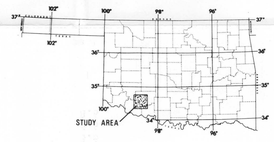
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE REPORT
79-256

FLOOD OF AUGUST 27-28, 1977, WEST CACHE CREEK AND BLUE BEAVER CREEK, SOUTHWESTERN OKLAHOMA

By
Robert K. Corley and
Thomas L. Huntzinger



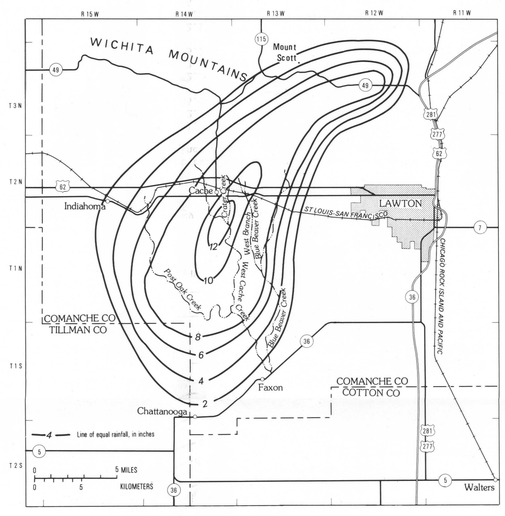


Figure 1.—Distribution of rainfall for the August 27-28, 1977, storm.

INTRODUCTION

The storm of August 27-28, 1977, in southwestern Oklahoma, shown on the map in figure 1, resulted in extensive inundation of property and damages estimated at close to $1 million (National Weather Service, 1977).

Major flooding occurred on Blue Beaver and West Cache Creeks and their tributaries in Comanche County near the communities of Cache and Faxon, Oklahoma. The area studied extends from the confluence of Blue Beaver and West Cache Creeks near Faxon, north to U.S. Highway 62 at Cache. Peak discharges at selected points along major streams in the area were computed and compared to estimated flood frequencies. Observed highwater marks were used to establish flood profiles and to map flooded areas. Rainfall amounts for the storm and depth-duration-frequency data for the area are included. (National Weather Service, 1977)

UNITS OF MEASUREMENT

The analysis and compilations in this report were made with inch-pound units of measurement. Inch-pound units only are shown in tables. To convert inch-pound units to metric units, the following conversion factors should be used:

Inch-pound units	Multiply by	Metric units
inch (in.)	2.540	centimeter (cm)
foot (ft)	0.305	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.0283	cubic meter per second (m^3/s)
cubic foot per second per square mile ($ft^3s^{-1}\ mi^{-2}$)	0.0190	cubic meter per second per square kilometer ($m^3s^{-1}\ km^{-2}$)

PHYSIOGRAPHY & CLIMATE

Blue Beaver and Cache Creeks, the major streams in the area, originate in the Wichita Mountains to the north of the study area and flow southward toward the Red River. The mountainous upper portion of the drainage basins is rocky and the steep slopes are covered with oak brush and small trees. Lower parts of the drainage basins in the study area lie in rolling, grassy plains underlain by weakly consolidated reddish clays and sandstone. Even though the uplands are open, the stream channels are covered with dense brush and trees. Elevations of the West Cache Creek and Blue Beaver Creek drainage basins range from 2,500 feet in the Wichita Mountains to 1,050 feet at the streams' confluence at Faxon.

The area has a dry, temperate continental climate, characterized by movements of warm moist air from the Gulf of Mexico, or dry, cooler continental air from the north. Rapid changes in weather are common, accompanied by distinct fluctuations of temperature, humidity, and wind. Marked seasonal changes occur with hot summers and mild winters. The spring season often brings scattered severe thunderstorms with locally heavy rainfall and tornadoes (U.S. Department of Agriculture, 1967).

RAINFALL

The average annual precipitation ranges from 29 inches in the Wichita Mountains to 30 in. at lower elevations. In an average year, the spring season (March-May) receives 34 percent of the annual precipitation with May being the wettest month. The winter season (November-February) receives 15 percent of the annual precipitation during which January is the driest. The remaining precipitation occurs in summer and fall months. Every season except winter may experience intense, severe rainstorms which can bring 24-hour rainfalls of 3 in. or more (U.S. Department of Agriculture, 1967).

