



# FLOOD HAZARD NEWS

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## THE DISTRICT ENTERS THE IMPLEMENTATION PHASE

by L. SCOTT TUCKER  
Executive Director

The District's mill levy was increased from 0.1 mill to 0.5 mill by the Colorado State Legislature in 1974. The Legislature, in providing the increased mill levy, earmarked the entire 0.4 mill increase to capital improvements. The 1974 Capital Improvement Fund, along with 1975 projected income, has been used or committed to initiate several construction efforts.

Combined with matching local monies and State and Federal funds, the total implementation effort is off to a good start. The following is a brief summary of each of the implementation projects.

### NIVER CREEK IMPROVEMENTS COMPLETED

Channel improvements to Lower Niver Creek were completed by Winslow Construction Company in November 1974. The project, a cooperative effort between Adams County and the Urban Drainage and Flood Control District, was jointly funded by Adams County - \$113,296; the Urban Drainage and Flood Control District - \$113,296; The Federal Disaster Assistance Administration - \$162,911; and the State of Colorado - \$50,000. The total cost of the project was \$439,503.

Lower Niver Creek was straightened many years ago and since that time has eroded badly. Several concrete rubble drop structures were installed in an attempt to control erosion, but they were not effective. The May 1973 storm caused considerable damage to the channel and something had to be done. The Federal Disaster Assistance Administration agreed to contribute \$162,911 to restore the channel to its pre-storm condition. Adams County and the District recognized that this would not solve the problem; as soon as another significant storm came, the agencies would be faced with another restoration problem. Consequently, Adams County and the District raised the necessary additional funds to provide a permanent solution to the problem.

"Before and after" pictures for two locations accompany this article. The "before" picture at the first location shows an old concrete rubble drop structure and the badly eroded channel. The "after" picture shows a concrete baffle drop structure that replaced the concrete rubble facility. The "before" picture at the second location illustrates the badly eroded channel prior to improvements. It can be seen that the channel was merely trying to re-establish its meanders and reach a state of equilibrium. Unfortunately, the channel had to be kept in a public right-of-way. The "after" picture shows the creek after channelization. The bottom and sides of the channel were lined with rock riprap. The improved channel is owned by Adams County and they will be responsible for maintenance.

A brief dedication ceremony for the Niver Creek improvements was held on January 30, 1975. Commissioner

Jerry Grant of Adams County, who is also a member of the District Board of Directors, presided at the ceremonies.

### IMPROVEMENTS TO ENGLEWOOD DAM INITIATED

Bids were opened on September 6, 1974, for construction of improvements to Englewood Dam in Arapahoe County. Nine bids were received and the low bid was submitted by Herron-Strong, Inc. of Platteville, Colorado. Herron-Strong's low bid of \$299,251 was accepted. This was substantially underneath the engineer's estimate of \$500,000. The project is scheduled for completion by May 1, 1975.

Improvements to the facility include raising the embankment by 12 feet; constructing a new 300 ft. wide earth spillway; replacing the downstream outlet facility; reseeding the new embankment, spillway, and other construction areas; and landscaping the area around the outlet facility. Englewood Dam is the first facility that the District will actually own and operate.



Englewood dam during the May 1973 flood. A new emergency spillway is being constructed to meet requirements of the State Engineer.

The project is jointly funded by the City of Englewood, Arapahoe County, City of Cherry Hills Village, the State of Colorado, and the Urban Drainage and Flood Control District. Although maintenance of the dam will be provided by the District, the four local entities involved will annually reimburse the District for actual maintenance costs incurred.

The improvements to the dam were necessitated by the fact that the facility could fail under storm conditions greater than a 100-year flood. This situation was unacceptable to the State Engineer and improvements to the dam were required. Also, the Urban Drainage and Flood Control District would not accept responsibility for the

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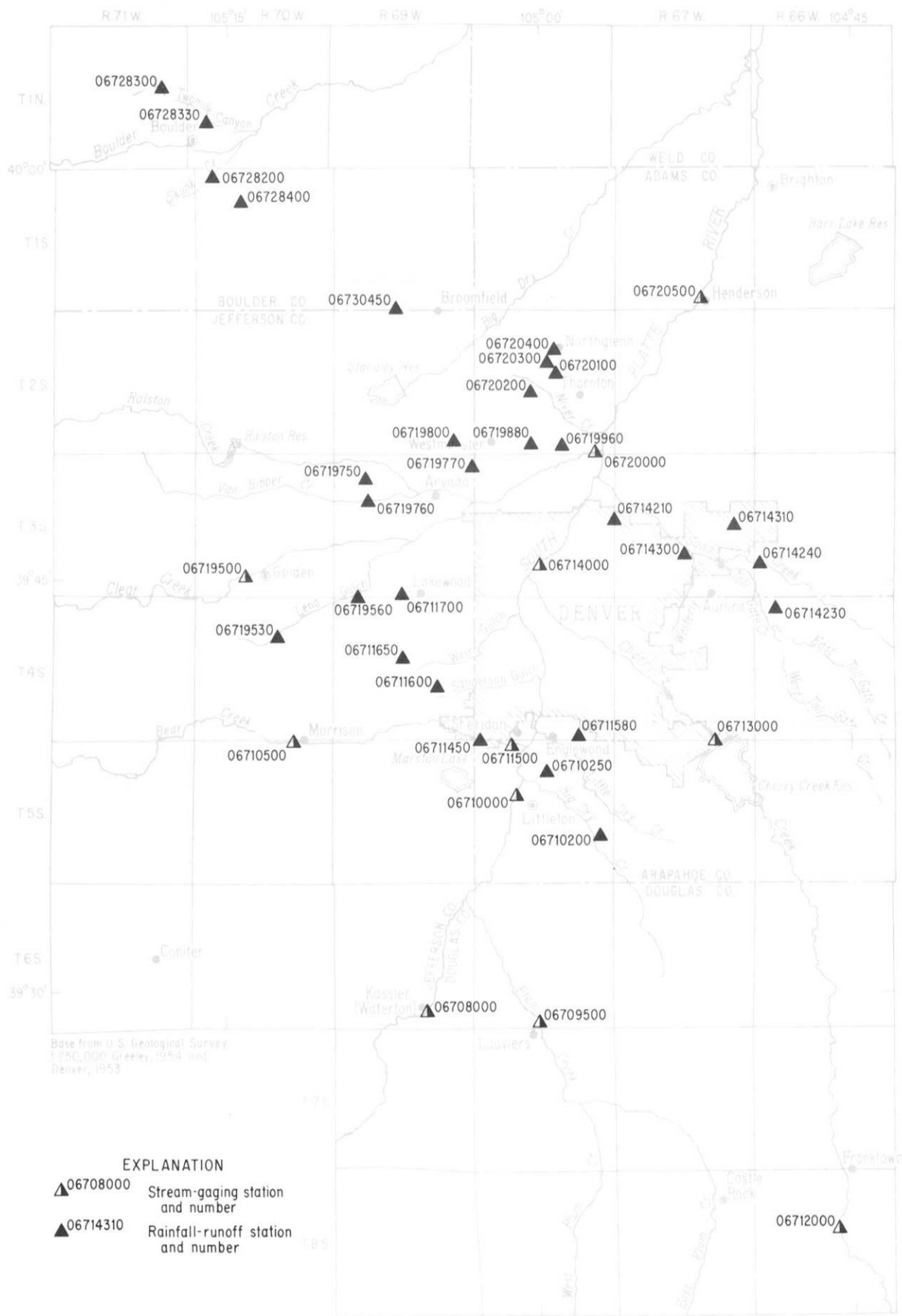


