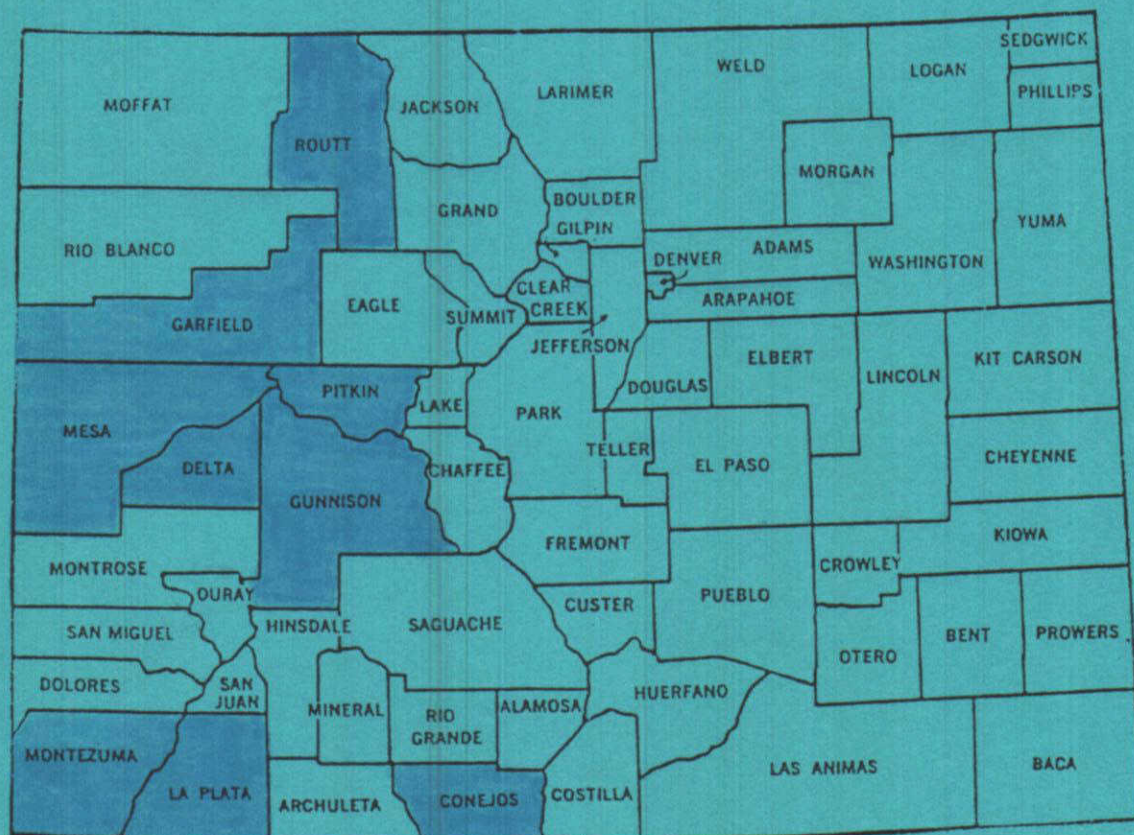


1993 COLORADO FLOOD REPORT

by

The Flood Control and Floodplain Management Section
Colorado Water Conservation Board
Colorado Department of Natural Resources



*Ken Salazar, Executive Director
Colorado Department of Natural Resources*

*Daries C. Lile, P.E., Director
Colorado Water Conservation Board*

STATE OF COLORADO

Colorado Water Conservation Board Department of Natural Resources

721 State Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone (303) 866-3441
FAX (303) 866-4474



Roy Romer
Governor

James S. Lochhead
Executive Director, DNR

Daries C. Lile, P.E.
Director, CWCB

FROM THE DIRECTOR

Historically, floods have occurred in Colorado, and given the state's current growth environment, it is highly likely that the state will experience major flood losses in the future with greater frequency.

As we approached the 1993 snowmelt runoff season, the state's snowpack was the highest it had been since the 1984 flood season when a \$31 million presidential declaration was declared in Colorado. This report provides a record of the flood events which occurred in Colorado during the spring and summer of 1993. It describes what occurred and how government responded. It identifies those innovative actions that evolved such as the integration of mitigation techniques to reduce future flood damage. It further identifies lessons learned and provides recommendations for future flood preparation and recovery operations.

I offer it to you for your professional understanding of flood disasters, their impacts and the mitigation opportunities that follow in their wake.

Sincerely,

A handwritten signature in cursive script, appearing to read "Daries C. Lile".

Daries C. Lile, Director
Colorado Water Conservation Board

1993 COLORADO FLOOD REPORT

Prepared For

**COLORADO DEPARTMENT OF NATURAL RESOURCES
COLORADO WATER CONSERVATION BOARD**

By

**Larry F. Lang
Brian R. Hyde
Mark D. Matulik**

JUNE 1994

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I. EXECUTIVE SUMMARY

As Colorado approached the winter of 1992-93, early snows in November indicated that if storm tracks remained constant, the central and southern mountains could receive the highest snowpack in recent years. In January 1993, as storms continued to affect the southern half of the state, snow readings began to climb. As usual, March was a snowy month and readings soared throughout the southern half of the mountainous areas of Colorado.

Preparations to address concerns regarding Colorado's abnormally high winter snowpack began in earnest during March 1993 with a mailing to numerous local officials from the CWCB which provided guidance about preparations for flooding. Next, meetings with communities that responded to the March letter were scheduled for late April 1994. Then, during the week of April 19-24, 1993 representatives of the Colorado Water Conservation Board, the State Engineer's Office, the Colorado Office of Emergency Management, and the U.S. Army Corps of Engineers performed field inspections of selected west slope locations to determine what levels of flood threat existed for various communities.

Significant snowmelt runoff began in the second week of May as streams across western Colorado swelled due to higher temperatures. Then, on the evening of May 15-16, 1993 a thunderstorm centered over the Government Creek basin north of Rifle dumped 2.5 inches of water in a 4-hour period. The resulting flash flood damaged 12-13 homes and businesses in Rifle causing an estimated \$150,000 in losses. Additionally, vehicles were swept away from several locations and estimates of losses totalled \$50,000.

On May 28, 1993, 1.5 inches of rain fell on melting snow above Paonia in a 5-hour period causing the North Fork of the Gunnison River to approach 100-year flood levels. The high water event precipitated bank erosion to agricultural land throughout this portion of Delta County. The Town of Paonia's flood control facilities, comprised mostly of bank armoring, were severely damaged.

This report provides an explanation and accounting of 1) the flood threat posed by the heavy snowpack, 2) the actual flood events, and 3) the flood response by state and local officials during the 1993 flood season.

The CWCB's flood response actions included 1) anticipation, 2) preparation, 3) response, and 4) follow-up actions to mitigate future flooding impacts.

II. INTRODUCTION

As Colorado's mountain snowpack continued to increase during the first two months of 1993, it became very obvious to state officials that the potential for heavy spring runoff and flooding was possible. In preparation for this possibility, state agencies such as the CWCB, Office of Emergency Management (OEM) and the State Engineer's Office began to undertake actions to address the potential threat.

This report will serve to 1) document the flood threat posed by the heavy snowpack, 2) document the actual flood events, 3) document the actions undertaken by state and local government agencies to respond to the flood threat.

1983 and 1984 were the last years when an abnormally high snowpack caused flooding in Colorado. In 1984, 17 counties and their associated municipalities were declared eligible for disaster relief under a Presidential Flood Disaster Declaration. Ultimately \$31 million was made available to Colorado under the declaration. Both years, long periods of warm weather in May (1984) and June (1983) caused rapid melting of the high snowpack and snowmelt flooding resulted on many streamcourses. In 1993 the snowpack was even higher than 1983 and 84 in many basins, however, warm/cool, warm/cool, etc. weather cycles prevented extensive snowmelt flooding.

Following the Presidential Declaration in 1984, many local governments with assistance from the CWCB and OEM began to implement post-mitigation actions which would lessen flood impacts in the future. Bank stabilization projects at Paonia and Delta proved to be just the answer to the flood waters of 1993. Levee rehabilitation at Redstone provided increased protection from flooding this year as well. There are many such cases of post-mitigation actions in western Colorado that prevented significant flood damages in 1993. Further post-mitigation actions following the spring flooding in 1993 should serve to reduce flood damages in the future and lessen the cost to taxpayers who ultimately pay for the unwise uses that often occur in Colorado's floodplains.

