BIG THOMPSON FLOOD DISASTER

FINAL REPORT TO THE GOVERNOR OF COLORADO

DECEMBER 31, 1977

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OTHER WATER-ORIENTED PROJECTS

December 31, 1977

The Honorable Richard D. Lamm
Governor of Colorado
State Capitol
Denver, Colorado 80203

Dear Governor Lamm:

The response to the Big Thompson Flood Disaster of July 31, 1976, has been a blend of talent and resources from local, state, federal and private sectors. As Special Consultant on the recovery effort, we have appreciated being involved in contributing our resources to that blend.

The State effort represented a dedicated response to the needs of Larimer County and the victims while balancing the interests of the rest of the citizens in the state.

As a final report to you, it was our purpose to develop a review so that future state officials, when faced with a similar disaster, might be aware of the general history and actions of the state taken in response to the Big Thompson Flood.

Further, much has been written about the flood. Various evaluations have been and will continue to be made. This report attempts to avoid duplicating those evaluations but provide the perspective of the state as seen from the position of the Special Consultant, outside state government.

While evaluations of the process are made throughout the text, certain general maxims about the disaster recovery process are noted in Chapter VIII and should be important considerations in future disaster response efforts.

Finally, as many have mentioned to us, the support of the Executive is critical in implementing many of the special programs of the relief effort. Your dedication and personal attention to the needs of the disaster response and recovery have made our job easier and were key to the successful results which were achieved by the State.

Sincerely,

Kenneth R. Wright
Special Consultant

Marilyn M. Stokes

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

CHAPTER I

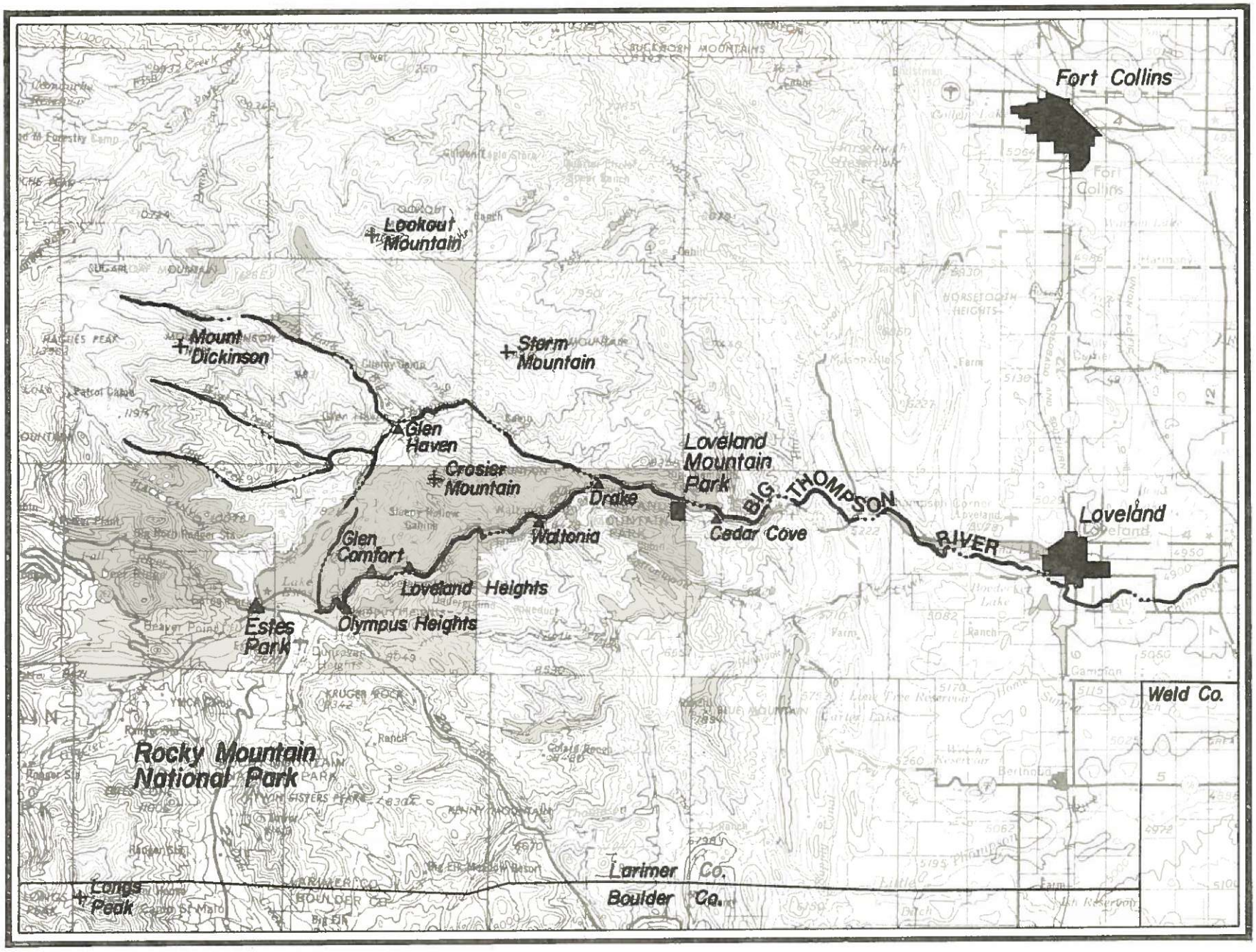
DESCRIPTION OF FLOOD EVENT

LOCATION OF FLOOD DISASTER

The Big Thompson River descends from the high mountain basin headwaters located in Rocky Mountain National Park to Lake Estes, below Estes Park, where it is impounded by Olympus Dam. Downstream from the reservoir the main river flows through Big Thompson Canyon for a distance of about 18.5 miles to the canyon mouth. The North Fork basin collects waters from the northeast portion of Rocky Mountain National Park and joins the Big Thompson at Drake. From the canyon mouth, the river descends to the plains area and continues in an easterly direction for about 30 miles to its confluence with the South Platte. At this point the watershed measures 818 square miles. Basinwide elevations range from 14,255 feet at the headwaters to 5,400 feet at the mouth of Big Thompson Canyon, with basin slopes ranging from 40 percent to 5 percent.

The topography of the Big Thompson drainage basin is characterized by steep north-and-south facing slopes with rugged rock faces along the ridges. A thin soil mantle at lower elevations supports a moderate stand of coniferous trees.

The pattern of river flow through the canyon is generally characteristic of a geologically aging stream. Hydrogeologic conditions have resulted in the present characteristics of the Big Thompson River--a steep, slightly meandering drainage. The pronounced descent of the Big Thompson Canyon--2,500 feet through the 25 mile long canyon--generates rapid flows in spite of the energy dissipation capabilities of the naturally curving channel. Sharp changes in stream direction and slope have resulted in deposition of sediment over the years, producing localized wider alluvial areas. Some wide areas are also caused by outwash from side streams. Such areas are close to the stream channel and have been considered as areas for settlement due to the flatter topography. Thus, many settlements in the Big Thompson Canyon are located where the alluvial depositions



Location Map - BIG THOMPSON RIVER, COLORADO

Scale 1:250, 000

Figure 1

are the widest. In some cases, these areas are in the designated flood plain.

Big Thompson Canyon provides a scenic route for the traveller as it winds from the Continental Divide to the plains. Estes Park marks the western end of the Canyon, and it ends west of Loveland. Dotted with several small communities of many year-round homes and summer mountain cabins, the Canyon had a permanent population of about 600. The influx of summer residents brought the part-time population to 1,200. The Canyon also attracted hundreds of overnight visitors each weekend to the cabins, motels, campgrounds, and camper/trailer sites scattered along its length. The canyon is easily accessible from both ends with U.S. Highway 34 following the river through the narrow canyon.

PRECIPITATION AND FLOOD FREQUENCY

Precipitation in the basin is influenced by its elevation and location. High mountains to the west of the basin remove a large portion of the moisture borne by the prevailing westerlies. For this reason, mean monthly snowfall is usually less than two feet.

During spring and summer months, the Gulf of Mexico supplies a major portion of the moist air for precipitation to the basin. The largest amount of precipitation normally occurs during the months of May and June. Summer precipitation usually occurs in the form of thundershowers. The average annual precipitation varies from about 16 inches at Estes Park, to 12 inches at Loveland.

Floods on the Big Thompson River at higher elevations are caused by snowmelt runoff, but at lower elevations floods can result from snowmelt, rainfall or a combination of rain and snow.

The type and extent of flows in the main-stem river as it enters Big Thompson Canyon are subject to a degree of manipulation. The natural hydrologic regime has been modified by facilities of the Colorado-Big Thompson Project, which imports water from Lake Granby and Grand Lake

(Colorado River basin) on the western slope of the Continental Divide and stores the water in Lake Estes. The lake serves as a regulatory reservoir for all Big Thompson Project flows, but because of its size (3,100 acre-feet capacity), it provides no significant flood control. Water, impounded in the lake by the Olympus Dam (Bureau of Reclamation), is released both to the Big Thompson River and to the Olympus Tunnel. The river flow is further affected by diversions for irrigation and power developments. However, low flow regulation by the dam allows fisheries to be maintained year-round. The Big Thompson River has been an important fishing stream.

Records for the Big Thompson indicate that, historically, floods have occurred about once every six years. Flood discharges at the mouth of the Canyon have ranged upwards from 3,300 cfs, with a recorded peak flood of 7,600 cfs in July, 1945.

Predictions for the various frequency discharges on the Big Thompson River are shown in the following table:

CANYON MOUTH
FLOOD FREQUENCY-DISCHARGE

Return Period (Years)	Discharge (cfs)
10	4,250
50	11,500
100	16,900
500	38,900

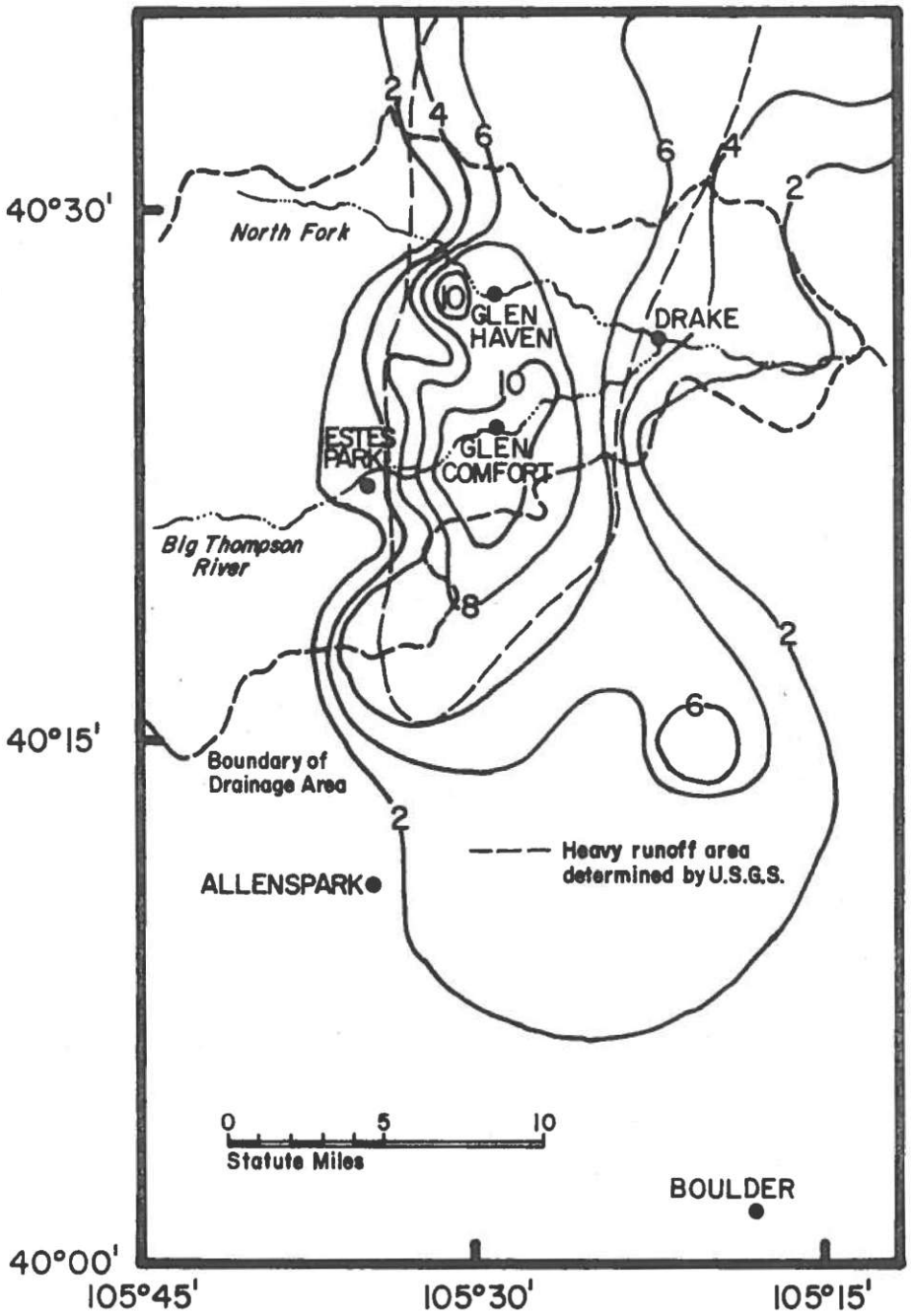
The river in the Canyon is confined by the steep canyon walls, allowing little bank storage to attenuate the flood discharge. Flood duration usually ranges from a few hours to two days.

JULY 31, 1976 - THE FLOOD

The meteorological conditions that produced the 1976, 4-1/2 hour deluge were unusual. On Friday, July 30th, and Saturday, July 31st, a surface cold front had moved slowly southward through the Central Plains states. By 6:00 p.m. Saturday, July 31, the almost stationary front lay east-west through Missouri and Kansas into central Colorado where it curved northward along the eastern slopes of the Front Range of the Rocky Mountains from about Denver into central Wyoming. The air on both sides of the front was conditionally unstable with abnormally high amounts of moisture in lower levels concentrated on the north side of the front.

Convective activity, that had persisted along the frontal zone into Saturday morning as light scattered showers, began to intensify by early afternoon in eastern and south-central Colorado. Thunderstorms had reached severe intensities by 3:00 p.m. when severe thunderstorm warnings were issued for Kit Carson and Cheyenne counties in eastern Colorado. Also, active thunderstorms were scattered along the Front Range in a generally north-south line or zone from northern New Mexico into southern Wyoming. About 6:00 p.m., Limon weather radar first detected convective cells beginning to develop over the Big Thompson drainage basin. During the brief period from 6:30 to 7:00 p.m. the organization and intensity of the thunderstorm activity began very significant and rapid changes. The new convective cells along the Front Range began to intensify, with explosive development in north-central Colorado. Storms along the remainder of the frontal zone began a rapid decay. By 8:00 p.m. only the band of storms along the Front Range remained active. Slow northerly movement coupled with rapid development of new cells to the south combined to produce an intense, seemingly stationary storm and very heavy precipitation over the Big Thompson drainage basin from about 6:30 p.m. to 11:00 p.m. on July 31, 1976.

The rainfall amount of 12+ inches in about four hours is not really unusual when viewed with other events. For example, in 1969, 32+



TOTAL PRECIPITATION (IN INCHES) JULY 31 - AUGUST 2, 1976
BASED ON CLIMATOLOGIC NETWORK AND
SUPPLEMENTED BY UNOFFICIAL PRECIPITATION REPORTS
(FROM NOAA, 1976:3, INCLUDING REVISIONS OF APRIL 1, 1977

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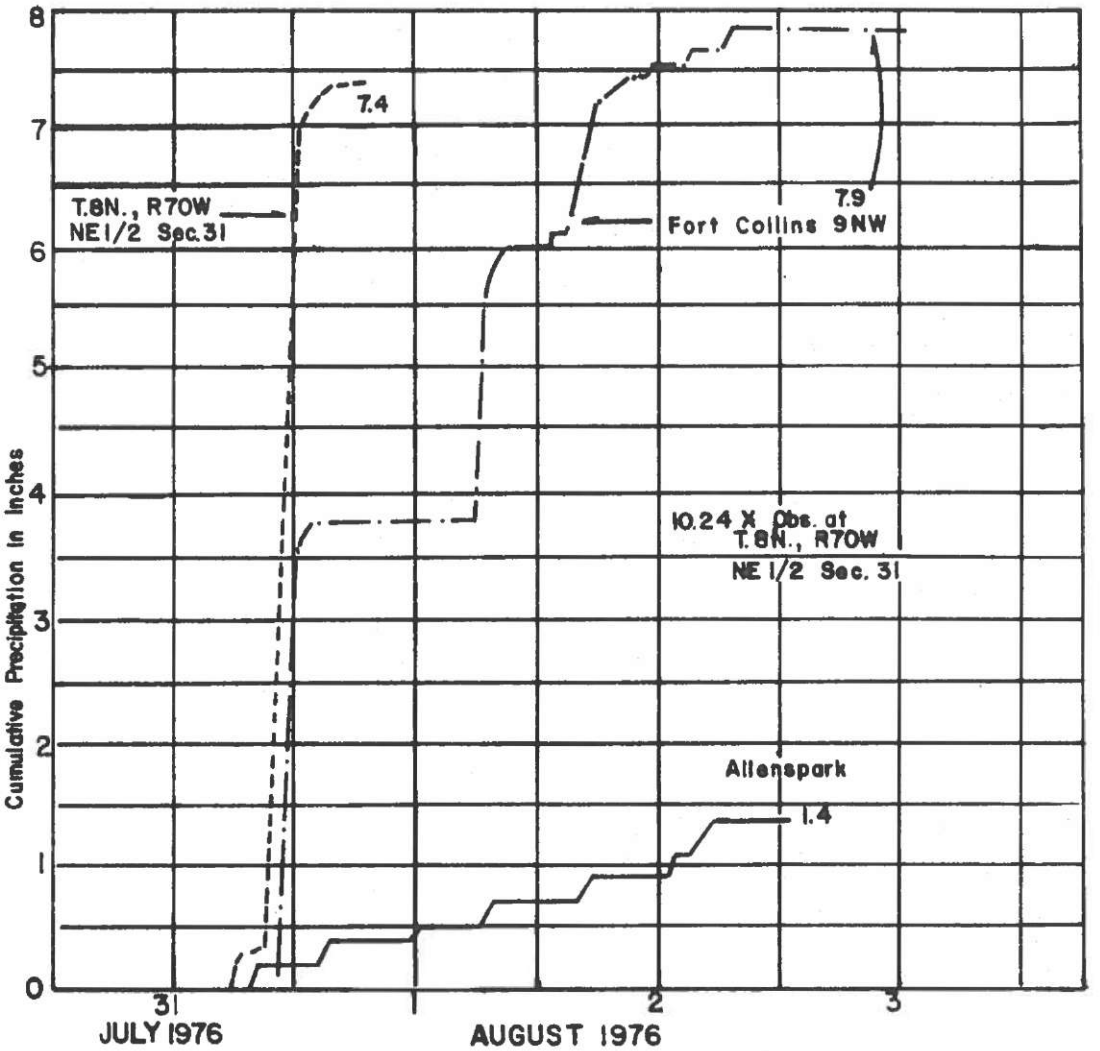
Figure 2



BIG THOMPSON RIVER, COLORADO

TOTAL PRECIPITATION

JULY 31 - AUGUST 2, 1976

BASED ON CLIMATOLOGICAL NETWORK AND SUPPLEMENTED BY ABOUT 120 UNOFFICIAL PRECIPITATION REPORTS

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Figure 3

inches (over 810 cm) of rain fell in less than 8 hours in southwestern Virginia, and rainfall amounts of 10-12 inches (250-300 cm) in a three to four hour period occur in several locations each year. Third, there are flash floods similar to this one occurring frequently during the summer in the Rocky Mountains. However, most of these flash floods go unnoticed because the canyons are devoid of people and roads. The Big Thompson flash flood effect was greatly amplified by the constriction due to the narrow channeled flood plain in the Canyon.

Precipitation totals were as much as 10 inches between Estes Park and Drake and more than 12 inches in the Glen Haven area. Very little rainfall contributing to the flood occurred east of Drake and west of Estes Park.

Flood runoff in the Big Thompson basin derived from an area of approximately 60 square miles centered on the Big Thompson River from Lake Estes to Drake. Because of the steep slopes and small storage capacity of the soils, storm runoff quickly reached nearby surface channels. Based on records at stream-gaging stations in the area and on information from individuals who observed the flood, most streams in the area started to rise about 7:00 p.m. The first reported damage occurred about 7:30 p.m. along U.S. Highway 34, 7.5 miles east of Estes Park where the highway was blocked by rocks and trees deposited by water cascading down the canyon walls and small gulches along the north side of the Big Thompson River.

The normally placid Big Thompson River quickly responded to the large volumes of water entering from several small tributaries between Lake Estes and Waltonia and became a raging torrent of water, trees, debris, and boulders moving downstream with an indescribable force. The reported peak stages on the Big Thompson River occurred as follows: 8:00 p.m. at Glen Comfort, 8:30 p.m. at Waltonia, 9:00 p.m. at Drake, 9:30 p.m. at Loveland power plant, and about 11:00 p.m. at the mouth of the Canyon about 8 miles west of Loveland. Because the river reportedly remained extremely high from the first peak stage until after

midnight, it is apparent that several other periods of intense rainfall produced secondary rises on streams in the area during the night. A gaging station on Fish Creek, southeast of Estes Park and upstream from Lake Estes, recorded a rise which peaked at 10:00 p.m. and a smaller rise which peaked at 4:00 a.m. Dry Gulch which flows into the Big Thompson River from the north just downstream from Lake Estes peaked at 10:30 p.m., as recorded by the gaging station on the Big Thompson River near Estes Park.

The flood on the North Fork Big Thompson River resulted from extremely heavy rainfall within a few miles of Glen Haven. The western limit of significant flood runoff was about 2 miles west of Glen Haven while the eastern limit was about 3 miles east of Glen Haven. Extreme flood runoff occurred from the basin divide on the south to about 4 miles northeast of Glen Haven.

Although heavy rainfall was reported to begin at Glen Haven at about 7:30 p.m., the first report of extreme flooding in that area was on Fox Creek which reached the peak stage at 9:00 p.m. at Glen Haven. Another rise almost as high as the first one occurred at about 11:00 p.m. north of Glen Haven; both Miller Fork and Black Creek reached peak stages about 11:00 p.m., with local residents reporting no flood runoff in the streams prior to that rise. A stream-gaging station operated by the Colorado State Engineer's Office on the North Fork Big Thompson River at the mouth at Drake operated satisfactorily until about 11:00 p.m. when the intakes were covered by deposited bed material. The record from this station indicates one peak at 9:15 p.m. (possibly backwater from the Big Thompson River), a recession of about 0.3 foot until 9:30 p.m., then an additional rise of about 0.8 foot which peaked at 9:40 p.m. Flood water from Miller Fork and Black Creek reached the Drake area shortly after 11:00 p.m. but the peak from this rise was lower than the 9:40 p.m. peak.

