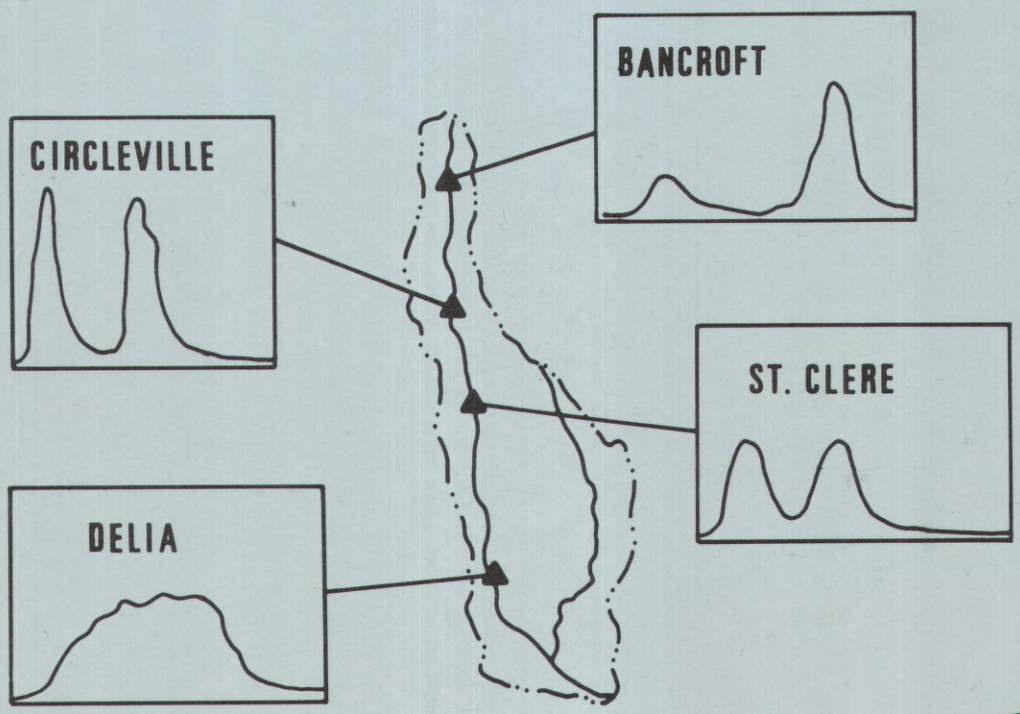
DESCRIPTION OF DATA-COLLECTION SYSTEM AND SYNOPSIS OF SELECTED HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS

U.S. GEOLOGICAL SURVEY

Open-File Report 78-678



Prepared in cooperation with
the Kansas Water Resources Board

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DESCRIPTION OF DATA-COLLECTION SYSTEM AND SYNOPSIS OF SELECTED HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS

By W. J. Carswell, Jr.

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DESCRIPTION OF DATA-COLLECTION SYSTEM AND SYNOPSIS OF SELECTED HYDROLGOIC DATA FOR SOLDIER CREEK BASIN, KANSAS

W. J. Carswell, Jr.

ABSTRACT

Soldier Creek basin is a long, narrow basin encompassing an area of about 290 square miles almost directly north of Topeka, Kansas. A wide range of hydrologic data has been collected in the basin since the spring of 1964. These data include rainfall, stream discharge, sediment concentrations, chemical quality of water, and ground-water altitudes.

The data collection system consists of 7 recording streamflow stations, 5 recording rainfall stations, 51 nonrecording rainfall stations, and 31 ground-water observation wells. Sediment and chemical quality of water samples were collected intermittently at selected sites.

A synopsis of the time and space distribution of rainfall and peak flow are provided in graphic and tabular form for selected events of rainfall and peak flow. Representative data concerning the chemical quality of water and the fluvial sediment also are included. Selected ground-water and seepage-invesitgation data are depicted graphically.

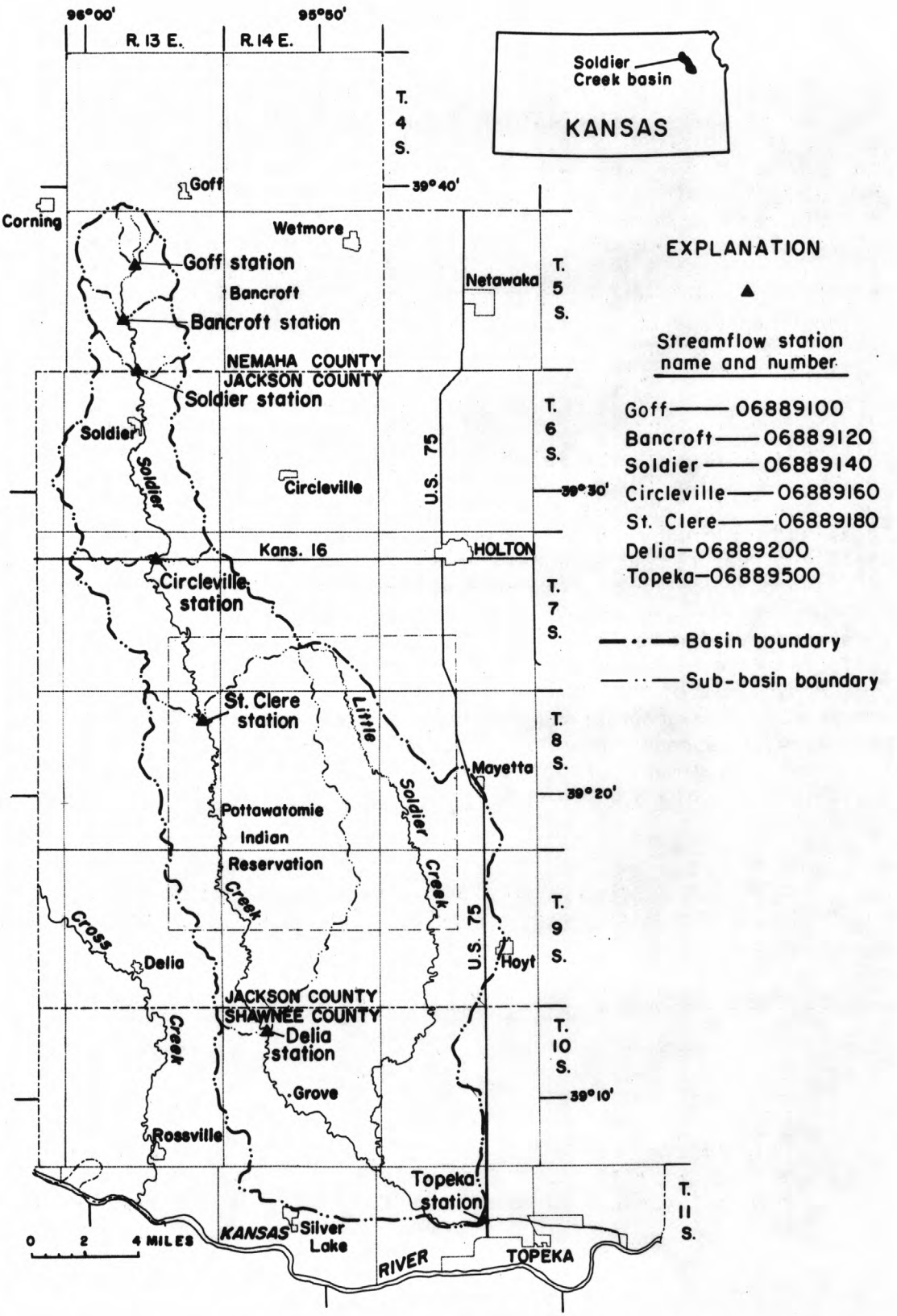


Figure 1.--Location of Soldier Creek basin and streamflow-gaging stations.

INTRODUCTION

In the spring of 1964, the U.S. Geological Survey in cooperation with the Kansas Water Resources Board designed and installed a hydrologic-data-collection system in Soldier Creek basin. The basic system was designed primarily to obtain detailed rainfall and runoff data. This basic system was expanded to include collection of supplementary data that would provide additional insight concerning the basin's general hydrologic framework. The basic system is composed of: (1) 7 recording streamflow stations, as shown in figure 1; (2) 5 recording rainfall stations; and (3) 51 nonrecording rainfall stations located within and adjacent to the basin. The remainder of the system includes intermittent chemical quality of water and sediment-sampling sites and 31 ground-water observation wells. A comprehensive compilation of hydrologic data collected in the basin is available to users in computer-readable form from a nine channel magnetic tape (Carswell, in preparation). If a potential user does not have access to computer facilities, tables of selected data can be obtained by request from the nearest U.S. Geological Survey, Water Resources Division, office.

The twofold purpose of this report is: (1) to describe the data-collection system and (2) to display selected data collected in the basin in such a way that a potential user can determine if the data available for the basin will fit his needs. The major thrust of this report will coincide with that of the system, that is major emphasis on the rainfall and flood-hydrograph data, supplemented with data for other aspects of the hydrologic setting. The data available for Soldier Creek basin will provide a wealth of information for water-resources studies including, but not limited to, rainfall-runoff modeling, flood routing, sediment yield, and the relation of surface water to ground water.

