

DISTRICT FLOOD CONTROL FACILITIES PUT TO TEST THE GOLDSMITH GULCH FLOOD OF AUGUST 17, 1988

By Kevin G. Stewart, Project Engineer
Floodplain Management Program

Introduction

During the late afternoon of August 17, 1988, very intense rainfall occurred in the vicinity of the Denver Tech Center forcing a rush hour closure of southbound I-25. The storm also caused significant flooding along Goldsmith Gulch through Denver and received a considerable amount of news media attention.

The thunderstorm was centered near the intersection of I-25 and East Belleview Avenue and dumped between 2- and 3-inches of rain within a 1-hour period. This article focuses on the events of that day by highlighting weather forecasting activities, evaluating how existing flood control facilities performed, reporting actual flood damages and providing a retrospective look at what might have happened if conditions had been different.

Location

Goldsmith Gulch is a left bank tributary to Cherry Creek with its confluence point located just upstream of Monaco Boulevard. The Goldsmith Gulch drainage basin is approximately 7-miles long and 1-mile wide. The basin parallels I-25 on the east with I-225 essentially bisecting the basin on the north side of the Denver Tech Center. Goldsmith Gulch drains approximately 3.5 square miles at its crossing with I-225 and 8.0 square miles at its confluence with Cherry Creek.

The headwaters of the drainage basin are located within unincorporated Arapahoe County just south of East Arapahoe Road. The drainage basin is almost entirely developed and has numerous major road crossings. Goldsmith Gulch floodplains impact Arapahoe County, Greenwood Village and the City and County of Denver.

Drainage and Flood Control Facilities

The majority of the drainage basin is urbanized and collects storm runoff through a network of streets and storm sewers. Due to the nature of these storm drainage facilities and the narrowness of the drainage basin, surface runoff is rapidly conveyed to the Goldsmith Gulch channel.

Numerous drainage and flood control facilities exist along the major drainageway. In addition to major street crossings, certain reaches of Goldsmith Gulch have been channelized. George Wallace Park is located between East Belleview Avenue and I-225 and represents one of the most attractive features along the watercourse. A major flood control facility known as Temple Pond is located within George Wallace Park immediately upstream of where Union Avenue crosses the gulch. This facility was completed in 1986, and was jointly funded by the Goldsmith Metropolitan District, the City and County of Denver and the Urban Drainage and Flood Control District. In 1987, a self-reporting rain and stage gauge was installed at Temple Pond as part of the District's ALERT flood detection network. This automated gauge was operating on August 17, 1988.

Downstream of I-225, Goldsmith Gulch crosses Quincy Avenue and flows through Rosamond Park. Downstream from this point, an improved open channel carries flows to the Hampden Avenue crossing. A short distance downstream, Dartmouth Avenue and the Highline Canal cross the gulch. Storm drainage is conveyed by a 36-inch RCP beneath the Highline Canal. Flows frequently exceed the capacity of this 36-inch concrete pipe and discharge directly into the canal, which also has limited hydraulic capacity.

Downstream of the Highline Canal, Goldsmith Gulch flows through Bible Park. Yale Avenue crosses the gulch and runs adjacent

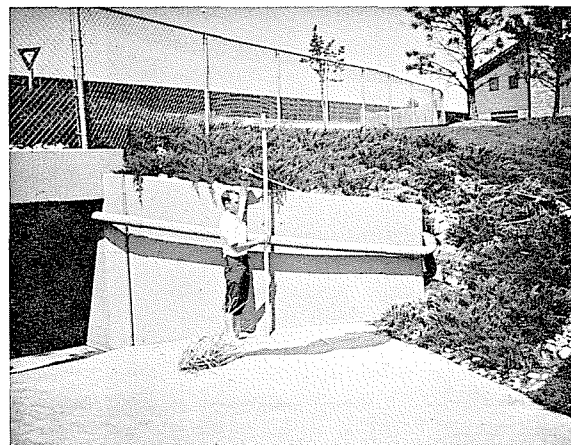
to the northern boundary of Bible Park. Between Yale and Iliff Avenues, Goldsmith Gulch is comprised of a limited capacity open channel. Between Iliff and Evans Avenues, the gulch is confined to a limited capacity box culvert underneath an apartment complex and shopping center area. An improved grass-lined channel conveys flows between Evans and Jewell Avenues. From Jewell to Monaco the gulch flows through a combination of grass-lined and concrete rectangular channels having very limited capacity. From Monaco to the Cherry Creek confluence, Goldsmith Gulch consists of an unimproved channel.

The Flood

Special efforts were made by the District following the August 17 flood to document the experience. Leonard Rice Consulting Water Engineers (LRCWE) was contracted to survey the flooded area, take photographs, and document their findings. During the event, data was collected in real-time via radio transmissions from the Temple Pond rain/stage gauge. Also, a District staff member videotaped the flood as it occurred at various points along the gulch. Numerous newspaper accounts and television coverage also provided valuable documentation of the event.