Figure 1. - MAP SHOWING LOCATION OF GAGES

# RAINFALL-RUNOFF GAGING IN DENVER METRO AREA

In June 1968, the U.S. Geological Survey, in cooperation with local governmental agencies, launched an extensive rainfall-runoff data collection effort in the Denver metropolitan area. Support for this effort is now provided by the Urban Drainage and Flood Control District. The data will be used to improve techniques for estimating the runoff hydrograph in small urbanized basins for designing bridges, culverts, and other structures.

Detailed records of rainfall and stream stage are collected at each station by two digital recorders that record the data every 5 minutes. A timing device actuates both recorders simultaneously to provide a time base between storm precipitation and associated runoff. The stage-gage and rain-gage are located at the outfall of each study basin and are operated during the anticipated storm runoff period from mid-April to mid-October.

The continuous-recorder network consists of the following stations (Fig. 1):

Station Number	Installation Date	Station Number	Installation Date
06710200	June 1969	06719750	April 1970
06710250	May 1971	06719760	May 1970
06711450	April 1971	06719770	April 1970
06711580	April 1971	06719800	June 1968
06711600	June 1969	06719880	April 1971
06711650	April 1971	06719960	April 1971
06711700	May 1971	06720100	June 1968
06714210	April 1971	06720200	June 1968
06714230	May 1970	06720300	June 1968
06714240	April 1971	06720400	June 1968
06714300	May 1970	06730450	May 1971
06714310	April 1971	06728200	April 1970
06719530	June 1974	06728300	April 1970
06719560	June 1974	06728350	May 1971
		06728400	April 1970

In addition to the rainfall-runoff gage network, 11 stream-gaging stations are operated on the main-stem South Platte River and four major tributaries whose confluences are in or near the Denver metropolitan area. These stations are also shown in Figure 1 and are as follows:

06708000	May 1926 to current year
*06709500	October 1947 to current year
*06710000	July 1941 to current year
06710500	September 1887 to September 1891, May 1895 to December 1901, February 1902, October 1919 to current year
06711500	April to November 1914, March 1927 to current year
*06712000	November 1939 to current year
*06713000	June 1950 to current year
06714000	May to October 1889, June to October 1890, July 1895 to current year
06719500	October 1908 to December 1909, June 1911 to current year
06720000	April to November 1914, March 1927 to current year
06720500	May 1926 to current year

\*Stations operated by U.S. Geological Survey. All others operated by Colorado Division of Water Resources.

Information from the rainfall-runoff data-collection network may be obtained by contacting the U. S. Geological Survey at 5287 W. Louisiana or by calling (234-4061). Current data from the stream-gaging stations on the South Platte River and major tributaries may be ob-

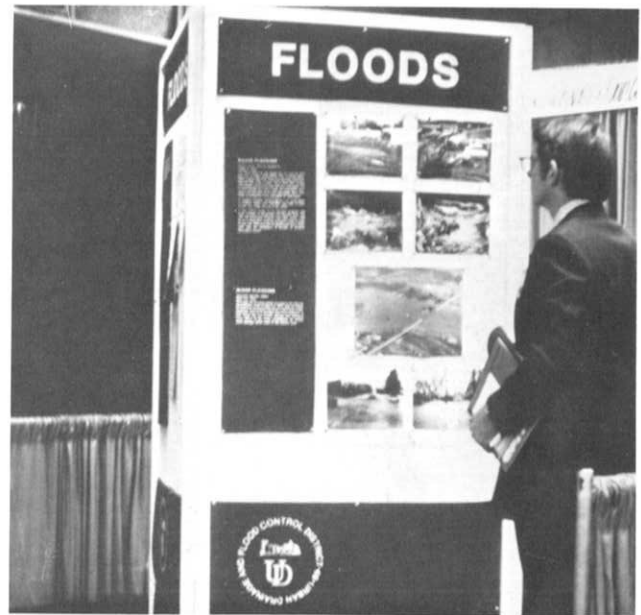
tained from the U.S. Geological Survey or the Colorado Division of Water Resources. Data compiled for previous years are found in the annual publication *Water Resources Data for Colorado—Part 1. Surface Water Records*, copies of which are available from the U.S. Geological Survey or the Colorado Division of Water Resources.

## Flood Plain Management Conference To Be Held This Summer

Scott Tucker, Executive Director of the Urban Drainage & Flood Control District, and Tom Lee, Chief, Flood Plain and Shoreland Management Program, Wisconsin Department of Natural Resources, are co-chairmen of a Flood Plain Management Conference to be held in July 1975. The purpose of the conference will be to correlate and integrate the many options that are now available with regard to flood plain management. Many diverse interests such as regulatory, planning, recreation, open space, flood protection, and environmental preservation will be interfaced with problems and solutions such as flood plain regulations, structural improvements, flood plain purchase, early warning, floodproofing, flood insurance, and recreational development. Also addressed will be legal restraints to flood plain management and steps that might be taken to achieve local involvement and acceptance of flood plain management.