The major part of flood damage in the North Fork Big Thompson River basin occurred in the vicinity of Glen Haven, caused mainly by the

combined flow of Devil's Gulch and West Creek which entered the town from the southwest. The basin between Glen Haven and Drake is sparsely developed; thus, the main damage in this reach was to the county highway which generally follows the river.

The relative timing of the peak stages was such that the peak on the Big Thompson River just downstream from Drake occurred before the peak from the North Fork arrived at Drake. The flood peak moved through the 7.3 mile length of channel between Drake and the canyon mouth in about 2 hours with no apparent reduction in discharge as indicated by the computed peak discharges.

East of the canyon mouth, the Big Thompson river valley widens rapidly and the flood discharge was quickly reduced by flood plain storage. The peak discharge on the Big Thompson River at its confluence with the South Platte River near La Salle was only about 2,500 cubic feet per second (cfs) occurring at midnight. Before the storm the flow at this point was 63 cfs. The peak flow recorded 35 miles upstream at the mouth of the canyon was 31,200 cfs. This was more than four times the previous recorded peak flood flow. The flow in the river at this point just before the rain began was only 137 cfs. The Cache la Poudre River showed a peak flow of 7,340 cfs at the mouth of the canyon near Fort Collins, compared with a pre-storm flow of only 16 cfs.[1]

LOSS OF LIFE AND PERSONAL INJURY

In the Big Thompson flood, 139 people died, 88 were injured, and 6 are still missing as of December 31, 1977.

The following tables show the age distribution of the victims and geographical location of residence. A large number of elderly people died in the flood. Of the victims, 45 percent were male and 55 percent were female. One-third of the residents were from outside Colorado.

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[1] Grozier, R.U., McCain, Jerald F., Lang, Larry, and Merriman, Danny, The Big Thompson River Flood of July 31-August 1, 1976, Larimer County, Colorado, U.S. Geological Survey and Colorado Water Conservation Board, October, 1976.

AGE DISTRIBUTION OF VICTIMS[1]

Age	No. of Victims	% of Total
0-10	10	7.6
11-20	19	14.4
21-30	23	17.4
31-40	7	5.3
41-50	12	9.1
51-60	25	18.9
61-70	25	18.9
71---	11	8.3
TOTAL	132	100.0
Ages Unknown	7	

[1] Prepared by Tom Downing, Institute for Behavior Sciences, University of Colorado.

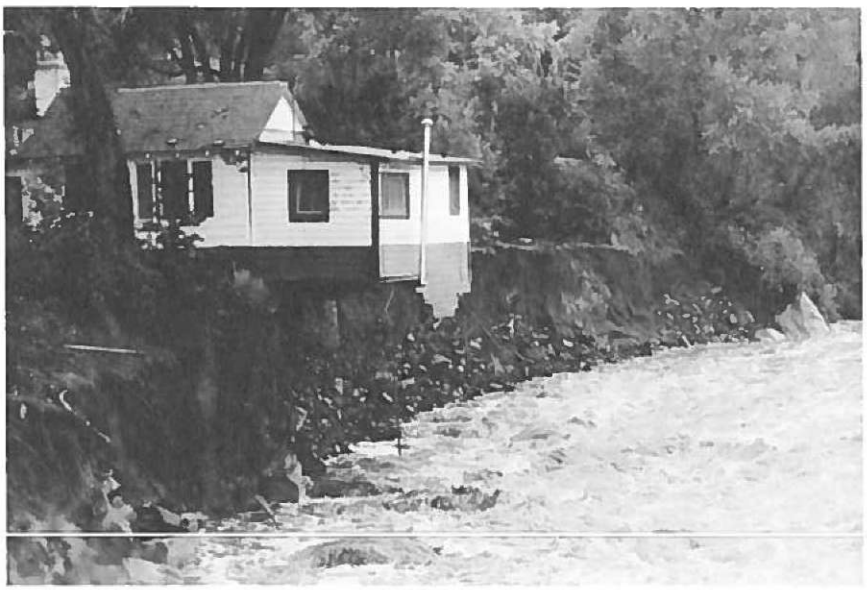
LOCATION OF RESIDENCE OF VICTIMS[1]

% of Total	No. of Victims	Location
29.7	41	Big Thompson Canyon
7.2	10	Loveland
4.3	6	Larimer County
24.6	34	Colorado
	17	Denver
	6	Greeley
	11	Other
33.3	46	USA
0.7	1	Foreign
100.0	138	TOTAL COUNTED

DAMAGE AND PROPERTY LOSSES

The force of the flood waters and geologic processes caused extensive property damage.

Destroyed:	316 homes
	45 mobile homes
	52 businesses
Major Damage:	73 homes

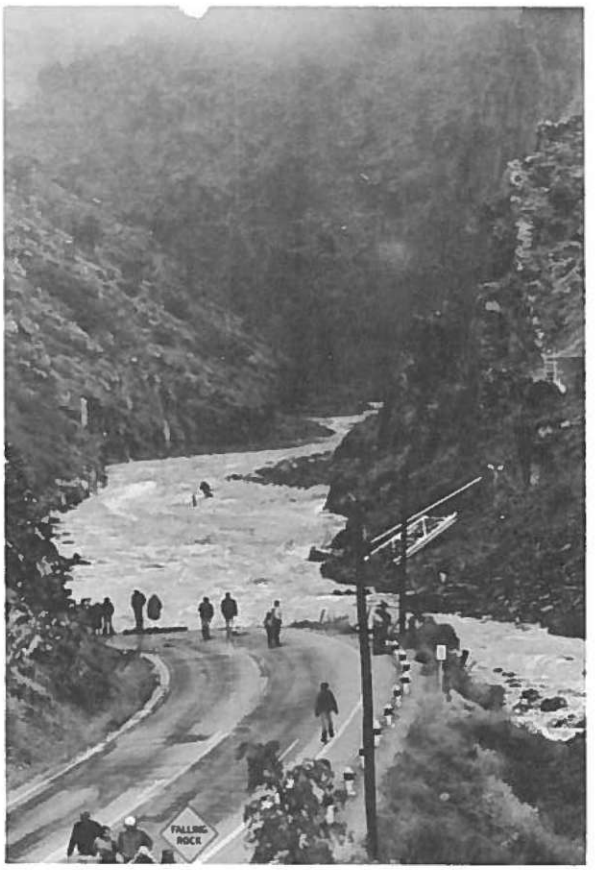


BANK EROSION ALONG BIG THOMPSON RIVER

Additional private damage or destruction included damage to land, fences, irrigation systems, crops, farm buildings and equipment, telephone systems, wells, private wastewater systems, cars, recreational vehicles, private bridges and roads, landscaping, electricity service, propane tanks and household goods. Additionally, public utilities and private, non-profit facilities were affected.

Damage or destruction to public facilities included:

- Long sections of Highway 34
- Park facilities of the City of Loveland
- Bureau of Reclamation facilities
- Water control facilities
- Bridges
- Division of Wildlife fish hatchery
- Erosion and watershed damage to U.S. Forest Service lands
- County roads



DESTRUCTION OF HIGHWAY 34
BIG THOMPSON CANYON

DAMAGE FROM SEDIMENTATION
BIG THOMPSON CANYON

EVALUATION OF SIMILARLY SITUATED CANYONS

The conditions in the Big Thompson Canyon are not dissimilar to the many other mountain canyons in Colorado. Many of them are steep canyons with development in the flood plains and on debris fans and other naturally hazardous areas. In many of them, development has encroached on the stream channel, thus restricting the flow. The State Geological Survey has identified the top ten canyons which present significant geologic hazard but which have not been formally studied. These are: Boulder Canyon, Boulder County; Bear Creek, Jefferson County; San Miguel River, San Miguel County; Arkansas River Canyon, Fremont and Chaffee Counties; Animas River (Durango and vicinity), La Plata County; Fountain and Mounment Creeks, El Paso County; St. Charles River and tributaries, Beulah Area, Pueblo County; Clear Creek-Tucker Gulch, Jefferson and Clear Creek Counties; Grand Junction Area, Book Cliffs and National Monument tributaries, Mesa County; North Fork Gunnison River; Gunnison and Delta Counties.

Priority should be given by the State to funding the study and mapping of natural hazards in those canyons which the State Geologist has identified as having significant hazard potential.

Additionally, the State has the capability and responsibility to require local government to prevent new development in the flood plain or encroachment in the stream channel which can aggrevate damage from natural hazards. The State's role should be one of providing technical assistance and the bottom line minimum standards.

CHAPTER II

FLOOD WARNING

Flood warning systems in Colorado have never been well defined. They still are not. During the last year and a half, progress has been made on improving matters on an overall basis and in specific drainage basins. Much still remains to be done.

Weather radar coverage of eastern Colorado is provided by the Limon radar station, which is located 65 miles southeast of Denver. Estimates of rainfall rate are based on the intensity of weather radar echoes. Accuracy decreases with distance between the precipitating cloud and the radar, so no quantitative estimates of rainfall rate are made for ranges beyond 150 miles for the type of radar which is at Limon.

BIG THOMPSON WARNING

The distance of the Big Thompson Canyon from Limon (115 miles) approaches the effective limits of the radar. Thus, the predictions made by radar observers lacked wording that conveyed the necessary sense of urgency because the radar observers did not get any feedback from ground observers until 11:00 p.m. on July 31st. At that point the weather office received a report indicating the location and seriousness of the flooding and that the "Big Thompson had already crested at the mouth of the Canyon." They then issued a flash flood warning.

In addition to the weather radar station in Limon, there is a National Weather Service Forecasting Office (WSFO) in Denver. The forecasting office receives four types of surface observations for its forecast and warning programs: (1) aviation observations from first and second order stations and supplementary aviation weather reporting stations; (2) reports from cooperative or paid observers in the hydrologic, fire, weather, and public service networks; (3) reports from automated reporting equipment; and (4) reports from the public, spotter networks, and law enforcement agencies.

The WSFO then disseminates its information over the National Oceanic and Atmospheric Administration (NOAA) wire service.

While numerous eyewitness accounts of downpours and flooding were later reported in the newspaper, not one of the reports from ground observers reached the National Weather Service forecaster in Denver in time to refine his warning and reflect the disastrous events in the Canyon.

Another source of confirmation for the WSFO is the Weather Bureau Radar Remote (WBRR), which provides a facsimile of the radar picture in Limon. The WBRR was out of service the night of July 31, 1976, and the WSFO lead forecaster had to rely on a verbal description of the radar echoes. This did detract from the capability of the lead forecaster in Denver.

The local Sheriff's Department and the State Patrol were not aware of flooding until a report came in at 8:45 p.m. from a patrolman near Estes Park. Officers began issuing warnings to residents, motorists, and campers.

WARNING RESPONSE IN THE BIG THOMPSON FLOOD

Many people who actually experienced the flood were unable to fully accept the reality of the situation and to take rational actions under the dangerous conditions which faced them. The Larimer County Sheriff said, "We had trouble convincing them (the people in the Canyon) that the river was even coming up. The problem is that there wasn't time to convince the people, to get the urgency across to them."

Attempting to evacuate by auto on the Canyon road rather than abandoning their property and climbing to higher ground cost many people their lives. Even some law enforcement officers on the scene early had difficulty recognizing the magnitude of the disaster and the need for immediate life preserving measures.

CRITERIA FOR AN EFFECTIVE WARNING SYSTEM

The necessary steps in implementing an effective warning system include determining the appropriate level of protection to be afforded by the system, possible funding strategies, determining responsible agencies and their relevant obligations, establishing an effective chain of command, and drawing up a preparedness plan with the participation of all involved officials.[1]

Despite the sophistication of the prediction network, if planning for the flood hazard does not include careful consideration of warning dissemination, warning content, and other variables that influence response to the warnings, the system may foil its major purpose: safe evacuation of vulnerable areas.

Design Parameters

Of practical importance in the design of a warning system are the variables related to the characteristics of the warning. These include the reliability of the detection network, the credibility of the warning, the nature of the communication mode, the content of the message, confirmation of the warning, the number of warnings received, and the public awareness of the hazard. Other important variables include the presence of physical evidence that a potential for flooding does exist, e.g. heavy rainfall, rising river levels, or history of flooding.

Another important variable is the type and attitude of the group a person is in when the warning is received. Personality traits may influence response but are difficult to anticipate in a warning system. Past experience with minor flooding may hinder a person's response to a major event, such as flash flood disasters. The elderly and low and high socio-economic level groups tend to respond less adaptively to warnings than other age and social status groups. In a number of

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[1] National Oceanic and Atmospheric Administration, 1977, Flash Flood Preparedness Planning Guide, H. James Owens.

disasters the elderly have formed a disproportionately large number of the victims.[2] In the Big Thompson disaster, nearly 40% of the 139 reported dead were aged 55 or older.

In previous disasters, studies have shown that because of the greater responsibility between members, family groups tend to respond more adaptively than peer groups. This was not the behavior pattern in the Big Thompson flood, and the reason probably results from the influence of other variables.[3]

Establishment of a comprehensive warning system to the flash flood problem may be separated into two general categories--pre-disaster planning of a warning system and implementation of the system when a flood is imminent. The first category would include public education and emergency preparedness. The second category would include flood prediction, official response to possible flooding, evacuation decision, warning dissemination to the public and post-flood activities.

Pre-Flood Adjustments

Effective decision-making in a flash flood situation is related to the extent of preparedness planning. This involves the development and practice of emergency procedures for a flash flood situation. The key to an effective preparedness plan is the regular maintenance and updating of the various components. This would include regular contact between its members, periodic practices of the plan, the updating of personnel and telephone lists, and the maintenance of rain and stream monitoring equipment. Schedules and criteria for making important decisions should be specified. Responsibility for making the various decisions should be delegated.

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[2] "The Differential Distribution of Death in Disaster: A Test of Theoretical Propositions", Hutton, J.R. Paper presented at Joint Meeting of the Society for the Study of Social Problems and the American Sociological Association, New York, 1976.

[3] What People Did During the Big Thompson Flood, Gruntfest, Eve C., Natural Hazards Research Working Paper 32. Boulder: University of Colorado Institute of Behavioral Science, 1977.

Complementing the preparedness planning should be an extensive public education effort. Public information can be used to expand the population's awareness of the hazard. Particularly where the population turnover is high or there is a large number of tourists, the education efforts need to be conducted at frequent intervals. Information on other types of adjustments such as federally subsidized flood insurance, may be included in the education program.

Signs advising people of the flash flood hazard and directing them to climb the canyon side in the event of a flood should be placed at strategic points in the canyon. This has been done in the Big Thompson Canyon, Boulder County canyons and other streams. After evaluating this signing program, the State Highway Department will consider placing warning signs in other hazardous canyons in Colorado. Signs may also be erected that indicate the expected limits and heights of flooding.

Officials should work closely with the news media. Public utility or local services bills may be used to notify residents of the flood risk.

Flood Prediction

A fully integrated flood prediction system will include a regional radar station along with a network of automatic rain gauges, river elevation recorders and volunteer rainfall observers. The prime objectives of the system are to estimate the magnitude and expected lead times of the flood, i.e. the amount of time between the first warning (or prediction) of a flood and its arrival. Several aspects of the network are particularly important. The system must be reliable. No one will be warned by official sources if the network fails to detect the flood, or fails to transmit the data to the proper officials. If the credibility of the network is low, i.e. if it has a high false alarm rate, it will be found that both officials and citizens will trust the system less and less and the warnings will become less effective.

A reliable and credible warning system should be able to distinguish to some extent between the more frequent events and the more severe floods. This would enable evacuation of only the areas likely to be flooded and prevent overwarning which would be detrimental to later warning efforts.

All data provided by the prediction network should be channeled to a central body where officials can interpret the incoming data. Based on this information, the warning agency must decide whether or not to issue a warning. To insure an objective decision, public officials should be freed from responsibility for the consequences of a false alarm.

Subsequent warning activities will have to be carried out within the time limits determined by the physical event and the detection network. Several levels of warning may be used: (1) an alert notifies the appropriate emergency personnel of the potential danger (but it is not disseminated to the public); (2) a watch is disseminated to the public and indicates meteorological conditions in the area are conducive to a flood event; and (3) a warning tells everyone that flooding is imminent or occuring. If the lead time is short, the warning may not be preceded by both a watch and an alert.

First reports of an imminent flood threat must be confirmed to insure an accurate warning. Such confirmation may come from observers or river gauges that indicate rising river levels. Warnings from official sources have been found to encourage a more adaptive response than those from unofficial sources. Flood plain occupants will typically seek to confirm the first warning they receive. This may involve calling official sources, checking radio and television stations, or finding out what friends and neighbors are doing. In Rapid City, only about 20 percent of flood plain occupants evacuated after the first warning.

Warnings disseminated through personal communication modes such as telephones, bull-horns, personal contact are found to be much more effective than the impersonal modes. Warnings should be issued repeatedly and an indication of the number of warnings should be given. The warnings should be disseminated through as many channels as possible. Large establishments in the hazard zone such as schools, hospitals, motels and major offices should be directly linked into the warning network.

With the initial warnings, any roads into the potential hazard area should be blocked as a precaution against cars entering the danger zone.

If the lead time provided by the network is sufficient, the content of the warnings can encourage some emergency flood proofing measures without undue risk to life. In the Eastern Front Range canyons of Colorado, evacuation should be emphasized. Other aspects of the warning should include specific instructions as to evacuation routes and means, the most accurate estimate of the size of the expected flood possible, an estimate of when the flood will arrive, examples of others taking adaptive actions, mention of who made the prediction if the source is known to be credible, confirmation from other sources, the number of warnings issued and mention of physical evidence that flooding is imminent. Warning messages from different sources should agree in content. Increasing degrees of specificity are desirable as more is known about the flood.

Flooding caused by snowmelt or long duration rainfall would allow for greater flood-fighting efforts including bridge clearing, sand bagging and emergency flood proofing. A flash flood warning network could also provide reasonably accurate forecasting of flood heights and lead times in a long duration flood.

Importance of On-Site Observers

Feedback reports from the public, spotter networks and local and state officials are vital to an effective warning system. Radar and satellite

systems give indications, but do not tell exactly what weather is occuring. Most severe local storms are too small in horizontal extent to be identified by the standard surface observing networks such as satellites and radar.

These networks must therefore be augmented by on-the-spot cooperative observers if the warnings are to be given the precision and accuracy needed to make them useful and credible to the public.

ROLE OF THE STATE IN DEVELOPING WARNING SYSTEMS IN COLORADO

While the preceding discussion represents the optimum elements of a warning system, intermediate steps may be taken by the State in fostering an effective, less sophisticated warning system which still represents an improvement over the status quo.

The State should further identify the critical flood hazard areas in Colorado for which an on-site observer network should be established. The State should provide technical assistance to local governments in establishing and maintaining a local observer network. Volunteer observers in these networks would either initiate reports of environmental cues (heavy rain, etc.) to a central local office (sheriff, county emergency preparedness office) who would confirm them with the National Weather Service; or the observers would be available to confirm information which the National Weather Service obtained from other sources.

Additionally, the State should initiate periodic public eduation programs to inform people of the proper response to a flood warning. The flood warning sign program for hazardous canyons which the Department of Highways is currently testing should be completed as soon as possible and expanded through the State of Colorado.

The State should provide technical assistance to local governments in the techniques of warning dissemination and strongly encourage development of local warning dissemination systems.

An effective state wide program geared to needs of local areas must be a local responsibility. However, such a program will not succeed without effective technical leadership from state government.

CHAPTER III

DISASTER RESPONSE

EMERGENCY PHASE

August 1, 1976, was Colorado's 100th birthday, and numerous events throughout the state had been scheduled. It was a three-day weekend for most local and state government employees. A worse weekend could not have been chosen for the flood from both the standpoint of the holiday weekend for local and state personnel and holiday tourists and summer visitors in the Big Thompson Canyon. To further add to the adversity of the weekend selected by Mother Nature for the flood, the Larimer County primary and general elections were scheduled for September and early November; two incumbent County Commissioners had to stand for reelection.

As is usual in emergencies, the Sheriff's office became involved at the first hint of the pending disaster. He acted as the central figure for warning and emergency response. From the state level, the Colorado Highway Patrol officers represented the initial involvement. Their leadership and effort in initial evaluation of the flood extent and immediate warnings given Canyon occupants under extremely hazardous conditions was heroic. Their support to, and cooperation with, the Larimer County Sheriff was a model of intergovernmental relations. One State Patrol officer lost his life while in the process of warning citizens of the flood danger.

The county officially alerted the Colorado Division of Disaster Emergency Services (DODES) during the evening of July 31st to the potential need for assistance. When the magnitude of the disaster and the specific needs were better understood, about 2 a.m., the county notified DODES and requested state assistance. DODES in turn called the Governor in the middle of the night.

At this point it should be noted that State Statute 28-2-104, C.R.S. gives the Governor the responsibility of "meeting the dangers to the state and people presented by disasters." Extraordinary powers are conferred upon the Executive for meeting those responsibilities.(Colorado Disaster Emergency Act of 1973, as amended). Issuance by the Governor of an executive order or proclamation declaring a "state of disaster emergency" activates the disaster response and recovery aspects of the state, local, and interjurisdictional disaster emergency plans which are in effect pursuant to the Disaster Emergency Act.

In general terms, the Governor is given discretion to provide the leadership and management which is necessary in a disaster emergency which would increase safety, minimize damage and loss, provide prompt search and rescue, and assure efficient, rapid recovery and restoration. This is a difficult assignment because of the usual confusion and conflicting reports during the early states of a disaster.

Early Sunday morning, state and local efforts were set in motion. At the Governor's direction, helicopters were brought in to the disaster area. At dawn the National Guard, State Patrol and County Sheriff surveyed the canyon by air. Evacuation and rescue efforts were undertaken in the affected area. National guardsmen were dropped off by helicopters to assemble stranded victims in a location accessible to the helicopters. The physical terrain made damage assessment and reconnaissance and rescue operations difficult and extremely hazardous.

Luckily, the helicopter pilots of the Colorado Army National Guard highly trained in adverse mountain weather flying conditions. Thus, access to the Canyon was gained on August 1st, where otherwise rescue personnel would not have gotten in until the next day, and even then in a less effective manner.

Early Sunday morning state agency personnel were alerted, as well as the Federal Disaster Assistance Administration (FDAA). The American Red Cross began establishing shelters to aid the victims. The private

sector was responding with donations of food, clothing, and personnel assistance. As the day continued and blended into the following days, the emergency response gained momentum. Neighbor helped neighbor, church leaders initiated and coordinated private responses. So many simultaneous actions took place during this time that it would be impossible to relate them all. Therefore, this narrative continues to provide simply a general picture of the timing and nature of the response, particularly focusing on the state's role.

Using the broad estimate of damage made by the National Guard, Sheriff and State Patrol in their aerial review, the Governor, with the aid of the FDAA and DODES, requested President Ford to issue a declaration of a major disaster. Approval was quickly confirmed. Federal personnel and assistance were concentrated on the Big Thompson immediately to supplement the local and state effort.

The Governor called a meeting Tuesday morning in Loveland with state, federal and local officials and leaders to coordinate information on available assistance and to organize the response effort. The Governor had already assigned two of his staff members full time to work on the emergency response in Loveland. Numerous state agencies had personnel in the field. A Colorado Water Conservation Board (CWCB) staff member ordered the taking of aerial photographs.

