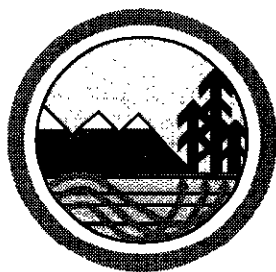


---

**FLOOD HAZARD MITIGATION AND  
FLOOD HAZARD AWARENESS  
FOR RESIDENTS OF  
BUFFALO CREEK, COLORADO**

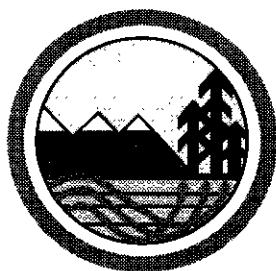


**Department of Natural Resources  
Colorado Water Conservation Board  
Flood Control and Floodplain Management Section  
1313 Sherman Street, Room 721  
Denver, Colorado 80203**

**April 1997**

# **FLOOD HAZARD MITIGATION AND FLOOD HAZARD AWARENESS FOR RESIDENTS OF BUFFALO CREEK, COLORADO**

**Prepared by:  
Colorado Water Conservation Board**



**COLORADO**



**DEPARTMENT OF  
NATURAL  
RESOURCES**

**Department of Natural Resources  
Colorado Water Conservation Board  
Flood Control and Floodplain Management Section  
1313 Sherman Street, Room 721  
Denver, Colorado 80203**

**April 1997**

# STATE OF COLORADO

## Colorado Water Conservation Board Department of Natural Resources

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



April 15, 1997

Roy Romer  
Governor

James S. Lochhead  
Executive Director, DNR

Daries C. Lile, PE.  
Director, CWCB

To the Residents of Buffalo Creek:

As a result of the forest fire in May 1996 and the lessons we have learned after the July 1996 flash flood, your community will likely be at greater risk of flash flooding for several years. Because of the impacts that fire and the flood had in your community, we are grateful for the opportunity to help prepare this report in hopes that future land use, forest management, flood preparation, flood warning, and other measures can be coordinated to minimize future risk to your homes and families.

On behalf of the Colorado Water Conservation Board, I would like to thank the Buffalo Creek Crisis Committee, the Jefferson County Sheriff's Department, the Jefferson County Office of Emergency Management, and the North Fork Fire Department for their dedication and assistance to your community during and after the 1996 disasters. The information presented in this report is intended to provide general recommendations for flood hazard mitigation that can be implemented by you if you so desire. In addition, this report contains information on flood hazard awareness that should be reviewed annually.

I also want to thank Ron Cattany, Larry Lang, Tom Browning, and Brian Hyde for their dedication to the assessment of future flood risks and flood hazard mitigation needs in the Buffalo Creek Watershed, and for the long days and weekends they put into this important effort.

Finally, I want to acknowledge the incredible effort you have made, with your neighbors and other emergency officials, to cope with and recover from the terrible consequences associated with the fire and flood of 1996.

Sincerely,

Daries C. Lile  
Director

DCL/scm

c:\seca\buffalo\mitig\res-ltr.doc

## TABLE OF CONTENTS

<u>Section</u>	<u>Page Number</u>
<b>I. BACKGROUND</b>	<b>1</b>
A. INTRODUCTION	
B. PURPOSE AND SCOPE	
<b>II. FLOOD HAZARD MITIGATION</b>	<b>2</b>
A. REHABILITATION OF PRIVATE LANDS	
B. STRUCTURAL MITIGATION	
C. NON-STRUCTURAL MITIGATION	
<b>III. FLOOD HAZARD AWARENESS</b>	<b>7</b>
A. JULY 12, 1996 STORM EVENT	
B. HIGH HAZARD AREAS	
C. WATERSHED RECOVERY	
D. NATIONAL WEATHER SERVICE RAIN GAGES	
E. PRE-FIRE MANAGEMENT	
<b>IV. EMERGENCY RESPONSE PLAN</b>	<b>12</b>
<b>V. TIPS TO MINIMIZE LOSS OF LIFE AND PROPERTY IN THE EVENT OF A FLOOD</b>	<b>13</b>
<b>VI. REFERENCES</b>	<b>17</b>

## I. BACKGROUND

### A. INTRODUCTION

On the night of July 12, 1996, a thunderstorm occurred in the area of the community of Buffalo Creek, Colorado. The storm produced heavy precipitation over a short period of time. A flash flood occurred along Buffalo Creek, Sand Draw, Spring Gulch, the North Fork of the South Platte River (North Fork) below its confluence with Buffalo Creek, and several other tributary streams in the area. Two lives were lost as a direct result of the flooding. Roads, bridges, water lines, and other utility lines were damaged or destroyed. Numerous homes, outbuildings, and vehicles were damaged or destroyed as well. A large quantity of sediment and debris was carried from the watershed and deposited along the affected stream reaches. Although the geographic area affected was smaller than in some other floods, the July 12 Buffalo Creek flood event was truly a disaster. Other smaller scale floods occurred in Buffalo Creek between June and September of 1996 as well.

In May of 1996, less than two months before the July 12 flood event, a wildland fire burned about 12,000 acres of forested area in the Buffalo Creek vicinity. The fire burned intensely and quickly, leaving behind charred timber and a barren landscape devoid of vegetation and ground cover. The burned soils exhibited hydrophobic (water repelling) properties, and the burned area's natural erosion control and runoff inhibiting characteristics were altered by the fire. Those conditions, in conjunction with a heavy rainstorm on July 12, were the recipe for disaster in Buffalo Creek.