The thrust of the conference will be on comprehensive flood plain management concepts. The conference will be of interest to land use planners, engineers, local government officials and administrators, Federal Insurance Administrators, State agencies, outdoor recreation representatives, consulting engineers, developers (housing, industrial, resource, etc.), attorneys, and motivated citizens.

The conference will be held at Franklin Pierce College in Rindge, New Hampshire from July 20 to July 25, 1975. The conference will be by invitation only and attendance will be held to about 100. If you are interested, contact the Engineering Foundation, 345 East 47th Street, New York, New York 10017 or Scott Tucker, 181 East 56th Avenue, Denver, Colorado 80216.



The District has developed a display, in the form of an obelisk, which shows good and bad flood plain development, District projects in various stages of completion and the types of flood hazard information available. The message of the display is that proper use of flood hazard information can reduce flood damage and the need for expensive remedial structures.

The  
URBAN **UD** DRAINAGE  
&  
FLOOD CONTROL DISTRICT

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## The Flood Hazard Cost of Settling Floodplains

by RONALD I. BLEWITT

What is the "flood hazard cost" of settling floodplains in the Denver area? What are the alternatives? A study I made several years ago based upon 1969 figures indicated that the cost is at least \$74,000 per acre of floodplain that will be adequately protected. Startling? Yes, particularly since these figures are flood hazard costs only and do not include any cost of development. They represent only the cost of the three major structures needed to protect the developed flood-prone lands along Bear Creek, Cherry Creek and the South Platte River in the vicinity of Denver, plus the flood damage caused by the June 1965 flood as it raged through the Denver area. Other flood damages have not been included.

Neither has any part of the eventual cost that will be borne by people who settle in the floodplains below the Denver area under a false sense of security that full protection will be afforded by these dams that are many miles upstream from them been included. Even when Bear Creek Dam is completed, *adequate* protection from the Cherry Creek, Bear Creek and Chatfield Dams cannot extend beyond the confluences of Clear Creek and Sand Creek with the South Platte River at the north side of Denver.

Adequate protection cannot be provided below the confluence of either Clear Creek or Sand Creek with the South Platte River because it takes only a relatively small area to yield a large flood in a big storm. Look at the figures in Table 1 from the U. S. Geological Survey report of the Colorado floods of June 1965.

Note that a flood larger than the one that hit the Denver area in June 1965 was generated on Jimmy Camp Creek east of Colorado Springs from only 60 square miles of drainage area.

Flooding from Templeton Gap was so severe at Colorado Springs in the May 1935 storm that the Corps of Engineers has constructed a floodway to control floodwater from a watershed area of only 8.5 miles.

The Denver map (Figure 1) shows why the area that can be given the needed adequate protection from the three dams is so small. Sand Creek enters the South Platte at the north edge of Denver with 187 square miles of drainage area, and opposite it Clear Creek enters from the west with 575 square miles. Extensive flooding in the South Platte River floodplain is possible downstream from their entry. People farther downstream would be living under a false sense of security if they expected more than partial protection from the three dams above—only two of which have been completed to date. It is recognized, of course, that adequate protection will be provided to floodplain occupants below the confluences of Clear Creek and Sand Creek with the South Platte River, provided the major storms fall above the dams. However, little or no protection may be afforded by them if a storm centers over the Clear Creek or Sand Creek watersheds.

Now, let us examine the cost of the major dams and the area that can be protected by them. In computing this area, I calculated the area of the standard project flood inundation as delineated in "Flood Plain Information, Denver Metropolitan Region, Volume I," U.S. Army Corps of Engineers, October 1963, rather than just the area that would be inundated by the intermediate regional flood (100-year storm). The latter area is smaller and would have resulted in even higher costs per acre if used (see Table 2).

The cost per acre of the 21.9 square miles of land protected is \$9,600. However, if we subtract the 12.6 square



miles of land required by the flood pools from that area protected and apply the structural cost against the net gain area of 9.3 square miles, the cost becomes \$22,700 per acre. The \$300,000,000 flood damage losses in 1965 also need to be added to the cost of settling this land, and there is no guarantee that additional losses will not be suffered before Bear Creek Dam is completed. The cost of settling this floodplain land then becomes at least \$435,000,000 or \$74,000 per net gain acre, or \$47,000,000 per square mile. In 1969 undeveloped land out of the floodplain but next to developed land could be purchased in the Denver area for \$3,000 per acre. Less than 25 years age, good one-acre suburban lots with domestic water available could be purchased for as little as \$1,000 each. Under these conditions, it obviously was not wise to permit investment in the floodplains. Land purchase or other land use control programs would have been far wiser.

We can put the land value matter another way, "If the flood hazard cost of having occupied and then protecting this floodplain with dams was \$74,000 per acre and suitable developing land outside of the floodplain was selling for \$3,000 per acre, was the value of the floodplain land for such occupancy a negative \$71,000 per acre?" It would appear that it was. We can only conclude that such occupancy is grossly economically unwise. In addition, life and property is exposed to flooding hazards until needed control structures can be built.

Alternates to avoid unwise floodplain occupancy include floodplain zoning, subdivision regulations, building codes, tax adjustments and the purchase of development rights. Flood insurance coupled with land use controls can also be a deterrent to occupation. The 1974 Colorado Land Use Act, previous floodplain designation legislation, and the National Flood Insurance Act all encourage local jurisdictions to manage floodplains to avoid or curtail unwise use. At the same time, some protection is afforded to life and property—and the taxpayer's pocketbook.



Ronald I. Blewitt, a native of Ida County, Iowa, obtained his Bachelor of Science in Civil Engineering from Colorado State University in 1936. Upon graduation, he joined the Soil Conservation Service. For the next nineteen years, with the exception of time spent with the U. S. Army, he worked on engineering phases of con-

servation work for the SCS in Colorado Springs, Springfield, Simla, and Littleton, Colorado, and Dalhart, Texas. From 1955 to 1961, he was the State Conservation Engineer with the Soil Conservation Service in Hawaii. Returning to Colorado, he spent the next ten years as assistant State Conservation Engineer with the SCS in Denver. From 1971 to 1973 he was Assistant Division Engineer for the Colorado Division of Water Resources in Montrose, Colorado. In 1973 he became Division Engineer for the Colorado Division of Water Resources in Alamosa, Colorado. Mr. Blewitt joined the Colorado Water Conservation Board as Chief, Flood Control and Conservation Section, in October, 1974.