RECOVERY PHASE

At the time the emergency response was taking place, plans for the recovery effort were getting underway. FDAA and DODES personnel were setting in motion programs which were triggered by the Presidential declaration.

Damage assessment teams were formed of local, state and federal agency personnel to estimate losses. The General Services Administration and the FDAA set up a disaster operations center in Loveland. The FDAA also sent out scouts to locate sites for the "one-stop assistance centers," which were to provide counseling and information to

victims. By Wednesday, four such centers were established. Personnel at the centers were on hand to explain the various assistance programs and process assistance applications. Legal and insurance experts, along with social workers, were present to offer counseling. The Interfaith Task Force workers served as advocates for victims in helping them through the process. On August 5th Governor Lamm appointed a special consultant to insure that all state resources were made available to Larimer County and to coordinate the state effort for maximum efficiency and assistance to Larimer County.

FDAA and DODES worked with the Army Corps of Engineers to organize the debris cleanup program. The first sections went to bid on Saturday, August 7th.

While the Governor is charged by state statute with meeting dangers to the state presented by disasters, which action generally occurs during the emergency response, the authority to manage the recovery response was taken by the Larimer County Commissioners. Commissioner Warren Wolaver stated on August 14, 1976, that "the Commissioners will ask the people what should be done, not other interests."

However, as the disaster response moved from the emergency phase into the recovery phase, some observers noted that a leadership vacuum existed at the local level. The Rev. Bob Schelling of Interfaith was quoted in the ESTES PARK TRAIL-GAZETTE (July 29, 1977) as saying, "The Governor really tried to let the county run the program, but they weren't ready for the disaster and they come off like they're campaigning rather than trying to solve problems."(sic). Later, the County Flood Coordinator said that "the timing of the flood relative to the September primary election and the November general election in Larimer County contributed to the problem of slow recovery."

State statute authorizes the Governor to establish an interjurisdictional organization to respond to a disaster if such an arrangement

would be more responsive to the needs of the situation. On August 6, 1976, a specific recommendation was made by the Governor to the County Commissioners for the formation of a Big Thompson Advisory Committee. The Larimer County Commissioners stalled in concurring with the establishment of the committee. The formation was delayed until August 20th. The Committee, with five representatives from local government and four state representatives, held their first meeting on August 23, 1976. Commissioner John Michie and Ken Wright, the Governor's Special Consultant, served as co-chairman.

At the first meeting of the advisory committee on August 23, 1976, a spirit of cooperation and communication dominated. A set of goals and objectives were presented and adopted without dissenting opinions. Summarily they include:

1. Economic and Social - Assist survivors, property owners, and communities in readjustment.
2. Physical and Public Works Projects - Recovery and rehabilitation of Canyon to be accomplished in safe and orderly manner.
3. Planning - Achieve positive results and avoid duplication of past mistakes.
4. Financial - Assure maximization of planning and public works financial assistance.

(See Appendix A for full text.)

In September, six weeks after the flood, Mr. Willard Quirk was hired as a County Flood Coordinator. Mr. Quirk established an office in Loveland and a branch office in Estes Park. He began to develop recovery plans for the county. His office became known as the Big Thompson Recovery Planning Office (BTRPO). Too much time passed before the Coordinator was hired. Most observers agree that the County Commissioners should have made the selection in early August.

On September 14th, the Big Thompson Advisory Committee authorized the formation of a joint governmental task force to formulate

alternatives for land acquisition and recreational use in the Canyon. The activities of the Task Force are described in detail later in this report. However, because of foot-dragging by local interests, opportunities for special federal funding tended to diminish. The original time schedule for the Washington effort, which had been set with the assistance of Senators Hart and Haskell, was not met.

Other types of recovery activities which were underway in the beginning months included the following:

- Initiation of flood plain mapping and delineation.
- Identification of funding sources.
- Development of bridge reconstruction program.
- Rebuilding of a temporary road along the Highway 34 alignment. (Accomplished in 100 days)
- Design and construction for rebuilding Highway 34.
- Evaluation and designation of geologic hazard areas.
- Application for '701' planning grant from the Department of Housing and Urban Development.
- Initiation of a 6-month moratorium until flood plain and geologic hazard mapping and designation were completed.
- Review of published disaster recovery studies.
- Statistical assessment on damage and losses.
- Flood peak flow studies.
- Channel work and planning.
- Mental health counseling.
- Additional field inspections made by recovery managers and technical personnel.
- Briefings by local government officials who had disaster experience (Mayor of Rapid City).
- Planning for replacement and rehabilitation of public facilities (Sewer lines, power plant, water treatment).
- Collection of financial contributions.
- Short and long term housing needs.

Dissatisfaction on the part of the Larimer-Weld Council of Governments (LWCOG) and the County Commissioners with the composition of the Advisory Committee resulted in a request in October to the Governor to reconstitute the group. There was a strong feeling on the part of the LWCOG's 208 Project Director that the state role should be minimized. While some felt that reconstituting the Committee only served as internal busy work and another source of delay, the Governor responded to the wishes of the Larimer County Commissioners. The restructured group consisted of three representatives from state government (Department of Highways, Land Use Commission, and State Geological Survey); three Larimer County Commissioners; four members representing adjacent local governments; two Canyon residents; and a representative from the Northern Colorado Water Conservancy District. The Committee was renamed the Big Thompson Recovery Planning Council.[1]

The Recovery Planning Council then served as an advisory group to Larimer County primarily and provided a regular communications forum for coordination of intergovernmental actions. Initially it met weekly, then bi-weekly, and finally, monthly.

Figure 4 shows a simplified version of the relationship of the various groups to Larimer County and the BTRPO. The top of the figure shows Larimer County, which carried the management responsibility. The solid lines represent the primary lines of communication and activity; the broken lines represent the advisory and informal relationships. As can be seen in the figure, there were many avenues of communication--which could and did confuse some of the citizens and other individuals working on the recovery program.

An informal but important arm of the recovery organization was the citizens group, the Big Thompson Action Group, which is discussed later in this chapter.

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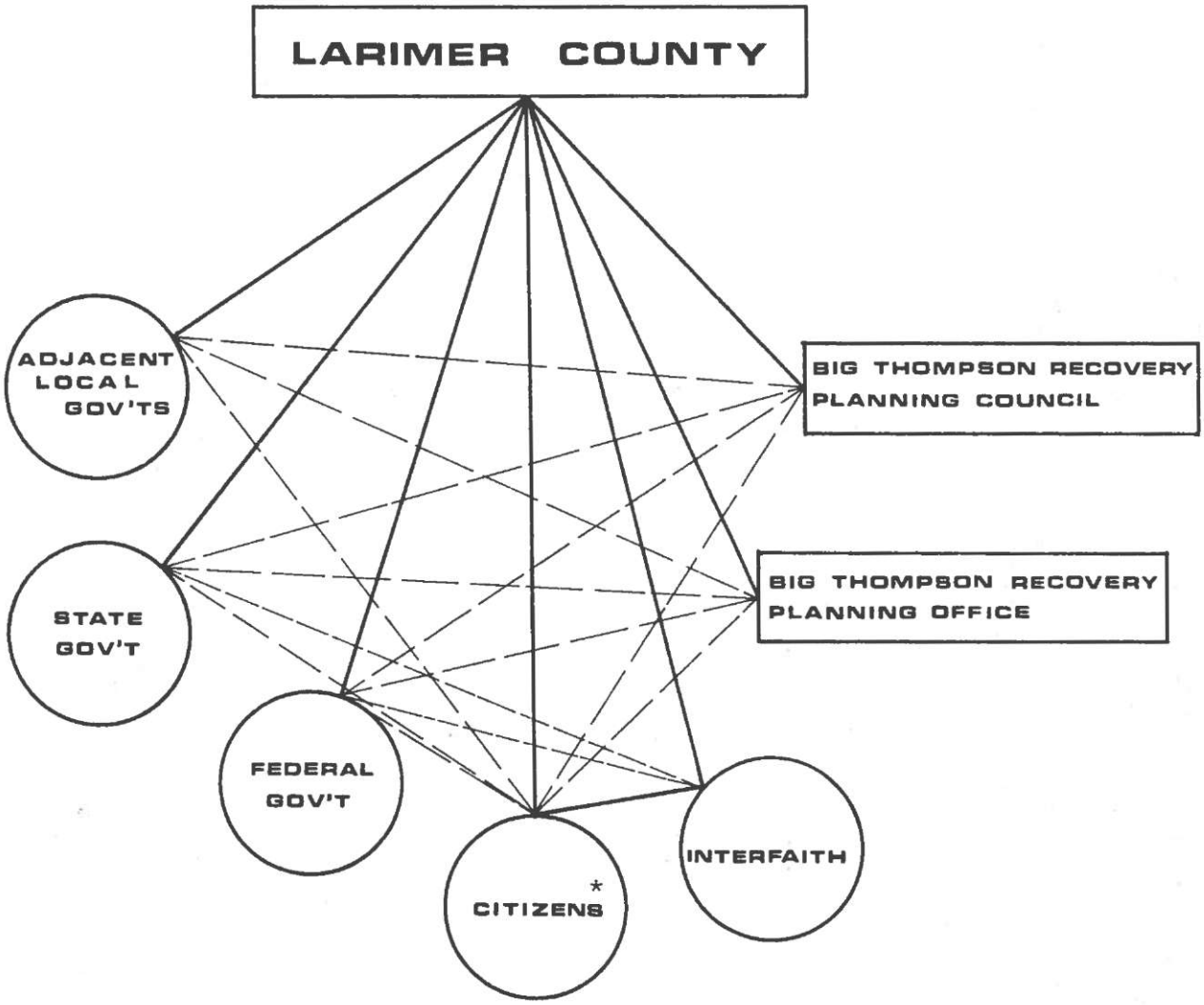
1 It should be made clear that the Council was not an official council pursuant to Title VIII of PL 93-288. To date, that section of the Act has not been funded.

RECOVERY MANAGEMENT ORGANIZATION



* Includes Big Thompson Action Group

FIGURE 4

Within the County, the County Commissioners were responsible for most of the financial and policy decisions. Approval of the comprehensive planning is a function handled by the Larimer County Planning Commission. No member of the Planning Commission was on the Big Thompson Recovery Planning Council.

Besides the change in the composition of the Recovery Advisory Council, another factor contributed to the discontinuity in the recovery management. Larimer County Commissioners John Michie and Warren Wolaver faced Fall elections. Mr. Wolaver lost the primary election in September and Mr. Michie lost his seat in the November general election. "It was difficult for the original commissioners to recognize and attend to problems of such a massive recovery while also trying to direct a reelection campaign. With two new commissioners being elected, they had to repeat the learning process of the original commissioners several months after the flood.[2]

RECOVERY PROGRAM - MAJOR STATE ACTIVITIES

Governor

While delegating the day-to-day activities to state agencies and his special consultant, the Governor continued to keep abreast of the recovery program and provided personal support at each junction which required particular assistance. Governor Lamm contacted President Ford and the Colorado congressional delegation in October regarding the matter of special funding which would provide the opportunity for purchase of land. He also requested funding for Title VII of the Federal Disaster Act. The Governor monitored and provided personal support for state legislation providing $100,000 for bridge improvements and a general appropriation of $862,000 as matching funds for land acquisition. The Governor held personal discussions with the Secretary of Interior, Mr. Cecil Andrus, concerning his authorization

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[2] Larry A. Muller and Patrick F. Mulhern, "1976 Big Thompson Flood and Flood Recovery Planning", American Society of Engineers, Preprint No. 3105, October, 1977.

of contingency land acquisition funds from the Land and Water Conservation Fund. The Governor made personal requests to the Congressional delegation for Federal legislation providing reduction in SBA loan rates, land acquisition at pre-flood values, and additional funding for the U.S. Forest Service/Soil Conservation Service "216 Program". The Governor also authorized the expenditure of $50,000 for private bridge rebuilding from the Colorado Agriculture Discretionary Fund. (See Appendix B for the Governor's program.)

The Governor personally saw to it that the resources of state government were available to Larimer County when requested and that the state agencies were coordinated to provide this assistance with maximum efficiency. He outlined design criteria recommendations for planning of the reconstructed Highway 34 through the Canyon and directed that the highway construction proceed in a manner which would minimize adverse impact of the flood on Estes Park and Loveland.

Governor Lamm acted in every manner as commander-in-chief of the state emergency and recovery responses up to the full limit of his statutory authority without crossing over that line into the domain of local government without being requested to do so.

State Legislature - 1977 Session

The Colorado State Legislature passed the following two measures relating to the Big Thompson flood disaster: (See Appendix C for text.)

SB 399 amended the Colorado Disaster Emergency Act of 1973 and gave certain powers to the Governor to provide disaster relief. Additionally, it appropriated $100,000 to Larimer County for its Big Thompson Canyon, North Fork bridge fund for bridge construction to replace bridges destroyed in the flood.

SB 419 appropriated $862,000 to Larimer County for the purpose of providing "local" matching money to a Bureau of Outdoor Recreation

grant for the acquisition of property in the Canyon for parks and recreational use.

Individual members of the legislature attended meetings in Loveland and elsewhere to provide guidance and assistance when appropriate.

Colorado Department of Military Affairs

The Division of Disaster Emergency Services (DODES) within the Department of Military Affairs has primary responsibility for maintaining the state's disaster response and coordinating with the federal disaster assistance programs. DODES conducted the state's disaster emergency operations center and coordinated emergency resouces management in evacuation, and damage assessment. The Department of Military Affairs played a major role in the search and rescue efforts. Throughout the recovery period DODES had primary responsibility for coordinating the local and state efforts with the federal disaster assistance programs.

The head of DODES, Colonel Logan Rappe (retired) had special experience with Colorado floods dating back to the 1965 South Platte River, Arkansas River, Kiowa Creek and other flooding; the 1969 flood; and the 1973 flooding which was extensive along the Front Range of Colorado. Thus, the key state official for assisting local government brought with him an extensive background in emergency flood response.

Special Consultant - Wright-McLaughlin Engineers

A special consultant, outside state government, was appointed by the Governor to plan and coordinate the overall state effort for assisting in the Big Thompson restoration effort. The scope of work covered by the consultant is enumerated in Appendix D.

Work included evaluation of problems and needs; recommending design criteria for highway reconstruction planning, bridge construction, flood plain delineation, management organization; preparation of

goals and objectives and policy for recovery; coordination with other levels of government, including direct contact with the congressional delegation; coordination of state policy on the recovery effort; and recommendations of flood policy and corrective work in similarly situated canyons in Colorado.

The special consultant regularly reported his activities at the Big Thompson Recovery Planning Council meetings and to the Governor. The report of November 11, 1976, found in Appendix E provides a sample of the type of work conducted by the consultant.

Attorney General

The office of the Attorney General provided clarification of Colorado Statutes as they pertained to flood recovery programs, such as flood plain regulations and the interpretation of SB 419 in the land acquisition program. The short reaction time of this office along with their full cooperation made it possible to proceed at all times with confidence that state laws were being followed.

Colorado Department of Health

Personnel from the State Health Department made the damage assessment on each structure in the flood plain to determine if it was a hazard and whether or not it was damaged more than 50 percent. Health officials also reviewed the area to assess potential health hazards, advise on water quality, assist with individual sewerage systems, and provided help to Larimer County when requested.

Colorado Department of Highways

Because Highway 34 paralleled most of the disaster area, provided the only access through the Canyon, and received major damage, the Highway Department played a major role in the recovery effort. The Department rebuilt a temporary road, reviewed alternatives for constructing a permanent road, and followed the criteria recommended by the Governor in designing and constructing the new highway. The Department also aided in vehicle identification and disposal.

Additionally, the Department has initiated hazard warning signs in the Canyon, maintained highway litter barrels, and coordinated with the other agencies planning developments along the highway alignment. One of the first outsiders into the stricken area was the District Highway Engineer. He also counseled local officials, assisted individuals, and personally made sure that the full resources of the Department were available to help in the emergency and recovery phases.

Colorado Geological Survey

The Colorado Geological Survey conducted an unprecedented evaluation and mapping of the geologic hazards in the disaster stricken area for the county geologic hazards regulation. The Geologic Survey also used the Big Thompson flood as a case study of geologic processes and their relationship to man's activities. By analyzing the situation of a mountain torrent, Geologic Survey personnel were better able to assess the criteria which should be used in regulating development in geologic hazard areas. Personnel also provided technical assistance to individual property owners and to Larimer County. The State Geologist was one of the most regular attendees and faithful members of the BTRPC.

Colorado Land Use Commission (LUC)

The Land Use Commission is responsible for overseeing local compliance with H.B. 1041, the Colorado Land Use Act, and protecting state interest in matters which have an affect beyond the local jurisdiction. The Land Use Commission staff also provides technical assistance to local governments in evaluating land use regulations and designation of hazardous areas.

While conflicts did arise between Larimer County and the Land Use Commission, the LUC served an important role in protecting the public interest from decisions which served to provide short-term solutions while repeating past mistakes and creating a potential for future damage from natural hazards.

Colorado Department of Natural Resources - Division of Parks and Outdoor Recreation

The Division of Parks and Outdoor Recreation provided guidance to the County in processing its application for Land and Water Conservation Funds (L&WCF). Since the acquisition program was unique and since Congressional and State legislative statutes modified the normal L&WCF program, an extensive amount of time was required to be given to the effort by the Division staff and Parks Board.

Colorado Department of Natural Resources - Division of Wildlife

In view of the recreational value of the Big Thompson River as well as the destruction of the fish hatchery on the North Fork, rehabilitation of the area was an important concern of the Division. They provided significant information to the recreational alternatives study team, coordinated with federal and state agencies that worked on the stream channel, and developed plans to rehabilitate the fishery. Considering the important asset of the Big Thompson River to Larimer County and the state, the Division's work has been an important aspect.

Colorado Water Conservation Board (CWCB)

The CWCB staff along with the Federal Insurance Administration (FIA) initiated the mapping of the flood plain, which had not been done prior to the flood. The CWCB monitored the flood plain regulations and provided technical assistance for the county and other state agencies. The ready assistance of trained flood management engineers from CWCB was very important to the local, state, and federal government effort. The Executive Director gave of his expertise and time whenever needed.

Additional assistance from state agencies included:

Department of Higher Education -- The state forester assisted in bank stabilization studies and debris disposal.

Department of Institutions -- The Division of Mental Health supervised the crisis counseling programs in Larimer and Weld Counties.

Department of Labor and Employment -- This agency provided unemployment, re-employment, and job corps training assistance.

Department of Revenue -- Assisted in body and vehicle identification

Department of Social Services -- This department participated in the food stamp program for disaster victims, as well as the "408" individual assistance program.

EVALUATION OF RECOVERY MANAGEMENT

A leadership vacuum existed at the beginning of the recovery phase. While the Governor is given the authority by statute to provide direction, in reality it becomes the choice of the local government as to the interests which shall provide the management direction. Additionally, the attention of local government officials during the critical first weeks is focused on meeting the immediate needs of the individuals. Long-term planning is secondary..

Simply looking at the probabilities, local government officials are the least likely to have had previous experience in disaster recovery planning. Personnel at the state level are apt to have faced more disasters, and federal agencies see them most frequently. This was the case with the Big Thompson Flood.

Most of the issues in a disaster response are predictable.[1] Additionally the needs and responses of victims are generally predictable. Therefore, not only can experience lead to better recovery management, but planning can actually speed recovery and improve the response.

It is critical that time not be lost in struggles over recovery management authority. Pre-disaster agreements statewide should be initiated which clearly establish the roles which each level of government shall play. A management structure should be pre-determined.

In view of the lack of flood recovery experience at the local level and the larger resources of the state, the State Legislature should clarify current authority and articulate a more specific role for the state in recovery management.

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1 Eugene Haas, R.W. Kates, and R.W. Bowden, Editors, Reconstruction Following Disaster, The MIT Press, Cambridge, Massachusetts and London, England, 1977, p. xxvi.

EVALUATION OF RESPONSE TO EMOTIONAL NEEDS

As psychologists come to understand more about the grief processes associated with the death of loved ones, the trauma of significant losses, and the stress of a disaster, there is greater awareness of the psychological needs of disaster victims.

In the Big Thompson, the Interfaith Task Force--a private, church-assisted group--watched for emotional stress and responded to it, provided personal counseling, served as advocates for the victims, and gave physical and financial assistance where needed.

The Human Services Project of Larimer County, funded by public monies, provided professional counseling to disaster victims. Continued care was available through the Larimer County mental health agency.

However, it is important that in the recovery programs, planning and the face-to-face contact with disaster victims that disaster workers understand the emotional stages which the victims may be encountering. Thinking may be clouded and tasks such as completing government forms may be overwhelming to such victims.

A valuable aspect of the recovery program was the spontaneous formation of the Big Thompson Action Group--a group of disaster victims and Canyon residents. This group met regularly, discussed recovery plans, received presentations from recovery personnel on the progress of various programs, and sent representatives with the group's opinions to the BTRPC meetings.

Disaster recovery workers and recovery managers should be trained to know what types of psychological conditions victims may be experiencing, recognize those stages, and know how to respond. Additionally, the timing of recovery programs should recognize the human condition.

Recovery programs should automatically establish a clear channel for information dissemination of recovery efforts to the flood victims, as well as a forum for citizen response and discussion.

The long term impact of mental distress may be the single most costly aspect of flood disasters. Local, state and federal programs are mostly oriented towards physical recovery.

CHAPTER IV

DISASTER ASSISTANCE

INTRODUCTION

The Colorado Disaster Emergency Act of 1973 stipulates that "Each political subdivision within this State shall be within the jurisdiction of and served by the division and by a local or interjurisdictional agency responsible for disaster preparedness and coordination of response" (28-2-107, CRS, 1973). Each agency is directed to prepare an emergency disaster plan.

When a disaster threatens or occurs, the principal executive officer of a political subdivision makes a local disaster emergency declaration. "The effect of a declaration...is to activate the response and recovery aspects of any and all applicable local and interjurisdictional disaster emergency plans and to authorize the furnishing of aid and assistance under such plans" (28-2-109).

When the assistance needed to cope with a natural disaster is beyond local government's capability to respond, the head of government may ask the Governor and/or Division of Disaster Emergency Services for the additional assistance needed. If the relief requested is beyond the State's capability, the Governor may request Federal assistance by requesting the President to declare an "Emergency" or a "Major Disaster" in accordance with Public Law 93-288, Disaster Relief Act of 1974.

A "major disaster" is defined in the Disaster Relief Act of 1974, Public Law 93-288, as any "hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States which, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance above and beyond emergency services by the Federal government to supplement the efforts and available resources of States, local governments, and private relief organizations

in alleviating the damage, loss, hardship or suffering caused by a disaster."

An "emergency" is defined as any of the various types of natural disasters included in the definition of a "major disaster" which requires Federal emergency assistance to supplement State and local efforts to save lives and protect property, public health and safety or to avert or lessen the threat of a disaster.

SOURCES OF ASSISTANCE

Federal Assistance

If a major disaster or emergency is declared by the President, assistance is provided through the Federal Disaster Assistance Administration. These assistance programs include technical and financial assistance to individuals, state agencies, and local governments. FDAA assistance programs are applied for and monitored through the Division.