III. ACKNOWLEDGEMENTS

The Colorado Water Conservation Board would like to acknowledge the assistance and work provided by the following agencies and individuals during the response to the 1993 flood season. Without their cooperation, much of the assistance provided to communities would not have been possible.

Agency/Community

Type of Assistance

Colorado Water Conservation Board

*Chuck Lile, Larry Lang, Brian Hyde,
Mark Matulik, Gloria Lung, Jeff
Baessler, Greg Espegren, Bill Stanton*

Flood threat assessment.
Advanced measures. Mitigation
recommendations. Daily snowpack
and streamflow monitoring. On-site
mitigation assistance during flood events.

U.S.D.A

Soil Conservation Service

*Mike Gillespie, Ben Adams
Nyles Jordre, Mike Diluzio
Harry Smith, Flavio Gonzales*

Access to Snotel database
in Portland. Set up of
CWCB's computer to access
the database. Post-flood
emergency projects.

Division of Water Resources

*Jim McDanald, Greg Ibarra
Glen Humisted (Cortez office)*

Access to daily streamflow
data. Graphs showing
streamflow trends.

U.S. Army Corps of Engineers

Sacramento District

Jerry Kanenaga, Mark Verke

Flood threat assessment.
Advanced measures.
Mitigation recommendations.

Colorado Office of Emergency Mgmt.

*Jerry Smith, Hal Knott, Len Boulas,
Mike Reddy, Bob Kistner, Charlie Unseld*

Flood threat assessment.
Advanced measures.
Mitigation recommendations.

Town of Paonia
John Norris, Manager

On-site mitigation
implementation and flood
fight.

Town of Redstone
Tom Newland, Engineer, Pitkin County

On-site mitigation
implementation.

Town of Crested Butte
*Bob Gillie, Pub. Works Dir.; Bill Crank
Mayor; Larry Adams, Planner*

On-site mitigation
implementation and post-
flood emergency projects.

City of Grand Junction
*Mark Relph and Karl Metzner
Engineer and Planning Director*

On-site mitigation
implementation and
advanced measures.

Town of Basalt
Glenn Hartmann, Planner

On-site mitigation
implementation.

Delta County
Duane Freeman, Emerg. Coord.

On-site mitigation
implementation.

La Plata County
Butch Knowlton, Bldg. Official

On-site mitigation
implementation and
emergency preparedness
activities.

Town of Dolores
Shawna Valdez, Clerk

On-site mitigation
implementation.

Gunnison County
Jo Anne Stone, Emerg. Coord.

Preparedness meetings;
on-site mitigation
implementation.

Routt County
Lou Gabos, Engineer

Post-flood emergency
project.

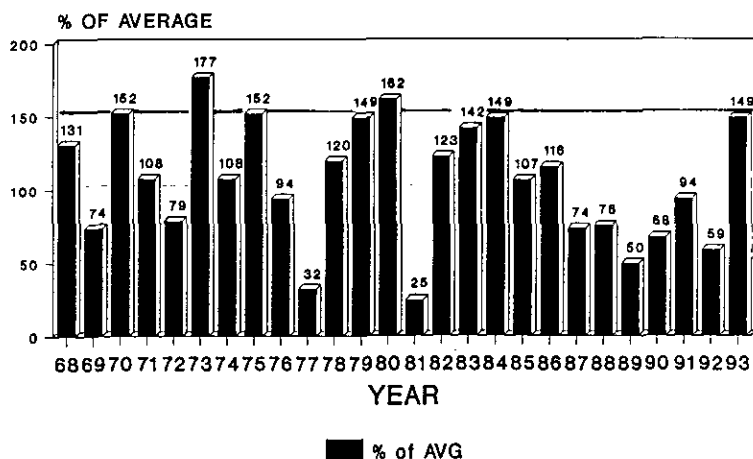
IV. OVERVIEW OF THE FLOOD YEAR

During the 1993 flood season the first three types of flooding occurred in Colorado:

- Snowmelt: occurring mainly in May and June,
- Rain on Snowmelt: occurring mainly in May and June,
- Thunderstorms: most prevalent in May, June, July, August and September, and
- General Rain: occurring mainly in May and June and again in September and October (mostly southwest Colorado).

Snowmelt Flooding

MAY 1 SNOWPACK STATE WIDE



Prepared by Snow Survey Staff, Colorado

Snowmelt flooding results from a heavy snowpack experiencing several consecutive days of hot weather. Although the snowpack was heavy in many locations in 1993, there was not a sustained period of hot weather sufficient enough to cause serious flooding in most locations. The month of May was not especially hot and most periods of hot weather lasted only 2 or 3 days with cooler weather following.

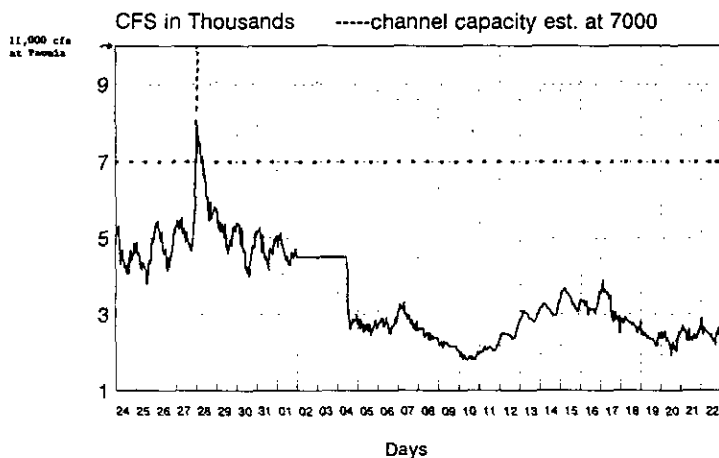
Examples of snowmelt flooding occurred at Redstone on the Crystal River, at Delta on the Gunnison River and at Dolores on the Dolores River. In Redstone, the levees that were constructed following the 1984 flood season prevented floodwaters from entering the community. However, lower portions of the system were threatened significantly. At Dolores, the non-engineered levee system was a major concern. As water approached the top one foot of the levee system, infiltration could have begun and structural failure would have soon followed. Just upstream of the levee system in unincorporated Montezuma County, residents sandbagged the streambanks so that floodwaters would be repelled.

Rain on Snowmelt Flooding

Rain on snowmelt flooding occurs most often in Colorado during the month of May. It is at this time of year that large general rainstorms occur over western Colorado. These rainstorms are most often caused when warm moist air from the Gulf of Mexico begins pushing far enough north that it begins to affect western weather. In combination with this movement of air mass is the continued possibility of cold fronts moving into Colorado from the Pacific Northwest. When these weather phenomena collide, long lasting general rainstorms can often occur. Rain on snowmelt exacerbates an already tenuous situation as snowmelt waters rush down heavily incised stream channels. Any abnormal increase in flow from other sources usually causes streams to leave their banks.

Rain on snowmelt flooding occurred at Paonia on the North Fork of the Gunnison River. The rainfall which occurred over a 5-hour evening period on May 28, 1993 caused the North Fork of the Gunnison River to reach its highest level since the 1984 flood season. Many miles of agricultural land experienced severe bank erosion in unincorporated Delta County. The stone riprap at Paonia's wastewater treatment plant experienced severe damage as did the bank armoring at Huff Addition #1 (a subdivision).

North Fork of the Gunnison River near Somerset
May-June 1993



Prepared on June 23rd by
Division of Water Resources

Thunderstorm-Induced Floods

Large and powerful thunderstorms begin occurring in Colorado during the last half of May. They reach their peak in mid-July and taper off in occurrence into late August. These storms, depending on duration, deposit the largest amounts of rainfall in the shortest periods of time. In May, most Colorado streams are already swollen with runoff. Any abnormal increase in streamflow will usually precipitate a flood event.

A thunderstorm-induced flood event occurred at Rifle on Rifle and Government Creeks. As is usually the case, the highest flows in the shortest period of time occurred when an estimated 125-year flood discharge impacted Rifle as the result of an intense late day thunderstorm on May 15-16, 1993. To date, an estimated \$150,00 - \$200,000 in losses to structures and vehicles was sustained.