### B. PURPOSE AND SCOPE

The purpose of this report is to provide residents of Buffalo Creek with a single document that contains an emergency response plan, information on flood hazard mitigation, and information on flood hazard awareness. This document is intended to be an informational guide with basic information that should be useful to Buffalo Creek residents. Family members and guests who plan on residing in or visiting the Buffalo Creek area during the months of April through October should familiarize themselves with the pertinent information in this guide. **Since the threat of flash flooding in Buffalo Creek could exist for many years to come, it is recommended that residents review the information in this document each spring before the flood season begins.** History has shown that the lessons learned from the events of a flash flood are sometimes forgotten within a short amount of time. In addition, new residents and visitors to the area may have no appreciation or knowledge of the devastating power of a flash flood. Existing residents should try to assist any newcomers by sharing valuable information that could save lives and property.

## II. FLOOD HAZARD MITIGATION

### A. REHABILITATION OF PRIVATE LANDS

The Colorado State Forest Service (CSFS) has been involved with rehabilitation of private lands in the Buffalo Creek vicinity. In particular, they have been working with land owners in the Sand Draw and Spring Gulch watersheds. As of October 1996, three Forest Stewardship plans have been completed that address rehabilitation on 197 acres in those areas.

As part of the effort, 250 linear feet of straw bale dams have been placed, 400 pounds of grass seed have been spread, 400 trees have been planted, and 600 trees have been purchased for Spring planting. The labor expended to date includes 300 hours of volunteer service, 30 hours of CSFS technical assistance, and 4 hours of CSFS environmental education.

Another project which is now pending includes the purchase of 500 or more tree seedlings by the Rocky Mountain News. Those trees are planned to be planted during the spring of 1997 by CSFS personnel or by volunteers.

### B. STRUCTURAL MITIGATION

Mitigation practices can involve temporary or permanent structural measures such as sandbags, floodwalls, levees, channel improvements, elevation of buildings, and flood proofing/retrofitting. The descriptions below are very brief and are intended to illustrate some of the alternatives available. There are numerous mitigation documents available, and the CWCB can provide further information and assistance to interested parties. The Colorado Office of Emergency Management and the Federal Emergency Management Agency have information and expertise in these areas as well.

#### Temporary Measures

Sandbags have long been used as a temporary flood control measure. The basic supplies required for an emergency sandbag levee are:

- Sandbags (standard issue cloth or plastic bags are recommended)
- Source of Sand
- Polyethylene (Poly)
- Heavy Equipment
- Shovels, Wheelbarrows, and other hand tools
- People

Some general tips on how a sandbag levee should be created:

- The sandbag levee requires careful and well-planned placement.
- A properly filled sandbag is only half-full, and weighs about 40 pounds.
- The open end of a filled sandbag should be folded over, not stitched or tied.
- A key trench should be excavated to a depth of 4 to 6 inches and a width of 18 to 24 inches prior to placing any sandbags.

- Poly should be placed in the trench and anchored with several sandbags. A sufficient width of the poly is placed on the water side of the levee.
- Sandbags should be stacked in alternating rows, similar to the alternating joints of a brick wall.
- Sandbags should be stacked in a pyramidal structure using a 3 to 1 ratio of the base width to the height.
- The elevation of the levee should be maintained to the desired level of protection.
- The poly sheeting should provide a water proof cap, once the levee has been built.
- Sandbags are placed to secure the poly on top of the levee.
- Levees should be kept at least 6 feet from foundation or basement walls.

Figure 1 depicts a typical cross-section of a properly constructed sandbag levee.

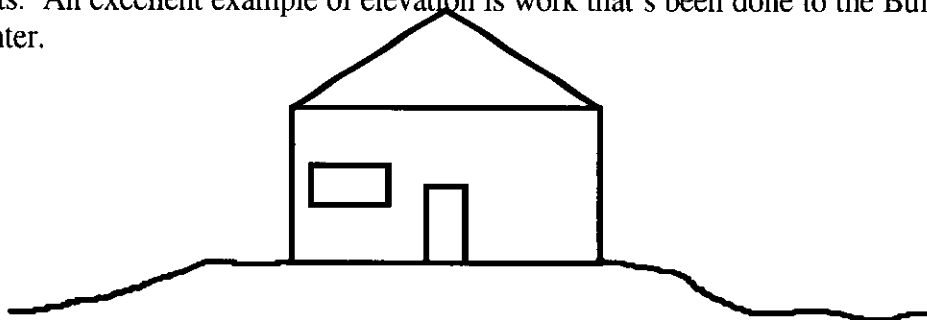
Straw bale dams can be constructed in streams and along properties for flood and sediment control purposes. The straw bales are used to slow the velocity of water moving downslope, reduce amount of runoff by allowing infiltration, and reduce amount of sediment moving downslope. The straw bale placement is best accomplished by hand crews. Figure 2 presents an installation guide for straw bales.

### Flood Proofing

Flood proofing is defined as “any combination of structural or non-structural changes or adjustments incorporated in the design, construction, or alteration of individual buildings or properties that will reduce flood damages.” Simply stated, flood proofing includes any effort property owners may take to reduce flood damage to buildings and their contents. Flood proofing can benefit the property owner by reducing future flood damages and the inconveniences due to cleanup and repair. Other benefits may include less time off work, improved health and safety, and other intangible benefits. There are three general classifications of floodproofed structures: 1) Permanent flood proofing which does not require human action to initiate, 2) Contingent flood proofing which requires human action at the time of flood warning, and 3) Emergency measures used and initiated at the time of flooding. Some of the most common types of flood proofing practices are described below.

### Elevation

Elevation of a building involves raising a building in place so that the lowest floor is above the flood level for which protection is being provided. Buildings can be elevated on several different types of foundations including raised foundation walls or an open foundation on piers, posts, or piles. Buildings may also be elevated by filling the property to raise the ground elevation on which the structure sits. An excellent example of elevation is work that’s been done to the Buffalo Creek community center.



# Flood Control Procedures

Use Poly with Sandbags for best protection!