The flood forecasting activities which preceded the event are also of interest. The consulting meteorological firm of Henz Kelly and Associates (HKA) is contracted by the District to provide area-wide flash flood predictions for events such as this. HKA forecast services are intended to supplement

Surveying high water marks after the flood.



Below I-225, a District maintenance construction project was damaged through the Rosamond Park area. Erosion damages occurred and losses were sustained by the contractor.

Further downstream, at least two residences had water in their basements and received peripheral property damage. Parking lots were flooded at a condominium complex and the floodwaters came very close to damaging a number of units.

Flows entered the Highline Canal just downstream of the East Dartmouth Avenue crossing of Goldsmith Gulch. Overtopping of the Highline Canal occurred at five locations but minimal damage was noted. Since the Highline Canal was essentially empty at the time of the flood, significant benefits were provided by the canal carrying away potentially damaging flows.

Flows leaving the Bible Park area came within 6-inches of overtopping Yale Avenue. The channels, conduits and crossing structures downstream of Bible Park flowed very close to maximum capacity and no major damages were reported.

In Retrospect

Floodplain occupants along Goldsmith Gulch can consider themselves most fortunate on August 17. If Temple Pond had not existed, and if the Highline Canal had been carrying irrigation water at the time of the storm, flood losses would have been much higher. Also, floodplain occupants can be thankful that the storm was localized and not widespread. If the event had covered more of the basin, the flood losses would have been substantially greater, given the same hydraulic conditions.

Denver is fortunate that the August 17 event was not more serious. The lessons learned from that day will prove beneficial in handling future flooding situations. The District would like to recognize the contributions made by the various agencies and individuals involved with flood warning, emergency operations, damage documentation and technical evaluation for the August 17 flood. This experience will lead to improved flood warning capabilities and future flood control improvements for Goldsmith Gulch and other major drainageways within the District.

→ The Jersey barriers along I-25 caused a major obstruction to drainage forcing southbound traffic to be halted and rerouted. Serious drainage problems occurred west of I-25 as a result of the locally intense rain. While flood damages were reported, it should be noted that this area is not within any identified floodplain or along any major drainageway. The heavily developed land west of I-25 represents a remote area tributary to Goldsmith Gulch which must drain across the freeway. Existing storm drainage facilities were inadequate to handle the storm runoff.

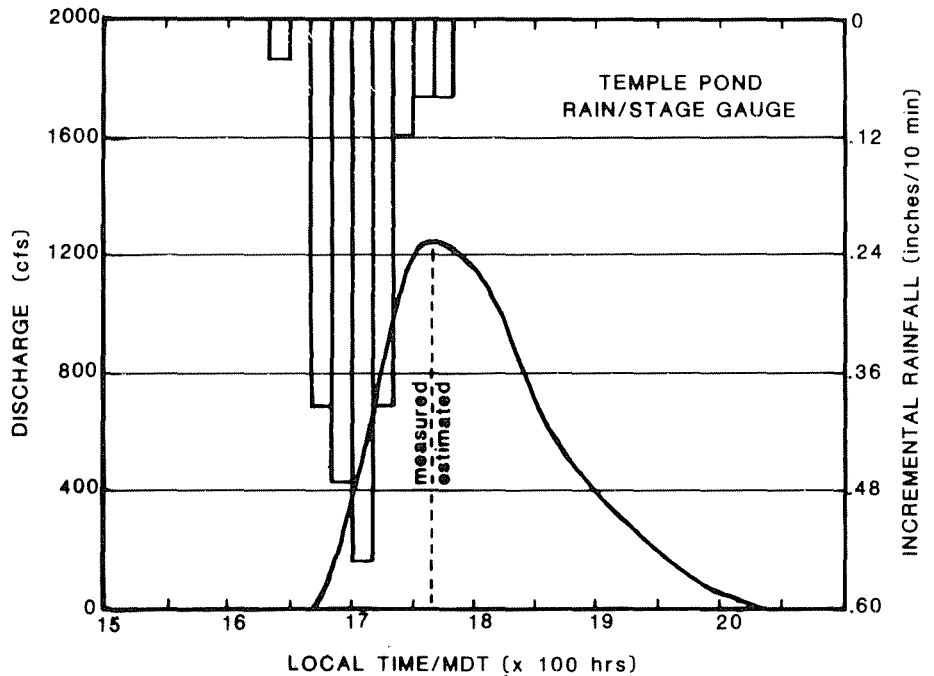
Along Goldsmith Gulch between East Belleview Avenue and I-225, existing facilities performed well with only minor erosion damage occurring. Clean-up activities in George Wallace Park began the next morning. By noon that day, there

was little evidence that a flood had occurred through the park area.

