DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED BY
UNITED STATES GEOLOGICAL SURVEY

WATER RESOURCES INVESTIGATION NO. 5-73
(SHEET 1 OF 2)

BASE BY U.S. GEOLOGICAL SURVEY
GARVIN AND IDABEL 7-1/2 MINUTE
QUADRANGLES — 1951 EDITION

OKLAHOMA
QUADRANGLE LOCATION

APPROXIMATE MEAN DECLINATION, 1950

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL.

Schematic diagram showing location of gaging stations and Pine Creek Reservoir (not to scale).

EXPLANATION
- GAGING STATION
- DISCONTINUED GAGING STATION
- (34) RIVER MILES
- DECEMBER 1971 FLOOD
- OCTOBER 1972 FLOOD

FLOODS OF 1971 AND 1972 ON GLOVER CREEK AND LITTLE RIVER IN SOUTHEASTERN OKLAHOMA

INTRODUCTION — Heavy rains of December 9-10, 1971, and Oct. 30-31, 1972, caused outstanding floods on Glover Creek and Little River in McCurtain County in southeastern Oklahoma. This report presents hydrologic data that document the extent of flooding, flood profiles, and frequency of flooding on reaches of both streams. The data presented provide a technical basis for formulating effective flood-plain zoning that will minimize existing and future flood problems. The report also can be useful for locating waste-disposal and water-treatment facilities, and for the development of recreational areas.

The area studied includes the reach of Little River on the Garvin and Idabel 7½-minute quadrangles (sheet 1) and the reach of Glover Creek on the southwest quarter of the Golden 15-minute quadrangle (sheet 2). The flood boundaries delineated on the maps are the limits of flooding during the December 1971 and October 1972 floods. Any attempt to delineate the flood boundaries on streams in the study area other than Glover Creek and Little River was considered to be beyond the scope of this report.

The general procedure used in defining the flood boundaries was to construct the flood profiles from high-water marks obtained by field surveys and by records at three stream-gaging stations (two on Little River and one on Glover Creek). The extent of flooding was delineated on the topographic maps by using the flood profiles to define the flood elevations at various points along the channel and locating the elevations on the map by interpolating between contours (lines of equal ground elevation). In addition, flood boundaries were defined in places by field survey, aerial photographs, and information from local residents. The accuracy of the flood boundaries is consistent with the scale and contour interval of the maps (1 inch = 2,000 feet; contour interval 10 and 20 feet), which means the flood boundaries are drawn as accurately as possible on maps having 10- and 20-foot contour intervals.

PRECIPITATION — Precipitation was 360 percent of normal in southeastern Oklahoma for December 1971. The 24-hour total of 11.34 inches at Bear Mountain Tower (fig. 1) from 0700 on December 9 to 0700 on December 10 was the highest 24-hour total in the State for any December since 1892. Precipitation also was above average in October 1972. The 24-hour total of 12.30 inches recorded at Hee Mountain Tower (fig. 2) from 0700 on October 30 to 0700 on October 31 was the highest 24-hour total in the State for any October since records began in 1892. Both 24-hour totals at Bear Mountain Tower and Hee Mountain Tower are in excess of the 100-year 24-hour precipitation total of 9.6 inches for this area of Oklahoma. The December 9-10, 1971, and October 30-31, 1972, average 24-hour precipitation totals over the Glover Creek and Little River basins have the following frequencies:

	Average 24-hour total		Frequency	
	Dec. 9-10, 1971	Oct. 30-31, 1972	Dec. 9-10, 1971	Oct. 30-31, 1972
Glover Creek basin	8.64	7.61	90 year	40 year
Little River basin	7.88	5.86	50 year	10 year

The above precipitation frequencies were computed from U.S. Weather Bureau Technical Paper No. 40 and have been adjusted to agree with point-rainfall frequencies. Isohyetal maps of the Dec. 9-10, 1971, 24-hour precipitation and the Oct. 30-31, 1972, 24-hour precipitation are shown in figures 1 and 2. The shaded areas on these figures are the Glover Creek and Little River basins.