Looking east from Rifle Creek and 4th Street in Rifle, CO

The threat of serious flooding also occurred at Parachute, Colorado on May 16. The same thunderstorm event which occurred above Rifle deposited large amounts of rain in the Parachute Creek basin. Town officials notified residents of a mobile home park on Parachute Creek to be on alert for possible evacuation. Fire Department employees were stationed on Parachute Creek above town and maintained radio communication with town offices. Town crews removed debris accumulations at two sites on the creek and stayed ready to participate in the evacuation process. Though the evacuation was not necessary, Parachute Creek reached levels higher than in many years.

FLOOD EVENTS - SUMMER 1993

Following the end of the snowmelt runoff season, the thunderstorm-induced flood season began in earnest in Colorado. The first major event was a flash flood on June 17 on Shooks Run in Colorado Springs. Damage occurred mostly to residences in a mobile home park on the creek's edge and losses were estimated at \$1,000,000 by the Colorado Office of Emergency Management (OEM).

In July, the Town of Otis and the unincorporated area of Cope in Washington County and the City of Yuma in Yuma County experienced a weekend flood event as a result of three consecutive days of thunderstorms. Several homes received damage and roadways were inundated. Damage estimates from the CWCB and OEM were \$650,000. In Otis, a flood control and storm drainage project protecting the northern half of town worked very well. Now the town would like to extend the project further south to offer protection to an area that is currently unprotected. In Yuma, plans are already in place for further drainage improvements.

Then on August 10, 1993, flash floods occurred on several creeks in Delta County. Two roads were washed out and a flood fight was conducted with sandbags on Robideaux Creek near the State Department of Corrections Detention Facility.

According to reports from local officials, general rainstorms from the remnants of Tropical Storm Hillary caused flooding in Archuleta and La Plata counties during the period August 26-29, 1993. A subdivision in Archuleta County was threatened and roads damaged as the Rio Blanco overflowed its banks south of Pagosa Springs. In Durango, the Fire Department had their emergency operations plan in effect and came very close to evacuating residents of a mobile home park on the Animas River.

V. COMPARISONS TO OTHER LARGE FLOOD EVENTS

In 1984, Colorado also experienced flooding as a result of an abnormally high snowpack. During the fourth week of May that year, temperatures approached 90 degrees in Gunnison, Colorado for seven (7) days in a row. Record streamflows were recorded on May 25 and 26 over much of western Colorado. In addition, nighttime temperatures did not drop below freezing at the higher altitudes. This combination caused snowmelt flooding which resulted in a Presidential Declaration totalling 31 million dollars. Seventeen counties and their associated municipalities were declared disaster areas.

The 1993 snowmelt runoff flood season does not approach the magnitude of the 1984 flood event in most basins. However, some parallels can be drawn. Both years had abnormally high snowpacks. In many areas, the snow water content in 1993 exceeded that of 1984. Yet warm temperatures in 1993 did not materialize like they did in 1984. Warm/cool, warm/cool, etc. weather cycles were the rule in 1993 and as a result flood levels for the most part did not reach the levels of 1984 on as many streams. However in at least one community, flood levels exceeded 1984 levels. Paonia experienced a flood event on May 28, 1993 that approached the 100-year recurrence interval. It resulted from rain on snowmelt when 1.5" of rain fell in five (5) hours above Paonia but below Paonia Reservoir. However, post-flood mitigation actions following the 1984 flood event prevented excessive damage to the streambanks of the North Fork of the Gunnison River at Paonia. Post-flood mitigation techniques also prevented excessive damage to levees on the Colorado River at Grand Junction.

For the most part, post-flood mitigation actions that were implemented following the 1984 flood event prevented significant damage during the 1993 flood season. These actions from 1984 guided state agencies as they prepared and responded to the flood threat in 1993. There now exist opportunities for further post-flood mitigation activities on streams impacted during 1993. Hopefully these actions will reduce damages even further when the next flood occurs.

VI. IMPACTED AREAS

The southern half of the mountainous areas of Colorado, the mountain valleys of the Western Slope and the San Luis Valley all experienced varying degrees of flood damage during the spring 1993 flood season. The following tabulation lists the communities and associated streamcourses which experienced high water.

<u>Community</u>	<u>Streamcourse</u>
Montezuma County Dolores	Dolores River Dolores River
La Plata County	La Plata River Junction Creek
Durango	Animas River
Gunnison County	Ohio Creek Tomichi Creek Gunnison River East River
Crested Butte	Coal Creek
Mesa County	Colorado River
Collbran	Plateau Creek
Grand Junction	Colorado River
Delta County	Gunnison River N. Fk. Gunnison River Muddy Creek Minnesota Creek Hubbard Creek
Paonia	N. Fk. Gunnison River
Pitkin County (Redstone)	Crystal River
Garfield County	Three Mile Creek
Rifle	Rifle Creek Government Creek
Conejos County	Rio San Antonio River Alamosa River Conejos River
Costilla County	Culebra Creek Trinchera Creek

DAMAGE OVERVIEW

Damages were tabulated for several communities experienced flood damage during the 1993 flood season. Damage ranged from impacts to residences and businesses in Rifle to significant loss of agricultural land in Delta County due to severe bank erosion. The following tabulation presents **public** damage estimates by community as of December 31, 1993:

<u>Community</u>	<u>Type of Damage</u>	<u>Estimated Dollar Value</u>	<u>Stream</u>
Paonia	Streambank Erosion	\$ 50,000	N.Fk. Gunnison R.
Delta County (unincorporated)	Streambank Erosion	\$150,000	N.Fk. Gunnison R.
Rifle	Flooded residences & businesses Streambank Erosion	\$100,000	Government & Rifle Cks.
Conejos County (unincorporated)	Streambank Erosion	\$100,000	Conejos R. Alamosa R.
Gunnison County (unincorporated)	Streambank Erosion	Not Available	Tomichi C. Ohio C.
Dolores	Levee Degradation	Not Available	Dolores R.
Grand Junction	Levee Degradation	\$300,000	Colorado R.
La Plata County (unincorporated)	Streambank Erosion	Not Available	Animas R.

DAMAGE OVERVIEW (Continued)

<u>Community</u>	<u>Type of Damage</u>	<u>Estimated Dollar Value</u>	<u>Stream</u>
Collbran	Streambank Erosion	Not Available	Plateau C.
Garfield County (unincorporated)	Streambank Erosion	\$15,330	Threemile C. Roaring Fork R.
Pitkin County (Redstone)	Levee Degradation	\$50,000	Crystal R.
Delta	Streambank Erosion	\$28,350	Uncompahgre R. Gunnison R.
Orchard City	Streambank Erosion	\$ 650	Surface C.
Cedaredge	Streambank Erosion	\$ 500	Surface C.
Hotchkiss	Streambank Erosion	\$100,000	N. Fk. Gunnison R.

Damage estimates were obtained from the Colorado Office of Emergency Management, Colorado Water Conservation Board and the affected communities. Estimates for those areas above listed as "not available" have not been compiled. These damage values are only estimates and do not reflect total losses in the basin or watershed and the values do not include the loss of many acres of valuable agricultural land.

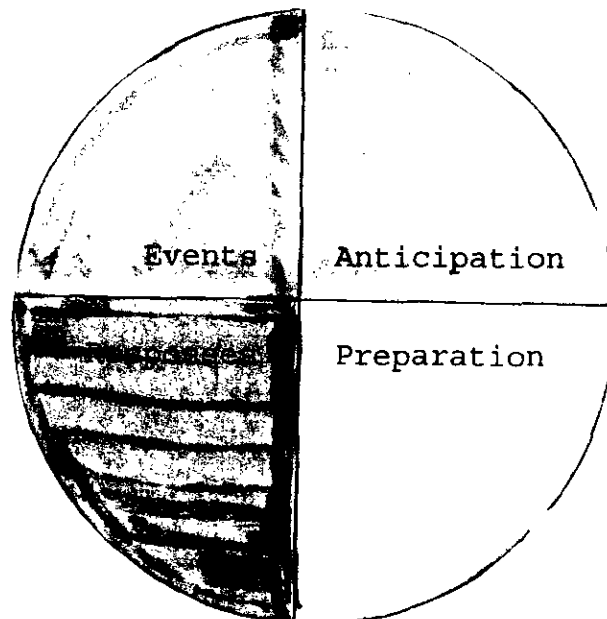
VII. STATE ACTIONS AND RESPONSE

Several state agencies participated in the preparation, monitoring and response to the spring 1993 flood threat. Agencies which played a major role included: the Governor's Office; the Executive Director's Office of the Colorado Department of Natural Resources; the Colorado Water Conservation Board; Executive Director's Office of the Colorado Department of Local Affairs; the Colorado Office of Emergency Management; and the State Engineer's Office.