CONVERSION TABLE

For users of this report who may wish to convert American Customary units to metric units, the following factors and standard abbreviations are given:

American Customary unit	Multiply by	Metric unit
inch (in)	25.4	millimeters (mm)
foot (ft)	.3048	meter (m)
mile (mi)	1.609	kilometers (km)
acre	4,047	square meters (m^2)
square mile (mi^2)	2.590	square kilometers (km^2)
foot per mile (ft/mi)	.1894	meter/kilometer
cubic foot per second (ft^3/s)	.02832	cubic meter per second (m^3/s)

ACKNOWLEDGMENTS

Streamflow, rainfall, and sediment data used in this report were collected by the U.S. Geological Survey through cooperative programs with the Kansas Water Resources Board and the Corps of Engineers, U.S. Department of the Army.

Data on chemical quality of water were collected through the cooperative program between the U.S. Geological Survey and the Kansas Department of Health and Environment.

Observation wells for monitoring water-level changes were installed with assistance from the Kansas Geological Survey as part of the statewide cooperative ground-water investigation program.

GENERAL DESCRIPTION OF BASIN

Physical Features

The Soldier Creek basin (fig. 1) lies in the Dissected Till Plains and Attenuated Drift Border sections of the Central Lowlands physiographic province. Rock formations that crop out in the basin are principally shales and limestones of Pennsylvanian and Permian age.* Pleistocene glaciation has affected the stream patterns and has left till and outwash accumulations that are the predominant surface material over much of the basin. A thin cover of windblown silt or loess overlies the till in some areas, but the thicker deposits occur in the northern part of the basin. Alluvial sand, gravel, silt, and clay of Pleistocene to Holocene age, which are the major source of ground water, underlie the valleys of Soldier Creek and its major tributaries. For additional discussion concerning the geology and ground-water resources of the basin and surrounding area, the reader is directed to Walters (1953) and Ward (1974).

The Soldier Creek valley is about 48 miles long and ranges from about one-half mile wide in the upper reaches to about 2 miles wide near its entrance to the Kansas River valley. The lower reach of Soldier Creek flows in the valley of the Kansas River for about 10 miles.

The topography of the basin is undulating with relief commonly greater than 100 feet. The soil on the level alluvium in the valley consists of sand, gravel, silt, and clay. The side slopes are composed of stony or gravelly soils, whereas the uplands have a rather heavy-textured, nearly impermeable soil. Land use in the basin is almost exclusively agricultural with 54 percent cropland, 38 percent pasture, and 8 percent forested area and other uses.

* The stratigraphic nomenclature used in this report is that of the U.S. Geological Survey and may differ somewhat from that of the Kansas Geological Survey.

Climate

Soldier Creek basin lies in northeast Kansas where the climate is characterized by warm to hot summers, cold winters, moderate surface winds, and average annual precipitation of 35 inches. Warm, moist air from the Gulf of Mexico is the primary source of moisture for the precipitation that falls on the basin. Approximately 70 percent of the average annual precipitation falls during the growing season, April through September, with June having the maximum monthly average.

DESCRIPTION OF DATA-COLLECTION SYSTEM

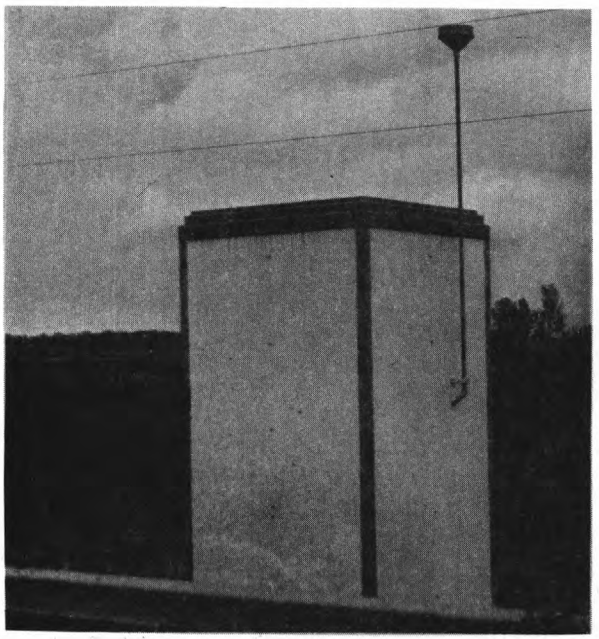
Rainfall Gages

Data on the quantity and areal distribution of rainfall during the period of study were collected at 56 sites in and adjacent to the Soldier Creek basin. Five of the rainfall-data sites are equipped with recording gages located at streamflow-gaging stations.

These synchronous rainfall and river-stage gages, as shown in figure 2, are located at the gaging stations near Goff, Bancroft, Soldier, Circleville, and St. Clere. The equipment for collecting the rainfall data is shown in figure 3. A funnel 7.51 inches in diameter, similar to the type used by the National Weather Service (National Oceanic and Atmospheric Administration, U.S. Department of Commerce), provides the desired ratio with the diameter of the collecting well. The funnel is supported approximately 11 feet above the ground by a 3/4-inch diameter galvanized intake pipe. Copper tubing connects the intake pipe to the collector well. The well is a 3-inch diameter galvanized pipe, 54 inches long, capped at one end, and is attached to the instrument shelf. A beaded chain attached to a solid plastic float activates a digital-punch recorder (15-minute punch interval).

Both digital-punch recorders for collecting rainfall data and river-stage data at each station are operated by the same timer to eliminate time differences. Prior to April 1969, the rainfall at these gage installations was recorded to an accuracy of 0.02 inch. Beginning in April 1969, rainfall was recorded to an accuracy of 0.01 inch.

The 51 nonrecording rainfall gages were installed at selected sites, as shown in figure 4. These rainfall gages were operated by local observers on a daily basis, except during the winter months (November through March). All observers were instructed to read the gage as near to 7:00 a.m. as possible. The rainfall was to be recorded to the nearest 0.01 inch for the preceding 24 hours on the day that the gage was read. Weather Service form 612-14 was used by the observers to record the rainfall. A spot comparison of observer readings with each other and with the recording cages indicated some inconsistencies. It was apparent that some readings were not made at 7:00 a.m., and occasionally some rainfall was recorded on the wrong day.



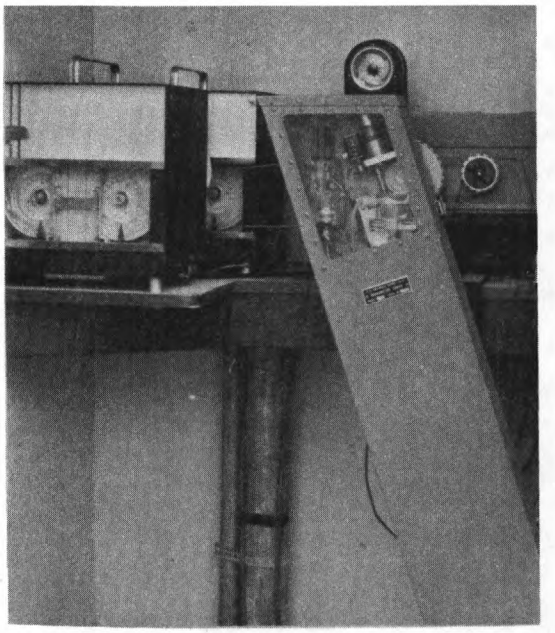
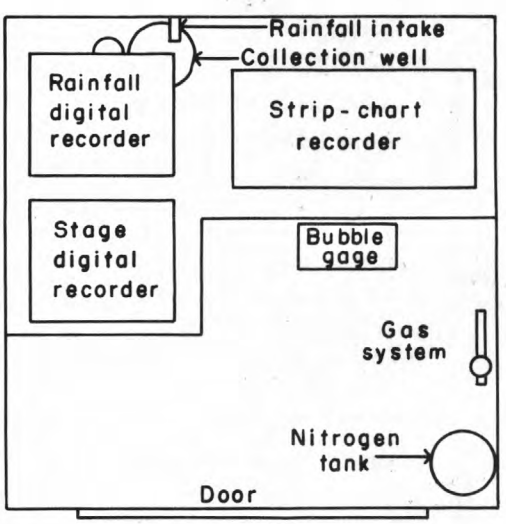
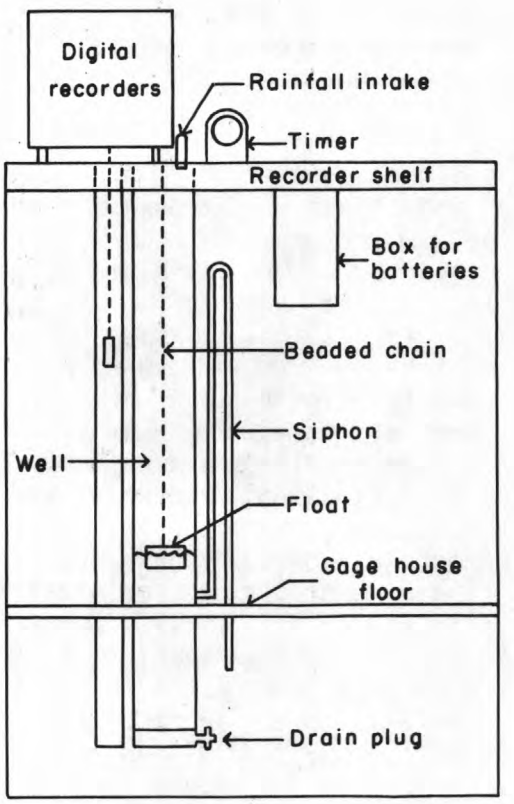


Figure 2.--Dual-purpose installation for collecting river-stage and rainfall data.