In the absence of a Presidential disaster declaration, some federal agencies are in a position to provide assistance in the course of its regular program or as a result of legislation providing aid for floods of less major consequences. Areas covered under these programs include:

- Flood Protection
- Health and Welfare
- Emergency Conservation Measures
- Emergency Loans for Agriculture
- Disaster Loans for Homeowners and Businesses
- Repairs to Federal Aid System Roads
- Tax Refunds

State Assistance

State assistance is coordinated through the Division of Disaster Emergency Services (DODES). Contact can be made directly to any agency--especially in regular program assistance--but should be coordinated with DODES.

In extraordinary circumstances, the Governor may appoint a special assistant or consultant to further assist local government and provide additional coordination of state resources. The Governor's office can also serve to facilitate assistance.

State Regional Assistance

In general, the technical assistance provided by state regional agencies (such as Councils of Government) following a disaster is an extension of their normal roles.

Federal Regional Assistance

The Four Corners Regional Commission can supplement certain federal grant programs.

Private Assistance

Many non-profit agencies have inter-agency agreements, as well as memorandum of understanding with federal, state and local disaster entities to provide automatic response.

ASSISTANCE PROVIDED IN RESPONSE TO THE BIG THOMPSON FLOOD DISASTER

Since the Big Thompson flood was declared a major disaster, the resources of the federal government were made available to Larimer County. Additionally, the resources of the state were provided to the local government. Private help came from institutions such as the Red Cross, Mennonite Disaster Service, Interfaith Task Force, and the Loveland Chamber of Commerce.

The following chart indicates the types of assistance provided by the local, state and federal governments and private organizations, along with the amount of financial assistance. The total funds either spent or committed as of December 31, 1977, for disaster relief and related expenses amount to $57,987,771. Figure IV-A provides a graphic illustration of the flow of these funds.

Technical and physical assistance were also provided in the disaster response. These aspects are less quantifiable, because technical

assistance may be given in the daily course of duties of an agency, such as the extensive assistance provided by the Colorado Geological Survey or the Colorado Water Conservation Board.

FIGURE IV-A

BIG THOMPSON DISASTER ASSISTANCE
SPENT OR COMMITTED AS OF DECEMBER 30, 1977
(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
PERSONAL ASSISTANCE					
Crisis Counseling	107,322				
Food Stamps	8,422				
Individual & Family Grants	399,047	133,015			
Job Corps Assistance	43,000				
Supplemental Assistance to Individuals	25,000				
Unemployment Assistance	300,000*				
Social Security Payment	25,000				
Interfaith Task Force & Loveland Chamber of Commerce (grants, clothing, housing, & materials)				512,268[a]	
Red Cross (food, clothing, maintenance, household furnishings, building & repair and medical				105,783	
Insurance Information-American Insurance Association				b	
Legal Assistance Young Lawyers Sec./ ABA				b	
Veterans Benefits	c				
Mennonite Disaster Service-Support of Volunteers, Building Supplies and Tools				15,464	
TOTAL PERSONAL ASSIST.					1,674,321

* Estimate

[a] Added to this figure are 16,500 worker days of volunteer labor

[b] Voluntary assistance

[c] Costs not identifiable

FIGURE IV-A

BIG THOMPSON DISASTER ASSISTANCE
SPENT OR COMMITTED AS OF DECEMBER 30, 1977
(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
BUSINESS LOANS/GRANTS					
SBA Business Loans	4,377,200				
Red Cross-Occupational Supplies & Equipment				2,672	
TOTAL BUSINESS LOANS/GRT					4,379,872
PERSONAL PROPERTY LOANS					
SBA Personal Property/ Home Loans	2,994,300				
FHA Rural Housing Loans	27,000				
TOTAL PERSONAL PROP. LOAN					3,021,300
AGRICULTURAL LAND REHAB-ILITATION					
Emergency Conservation Measures	31,283			7,821	
Emergency Watershed Protection (216 Prog)	1,151,000				
	903,000[d]				
TOTAL AGRIC. LAND REHAB.					2,093,104
HOUSING					
HUD Temporary Housing	400,000*				
HUD Housing Assistance Payments	8,294,400[e]				
TOTAL HOUSING					8,694,400

* Estimate

[d] Awaiting final Congressional approval.

[e] 72-unit apartment complex constructed by Loveland Public Housing Authority to house low-income elderly displaced by the flood. HUD pays $240/month subsidy for each unit. An exact cost attributable to disaster victim assistance is unavailable.

FIGURE IV-A

BIG THOMPSON DISASTER ASSISTANCE
SPENT OR COMMITTED AS OF DECEMBER 30, 1977
(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
DISASTER SEARCH & CLEANUP					
FDAA & Corps of Engineer Debris Cleanup	1,600,000				
FDAA Protective Measures	795,034 (to date)				
LEAA Discretionary Grant for canyon security & communications	150,204				
FDAA/Army Search & Rescue	50,000				
Red Cross Emergency Mass Care				11,564	
TOTAL DISASTER SEARCH & CL					2,606,802
PUBLIC FACILITIES ASSIST.					
FDAA Reimbursement for damage to public facilities	110,494				
FDAA Reimbursement for damage to parks & recreation facilities	396,015				
FDAA Reimbursement for damage to public utilities	3,597,504				
U.S. Bureau of Reclamation repair of facilities	519,200				
FDAA reimbursement to Rural Fire Protection Districts for damage facilities	37,939 (to date)				
HEW-Repair of water control facilities	4,000				
FDAA-Repair of water control facilities	731,539 (to date)				
TOTAL PUBLIC FACILITIES					5,396,691

FIGURE IV-8

BIG THOMPSON DISASTER ASSISTANCE

SPENT OR COMMITTED AS OF DECEMBER 30, 1977

(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
ROADS AND HIGHWAYS					
Federal Highway Administration/FDAA Road Repair	24,000,000*				
TOTAL ROADS & HIGHWAYS					24,000,000
PRIVATE BRIDGES					
Big Thompson/North Fork Bridge District		150,000	60,000	100,000 (Interfaith)	
				140,000 (Property Owners)	
TOTAL PRIVATE BRIDGES					450,000
COMMUNITY DEVELOPMENT BLOCK GRANTS					
HUD Discretionary Grant	133,000				
HUD Disaster Grant for Relocation & Rehabilitation	811,000				
TOTAL COMM. DEV. BLOCK GT					944,000
PLANNING AND MAPPING					
Corps of Engineers Hydrology Studies	11,000				
FIA Flood Hazard Mapping	53,000				
HUD '701' Comprehensive Planning Assistance	187,667		93,833		
TOTAL PLANNING & MAPPING					345,500

* Estimate

FIGURE IV-A

BIG THOMPSON DISASTER ASSISTANCE
SPENT OR COMMITTED AS OF DECEMBER 30, 1977
(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
LAND & WATER CONSERVATION FUNDS					
Larimer County/U.S. Bureau of Outdoor Recreation (BOR) Acquisition	1,012,600 (BOR) 150,000 (Four Corners Regional Com)	730,959	131,641		
Larimer County-appraisal for land acquisition program			184,000		
Larimer County-Development of Park Land			Unknown		
U.S. Forest Service land acquisition program	1,500,000				
TOTAL LAND & WATER CONSERVATION FUNDS					3,709,200
ADMINISTRATIVE COSTS					
Governmental administrative costs not reimbursed by disaster funds or other aid	c	385,000	25,000		
Interfaith				40,000	
Red Cross-Service Costs for assistance to individuals and administrative costs				32,251	
TOTAL ADMINISTRATIVE COSTS					482,281

* Estimate

c Costs not identifiable

FIGURE IV-A

BIG THOMPSON DISASTER ASSISTANCE
SPENT OR COMMITTED AS OF DECEMBER 30, 1977
(Based on Best Available Figures)

Program	Federal	State	Local	Private	Total
COUNTY FLOOD RELATED EXPENSES					
Contingency Fund			100,000		
Revenue Sharing			90,000		
TOTAL COUNTY EXPENSES					190,000
TOTAL ASSISTANCE TO DATE					57,987,771

EVALUATION OF DISASTER ASSISTANCE

Mr. Steve McMillan, Assistant County Flood Coordinator, commented that it was felt that the assistance programs which were directly administered by the FDAA and DODES went very smoothly. He indicated that it was also generally felt that Mr. Don Eddy and his staff at FDAA are very knowledgeable and very effective. High praise was given to Mr. Logan Rappe (DODES) for being an extremely cooperative person and responsive to the problems as they surfaced. The staff of FDAA and DODES were (1) aware of the disaster assistance programs and the way in which they applied to the Big Thompson situation, (2) knew the procedures for expediting programs, (3) understood the needs of disaster victims, and (4) served as an advocate for the county in working with the upper levels of government.

Difficulty and delay arose over the following situations:

(1) Meeting needs for which there was no Congressional or legislative authorization. This was the case in obtaining state monies for land acquisition, authorizing state funds for use by the bridge district; increasing the appropriation to the "216" stream restoration program, and appropriating funds for land acquisition by the U.S. Forest Service.

(2) Obtaining changes in already authorized programs. This category included reduction in SBA loan rates, authorization for the Bureau of Outdoor Recreation to use monies from the Land and Water Conservation Fund (L&WCF) to purchase at pre-flood values; and applying the recreationally-oriented L&WCF program to mainly a flood-relief purpose.

(3) Obtaining administrative authorization when the requested assistance was contrary to administrative policy. This situation occurred with the disbursement of disaster funds from the Community Development Block Grant Program, where there was a reluctance to provide monies for relocation assistance.

(4) Disaster programs which were outside the purview of FDAA, such as the '701' planning grant and the Community Development Block Grant.

In these cases, county personnel had to serve as their own advocates and were required to learn how each agency, Congress, or the legislature functions. Staff underwent "on-the-job training" in grantsmanship and understanding government.

Getting authorization through Congress or the Colorado Legislature necessarily takes time, waiting for the bodies to convene and then getting the measures through the traditionally slow process. There is always a reluctance on the part of legislators to provide special legislation which might set precedents in other disasters.

Non-disaster oriented agencies too felt that their purposes should not be altered to provide disaster relief, which action might set a precedent. Some non-disaster agencies had policies which contradicted or complicated other disaster mitigation policies.

The additional assistance which Larimer County sought focused on individual assistance, which many felt was inadequate.

> Much criticism, for example, was leveled at the SBA loan program with interest rates at 6-5/8%. At this rate, qualifying for a sufficient loan was difficult for many people whose only income was a retirement pension or a tourist business swept away by the flood. Grants up to $5,000 per family or individual were generally available only to persons who could not qualify for SBA or other types of loans; and the average grant fell well below the maximum amount.[1]

Individual financial assistance was sought for rehabilitation, relocation, lowered loan rates, and purchase of land, since most all of

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[1] Larry A. Muller, "1976 Big Thompson Flood and Flood Recovery Planning", American Society of Civil Engineers, Preprint 3105, Oct. 9177.

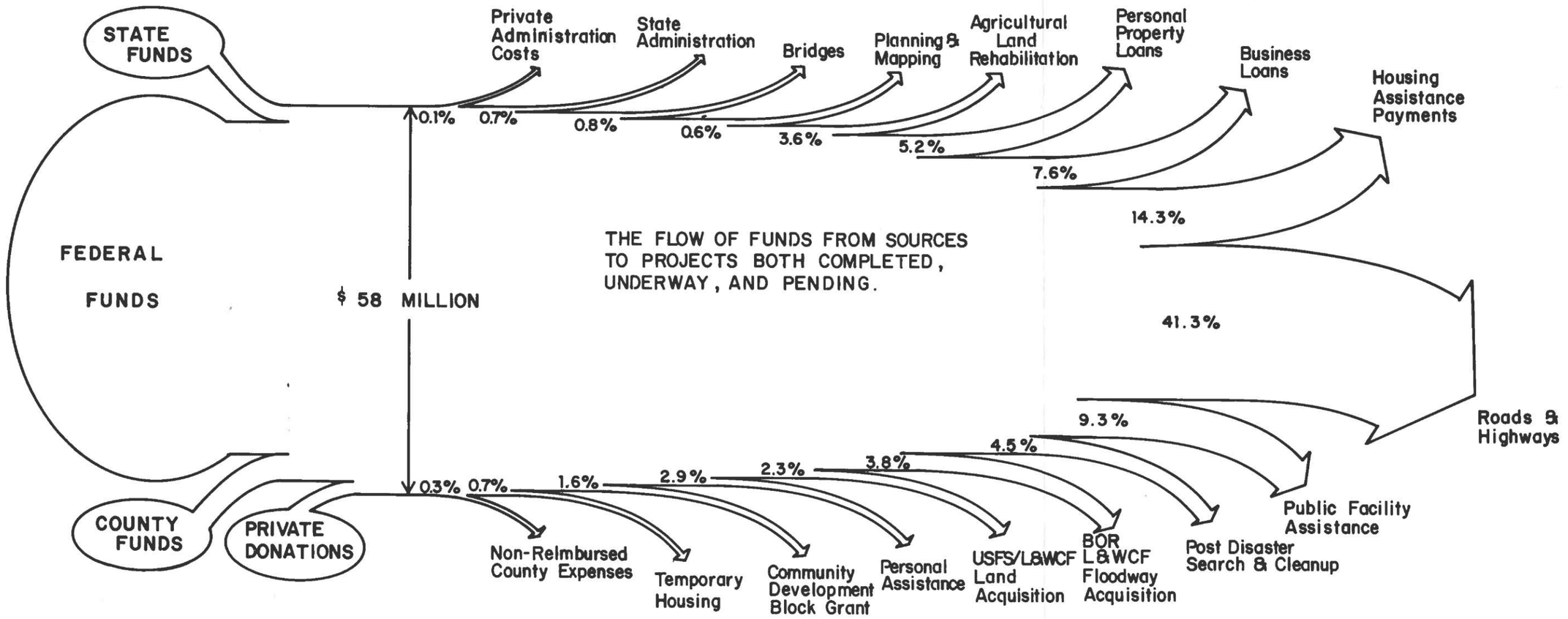
the residents did not carry flood insurance and felt that they received limited financial assistance.

In future disasters it would be important for recovery planning staff to be experienced in governmental procedures and federal aid programs.

Priority must be given to increasing the enrollment and participation in the federal flood insurance program. While increased individual assistance in disaster relief is needed, the federal flood insurance program provides a better method to assure assistance through individual indemnification.

BIG THOMPSON RECOVERY PROGRAM
SUMMARY GRAPH

DECEMBER 31, 1977



WRIGHT-McLAUGHLIN ENGINEERS
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CHAPTER V

FLOOD PLAIN REGULATION AND MANAGEMENT

This section of the report presents a chronological summary of the primary steps which have affected regulation of the Big Thompson Canyon flood plain. It is presented to provide the reader with a perspective dating back to 1966 so as to better deal with the future.

The reader is encouraged to review the specific legislation mentioned and to read Executive Orders by Governor Lamm dated August 1, 1977, and October 1, 1977, plus the Executive Order by President Jimmy Carter dated May, 1977 (see Appendix F).

The Colorado Water Conservation Board (CWCB) Model Flood Plain Regulation is the standard upon which local regulations are measured. Local county regulations may be more restrictive, but they cannot be less restrictive. This opinion was expressed by Mr. Felix Sparks in his memo to the CWCB on February 11, 1975. It was later confirmed by the Attorney General's office in an informal opinion on August 17, 1976.

In Governor Lamm's Executive Order dated August 1, 1977 he states:

> "minimum flood plain and floodway regulation criteria have been promulgated by the Colorado Water Conservation Board and the Colorado Land Use Commission on the premise that wise use of our State's flood plains is the key to controlling and minimizing future economic losses and suffering of our citizens" (emphasis added).

Then on October 1, 1977, Governor Lamm issued an additional Executive Order at the specific request of the Federal Insurance Agency (FIA). In that Order the Governor stated:

> "The floodway (high-hazard zone) limits shall be consistent with the criteria established by the Colorado Water Conservation Board's Model Flood Plain Regulation, dated February 26, 1975, which was prepared under the authority of Title 24, Article 65.1, Colorado Revised Statutes 1973, as amended."

Thus, the important criteria given in the CWCB flood plain regulation on defining the low hazard area as against the high hazard area (floodway) is the least restrictive criteria which should be used by local government and accepted by the CWCB when designating flood plains under state law. Further, the FIA should use this minimum criteria for floodway delineation throughout Colorado.

CHRONOLOGICAL REVIEW

1966 Report published and released entitled A Unified National Program for Managing Flood Losses by a presidential task force chaired by Dr. Gilbert White of University of Chicago. Concurrently President Johnson issued Executive Order #11296.

1968 The National Flood Insurance Act was passed by Congress.

1973 The Flood Disaster Protection Act was passed by Congress. These two acts, as amended, provide the basis for the National Flood Insurance program.

1973 House Bill 1041, passed by the Colorado Legislature, provided alternative authority for counties to regulate flood plains. These statutes along with the zoning enabling act were the basis for administration of flood plains.

July 1974 Larimer County joined the emergency National Flood Insurance Program and property owners became eligible to purchase flood insurance at subsidized rates.

Feb. 26, 1975 — The Colorado Water Conservation Board adopted a model flood plain regulation as directed by House Bill 1041. The regulation defines the flood plain as that which is subject to flooding as a result of the flood with a one percent chance of being equalled or exceeded in any one year. The flood plain may be subdivided into the floodway zone and low hazard zone based upon stated criteria. Restrictions are placed upon the uses of the flood plain. Development in the low hazard zone is permitted if precautions are taken. Existing uses or structures at the time of enactment of the regulation are permitted to remain unless substantially damaged or altered. In those cases, the reconstruction or alteration must conform to the regulations. The appeal for exceptions to the regulations is outlined. The granting of variances (permits for exceptions) must be made only upon an appropriate basis. The model regulation was designed as a guideline for regulations to be adopted by counties and cities for administration of flood plains. Local regulations can be more restrictive than those of the CWCB, but not less restrictive.

Dec. 1, 1975 — Larimer County Commissioners adopted a flood plain regulation as an amendment to the County Building Code. The Regulation included many of the same aspects as the model regulation developed by the CWCB. There are some differences in the regulations. These include no specific criteria for determining what portion of the flood plain would be a low hazard area, called the Flood Fringe District in the County regulation. The County regulation requires minimum floor elevations be one and one half feet above the one percent flood elevation or flood proofed, while the CWCB regulation requires elevation of one foot as flood proofing. A special Board of Review was created by the Board of County Commissioners to make recommendations to the County Commissioners pertaining to permit applications and zone boundaries.

April 1976 — Federal Insurance Administration contracted with Gingery Associates, Inc., Consulting Engineers, to perform a Flood Insurance Study (FIS) in Larimer County. The Big Thompson River was not included in the contract.

July 31-Aug 1, 1976 — Big Thompson Flood. Twenty-three flood insurance policies were in effect in Larimer County; only one policy was in effect in the Big Thompson Canyon. The flood plain was not defined for regulatory purposes and not regulated.

Aug 10, 1976 — Larimer County Commissioners passed a temporary flood plain resolution delineating the July 31-August 1 high water boundary as the floodway district. The regulation expired upon enactment of a permanent regulation or upon elapse of six months, which ever occurred first.

Sept 1976 — Larimer County Flood Information Study contract amended to include the Big Thompson River.

Sept 9 1976 — Air photos were taken of the Big Thompson Canyon River for mapping required in the Flood Insurance Study.

Oct 15 1976 — Preliminary draft of the hydrology study for the Big Thompson River was completed by Gingery Associates, Inc., and distributed for comment.

Nov 10, 1976 — Larimer County Commissioners approved a Special Permit for building a retaining wall in the Floodway District at the Big Bend Motel. The application for permit was made <u>after</u> the wall was constructed (no building permit was obtained). The location of the retaining wall posed an increase in flood hazard to adjacent property. The Flood Review Board recommended <u>against</u> issuing the permit.

Dec 22, 1976 — Preliminary flood plain delineation maps were completed by Gingery Associates, Inc., and made available for review.

Feb 1, 1977 — The Big Thompson Canyon flood plain was "designated" by the Colorado Water Conservation Board.

April 13, 1977 — The Larimer County Commissioners approved use of the floodway of the Big Thompson River for overnight camping as a "use by right."

May 24, 1977 — President Jimmy Carter issued Executive Order #11988 entitled "Flood Plain Management".

June 24, 1977 — The Colorado Land Use Commission formally requested Larimer County to designate the flood plain of the Big Thompson River as an area of State interest according to the provisions of C.R.S. 1973, Title 24, Article 65.1.

July 1977 — The Larimer County Commissioners held a public hearing concerning the use of the Big Thompson River floodway for overnight camping. The Commissioners decided to require a Special Permit for overnight camping in the floodway rather than allowing overnight camping as a use by right.

July 6, 1977 — The Larimer County Commissioners held a rehearing on the Special Permit for the retaining wall at the Big Bend Motel. No decision was made on the issue.

Aug 1, 1977 — Governor Lamm issued Executive Order #8491 on evaluating flood hazards in state actions and construction.

Sept 30, 1977 — Two hundred ninety three flood insurance policies were in effect in Larimer County (no information available on the number of policies in the Big Thompson Canyon). This is considered to be an alarmingly low number of policies in view of the flood history in Larimer County.

Oct 1, 1977 — Governor Lamm issued Executive Order # 8504 on "Requirements and Criteria for State Participation in the National Flood Insurance Program."

Nov 4, 1977 — The Federal Insurance Administration sent the Larimer County Commissioners notice of changes to the County's flood plain regulation necessary to conform to federal guidelines. The changes required were: (1) The criteria for altering a non-conforming structure must be based upon the value of the alteration relative to fifty percent of the current market value, not upon the percentage of floor area.

(2) Federal regulation did not permit flood proofing of residential structures; and (3) The variance procedure of the flood plain regulation must conform to Federal requirements. The justification for variances must be recorded.

Dec 1977 — Most of the areas within the State with significant flooding problems have joined the Flood Insurance Program. The exceptions include some areas of the Arkansas River Valley.

Larimer County is reviewing its flood plain regulations and plans to revise them as necessary to conform to Federal Insurance Administration.

The CWCB and FIA plan to meet in the near future to resolve differences in State and Federal flood plain regulations.

CHAPTER VI

COMPREHENSIVE PLANNING
(701 PLANNING PROGRAM)

PROCESS

Section 701 of the Housing Act of 1954 provides funding and authorization for comprehensive local planning. Special funds are available under the 701 planning process for community planning subsequent to a disaster.

An application to HUD was prepared by the Larimer County Planning Department. The A-95 review process was waived by the Governor to speed the application review so planning could commence as soon as possible. The application was submitted. However, a question arose over whether Larimer County or the Larimer-Weld Council of Governments (LWCOG) should make the application and administer the 701 planning funds. The question was resolved in favor of the LWCOG. This tended to delay the application to the Department of Housing & Urban Development and its final approval. The master planning scope of work, interviewing of consultants, and consultant selection was handled without state input or consultation.