Table 1 - COLORADO FLOODS OF JUNE 1965

Stream	Location	Flood (cfs)	Drainage Area (Sq. Mi.)
So. Platte River	Near Littleton	110,000	3,069
E. Plum Creek	Near Castle Rock	126,000	114
Jimmy Camp Creek	Near Fountain	124,000	60
Black Squirrel Creek	Near Ellicott	141,000	350
Clay Creek	Near Lamar	158,000	228

Table 2 - DAMS DATA

Structure	Cost	Floodplains Adequately Protected (Sq. Mi.)	Area of Flood Pool (Sq. Mi.)
Cherry Creek Dam	\$ 15,000,000	8.1	4.1
Chatfield Dam	83,645,000	4.0	7.5
Bear Creek Dam	36,440,000	2.6	1.0
Additional land protected by all three		7.2	
	\$135,985,000	21.9	12.6

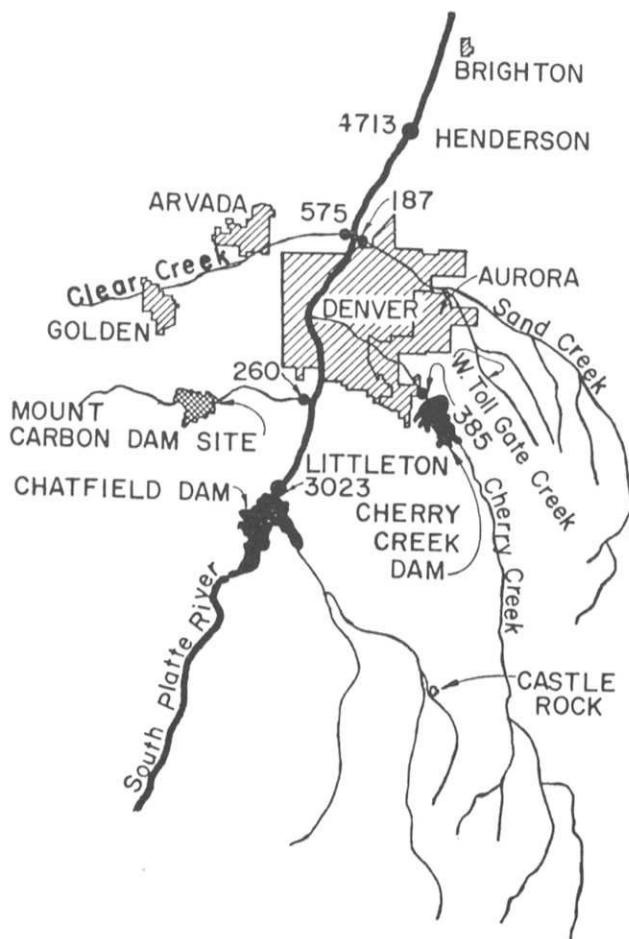


FIG. 1—Drainage Areas (sq. mi.) in Denver Metro Area

# Tucker-Talk

by L. SCOTT TUCKER

*Timely Comment from the District's Executive Director*



## **MAYOR PAUL BECK DIES OF CANCER**

Mayor Beck of Aurora succumbed to cancer in December, 1974. Mayor Beck was one of the most active and well-liked members of the Board. He had served on the Board of Directors since the inception of the District in 1969. Needless to say, we all were deeply saddened by the passing of Mayor Beck.

## **MAYOR CARRILLO RESIGNS**

Mayor Carrillo of Thornton resigned from the Board in December, 1974. Mayor Carrillo suffered a serious heart attack and had to substantially cut back his activities. Mayor Carrillo graduated from the University of Colorado with a degree in architectural engineering and his technical background will be missed by the Board.

## **FLOOD CONTROL LEGISLATION INTRODUCED**

Legislation has been introduced to the Colorado State Legislature by Senator Joe Shoemaker regarding special assessments for drainage projects. Traditionally, the Courts have narrowly defined benefits as those that will accrue to a property owner by virtue of his property being increased in value by the proposed drainage project. Senator Shoemaker's bill will expand the definition of benefit to include other benefits such as handling excess surface runoff waters from upstream property owners; alleviation of health and sanitation hazards; reduction of maintenance costs; and recreational improvements. The bill is designated as Senate Bill 52 and as of this writing has been given preliminary approval by the Colorado Senate. Senator Shoemaker expands on the definition of benefits elsewhere in this issue of *Flood Hazard News*.

Another bill related to drainage and flood control that has been introduced to the Colorado State Legislature is Senate Bill 6 by Senator Anderson. Senate Bill 6 authorizes County Commissioners to control floods by removing obstructions and constructing works to control stream channel erosion and flooding. It also authorizes the Commissioners to adopt plans for flood control subject to approval by the Colorado Water Conservation Board. Methods are provided in the bill to inspect for flood hazards and it authorizes a three-mill tax levy to establish County flood control funds.

## **BUDGET AND WORK PROGRAM ADOPTED**

The Board adopted an operating and planning budget of \$840,900 for 1975. Planning projects, flood plain delineations, and the general operation of the District is financed by the operating and planning budget. Funds for operation and planning activities are derived from a .1 mill tax levied over the entire District, local entity participating funds, and State sources. In a separate action, the Board also adopted a \$4,850,000 Capital Projects budget for 1975. Income for the 1975 Capital Improvement program will consist of \$1,672,000 from a .4 mill tax levied by the District, \$450,000 of State funds, \$1,772,700 of local matching funds, \$75,000 of estimated interest income, and a \$180,000 transfer from the general fund.

The proposed Capital improvement expenditures will be for Weir Gulch, Sanderson Gulch, and a detention facility on Niver Creek.

The assessed valuation of taxable property within the District for the year was \$3,903,418,542. This was up from the total assessed valuation of \$3,521,546,195 in 1973.

Along with the budget, the Board adopted a comprehensive 1975 Work Program. In the adopted Work Program, the Board reaffirmed their commitment to implement District flood plain regulations in those local jurisdictions that do not adopt flood plain regulations. Also included in the 1975 Work Program are the implementation of approved drainage and flood control projects, delineation of flood hazard areas, coordination of FIA activities, review of proposed developments in flood plains, continuation of the U.S.G.S. rainfall runoff program, upgrading hydrologic methodologies, development of a storm-water data collection program, and master planning projects. 1975 should be a busy year.