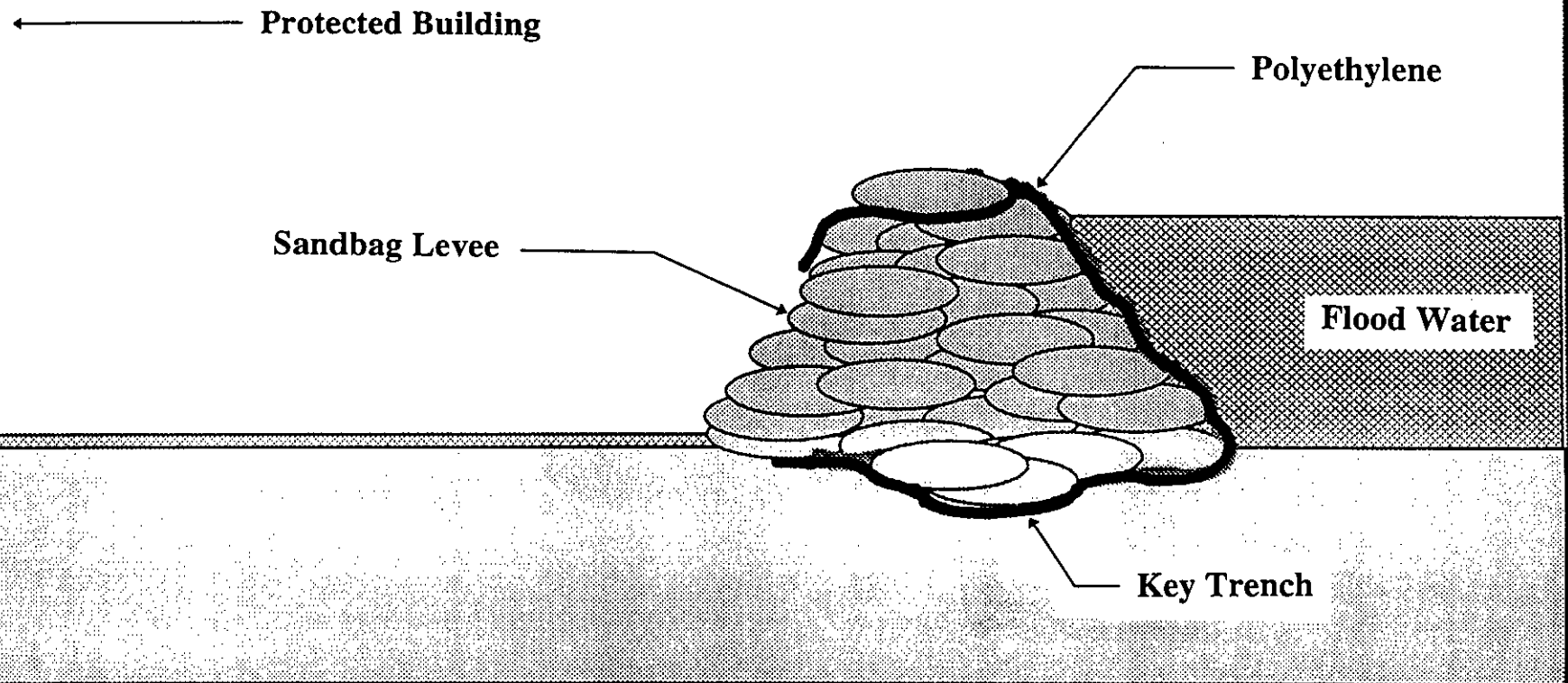
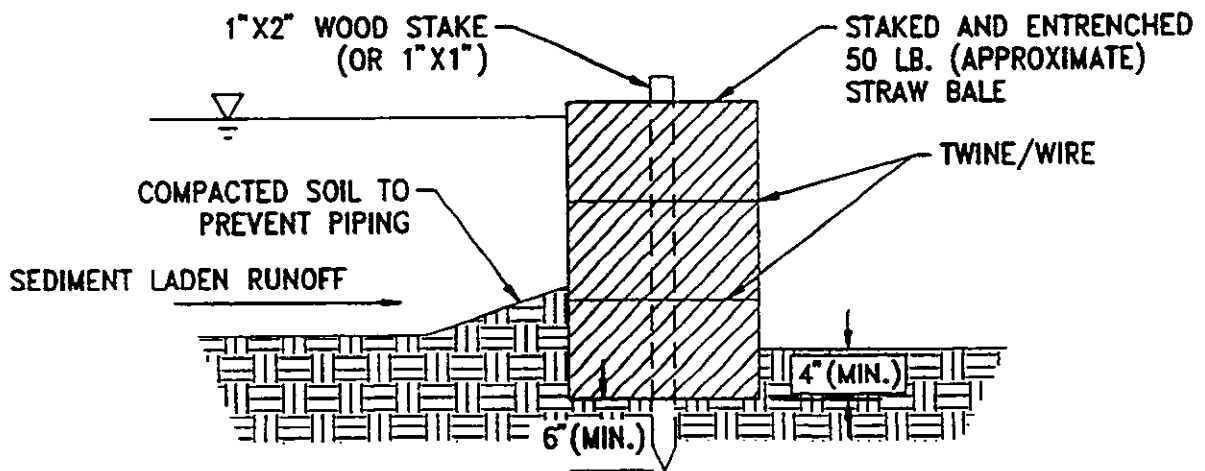
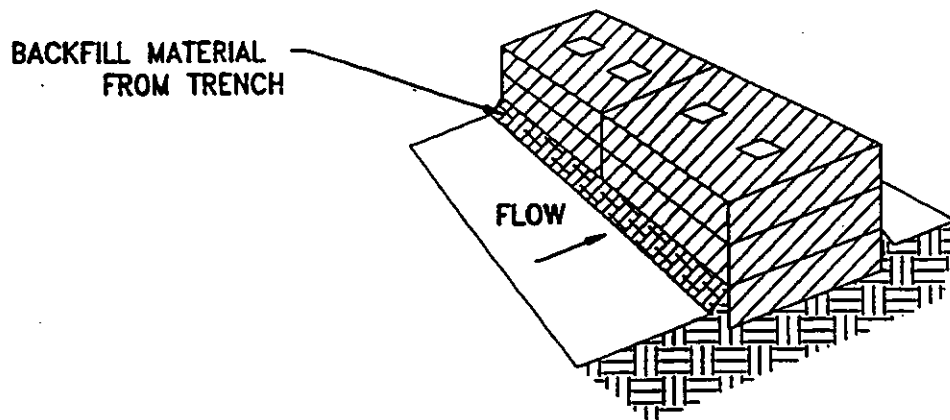
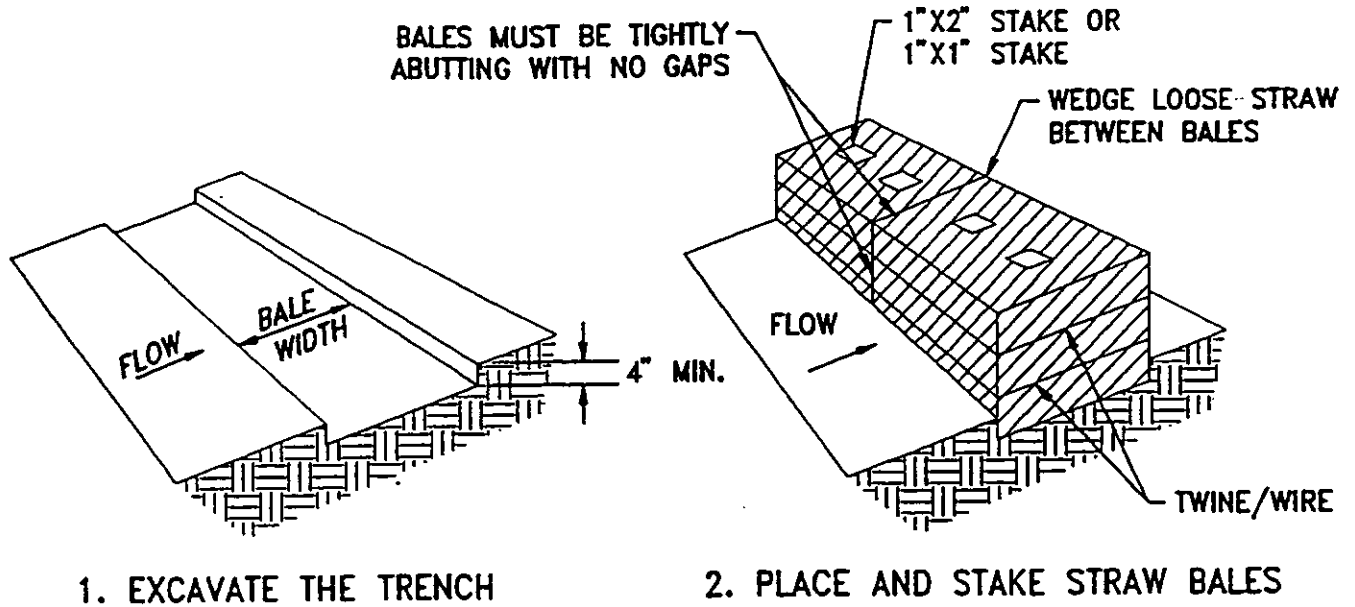