The consultant, Toups Corporation, was put under contract by the LWCOG in December, 1976. The first phase of the assignment, site evaluation and mapping, was not completed until May, 1977. Alternative plans were developed and numerous public hearings were held to receive suggestions and comments on the suggested alternatives. A final plan was then formed, additional hearings conducted, and the plan finally approved by the Larimer County Planning Commission on November 30, 1977. The plan was not adopted until 16 months after the flood. By that time most land use decisions and recovery planning had been made. The Larimer County Recovery Planning Coordinator had resigned, the Interfaith Task Force had disbanded, and most state, local, and federal efforts had wound down to a routine level.

PLAN

The master plan follows the present zoning, which restricts all new development to ten-acre sites, thus allowing approximately 760 acres of presently undeveloped land to be used for expanded residential development. The 760 acres, along with lots already approved, provides a total of 178 lots which could be developed in the Canyon, or a potential increase in population of approximately 545 people.

The 10-acre lot limit is estimated to be that size which can accommodate new development while maintaining water quality. The consultant proposes that with community water and wastewater systems that the 10-acre lot restriction could be lifted and additional population accommodated at 1-acre lot density. Assuming the above, the consultant then predicts a summer population of 5,022 by the year 2000 based on the 1-acre lot use. This represents an increase over 23 years of 119%.

The plan proposes cluster wells serving two or more houses. The anticipated depth of well is from 250 feet to 730 feet. The cluster well system would involve cooperative use of a well and the associated supply system. Ownership could be by individual property owners or through incorporation into a water district.

For a wastewater system, the consultant proposes seven wastewater treatment plants consisting of a clarifier/recirculating filter system. This system includes a settling tank, a recirculating tank, a sand filter, and a chlorinator. For purposes of obtaining funding and to provide better operation and maintenance, the consultant proposes one management agency.

The consultant has estimated the present maximum summer population at 2,290 people with 569 potential sewer taps (residential and commercial). Estimates indicate that about this number of people were in the Canyon on the night of the July 31, 1976 flood.

The master plan indicates that cluster area water supply can be provided at a capital cost of $890,000. Annual water costs with operation and maintenance (O&M) included would be $102,200 per year.

Central sewerage systems can be constructed for $2,160,000. Annual sewerage costs with O&M would be $291,000.

Grants of up to 100 percent of the capital cost of construction would be sought. Annual service charges for water and sewer are estimated to be $278 per customer with 100 percent grants. Without grants, the annual service charge would be $918 per customer for water and sewer.

State and federal agencies would review the grant requests in light of the public interest and in light of the fact that numerous of the summer residences are owned and/or used by out-of-state visitors as summer and vacation homes.

It is not presently advocated at the state level to encourage increased occupancy of hazardous canyons in Colorado, even when the new building is outside of specific delineated hazardous areas. The support components of utilities, roads, and service centers represent additional public investments of which the appropriations must be weighed in light of the history of this Canyon. Further, more than doubling the Canyon population by virtue of the centralized utility systems would tend to increase non-point pollution sources and urban type erosion and sedimentation problems which would diminish water quality benefits from municipal sewage treatment plants. One acre zoning for new lot development would eliminate some of the open area attributes of the Canyon environment.

The potential of obtaining bedrock deep wells to support cluster development is questionable. While the wastewater treatment process appears good from the published literature[1], it should be demonstrated

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[1] American Society of Civil Engineers Journal, August, 1976, pgs. 787-803.

to work successfully in a similar environment before it is introduced into the environmentally sensitive Canyon.

Prior to action on any grant requests for water and sewer facilities an environmental impact study would be needed to assess both primary and secondary impacts resulting from increased zoning density and increased population facilitation created by the new systems.

EVALUATION

Master planning can be a useful tool in the reconstruction process, if it is done expediently so that the results could be used by the decision-makers. Because of controversy between the Larimer-Weld Council of Governments and Larimer County over administration of the 701 planning funds from the Department of Housing and Urban Development (HUD), the application to HUD was delayed. When funds were received, the planning process took too long to complete.

A commendable part of the planning process was the numerous hearings which the consultant conducted with Canyon residents to explain the master plan and receive opinions, so that by the time it reached the Planning Commission it was understood by the affected citizens.

Delay is the enemy of good recovery. It serves as a source of frustration to victims who are looking for direction and are anxious to return to a state of normalcy as soon as possible.

The more elaborate the plan, the less likely that it will be implemented. The elaborate, complex plan takes longer to develop and is more likely to be resisted by those wishing to return the area to the way it was before the disaster. The longer the plan takes to develop, the more private decisions will be made in an effort to return to normalcy and thus subvert the plan.

Master plans should be kept simple and allow for improved land use without major development alterations. Comprehensive planning

should be initiated immediately following a disaster. The planning can be expeditious and thorough and preferably should be completed at the same time other studies are completed, such as flood plain mapping and geologic hazard identification.

CHAPTER VII

LAND ACQUISITION

PROGRAM

On September 14, 1976, the BTRPC authorized the establishment of an intergovernmental planning group to look at the potential for recreational land acquisition in the Canyon. The Motion unanimously approved read as follows:

> The Big Thompson Advisory Committee will invite the U.S. Fish and Wildlife, U.S. Forest Service, Bureau of Outdoor Recreation, U.S. Bureau of Reclamation, and the U.S. Park Service to set up a study team, with input from appropriate State and local agencies, for a Master Plan development for recreation in the Big Thompson Canyon, this plan to be submitted to this Committee for its consideration in total rehabilitation of the Canyon.

Over five weeks later, the County still had not followed through on the motion and formally requested the federal and state agencies to proceed. When the study-planning team was formed (October 27, 1976), it consisted of two members from Larimer County Planning Office, two members from the Colorado Department of Natural Resources, two members from the National Park Service, two from Bureau of Outdoor Recreation, and two from the U.S. Forest Service. The Governor's special consultant assisted the group with computations of costs.

The team developed a general plan which would allow for a composite of land acquisition by the Bureau of Outdoor Recreation and the U.S. Forest Service. It was thought that the U.S. Forest Service, given special Congressional funding, could expand their present holdings in the Canyon to increase access and consolidate management and at the same time provide another significant source of funds for assisting survivors in reestablishing themselves.

By December 20th, a set of alternatives were developed and presented to the Recovery Council. (See Appendix G .)

The Council endorsed a combination of Alternatives C and D, that is, recreational nodes along the Canyon for high or low intensity recreational use--or up to $17 million in land acquisition at pre-flood values. However, action was delayed, presentation to Senator Haskell on the requested program was vague, and finally the county withdrew support for a comprehensive acquisition program. Instead, the county pursued acquisition of the floodway with Bureau of Outdoor Recreation (BOR) funds. A small U.S. Forest Service acquisition program of approximately $1.5 million was also sought. Special Congressional authorization was given in H.R. 5306 to purchase certain lands in the Big Thompson Canyon at pre-flood values. (See Appendix H for text of legislation.) In appropriating funds to the U.S. Forest Service, Congress expressed the intent that a designated portion was to be used for land acquisition in Big Thompson.

The county, in the final application to BOR, sought to purchase 166 parcels of land for a total of $2,025,200. The funding sources are as follows:

BOR Land and Water Conservation Fund	$1,012,600	50.0%
Four Corners Regional Commission	150,000	7.4%
State of Colorado	730,959	36.1%
Larimer County	131,641	6.5%

The county will maintain the land once it is acquired and is to "develop" it along the lines presented to the BOR in the County's conceptual development plan. The area will be passive recreational sites, allowing scenic pull-offs, stream access, and picnic grounds.

EVALUATION OF LAND ACQUISITION

The land acquisition program required a major amount of the time of flood recovery staff and state and federal personnel. Congressional and state legislative representatives also participated in pulling the funding package together.

In the final evaluation, the land acquisition program could have provided more assistance to financially strapped land owners in the Canyon and more of a recreational and wildlife benefit. It could have been accomplished more quickly and effectively.

The land acquisition program in the floodway does not represent a precedent for land acquisition in future floods because of the unique position of the residents in the Canyon. The state's position is that regulation of the flood plain is a rightful exercise of local authority to protect the health, safety and welfare of its citizens.

On land acquisition, the entire Colorado Congressional delegation was of assistance and supported the efforts of local and state government. Senators Haskell and Hart were particularly helpful over an extended time period as was Representative Johnson.

CHAPTER VIII

AXIOMS FOR FUTURE DISASTERS

A review of the Big Thompson disaster and other disasters shows a pattern. Certain axioms can be stated about the recovery process.

1. Delay is the enemy of good restoration. Although victims may need some time following a disaster before their capability to make rational decisions is functional, generally delay in the disaster response and recovery program is detrimental.

2. The issues of disaster recovery are knowable and predictable. Therefore, not only can certain issues be resolved ahead of time by pre-disaster planning and agreements, but in the event of a disaster, recovery managers can be aware of potential problems and adjust their actions accordingly.

   Predictable issues include:

   a. Should decision making mechanisms be normal or extra-ordinary during the course of the recovery?
   b. Should there be changes in land use?
   c. Should regulations and laws be changed to mitigate similar future damages?
   d. Should the rebuilding opportunity be used to improve the livability and environment of the urbanized area?
   e. What level of financial aid should be made to cover private property losses?
   f. How, and to what extent, should the social and personal problems be assisted?
   g. How can the increased local financial burden due to the disaster be borne?
   h. How should communications be handled to decrease un-certainity?

3. The more elaborate the recovery plans, the less chance of their implementation. Land use plans for post-disaster restoration should be kept simple and able to be implemented in a relatively short period of time. Ambitious planning is counterproductive. If planning is to be more elaborate, the phasing is important so that within a short time after the disaster, the first part can be implemented. Too often, planners consider their end product a completed report rather than an implementation of the plan.

4. Reconstruction issues are value choices. Some of the values may be mutually exclusive, partially in conflict, or partially complementary. The immediate needs of the victims to return to normal may conflict with the goal to prevent repeating of past mistakes and mitigate future hazards. Recovery managers must be in a position to weigh costs and benefits to the public as well as to the victims.

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APPENDIX A

August 23, 1976

(Larimer County - State Committee)

GOALS FOR

BIG THOMPSON ADVISORY COMMITTEE

Economic & Social

1. Assist survivors, property owners, and communities in readjustment.

Physical & Public Works Projects

2. Recovery and rehabilitation of Canyon to be accomplished in safe and orderly manner.

Planning

3. Achieve positive results and avoid duplication of past mistakes with various programs.

Financial

4. Assure maximization of planning and public works financial assistance from federal agencies.

CHANNEL

1. Protect against adverse sediment transport downstream to plains.

* 2.

3. Do not move channel, or fill channel, without overall plan for stability.

4. Restore channel vegetation and scenic attributes.

5. Provide for establishment of aquatic habitat.

6. Private bridges to meet or exceed basic criteria.

CANYON OCCUPANCY

1. Insure compatibility of occupancy patterns with natural hazards.

2. Develop programs for acquisition of certain properties.

ADMINISTRATIVE

1. Insure State - County - Federal communication and cooperation.

2. Provide for information dissemination to avoid uncertainty by public.

   a. Keep those who have been affected by the disaster informed of all efforts being made and present a clear schedule of project milestones and completion dates.

   b. Keep those who have been affected by the disaster informed of their individual and group options.

3. Assist in application preparation and submittal.

   a. Make recommendations regarding establishment of the proper staffing and an organizational framework to ensure that citizen participation, planning and grant application procedure are rapidly, effectively and efficiently carried out.

* Indicates Committee revision on August 23, 1976.

4. Provide schematic and preliminary plans early for submittal applications.

   - Early completion of plans cannot be over emphasized for funding,
   - Delay in plans will tend to cause rebuilding of pre-disaster conditions, and
   - Don't be overly ambitious in early planning work.

5. Involve to the maximum extent practical, residents of affected areas in the processes of developing alternative flood plain management plans, final plan selection and plan implementation.

CANYON RESIDENT WELFARE

1. Assess needs of elderly and financially troubled residents.
2. Crisis intervention counselling.
3. Counselling on individual assistance.
4. Develop practical assistance programs.
* 5. Manage traffic to provide adequate access for residents and work crews and minimize thru traffic during recovery period.

ECONOMIC BASE

1. Assess economic impact on Loveland, Estes Park, and Canyon units.
2. Identify economic opportunities.
3. Prepare economic stabilization plans for implementation.

FINANCIAL

1. Assure that all Federal, State, and local funds and action programs are highly integrated, of a single purpose, and non-duplicative in nature.
2. Exert all possible influence in receiving the highest possible amount of State and Federal funds to support flood plain management planning and implementation efforts.

* Indicates Committee revision on August 23, 1976.

* POLLUTION CONTROL AND PUBLIC SAFETY

1. Protect water supply sources from contamination (including virus) for City of Loveland and Canyon residents.

2. Provide means for the evaluation of existing and proposed alternative sanitary systems, including small community systems, such as at Drake which might be based on land application to help protect water quality.

3. Assure adequate fire protection for the Big Thompson Canyon.

4. Provide the necessary mechanisms to assure that security is maintained in the Big Thompson Canyon.

5. Assure that adequate ambulance service can be provided in times of emergency within the Canyon.

* Indicates Committee revision on August 23, 1976.

August 23, 1976

OUTLINE OF

OBJECTIVES

HIGHWAY

1. Select route and criteria as soon as possible.
2. Highway to be designed with modern engineering and planning standards.

   Highway safety,
* Strive to withstand 100-year flood, if in Canyon,
   Scenic drive, and
   Bridges designed for debris, if in Canyon.
3. Provide for County policy input to highway decisions.
* 4. Coordination with local governments.

FLOOD PLAIN MANAGEMENT

1. Provide direction and guidance in the development and implementation of a flood plain management plan as quickly as possible so as not to close desirable options through delay.
   a. Provide for full consideration of private property rights under the law.
2. Delineate flood of record and 100-year flood plain.
3. Define zone of no building or filling based on velocity and erosion criteria along with high hazard criteria.
4. Flood plain of record as used by County for special planning area to insure resident safety and welfare.
5. Encourage flood insurance policy purchases striving for 100% in Regulatory Area.
6. Plan for minimum flood debris and debris blockage.

* Indicates Committee revision on August 23, 1976.

OUTLINE OF STRATEGY FOR GOVERNOR'S OFFICE FOR BIG THOMPSON CANYON FLOOD

POLICY AND GOALS

The Big Thompson Canyon flood of August 1, 1976 has caused loss of life and suffering, loss of property and economic hardship, and special burdens for local, State, and Federal government.

Now that the initial rescue and victim recovery operation phase is drawing to a close, the difficult challenge related to aid and assistance to the survivors, and planning to avoid future disasters is at hand. It is from this moment that the action and decisions by the three levels of government have future impact. These actions and decisions will be important in determining how well the survivors can readjust and recover from economic losses, and how the area economy will be able to grow and prosper.

With the above in mind, the State of Colorado government is committed to assisting the physical and economic recovery of this region. Further, the State government is committed to assist local government so as to assure that this tragedy will never again occur in the Big Thompson Valley.

We must plan carefully to assure that the chances of this type of disaster in similar valleys will be reduced.

The goals which the State administration supports and which it will assist local officials in achieving are:

1. Relieve suffering of survivors and victims' families.
2. Achieve positive results from disaster relief programs and funds to avoid duplicating past mistakes in hazardous area occupancy.
3. Assure orderly and safe redevelopment and rehabilitation.
4. Assess similar recreational hazard areas and undertake efforts to reduce their vulnerability to natural hazards.

To achieve these goals, the cooperation and communications between local, State and Federal governments must be maximized. To this end a Big Thompson Recovery and Development Council will be established representing Larimer County and State Government.

STRATEGY FRAMEWORK

To achieve the goals outlined, a four part action plan has been developed. These four parts will run concurrently with emphasis on Phase I which is oriented towards relief of suffering and adverse economic impact on survivors. Many items noted have been initiated by the three levels of government and agencies such as the Red Cross.

Dissemination of data to the community is vital so as to avoid uncertainty by the survivors, related businesses, and affected property owners.

I. Immediate After Search Phase. (Temporary Housing Complex Period)

1. Temporary Housing Planning with FDAA
   - Provide for trailer spaces
   - Planning for urban services support, and
   - Use 208 planning monies from EPA with contract addendum if needed.

b. Shelter.
- Use HUD trailers,
- Select and/or establish trailer facilities with utilities, and
- Provide for cultural enrichment with Colorado Council on Humanities.

c. Crisis Intervention Counselling.
- Centers readily available to survivors including outreach efforts.

d. Counselling on Individual Assistance.
- Loans for immediate cash and housing,
- Legal assistance,
- Unemployment benefits,
- Internal Revenue Service advice,
- Handbook for applicants,
- Consumer protection,
- Disability benefits from agencies and insurance, and
- Federal and State welfare programs where appropriate.

2. Economic Base Support.
   a. Assessment of economic impact,
   b. Providing of support through special projects,
   c. Loans to survivors,
   d. Contact banks to minimize loans and mortgage payment pressures on survivors and local businesses,
   e. Encourage FDAA to work towards aid in balancing out economic impact, and
   f. Analyze PL 93-288 for maximizing assistance locally.

3. Debris and Channel Cleaning.
   a. Use care in dozing so as not to cause irreversible channel damage which would result in future sediment and erosion damage,
   b. Debris to managed solid waste storage areas,
   c. Usual "clearing and snagging" approach to cleanup should be avoided when feasible, and
   d. Coordination, advising and/or supervision of contractor in disaster area.
   e. Special U.S. Fish & Wildlife teams to advise on stream and channel rehabilitation to optimize future recreational benefits.
4. Medical and Health.
   a. Insure medical aid available on reasonable basis and at no cost where appropriate, including mental health counselling,
   b. Support Red Cross efforts,
   c. Assessment by Colorado Department of Health on sanitation, drinking water, sewage treatment, solid waste, disease and epidemic. Provide appropriate advisories on cautions to be exercised and provide innoculation as deemed appropriate. Assess and inventory leaching field status in flood damaged area. Monitor water quality and assist in making water systems immune to contamination.

5. Emergency Power, Fuel, Water, and Telephone.
   a. Provide generators on limited basis,
   b. Fuel delivery assistance,
   c. Safe drinking water, and
   d. Emergency communication for Canyon survivors.

6. Security.
   a. Provide appropriate assistance to avoid problems of looting.

The State is committed to making the Big Thompson Canyon a better and safer place in the future.

II. Long Range Planning. (Plan for Valley and Canyon Redevelopment)

Planning needs to include local citizens and groups who may not normally be active in community level decisions. This involvement would be advisory, but direct.

Target dates for important decisions are needed so as to reduce uncertainty. Target dates must be met.

Pressures will exist to allow the Big Thompson Canyon to return to its previous, familiar, but demonstrably unsafe condition. These pressures are predictable and understandable since they occur after all major diasters. For the Big Thompson these pressures must be reoriented for the long term good of the region, the County, and the Canyon and its occupants. A clearly articulated policy should be the first order of business of the Big Thompson Recovery Committee as soon as Larimer County forms the Committee.

There are many issues with which the Committee must deal. Several of them follow to elucidate the scope and complexity.

1. Should there be substantial changes in occupancy and building patterns in the Canyon?
2. Are building code changes necessary?
3. Should there be a concerted effort to make the Canyon more attractive and with reduced hazard to occupants, motorists, and visitors?

4. Should there be special and/or unusual compensation to private property owners to relieve economic hardships?
5. How can disaster produced personal and family problems be best overcome.
6. How can increased Larimer County public expenditures for the flood be mitigated?
7. How can delay in decision making and recovery be overcome?
8. What is the best way to disseminate information to avoid unnecessary uncertainty?

Items important to long range planning are listed blow. This is a partial list to which other items will be added.

1. Moratorium of six months on all permits in floodplain of record.
2. Floodplain Mapping and Delineation.
   a. Fly and photograph floodplain, (done)
   b. Extend contract for floodplain delineation into Canyon to Lake Estes and up North Fork, (done)
   c. Use appropriate scale suitable for potential highway reconstruction use, and
   d. Define flood of record and 1 percent floodplain of 17,000 CFS $\pm$.
   e. The CWCB and FIA have their work items underway, with CWCB report and floodplain delineation due about mid-December, 1976. An effort will be made to speed up the process by overtime work and extra efficiency.

3. Define physical plan alternatives.
   a. Circulation for traffic. Highway location,
   b. Housing,
   c. Support for linkage to regional plans,
   d. Flood of record to be regulatory area?,
   e. One percent flood to be floodway?, and
   f. Consider that 61 percent of USA flood losses occur from floods larger than 1 percent magnitude.

4. Economic Opportunity Analysis.
   a. Local - regional - State - federal linkage,
   b. Economic opportunities for Larimer County, Loveland, Canyon, and Estes Park, and
   c. Study viable local economic units, particularly in Canyon.

5. Use historic photographs.
   a. Use 1970 USGS photography,
   b. Use October, 1975 photography, and
   c. Satellite photographs.

6. Agricultural Economy.
   a. C-BT water supply,
   b. Damaged headgate and ditches, and
   c. Silted fields recovery.

7. Highway Reconstruction.
   a. Keep out of high hazard areas,
   b. Consider number of bridges and openings to minimize future hazards and highway closing,

c. Consider constructing a safe, two lane NPS type highway with scenic turnouts to enhance the approach to the Rocky Mountain National Park which would also commence for visitors the National Park experience at the Canyon mouth.

d. Readjust right-of-way as needed, this may assist in damage property acquisition, and

e. Consider alternatives of relocation of all or a portion of the highway outside of the Canyon.

8. Land Use Commission to cooperate with Larimer County on special needs and assistance for zoning, moratorium, and advice on regulation drafting when requested.

9. USBR Siphon.
   a. Assist in criteria for replacement of siphon to insure compatability with highway and future flooding events.

10. Revegetation of Floodplain.
   a. Avoid take-over of silted area by phreatophytes and weeds,
   b. Assessment by aquatic biologists and riparian vegetation specialists from Larimer County (CSU), and
   c. Review future sediment and erosion potential problems as they relate to vegetation.

11. Sediment Deposition and Potential Pollution.
   a. Evaluate great sediment deposition in Canyon ranging from 2 to 10 feet in depth (silt, sand, gravel, boulders) which is presently in unstable condition due to steep slope,

b. Determine optimum methods of stabilizing sediment. Avoid highway construction which would cause sediment to move down into lowlands with spring runoff which would add to problems and damage.
c. Utilize Larimer County channel stability experts at CSU for technical advice.

III. Assessment of Similarily Situated Recreational Facilities and Canyons.

1. Review PL 93-288, Section #201 opportunities for disaster preparedness planning.
   a. Colorado is already one year into the $250,000 planning study. Determine status and applicability to Phase III. Work presently being done by State Department of Military Affairs though some redirection needed, and
   b. Cost of updating shared with federal government 50% up to $25,000 per year.

2. Undertake assessment for whole State on recreational areas.
   a. Many areas and canyons have similar physical features as Big Thompson Canyon.

3. Identify hazard areas and set standards.
   a. Criteria for floodplain,
   b. Existing hazardous building,
   c. Empty lots,
   d. New legislation and assessment of present legislation, and
   e. Provide preparedness plans, including warning systems and evacuation procedures.

Outline of Strategy for Governor's Office for
Big Thompson Canyon Flood

IV. Financial Strategy.

1. Consider use of "flexible funding" provision of PL 93-288.
   a. See Section 402F and 419 for public facilities,
   b. Where the welfare of the public would be served, use 90% of cost of rebuilding for other public projects,
   c. The 90% rule need not be a significant disadvantage, and
   d. Applies to local and State public facilities.