The average precipitation over the Glover Creek basin upstream from the gaging station at State Highway 7 (mile 9.2) and the Little River basin upstream from the gaging station at U.S. Highway 70 (mile 103.4) was 10.7 inches and 9.9 inches, respectively, during the December 1971 storm (2 days). The corresponding direct runoff was 9.0 inches on Glover Creek and 4.1 inches on Little River, which is 84 and 41 percent of the precipitation, respectively. The large percentage of runoff from the Glover Creek basin reflects the fact that the shallow soil zone in this region was already saturated by earlier rains. Runoff at the gaging station on Little River was affected by storage in Pine Creek Reservoir. This reservoir, located 4.7 miles upstream from the gaging station on State Highway 98, was closed in June 1969 and provides flood control for 635 square miles of the Little River basin.

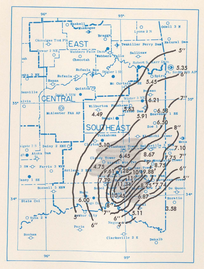

Figure 1. — Precipitation map of Dec. 9-10, 1971 24-hour precipitation

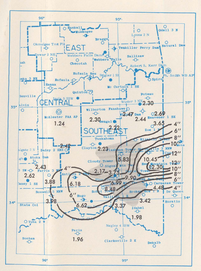

Figure 2. — Precipitation map of Oct. 30-31, 1972 24-hour precipitation

EXPLANATION
- Precipitation only
- Precipitation and Temperature
- Precipitation, Temperature and Evaporation

Shaded area is Glover Creek and Little River basins
Type of gage: ○ Non-recording
● Recording ◑ Both types

Double circle combinations indicate the availability of more detailed meteorogical data.

FLOOD HEIGHT AND DISCHARGE — The height of a flood at a gaging station is usually stated in terms of gage height, or stage, which is the elevation of the water surface above a selected datum plane. In this report, all flood heights at gaging stations are reported as feet above mean sea level or gage height, feet above gage datum. Depth of flooding at any point along Glover Creek and Little River can be estimated for either of the floods by subtracting the ground elevation from the water-surface elevation at that point as indicated by the profiles in figures 3 and 4. The approximate ground elevations can be determined from contours on the maps, or more accurate elevations can be obtained by leveling from nearby bench marks.

The rate of discharge of a stream is the volume of flow that passes a particular location in a given period of time. Discharge rates are usually expressed in units of cubic feet per second (cfs). Peak discharge is the maximum discharge attained by a flood and generally occurs at the time of maximum stage or height of the flood unless the stream is affected by variable backwater.

Flood stages, elevations, and discharges are listed in table 1 for the highest known floods and the 1971 and 1972 floods at the gaging stations in the study area.

Table 1. — Flood data for gaging stations in study area.

Station no.	Station name	Date of flood	Stage	Elevation	Discharge
07337900	Glover Creek near Glover, Okla.	1908	(Greater than May 1961 flood)		
		Feb. 1938	(Comparable to Oct. 1972 flood and possibly higher)		
		May 1961	28.54	407.54	88,200
		Dec. 10, 1971	29.72	408.42	98,600b
		Oct. 31, 1972	28.66	407.36	86,300b
07337500	Little River near Wright City, Okla.	Jan. 25, 1949	45.04	391.80	69,000
		Sept. 16, 1950	45.77a	392.53	75,400
		May 20, 1960	44.71	391.47	69,100
		May 6, 1961	45.60	392.36	78,200
		Dec. 10, 1971	35.68	382.44	11,200b
		Oct. 31, 1972	26.55	373.31	5,800b
07338500	Little River below Lukfata Creek, near Idabel, Okla.	Feb. 18, 1938	59.7	351.78	86,000
		Mar. 30, 1945	Unknown	Unknown	71,000
		Jan. 26, 1949	59.22	351.30	82,000
		Sept. 17, 1950	57.30	349.38	66,100
		Dec. 10, 1971	59.38	351.46	103,000b
		Nov. 2, 1972	52.45	344.53	22,500b

a Stage affected by backwater
b Provisional data

FLOOD PROFILES — As noted earlier, the profiles in figures 3 and 4 are based on high-water marks from field surveys and flood elevations recorded at stream-gaging stations. Consideration was also given to the streambed profile in drawing the profiles for the two floods. River miles shown on the profiles correspond with those marked along the streams on the flood map. To determine the elevation of either flood at some point along the stream, first determine the river mile of the point from the map, and second enter the appropriate profile with the river mile and determine the flood elevation.