Figure 1



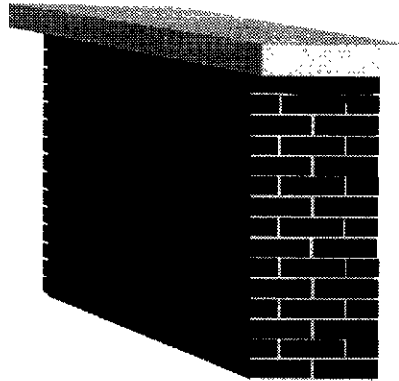
## GENERAL INSTALLATION OF STRAW BALES



CROSS-SECTION OF A PROPERLY INSTALLED STRAW BALE

### Floodwalls and Levees

Floodwalls and levees are free standing structures that prevent floodwaters from encroaching into the protected buildings. They may completely surround the building or protect only the low side of the property. Construction of floodwalls and levees may require local, state, and/or federal permits in order to protect other properties from adverse impacts, to avoid filling in wetlands, and to maintain regulatory floodways. The desired aesthetics of the neighborhood should also be taken into account when considering a floodwall or levee. The most important consideration is that property owners who have constructed a floodwall or levee should not have a false sense of security about their property protection. The protected area should always be evacuated prior to flooding.



### Dry Flood Proofing

This technique involves sealing building walls with waterproofing compounds, impermeable sheeting, or other materials and using shields for covering and protecting openings from floodwaters. Dry flood proofing works best on structures in the flood fringe where the flows are shallow with low velocities. Building walls can be protected to a height of about three feet, depending on building construction. This technique is not recommended for buildings with a basement or a crawl space due to underseepage problems that can occur.

## **C. NON- STRUCTURAL MITIGATION**

A comprehensive approach to flood hazard mitigation can and should also include equally effective non-structural measures such as flood insurance, emergency preparedness, public education and awareness, and acquisition and relocation of structures. These measures are briefly described below. There are numerous mitigation documents available, and the CWCB can provide further information and assistance to interested parties. The Colorado Office of Emergency Management and the Federal Emergency Management Agency have information and expertise in these areas as well.