2. Utilize a blend of various contract, grant, assistance, and loan sources, such as:
   a. EPA 208 planning grant addendum,
   b. Department of Transportation (Highways),
   c. HUD Community Development,
   d. Bureau of Outdoor Recreation,
   e. U.S. Bureau of Reclamation,
   f. U.S. Forest Service,
   g. Land and Water Conservation Fund, via CWCB,
   h. National Park Service,
   i. State Department of Fish and Wildlife,
   j. U.S. Department of Fish and Wildlife,
   k. FDAA, Federal Disaster Assistance Agency,
   l. FIA, Federal Insurance Agency,
   m. HUD Uniform Relocation Act,
   n. Recently passed "Jobs Bill" if applicable here,
   o. U.S. Army Corps of Engineers,
   p. State legislature,
   q. Disaster Relief Foundation from private contributions,
   r. SBA, Small Business Administration,
   s. Red Cross, and
   t. U.S. Geological Survey.

3. Cooperation with FDAA and Federal Mountain Plains Regional Council.

   a. Coordinate redevelopment policy with funding.

4. Provide information and advice to Larimer County regarding financial assistance, auditing requirements, and qualifiying and non-qualifying local expenditures of various types. This information must be disseminated to avoid uncertainty.

1977

An Act

SENATE BILL NO. 399. BY SENATORS Anderson, Allshouse, Bishop, Cole, Cooper, Hughes, Kadlecek, Kinnie, McCormick, Meiklejohn, Schieffelin, Soash, and Strickland; also REPRESENTATIVES Showalter, Burns, DeMoulin, Dittemore, Gustafson, Kirscht, Neale, Strahle, Valdez, and Zakhem.

CONCERNING DISASTER RELIEF ACTIVITIES CONDUCTED BY THE STATE GOVERNMENT.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 28-2-110 (2), Colorado Revised Statutes 1973, is REPEALED AND REENACTED, WITH AMENDMENTS, to read:

28-2-110. Disaster prevention. (2) All state departments, in conjunction with the division, shall conduct studies and adopt measures to reduce the impact of, and actions contributory to, a disaster. The studies shall concentrate on means of reducing or avoiding the dangers caused by such occurrences or the consequences thereof.

SECTION 2. Article 2 of title 28, Colorado Revised Statutes 1973, as amended, is amended BY THE ADDITION OF A NEW PART to read:

PART 5

DISASTER RELIEF

28-2-501. Power to make rules. The governor is authorized to make rules and regulations necessary to carry out the purposes of this part 5, including, but not limited to, standards of eligibility for persons applying for benefits; procedures for applying and administration; methods of investigating, filing,

Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.

and approving applications; and formation of local or statewide boards to pass upon applications and procedures for appeal.

28-2-502. Emergency relief. (1) In an emergency, the governor may provide assistance to save lives and to protect property and public health and safety.

(2) The governor may provide such emergency assistance by directing state agencies to provide technical assistance and advisory personnel to the affected state and local governments in giving:

(a) Aid in the performance of essential community services, warning of further risks and hazards, public information and assistance in health and safety measures; technical advice on management and control, and reduction of immediate threats to public health and safety; and

(b) Assistance in the distribution of medicine, food, and other consumable supplies or emergency assistance.

(3) In addition, in any emergency, the governor is authorized to provide such other assistance under this part 5 as he deems appropriate.

28-2-503. False claims - penalties. Any person who fraudulently or willfully makes a misstatement of fact in connection with an application for financial assistance under this part 5 and who thereby receives assistance to which he is not entitled is guilty of a felony and, upon conviction thereof, shall be punished by imprisonment in the state penitentiary for not less than one year nor more than four years, or by a fine of not more than five thousand dollars, or by both such fine and imprisonment.

28-2-504. Temporary housing for disaster victims. (1) Whenever the governor has proclaimed a disaster emergency under the laws of this state or the president of the United States has declared an emergency or a major disaster to exist in this state, the governor is authorized:

(a) To enter into purchase, lease, or other arrangements with any agency of the United States for temporary housing units to be occupied by disaster victims and to make such units available to any political subdivision of the state;

(b) To assist any political subdivision of the state which is the locus of temporary housing for disaster victims to acquire sites necessary for such temporary housing and to do all things required to prepare such site to receive and utilize temporary housing units by:

(I) Advancing or lending funds available to the governor

from any appropriation made by the legislature or from any other source;

(II) "Passing through" funds made available by any agency, public or private; or

(III) Becoming a copartner with the political subdivision for the execution and performance of any temporary housing project for disaster victims; and

(c) Under such regulations as he shall prescribe, to temporarily suspend or modify for not to exceed sixty days any public health, safety, zoning, transportation (within or across the state), or other requirement of law or regulation within this state when by proclamation he deems such suspension or modification essential to provide temporary housing for disaster victims.

(2) Any political subdivision of the state is expressly authorized to acquire, temporarily or permanently, by purchase, lease, or otherwise, sites required for installation of temporary housing units for disaster victims and to enter into whatever arrangements (including purchase of temporary housing units and payment of transportation charges) which are necessary to prepare or equip such sites to utilize the housing units.

28-2-505. Debris removal. (1) Whenever the governor has declared a disaster emergency to exist under the laws of this state or the president of the United States, at the request of the governor, has declared a major disaster or emergency to exist in this state, the governor is authorized:

(a) Notwithstanding any other provision of the law, through the use of state departments or agencies or the use of any of the state's instrumentalities, to clear or remove from publicly or privately owned land or water debris and wreckage which may threaten public health or safety, or public or private property; and

(b) To accept funds from the federal government and utilize such funds to make grants to any local government for the purpose of removing debris or wreckage from publicly or privately owned land or water.

(2) Authority under this part 5 shall not be exercised unless the affected local government, corporation, organization, or individual first presents an unconditional authorization for removal of such debris or wreckage from public or private property and, in the case of removal of debris or wreckage from private property, first agrees to indemnify the state government against any claim arising from such removal.

(3) Whenever the governor provides for clearance of debris

or wreckage pursuant to subsections (1) and (2) of this section, employees of the designated state agencies or individuals appointed by the state are authorized to enter upon private land or water and perform any tasks necessary to removal or clearance operations.

28-2-506. Grants to individuals. (1) Whenever the president of the United States, at the request of the governor, has declared a major disaster to exist in this state, the governor is authorized, upon his determination that financial assistance is essential to meet disaster-related necessary expenses or serious needs of individuals or families adversely affected by a major disaster which cannot be otherwise adequately met from other means of assistance, to accept a grant from the federal government to fund such financial assistance, subject to such terms and conditions as may be imposed upon the grant.

(2) Notwithstanding any other provision of law or regulation, the governor is authorized to make financial grants to meet disaster-related necessary expenses or serious needs of individuals or families adversely affected by a major disaster which cannot otherwise adequately be met from other means of assistance, which grants shall not exceed five thousand dollars in the aggregate to an individual or family in any single major disaster declared by the president.

28-2-507. Community loans. (1) Whenever, at the request of the governor, the president of the United States has declared a major disaster to exist in this state, the governor is authorized:

(a) Upon his determination that a local government of the state will suffer a substantial loss of tax and other revenues from a major disaster and has demonstrated a need for financial assistance to perform its governmental functions, to apply to the federal government, on behalf of the local government, for a loan and to receive and disburse the proceeds of any approved loan to any local government making application therefor;

(b) To determine the amount needed by any local government making application therefor to restore or resume its governmental functions and to certify the same to the federal government; except that no application shall exceed twenty-five percent of the annual operating budget of the applicant for the fiscal year in which the major disaster occurs; and

(c) To recommend to the federal government, based upon his review, the cancellation of all or any part of repayment when, in the first period of three full fiscal years following the major disaster, the revenues of the local government are insufficient to meet its operating expenses, including additional disaster-related expenses of a municipal character.

28-2-508. Bar against suits. Except in cases of willful misconduct, gross negligence, or bad faith, any state employee or agent complying with orders of the governor and performing duties pursuant thereto under this part 5 shall not be liable for death of or injury to persons or damage to property.

28-2-509. Interstate compacts. The governor is authorized to enter into interstate compacts for prevention of disasters and for carrying out the purposes of this part 5.

SECTION 3. Appropriation. In addition to any other appropriation made, there is hereby appropriated out of any moneys in the state treasury not otherwise appropriated, to the governor's disaster emergency fund, for the current fiscal year, the sum of one hundred thousand dollars ($100,000.00), or so much thereof as may be necessary, for payment to Larimer County for its Big Thompson canyon, North Fork bridge fund, for bridge construction to replace bridges destroyed in the Big Thompson flood disaster July 31, 1976.

SECTION 4. Appropriation. In addition to any other appropriation for the current fiscal year, there is hereby appropriated, out of any moneys in the state treasury not otherwise appropriated, to the governor's disaster emergency fund, the sum of eighty-four thousand three hundred seven dollars ($84,307), or so much thereof as may be necessary, for disaster relief in the following named counties in the amounts specified: Cheyenne, eleven thousand eight hundred twenty-three dollars ($11,823); Lincoln, nine thousand seven hundred fifty-three dollars ($9,753); Kit Carson, four thousand six hundred fifty-six dollars ($4,656); Sedgwick, four thousand five hundred eighty-six dollars ($4,586); Phillips, twenty-two thousand three hundred six dollars ($22,306); Washington, six thousand nine hundred seventy-five dollars ($6,975); Yuma, sixteen thousand six hundred forty-eight dollars ($16,648); and Logan, seven thousand five hundred sixty dollars ($7,560). Such funds shall be available to reimburse said counties for overtime compensation of county and municipal employees and contract costs of said counties and municipalities for snow removal, rescue services, utility repair or replacement expenses, and other similar extra costs resulting from the snow and windstorm on or about March 9, 1977. Each county shall certify that the county has not been reimbursed by any governmental agency for the amount for which reimbursement is sought.

SECTION 5. Safety clause. The general assembly hereby

finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

Fred E. Anderson
PRESIDENT OF
THE SENATE

Ronald H. Strahle
SPEAKER OF THE HOUSE
OF REPRESENTATIVES

Marjorie L. Rutenbeck
SECRETARY OF
THE SENATE

Lorraine F. Lombardi
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES

APPROVED _____

Richard D. Lamm
GOVERNOR OF THE STATE OF COLORADO

An Act

SENATE BILL NO. 419. BY SENATORS Anderson, Allshouse, Bishop, Comer, Cooper, Groff, Kadlecek, Kogovsek, MacManus, McCormick, Soash, Stewart, and Strickland; also REPRESENTATIVES Babitz, Baca-Barragan, Boley, Brown, DeHerrera, DeMoulin, Dittemore, Gustafson, Hamlin, Hinman, Howe, Jones, Kirscht, Lloyd, Lucero, Marks, Massari, McCroskey, Orten, Sears, Showalter, Strahle, Valdez, Webb, and Zakhem.

CONCERNING THE ACQUISITION OF PROPERTY FOR PARKS AND RECREATIONAL PURPOSES BY LARIMER COUNTY, AND MAKING AN APPROPRIATION THEREFOR.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. Part 7 of article 20 of title 30, Colorado Revised Statutes 1973, is amended BY THE ADDITION OF A NEW SECTION to read:

30-20-702.5. Acquisition of land by Larimer county authorized. (1) The general assembly finds and declares that it is in the best interests of the state for Larimer county to acquire certain properties in the floodplain areas of the Big Thompson canyon and the north fork thereof. In making such acquisitions, Larimer county shall be subject to the findings of the Colorado water conservation board with respect to the location of said floodplain areas. The county shall establish a recreation district pursuant to the provisions of this article for the purpose of making the acquisitions authorized and for the further purposes of the future management, control, and financing of all park and recreational areas developed following such acquisitions. In acquiring lands as authorized, the county and the recreation district shall seek primarily lands near inhabited areas which are unlikely to be the subject of direct acquisition by the federal forest service or other federal agency.

Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.

(2) The division of parks and outdoor recreation, as a part of its duties under section 33-2-108, C.R.S. 1973, shall undertake the duties of coordinating federal, state, and local efforts and contributions, in the development of the land acquired pursuant to this section, in order that the people of the state shall receive benefits from the park and recreational facilities thus acquired.

SECTION 2. Appropriation. (1) Subject to the contingency provisions of subsection (2) of this section, there is hereby appropriated, out of any moneys in the state treasury not otherwise appropriated, to the division of parks and outdoor recreation, the sum of eight hundred sixty-two thousand dollars ($862,000), or so much thereof as may be necessary, for the purposes of this act.

(2) This appropriation is contingent upon matching appropriations or grants, for like purposes, of the following amounts:

(a) Federal funds, the sum of one million four hundred fifteen thousand dollars ($1,415,000).

(b) Larimer county, two hundred fifty-three thousand dollars ($253,000).

(3) Of the moneys appropriated by subsection (1) of this section, two hundred sixty-five thousand dollars ($265,000) shall be available to match bureau of outdoor recreation land and water conservation funds, and the balance of said appropriation shall be to match federal funds as they become available. In the event that any portion of the matching appropriations or grants are not obtained by January 1, 1979, any remaining moneys appropriated by subsection (1) of this section shall revert to the general fund. In addition, any increase in the amounts received under subsection (2) of this section shall act to reduce the amount of state moneys appropriated by an equivalent amount.

SECTION 3. Safety clause. The general assembly hereby

finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

Fred E. Anderson
PRESIDENT OF
THE SENATE

Ronald H. Strahle
SPEAKER OF THE HOUSE
OF REPRESENTATIVES

Marjorie L. Rutenbeck
SECRETARY OF
THE SENATE

Lorraine F. Lombardi
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES

APPROVED _____

Richard D. Lamm
GOVERNOR OF THE STATE OF COLORADO

ENGINEERING CONSULTANTS
DENVER, COLORADO 80211
(303) 458 5721

IN THE SPECIALTY FIELDS OF
WATER SUPPLY AND IRRIGATION
WATER AND SEWAGE TREATMENT
SEWAGE COLLECTION AND REUSE
INDUSTRIAL WASTES
STORM DRAINAGE
FLOOD CONTROL AND
OTHER WATER ORIENTED PROJECTS

ASPEN OFFICE
P. O. BOX 5178
ASPEN, COLORADO 81611

STEAMBOAT OFFICE
P. O. BOX 5128
STEAMBOAT VILLAGE, COLORADO 80499

DILLON LAKE OFFICE
FRISCO, COLORADO 80443

4 September 1976

EXHIBIT A

ATTN: Lee White
State of Colorado
Office of the Governor
State Capitol Building
Denver, Colorado 80203

Gentlemen:

PROPOSAL FOR ENGINEERING SERVICES

We propose to furnish professional engineering services to the State of Colorado for the purpose of the planning and restoration phase of the Big Thompson Canyon Flood Disaster in Larimer County, Colorado.

SCOPE OF WORK

A. First Phase.

This phase includes evaluation of problem, preparation of planning strategy for State, organization of Advisory Committee, and outline of planning and implementation.

1. Assemble basic data and evaluate,
2. Field inspection,
3. Develop and prepare strategy for Governor's Office and agencies,
4. Assemble Advisory Committee and assist as needed with organization,
5. Serve as Co-Chairman of Advisory Committee,
6. Assist County Commissioners in recovery and restoration,
7. Prepare policy, goals, and objectives for recovery,
8. Assist in information dissemination,
9. Assist in defining funding sources available for recovery and restoration,
10. Assist and coordinate FIA activites to accomplish timely flood plain study for the Big Thompson Canyon, and
11. Coordinate activities of professional volunteers, such as social impact assessments and canyon resident survey.

B. Second Phase.

This phase of the assignment includes continuation of First Phase and initiation of grant application, planning, coordination of Federal agencies involved with restoration and assistance.

1. Identify funding sources,
2. Assist County in bridge criteria,
3. Identify and arrange for broad area of planning by other agencies,
4. Provide policy input for highway design,
5. Evaluate hazard areas within flood plain,
6. Review grant applications as appropriate,
7. Prepare decision and action schedule,
8. Report regularly to Governor's office,
9. Other duties deemed necessary, and
10. Coordinate activities of professional volunteers, such as social impact assessments and canyon resident survey.

C. Third Phase.

This phase of the effort deals with implementation and evaluation.

1. Provide assistance to County Commissioners,
2. Assist Federal agencies,
3. Recommend flood plain administration methods when needed,
4. Coordinate State agencies when needed,
5. Evaluate restoration program and report,
6. Information dissemination,
7. Participate in Advisory Committee,
8. Evaluate need for corrective and preventive work in similarly situated canyons, and
9. Recommend flood policy to Governor's Office for prevention and rehabilitation.

SCHEDULE

The Engineer anticipates that the term of the assignment will extend to December 31, 1977.

REMUNERATION

The Engineer will receive remuneration for his services in accordance with the attached schedule of hourly rates, plus out-of-pocket expenses.

The statements for services will be submitted monthly.

Submitted by,

WRIGHT-McLAUGHLIN ENGINEERS

By _____
Kenneth R. Wright

KRW:jlb
Attachment

RONALD C. McLAUGHLIN
KENNETH R. WRIGHT
HALFORD E. ERICKSON
DOUGLAS T. SOVERN
JOHN T. McLANE
WILLIAM C. TAGGART

THOMAS W. MORRIS
JIMMIE D. WHITFIELD

WRIGHT-McLAUGHLIN ENGINEERS
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2420 ALCOTT STREET
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COMPLETE ENGINEERING SERVICES
IN THE SPECIALTY FIELDS OF
WATER SUPPLY AND DISTRIBUTION
WATER AND SEWAGE TREATMENT
SEWAGE COLLECTION AND REUSE
INDUSTRIAL WASTES
STORM DRAINAGE
FLOOD CONTROL AND
OTHER WATER ORIENTED PROJECTS

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ASPEN, COLORADO 81611

STEAMBOAT OFFICE
P. O. BOX 5220
STEAMBOAT VILLAGE, COLORADO 80499

DILLON LAKE OFFICE
FRISCO, COLORADO 80443

APPENDIX E

November 11, 1976

MEMORANDUM

TO: GOVERNOR RICHARD LAMM

FROM: Kenneth R. Wright, Special Consultant

RE: BIG THOMPSON CANYON ACTIVITY SUMMARY

A brief summary report of our activities under our contract with the State of Colorado, dated August 15, 1976, in regard to the Big Thompson Canyon restoration follows. Our work has been fully oriented towards coordination of State agencies and providing assistance to Larimer County.

This summary of our activities relates to the scope of work included within the contract and is meant to convey the range of activities with which our office has been involved.

Contract services to date have been performed by several of our staff members including Messrs. Douglas Sovern, Richard Johnson and several others in our office.

The base has been established at the County level for substantive planning work by the County Coordinator, planning consultants who are soon to be retained by the County, the County Planning staff, and the Commissioners. At the same time, State studies are soon to be completed for the flood plain management program and geologic hazards planning. Further, the State Highway Department has completed its 100-day effort at providing a temporary road through the Canyon and they are now proceeding on final highway design and layout. We believe that during the next restoration period there will be a high level of County-State cooperative effort on many activities ranging from the actual planning process to implementation. Additionally, we believe that there will be a substantial need to provide recommendations and data to members of the State Legislature concerning specific legislative proposals from your office. In this regard, we will consult with Mr. Alan Merson, Reverend Robert Schelling, John Rold, Jack Kintslinger, Betty Miller and others.

It appears that there will be a new chairman of the Big Thompson Recovery Planning Council shortly and, as a result of recent elections, the make up of the County Commission will be changed, i.e., two of the three Larimer County Commissioners will be replaced just at the time when physical planning and implementation of flood plain management mapping will be underway. Because of this change in leadership, it is our opinion that State agencies must be ready to be of assistance to the County to ensure the most efficient and productive continuity of

effort. We will place special emphasis on coordination for the agencies to ensure a maximum level of service to the County Commissioners and their staff.

The summary of our activities follows:

PHASE A

1. Basic Data and Evaluation

   a) This included assimilation of mapping in Big Thompson Canyon from U.S.G.S., Hogan Olhausen, State Geological Survey, U.S. Forest Service, and aerial photo contact prints. Arrangements were made for coordinated topographic mapping efforts for post disaster requirements by Larimer County and various State agencies.

   b) Arrangements were made with Dr. Daryl B. Simons of CSU for channel stability analyses and assistance on evaluation of basic data, after clearing with Mr. Lou Brown of Larimer County.

   c) The services of NASA - Houston were obtained for special aerial photography at two elevations. Completed aerial prints were given to CSU for channel stability work.

   d) Stream records were reviewed for flood history.

   e) Assistance was provided for Canyon residents survey to obtain basic data through Mr. Tom Downing.

   f) Visits were made to Loveland Disaster Office to collect data and interview personnel.

   g) Inspection of highway damage character and role highway played in number of fatalities was evaluated as part of basic data for preparation of highway design criteria recommendations.

2. Field Inspections

Helicopter and auto field inspections have been made to assess extent and character of damage, impact on highway, extent of flood plain.

3. Strategy Development For State

Research was undertaken for post disaster case studies and analyses of typical problems and recommended solutions. Copies of special study by Dr. Gene Haas were printed and distributed to key individuals.

Meetings were held with State, local, and federal officials.

A special 11 page strategy paper was prepared for State use to coordinate goals and objectives in a 4-phase effort to insure continuity and common direction.

Meetings were held with various State and federal agencies relative to design criteria for highway reconstruction and interim highway construction.

4. Advisory Committee

Assistance was rendered for creation of the Big Thompson Canyon Advisory Committee in early August through meetings and arrangements with local, State and federal officials that covered a two-week period from August 6 through August 20.

5. Co-chairman of Advisory Committee

From August 23 through October 19 Mr. Wright served as co-chairman of the Advisory Committee. Work included the taking of minutes of all meetings, preparing agendas, mailing of minutes to other parties, and helping to arrange the program for each meeting.

6. Assistance to Commissioners

The former Mayor of Rapid City was brought to Larimer County on August 6 to meet with Commissioners and others. Servicing of Advisory Committee,

coordination of State activities relative to restoration, waiving of A-95 review procedures at State level, assistance on private bridge problems, provision of critical drafting services, flood plain management arrangements, the geologic hazards survey, and related matters are State efforts at assisting the Commissioners.

7. Policy, Goals and Objectives

During August, the problems and needs of the Canyon were evaluated. As a result, the Policy, Goals, and Objectives for restoration were provided to the Advisory Committee for discussion on August 23. After some modifications, the document was adopted by a unanimous vote of the Committee on August 23.

8. Information Dissemination

Minutes of the Advisory Committee meetings were distributed to Canyon resident groups by mail. Minutes were also provided to the Interfaith Task Force.

Special presentations have been arranged for FIA and CWCB personnel to explain flood plain management and regulation procedures.

The paper on post disaster restoration was presented and distributed to interested parties. Former Mayor Barnett of Rapid City provided information on useful programs and need to avoid delay in planning.

Letters from Canyon residents were answered with specific recommendations as appropriate.

Data on "in-house use only" well permit transfers were developed in conjunction with the State Engineer's Office and transmitted to affected property owner.