The Temple Pond detention facility performed well, releasing an estimated peak discharge of 1250 cfs. The peak stage was confirmed by field survey on August 18 with floodwaters reaching an elevation 3.3-feet above the headwall of the outlet structure (twin 96-inch CMPs). Calculations indicate that the facility received a peak inflow of more than twice its release rate.

Downstream of Temple Pond, the I-225 box culvert flowed very close to its maximum capacity. The I-225 culvert is capable of handling approximately a 10-year discharge. It is obvious that Temple Pond proved its worth on August 17 and that damages downstream would have been much worse if the detention facility had not existed.

Event of August 17, 1988



QUANTITATIVE PRECIPITATION FORECAST FOR AUGUST 17, 1988

Duration	Forecast	Forecast	Measured Rain
	Time: 0955L	Time: 1543L	Start: 1640L End: 1735L
10 min.	0.7"		0.67"
20 min.	1.0"		1.11"
30 min.	1.8"		1.50"
60 min.	2.5"	1" to 2"	2.07"
90 min.~	3" to 4"		2.17"

TABLE 1
COMBINATIONS OF RAIN GAGES USED IN MODELLING TOTAL
BASIN

1. Harvard Park only
2. Harvard Park, Bradley only
3. Harvard Park, Bradley, University Park only
4. Harvard Park, Bradley, University Park, Slaven only
5. Harvard Park, Bradley, University Park, Slaven, Bethesda

TABLE 2
HARVARD GULCH AT H. PARK — PEAK FLOW
PERCENT VARIATION FROM THE FIVE GAGE CALIBRATED RUN

NO. OF GAGES REPORTING	RANGE OF VARIATION	MEAN	STANDARD DEVIATION
1	-100.00 to 150.00	-24.2	78.5
2	75.3 to 94.5	0.5	51.0
3	32.2 to 63.6	15.8	29.4
4	32.2 to 18.8	-0.9	11.6
5	0.0 to 0.0	0.0	0.0

TABLE 3
HARVARD GULCH AT H. PARK — RUNOFF VOLUME
PERCENT VARIATION FROM THE FIVE GAGE CALIBRATED RUN

NO. OF GAGES REPORTING	RANGE OF VARIATION	MEAN	STANDARD DEVIATION
1	-98.6 to 152.8	-16.5	79.9
2	-66.7 to 185.2	-12.4	38.4
3	-32.2 to 59.4	11.3	22.8
4	-20.8 to 19.1	4.6	10.5
5	0.0 to 0.0	0.0	0.0

TABLE 4
HARVARD GULCH AT H. PARK — PEAK FLOW COMPOSITING
RESULTS

PERCENT VARIATION FROM THE FIVE GAGE CALIBRATED RUN COMPOSITE TYPE	RANGE OF VARIATION	MEAN	STANDARD DEVIATION
Peak Preservation	-65.1 to 4.9	-17.4	18.1
Simple Linear	-60.5 to 9.7	-16.7	18.0

TABLE 5
HARVARD GULCH AT H. PARK — RUNOFF VOLUME COMPOSITING
RESULTS

PERCENT VARIATION FROM FIVE GAGE CALIBRATED RUN COMPOSITE TYPE	RANGE OF VARIATION	MEAN	STANDARD DEVIATION
Peak Preservation	-18.8 to 9.0	-3.3	7.7
Simple Linear	-20.1 to 9.0	-2.8	7.6



An energy dissipater on Little Dry Creek in Westminster.

District Assists Boulder County in Fire Fighting Efforts

While the Yellowstone Park fire of 1988 received the attention of the news media as the worst national park forest fire on record, firefighters around the country fought numerous other fires within forested areas of the western United States. Boulder County, Colorado experienced its share of fire fighting activities over a two-week period in mid-September of this year. Firefighters in Boulder County deserve credit and recognition for saving both lives and property.

During the peak of the Boulder County firefighting efforts, the District was asked to assist the County by making the Electronic Bulletin Board available for relaying fire-related weather information. Boulder County was one of the primary users of the Bulletin Board during the 1988 flood season and found that it was a very quick and efficient way of relaying critical weather information. Henz Kelly and Associates (HKA) were contacted by Boulder County to assist with fire-related forecasting and weather reporting. The District's Bulletin Board was used as a means of disseminating hard copy information directly to the Boulder County Sheriff's Department. Wind, temperature and rainfall forecasts were considered essential for positioning equipment and human resources. Captain Charles Pringle, of the Boulder County Sheriff's Department, was responsible for making the arrangements and deserves special recognition for his contributions.

The District appreciates the confidence expressed by Boulder County in the Bulletin Board service. If future emergency situations arise, the District stands ready to assist local governments in whatever way possible. Considering the response the District received from Boulder County and others concerning the Bulletin Board, such services can be expected to continue in the future.