Top View



Front View

(bubble gage and strip-chart recorder not shown)

Figure 3.--Location of equipment in an installation for collecting river-stage and rainfall data.

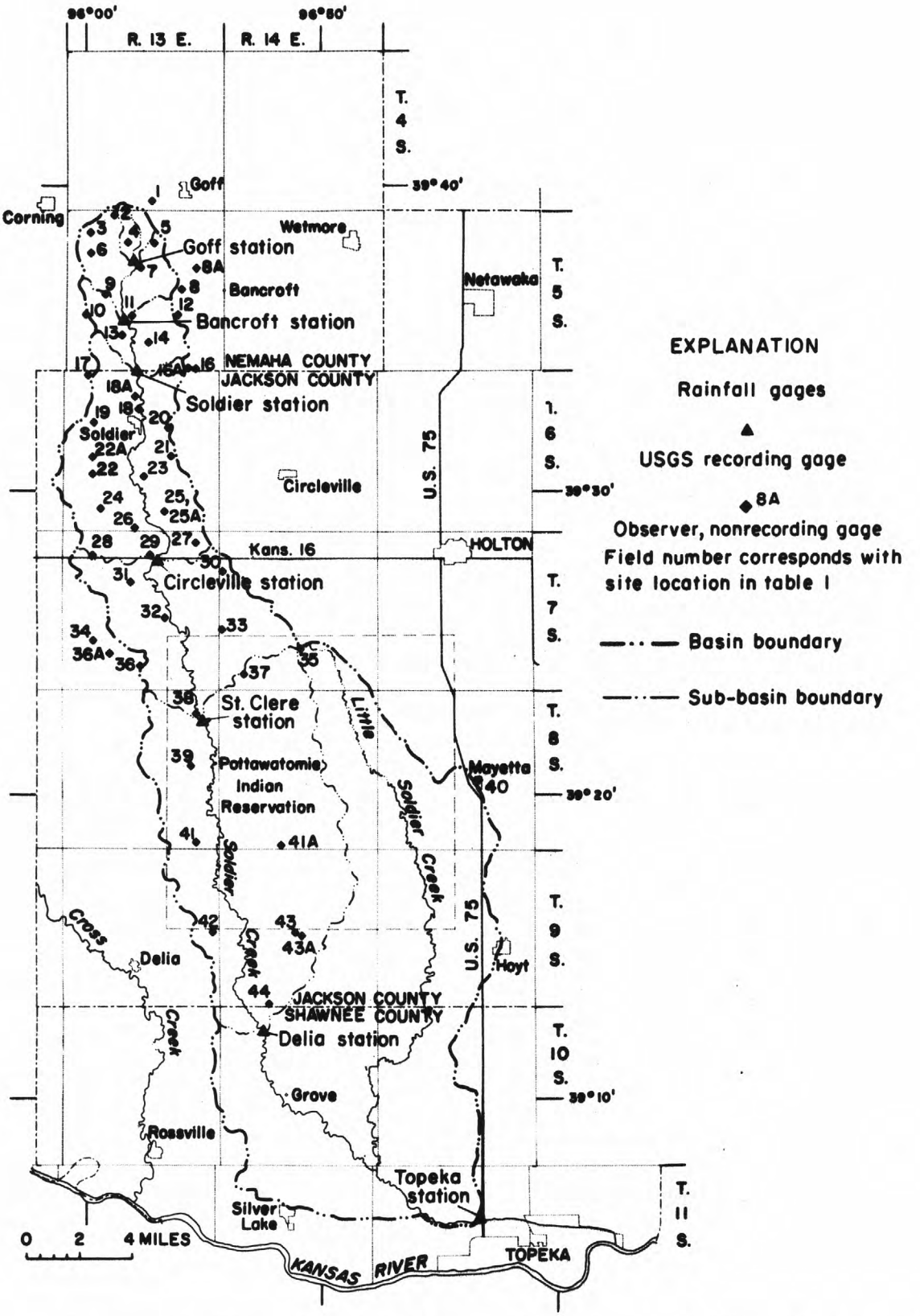


Figure 4.--General location of rainfall gages in and near Soldier Creek basin.

Table 1 gives a list of the nonrecording rain gages showing the assigned field number corresponding to figure 4, observer's name, site location, and inclusive dates of available data for each gage.

The location of rainfall-observation sites are described according to the Bureau of Land Management's system of land subdivision. The first number indicates the township; the second number, the range east of the Sixth Principal Meridian; and the third number, the section. The first letter designates the quarter section (160-acre tract); the second letter, the quarter-quarter section (40-acre tract); and the third letter, when used, designates the quarter-quarter-quarter section (10-acre tract). The 160-acre, 40-acre, and 10-acre tracts are designated A, B, C, and D in a counterclockwise direction beginning in the northeast quadrant. For example, the location of rainfall-observation site 5-13E-9BA is in the NE$\frac{1}{4}$, NW$\frac{1}{4}$, sec.9, T.5 S., R.13 E., as shown in figure 5.

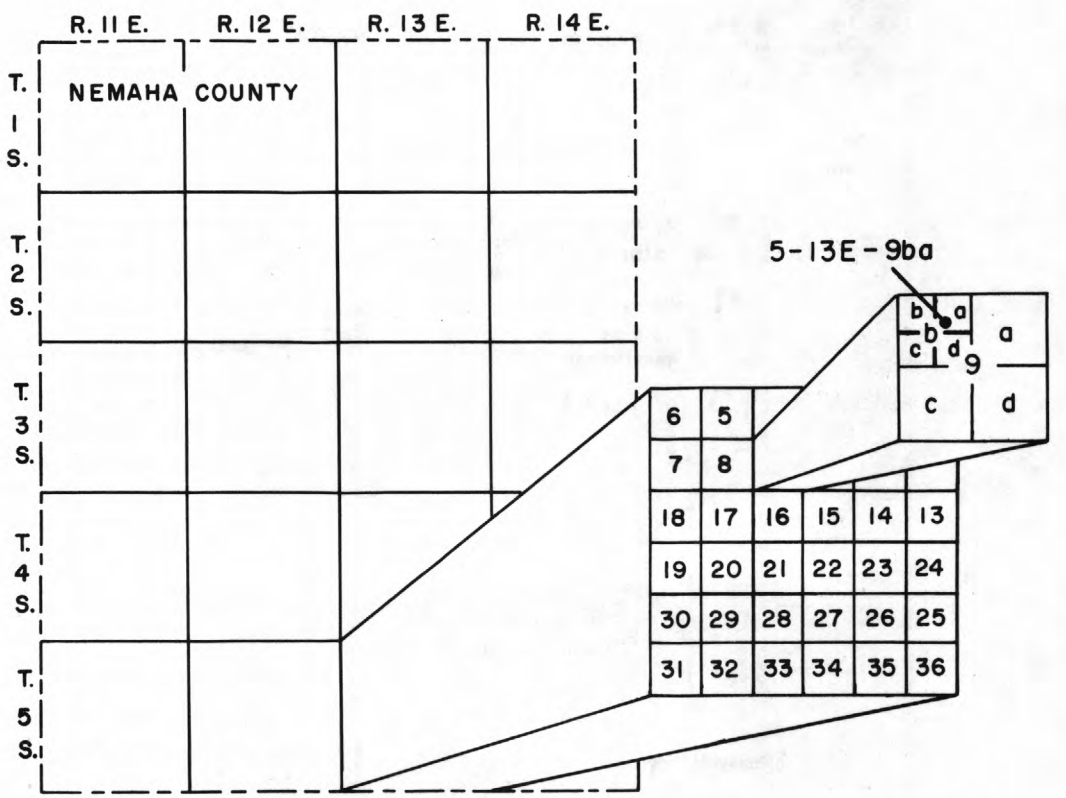


Figure 5.--Numbering system used for location of rainfall gages, observation wells, and seepage-investigations sites.

Table 1.--List of rainfall observers.