## **HIDDEN LAKE MASTER PLAN BEGUN**

A contract was awarded in November 1974 to Hydro-Triad, Ltd. to develop a drainage plan for the Hidden Lake Basin. The Hidden Lake Basin is located in Arvada and Adams County and is a tributary to Clear Creek. The Basin consists of about 4.8 square miles with the intersection of 64th Avenue and Sheridan being approximately the center of the Basin. Bell Surveying Company is providing topographic mapping for the project.

## **CHERRY CREEK PLANNING STUDY**

A selection committee comprising individuals from the City and County of Denver, Arapahoe County, Glendale, and the District selected Merrick and Company to perform a comprehensive planning study on Cherry Creek. Negotiations are now underway with Merrick for the study. The study will cover Cherry Creek Dam downstream to its confluence with the Platte River. Flood control will be an important part of the effort but emphasis will be also placed on other uses such as parks and recreation, open space and transportation.

The planning project will be coordinated with the Omaha District of the Corps of Engineers. Following completion of Phase A, a decision will be made by the Corps whether or not to seek Corps funding for the flood control aspects of the adopted plan.

The firm of Harmon, O'Donnell, and Henninger will provide the planning input to the project. Mr. Sears Merrick of Merrick and Company will represent the engineering-planning team as project manager and Bob O'Donnell of HOH will personally supervise the planning aspects. The project is being jointly funded by the City and County of Denver, Arapahoe County, City of Glendale and the Urban Drainage and Flood Control District.

Cherry Creek is of vital interest to the Denver metro

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# The South Platte River: A Flood History

by JEANNE RAUDENBUSH

The South Platte River is the major stream of north-eastern Colorado. The South Platte watershed above Denver consists of 4,850 square miles with headwaters reaching to the Continental Divide.

Denver was established in 1844 as a small gold camp located near the confluence of the South Platte River and Cherry Creek. Since that time the South Platte has consistently overflowed its banks and flooded the occupied areas of the flood plain. The earliest recorded flood on the South Platte was in 1844. According to eye witness accounts, the bottom lands in the vicinity of Denver were "covered with water from bluff to bluff."

The first written accounts of floods in the Denver area documented three floods which occurred in May and June of 1864. Melting snow along with heavy rains caused the floods which inundated the new town of Denver to depths of one to five feet and left great deposits of sand and gravel. Much of the early building in Denver had been done in and near the river beds of Cherry Creek and the South Platte, and many of these buildings were destroyed or carried off by the flood. Damages from this flood were estimated at between \$500,000 and \$1,000,000.

A flood in 1867 was reported to be larger in terms of the amount of water flowing in the river. However, the channel had been enlarged so greatly by the 1864 floods that the South Platte did not overflow its banks.

The flood of 1876, again caused by a combination of rain and snow melt, caused severe damage to buildings built on the flood plain as well as bridges. The flood was judged by reporters to be several feet higher than the floods of 1864.

Many Denver floods were caused by a combination of rain and melting snow in and close to the mountains. In 1900, when the Mississippi Street bridge was washed away, the Denver Republican reported that, "One reason for the extraordinary high water is that no ditches are open. Usually a good deal of irrigating is done in the latter part of April, but the ground has been so thoroughly soaked by the storm that the farmers have the headgates of their ditches nailed tight."

As a result of the flood of 1912, the Denver City Council passed a bill in 1915 which authorized the City to define and acquire the channel of the South Platte River within the city limits. The passage of this bill led builders and planners to hope for a day when the South Platte would be a river of beauty. They hoped to see the low land raised, the channel widened, straightened and walled, and great shaded boulevards built on either side from city limit to city limit. However, the channel was not acquired because no cost estimate for acquisition was every made.

In 1921, Denver constructed channel improvements on about 11.5 miles of the South Platte. The discharge capacity for this improved reach ranged from 9,500 c.f.s. to 29,000 c.f.s.

Rains from June 2-7, 1921 caused one of the largest floods on the South Platte. Many people were forced to evacuate their homes as the river in Denver rose 7 feet. The stockyards and railroad yards were flooded and many bridges were destroyed. Other bridges were saved by firemen using poles and grappling hooks to ward off wreckage and tree trunks from the bridges. Interesting statistics published after this flood show that 1630 lbs. of lime were used to disinfect flooded basements and 40 gallons of creosote were used to disinfect stagnant ponds.

By 1923, Denver was beginning to face many of the

complex problems associated with the South Platte. The city had to keep in mind with its various projects that the river flowed over sandy material, and while it washed out a channel readily, the channel was soon obstructed with sand bars. Willows and cottonwoods would quickly spring up on these bars and the channel would again be blocked, the river would cut a new route, and the process would be repeated. An example is the channel south of the Alameda Avenue bridge. In 1908, this section was deep and swift, but by 1923 the river in some places was almost level with the banks. Thus, Denver had to worry not only about confining the stream, but also about keeping a deep channel free of obstructions.

In 1924, legislation similar to that of 1915 was passed. A fact finding commission was named by the City Council to investigate and report on the cost of acquiring the channel of the South Platte and to determine the necessary steps for control of the river within the limits of Denver. As a result of the findings of the commission, City Council set aside \$100,000 in the 1925 budget for Platte River flood prevention. The committee recommended securing a right-of-way for the channel in the city limits and then concentrating on removing obstructions caused by dams built for industrial purposes and to raise the banks of the river.

A project to straighten and improve a half-mile stretch of the river, from the Burlington bridge below 38th Avenue to the rear of the Stockyards Exchange was begun in 1927. Improvements consisted of moving the river bed east, widening the bed to 200 ft., and replacing the 2' to 6' high natural banks with 15' high banks. By 1928, \$475,000 had been spent on flood protection work.

The depression brought great working forces to the South Platte. A force of 3700 workmen was engaged in straightening the river from the northern Denver city limits into Adams County. The channel was deepened and the banks riprapped. The project was funded by the Work Projects Administration, the Civil Works Administration and the Federal Emergency Relief Administration. The channel capacity in places was increased to 32,000 c.f.s. Islands were removed and long, easy curves replaced the sharp bends. By 1939, large islands had again developed in the river. The islands were formed primarily from sand and silt from Cherry, Plum and Sand Creeks.

There were floods during the '30s but these received little publicity compared to the 1942 flood, during which 15,000 residents were warned to leave their homes. One report said that the Platte was roaring more than a mile wide near its juncture with the twin forks of Plum Creek. The bridges at West Evans and West Mississippi were swept away.