The Flood Control and Floodplain Management Section of the Colorado Water Conservation Board played a major role in the following areas during the spring 1993 flood season:

- Field inspection of flood threatened communities,
- Recommendations for emergency response in the event of flooding,
- Snowmelt and streamflow monitoring for State Agencies and local communities,
- Flood forecasts as a result of monitoring,
- Field documentation of flood events e.g. Rifle, and
- Recommendations for post-mitigation activities.

Also, the CWCB staff of the Flood Control and Floodplain Management Section served as members of the State's Flood Mitigation and Preparedness Team. In this capacity, the CWCB participated with the U.S. Army Corps of Engineers, Sacramento District; the Colorado Office of Emergency Management; the State Engineer's Office; and the Colorado Geological Survey in performing flood threat assessments in several Colorado west slope communities in April 1993.



A. PREPARATION

The first phase of state agency actions involved preparation for potential spring flooding. The CWCB, the Colorado Office of Emergency Management, the State Engineer's Office and the Colorado Geological Survey were all actively involved in the process.

March 1993

In mid-March, the CWCB staff sent correspondence to over 40 west slope and San Luis Valley communities. The letter notified communities that the increasing winter snowpack had the possibility of causing flood problems during the spring runoff months (May-June). It offered 1) assistance to identify locally flood threatened areas, and 2) recommendations to mitigate flood problems should they be realized. Response from the communities was significant. And as a result of this response, reconnaissance field trips were scheduled for April for flood-threatened communities.



Non-Engineered Levee at Dolores, Colorado on the Dolores River

April 1993

On April 14, 1993, staff members of the Flood Control and Floodplain Management Section participated in a "State Agency Disaster Coordinators Hazard Mitigation Team Meeting" to begin preparations for spring flooding.

Next, the CWCB arranged tours of Colorado's flood-threatened areas with representatives of the Colorado Office of Emergency Management, the State Engineer's Office, the State Geologist's Office and the U.S. Army Corps of Engineer's, Sacramento District for the week of April 19-24, 1993. After a flood threat analysis from local officials who responded to the March flood threat inquiry, the following communities were visited:

Grand Junction	Delta County	Delta
Mesa County	Gunnison County	Gunnison
Garfield County	Ouray	Ouray County
Parachute	Paonia	Silverton
Pitkin County	San Juan County	La Plata County
Durango	Basalt	

"Advanced Measures" were provided individually to each community. Advanced measures can be defined as actual "on-ground" activities which are an attempt to reduce flood damages prior to a flooding event. Levee repair and improvement is an example.



Emergency Levee at Riverside Subdivision - Grand Junction, CO

On April 29, 1993, CWCB staff attended and made a presentation at the "Flood-Landslide Awareness

Meeting" in Glenwood Springs which was conducted by the Colorado Natural Hazards Mitigation Council.
B. MONITORING

The second phase of state actions involved monitoring selected locations for flood threat potential. The monitoring program involved several agencies. The CWCB monitored the Soil Conservation Service's SNOTEL system to obtain daily snowpack readings for selected drainage basins. The State Engineer's Office provided daily streamflow hydrographs to the CWCB to augment the snowpack information. And OEM field employees monitored stream conditions in selected communities in preparation for flood response actions.

May 1993

On May 12, CWCB staff members travelled to Crested Butte to provide flood preparedness assistance. Actions included:

- 1) Repairing the CWCB's staff gage on Coal Creek,
- 2) Installing a second, new staff gage on Coal Creek in its lower reach,
- 3) Developing rating curves for the two gages to determine volumes of water in Coal Creek based on gage heights, and
- 4) Preparing a document entitled "*Flood Preparedness Planning on Coal Creek for the Town of Crested Butte and Gunnison County*" for use by local officials.



Overflow Channel at Crested Butte, CO just east of Coal Creek

On May 19, CWCB staff completed and put into operation its "*Flood Monitoring Program*". Through the use of 1) *daily snowpack data* from the Soil Conservation Service's Snotel Satellite System, 2) *streamflow data* from the State Engineer's satellite monitoring system, and 3) *weather information* from the National Weather Service and local weather observers, the CWCB began issuing "*Flooding Activity Daily Reports*."

The snowpack data was incorporated into a Lotus 123 spreadsheet whereby daily averages could be quickly calculated for numerous locations. The streamflow data was used to determine whether streams were rising or falling as a result of snowmelt or rain on snowmelt. Daily high and low temperatures were used to focus on weather trends which could affect the rate of snowmelt. The report enabled state agencies to monitor stream and snowpack conditions on a daily basis and in turn make recommendations for actions when flooding became imminent. It was provided daily to:

- Governor's Office,
- Colorado Department of Natural Resources,
- Colorado Office of Emergency Management,
- Colorado Department of Local Affairs,
- Rocky Mountain News, and
- Channel 4 Television.

Also in May, employees of the Executive Director's Office of the Colorado Department of Natural Resources, the CWCB, OEM and the State Engineer's Office met with Governor Romer and his staff to provide advice regarding further state actions for the already occurring flood events. Employees of these agencies also provided daily information to news agencies regarding flooding and flood threat potential.

May/June 1993

As the flood season progressed, CWCB staff utilized the "*Flooding Activity Daily Report*" to full advantage (for the period May 15 - June 15, 1993 see appendix for report). The "*Activities/Contacts Regarding Flooding*" section of the report required that local officials in flood-threatened communities be contacted at least every day so that the flood threat status in the community could be updated. Snowpack and streamflow data were provided to local officials during these calls. The report was also made available to state and local officials and the media daily. Such correspondence allowed the CWCB to stay actively involved in the assistance process and on two occasions necessitated CWCB staff travelling to the west slope communities of Crested Butte, Paonia, Delta, Grand Junction, Redstone and Basalt to provide flood mitigation assistance. Damage surveys were performed during these visits as well. Contacts were established and maintained throughout the flood season in the following communities:

Gunnison County
Crested Butte
Costilla County
Conejos County
La Plata County
Durango

Delta
Delta County
Mesa County
Rifle
Basalt
Redstone

Paonia
Grand Junction
Parachute
Garfield County
Pitkin County

One community which received considerable assistance was the Town of Crested Butte in Gunnison County. Crested Butte is bisected by a stream called Coal Creek. According to snowpack Snotel readings, the basin which drains into Coal Creek had as much as 275% of normal snowpack compared to the record for a thirty-year period. The streambanks of Coal Creek have been encroached upon over the years such that some residences and businesses are built right on the edges of the bank. Severe erosion from flooding would most certainly threaten these structures.

In response to requests from local officials, CWCB staff prepared a "*Flood Preparedness Planning on Coal Creek for the Town of Crested Butte and Gunnison County*". Flood preparedness required that local officials:

- Record daily "high" and "low" temperatures to determine degree days,
- Read and record staff gage levels to determine the daily discharge,
- Obtain the daily water content of the snowpack in the Coal Creek basin (provided by the CWCB), and
- Develop a "Mitigation Plan" for discharges greater than 500-600 cubic feet per second (provided by the CWCB).

As a result of this mitigation planning effort, the community has implemented a number of flood preparedness activities including:

- Obtaining access agreements,
- Monitoring the flood gages,
- Daily/weekly assessment of the flood threat,
- Developed a flood preparedness plan,
- Implemented preparedness procedures,
- Constructed an overflow path for excessive floodwaters, and
- Organized a work force to address the flood threat.

C. RESPONSE

The third phase of state agency actions involved response to spring flooding. The CWCB and the Colorado Office of Emergency Management were actively involved in the process. The CWCB provided engineering flood documentation at Rifle following the May 15-16 flood event. Field surveys were performed and calculations were made to determine the volume of water which caused the flood on Rifle and Government Creeks. OEM interviewed local officials and residents in Rifle and performed damage surveys to determine the extent of dollar damages in the community.