Field number	Observer	Site location	Record available
1	M. Powell	4-13E-34CB	May 1964 to May 1974
2	B. H. Engleken	5-13E-5AB	May 1964 to Sept. 1976
3	W. F. Eisenbarth	5-13E-6DA	May 1964 to Aug. 1969
4	L. Jerome	5-13E-9BA	Apr. 1964 to Sept. 1976
5	J. Mulroy	5-13E-10BB	May 1964 to Sept. 1976
6	D. Alexander	5-13E-7AD	May 1964 to Sept. 1976
7	E. Hermesch	5-13E-16AB	Apr. 1964 to Sept. 1965
8	C. Alley	5-13E-14CD	May 1964 to June 1969
8A	I. Bloom	5-13E-14AA	July 1969 to Sept. 1976
9	D. Feldkamp	5-13E-20BA	May 1964 to Sept. 1976
10	C. J. Meyer	5-13E-19DC	May 1964 to Sept. 1976
11	F. H. Swartz	5-13E-21DC	May 1964 to Nov. 1964
12	R. Watkins	5-13E-23CC	May 1964 + Sept. 1976
13	L. L. Barnes	5-13E-28CB	May 1964 to Oct. 1972
14	L. E. Watkins	5-13E-27CC	May 1964 to Sept. 1976
16	W. J. Leuthold	5-13E-35CD	May 1964 to Sept. 1964
16A	T. W. Mohringer	5-13E-35DD	Oct. 1964 to Sept. 1976
17	B. Coe	6-13E-6AA	May 1964 to May 1976
18	E. I. Schrieber	6-13E-9AD	May 1964 to Oct. 1964
18A	S. Franz	6-13E-4DD	Apr. 1965 to July 1965
19	E. Cordell	6-13E-8CC	May 1964 to Aug. 1968
20	E. Freel	6-13E-14BB	May 1964 to Sept. 1976
21	A. Staehli	6-13E-23BB	May 1964 to Sept. 1976
22	O. H. Moulden	6-13E-20CC	May 1964 to May 1969
22A	L. Stanton	6-13E-20BB	June 1969 to Sept. 1976
23	C. Rieschick	6-13E-22CC	May 1964 to Sept. 1976
24	K. Rieschick	6-13E-32BA	May 1964 to June 1969
25	H. Fisher	6-13E-34AA	May 1964 to May 1974
25A	R. Dugan	6-13E-34DA	May 1973 to Oct. 1975
26	E. Claycamp	6-13E-33DD	June 1964 to Sept. 1976
27	H. Wolcott	7-13E-1BC	May 1964 to July 1968
28	F. Fisher	7-13E-5CC	May 1964 to Sept. 1976
29	J. Cowger	7-13E-3CD	Apr. 1964 to Sept. 1976
30	G. Beightel	7-14E-7BC	May 1964 to Sept. 1976
31	W. Stewart	7-13E-9DC	May 1964 to Oct. 1971
32	A. Cowger	7-13E-22AA	May 1964 to Sept. 1976
33	L. Valburg	7-14E-19CC	May 1964 to May 1976
34	W. C. Eby	7-13E-29BB	May 1964 to Oct. 1968
35	M. McClane	7-14E-27BC	May 1964 to Oct. 1973
36	R. May	7-13E-33AA	June 1964 to Aug. 1966
36A	M. Dibbern	7-13E-29DA	May 1967 to May 1968
37	H. Brucken	7-14E-31AD	May 1964 to Sept. 1976
38	F. Kruger	8-13E-1CC	Apr. 1964 to Sept. 1976
39	E. W. Houck	8-13E-14DD	May 1964 to Sept. 1976
40	I. James	8-15E-22AD	July 1965
41	L. V. Keller	8-13E-36CC	May 1964 to Aug. 1965
41A	M. Wyatt	8-14E-33CD	May 1968 to Sept. 1973
42	D. Wulfkuhle	9-13E-24AB	May 1964 to Sept. 1976
43A	M. Bailey	9-14E-22BB	May 1964 to Oct. 1964 July 1969 to Sept. 1976
43	V. E. Albright	9-14E-21AA	Apr. 1965 to June 1969
44	J. Bahner	9-14E-32DD	May 1964 to Aug. 1966

Streamflow Gages

Streamflow data summarized in this report were obtained at seven streamflow-gaging stations having contributing drainage areas ranging in size from 2.06 to 290 square miles. Two gaging stations in existence prior to the investigation provided long-term records for the basin. Five additional gaging stations were installed to provide streamflow records from various sizes of contributing drainage areas.

The earliest records are from the station on Soldier Creek near Topeka, established in May 1929, and from the station on Soldier Creek near Delia, established in October 1958. The remaining five gaging stations on Soldier Creek were installed in March 1964. Each station is equipped with a digital-punch recorder (15-minute interval) and a graphical recorder driven by a 50-foot-range bubble gage for monitoring the river stage.

Streamflow data collected at each gaging station consists of stage records and current-meter measurements of discharge at specific stages. Rating curves and tables for each station are prepared showing the stage-discharge relation defined by the discharge measurements. Extensions to the rating curves, necessary to express discharge greater than measured, are made on the basis of indirect measurements of peak discharge, velocity-area studies, or a logarithmic plotting of the stage-discharge relation. The mean daily discharges and peak discharges are computed from recorded gage heights and rating tables.

In appendix A, a detailed description of each gaging station is given that includes: station name and number (assigned by U.S. Geological Survey); location by latitude and longitude, land subdivision, geographic description, and distance above mouth in stream miles; drainage area; date of installation and operating agency; type of gage and recorder installation; gage datum above NGVD (National Geodetic Vertical Datum) of 1929; channel-control conditions; historical record of operating conditions, floods, and regulation; and selected climatic and physiographic parameters.

Water-Quality Sampling Sites

The water-quality data collected in Soldier Creek basin is not as detailed as that for rainfall and streamflow. However, a significant amount of water-quality data has been collected in the basin. The water-quality information includes chemical and physical characteristics, and fluvial-sediment data.

The chemical-quality information includes concentrations of individual dissolved constituents, expressed in milligrams per liter (mg/L), and other characteristics such as hardness, sodium-absorption ratio, specific conductance, and pH. The Soldier Creek near Delia station is the only site at which chemical-quality data were routinely collected, and records from November 1965 to September 1975 are published in the annual Water Resources Data for Kansas (U.S. Geological Survey, 1964-76).

Fluvial-sediment data collected during the study at all streamflow-gaging sites except Topeka include the water discharges, concentrations of suspended sediment, and the particle-size distribution of both bed material and suspended sediment. Standard techniques of the U.S. Geological Survey were used to collect and analyze the sediment data. Suspended-sediment samples were collected using depth-integrating and single-stage samplers.

SEEPAGE-SALINITY INVESTIGATIONS

As an additional aid to better define the general hydrologic framework, two seepage-salinity investigations have been conducted in the Soldier Creek basin. A list of the measurement and sampling sites, their location, river mile, and drainage area is given in table 2. Field numbers shown in the first column preceded by an R denote a main-stem site, and numbers preceded by a T denote a tributary site. For the user's convenience, the site location is in the same form as that used for the rainfall-observation sites. The station number is given in parenthesis below the site location if the site is a regular streamflow station. The latitude and longitude are given for each site to correspond with the location given in that form on the Soldier Creek data tape (Carswell, in preparation). The river mile and drainage area listed for mainstem sites correspond to the location at which the data were collected. If the site is on a tributary, the river mile is given for the point at which the tributary joins the main stem. The drainage area given in the table is the total area contributing from the tributary, with the data collected as close to the mouth as possible. Data obtained during the seepage investigations on November 7, 1963, and July 22, 1964, include water discharge and chemical analysis of the water sample collected at the time of each measurement. The location of main-stem sites of the seepage investigations is shown in figure 6.

Table 2.--List of seepage-investigation sites.

Field number	Site location (station number)	Latitude - Longitude		River mile	Drainage area (mi^2)
R1	5-13E-16ABB (06889100)	39°27'27"	95°57'57"	71.9	2.06
T1	5-13E-9DDC	39°37'29"	95°57'26"	71.7	.80
T2	5-13E-17DDC	39°36'43"	95°58'22"	70.0	4.11
R2	5-13E-28BBA (06889120)	39°35'42"	95°58'17"	68.7	10.5
T3	5-13E-29AAA	39°35'38"	95°58'22"	68.4	1.67
R3	6-13E-4AAB (06889140)	39°33'57"	95°57'45"	65.7	16.9
R4	6-13E-10BBB	39°33'02"	95°57'35"	64.5	20.2
T4	6-13E-4DDC	39°33'08"	95°57'52"	64.2	1.93
T5	6-13E-9DAB	39°32'36"	95°57'52"	63.5	1.68
R5	6-13E-15BBB	39°32'10"	95°57'35"	62.9	24.4
R6	6-13E-16DAD	39°31'37"	95°57'43"	62.1	25.6
T6	6-13E-16DBD	39°31'37"	95°58'00"	61.9	2.83
T7	6-13E-21CBB	39°30'51"	95°58'42"	60.3	2.21
R7	6-13E-28ABA	39°30'25"	95°58'00"	59.5	32.7
T8	6-13E-28AAA	39°30'25"	95°57'43"	59.2	1.71
R8	6-13E-28DAA	39°29'59"	95°57'43"	59.0	34.8
T9	6-13E-33AAA	39°29'33"	95°57'43"	58.3	4.95
R9	6-13E-34BBB	39°29'33"	95°57'35"	58.2	40.1
T11	7-13E-2CBB	39°28'14"	95°56'28"	55.7	1.83
T10	7-13E-4ADA	39°28'27"	95°57'43"	55.2	1.85
R10	7-13E-10ABB (06889160)	39°27'47"	95°57'00"	55.2	49.3

Table 2.--List of seepage-investigation sites (continued).