In 1947, a comprehensive flood control plan was outlined for the South Platte River from south of Littleton, northward nearly to Greeley. The cost, estimated at \$28,738,450.00 included a reservoir and a system of levees and channel improvements. This plan was never implemented.

In 1965, the largest recorded flood in the history of the South Platte River occurred. Damage to Denver was devastating with damage estimates running into the hundreds of millions of dollars. As a result of this flood, a revised South Platte flood control project was drawn up by the U.S. Army Corps of Engineers. The Chatfield Dam, approved by Congress in 1959 at an estimated cost of \$32 million, but shelved for lack of funds was again

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## FLOOD PLAIN MANAGEMENT Developing a Program

by BILL DeGROOT

### ADMINISTRATOR FLOOD PLAIN MANAGEMENT PROGRAM DISTRICT FLOODWAY PHILOSOPHY

A primary objective of a good flood plain regulation program is to preserve a passageway capable of carrying the 100-year flood. A common method of achieving this goal is to divide the 100-year flood plain (flood regulatory district) into two districts, the floodway district and the flood storage district. Uses within the floodway should then be restricted to those uses having a low flood damage potential which do not obstruct flood flows. If the floodway district has the capacity to carry the 100-year flood, the flood storage district can accommodate more intensive uses, as long as these uses (including structures) are elevated or flood proofed to a point one or two feet above the 100-year water surface elevation.

During the past year, we have spent a considerable amount of time and effort in trying to arrive at a logical method for delineating floodways on a regional basis. We have discovered there are many different criteria presently in use throughout the country for sub-dividing the flood plain into the floodway district and the flood storage district. One method commonly in use is to assume filling of the flood plain, beginning at its outer boundaries and filling toward the channel, to the point where the water surface elevation rises a specified amount, usually one-half foot or one foot. Other criteria in common use state that the depth of water in the flood storage district shall not exceed a given depth, usually one to two feet, and/or shall not exceed a given velocity, usually two feet per second to four feet per second. Other factors are sometimes used, but they are not as common as the above listed criteria.

In November, 1974, the Board of Directors of the District adopted the requirement that the sub-division of a floodplain into the floodway district and the flood storage district must not create a water surface elevation rise of more than one-half foot. This is believed to be a reasonable approach for a regional flood plain regulation, which, if implemented on a district wide basis, could apply to approximately 1,100 stream miles of flood plain.

An important aspect of the District's criteria is that the one-half foot rise is a minimum standard. Because each drainageway possesses unique characteristics, other factors may govern the floodway selection. Since the one-half foot use is a minimum standard, any additional factors will tend to widen the floodway. Additional factors are determined on a stream by stream and reach by reach basis, as recommended by District consultants and approved by the District. For example, additional criteria may be suggested to account for debris blockage at a bridge if the passageway is very restrictive. Also, if excessively erosive velocities occur at the edges of the floodway, it may be necessary to increase the floodway width. If a stream is in the critical flow regime, the one-half foot use would not be applicable and the whole channel would comprise the floodway.

The present District policy is to encourage and assist each local government within the District to adopt and enforce adequate flood plain regulations. Hydraulic engineers should not be given total responsibility for defining floodway boundaries and the governing body of each entity should become actively involved in the determination

of the floodway boundaries. When determining these boundaries, the governing body should consider local plans for parks and recreation, open space, transportation, historic areas, environmentally sensitive areas, and commercial, industrial and residential development. All of these factors should be incorporated with the hydraulic engineer's technical advice to assure that the community will arrive at the best possible floodway delineation.

### FLOOD HAZARD INFORMATION

The Colorado Water Conservation Board and the United States Geological Survey are combining efforts to publish a flood hazard information map. The map will show and list all flood plain information studies available for the State of Colorado. It will also show all the USGS quads which have flood hazard areas identified on them.

The map will be printed by the USGS and should be available by mid-March. The map will be a valuable resource for everyone concerned with flood hazards in Colorado.

### EDITOR'S NOTES

The front page story of this issue of *Flood Hazard News* details an important milestone in the brief history of the District. With the completion of the Niver Creek Rehabilitation project and the start of construction on Englewood Dam, the District has established itself as an implementaion as well as a planning agency.

The District has also been making good progress in flood hazard area delineation and flood plain regulation. These efforts will be described in the next issue of *Flood Hazard News*.

## FLOOD PLAIN INFORMATION MAPS NOW AVAILABLE

The District has completed the transfer of flood plain delineations from various technical reports to a series of standardized Flood Plain Information Maps. These are strip maps with a scale of 1" = 1000' obtained from USGS photo revised quads. An example of these maps was published in the August, 1974 Flood Hazard News. The maps are available from the District at a cost of \$1.00 per sheet. Following is a list of available maps.

- Sand Creek (2 sheets)
- S. Boulder Creek
- Lena Gulch
- Sanderson Gulch
- Weir Gulch
- Lakewood/McIntyre Gulch
- Van Bibber Creek
- Clear Creek (2 sheets)
- Ralston/Leyden Creeks (2 sheets)
- Cherry Creek (2 sheets)
- Goldsmith Gulch
- Grangehall Creek
- Toll Gate Creek (2 sheets)
- Big Dry Creek (Arapahoe County)
- Little Dry Creek (Arapahoe County - 3 sheets)
- S. Platte River (5 sheets)
- S. Boulder Drainageways
- N. Boulder Drainageways
- Boulder Creek (2 sheets)
- Dutch, Coon, Lilley Creeks (2 sheets)
- Bear Creek (Below Mt. Carbon)
- Bear & Mt. Vernon Creeks (Morrison)
- Little Dry Creek (Adams County)
- Big Dry Creek (Adams County - 2 sheets)
- Niver Creek



## New Board Members Appointed

Governor Richard D. Lamm has appointed Mayor Gilbert A. Bean of Westminster and Mayor F. Vaughn Gardnier of Littleton to the District's Board of Directors. They will fill the vacancies created by the death of Mayor Paul Beck and the resignation of Mayor Tom Carrillo.