On May 19, CWCB staff performed a field documentation of the flash flood which occurred in Rifle, Colorado. Actions included:

- 1) Obtaining field cross-sections on Government and Rifle Creeks,
- 2) Photo documentation of flood damage,
- 3) Interviews with local officials to determine extent of damages and associated costs,
- 4) Preparation of a "Preliminary Post-Flood Report", and
- 5) Formulate Post-Flood Mitigation Projects.

OEM also had employees in the field throughout the flood season providing flood fighting assistance during flooding and damage assessment after flood events occurred.

The CWCB and OEM are participating with flood-impacted communities to develop and implement mitigation strategies which will reduce future flood damages in Colorado.

D. MITIGATION

Following the flood events, the appropriate state agencies become involved in the development and implementation of mitigation activities which 1) will repair flood-damaged structures/areas, and 2) will reduce future flood damages. The Flood Control and Floodplain Management Section of the CWCB is a major participant in developing mitigation strategies and was involved following the 1993 flood season as follows:

1. Recommended the following strategies to the CWCB members:

- Development of a Colorado Snowmelt Runoff Model which will improve flood prediction forecasts,
- Conduct an annual campaign about flood insurance and its availability,
- Develop a CWCB Emergency Response Plan,
- Improve the federal permitting process during times of flooding,
- Develop a policy or standard for restoring and reclaiming stream channels,
- Update the Colorado Flood Hazard Mitigation Plan, and
- Implement a Multi-Objective River Management Planning process.

2. Prepared reconnaissance studies for nine (9) flood-impacted sites in:

Pitkin County (Redstone area)
Gunnison County (Crested Butte)
Mesa County (Grand Junction)
Delta County (Hotchkiss, Paonia, Delta)
Conejos County
Routt County

VIII. LOCAL ACTIONS AND RESPONSE

Flood response is a collaborative process which involves federal, state and local agencies which cooperate together to mitigate flood damages at selected locations. Local government actions paralleled state actions and consisted of the same phases 1) preparation, 2) monitoring, 3) response, and 4) mitigation.

A. PREPARATION

On March 23, 1993, the CWCB sent out a notice to local government officials in over 40 flood-threatened communities in Colorado. They responded to an inquiry by the CWCB asking, that in light of an impending high water year, if their communities had certain locations which could be impacted by flooding.

In light of this response the CWCB arranged meetings to conduct field visits to the communities. During the week of April 19-24, 1993, local officials assisted the CWCB staff and other state and federal representatives in pinpointing trouble locations and cooperating to develop "advanced measures" to address the flood threat.

Mesa and Gunnison Counties with assistance from OEM conducted a series of public information meetings in April and May to alert the public to the potential flood threat and to develop community actions should the flood threat be realized.

Pitkin County developed a Mud/Flood Task Force Handbook which sets forth procedures for responding to flood and mudslide events.

La Plata County provided information on flood insurance to county residents prior to flooding.

B. MONITORING

Most local officials in flood-threatened areas realized the value of monitoring streamcourses in their communities prior to and during high water events. Requests were made to State and Federal agencies for information regarding flood potential and outlook.

The Town of Crested Butte participated with the CWCB in monitoring snowpack conditions and installing a new stream gage on Coal Creek in their community with the implementation of an Emergency Operations Plan.

The Town of Paonia monitored flow conditions daily on the North Fork of the Gunnison River in preparation for flood fight actions.

Gunnison County monitored the Gunnison River, Ohio Creek, Tomichi Creek and the East River with local residents who reported stream conditions daily.

Pitkin County followed the guidelines set forth in their Mud/Flood Task Force Handbook.

Grand Junction maintained a daily log of river stages and advised the public through the local news media.

C. RESPONSE

Grand Junction expended \$85,000 on levee rehabilitation along the Colorado River to protect residences and businesses.



Emergency Levee at Riverside Area in Grand Junction, CO

La Plata County participated in flood fighting by providing sandbags to residents above Vallecito Reservoir on Vallecito Creek.

Paonia, Colorado made emergency repairs following peak flows on the North Fork of the Gunnison River on May 17 and again on May 28.



Emergency Bank Stabilization Operations at Paonia, Colorado

Delta County provided rip-rap in many critical locations on the North Fork of the Gunnison River as well.

D. MITIGATION

Several communities have implemented or will implement mitigation actions following the 1993 flood season. The following communities made mitigation requests:

The Town of Paonia made emergency repairs to washed-out rock at selected streambank locations in the community and made a request to the CWCB for a reconnaissance investigation for their 1984 flood mitigation project.

Mesa County in cooperation with the U.S.D.A. Soil Conservation Service and the CWCB, requested a rock jetty streambank protection project which will provide flood protection to the Rosevale Area.

Gunnison County is preparing to replace the Gothic Bridge on the East River so that the new structure will pass higher future flows.

La Plata County has requested a new floodplain information study for selected locations in the county. This will be done on a cost-sharing basis with either the Corps of Engineers or the Soil Conservation Service.

Rifle has requested a mitigation project which includes a trails and open space system along Rifle Creek in an attempt to prohibit further encroachment into the floodplain.

Delta County, in cooperation with the U.S.D.A. Soil Conservation Service and the CWCB, has requested emergency streambank protection for the entire reach of the North Fork of the Gunnison River. Areas of major damage include the Paonia Irrigation Ditch, the Hotchkiss East End Levee System, the Hotchkiss Trailer Park and the Delta County Fairgrounds.

IX. MITIGATION RECOMMENDATIONS FOR FOLLOW-UP ACTIONS BY AGENCIES AND COMMUNITIES

Several communities which were impacted by 1993 snowmelt flooding have follow-up post-flood mitigation activities which should be implemented. The CWCB's recommendations for action are listed below:

<u>Community</u>	<u>Activity</u>	<u>Agency/ Community Involved</u>
Paonia	Streambank Protection	Corps CWCB Paonia
Delta County	Streambank Protection Channel improvement	Corps SCS CWCB Delta County
Dolores	Levee Improvement	Corps CWCB
Rifle	Streambank Protection Parkway Residential acquisition	DOLA CWCB Rifle
Grand Junction	Levee Improvement	Corps CWCB
La Plata County (unincorporated)	Streambank Protection Channel improvements	Corps CWCB La Plata County
Collbran	Streambank Protection	Corps CWCB Collbran
Pitkin County (Redstone)	Levee Improvement	Corps SCS CWCB Pitkin County
Conejos County (unincorporated)	Streambank Protection	Corps CWCB Conejos County
Crested Butte	Streambank Protection	CWCB Crested Butte

Post-Flood Activities

During August 1993, the Colorado Water Conservation Board assisted six communities (at nine sites) in preparing applications to the USDA Soil Conservation Service's Emergency Watershed Protection Program ("216 Program") for \$718,000 in funding. Initial funding of \$200,000 was extended to Conejos County, Delta County and Pitkin County (3 sites) prior to the end of the federal fiscal year on September 30, 1993. The remaining \$518,000 was made available to the last 5 sites after October 1, 1993.

The funds are being used to apply streambank protection measures to prevent further flood losses in watersheds which experienced damage during the spring/summer snowmelt runoff. During runoff, damage was inflicted on irrigation systems, riparian habitat, residential and commercial properties, public facilities, railroads and historic districts. Federal dollars for the projects are available through the 216 Program on a 75% - 25% cost share basis. The 25% local share can be in the form of cash and in-kind services such as equipment and personnel. All projects are expected to be completed prior to the 1994 flood season.

X. COMPLETED FOLLOW-UP ACTIONS

During the high spring and summer runoff, damage was inflicted on irrigation systems, riparian habitat, residential and commercial properties, public facilities, railroads and historic districts. Neither a state or federal disaster was declared as a result of damage suffered from the flood. However, the CWCB's Flood Control and Floodplain Management Section staff assisted several communities in the implementation of mitigation measures which upon completion will reduce future flood damages through the repair of damaged flood protection structures.

On August 4, 1993, CWCB Director Chuck Lile requested \$693,000 in Emergency Watershed Protection Funds from the USDA's Soil Conservation Service. On August 12, \$200,000 was awarded. The remaining \$493,000 was made available following October 1, 1993. The funds are being used to apply streambank protection measures to prevent further flood losses in eight identified watersheds which were damaged during the spring and summer runoff period.