Field number	Site location (station number)	Latitude - Longitude		River mile	Drainage area (mi^2)
T12	7-13E-3CDD	39°27'54"	95°57'10"	55.1	.66
R11	7-13E-10DCC	39°27'02"	95°57'01"	53.4	51.5
T13	7-13E-16AAD	39°26'49"	95°57'43"	52.8	4.43
T14	7-13E-16CDC	39°26'10"	95°58'25"	51.6	2.26
R12	7-13E-23BBB	39°26'03"	95°56'28"	51.5	60.4
T15	7-13E-23BCC	39°25'43"	95°56'28"	50.9	.29
T16	7-13E-26AAA	39°25'11"	95°55'29"	48.9	11.1
T17	7-13E-36BBC	39°24'12"	95°55'21"	47.3	.20
R13	7-13E-35DDA	39°23'39"	95°55'29"	46.3	75.9
T18	7-13E-36CCC	39°23'32"	95°55'21"	46.2	1.18
R14	8-13E-12BAB (06889180)	39°22'33"	95°55'05"	44.5	80.5
T19	8-13E-12BBC	39°22'27"	95°55'21"	44.2	1.49
T20	8-13E-12AAA	39°22'33"	95°54'23"	43.0	1.05
R14A	8-13E-13DDB	39°21'02"	95°54'31"	40.0	93.5
T21	8-13E-13CCC	39°20'55"	95°55'21"	39.1	3.22
T22	8-13E-25DCC	39°19'11"	95°54'48"	38.3	1.25
T23	8-14E-30BAA	39°19'56"	95°53'48"	36.5	13.4
R15	8-13E-36AAA	39°19'04"	95°54'23"	36.1	106
T24	8-14E-31BDA	39°18'50"	95°53'48"	35.7	7.16
R16	9-13E-12AAA	39°17'19"	95°54'23"	32.4	119
T25	9-14E-17AAA	39°16'26"	95°52'07"	28.4	11.1
R17	9-14E-29BBB	39°14'42"	95°53'05"	26.6	140
T26	9-14E-29AAA	39°14'42"	95°52'07"	26.4	8.35

Table 2.--List of seepage-investigation sites (concluded).

Field number	Site location (station number)	Latitude - Longitude		River mile	Drainage area (mi^2)
R18	9-14E-31DDD	39°13'03"	95°53'14"	23.8	151
T27	10-14E-5BBA	39°12'57"	95°52'57"	23.3	1.20
R19	10-14E-5DCD (06889200)	39°12'08"	95°52'25"	21.9	157
R20	10-14E-21DBC	39°09'47"	95°51'26"	17.0	167
T28	10-14E-21ACD	39°10'00"	95°51'17"	16.7	12.0
R21	11-14E-1AAA	39°07'43"	95°47'55"	11.2	188
T29	11-15E-6BBB	39°07'43"	95°47'47"	11.0	74.4
R22	11-15E-6DDD	39°06'57"	95°46'49"	9.6	264
T30	11-15E-5CDD	39°06'57"	95°46'16"	9.1	9.64
T31	11-15E-5CDC	39°06'57"	95°46'24"	9.1	9.64
T32	11-15E-17BBB	39°05'58"	95°46'41"	7.9	8.20
R23	11-15E-16ADB	39°05'45"	95°44'45"	7.4	284
T33	11-15E-10CBB	39°06'24"	95°44'28"	6.8	5.45
R24	11-15E-14BBC (06889500)	39°06'00"	95°43'27"	6.0	290
T34	11-15E-11CAB	39°06'24"	95°43'05"	5.5	0.57
R25	11-15E-12CBC	39°06'17"	95°42'16"	4.9	291
T35	11-15E-12BDD	39°06'30"	95°41'51"	4.5	22.8
R26	11-16E-18ADC	39°05'38"	95°40'19"	3.0	316
T36	11-16E-8DBA	39°06'24"	95°39'21"	1.8	12.3
R27	11-16E-16CAA	39°05'32"	95°38'31"	1.4	331

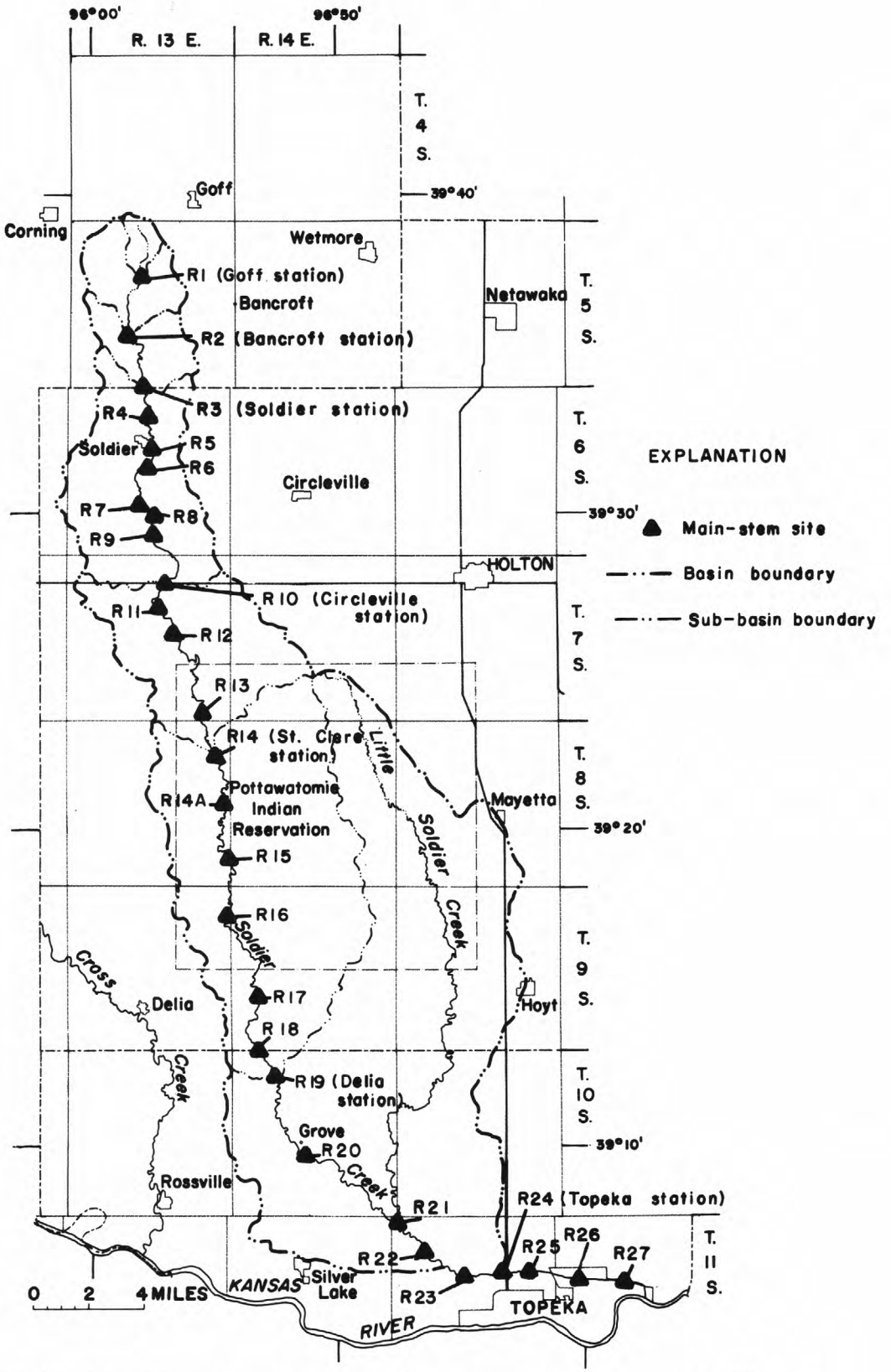


Figure 6.--Location of main-stem sites of seepage investigations.

Ground-Water Observation Wells

In August 1963, observation wells were installed to measure the water-table altitude in the alluvial deposits beneath the flood plain of Soldier Creek. At the streamflow-gaging sites near Goff, Bancroft, Soldier, Circleville, St. Clere, and Delia, wells were located in a line approximately perpendicular to the stream (fig. 7). For monthly observations, holes were bored to bedrock and cased with 1.0- or 1.25-inch pipes that generally were installed with 2-foot lengths of screen. Two wells at the St. Clere site were cased with 5-inch pipe and equipped with float-operated graphic recorders for continuous measurements. The location, description, and years of available record at each site are given in appendix B.

The numbering system for well locations given in appendix B is the same as that described for the rainfall-observation sites. When two or more wells are located in the same 10-acre tract, they are numbered serially, beginning with 2, in the order in which they were installed. Altitude of land surface at each well was determined by leveling to the top of the pipe, then subtracting from that altitude a distance that would give the best approximation of the land surface at the well. Measurements of water levels in observation wells are given in appendix B with reference to LSD (land-surface datum), which is approximately the land surface at each well. Measurements are made from a fixed point that may be a short distance above or below land surface and then adjusted so that the water levels are reported in feet below LSD.

DATA FOR SELECTED EVENTS OF RAINFALL AND PEAK FLOW

This section contains a tabulation (table 3) and graphic presentations (figs. 8-29) of selected events of rainfall and peak flow from 1964 to 1974. The table and graphs have been included to provide a synopsis for the time and space distribution of the rainfall, peak flows, and flood hydrographs for the largest events of rainfall and peak flow. It is hoped that presentation of the data in this form will enable the reader to determine if the data available for Soldier Creek basin would be useful for his studies.