The storm of August 27, 1977, caused by a cold front moving southwest to northeast across Oklahoma, resulted in heavy rainfalls throughout the West Cache and Blue Beaver Creek basins. Informal rainfall surveys made by the Civil Defense Office and the U.S. Geological Survey, and reports by the National Weather Service and local citizens were used to draw a map of the area with isohytal lines of equal rainfall as shown in figure 1. The data collected indicated 24-hour totals of 12 in. immediately south of Cache and from 4 to 8 in. in the surrounding area.

The storm traveled in a northeasterly direction, originating southwest of Faxon and ending in the Wichita Mountains northeast of Cache. An area-weighted average rainfall of 7.7 in. fell during a 6-hour storm period, between 7:30 pm August 27 and 1:30 am August 28, with more than 4 in. falling in less than 3 hours. The 4-in. isohyet in figure 1 covers about 200 mi^2, with the 12 in (plus) center located approximately 3 mi south of Cache. An unconfirmed amount of 14 in. was reported near the storm center. The rainfall frequencies for the area, as determined by the National Weather Service (U.S. Weather Bureau, 1961), are given in table 1 with area adjustment curves shown in figure 2. The point rainfall amounts shown in table 1 and adjusted for the storm area from figure 2 indicate that the August 27-28 average rainfall of 7.7 in. during 6 hours exceeds a 100-year storm in the 200 mi^2 area. Blue Beaver Creek basin received intense rainfall throughout its length but West Cache Creek received intense rainfall only on the lower portion of the basin. Post Oak Creek, a major tributary to West Cache Creek, also received heavy rainfall which contributed to the runoff in the lower reaches of West Cache Creek.

Table 1.–Expected point-rainfall intensity and frequency for August 27-28, 1977 storm area (National Weather Service, 1961).

Duration in hours	Recurrence interval in years	Point rainfall, in inches
1	2	1.7
	10	2.7
	100	4.0
3	2	2.2
	10	3.5
	100	5.2
6	2	2.1
	10	4.2
	100	6.2
24	2	3.6
	10	5.6
	100	8.6

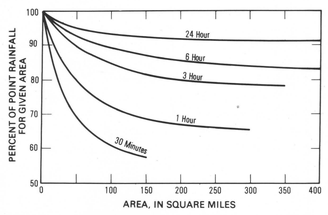


Figure 2.–Area point rainfall adjustment curve (Weather Bureau, 1961).

Table 2.–Flood peak and unit discharges of the August 27-28 flood and completed flood frequencies for selected sites.

Site	1/ Gaging station	Measurement site and selected basin and climatic characteristics 2/	Flood frequency data: Recurrence interval (years)	Flood frequency data: Discharge (ft^3/s)	August 27-28 flood data: Peak discharge (ft^3/s)	August 27-28 flood data: Unit discharge ($ft^3s^{-1}\ mi^{-2}$)	Previous maximum flood data: Date	Previous maximum flood data: Gage height (ft)	Previous maximum flood data: Discharge (ft^3/s)	Period of record
1.	07311200	Blue Beaver Creek near Cache	25	5,860			5/6/69	12.17	3050	1964-present
		Drainage area 24.4 mi^2	50	7,720						
		Slope 36/4 ft/mi	100	9,850						
		Precipitation 30 in/yr			13,500 3/	547				
2.		West Branch Blue Beaver Creek	25	2,500						
		Drainage area 4.67 mi^2	50	3,190						
		Slope 57.2 ft/mi	100	4,050						
		Precipitation 30 in/yr			6,370	1,360				
3.		Unnamed Blue Beaver Creek Tributary	25	477						
		Drainage area 0.45 mi^2	50	607						
		Slope 49.4 ft/mi	100	751						
		Precipitation 30 in/yr			933	2,210				
4.		West Cache Creek near Cache	25	13,400						
		Drainage area 63.1 mi^2	50	17,000	13,600	216				
		Slope 38.4 ft/mi	100	22,000						
5.		Post Oak Creek near Cache	25	20,700						
		Drainage area 148 mi^2	50	26,100	23,000	155				
		Slope 22.7 ft/mi	100	33,900						
6.		West Cache Creek near Faxon	25	30,500						
		Drainage area 285.4 mi^2	50	38,400						
		Slope 18.4 ft/mi	100	50,100	45,700	160				
		Precipitation 30 in/yr								

1/ The locations of indirect measurement sites are shown on figure 3.

2/ Basin characteristics obtained according to Thomas and Corley, 1977.

3/ Maximum gage height of the August 1977 storm was 18.02 ft.