### Flood Insurance

The National Flood Insurance Program (NFIP) is a federally subsidized program that is available to any property owner whether or not the building is in a floodplain. Insurance is sold through a private insurance agent who wants to sell it in a community who has joined the program. As of August 5, 1986, Jefferson County has been participating in this program. The NFIP is based on an agreement between local communities and the federal government which states that if a community will implement measures to reduce future flood risks to new construction or substantial re-construction, the federal government will make flood insurance available within the community as

financial protection against flood losses which do occur. **It is very important to know that most homeowner's insurance policies do not cover losses from flooding. The only way to get federally-backed flood coverage is through the NFIP.** It is interesting to note that about one third of all flood insurance claims come from outside of the mapped regulatory floodplain areas (100-year floodplains). Homeowners may check with their local insurance agent to find out more about flood insurance coverages and costs.

#### Emergency Preparedness

There is no substitute for living by the motto of "Be Prepared." By taking some simple and low-cost precautionary measures at home, individuals and families can help to minimize the devastation caused by a flood event, and they may even save their own lives. Section IV presents tips to minimize loss of life and property in the event of a flood. These tips should be studied and discussed by family members before a flood event occurs.

#### Public Education and Awareness

Residents of the community, emergency personnel, hikers, campers, roadway users, and anyone else who visits Buffalo Creek needs to be made aware or reminded of the flash-flood hazards in the area. Community members, the volunteer fire department, the Jefferson County Sheriff's Department, and the Jefferson County emergency management personnel will need to serve as the key players in public education and awareness.

### **III. FLOOD HAZARD AWARENESS**

#### **A. JULY 12, 1996 STORM EVENT**

The summer storm that produced flash flooding in the Buffalo Creek area was a "convective" type cloudburst event. This type of event is common along the foothills and plains in eastern Colorado. Storms like this form quickly and can produce large amounts of rainfall, hail, and severe weather conditions within a short amount of time. This is the type of event that will pose the most threat for flash flooding in the Buffalo Creek area. Flooding due to snowmelt runoff (or general rains with low rainfall intensities and long durations) will not likely be a major concern for the Buffalo Creek area.

At this time, preliminary information is available describing the July 12, 1996 storm over Buffalo Creek. The information is based on a detailed meteorological analysis performed by Henz Meteorological Services. The analysis was cooperatively funded by Jefferson County, the Colorado Water Conservation Board, the Urban Drainage and Flood Control District, the Colorado Geological Survey, and the Denver Water Board. The storm information is also based on field analyses conducted by the Colorado Water Conservation Board, the U.S. Geological Survey, and the National Weather Service. In addition, information was obtained through rain gages and interviews with witnesses and local residents. The most intense rainfall amounts are estimated to be at least 3 inches, but up to 5 inches, within about 90 minutes. The storm covered a substantial area of over 20 square miles. To provide a point of reference, the 100-year, 1-hour precipitation depth for southern Jefferson County is reported to be about 2.1 inches according to the Jefferson County Storm Drainage Design and Criteria Manual. In other words, the July 12 storm had a very

large magnitude of rainfall and is considered to be a rare event for the area. According to the statistics and the available published data, the chance of having a similar event in any given year is quite small. However, this does not mean that the flood threat is minimal.

It is important to note that the flood peaks on Sand Draw, Spring Gulch, Buffalo Creek, and other nearby tributaries occurred within less than one hour from the start of the heavy rainfall. Flow velocities in some streams were at least 15 to 20 feet per second. This situation, known as flash flooding, is extremely dangerous. Residents, recreationists, and visitors should be aware of and prepared for future flash flooding that could potentially occur in the area. Property damage and loss of life is always a possibility during flash flooding. As the Buffalo Creek residents are well aware, the power of a flash flood event should not be underestimated!

**B. HIGH HAZARD AREAS**

Due to the burned areas in the Buffalo Creek and adjacent watersheds, several streams have been identified as having unusually high flood potential until such time that their watershed areas recover from the forest fire. Following are examples of the high hazard streams in the area:

<b>Stream Name</b>	<b>High Hazard Reaches</b>
Buffalo Creek	From the confluence with the North Fork upstream to the intersection of Forest Roads 543 and 550
Sand Draw	From the confluence with Buffalo Creek upstream to the headwaters
Spring Gulch	From the confluence with Buffalo Creek upstream to the headwaters
Shinglemill Creek	From the confluence with Buffalo Creek upstream to the headwaters
Morrison Creek	From the confluence with Buffalo Creek upstream to the headwaters
Spring Creek	From the confluence with the South Platte River upstream to the headwaters
North Fork of South Platte River	From the confluence with the South Platte River upstream to the confluence with Buffalo Creek
South Platte River	From Strontia Springs Reservoir upstream to the confluence with Spring Creek

**C. WATERSHED RECOVERY**

The natural recovery of the burned areas in the Buffalo Creek vicinity could be a long process. Fortunately, with the aggressive reclamation actions by the U.S. Forest Service and the Colorado State Forest Service, the initial stages of the recovery should be enhanced and accelerated. The hydrologic response of the burned watersheds will likely depend on the level of vegetative and soil surface recovery. Following are some key phases to the recovery process:

- Break-up of hydrophobic (water repellent) soils
- Recovery of native grasses, forbs, and shrubs

- Recovery of native trees
- Recovery of humus layer (organic layer at soil surface)

The effects of an intense fire on the watershed's soil structure and hydrology can be significant. The following key points about the effects of fire on soil and hydrology were extracted from U.S. Forest Service publications.

- For arid areas of the U.S., vegetative regrowth after a severe burning can be very slow.
- Coarse textured soils are more likely to become highly water repellent than fine clay soils.
- Lodgepole and Ponderosa Pine forests have displayed high water repellency after burning.
- Soil formed from granitic parent material is sensitive to erosion. The erosion rate is a function of the burn intensity.
- For recently burned watersheds, peak streamflows have been reported to be 2 to 60 times greater than normal after a heavy rain.