Observer-rainfall data were used to obtain the areal distribution of rainfall, which is shown with each event. The more detailed time distribution of the rainfall and resulting flood hydrograph is shown in three groups. Rainfall and flood-hydrograph data from the Goff and Bancroft recording streamflow gages are shown together, as are data from the Soldier and Circleville recording streamflow gages. Rainfall from the St. Clere rain gage is shown in the group with the St. Clere, Delia, and Topeka flood hydrographs. Rainfall is shown in inches, and discharge on the flood hydrograph is shown in cubic feet per second. Both time and flood hydrograph scales may differ from one group to the next.

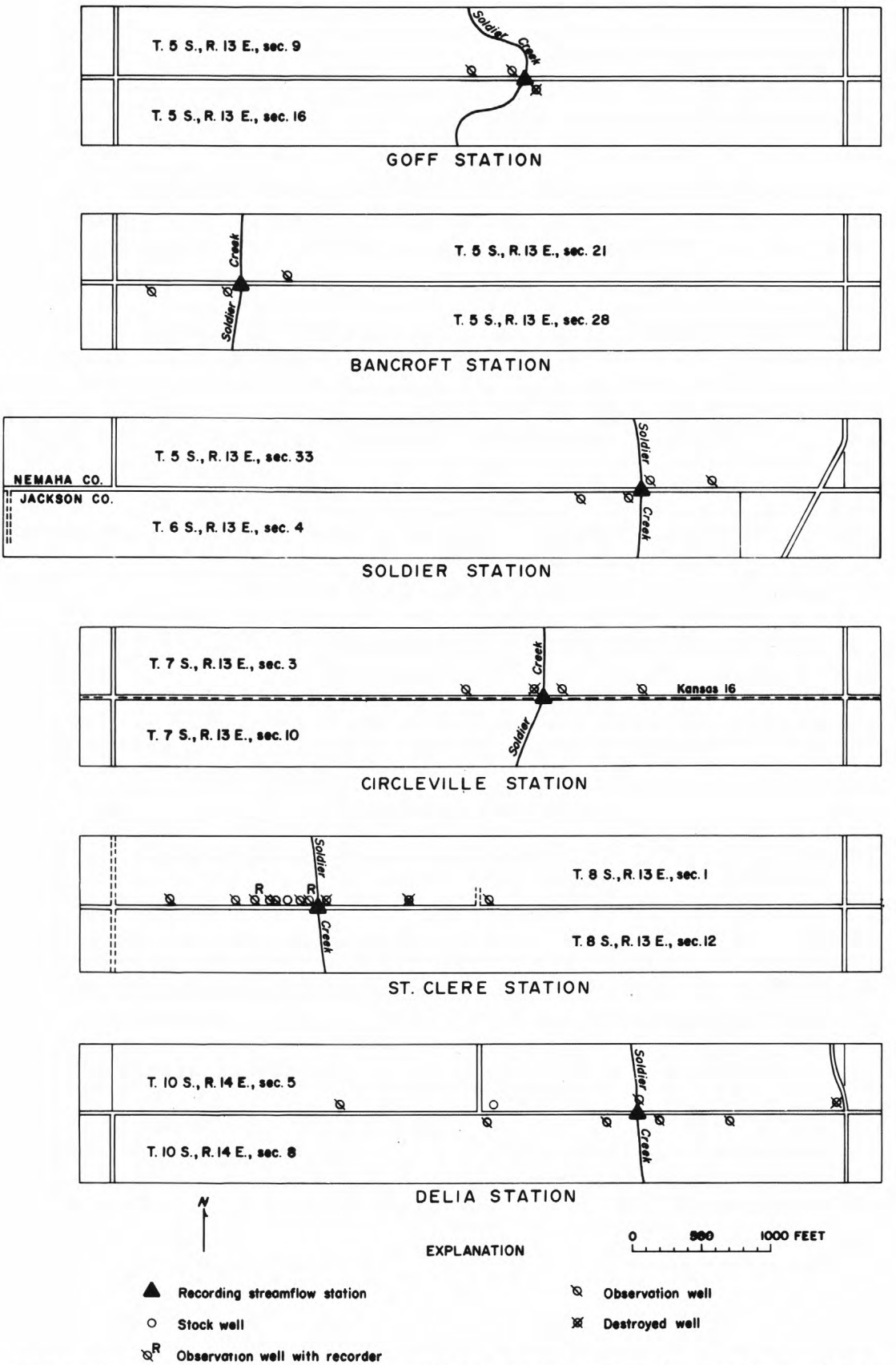


Figure 7.--Location of water wells at the upper streamflow-gaging sites.

Table 3.--Soldier Creek Rainfall and Peak-Flow Data.

1964 WATER YEAR

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1/]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
4-22-64	0.82		0.82		0.84	84	0.86		0.86				0.81
4-23-64	0	18	0	68	*		0	105	.20	180		127	.03
4-24-64	0		0		*		0		0		91		0
4-25-64	.14		.14		*		.14		.04				.34
4-26-64	1.98	139	1.64	695	*	960	.98	1270	.08	1150			.53
4-27-64	.04		.02		*		.02		.02		903	670	T
5-01-64	.50	7.3	.52	24	.62		.52		.52	110			.11
5-02-64	0		0		0		0		0		97	169	0
5-06-64	.34		.36		.30		.32		.84	95	802	1330	.24
5-24-64	.28	1	.30	<1	.54	1	1.10	174	.92	92			.19
5-25-64	0		0		0		0		0			143	0
5-26-64	.88	1.6	.72	<1	1.00	2.3	.82		.56				.03
5-27-64	.76	2.8	.74	1.0	.72	15	.80	136	.64				1.12
5-28-64	0		.02		.02		.02		.06	130	150		T
5-29-64	0		0		0		0		0			246	T
6-04-64	2.14	26	2.84	390	2.82	1340	2.28	3100	1.00	2890			.64
6-05-64	0		0		0		.04		.10		1860	1990	.62
6-11-64	1.40	64	1.44	420	1.20		.76		1.26				.23
6-12-64	.86	112	.94	669	.96	1540	.80	3000	.98	3010		3480	1.80
6-13-64	0		0		0		0		0		2190		.50
6-14-64	1.30	239	1.00		1.12		1.08		1.18				1.14
6-15-64	0		.02	982	0	1150	0	2300	0	2350	1800	2630	.01
6-21-64	1.38		1.48		1.22		.74		.84				.04
6-22-64	.92	192	1.34	770	1.54	1430	1.96	4750	1.52	6310			1.25
6-23-64	.02		.02		0		0		0		3050	3190	0
7-08-64	.14		.18		.14		.46		.80	21	212	254	.63
7-11-64	.18	0	.18	0	.58	1.1	.96	13	2.72	614	737	834	.45
8-27-64	1.18	.1	1.08	0	1.16	2.1	.80	16	.52				.64
8-28-64	0		0		0		0		0	7.5			T
8-31-64	1.04	1.0	1.06	0	.24	1.6	0.80	19	1.04	14	15	1030	3.28

1965 WATER YEAR

11-03-64	1.00	1.0	.74	0	.52	0.3	1.18		1.10				.60
11-04-64	.02		.02		.02		.04		.06	21			.48
11-15-64	1.60	4.4	1.40	0	1.42	1.3	1.52		2.26				4.66
11-16-64	.08		.08	0	.10	0	.02	0	0	92	814	1560	.15
1-01-65	.74		.78		.94	15	1.54	420	1.62	897			.67
1-02-65	0	2.6	0	0	0	6	0		0		2170	4040	0
2-28-65	1.42		1.78	76	1.76	1510	.98		.62				.20
3-01-65	.12	187	.14		.12		.04	4160	.10	3890	2480	2640	.34
3-16-65	.80		.72		.76		.74		.76				.88
3-17-65	.22	34	.24	262	.20	*	.16	598	.12		882	1920	.04
4-24-65	*		.50		.54		.58	8	.56				.34
4-25-65	*		.26	3	.24		.24	72	.20	106	538	1130	.29
5-18-65	.52		.42		.74	5	.44	13	.16		83		.06
5-19-65	0		0		0		0		0			318	T
5-21-65	.48	<1	.38		.50	16	.76	16	.62	19	244	313	.53
5-24-65	.50	3	.42		.50		.46	25	.34				.98
5-25-65	.18		.20		.22		.14		.14				T
5-26-65	.06		.06		.04		.10		.16		112	1140	.99
5-31-65	.18		.20		.42		.32		.46				.38
6-01-65	.44		.52		.78	40	1.36	414	.28	345	228		.48
6-02-65	0		0		.02		0		0			268	T
6-04-65	.68	3	.56		.54		.60		.58				1.37
6-05-65	.50	18	.50	2.4	.40	9.6	.32	93	.36	131		846	.54
6-06-65	.06		.04		0		0		0		124		0
6-07-65	.46		.54	2	.48		0		.50				.57
6-08-65	.12	1	.08	9	.06	24	0	52	.06			217	.29
6-09-65	.14	6	0	60	.56	92	0	187	.66	221		685	1.07
6-10-65	0		0		0		0		0		152		0

1/ NWS - Rainfall records at Topeka from National Weather Service

*Gage Malfunction

Note: Rainfall data for Circleville is questionable June 7-9, 1965.

Table 3.--Soldier Creek Rainfall and Peak-Flow Data (Continued).