Streambank and properties being protected are on the:

- Rio San Antonio in Conejos County (Photo No. 1),
- Coal Creek at Crested Butte (Fall 1994),
- Crystal River near Redstone (Photo No. 2),
- Colorado River in Mesa County (Photo Nos. 3 & 4),
- North Fork of the Gunnison River in Delta County, 4 sites (Photos 5, 6 & 7), and
- Elk River in Routt County (Photo Nos. 8 & 9).



Photo No. 1

*Flood Protection Improvements to the Rio San Antonio
in Conejos County completed October 26, 1993*



Photo No. 2

Levee Improvements at Redstone, CO completed May 5, 1994



Photo No. 3
*Rosevale Area on the Colorado River
in Mesa County before project completion*



Photo No. 4
*Rock jetties at the Rosevale Area on the Colorado River
completed May 3, 1994*

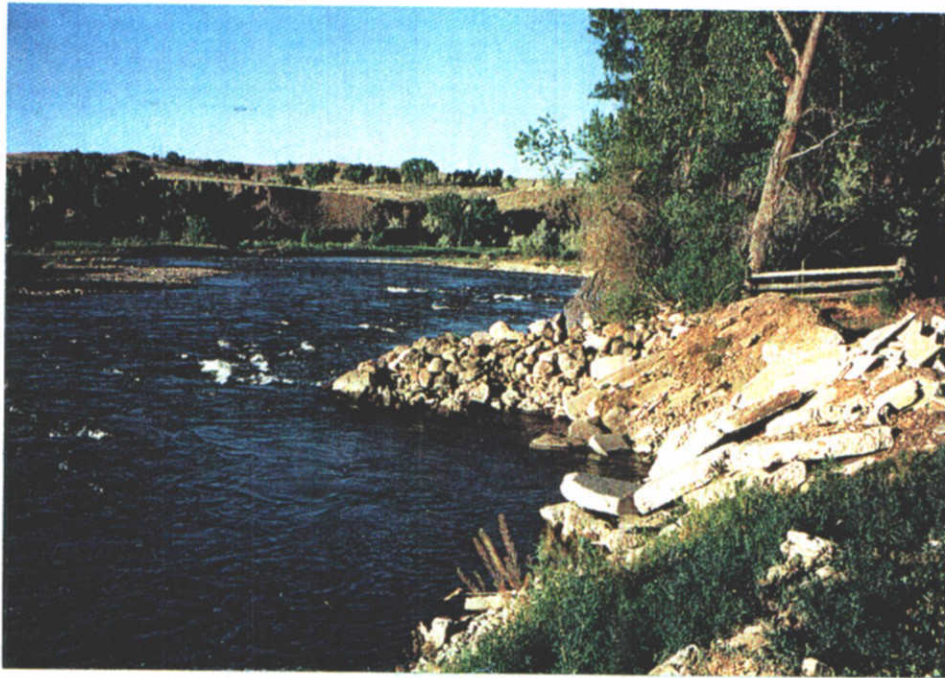


Photo No. 5

*Streambank protection for the North Fork of the Gunnison River
at the Delta County fairgrounds in Hotchkiss, CO completed December 20, 1993*

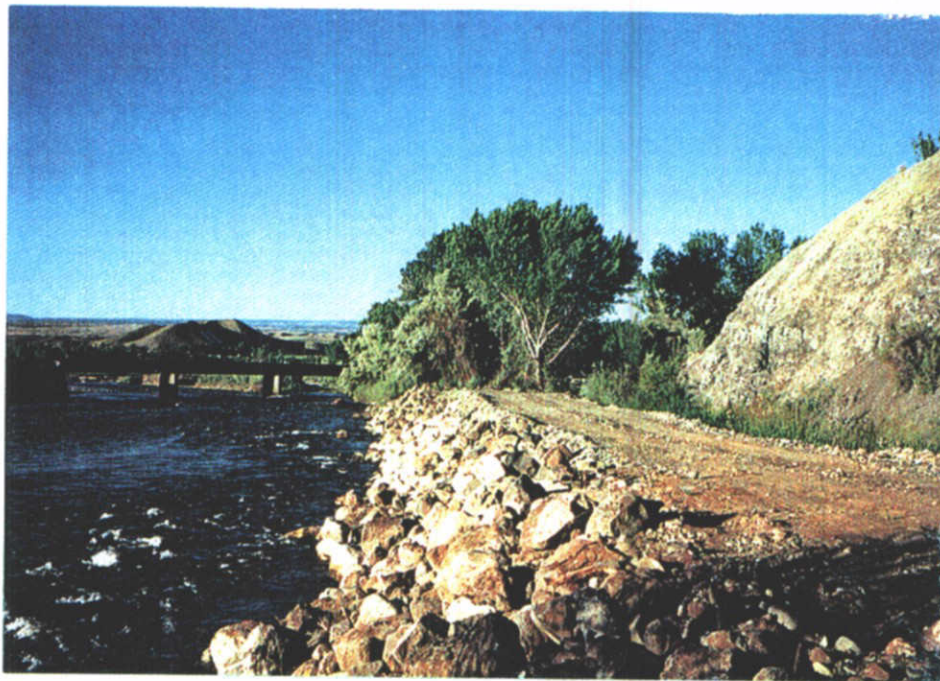


Photo No. 6

*Streambank protection for the North Fork of the Gunnison River
in east Hotchkiss, CO completed April 6, 1994*



Photo No. 7

*Paonia Ditch jetty protection for the North Fork of the Gunnison River
in east Hotchkiss, CO completed March 31, 1994*



Photo No. 8

Streambank damage on the Elk River near Clark, CO



Photo No. 9

Streambank protection on the Elk River near Clark, CO completed April 20, 1994

By December 31, 1993, the El Coda Project on the Rio San Antonio had been completed. The remaining eight projects will begin during Spring 1994 with completion by early Summer 1994.

At the request of the Colorado Water Conservation Board, the staff prepared an issues and recommendations paper for future legislative reforms and program modifications (See memoranda dated September 2, 1993 in the reference section). With the implementation of these recommendations, flood response activities will better service the public and result in increased flood loss reduction in Colorado.

XI. REFERENCES AND BOARD MEMORANDA

1. Colorado Water Conservation Board, *Flood Hazard Mitigation Plan for Colorado, Denver, Colorado, January 1985.*
2. Colorado Water Conservation Board, *Crested Butte, Colorado Flood Preparedness Planning on Coal Creek, Denver, Colorado May 1993.*
3. Colorado Water Conservation Board, *Preliminary Post Flood Report for Government and Rifle Creeks at Rifle, Colorado May 15-16, 1993 Flood Event, Denver, Colorado, May 1993.*
3. Colorado Division of Water Resources, *Watertalk Streamflow Satellite Monitoring System, Denver, Colorado, May 1993.*
4. U.S. Soil Conservation Service, *Snotel Snowpack Monitoring System, Portland, Oregon, May 1993.*
5. March 23, 1993 Memorandum
6. May 13, 1993 Memorandum
7. May 20, 1993 Memorandum
8. July 9, 1993 Memorandum
9. September 2, 1993 Memorandum

STATE OF COLORADO

COLORADO WATER CONSERVATION BOARD
Department of Natural Resources

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FAX (303) 866-4474



Roy Romer
Governor

Ken Salazar
Executive Director, DNR

Danes C. Lile, P.E.
Director, CWCB

MEMORANDUM

TO: Mayor and County Commissioners
Floodplain Management Administrators
County Emergency Managers

FROM: *DL* Daries "Chuck" Lile, Director, Colorado Water Conservation Board
WB Hal D. Simpson, State Engineer
LB Ben Bouldas, Director, Office of Emergency Management

DATE: March 23, 1993

SUBJECT: Spring 1993 Flood Potential - "Lets be Prepared!"

The purpose of this ANNOUNCEMENT is to make appropriate parties aware of a possible flood threat to certain Colorado communities. By reviewing the March 1, 1993 snowpack readings, as prepared by the U.S. Department of Agriculture, Soil Conservation Service, we can readily conclude that our central and southern Colorado communities may face a potential flood and streambank erosion threat during the months of May and June, 1993. There are a number of flood preparedness activities which you may want to undertake for your community to lessen the risks to life and reduce flood losses.