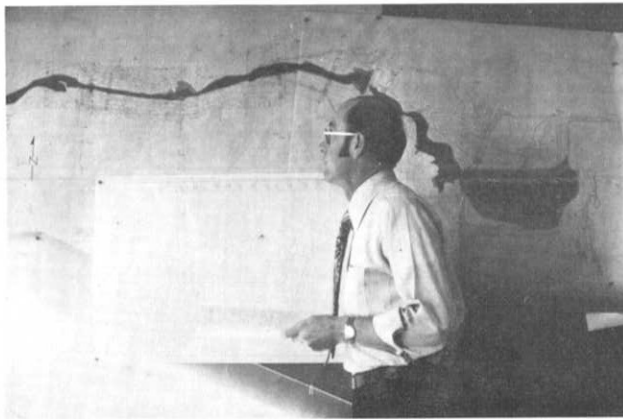
Governor Lamm has also re-appointed Mayor James Richey of Lakewood to another two-year term.

## FLOOD HISTORY

(Continued from Page Seven)

proposed at a cost of \$75 million. Construction of the dam was begun in 1967 and is now nearing completion. Construction was also begun on another dam located near Mount Carbon on Bear Creek.

In spite of all the attention the South Platte River has received over the years, it has evolved into an ugly and desolate eyesore as it winds its way through the metropolitan area. Within the past year, Denver has renewed its commitment to making the river a useful and attractive urban asset. The Mayor's Platte River Development Committee is drawing up ambitious plans to turn the Platte River Channel into a ten mile long linear park, and construction has begun on the first one mile stretch of this project.



Each consultant preparing a master plan for the District presents his findings to the District's Technical Advisory Committee during Phase A. Here, Dick Billups of CH2M/Hill discusses problems associated with Basin 6100.

## Tucker Talk

(Continued from Page Six)

area and we are looking forward to the development of a viable plan that will have a chance for implementation.

### FLOOD HAZARD AREA DELINEATION

The District entered into a contract with the Colorado Water Conservation Board to identify flood hazard areas within the District. The State will provide \$60,000 for use during fiscal year 1974-75 that must be matched by District funds. The District subsequently contracted with Fraiser and Gingery, Inc., consulting engineers, to delineate flood hazard areas on 69 miles of streams in Adams, Arapahoe and Douglas Counties. Fraiser and Gingery is under contract with the Federal Insurance Administration to prepare "approximate" delineations on the same streams. This provided an opportunity to coordinate local efforts with FIA studies. We hope it works. The six streams being delineated are Third Creek, Second Creek, Cottonwood Creek, Lone Tree Creek, Piney Creek, and Murphy Creek.

## Definition of Benefits Introduced To Colorado Legislature

by

W. JOSEPH SHOEMAKER

and

JAMES H. DOWNEY

The need for adequate urban drainage and flood control systems in the Denver metropolitan area has been clearly demonstrated. However, implementation of such systems is being hindered by the hesitancy of local officials to act in light of the statutory requirement that assessments be made according to "benefits" received, while the meaning of "benefits" remains undefined.

The following proposed statutory definition of "benefit," which has been introduced to the Colorado Legislature, would help to clarify the situation, and its enactment would be a positive step toward encouraging local officials to provide needed urban drainage improvements: The term benefit, for the purposes of assessing a particular property within a drainage district (or special improvement district, shall include, but shall not be limited to, the following:

- a. Any increase in the market value of the property;
- b. The provision for accepting the burden from specific property for discharging surface water onto servient property in a manner or quantity greater than would naturally flow because the dominant owner made some of his property impermeable;
- c. Any adaptability of property to a superior or more profitable use;
- d. Any alleviation of health and sanitation hazards accruing to particular property or of public property in the district if the provision of health and sanitation is paid for wholly or partially out of funds derived from taxation of property owners of the district;
- e. Any reduction in the maintenance costs of particular property or of public property in the district if the maintenance of the public property in the district is paid for wholly or partially out of funds derived from taxation of property owners of the district;
- f. Any increase in convenience or reduction in inconvenience accruing to particular property owners, including the facilitation of access to and travel over streets, roads and highways; and
- g. Aesthetic, ecological or recreational improvements accruing to particular property owners as a direct result of the drainage improvement.

The United States Supreme Court has ruled that the fact that lands included in a drainage district will receive no direct benefit is not *per se* enough to exempt them from assessment. Therefore, assessment according to the above model definition of benefit is well within judicial limits. Enactment of such a provision, defining benefits as a broader term than most state courts have followed, would be a step toward encouraging the construction of needed urban drainage improvements.

NOTE: As we went to press, legislation defining benefits essentially as described above had been passed by the Senate and sent to the Local Government Committee of the House.

## Implementation Phase

(Continued from Page One)

dam unless and until it met State Engineer standards.

Total cost of the project, including engineering, construction, inspection, and land acquisition will be approximately \$575,000.

### FINAL DESIGN NEARS COMPLETION ON VIELE LAKE CHANNEL

Final design of channel improvements to the Viele Lake channel in the City of Boulder and Boulder County is in its final phases. The total cost of the project is estimated to be \$527,400. Participating financially in the project are the City of Boulder, Boulder County, State of Colorado, and the Urban Drainage and Flood Control District.

The Viele Lake project starts downstream of Viele Lake in Boulder and terminates at the channel's confluence with South Boulder Creek a few blocks north of the Boulder Turnpike.

Improvements will consist of right-of-way acquisition, channel stabilization and beautification, and provision of a maintenance trail that will also serve as a hiker-biker trail. The firm of Drexel and Barrell is providing final design services. Final design is being supervised by the

City of Boulder. Construction will most likely be initiated during the first half of 1975.

### FINAL DESIGN IS INITIATED FOR WEIR GULCH IMPROVEMENTS.

Final design of improvements to Weir Gulch was initiated by Frasier and Gingery, Inc., consulting engineers, in October 1974. Final design is scheduled to be completed in July 1975. Lakewood, Denver, the Urban Drainage and Flood Control District, and the State of Colorado have committed funds for final design.

Preliminary cost estimates of the project are estimated to be approximately \$3,400,000. Funding for construction of the project will be subject to appropriation of the governmental entities involved. The District has budgeted for its share of construction funds in its 1975 budget.

Weir Gulch begins in Lakewood below Main Reservoir. It flows easterly through Lakewood and Denver entering the South Platte River at approximately 8th Avenue. The total project length is about 8½ miles.