The October 1972 flood profile shown in figure 4 is relatively flat upstream from Glover Creek which enters Little River at mile 128. Some flattening of the profile would be expected because no water was being released from Pine Creek Reservoir. Additional flattening was caused by the large amount of water from Glover Creek filling the channel of Little River and retarding its flow.

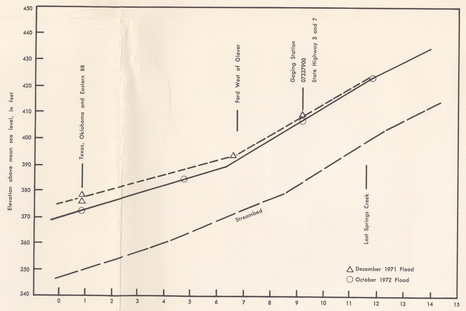

Figure 3. — Profiles of floods on Glover Creek

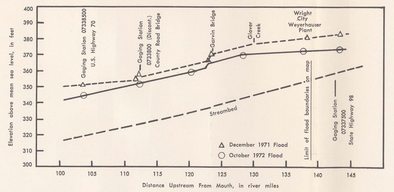

Figure 4. — Profiles of floods on Little River.

FLOOD FREQUENCY — Frequency of flooding on Little River and Glover Creek was derived by analyzing streamflow records at the three stations listed in table 1 and utilizing information about historical floods. Flood-frequency curves for the three stations are plotted in figures 5, 6, and 7. As applied to annual flood events, recurrence interval is the average interval of time between exceedances of the indicated flood magnitude. A flood of 100-year recurrence interval has a 1 in 100 or 1 percent chance of occurring in any given year. The fact that a major flood occurs in one year does not reduce the probability of a flood as great or greater occurring during the next year or even during the next week. This is illustrated by the fact that the two high recurrence interval floods of December 1971 and October 1972 occurred in consecutive years.

Frequency curves for Little River 2 miles west of Wright City on State Highway 98 (fig. 5) and Little River below Lukfata Creek, near Idabel (fig. 6) were computed by fitting the logarithms of annual floods to a Pearson Type III distribution in accordance with Bulletin No. 15 of the Water Resources Council (1968). The annual peaks for these two stations are plotted using the recurrence interval formula $\frac{n+1}{m}$ (n is the number of years of record and m is the order of the annual floods with 1 as the highest flood). The annual peak data for the discontinued station Little River near Idabel (station No. 07338000) for the years 1930-46 were combined with Little River below Lukfata Creek, near Idabel (station No. 07338500) for the years 1947-73 because the drainage areas of the two sites differed by less than 5 percent. The frequency curve for Little River near Wright City (fig. 5) represents conditions prior to closure of Pine Creek Reservoir. The effects of this reservoir on the frequency curve are not evaluated in this report.

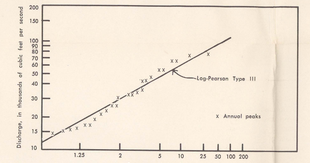

Figure 5. — Flood frequency curve for Little River near Wright City, Okla. (Station No. 07337500)

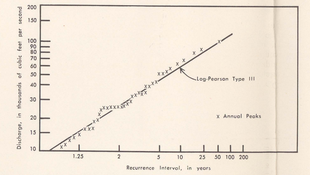

Figure 6. — Flood frequency curve for Little River below Lukfata Creek, near Idabel, Okla. (Station No. 07338500)