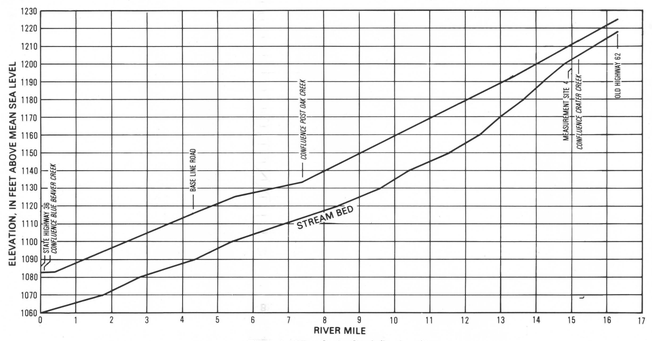


Figure 4.–West Cache Creek flood profile.

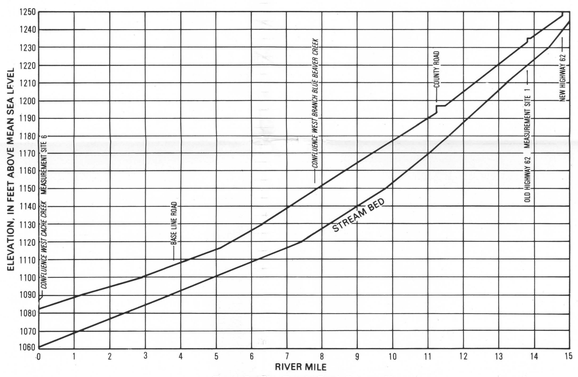


Figure 5.–Blue Beaver Creek floor profile.

STORM RUNOFF

The intense rainfall in the area resulted in extensive runoff and local flooding throughout the area between West Cache Creek and Blue Beaver Creeks. The peak discharge was determined by indirect methods (Matthai, 1967, and Dalrymple and Benson, 1967) at six locations as shown on figure 3. An indirect measurement was also made on Blue Beaver Creek at old highway 62 near the upper end of the study area at U.S. Geological Survey streamflow station 07311200, Blue Beaver near Cache. Discharges of the West Branch of Blue Beaver Creek and a small unnamed tributary 3 mi east of Cache on old highway 62 were determined to obtain the amount of runoff that occurred near the center of the storm. The West Cache Creek peak discharge was determined 2 mi south of Cache and just below the mouth of Blue Beaver Creek near Faxon.

Comparisons of the size of floods between streams and at different points along the same stream were facilitated by determining selected flood frequencies (Thomas and Corley, 1977) at each point where a peak discharge was computed for the August 27-28 storm. The flood discharges in table 2 indicate that the August 27-28 flood discharges ranged from a 25-year flood on upper West Cache Creek to more than a 100-year flood on West Branch of Blue Beaver Creek. Unit discharges for the August 27-28 flood are also included in table 2 and indicate that runoff was as high as 2,210 ($ft^3s^{-1}\cdot mi^{-2}$) in the upper reaches of West Cache and Blue Beaver Creeks.

Additional highwater marks located approximately every mile were surveyed to mean sea level datum along selected streams to determine the flood crest elevation throughout the area. The elevation of the highwater marks were plotted according to their locations along the stream channel to establish flood profiles. Profiles for the major streams of West Cache Creek, Blue Beaver Creek, West Branch of Blue Beaver Creek and Crater Creek are shown in figures 4-7. Locations of selected physical features in the area are included on the profiles.

Elevations taken from the profiles were used to determine the flooded area as shown on the map in figure 3. Locations of points where flood discharges were determined are also shown.

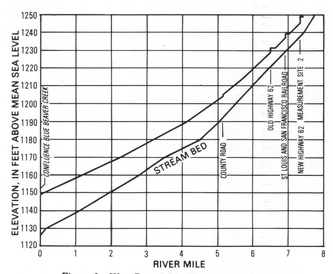


Figure 6.–West Branch Blue Beaver flood profile.

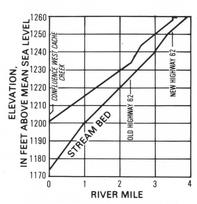


Figure 7.–Crater Creek flood profile.

SELECTED REFERENCES

Dalrymple, Tate, and Benson, M.A., 1967, Measurement of Peak Discharge by the Slope-Area Method: Techniques of Water-Resources Investigations of the U.S. Geological Survey Chapter A2, Book 3, 12 p.