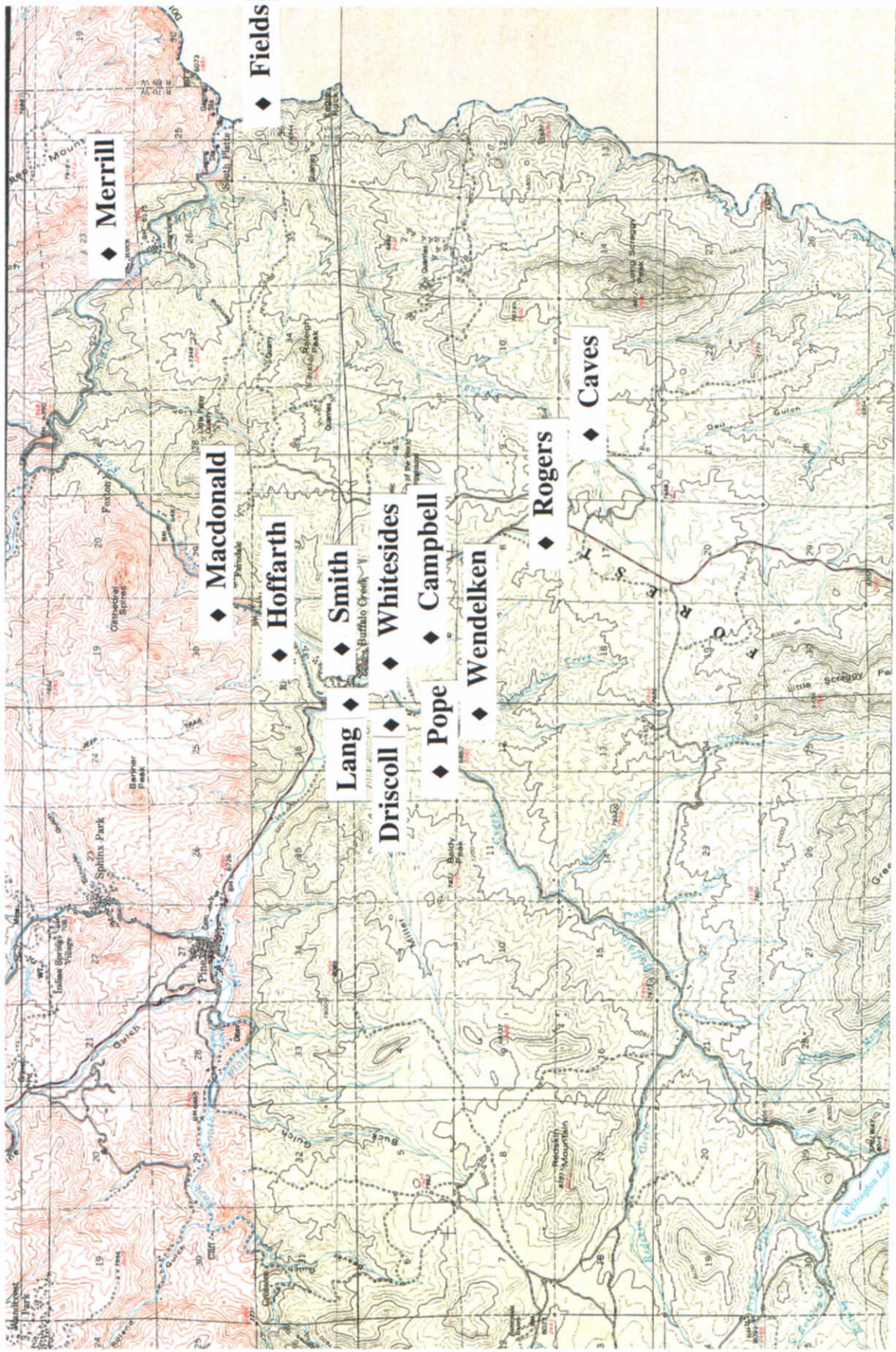
Unfortunately, the Buffalo Creek area fits all of the above categories. Strategic planning and mitigation can help to reduce the adverse affects caused by the fire. Previous research suggests that the complete break-up of the hydrophobic soils can occur naturally as soon as 1 to 2 years after the fire. The return of certain grasses and forbs should occur fairly rapidly as well. It will likely take a much longer time for larger trees and shrubs to develop in the burned watershed. It is likely that flash flooding could be a high risk over the next several years, and could then be a moderate risk for many years thereafter. After the Black Tiger Run fire in Boulder County, the Bureau of Reclamation observed that sediment production and runoff were most significant immediately following the fire. By the next summer season, sediment production had decreased significantly.

#### **D. NATIONAL WEATHER SERVICE RAIN GAGES**

Thirteen residents in the Buffalo Creek area have been provided with National Weather Service (NWS) rain gages. These gages are manual, non-recording instruments that are intended to collect precipitation for use in reporting purposes. The residents with the gages have been given the responsibility of placing, maintaining, monitoring, and operating them. Specific instructions from the NWS were distributed to the residents who received the gages. Rainfall amounts should be recorded and reported to the NWS during and after each storm event. The 24-hour NWS reporting number is (303) 361-0663. In addition, residents should report rain levels to Grant Macdonald at (303) 838-0106 for the purpose of summarizing precipitation totals for each storm and for each month during the flood season. The names, addresses, and phone numbers for the locations of the rain gages is presented in Table 1. The gage locations are presented graphically on the map that follows Table 1.

