 study for counties with insufficient information is assumed to be a minimum of 15 miles for unincorporated areas.
- The exceptions are that no extra miles were assumed where there are no or few existing panels or where the county is a non-NFIP community.
- Level 2 unit prices are based on \$8,000/stream mile in non-UD&FCD counties. Number of stream miles per panel is 3 for a unit price of \$24,000 per panel.
- Level 2 unit prices based on \$10,000/stream mile in UD&FCD counties. Number of stream miles per panel is 3 for a unit price of \$30,000 per panel.

An important additional assumption must be made clear:

- **No costs were developed for communities that do not currently participate in the NFIP, and that did not submit any map update needs to the CWCB.**

## Mapping Plan for Colorado

**Table 10.3 – Estimated Costs of Planned Production for Highest Priority Counties**

County	Level 1 Upgrade Panels	Level 2 Upgrade Panels	FEMA Contribution	State / Community Contribution	Total Cost
Douglas	32	35	\$941,625	\$313,875	\$1,255,500
Eagle	0	43	\$780,000	\$260,000	\$1,040,000
Larimer	42	55	\$1,073,325	\$357,775	\$1,431,100
Elbert	0	3	\$60,000	\$20,000	\$80,000
Garfield	33	13	\$308,250	\$102,750	\$411,000
Weld	27	42	\$822,000	\$274,000	\$1,096,000
Boulder	77	29	\$1,053,875	\$351,292	\$1,405,167
Teller	9	14	\$275,400	\$91,800	\$367,200
Broomfield	5	1	\$54,500	\$18,618	\$72,667
Routt	0	19	\$334,800	\$116,000	\$446,400
Park	23	5	\$141,750	\$47,250	\$189,000
Adams	25	84	\$2,022,400	\$674,133	\$2,696,533
Denver	20	4	\$193,850	\$64,617	\$258,467
Arapahoe	27	49	\$1,239,075	\$413,025	\$1,652,100
Rio Grande	0	35	\$633,600	\$211,200	\$844,800
Jefferson	0	74	\$1,669,500	\$556,500	\$2,226,000
<b>Total</b>					<b>\$15,471,933</b>

\* Assumes 75% of cost will be contributed by FEMA and 50/50 split of 25% between the State and local community.