Matthai, Howard F., 1967, Measurement of Peak Discharge at Width Contractions by Indirect Methods: Techniques of Water-Resources Investigations of the U.S.Geological Survey Chapter A4, Book 3, 44 p.

National Weather Service, August (1977), Monthly Report of River and Flood Conditions for Oklahoma. Limited circulation newsletter.

Thomas, W.O., Jr., and Corley, R.K., 1977, Techniques for Estimating Flood Discharges for Oklahoma Streams: U.S. Geological Survey, Water Resources Investigation 77-44, 171 p.

U.S. Weather Bureau, 1961, Rainfall frequency atlas of the United States for a duration from 30 minutes to 24 hours and return periods from 1 to 100 years: Technical Paper No. 40, Washington, D.C., 115 p.

U.S. Department of Agriculture, Soil Conservation Service in cooperation with Oklahoma Agricultural Experiment Station, 1967, Soil Survey, Comanche County, Oklahoma: U.S. Government Printing Office, Washington, D.C., 58 p.

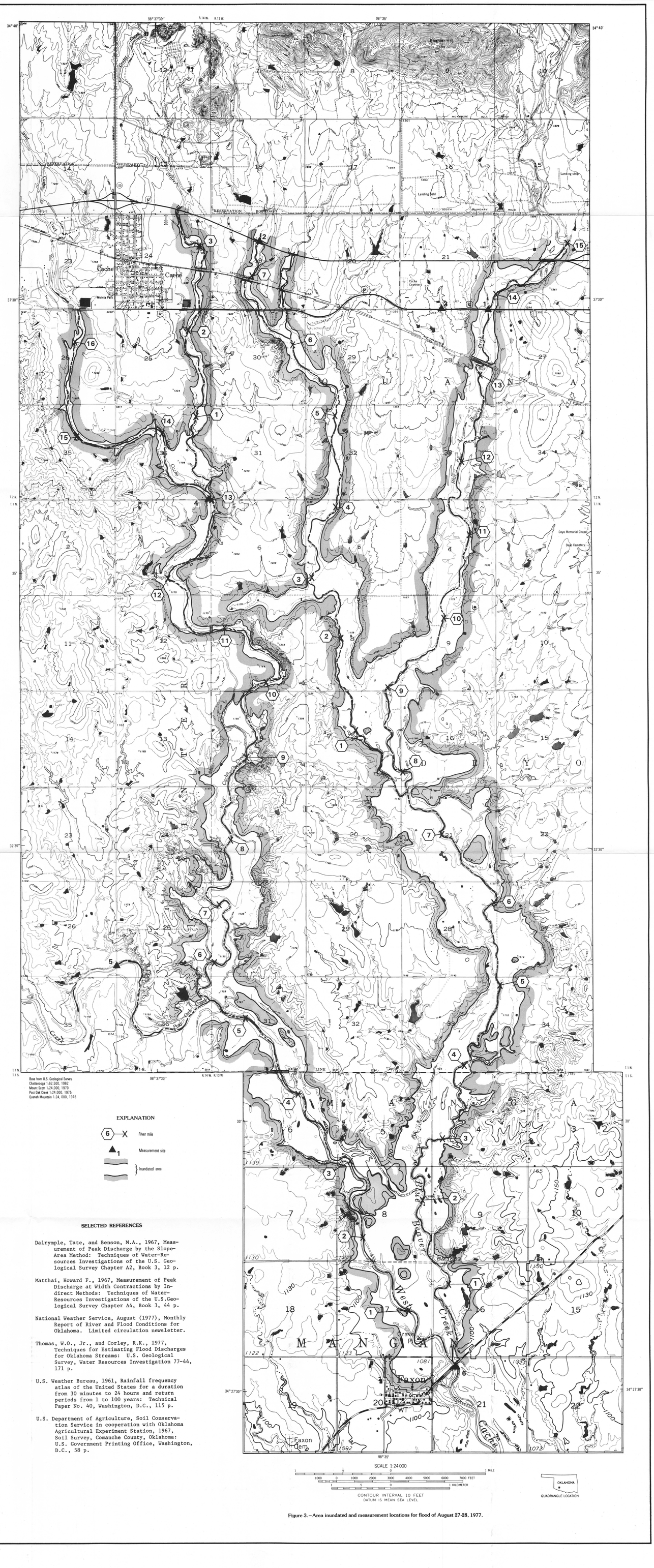


Figure 3.–Area inundated and measurement locations for flood of August 27-28, 1977.