**Table 1**  
**Location of National Weather Service Rain Gages**

<b>Name, Address, and Phone Number</b>	<b>Name, Address, and Phone Number</b>
David and Kathy Fields 3231 South Platte River Road Foxton, Colorado 80441 (303) 838-6415	Tim and Joni Driscoll 18301 Buffalo Creek Road Buffalo Creek, Colorado 80425 (303) 838-6314
David Merrill 17705 County Road 96 Foxton, Colorado 80441 (303) 838-5861	Fred Wendelken 18710 Buffalo Creek Road Buffalo Creek, Colorado 80425 (303) 838-7439
Grant and Cherry Macdonald 17105 County Road 96 Buffalo Creek, Colorado 80425 (303) 838-0106	John Lewis and Carla Pope 19221 Buffalo Creek Road Buffalo Creek, Colorado 80425 (303) 838-0709
David and Bulla Hoffarth 17555 County Road 96 Buffalo Creek, Colorado 80425 (303) 838-6215	Curt and Aimee-King Rogers 19345 County Road 126 Buffalo Creek, Colorado 80425 (303) 838-7254
Gene and Barbara Caves 19988 Argentine Way Spring Creek Ranch, Colorado 80425 (303) 838-4518	Vicki Porter and Pat Lang 23744 Hill Top Road Buffalo Creek, Colorado 80425 (303) 838-4164
Don and Marge Smith 18224 County Road 126 Buffalo Creek, Colorado 80425 (303) 838-5258	Jane Campbell 23721 Pine Top Road Buffalo Creek, Colorado 80425 (303) 838-5084
Page and Katheryn Whitesides 23916 Logan Ave. Buffalo Creek, Colorado 80425 (303) 838-8204	



**Location of National Weather Service  
Rain Gages in the Buffalo Creek Area**

## **E. PRE-FIRE MANAGEMENT**

In order to help prevent losses from future fires (and floods thereafter), the following pre-fire mitigation techniques have been suggested by forest management and emergency management experts:

### **Defensible Space**

The implementation of this measure can dramatically improve the survival rate of a structure during a fire. It involves the reduction of fuel loading by thinning or eliminating certain types of vegetation adjacent to the building. The distance required for the defensible space around the perimeter of the building is dependent on several factors including topography and fuel type. The minimum defensible space is generally recommended to be 30 feet.

### **Building Materials**

The type of materials used for the construction of a building can also have a significant effect on its survivability during a fire. A roof covering consisting of clay or concrete tile, composite shingle, or metal can help to protect the building from a fire. A roofing material such as cedar shake shingles will likely reduce the chance of the building's survival. Exterior finishes such as brick or stucco are more fire resistant than finishes such as wood siding or logs.

### **Fuel Breaks**

Fuel breaks, as the name implies, provide a line of defense where a fire theoretically will not cross and continue to burn on the other side of the break. A roadway can be used as the basis for a fuel break, combined with forest thinning on one or both sides of the road. The required width of thinning depends on factors such as topography and fuel type. The minimum recommended width for a fuel break is 200 feet.

### **Forest Wide Thinning**

The objectives of forest wide thinning are to reduce fuel loading, increase forest health, and improve aesthetics. In dense forests, fires quickly change from relatively harmless ground fires to catastrophic crown fires because of the "fuel ladder" effect. In a thinned forest, the fire will likely stay a ground fire, and will probably do little damage.

## **IV. EMERGENCY RESPONSE PLAN**

A local emergency response plan has been developed by members of the Buffalo Creek Crisis Committee in cooperation with the North Fork Fire Department. The Buffalo Creek emergency response plan is considered to be an addendum to this mitigation plan, but is not included within this document.



## V. TIPS TO MINIMIZE LOSS OF LIFE AND PROPERTY IN THE EVENT OF A FLOOD

The following tips are summarized from the Federal Emergency Management Agency's National Flood Insurance Program and should be used as suggested guidelines for action before, during, and after a flood.

### STEPS TO TAKE TODAY

- ⇒ **Make an itemized list of personal property**, including furnishings, clothing, and valuables. Photographs of your home - inside and out are helpful. These will assist an adjuster in settling claims and will help prove uninsured losses, which are tax deductible.
- ⇒ **Learn the safest route from your home or place of business** to high, safe ground if you should have to evacuate in a hurry.
- ⇒ **Keep a portable radio, emergency cooking equipment, and flashlights in working order.**
- ⇒ **Persons who live in frequently flooded areas should keep on hand materials** such as sandbags, plywood, plastic sheeting, and lumber which can be used to protect private property. (Remember, sandbags should not be stacked directly against the outer walls of a building, since, when wet, the bags may create added pressure on the foundation.)
- ⇒ **Buy flood insurance.** You should contact your property/casualty agent or broker about eligibility for flood insurance, which is offered through the National Flood Insurance Program. Generally, there is a five-day waiting period for this policy to become effective, so don't wait until the last minute to apply.
- ⇒ **Keep your insurance policies and a list of personal property** in a safe place, such as a safe-deposit box.
- ⇒ **Know the name and location** of the agent(s) who issued the policies.

### IF A FLOOD OCCURS

**The safety of your family is the most important consideration. Since flood waters can rise very rapidly, you should be prepared to evacuate before the water level reaches your property.**

- ⇒ **Keep a battery-powered radio** tuned to a local station, and follow all emergency instructions.

- ⇒ **If you're caught in the house by sudden rising water**, move to the second floor and, if necessary, to the roof. Take warm clothing, a flashlight, and a portable radio with you. Then wait for help, don't try to swim to safety. Rescue teams will be looking for you.
- ⇒ **When outside the house, remember - floods are deceptive.** Try to avoid flooded areas, and don't attempt to walk through floodwaters that are more than knee deep.
- ⇒ **If, and only if, time permits . . .** there are several precautionary steps that can be taken.
- ◆ Turn off all utilities at the main power switch and close the main gas valve if evacuation appears necessary . Do not touch any electrical equipment unless it is in a dry area and you are standing on a piece of dry wood while wearing rubber gloves and rubber soled boots or shoes.
  - ◆ Move valuable papers, furs, jewelry, clothing, and other contents to upper floors or higher elevations.
  - ◆ Fill bathtubs, sinks and jugs with clean water in case regular supplies are contaminated. You can sanitize these items by first rinsing with bleach.
  - ◆ Board up windows or protect them with storm shutters or tape to prevent flying glass.
  - ◆ Bring outdoor possessions inside the house or tie them down securely. This includes lawn furniture, garbage cans, tools, signs, and other movable objects that might be swept away or hurled about.
- ⇒ **If it is safe to evacuate by car**, you should consider doing the following:
- ◆ Stock the car with non perishable foods (like canned goods), a plastic container of water, blankets, first aid kit, flashlights, dry clothing, and any special medication needed by your family.
  - ◆ Do not drive where water is over the roads. Parts of the roads may already be washed out.
  - ◆ If your car stalls out in a flooded area, abandon it as soon as possible. Floodwaters can rise rapidly and sweep a car (and its occupants) away. Many deaths have resulted from attempts to move stalled vehicles.