These activities are:

- Knowing if a Flood Threat Exists;
- Being Aware of the Geographic Extent of Floodplains in Your Community
- Purchasing of Flood Insurance;
- Implementing Advance Protective Measures; and
- Knowing Your Emergency Response Plan Procedures.

Memorandum
Flood Potential
March 23, 1993
Page two

Actions which your community may want to implement which will assist in determining the magnitude of your immediate flood condition are:

Knowing the Flood Threat

The flood threat can be determined by

- reviewing your floodplain maps;
- knowing the storage status of upstream reservoirs;
- understanding the availability of flood preparedness information; and
- analyzing any protective works.

See attached memorandum dated March 3, 1993 to better understand the spring snowmelt runoff potential for your area.

Being Aware of the Geographic Extent of Floodplain in Your Community

By examining your community's floodplain maps you can determine which areas are subject to flooding. Those are the areas on which you should focus your flood-preparedness efforts. Some features to identify include:

- Buildings within the 100-year floodplain.
- Bridges and culverts subject to overtopping or failure.
- Low points where water could break out and flow overland.
- Places vulnerable to erosion and bank failure.
- Potential depths of flooding for determining the height of sandbags or other protective measures.
- Any critical locations where sandbags, dirt, rock or other such materials could be stockpiled.
- Roads that might be subject to closure.
- Emergency access routes.

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Flood Potential
March 23, 1993
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Purchase of Flood Insurance

Potential flood losses can be mitigated through flood insurance coverage. Information on the purchase of flood insurance is attached for your assistance. This information also provides instructions regarding the actual purchase of the insurance and general information for public education.

Implementing Advance Protective Measures

There are a number of actions which local, state and federal government can implement to lesson flood losses. To assist with the local and state emergency actions, the Corps of Engineers has an "emergency operations" program which can provide Colorado Communities with certain types of financial and technical assistance. The program is designed to provide assistance through "advance measures" and "flood fight" activities. Colorado Communities may be eligible for these Corps' assistance programs. The Board and the Office of Emergency Management will coordinate field inspections with the Corps to determine community eligibility.

The assistance activities are:

- Strengthening of Federal and non-Federal flood control works.
- Construction of temporary levees to protect life and improved property (removal of these structures is a local responsibility).
- Channel clearance and dredging to restore original design capacity for flood control projects or natural channels.
- Relieve threat of flooding from possible dam failures by dewatering the impoundment, controlled breaching or strengthening of the structure.
- Flood fight supplies including sandbags, pumps and other materials are located throughout each district and are available to complement state and local authorities during a flood emergency.

Should you desire an inspection of your potential flood hazard call Mr. Larry Lang, Chief, Flood Control and Floodplain Management Section 1-303-866-3441, Ext. 320 to schedule an inspection time. If you have questions regarding possible threats to or from existing dams in your area, call or the Division Engineer's Office for your area. If you cannot contact the Division Engineer's Office call Mr. Alan Pearson, Chief Dam Safety Section, Division of Water Resources 1-303-866-3581. See attached information regarding the State's Dam Safety Program.

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Flood Potential
March 23, 1993
Page four

Knowing Your Emergency Response Plan

Many Colorado communities have an emergency response plan which outlines preparedness activities. These activities cover training through seminars, flood fight capabilities, and emergency operations. Should you have questions or concerns regarding these activities, please contact your County Emergency Manager. You may also contact the Office of Emergency Management's Regional Planner for your area. They are Steven Denny, NW Co-ordinator, 1-303-248-7310 and Sue Clark, SW Co-ordinator, 1-303-273-1780. If you cannot reach these call Robert Kistner Chief, Local Services, Office of Emergency Management, 1-303-273-1779.

This announcement is provided to you as a means of alerting communities and individuals of services which will greatly reduce their exposure to flood risks and losses.

LFL/bj

Attachments

bj965.memo

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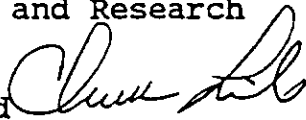
Roy Romer
Governor

Ken Salazar
Executive Director, DNR

Danes C. Lile, P.E.
Director, CWCB

M E M O R A N D U M

TO: Stewart Bliss, Chief of Staff
Alan Salazar, Director of Policy and Research

FROM: Danes C. Lile, Director
Colorado Water Conservation Board 

DATE: May 13, 1993

SUBJECT: Flood Risk Update

To keep you actively informed, we will prepare a "Flood Risk Update" periodically during the next 45 days so you are apprised of Colorado's communities at risk from flooding due to this year's abnormally high snowpack and its associated runoff.

The CWCB, in cooperation with the State Engineer's Office and the Colorado Department of Local Affairs, prepared information in March which alerted many West Slope communities about spring flood potential. The notification offered 1) assistance to local municipalities and counties in identifying flood threatened "trouble spots", and 2) actions to mitigate these problems should the threat of flooding be realized.

During the week of April 19-24, CWCB staff members along with representatives from the U.S. Army Corps of Engineers, the State Engineer's Office, Colorado Office of Emergency Management and local officials performed the flood hazard review at selected locations throughout western Colorado. As a result of that analysis, we have identified several locations which warrant monitoring. They are as follows:

- Grand Junction: The Riverside levee system, emergency levees at uranium tailings removal site, and the jetties at Redlands Parkway.
- Dolores: The community's poorly-maintained levee system,

- Crested Butte: Coal Creek throughout its reach within the town's corporate limits,
- Redstone: The community's recently improved levee system,
- Basalt: Low-lying areas adjacent to the confluence of the Roaring Fork and Fryingpan Rivers,
- Gunnison County: Resort areas at and near Almont and the Dos Rios Subdivision at Gunnison.

Through efforts by the Colorado Office of Emergency Management, all of the above-mentioned communities have stockpiled sandbags and activated their Emergency Operations Plans in preparation for the flood threat. In addition, my staff has recently performed the following activities as part of the State's response to the flood threat:

- May 12 at Crested Butte: Installed a new staff gage on Coal Creek so that streamflows can be monitored and water volumes calculated daily. The existing staff gage (installed by the CWCB in 1978) was also repaired. Stream cross-sections were surveyed at the gage sites so that accurate water volumes can be calculated. My staff will work throughout the runoff season with the Town staff to insure that flood emergency activities are successful.
- May 12 at Gunnison: Worked with the Gunnison County Emergency Manager, JoAnne Stone, to select a stream gage site for the Gunnison River and then work cooperatively with the Colorado Department of Transportation to insure that the gage is installed. On May 13, staff from the CDOT Gunnison Office will install the gage at the Colorado Highway 135 bridge over the Gunnison River, one mile north of the city.
- May 12 at Grand Junction: Coordinated with the U.S. Army Corps of Engineers and the City of Grand Junction regarding ongoing activities at the levee and jetty sites mentioned above.
- Activities with other selected communities are scheduled to begin the week of May 17.

Also on May 17, 1993, my staff plans to activate a daily monitoring system to keep communities apprised of snowmelt and runoff at selected locations on the western slope. By utilizing the State Engineer's Water Talk stream flow monitoring system, in conjunction with reports by modem from the Snotel Monitoring System

in Portland, Oregon, we will be able to keep communities alerted to the possibility of impending high water events.

We will keep you apprised frequently as to the progress of the State's efforts in assisting Colorado communities which are currently facing an imminent flood threat.

cc: Ken Salazar, DNR Executive Director
Hal Simpson, State Engineer
Len Boulas, OEM Director

STATE OF COLORADO

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Department of Natural Resources

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Roy Romer
Governor

Daries C. Lile P.E.
Director, CWCB

MEMORANDUM

TO: Members, CWCB

FROM: Daries C. Lile, Director
Larry Lang, Section A Chief

DATE: July 9, 1993

SUBJECT: Agenda Item 3, July 22-23, 1993, Board Meeting--
Flood Fight 1993

I am pleased to advise you that the flood potential which existed on May 1, 1993 came and went without too many serious problems. The heavy snowpack did not result in a flood event comparable to the 1984 event on most Colorado streams. However, the State did experience major flooding at a number of locations. These were:

Rifle -	Government and Rifle Creeks on May 15, 1993
Paonia and Delta County -	North Fork of the Gunnison River on May 27-28, 1993
Conejos County -	San Antonio River on May 14-17, 1993

The weather and the state agencies worked together to minimize flood problems in 1993. The preparedness efforts of DNR, DOLA, CWCB, SEO, OEM and local governments yielded many dividends during the spring runoff. The Board's Flooding Activity Daily reports provided information on the snowpack, water content, rate of melt, stream levels, and problem areas. The news media and local governments greatly appreciated our cooperation in providing this information.