Data was developed on availability of land survey information from BLM based on recent surveys for U.S.F.S.

9. Funding Sources

Research was undertaken to identify potential funding sources as well as potential planning agencies who might assist. A tabulation of 20 potential sources was provided on page 10 of the August 14 Outline of Strategy.

Regular contact with the office of the Colorado Senators has been maintained relative to land exchange/land purchase by the U.S. Forest Service. Concurrently, conferences were held with personnel of Bureau of Outdoor Recreation, U.S. Forest Service, U.S. Fish and Wildlife Service, and Department of Highways planning personnel. Following the Advisory Committee motion of September 23 inviting federal agencies to do planning, effort was expended to bring about the actual implementation of the motion with further contacts and requests.

Specific assistance has been rendered to State agencies for submittal of applications for multipurpose, joint-agency programs, and for development of funding strategies.

10. Coordinate FIA-CWCB Activities

Meetings have been held with FIA and CWCB at regular intervals from August 6 to present. Original work included Larimer County - FIA contract expansion to include Canyon and arranging for contributions of money from the State Highway Department and CWCB. Assistance was provided on mapping contract arrangements. Regular monitoring has taken place. In conjunction with Alan Merson, the complex relationship between County and State government on flood plain designation and floodway criteria have been clarified via an informal opinion of the Attorney General's Office. Information on this matter has been disseminated by our office.

11. Professional Volunteers

Commencing in August contacts and arrangements were made with public spirited personnel of CSU who were also Larimer County residents with expertise for special and direct assistance to Canyon resident organizations.

This has resulted in newsletter assistance, communications aid, and potential assistance in surveying.

Arrangements were made with Dr. Daryl Simons of CSU as channel stability advisor. Coordination was provided for assistance and research services of two University of Colorado graduate students specializing in natural hazards work.

Mr. Bill DeGroot of the Urban Drainage and Flood Control District volunteered to provide assistance on the development of early warning systems.

PHASE B

1. Identify Funding Sources

This effort has continued with Colorado Senators, federal agencies, and others on special appropriations for land acquisition. Liasion is maintained with Logan Rappe of the State Department of Military Affairs on financial assistance to residents, associations, and government agencies. Discussions have been had relative to State assistance to County for local share of #701 Planning monies.

2. Bridge Criteria

Recommendations have been made to County relative to using special bridge planning for "low profile" private bridges which would washout during a one percent flood. Bridges would be anchored with cable similar to our design for City of Denver on Cherry Creek. A drawing was provided on anchoring concept. Mr. Del Roupp of Department of Highways was assigned to assist County committee on bridge criteria.

3. Planning By Other Agencies

This has included contacts with USFS, BOR, USF&WS for recreational composite plan. Additionally, arrangements were made for contribution of services to planning by State DOW and Division of Parks and Recreation

on composite plan. Guidelines for plan needs were outlined to State personnel to assure timely and appropriate completion. Special drafting services were offered to assist in plan preparation. Direct assistance was offered to Mr. Quirk to aid his efforts on behalf of the County.

4. Highway Policy

An early August meeting with the State Policy and Planning Council led to adoption of motion on U.S. 34 design philosophy. Need for special consideration of safety and soundness was evaluated and recommendation was presented to Colorado Highway Commission on design criteria. While this recommendation represented the already established policy and criteria of the Commission, the recommendation was important in consolidating policy among various agencies.

5. Hazard Areas

The floodway criteria of the CWCB has been established as a minimum. Coordination with CWCB and FIA has been continued to assure reasonable and acceptable flood magnitudes based on dependable engineering data.

The natural hazards evaluation has progressed by the State Geologist and is intended to be completed concurrently with that of the flood plain study by CWCB. Drafting services have been offered to the State Geologist to insure timely completion.

6. Grant Application Review

Services were provided to Larimer County Planning Department on the 701 application. This included assisting laying out original scope and approximate dollar magnitude. Following preliminary submittal, the application was reviewed and changes were recommended to assist in approval.

Assistance is being provided to the Division of Wildlife and the U.S. Fish and Wildlife for submittal of grant application for main channel restoration.

7. Scheduling

The completion of the flood plain mapping, flood plain report, geological natural hazards study and report have been scheduled at earliest time for consulting planning work and moratorium termination. Overall scheduling of restoration is in hands of County. Scheduling of recreational composite plan for early December was important to achieve legislative deadlines.

8. Reports

Telephone and personal meetings have been held with State officials to brief them on progress, problems, and proposed solutions from time to time. Coordination meetings with State agencies have been held regularly to determine how the State can better serve the needs of Larimer County.

9. Other Duties

Other duties performed by the staff of Wright-McLaughlin have included assistance and coordination on numerous and varied matters. These include such items as:

Assistance in more rapid processing of amended State income tax forms from Canyon residents;
Arrangements for various programs for the Canyon resident meetings;
Determination of status of out-of-state well drillers for Canyon well drilling;
Liason with Interfaith Task Force;
Studies on Canyon residents' damage versus non-Canyon residents' damage;
Preparation of articles for the Canyon residents newsletter;
Analyses of fatality list for age and residence statistics;
Attandance and presentation of reports at the Monday night Big Thompson Action Group meetings; and
Liason with federal agencies.

Additionally, we have met with interested citizens, and special interest groups such as the Estes Park Chamber of Commerce and the Loveland CEQ.

APPENDIX F

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Reprint from Federal Register,

Executive Order 11988

VOL. 42, NO. 101

May 25, 1977

Executive Order 11988 May 24, 1977

FLOODPLAIN MANAGEMENT

By virtue of the authority vested in me by the Constitution and statutes of the United States of America, and as President of the United States of America, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Stat. 975), in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered as follows:

Section 1. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Sec. 2. In carrying out the activities described in Section 1 of this Order, each agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain; to ensure that its planning programs and budget requests reflect consideration of flood hazards and

floodplain management; and to prescribe procedures to implement the policies and requirements of this Order, as follows:

(a)(1) Before taking an action, each agency shall determine whether the proposed action will occur in a floodplain -- for major Federal actions significantly affecting the quality of the human environment, the evaluation required below will be included in any statement prepared under Section 102(2)(C) of the National Environmental Policy Act. This determination shall be made according to a Department of Housing and Urban Development (HUD) floodplain map or a more detailed map of an area, if available. If such maps are not available, the agency shall make a determination of the location of the floodplain based on the best available information. The Water Resources Council shall issue guidance on this information not later than October 1, 1977.

(2) If an agency has determined to, or proposes to, conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains. If the head of the agency finds that the only practicable alternative consistent with the law and with the policy set forth in this Order requires siting in a floodplain, the agency shall, prior to taking action, (i) design or modify its action in order to minimize potential harm to or within the floodplain, consistent with regulations issued in accord with Section 2(d) of this Order, and (ii) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain.

(3) For programs subject to the Office of Management and Budget Circular A-95, the agency shall send the notice, not to exceed three pages in length including a location map, to the state and areawide A-95 clearinghouses for the geographic areas affected. The notice shall include: (i) the reasons why the action is proposed to be located in a floodplain; (ii) a statement indicating whether the action conforms to applicable state or local floodplain protection standards and (iii) a list of the alternatives considered. Agencies shall endeavor to allow a brief comment period prior to taking any action.

(4) Each agency shall also provide opportunity for early public review of any plans or proposals for actions in floodplains, in accordance with Section 2(b)of Executive Order No. 11514, as amended, including the development of procedures to accomplish this objective for Federal actions whose impact is not significant enough to require the preparation of an environmental impact statement under Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended.

(b) Any requests for new authorizations or appropriations transmitted to the Office of Management and Budget shall indicate, if an action to be proposed will be located in a floodplain, whether the proposed action is in accord with this Order.

(c) Each agency shall take floodplain management into account when formulating or evaluating any water and land use plans and shall require land and water resources use appropriate to the degree of hazard involved. Agencies shall include adequate provision for the evaluation and consideration of flood hazards in the regulations and operating procedures for the licenses, permits, loan or grants-in-aid programs that they administer. Agencies

shall also encourage and provide appropriate guidance to applicants to evaluate the effects of their proposals in floodplains prior to submitting applications for Federal licenses, permits, loans or grants.

(d) As allowed by law, each agency shall issue or amend existing regulations and procedures within one year to comply with this Order. These procedures shall incorporate the Unified National Program for Floodplain Management of the Water Resources Council, and shall explain the means that the agency will employ to pursue the nonhazardous use of riverine, coastal and other floodplains in connection with the activities under its authority. To the extent possible, existing processes, such as those of the Council on Environmental Quality and the Water Resources Council, shall be utilized to fulfill the requirements of this Order. Agencies shall prepare their procedures in consultation with the Water Resources Council, the Federal Insurance Administration, and the Council on Environmental Quality, and shall update such procedures as necessary.

Sec. 3. In addition to the requirements of Section 2, agencies with responsibilities for Federal real property and facilities shall take the following measures:

(a) The regulations and procedures established under Section 2(d) of this Order shall, at a minimum, require the construction of Federal structures and facilities to be in accordance with the standards and criteria and to be consistent with the intent of those promulgated under the National Flood Insurance Program. They shall deviate only to the extent that the standards of the Flood Insurance Program are demonstrably inappropriate for a given type of structure or facility.

(b) If, after compliance with the requirements of this Order, new construction of structures or

facilities are to be located in a floodplain, accepted floodproofing and other flood protection measures shall be applied to new construction or rehabilitation. To achieve flood protection, agencies shall, wherever practicable, elevate structures above the base flood level rather than filling in land.

(c) If property used by the general public has suffered flood damage or is located in an identified flood hazard area, the responsible agency shall provide on structures, and other places where appropriate, conspicuous delineation of past and probable flood height in order to enhance public awareness of and knowledge about flood hazards.

(d) When property in floodplains is proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties, the Federal agency shall (1) reference in the conveyance those uses that are restricted under identified Federal, State or local floodplain regulations; and (2) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (3) withhold such properties from conveyance.

Sec. 4. In addition to any responsibilities under this Order and Sections 202 and 205 of the Flood Disaster Protection Act of 1973, as amended (42 U.S.C. 4106 and 4128), agencies which guarantee, approve, regulate, or insure any financial transaction which is related to an area located in a floodplain shall, prior to completing action on such transaction, inform any private parties participating in the transaction of the hazards of locating structures in the floodplain.

Sec. 5. The head of each agency shall submit a report to the Council on Environmental Quality and to the Water Resources Council on June 30, 1978, regarding the status of their procedures and the impact of this Order on the agency's operations. Thereafter, the Water Resources Council shall periodically evaluate agency procedures and their effectiveness.

Sec. 6. As used in this Order:

(a) The term "agency" shall have the same meaning as the term "Executive agency" in Section 105 of Title 5 of the United States Code and shall include the military departments; the directives contained in this Order, however, are meant to apply only to those agencies which perform the activities described in Section 1 which are located in or affecting floodplains.

(b) The term "base flood" shall mean that flood which has a one percent or greater chance of occurrence in any given year.

(c) The term "floodplain" shall mean the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

Sec. 7. Executive Order No. 11296 of August 10, 1966, is hereby revoked. All actions, procedures, and issuances taken under that Order and still in effect shall remain in effect until modified by appropriate authority under the terms of this Order.

Sec. 8. Nothing in this Order shall apply to assistance provided for emergency work essential to save lives and protect property and public health and safety, performed pursuant to Sections 305 and 306 of the Disaster Relief Act of 1974 (88 Stat. 148, 42 U.S.C. 5145 and 5146).

Sec. 9. To the extent the provisions of Section 2(a) of this Order are applicable to projects covered by Section 104(h) of the Housing and Community Development Act of 1974, as amended (88 Stat. 640, 42 U.S.C. 5304(h)), the responsibilities under those provisions may be assumed by the appropriate applicant, if the applicant has also assumed, with respect to such projects, all of the responsibilities for environmental review, decisionmaking, and action pursuant to the National Environmental Policy Act of 1969, as amended.

Jimmy Carter

THE WHITE HOUSE,
May 24, 1977

[FR Doc.77-15121 Filed 5-24-77;1:42 pm]

State of Colorado

EXECUTIVE CHAMBERS

DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER

EVALUATION OF FLOOD HAZARD IN LOCATING STATE BUILDINGS, ROADS, AND OTHER FACILITIES, AND IN REVIEWING AND APPROVING SEWAGE AND WATER FACILITIES, AND SUBDIVISIONS

WHEREAS, hazardous uses of Colorado flood plains are occurring and potential flood losses and loss of life are increasing despite substantial efforts to control floods; and

WHEREAS, economic losses due to floods in Colorado during the last twelve years place Colorado near the top of the Nation's list for per capita losses; and

WHEREAS, past inadequate land use policy and controls led to the major disaster in the Big Thompson Canyon on July 31, 1976; and

WHEREAS, minimum flood plain and floodway regulation criteria have been promulgated by the Colorado Water Conservation Board and the Colorado Land Use Commission on the premise that wise use of our State's flood plains is the key to controlling and minimizing future economic losses and suffering of our citizens; and

WHEREAS, wise use of our flood plains will promote public health, safety and welfare, reduce future public costs for relief and rehabilitation and contribute to the State's economy; and

WHEREAS, the State of Colorado has extensive and continuing programs for the construction of buildings, roads, and other facilities and further, State Agencies are involved in the review and approval of water and sewer treatment plants, subdivisions, trailer parks, campgrounds, and many other facilities throughout the State of Colorado; and

WHEREAS, both Federal and State Agencies have compiled significant data and studies concerning the frequency of floods and the location of flood plains and are expert at estimating flood hazards;

NOW, THEREFORE, by virtue of the authority vested in me as Governor of Colorado, it is hereby ordered as follows:

1. The heads of State agencies shall provide leadership in encouraging a broad and unified effort to prevent uneconomic uses and development of Colorado flood plains and in particular, to promote the public health, safety and welfare and to reduce the risk of flood losses in connection with Colorado lands and installations and State financed or supported improvements.

2. All State agencies directly responsible for the construction of State buildings, structures, roads, overnight campgrounds, or other facilities shall evaluate flood hazards when planning the location for new facilities and as far as practicable shall preclude the uneconomic, hazardous, or unnecessary use of flood plains in connection with such facilities.

3. Whenever practical and economically feasible, flood proofing measures shall be applied to existing facilities to reduce flood damage potential.

4. The Colorado Water Conservation Board and the Land Use Commission in cooperation with the appropriate state and federal agencies shall continue to undertake the evaluation of hazardous flood plain uses in the State of Colorado, proceed with the identification of flood plains, and prepare suitable flood disaster preparedness plans in cooperation with affected cities and counties, including an effective flood insurance information program, early warning system, and related steps to protect against future loss of life and unnecessary economic losses. Priority shall be given to the numerous hazardous canyons in the State of Colorado.

5. All State agencies responsible for the review and/or approval of sewage treatment plants, water treatment plants, interceptor sewers, subdivisions, trailer parks, and other facilities within the State of Colorado shall evaluate flood hazards in writing in connection with such review and approval of facilties and take measures to minimize the exposure of facilities, and development which they may induce, to potential flood damage and the need for future State expenditures for flood protection and flood disaster relief.

6. All State agencies responsible for programs which entail land use planning shall take flood hazards into account when evaluating applications for planning grants, when reviewing water and wastewater facility plans, and area-wide wastewater management plans.

7. Requests for flood hazard information and hazard assessment may be addressed to the Colorado Water Conservation Board or the Land Use Commission.

8. Any requests for appropriations for State construction of new buildings, structures, roads, or other facilities by State agencies shall be accompanied by a statement on the findings of the agency's evaluation and consideration of flood hazards in development of such requests.

9. As used in this Order, the term "State agency" includes any department, commission, division, or other organizational entity of the executive branch of State Government.

10. The State agencies shall proceed immediately to develop such procedures, regulations, and information as are provided for in, or may be necessary to carry out, the provisions of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado, this first day August, A.D., 1977.

Richard D. Lamm
Governor

State of Colorado

EXECUTIVE CHAMBERS

DENVER

RICHARD D. LAMM
Governor

EXECUTIVE ORDER

REQUIREMENTS AND CRITERIA FOR STATE PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

WHEREAS, on August 1, 1977, Executive Order Number 8491, entitled "Evaluation of Flood Hazard in Locating State Buildings, Roads, and Other Facilities, and in Reviewing and Approving Sewage and Water Facilities, and Subdivisions," was issued regarding State policy on the occupation and modification of Colorado floodplains by State agencies; and

WHEREAS, additional State procedures are to be established to meet the requirements of the National Flood Insurance Program; and

WHEREAS, the availability of programs for Federal loans and mortgage insurance, State financial assistance, and land use planning are determining factors in the utilization of lands; and

WHEREAS, the availability of flood insurance under the National Flood Insurance Program for state-owned properties as provided by the National Flood Insurance Act of 1968, as amended, and the Flood Disaster Protection Act of 1973 is dependent upon State coordination of Federal, State, and local aspects of floodplain, mudslide (i.e., mudlfow) area, and flood-related erosion area management activities in the State; and

WHEREAS, the Colorado Water Conservation Board is the State agency responsible for state-wide programs for flood prevention, flood control, flood protection, and flood hazard study criteria, as provided by Section 37-60-106(1), Colorado revised Statutes 1973, and Section 24-65.1-403, Colorado Revised Statutes 1973, as amended, (S.B. 126) L. 77.; and

WHEREAS, the Colorado Water Conservation Board is the State agency designated to coordinate the National Flood Insurance Act of 1968, as amended, and the Flood Disaster Protection Act of 1973; and

WHEREAS, the Division of Disaster Emergency Services is the agency responsible for the coordination of Federal, State, and local disaster activities, and

WHEREAS, the primary concerns of the Colorado Land Use Commission are the protection, utility, value, and future of lands within the State; and

WHEREAS, the availability of flood insurance for stateowned properties is conditioned upon the State's compliance with minimum floodplain management criteria of the National Flood Insurance Program regulations (24 CFR 1909, et. seg.);

NOW, THEREFORE, by virtue of the authority vested in me as the Governor of Colorado, it is hereby ordered as follows:

1. The Colorado Land Use Commission is hereby designated as the State agency to provide implementation of Section 1910.12, Rules and Regulations of the Federal Insurance Administration.

2. Each State agency has a responsibility to evaluate the potential effects of any actions it may take in a floodplain, to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplain management.

3. Before taking action, each State agency shall determine whether the proposed action will occur in a floodplain. This determination shall be based on a Department of Housing and Urban Development flood hazard boundary map (FHBM) or, if available, on more detailed floodplain delineation maps of the area on file with the Colorado Water Conservation Board. If flood hazard information and data are not available, the Colorado Water Conservation Board shall assist in the determination and the evaluation of any flood hazard to the proposed facilities or structures.

4. For state-owned properties in Federal Insurance Administration designated "Special Hazard Areas," the State shall, as a minimum, comply with the floodplain management criteria set forth in Sections 1910.3, 1910.4, and 1910.5 of the National Flood Insurance Regulations.

5. If a State agency has determined that no feasible alternative exists to avoid siting a proposed structure or facility within a floodplain, the agency shall (a) prepare and transmit to the Colorado Land Use Commission a notice containing an explanation of why the development is proposed to be located in the floodplain; (b) require the structure to be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement; (c) require the structure to be constructed with materials and utility equipment resistant to flood damage; (d) site the lowest floor of any structure not less than one foot above the base flood, unless such structure has been adequately flood-proofed to one foot above said base water elevation; and (e) elevate residential dwellings to not less than one foot above the maximum water elevation of the computed base flood.

6. The Colorado Land Use Commission and the Colorado Water Conservation Board shall assist State agencies in carrying out the floodplain management criteria set forth in Sections 1910.3, 1910.4, and 1910.5 of the National Flood Insurance Regulations with the following provisions:

a. Subdivision proposals shall be consistent with the criteria established by Title 30, Article 28, Colorado Revised Statutes 1973, as amended.

b. Policy on floodplain management shall follow the directives of Executive Order 8491 of August 1, 1977.

c. Disaster Preparedness Activities shall be consistent with the criteria established by Title 28, Article 2, Colorado Disaster Emergency Act, Colorado Revised Statutes 1973, as amended, within the scope of their applicability to the Executive Order and to Executive Order 8491, dated August 1, 1977, and as administered by the Colorado Division of Disaster Emergency Services. Provided further, noting in this order on in Executive Order 8491 shall apply to assistance provided for emergency work to save lives, protect property, and public health and safety, performed pursuant to the Colorado Disaster Emergency Act.

d. The floodway (high-hazard zone) limits shall be consistent with the criteria established by the Colorado Water Conservation Board's Model Floodplain Regulation, dated February 26, 1975, which was prepared under the authority of Title 24, Article 65.1, Colorado Revised Statutes 1973, as amended.

7. All State agencies responsible for the disposal of lands or properties shall evaluate flood hazards in connection with lands or properties which are proposed for disposal to other public instrumentalities or private interests and, in order to minimize future State expenditures for flood protection and flood disaster relief, shall attach appropriate restrictions with respect to uses of the lands or properties from disposal.

8. When State property in floodplains is proposed for lease, easement, right-of-way, or disposal to non-state public or private parties, the State agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State or local floodplain regulations; and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successors, except where prohibited by law; or (c) withhold such properties from conveyance.

9. As used in this Order:

a. "State agency" means any department, board, commission, or division; however, the directives as contained in this Order are meant to apply to those agencies which perform or regulate activities that are located in, or affect, floodplains.

b. "base flood" means the flood that has a one percent chance of being equalled or exceeded in any given year.

c. "floodplain" means an area in, and adjacent to, a stream, which area is subject to being inundated by the base flood in any given year.

d. "Flood-proofing" means a combination of structural provisions, changes, or adjustments to lands, properties, and structures subject to flooding, primarily for the reduction or elimination of flood damages to lands, properties, structures, and contents of buildings in a flood-hazard area.

10. As may be permitted by law, the head of each State agency shall issue appropriate rules and regulations to govern the carrying out of the provisions of this order in consultation with the Colorado Land Use Commission.

11. This Order shall take effect on October 1, 1977.

GIVEN under my hand and the Executive Seal of the State of Colorado, this 1st day of October, A.D., 1977.

Richard D. Lamm
Governor

BIG THOMPSON CANYON RECOVERY PLANNING
RECREATION ALTERNATIVES STUDY

INTRODUCTION

Big Thompson Canyon's significance as a scenic transportation corridor and vacation gateway to Colorado and Rocky Mountain National Park cannot be underestimated. Colorado Division of Highways statistics show an average (weekend) daily traffic count of 2,390 cars; for June, July and August, that daily average rises to 8,326 cars.

Given the canyon's inherent scenic qualities, it must also be acknowledged that the canyon's pre-flood environmental quality was something less than outstanding. The canyon was filled with non-conforming uses; many bridges were under specification for a 100 year flood, high residential density did not allow adequate space for leach fields with resultant pollution of the stream, structures were located too close to the river, often in geologically hazardous situations, and as was so unfortunately proven, flood warning systems (or adherence to them) were not adequate.

Tragic as the events of July 31/August 1 were (and remain for many people), Larimer County and the State are presented with opportunities as a result of the flood. The canyon's scenic and environmental quality can be improved. Its value as a resource could be increased if its natural functions, particularly its function as a drainage corridor, are accommodated in redevelopment decisions.