#### AFTER THE FLOOD

- ⇒ **If your home, apartment or business has suffered flood damage**, immediately call the agent or broker who handles your flood insurance policy. The agent will then submit a loss

form to the National Flood Insurance Program. An adjuster will be assigned to inspect your property as soon as possible.

- ⇒ **Prior to entering a building**, check for structural damage. Make sure it is not in danger of collapsing. Turn off any outside gas lines at the meter or tank, and let the house air for several minutes to remove foul odors or escaping gas.
- ⇒ **Upon entering the building**, do not use open flame as a source of light since gas may still be trapped inside; a battery-operated flashlight is ideal.
- ⇒ **Watch for electrical shorts or live wires** before making certain that the main power switch is turned off. Do not turn on any lights or appliances until an electrician has checked the system for short circuits.
- ⇒ **Cover broken windows and holes** in the roof or walls to prevent further weather damage.
- ⇒ **Proceed with immediate cleanup measures** to prevent any health hazards. Perishable items which pose a health problem should be listed and photographed before discarding. Throw out fresh food and previously opened medicines that have come in contact with flood waters.
- ⇒ **Water for drinking and food preparation** should be boiled vigorously for ten minutes (until the public water system has been declared safe.) Another method of disinfecting is to mix 1/2 teaspoon of liquid commercial bleach with 2-1/2 gallons of water . . . let stand for five minutes before using. The flat taste can be removed by pouring the water from one container to another or adding a pinch of salt. In an emergency, water may be obtained by draining a hot water tank or melting ice cubes.
- ⇒ **Refrigerators, sofas, and other hard goods** should be hosed off and kept for the adjuster's inspection. A good deodorizer when cleaning major kitchen appliances is to add one teaspoon of baking soda to a quart of water. Any partially damaged items should be dried and aired; the adjuster will make recommendations as to their repair or disposal. Take pictures of the damage done to your building and contents.
- ⇒ **Take all wooden furniture outdoors**, but keep it out of direct sunlight to prevent warping. A garage or carport is a good place for drying. Remove drawers and other moving parts as soon as possible, but do not pry open swollen drawers from the front. Instead, remove the backing and push the drawers out.
- ⇒ **Shovel out mud while it is still moist** to give walls and floors a chance to dry. Once plastered walls have dried, brush off loose dirt. Wash with a mild soap solution and rinse with clean water; always start at the bottom and work up. Ceilings are done last. Special attention at this early stage should also be paid to cleaning out heating and plumbing systems.

- ⇒ **Mildew can be removed** from dry wood with a solution of 4 to 6 tablespoons of tri-sodium phosphate (TSP), 1 cup liquid chlorine bleach, and 1 gallon water.
- ⇒ **Clean metal at once** then wipe with a kerosene-soaked cloth. A light coat of oil will prevent iron from rusting. Scour all utensils, and, if necessary, use fine steel wool on unpolished surfaces. Aluminum may be brightened by scrubbing with a solution of vinegar, cream of tartar, and hot water.
- ⇒ **Flooded basements should be drained and cleaned as soon as possible.** However, structural damage can occur by pumping out the water too quickly. After the flood waters around your property have subsided, begin draining the basement in stages, about 1/3 of the water volume each day.

## VI. REFERENCES

1. Colorado Water Conservation Board, "Colorado Flood Proofing Manual," October 1986.
2. Colorado Water Conservation Board, field data collected during July and August of 1996.
3. Connaughton, Charles A., U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, "Erosion of the National Forests of Colorado, Eastern Wyoming and Western South Dakota, February 10, 1938.
4. Federal Emergency Management Agency and U.S. Army Corps of Engineers, "Expedient Flood Training," Citizen Action Series, January 1995.
5. Henz Meteorological Services, "The Buffalo Creek Flash Flood of 1996," March 1997.
6. Jarrett, Robert, U.S. Geological Survey, field data collected during July, August, and September of 1996.
7. Macdonald, Grant, Buffalo Creek resident, "Emergency Disaster Plan for the Buffalo Creek Flood Zone," September 1996.
8. U.S. Army Corps of Engineers, National Flood Proofing Committee, "Flood Proofing, How to Evaluate Your Options," July 1993.
9. U.S. Forest Service, "Burned Area Emergency Rehabilitation - Buffalo Creek Wildfire, Pike National Forest," May 28, 1996.
10. U.S. Forest Service, "Burned Area Emergency Rehabilitation - Buffalo Creek Wildfire, Pike National Forest," August 2, 1996.
11. U.S. Forest Service, "Burned Area Emergency Rehabilitation - Buffalo Creek Wildfire, Pike National Forest," October 3, 1996.
12. U.S. Forest Service, General Technical Report WO-7, "Effects of Fire on Soil," April 1978.
13. U.S. Forest Service, General Technical Report WO-8, "Effects of Fire on Water," April 1978.
14. White, William D. and Wells, Steve G., Department of Geology, University of New Mexico, "Forest Fire Devegetation and Drainage Basin Adjustments in Mountainous Terrain," 1978.
15. Woodward-Clyde Consultants, "Application of Bonded Fiber Matrix at Buffalo Creek, Colorado," August 9, 1996.
16. Woodward-Clyde Consultants, "Stream Channel Stabilization Techniques for the Buffalo Creek Reclamation Project," August 20, 1996.