1965 WATER YEAR--Continued

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
6-25-65	1.86	177	1.40	444	.24	450	0		.12			1680	.75
6-26-65	1.16	70	1.30	588	2.58	656	2.00	1210	1.56	1170			1.34
6-27-65	1.50		1.28		1.42		1.32		1.38		984		.52
6-28-65	.44	238	.66	1360	.50	1580	.54	3640	.76	3980		6940	1.58
6-29-65	.14	6	.14	25	.18	31	.08		.10		2410		T
6-30-65	.16		.14	10	.16		.42	191	.82	528	1640	3810	.74
7-01-65	.28	19	.22	82	.34	82	.20	1070	1.10	706		1830	T
7-02-65	.48	26	.92	283	.30	678	.04	658	.02				.14
7-06-65	.04	18	*	103	.36	119	1.64	1460	.50	1380	836		1.19
7-07-65	0		*		.02		0		0			972	0
7-11-65	.38	49	*	336	.96	367	.50	345	.20	331			T
7-12-65	0		*		0		0		0		404	305	0
7-27-65	.40		.38		.46		.74		1.68	49	111		.72
7-28-65	0		0		0		0		0			125	0
8-17-65	.46		.48		.68	2	1.14	4	.58				.06
8-24-65	.16		.20		.24		.36	2	1.22	16			.32
8-25-65	.10		.22		.10		.04		0		33		T
9-03-65	.86	<1	1.04	<1	.44		.28		.16				.14
9-04-65	1.66	24	1.80	90	2.72	388	2.36	1020	2.20	1010	913	1110	1.44
9-09-65	1.14	11	1.12	27	1.52	205	.94	1160	.58				.94
9-10-65	.10		.16		.16		.20		.22	700	504		.26
9-11-65	0		0		0		0		0			493	0
9-18-65	.54	1.1	.58	3.6	.56	13	.72	123	.64	148	160	668	.72
9-19-65	.46		.32		.30		.30		.36				.74
9-20-65	2.74	368	2.90		2.68	2330	3.08		2.56				2.09
9-21-65	0		0	2140	.26		.02	5120	.24	7780		5950	.05
9-22-65	0		0		0		0		0		5380		0
						1966 WATER YEAR							
12-23-65	1.14	14	1.20		1.18		1.12		1.14				1.32
12-24-65	.08		.12	61	.08		.08	446	.12	434	498	1000	.51
1-01-66	.22		.26		.34		.78	935	.50				.09
1-02-66	.06		.06		.06	24	.06		0	825	692	644	T
4-29-66	1.44	41	1.86	83	1.86	640	.28		.40				.22
4-30-66	.06		.08		.06		.08	846	.06	468	282		.12
5-01-66	0		0		0		0		0			234	
5-10-66	.24		.22		.46		.44		.40				.08
5-11-66	.52		.56		.32		.28		.78		90		.16
5-12-66	0		0		0		0		0			427	0
6-07-66	.18		.20		.28		.20		.16				.23
6-08-66	1.54	26	1.40	78	1.36	77	1.82	304	2.22	2170		1440	1.37
6-09-66	0		0		0		0		0		1400		T
6-12-66	.44		.56	36	.50	23	.50		.10				2.86
6-13-66	.02		.06		.04		.06		.10	84	183	2140	.53
6-26-66	.64		.38		.30		.28		.22	8	16	1780	1.65
7-07-66	2.00	3	1.00	44	.90		.86		.70			70	.24
7-25-66	.44		.98		1.56	273	.48	321	.08				T
7-26-66	.54		.10		.04		.02		.08	149	20	8	.18
7-27-66	.08		.08		.10		.10		.10		48	28	0
8-09-66	.74		.76		.82		1.14		.90				.69
8-10-66	0		.08		.42		.46		.88				.58
8-20-66	1.20	2	*		.88		1.40		2.02				.04
8-21-66	.42		*	6	.44		.02	443	.70	375			.13
8-22-66	0		*		.20		0		0		218	269	0
9-01-66	2.08	34	*	110	1.16	72	1.16	108	.76	63			.31
9-02-66	0		*		.08		.02		.08				.20
9-03-66	1.00	157	*	408	.26	315	.14	238	.06	119	35	49	.15
9-04-66	0		*		0		0		0		60		0
9-05-66	0		*		0		.02		0			76	
9-17-66	1.16	<1	1.04		.68		.56		.14				.29
9-18-66	0		.02	13	.02	10	.06	12	0				.24
9-19-66	0		0		0		0		0	4			T

Table 3.--Soldier Creek Rainfall and Peak-Flow Data (Continued).

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1/]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
1967 WATER YEAR													
3-31-67	.62		.54		.62		.52		.34				1.05
4-01-67	1.28	16	1.24	68	1.44	135	1.32	501	1.54	501			2.95
4-02-67	0		0		0		0		.06		457		.66
4-03-67	.02											511	1.26
4-12-67	.10		.12		.14		.12		.22				.57
4-13-67	1.24	28	1.22	136	1.18	314	1.62	1270	1.42	1230			1.79
4-14-67	0		0		0		0		0		795	792	0
5-29-67	.62		.74		.88		.92		1.40				1.06
5-30-67	.14		.04		.10		.18		.14	49			.29
5-31-67	1.44	8.8	1.24	bf	1.20	220	1.22	1440	1.16	1570			1.35
6-01-67	.06		.06		.04		.02		0		1080	1210	T
6-04-67	.04		.46		.14		.14		.28				.10
6-05-67	1.48	162	.68	710	1.14	636	2.18	2880	2.52	5480		3410	.77
6-06-67	.02										3920		0
6-09-67	1.68	222	1.68	932	1.72	900	2.76	3110	1.68	2930			.03
6-10-67	.22	27	.60	238	.50	301	1.60	3090	1.84	6520	7080		1.66
6-11-67	*	133	*		1.66		1.06		2.20	5430			2.13
6-12-67	*	198	*	800	.04	1070	0	3820	0	8430	7580	18600	.54
6-19-67	.26		.22		.58		.56	534	*	486	284		1.15
6-20-67	.18		.20		.26		.30		*		356		3.20
6-21-67	1.08	149	1.48	726	1.36	1210	1.60	2970	*	3350		18300	2.32
6-22-67	.02		.02		0		0		*		2780		0
6-23-67	0		0		.04		.04		*				0
6-24-67	.78	46	.68	227	.84	322	1.24	1970	*	3110		3420	1.51
6-25-67	0		.02		0		0				2240		
7-08-67	1.48	21	.66		1.54		1.02		*		323	*	.16
7-09-67	0		1.16	162	.02	461	0	453	*	268		*	T
7-10-67	0		.04		0		0		*		224	*	0
9-19-67	.70		.62		.48	2	.64	2	*	9		22	.69
9-20-67	.54		.72		1.04	4	1.52	18	*	26			1.69
9-21-67	0		0		0		0		*		29	122	0
1968 WATER YEAR													
10-05-67	.90		.68		.38		*		*	85			.61
10-06-67	1.76		1.56		1.56		*		*				1.90
10-07-67	.48	32	.68	225	.62	236	*	1190	*	2200	1390	2510	1.10
5-13-68	1.54	30	1.30	105	.96	160	.52	179	*				.12
5-14-68	.02		.04		.14		.38		*	106			0
5-15-68	0		0		0		0		*		115	50	0
7-16-68	2.26	87	1.38	176	.64	151	*	106	*	8	184	2870	1.81
7-17-68	.06		.10		.08		*		*	26			.74
7-23-68	3.14	279	2.94	860	2.54		*		*				.57
7-24-68	.58		.68		1.02	935	*	940	*	836	2100	3430	.66
7-25-68	0		.02		0		*		*		2440	7400	.22
7-26-68	.14	42	.90	265	1.88	610	*	1380	*	1010	2280	3630	2.44
7-27-68	0	34	0	213	.08		*		*				.08
7-30-68	.70	77	*	373	.92	578	*	1350	*	1790	1540	3400	1.69
7-31-68	.40	111	*	645	1.10	780	*	3120	*	3520		5130	1.67
8-01-68	0		*		0		*		*		2310		T
8-02-68	.26	314	*	1730	.54	2090	*	3310	*	3580		6350	1.93
8-03-68	.02		*		0		*		*		3490		0
8-08-68	.44		.32		.30		*		*				.31
8-09-68	.98	75	1.12	339	1.46	470	*	1480	*	1800		5500	2.18
8-10-68	*	152	.74	547	.88	858	*	3100	*	3540	5560	15600	1.24
9-03-68	*	120	2.06	438	1.92	1520	*		*				.12
9-04-68	*		.14		0		*	2140	*	2260	1420		.22
9-05-68												1210	
9-23-68	*	81	1.18	358	.94	456	*	435	*	1080	798		1.73
9-24-68	*		0		0		*		*			770	0
1969 WATER YEAR													
10-08-68	*		.16		.10		*	845	*	400			1.97
10-09-68	*		.20		.22		*		*		242	234	.19
10-16-68	*	272	3.04	1320	2.86	1460	*	3380	*				1.08
10-17-68	*		.06		.10		*		*	4260	3690	5790	.01

bf Indicates base flow.

Table 3.--Soldier Creek Rainfall and Peak-Flow Data (Continued).