We cannot prevent floods, nor can we assume that a flood of this magnitude would never again occur in the Big Thompson Canyon. Another may come next year or next week. Through planning and management,

however, we can do much to prevent the accompanying tragedy. We can reduce the number of potential victims by regulating use of the canyon and providing a means of escape for its users. In this regard, there is little choice to be had; it is a clear responsibility.

A September 14, 1976 motion passed by the Big Thompson Recovery Planning Council requested that a multi-level task group undertake a recreation alternatives study. Intended to lead to a broader, long range redevelopment planning effort (consultant), the objective of this study was to collect and analyze basic data on a range of recreational alternatives. Land acquisition costs of the alternative concepts were to be estimated. The data and analysis are to be used as background information for state and federal legislative proposals relating to recovery and redevelopment of the canyon, as well as provide information for county land use decisions.

It is not the intent of the study group to recommend a particular alternative or course of action. This is left to the decision-making process at the local level. Public input on the various alternatives or recommendations on additional concepts should also be solicited during this stage. Nor was it the responsibility of the study team to identify management responsibilities; options for this will depend largely on the alternative or combination of alternatives selected.

Participating in the conceptual recreation planning were the U.S. Forest Service, National Park Service, Bureau of Outdoor Recreation, Colorado Division of Wildlife, Colorado Division of Parks and Outdoor Recreation, State Highway Department, and Larimer County. The study

area consisted of the Big Thompson Canyon along Highway 34 from Olympus Dam to the mouth of the canyon, and along the North Fork Road where it joins Highway 34 at Drake west to the switchbacks.

A primary concern of this study team has been to see that what happened in the Big Thompson is not forgotten - that its lesson be learned. Towards that end, a first recommendation (R1) is to construct within the canyon a suitable "interpretive" memorial to remind canyon residents and visitors of the river's potential for destruction as well as beauty and recreation. It is important in planning for the redevelopment of the canyon to remember that the river becomes destructive when in the course of pursuing its natural functions, man's functions are caught in its path.

The general nature, and the recreation-based purpose of this study effort, must be emphasized. The study group considered recreation in a broad sense, to include open space, dispersed use and developed facility areas.

The conceptual alternatives presented in the study are alternative recreational concepts - concepts and alternative policies for the acquisition of lands having recreational values, and development of facilities or access on the acquired lands or through interests in lands. These are not alternative compensation plans, although several of the alternatives accommodate compensation needs to varying degrees. The need for landowner compensation has been identified by Larimer County Commissioners and other study groups connected with the Big Thompson recovery effort. Recreation dollars cannot be expended where recreation demand and opportunity have not or cannot be demonstrated, justified, or reasonably expected.

The scenic aspects of the canyon are its primary recreational offering. The figures cited above indicate the significant numbers of tourists passing through the canyon. Commercial interests in the canyon prior to the flood were largely oriented to the automobile tourist/traveler.

Improved access to existing public lands is an important point of justification for some level of recreation development in the canyon. Private ownership of lands on either side of the main Big Thompson Canyon highway and the county road up the North Fork Canyon block access to many miles of stream fishing and thousands of acres of public land adjacent to the private lands.

Division of Wildlife data indicate that Larimer County is the most popular fishing county for Colorado residents and the third most popular fishing county for non-residents. Hiking and horseback trails, picnic areas (particularly group areas), and public hunting areas are reported as needed in Larimer County by the State Comprehensive Outdoor Recreation Plan.

Most stream access now available in the Big Thompson and North Fork Canyons is the result of highway right-of-way that extends to the stream edge. Public acquisition of additional stream access lands would provide fishermen parking areas and additional fishermen access areas as well as providing day use picnic areas and trailheads. Access to existing public lands for hiking, horseback riding, and hunting is severely limited at the present time.

It is also recommended by the study team (R2) that acquisition of lands for public use should be focused to those lands that provide large block acquisition, while at the same time improve or open new avenues

of access to existing public lands and non-accessible stretches of stream. Piecemeal acquisition is not feasible from the standpoint of negotiation, development or management.

The analysis which follows (in chart form for ease of comparison) develops policy recommendations along a series of ranges or scales. Five alternatives were generated through the study team discussions. These alternatives represent points along those scales with respect to acquisition, development and management policies for the canyon. For example, the alternatives present varying proportions of public ownership/use and private ownership, along a scale ranging from total private to total public. Recreation nodes, Alternative "C", would provide for a mixture of private and public uses, and is considered a middle range alternative.

Potential conflicts with a mixture of private and public uses are also indicated, generally. As with all points of analysis, a more thorough exploration of management and acquisition techniques, and more detailed site analysis will be necessary in the long range planning efforts now underway.

Graphic support material for the short term study is presented on two scales (1" = 200', and 1" = 1000'). Two sample areas of highly impacted portions of the canyon, the Drake area and the Cedar Cove area, are shown at 1" = 200'. To the extent that it could be collected, physical base information was plotted on overlays over topography of the two areas. Information included ownerships, geological hazards, slopes, vegetation, remaining structures, an unofficial, approximate indication of the 100 year floodplain. A site analysis of both areas is presented to permit a preliminary look at the types of physical opportunities and constraints operating in the post-flood situation.

Two of the alternatives are schematically represented, one at the Drake area at 200' scale; the other at 1" = 1000', allowing a view of the entire study area. Two alternatives (Alternatives "C" and "D") were chosen because time limitations prevented all from being demonstrated. "C" and "D" were selected because it was felt they would be the most difficult to visualize without graphic support.

The 1000' scale base map was also used to conduct a very approximate land acquisition cost analysis for each of the alternatives. An ownership base was first prepared to show the following ownership categories throughout the canyon:

Blocks of land having ownerships larger than ten acres-developable.
Blocks of land having ownerships larger than ten acres-- not developable.
Blocks of land from one to ten acres - developable.
Blocks of land from one to ten acres - not developable.
Blocks of land of one acre or less - developable or subdivided.
Blocks of land of one acre or less - not developable.
Within floodplain, blocks of ownership of one to ten acres - subdivided.
Within floodplain, blocks of ownership of one to ten acres - unsubdivided.
Less than one acre - subdivided; less than one acres - unsubdivided.

The estimated current market value for the various ownership categories was developed (see Wright memo, attached; actual land values will be determined by subsequent appraisals). The alternatives were applied over the ownership base to estimate the acquisition needs for each alternative, and the land value figures were applied. Results of this procedure are included in the attachments to this overall summary, as is an analysis prepared by Larimer County comparing the pre-flood market values of the categories to the extimated post-flood values.

The difficulty of schematically presenting alternatives at 1" = 1000', and deriving cost figures for land acquisition based on each must be stressed. The alternative plans at 1000' scale are extremely general, and it is

therefore difficult to develop even approximate canyon-wide cost estimates. Ownerships in some places overlap or are otherwise unclear. Prior to implementation of any type of land acquisition program, a complete survey would need to be completed to resolve the various legal description problems, as well as deriving accurate land values. The 100 year flood-plain designation has not been finalized, and this will affect land values significantly. The accuracy of acreage estimates also decreases when map scale increases.

ANALYSIS OF ALTERNATIVES

BIG THOMPSON CANYON RECOVERY PLANNING- RECREATION ALTERNATIVES STUDY

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
COORDINATING AGENCIES: STUDY AREA	Participating in the conceptual planning were the U.S. Forest Service, National Park Service, Bureau of Outdoor Recreation, Colorado Division of Wildlife, Colorado Division of Parks and Outdoor Recreation, State Highway Department, and Larimer County. The study area consisted of the Big Thompson Canyon along highway 34 from Olympus Dam to the mouth of the canyon, and including the North Fork Road joining the highway at Drake.				
OPTIMUM CONCEPT* *(note:	Return to pre-flood use patterns, as zoning and floodpl. regulations permit, and as landowners desire.	Direct, east to west scenic access, scenic gateway to Rocky Mtn. National Park. Residential and commercial uses as zoning and floodpln. regulations permit, and as desired by landowners.	Concentrated areas of open space and developed recreation *sited in selected locations depending on availability and suitability of sites for recreation use. Areas may be developed either for low or higher intensity of use. *nodes (need to define intensity)	Both concentrated and dispersed recreation uses of both low and higher intensity. Plan consists of use nodes of varying sizes. Corridors between them and extending from them.	Public ownership of skyline to skyline lands. Public outdoor rec. facilities provided as appropriate to base resource.
GENERAL PURPOSE AND PRIORITY	Accommodate private interests- (landowners and commercial interests)	Accommodate private interests. Public- recognition of driving for pleasure as a popular and well established recreational activity.	Public uses combined with restored and new private interests and uses. 'Benefit of doubt' to private interests when use conflicts arise in planning process.	Expanded public use while mixture of public and private uses is maintained. 'Benefit of doubt' will lean toward the public user when use conflicts arise in the planning process.	Total public use

ANALYSIS OF ALTERNATIVES - PAGE 2

BIG THOMPSON CANYON RECOVERY PLANNING
RECREATION ALTERNATIVES

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
ACQUISITION					
ASSUMPTIONS:	Recommendation (R.1) that overnight use,camping, be prohibited in the floodplain is adopted by the Commissioners. The most willing sellers will be those having properties in the floodplain with greater than 50% damage. Developable lands outside the floodplain will be at a premium for overnight use if R.1 is adopted. These lands will also increase in value, as a result of the flood. Acquisition can be accomplished through a range of techniques, and will not necessarily be through fee acquisition.				
POLICIES	No public acquisition other than that needed to accommodate changes in highway alignment.	Selective acquisition of lands for desired rest stops and pulloffs, as well as alignment adjustments. Acq. of lands or interests in lands at key scenic points.	Acquire selectively, and generally in fee on a willing seller basis. Location of open spaces and sites for developed recreation will depend primarily on lands presently or foreseeably available.	Selective acquisition based on implementation of a selected, detailed recreation plan.A more aggressive approach is employed in acquiring lands or interests in lands to implement this concept. Generally, concentrated open space and use areas should be acquired in fee, particularly floodplain lands. Acq. of trail corridors and access points may be through easements.	Acquire 100% of lands in fee within the designated public park boundary.
COSTS LEVEL OF COMPENSATION	Least cost. Lowest level of compensation.	Second least cost. Compensation level minimal, through acquisition of land for pulloffs and reststops. Acquisition of selected scenic easements will depend on degree of intent to develop scenic corridor. Greater emphasis on scenic corridor will increase compensation.	Middle range cost. Compensation increases through acquisition of lands for nodes, short trail extensions, andselected, limited scenic easements.	Second highest cost. Greatest compensation opportunity through fee purchases, easements, donations, etc while still allowing private uses.	Highest cost, significant increase over "D". Ultimate in compensation but does not permit permit private use

ANALYSIS OF ALTERNATIVES - PAGE 3

BIG THOMPSON CANYON RECOVERY PLANNING
RECREATION ALTERNATIVES

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
PRIVATE DEVELOPMENT	As existing, and as permitted by County regulations.	New residential, overnight accommodations, camping above floodplain. Restored commercial to consist of day use and services within floodplain. Recommend (R.2) that new development be clustered into service nodes in areas permitted by regulation. Other uses as existing and permitted.	Same as "B". Limited concession.	Same as "B". Generally less private development due to greater extent of acquisition. Concession.	Concession operations only.
VISITOR SERVICES	As existing and restored. motels restaurants gas and service shops, all as permitted by County zoning regs. Memorial.	Interpretive displays (signs) located at limited pulloffs. (to include memorial) Limited public sanitary. Other as for "A", existing and restored.	Interpretive displays (signs) at pulloffs and nodes. Existing or restored commercial services as for "A". Limited public sanitary. Encourage private recreation support services as appro- to fldpln regs.	Broadened interpretive- may extend to some trails. Increased private recreation support services (bait, horses, etc.) Public sanitary. Commercial services as in "A" as permitted. See R.2.	Extensive interpretive, inc. trails. Visitor center Concessions Public sanitary

SEE SECTION ON RECREATIONAL USES BELOW.

BIG THOMPSON CANYON RECOVERY PLANNING
RECREATION ALTERNATIVES

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
DEVELOPMENT LEVEL Numbers miles acres intensity type of site					
RECREATIONAL USES		De-emphasize recreation use	Concentrate, limited public access to lands.	Concentrated and dispersed, continuous, frequent access.	Total
TRAIL EASEMENTS	Not applicable	Acquisition of easements to provide and improve access to USFS lands.	Easements acq. on a selective willing seller basis as short loops or extensions from nodes. Node to node connection where possible-may be outside of canyon. Provide and improve access to USFS lands.	Acquisition of trail corridor emphasized along with node development, and connecting nodes. Continuous trail and numerous access points, though not necessarily in immediate road-stream corridor. USFS access important. Support services remain conc. at nodes.	Development of extensive recreational trail system linking facilities/use areas.

BIG THOMPSON RECOVERY PLANNING
RECREATION ALTERNATIVES

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
FISHERIES	None existing under post flood condition.	Limited, interrupted access. Fishery stocking and habitat restoration in public waters or where leases can be obtained.	As for "B", and somewhat increased level of stocking and access-at nodes.	As for "B", and increasing level of stocking and access	Intensive stream restoration along the length of the study area. Continuous access, frequent parking areas.
WILDLIFE MANAGEMENT CONSIDERATIONS	As existing	Provide access to hunting areas on USFS lands.	As for "B".	Acquire key habitat, migration routes now under private ownership.	Manage for habitat protection and enhancement, while serving recreational hunting needs to the extent possible.
CAMPING	See R.	Commercial camping above floodplain, requires permit on public lands.	Commercial and limited public above floodplain.	Same as "C".	Public and concessio provided above the floodplain.
OTHER RECREATIONAL USES	As existing, and permitted.	Scenic driving as primary recreational activity. Photography at pulloffs, located for scenic interest. Limited picnicking.	Scenic driving, photography. Public rec. conc at nodes- picnicking playground informal game playing fishing, wading	Same as "C". Additional emphasis on trail uses and support facilites. Increased number of nodes of varying sizes and use.	As for "D". More group areas

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
SCENIC CORRIDOR	As existing	As selected policy determines. May range from acq. of lands or easements at key viewing points to easements along the entire corridor.	Particular emphasis on acq. of key areas or easements to protect scenic quality around nodes.	Acquisition of scenic easements with acq. of trail corridor, as well as for "C"	Prior to complete acq. of lands in fee, scenic easements may be acquire
POTENTIAL USE CONFLICTS	Scenic disruption caused by unclustered, non-conforming uses, low quality signing, etc. Frequent private access to highway. People may park along side of road if adequate pulloffs are not provided.	Same as "A".	Same as "A". Uses crossing node boundaries present conflict between recreational users and residents.	Same as "C", although there will be less private development (residential) to be in conflict with. Elements of scenic disruption may also be reduced with increased level of public ownership.	
HIGHWAY STANDARDS AND VEHICULAR ACCESS	35 mph, structures, walls. Frequent private access to highway.	Same as "A". Public access limited to service nodes, pulloffs, and rest stops.	Same as "A". Public access limited to service and recreational nodes and pulloffs. (Rest stops would be incorporated within recreation or service nodes.)	Same as "A". More frequent public access to use areas.	

ALTERNATIVES / POLICY/analysis CATEGORY	STATUS QUO "A"	TRANSPORTATION CORRIDOR "B"	RECREATION NODES "C"	LINEAR PARK "D"	PUBLIC PARK "E"
ZONING & LAND USE		County zoning. Scenic easements to protect scenic features and limit new visually incompatible development.	Zoning to cluster restored commercial areas and any new development.	Same as "C".	Zoned park use.
UTILITIES	Selective relocation and concealment to enhance scenic quality - where feasible.	Degree of concealment increases.	Degree of concealment increases.	Degree of concealment increases.	Maximum possible concealment.
ALTERNATIVE APPROACHES RECOMMENDATIONS					

Public Law 95-42
95th Congress

An Act

June 10, 1977
[H.R. 5306]

To amend the Land and Water Conservation Fund Act of 1965, and for other purposes.

Land Water Conservation Fund Act of 1965, amendments.
16 USC 460*l*-4 note.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Land and Water Conservation Fund Act of 1965 (78 Stat. 987), as amended (16 U.S.C. 4601-4 et seq.), is further amended as follows:

(1) Section 2(c)(1) is amended by deleting "$600,000,000 for fiscal year 1978, $750,000,000 for fiscal year 1979, and $900,000,000 for fiscal year 1980" and inserting in lieu thereof "and $900,000,000 for fiscal year 1978".

16 USC 460*l*-5.
Appropriation authorization.
16 USC 460*l*-7.

(2) Section 5 is amended by adding the following at the end thereof: "Those appropriations from the fund up to and including $600,000,000 in fiscal year 1978 and up to and including $750,000,000 in fiscal year 1979 shall continue to be allocated in accordance with this section. There shall be credited to a special account within the fund $300,000,000 in fiscal year 1978 and $150,000,000 in fiscal year 1979 from the amounts authorized by section 2 of this Act. Amounts credited to this account shall remain in the account until appropriated. Appropriations from the special account shall be available only with respect to areas existing and authorizations enacted prior to the convening of the Ninety-fifth Congress, for acquisition of lands, waters, or interests in lands or waters within the exterior boundaries, as aforesaid, of—

"(1) the national park system;
"(2) national scenic trails;
"(3) the national wilderness preservation system;
"(4) federally administered components of the National Wild and Scenic Rivers System; and
"(5) national recreation areas administered by the Secretary of Agriculture.".

16 USC 460 *l*-9.

(3) Section 7(a) is amended by adding the following new paragraph:

"(3) Appropriations allotted for the acquisition of land, waters, or interests in land or waters as set forth under the headings 'NATIONAL PARK SYSTEM: RECREATION AREAS' and 'NATIONAL FOREST SYSTEM' in paragraph (1) of this subsection shall be available therefor notwithstanding any statutory ceiling on such appropriations contained in any other provision of law enacted prior to the convening of the Ninety-fifth Congress; except that for any such area expenditures may not exceed a statutory ceiling during any one fiscal year by 10 per centum of such ceiling or $1,000,000, whichever is greater. The Secretary of the Interior shall, prior to the expenditure of funds which would cause a statutory ceiling to be exceeded by $1,000,000 or more, and with respect to each expenditure of $1,000,000 or more in excess of such a ceiling, provide written notice of such proposed expenditure not less than thirty calendar days in advance to the Committee on Interior and Insular Affairs of the House of Representatives and the Committee on Energy and Natural Resources of the Senate.".

Notice to congressional committees.

(4) Section 7(b) is amended by changing the period at the end thereof to a colon and adding the following: "*Provided, however,* That appropriations from the fund may be used for preacquisition work in instances where authorization is imminent and where substantial monetary savings could be realized.". 16 USC 460*l*-9.

(5) Section 7 is amended by adding the following new subsection:

"(c) BOUNDARY CHANGES; DONATIONS.—Whenever the Secretary of the Interior determines that to do so will contribute to, and is necessary for, the proper preservation, protection, interpretation, or management of an area of the national park system, he may, following timely notice in writing to the Committee on Interior and Insular Affairs of the House of Representatives and to the Committee on Energy and Natural Resources of the Senate of his intention to do so, and by publication of a revised boundary map or other description in the Federal Register, (i) make minor revisions of the boundary of the area, and moneys appropriated from the fund shall be available for acquisition of any lands, waters, and interests therein added to the area by such boundary revision subject to such statutory limitations, if any, on methods of acquisition and appropriations thereof as may be specifically applicable to such area: *Provided, however,* That such authority shall expire ten years from the date of enactment of the authorizing legislation establishing such boundaries; and (ii) acquire by donation, purchase with donated funds, transfer from any other Federal agency, or exchange, lands, waters, or interests therein adjacent to such area, except that in exercising his authority under this clause (ii) the Secretary may not alienate property administered as part of the national park system in order to acquire lands by exchange, the Secretary may not acquire property without the consent of the owner, and the Secretary may acquire property owned by a State or political subdivision thereof only by donation. Prior to making a determination under this subsection, the Secretary shall consult with the duly elected governing body of the county, city, town, or other jurisdiction or jurisdictions having primary taxing authority over the land or interest to be acquired as to the impacts of such proposed action, and he shall also take such steps as he may deem appropriate to advance local public awareness of the proposed action. Lands, waters, and interests therein acquired in accordance with this subsection shall be administered as part of the area to which they are added, subject to the laws and regulations applicable thereto.". Notice to congressional committees. Publication in Federal Register. Consultation. Administration.

SEC. 2. (a)(1) For the purpose of improving the effectiveness and efficiency of the management of the Roosevelt National Forest, Colorado, and coordinating the acquisition of lands within the forest which are suitable for such management with the acquisition of lands for parks and recreation purposes pursuant to subsection (b) of this section, the Secretary of Agriculture is authorized to acquire those privately owned lands within the boundaries of the forest which are suitable for national forest purposes and which were adversely affected by the Big Thompson flood of July 31, 1976, and such other adjacent private lands within the boundaries of the forest as are available and suitable for national forest purposes. Land acquisition.

Fair market value.

(2) Lands identified for acquisition pursuant to paragraph (1) of this subsection which lie within the Big Thompson/North Fork Floodways, designated pursuant to the National Flood Insurance Act of 1968 (82 Stat. 572), as amended, shall be acquired at the fair market value of such lands (not including any improvements thereon) immediately prior to the occurrence of the flood: *Provided*, That such lands shall (i) be unimproved, or (ii) include structures which have sustained damage amounting to 50 per centum or more of their market value.

42 USC 4001 note.

(3) Lands identified for acquisition pursuant to paragraph (1) of this subsection which are not lands described in paragraph (2) of this subsection shall be acquired at no less than appraised fair market value based on an appraisal of each parcel of such lands approved by the Secretary of Agriculture under the authority of section 11 of the Act of August 3, 1956 (70 Stat. 1034, U.S.C. 428a(a)).

Funds, availability.

(4) Moneys appropriated to carry out this subsection shall be available until expended or until January 1, 1980, whichever is earlier.

(b) Notwithstanding any other provision of law, in the case of lands acquired for the Big Thompson/North Fork Canyons Recreational Lands Acquisition Project in Larimer County, Colorado, for which financial assistance is authorized under section 6(e)(1) of the Land and Water Conservation Fund Act of 1965 (78 Stat. 987, as amended: 16 U.S.C. 4601–4 et seq.), if such lands are located within the Big Thompson/North Fork Floodways and are (i) unimproved or (ii) include structures which have sustained damage amounting to 50 per centum or more of their market value, such assistance may be provided for an amount equal to the market value of such lands (not including any improvements thereon) immediately prior to the occurrence of the Big Thompson flood of July 31, 1976.

16 USC 460*l*–8.
16 USC 460*l*–4.

Approved June 10, 1977.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 95–156 (Comm. on Interior and Insular Affairs).
SENATE REPORT No. 95–162 (Comm. on Energy and Natural Resources).
CONGRESSIONAL RECORD, Vol. 123 (1977):
April 4, considered and passed House.
May 18, considered and passed Senate, amended.
May 25, House concurred in certain Senate amendments; concurred with amendment in another.
May 26, Senate concurred in House amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 13, No. 25:
June 11, Presidential statement.

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