The frequency curve for Glover Creek near Glover, Okla. (fig. 7) is based on 13 years (1961-1973) of streamflow record and supplemented by historical data. Although the 1973 water year (a water year begins in October and ends in September) has not been completed, it has been assumed, for purposes of computing the frequency curve, that the October 1972 flood will be the highest flood in the 1973 water year. The 1908 flood on Glover Creek was higher than the May 1961 flood according to local residents but its relationship to the December 1971 flood is unknown. The February 1938 flood was comparable to the October 1972 flood and possibly higher. This historical information was utilized in computing the frequency curve for Glover Creek near Glover. The annual peaks are plotted in figure 7 using the recurrence interval formula $\frac{n+1}{m}$. The 1963 water year peak is not plotted because it had a very low recurrence interval. The log-Pearson Type III curve, based on the 13 years of streamflow record, was not used because consideration was not given to the historical floods.

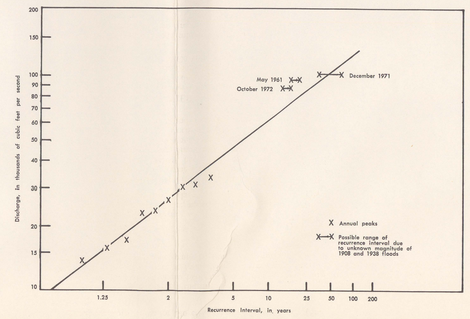

Figure 7. — Flood frequency curve for Glover Creek near Glover, Okla. (Station No. 07337900)

The December 1971 flood is probably the highest flood discharge at Glover Creek near Glover since at least 1908. Based on the combined record of the two gages near Idabel, it is the highest flood discharge on Little River below Lukfata Creek, near Idabel since at least 1930. The recurrence intervals of the December 1971 and October 1972 floods delineated on the map were computed from the frequency curves in figures 5, 6, and 7 and are summarized below:

Station no.	Station name	Recurrence intervals, in years Dec. 1971	Oct. 1972
07337900	Glover Creek nr. Glover, Okla.	50	30
07338500	Little River below Lukfata Creek, nr. Idabel, Okla.	50	1.7
07337500	Little River nr. Wright City, Okla.	1.04	<1.04

The low recurrence intervals for the Little River stations reflect the influence of Pine Creek Reservoir 4.7 miles upstream from the Wright City gaging station. Only the December 1971 flood on Little River below Lukfata Creek, near Idabel (station No. 07338500), has a high recurrence interval and this is because of the unusually high runoff from the intervening area between Pine Creek Reservoir and the gaging station. The floods on Little River undoubtedly would have been higher without Pine Creek Reservoir; however, the October 1972 flood (recurrence interval 1.7 years) inundated almost as much land as the December 1971 flood (recurrence interval 50 years). This inundation pattern reflects the low banks and wide, flat flood plain of Little River.

COOPERATION AND ACKNOWLEDGEMENT — Acknowledgement is made to the Corps of Engineers, U.S. Army, Tulsa District; to Weyerhaeuser Corporation; and to the Texas, Oklahoma, and Eastern Railroad for information on high-water marks. Acknowledgement is made to the McCurtain Gazette and the Broken Bow News for use of their newspaper files to research information on historical floods and to the National Weather Service for furnishing precipitation data. The McCurtain Gazette also furnished aerial photographs taken during flooding.

ADDITIONAL DATA — Additional information pertaining to floods on Little River, Glover Creek, and other streams in the area, can be obtained from a report by Westfall and Patterson (1964), and from the district office of the U.S. Geological Survey, 200 N.W. 4th Street, Oklahoma City, Okla.

REFERENCES CITED

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

Water Resources Council, 1967, A uniform technique for determining flood-flow frequencies: Bull. No. 15, Washington, D.C.: U.S. Government Printing Office.

Westfall, A. O., and Patterson, J. L., 1964, Floods in Oklahoma, magnitude and frequency: U.S. Geol. Survey open-file rept., 105 p.

Floods of 1971 and 1972 on Glover Creek and Little River in Southeastern Oklahoma

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