As in 1984, the most significant damages resulted from streambank erosion. Streambank erosion is a major concern to property owners in western Colorado counties. During the high flows this year, we had locations on the North Fork of the Gunnison River in Delta County that were losing 100 feet of agricultural lands within 24 hours. In Conejos County erosion took out sections of county roads.

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The CWCB and USDA-Soil Conservation Service (SCS) staffs will be meeting with western Colorado communities during the week of July 19-23, 1993 to determine if the SCS's 216 program "Emergency Watershed Protection" can assist property owners with their restoration activities. Provisions of this emergency program must be implemented within ninety (90) days of the flood event.

Larry will make a brief presentation at our July CWCB Board meeting. An advance copy of the CWCB flood report for the 1993 spring runoff and a copy of our news release on the availability of flood insurance is enclosed for your information.

A new floodplain management term came to the forefront during the spring runoff. That term is "LUCK." LUCK determined that we would not have a prolonged hot spell in May or early June, thereby avoiding the rapid snowmelt we saw in 1983 and 1984.

DCL/LFL/bj

bj1111.ag3

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Roy Romer
Governor

Danes C. Lee, P.E.
Director CWCB

MEMORANDUM

TO: Members, CWCB

FROM: Larry Lang

DATE: September 2, 1993

SUBJECT: Agenda Item 18a, September 9-10, 1993, Board Meeting--
1993 Flood Issues and Mitigation Opportunities

Overview:

At the July Board meeting in Meeker, Colorado, there were a number of questions regarding "the major concerns/issues for the 1993 flood operations" that arose from the experience of local and state officials and citizens during the CWCB flood emergency operations. My presentation entitled "1993 Flood Issues and Mitigation Opportunities" discusses 1993 issues and opportunities to mitigate future flood problems during the post-flood recovery period. In 1993 there were no flood disaster declarations made by the local, state or federal governments. However, we have received many requests for technical and financial assistance from towns/cities, counties, irrigation companies and individual property owners.

The Board has been successful in obtaining assistance for Colorado entities through the Corps of Engineers (Corps) and Soil Conservation Service (SCS) programs. The SCS's Emergency Watershed Program has proven to be the most beneficial program in addressing many of the streambank erosion problems. These programs address many problems but there are still some important issues that should be addressed. I present the following seven issues.

o A Colorado Snowmelt Runoff Model

Issue: Accurate projection of stream flows and stages for localized areas or stream reaches. Knowing is important!

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September 2, 1993

Discussion: The State of Colorado receives valuable data from the Soil Conservation Services' Snow Survey Unit and National Weather Services River Forecast Centers. However, the data is organized by river basin or general location. This requires additional analyses for the implementation of an Advance Flood Fight Operation. In addition to these forecast data, the Division of Water Resources Satellite Monitoring Network of stream gages provides real time data of stream levels for many stream reaches. However, many miles of stream are not gaged and some gages are subject to failure during large flows.

Action: The development of a Colorado Snowmelt Runoff Model would provide daily information based on temperature, snowpack, melt rate, snowpack elevations, increase runoff from rain, temperature trends and forecasts. A model would incorporate all existing data and would be designed to provide information for all Colorado sites and locations. It would greatly assist in the determination of when and where to cry "wolf."

o Confusion About Flood Insurance

Issue: Agents, governmental officials and property owners are misinformed about the purchase of flood insurance. Wrong rates costs \$\$\$!

Discussion: Presently 12 percent of that all flood prone properties are covered by a flood insurance policy. In other words, 88 percent of the properties that should have flood insurance DO NOT. Much confusion exists regarding the purchase procedures, insurance rates, coverage limits, availability, and eligibility.

Action: An annual education campaign needs to be implemented for agents, property owners, non-FEMA officials, news media, and general public.

o Flood Preparedness

Issue: Flood threats and events are not daily or annual occurrences; therefore, staffing and budgets do not exist within most state agencies to respond to floods. Responses are characterized by a crisis atmosphere. Prevention saves \$\$\$!

Discussion: Flood preparedness planning activities must address the

- Lack of awareness of a flood potential
- Lack of awareness of available advance preparedness measures

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- Lack of detailed information regarding the hydrology and hydraulic characteristics of many stream reaches
- Lack of technical/financial resources of local entities

Action: A response plan needs to be prepared which addresses actions that need to be implemented by the local-state-federal levels of government for a flood event. The "when-where-what type" questions need to be asked and answered ahead of the event as much as possible.

o Restore/Reclaim the Original Stream Channel

Issue: The major flood problem in 1993 was streambank erosion and channel migration. Who determines where the channel goes?

Discussion: During large spring snowmelt runoffs, much land is lost due to erosion and channel migration. Many land owners want to reclaim lost lands or move the channel back to its pre-flood alignment. There is no state policy on stream alignments. The Corps' 404 program is becoming more restrictive on what a land owner can or cannot do regarding this issue.

Action: A state standard or policy regarding the issue should be formulated among land owners, city and county governments and state and federal officials.

o Regulations Affecting Flood Fight Operations

Issue: At a number of locations, a flood fight operation was impaired due to a federal regulation. Don't tell me what to do!

Discussion: The Corps' 404 Program, the Wetland Reserve Program, and the FEMA National Flood Insurance Program have certain requirements which restrict activities in stream channels. During most flood fight operations, land owners are not completely aware of program requirements or do not feel that the program objectives are as important as their potential loss. This has resulted in a number of hostile confrontations.

Action: Certain special permits can be issued in advance of a flood alert/event which will reduce confrontations between land owners and government officials. In addition education about program objectives and requirements should be provided to property owners.

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o Post-Flood Response

Issue: The total dollar loss resulting from a flood event determines the amount of financial assistance available from government programs. The smaller, more localized, events generally result in less assistance or no assistance.
We need help!

Discussion: The assistance available to flooded areas greatly vary for "Major" and "Localized" events. In most localized events, the economic impact to the victims is proportionately greater than during a major event. In a localized event, most federal recovery programs are not applicable therefore, more creative financial assistance is required in flood mitigation activities by state and local agencies.

Action: The Flood Hazard Mitigation Plan for Colorado needs to be updated to explain changes in assistance programs. A state-wide Flood Reservist program needs to be developed which would provide a pool of experts that can assist during any level of flood recovery operation.

o Multi-Objective River Management Planning

Issue: What is the "Best" usage or combination of usages for the State's streams and their floodplains? My plan vs. Our plan!

Discussion: Colorado streams corridors are used for

- Agricultural, Industrial, and Municipal uses;
- Flood conveyance;
- Instream flows;
- Water quality improvements
- Reservoir storage site;
- Natural habitat; and
- Recreation and Aesthetics
- Associated environmental interests.

Through a flood event "Mother Nature" reclaims her interest in these stream corridors. This can result in substantial losses to the non-flood uses of the stream. There appears to be an ever increasing need to evaluate all uses when a stream-related proposal is made, whether it would impede flood conveyance or improve flood conveyance.

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Action: Through a Multi-Objective River Management Planning process, the interests of all stream users can be better achieved. Most mandated programs have standards which can be evaluated or amended in the planning process. Many times the flood conveyance of a stream is not properly evaluated or considered in a re-development proposal whose objectives are not flood protection. Likewise flood protection projects do not always properly consider other uses of the river. A multi objective approach should be required for all river projects.

Possible Legislative Issues

The above seven issues lead naturally to consideration of the possible need for legislative action by the State of Colorado.

There are many questions, misunderstandings, and pre-conceived opinions on the authorities and responsibilities which government officials and land owners have during a flood event.

Below is a list of issues that could be considered by the State:

1. Direction to public officials to implement "Best Management Practices" during a declared flood emergency by public officials
2. Designation of Natural Channel locations and alignments
3. Authorization of the State Engineer to divert flood waters and change reservoir storage
4. Authorization for state agencies to re-assign allocated funds
5. Clarification that expenditures by public entities are exempt from the provisions of Amendment No. 1 during a natural disaster emergency operation
6. Mandating flood insurance coverage as a requirement when state resources are used in a development activity
7. Others