### PLANS AND SPECIFICATIONS ARE COMPLETED FOR A PORTION OF SANDERSON GULCH

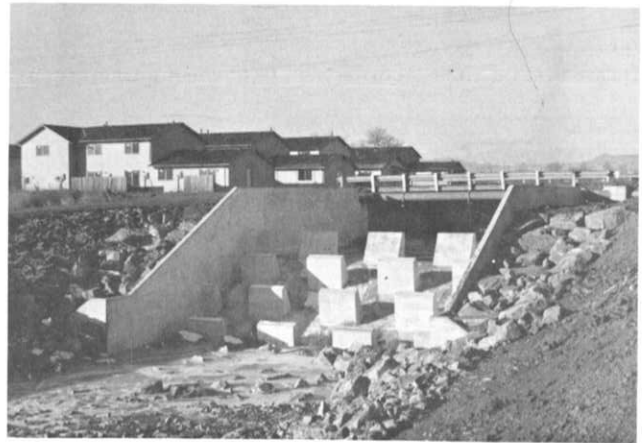
Final plans and specifications for bid purposes were completed by Frasier and Gingery, Inc. in January 1975

## NIVER CREEK

Before. . .



and After



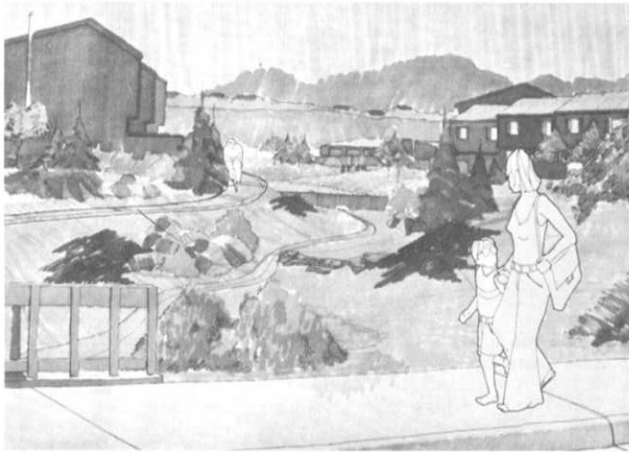
Looking upstream toward York Street



Looking downstream from York Street bridge

for improvements to North Sanderson Gulch. North Sanderson Gulch is part of the Sanderson Gulch project for which final design was initiated in October 1973. The advertising for bids and selection of contractors for the North Sanderson Gulch portion is being handled by the City of Lakewood. It is expected that construction will be underway on North Sanderson Gulch by April 1975.

Plans and specifications are nearly complete for the portion of Sanderson Gulch within the City and County of Denver. A third construction package will consist of improvements to main Sanderson Gulch in the City of Lakewood.



Artist's conception of the Viele Lake channel after construction.

Most recent project costs are estimated to be approximately 2.4 million dollars. This is approximately \$1,000,000 above the cost estimated in 1972. The District Board of Directors at their February 3, 1975 meeting agreed to commit up to \$800,000 of District monies to the project. District funds must be matched by monies from Denver and Lakewood. In addition, a \$498,500 grant was received from the Department of Housing and Urban Development and a \$350,000 grant from the State of Colorado.

Property acquisition is underway in both Denver and Lakewood. One house will be purchased in Denver to permit a realignment of the channel. Other property acquisitions consist of land for construction of the channel and maintenance access.

Denver and Lakewood will handle construction bidding and construction inspection and supervision. The District will continue to be involved, however, through completion of the project because of its accountability to HUD and the State for their respective funds. The com-



The present Sanderson Gulch is typically a narrow weed choked, neglected channel. The improvements will consist of a trapezoidal channel with a combination bike/maintenance path.

pleted facility will be owned by Denver and Lakewood. The respective jurisdictions will be responsible for maintenance of the channel. A maintenance agreement has been signed by Denver, Lakewood and the District to insure maintenance of the completed facility.

Several park areas along Sanderson Gulch have been developed in both Denver and Lakewood. The proposed improvements will tie in with these park developments and will provide lineal access from the Platte River upstream into Lakewood.

## DRAINAGE CRITERIA MANUAL TO BE REVISED

The District is in the process of revising portions of the *Urban Storm Drainage Criteria Manual, Volumes I and II*. This will be the second revision since the manual was first published in 1969. The District would welcome constructive criticism regarding the manual from consulting engineers and public agencies who are presently utilizing the manual. Please forward your comments to the District by April 15, 1975. The expected revisions are scheduled for distribution during the summer of 1975.

The District has an incomplete list of those who own a manual. In order to insure the widest possible dissemination of the revisions, we ask that all manual owners complete and return the form printed at the bottom of this page. Please pass this information on to those you know who own a manual and possibly do not receive the *Flood Hazard News*.

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### URBAN STORM DRAINAGE CRITERIA MANUAL — MAILING LIST

Please add my name to your mailing list for the revisions to the Urban Storm Drainage Criteria Manual.

Name \_\_\_\_\_

Organization \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Return to: Urban Drainage and Flood Control District  
181 East 56th Avenue, Suite 600  
Denver, Colorado 80216

## DISTRICT SPONSORS SEMINAR ON FLOOD PLAIN MANAGEMENT

Approximately 200 people were in attendance at the District's Seminar on Flood Plain Management which was held on November 14 and 15 at Stouffer's Denver Inn. Co-sponsors for the seminar were Colorado Counties, Inc., Colorado Municipal League, Colorado Water Conservation Board, American Public Works Association (Colorado-Southern Wyoming Chapter) and the Bureau of Outdoor Recreation (Mid-Continent Region).

The highlight of the seminar was the luncheon address by Rapid City Mayor Don Barnett. Mayor Barnett detailed Rapid City's experience before, during and after their disastrous 1972 flood. Other speakers included George Phippen; Chief, Flood Plain Management Services Branch, U.S. Army Corps of Engineers; and Nick Lally; Chief, Flood Plain Management Division, Federal Insurance Administration.

Session topics included Approaches to a Complete Flood Plain Management Program, The National Flood Insurance Program, Using Flood Plains for Recreation and Open Space, and Flood Plain Regulations. State Senator Joe Shoemaker and Boulder Councilman Kan Wright concluded the seminar by debating the question: "What Level of Government Should Regulate Flood Plains?"

Transcripts of the sessions are currently being edited and proceedings will be published in the near future.



Mayor Don Barnett of Rapid City uses a map to illustrate a point during his talk at the seminar.

*"Dedicated to reducing the danger to property  
and to the health and safety of persons living in the urban area"*

THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT  
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