1969 WATER YEAR--Continued

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1/]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
3-22-69	*		.60		.60		0		*				
3-23-69	*		1.08		1.02		1.12		*				.75
3-24-69	*	70	.34	491	.30	586	.26	1570	*	2170	2020	2250	.24
4-03-69	1.14		.80		.30		.26		.32				.03
4-04-69	.82	384	.78	1260	.84	1240	.70	1860	1.40	2070			1.94
4-05-69	0		0		0		0		0		2030	2860	T
4-16-68	1.38	95	1.56		1.96		1.18		1.32				1.82
4-17-69	.08		.08	465	.14	474	.14	1380	0	1570	1520	1790	.04
4-25-69	.02		0		0		*		0				0
4-26-69	2.12	233	2.24	1200	2.31	1420	*	3000	2.82	7140			3.24
4-27-69	0		0		0		*		0		4450	7310	0
5-07-69	1.87	211	1.71	954	2.07	905	1.49	2400	.82	3240			1.55
5-08-69	0		0		.02		.01		.01		2360	2250	.05
5-13-69	.42	1.5	.47	6.9	.55		*	276	.68	396			.31
5-14-69	0		0		0		*		0		361	432	0
5-15-69	.09		.09		.12		*		.19				.27
5-16-69	.79	4	1.05		.96	370	*	150	.48				.11
5-17-69	0	40	0	194	0		*	1980	0	1960	1440	1550	T
5-21-69	.86	125	.95	602	*	690	*	2300	1.53	2960			1.06
5-22-69	0		0		*		*		.01		2600	2630	.01
6-11-69	1.80		1.82		1.82	458	*		1.54				2.72
6-12-69	.08	22	.10	210	.21		*	1010	.13	875	778		.01
6-13-69	0		0		0		*		0			816	0
6-17-69	1.26	15	1.50	148	1.73	282	*	3240	1.72	3760			1.39
6-18-69	0		0		0		*		0		2620	2660	0
6-21-69	.03		.03		.06		*		.21				.94
6-22-69	1.73	83	1.22	417	1.24	484	*	3060	1.03	3110	2690	3270	1.02
7-07-69	.19		.13		.09		*		*				.45
7-08-69	.02		*		.03		*		*				T
7-09-69	1.18	240	*	1200	.48	2350	*		*				.73
7-10-69	0		*		.03		*	3080	*	2940	1760	2300	.11
8-20-69	1.64	6.4	1.95	19	*	*	*		.32				T
9-05-69	.47		.67	1.1	*	4.4	*		.92	20			1.18
						1970 WATER YEAR							
10-05-69	1.04	.3	1.31	.8	1.72	15	.87	16	1.20	12			.57
10-09-69	1.04	45	.53		.15		.02		.04				.27
10-10-69	.52		.41		.59		*		.69				1.04
4-18-70	1.39	21	.70	65	1.00	160	.61	525	1.28	595			2.10
4-19-70	0		0		0		0		0		539	655	0
4-30-70	.81	1	.30		.82	57	.53		1.14	460		998	.52
5-01-70	.01		.01		0		0		0		380		T
5-09-70	1.52		.41		1.22		.40	483	.61	603			.33
5-10-70	4.02	7080	1.65	13100*	1.48	11700	.25	5570	.12		438	456	.07
5-11-70	.01		0		0		0		0	7830	2610	2270	T
5-13-70	.11		0		.03		.04		.01				.62
5-14-70	.75	204	.18	509	.34	537	.28	675	.56	714	662	958	.96
5-22-70	0		0		0		0		.06				0
5-23-70	1.12	126	.23	331	0	306	.26		1.01	254			.03
5-24-70	.63	86	.36		.52		.32	211	.21		1100	1660	.14
5-25-70	.30		.05	266	.32	266	.03	259	.40	436			.92
5-28-70	1.00	104	.27	190	.76	167	.30		.51				.83
5-29-70	0		0		0		0		.08	216	370	1110	
5-31-70	1.02	88	.36	350	.72	350	.62	710	1.22	2240			.86
6-01-70	.10		.04		.09		.09		.05		1550	2300	.43
6-02-70	.70		.22		.57		.23		.86				1.15
6-03-70	1.07	126	.32	558	.80	585	.26	1470	.91	2450			.73
6-04-70	.02		.02		.02		0		.02		3930	6750	.05
6-11-70	.73		.15		.36		.31		.69	85			2.09
6-12-70	0		.01		0		0		0		968	2580	T
9-16-70	1.17	*	.19		.30		.50		.20				.35
9-17-70	.22		.16		.27		.18		1.01		812	1420	.28

Table 3.--Soldier Creek Rainfall and Peak-Flow Data (Continued).

1970 WATER YEAR--Continued

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1/]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
9-21-70	.56		.20		.70		1.01		1.37				2.29
9-22-70	1.29	*	.23	322	1.16	350	.34	1070	.61	1080	1820	4270	1.53
9-23-70	.69	*	.39	114	.62		.38		1.15	1050			.58
9-24-70	0		0		0		0		0		1720	3240	0
						1971 WATER YEAR							
4-26-71	.03		.49		1.33		.65		1.19				.23
4-27-71	0		0	257	.07	272	0	903	0	755	*	1160	T
5-21-71	0		.29		.94		.61		1.11				1.01
5-22-71	0		.10	547	.34	440	.48	1060	.72	1120	1400	2760	.63
5-31-71	.10		.37	437	1.23	845	.24	2370	0	1740	892		.10
6-01-71	0		0		0							954	T
6-10-71	0		*		.64		.41		1.00	29	800		1.44
8-04-71	.05		1.58	4	1.33	8	.36	8	.40				.13
9-04-71	.44		1.20	<1	*	*	1.20	8	.54				.45
						1972 WATER YEAR							
10-29-71	*		2.18		2.37	16	1.72	18	1.71	22	16	40	1.96
10-30-71	*		.56	*	.41	33	.25	18	.36	27	24	28	.33
10-31-71	*		0		0		0		0				0
11-01-71	*	88	2.07	*	2.13	603	1.42	1480	1.46	1350			1.85
11-02-71	*		0		0		0		0		908	981	0
5-06-72	*		1.15	31	1.26	112	.78	768	.03	854		3240	1.46
5-07-72	*		.01		0		0		.15		1070		T
6-06-72	*		.10		0		2.19	18	0				0
6-13-72	.15		.13		.20		.37		.02				.28
6-14-72	.80	<1	1.12	<1	1.51	59	1.42	85	.41				.82
7-11-72	1.77	4.3	1.19	49	.98	35	.11		.18				.29
7-17-72	1.88		2.00		1.67		1.47		.75				.90
7-18-72	0	22	0	105	.02	126	.03	81	0	64	177	303	.20
7-24-72	.49		.32		1.45	16	1.38	423	.23	259			.77
7-25-72	0		0		0		0		0		139	225	0
8-02-72	1.24		.71		1.30		.78		.59				1.03
8-03-72	.60	315	1.50	831	.73	1020	1.68	2640	.55	2720			.44
8-04-72	0		0		0		0		0		1760	1860	.01
8-24-72	2.30		1.61		1.28		1.35		.52				1.23
8-25-72	.10	10	.11	61	.07	64	.01	20	0				T
9-06-72	0		0		.04		.28		.50				.46
9-07-72	1.19	8	1.23	66	1.64	85	3.04	2690	2.32	3470		5260	2.32
9-08-72	0		0		0		0		0		3330		
9-13-72	.93		1.01		1.60	285	.35		.11				.30
9-14-72	0	26	0	223	0	249	0	2010	0	1440	908		T
9-15-72	0		0		0		0		0			889	0
						1973 WATER YEAR							
10-22-72	1.27	2	1.30	13	1.32		1.05	44	.38				1.22
10-23-72	0		0		0	32	0		0				0
11-09-72	.87		.81		.89	358	.80	1210	.42				.37
11-10-72	0		0		0		0		0	1180	1280	1510	T
11-12-72	.42		.19		.16		.28		.17				.47
11-13-72	1.00	136	1.06	525	1.44	769	1.08	2350	.66	2990		4460	1.03
11-14-72	*		0		0						3040		T
3-30-73	.59		.66		.63		.49		.48				.67
3-31-73	1.22	243	1.09	809	1.16	1150	.64	3360	.43	3860		5110	.47
4-01-73	0		0		0		0		0		4160		T
4-14-73	.55		.64	22	.67		.10	593	.14				.41
4-15-73	1.14	274	1.24	*	1.30	1120	.98		1.07				1.76
4-16-73	0		0		0		0	3110	0	3540	3780	5340	T
4-30-73	.71		1.11		1.37		1.71		.69				1.22
5-01-73	.07	4	.07	137	.04	518	.02	2700	0	2760	1980	1920	.01

Table 3.--Soldier Creek Rainfall and Peak-Flow Data (Concluded).

1973 WATER YEAR--Continued

Date	Goff		Bancroft		Soldier		Circleville		St. Clere		Delia	Topeka	Topeka NWS[1/]
	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Daily Precip. (in)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Peak Disch. (ft^3/s)	Daily Precip. (in)
5-06-73	1.52		1.50	317	1.63	555	1.63	2120	1.26	2430			1.18
5-07-73	.37	347	.42	980	.34	983	.16	2020	.30	2370	2540	3890	.01
5-26-73	.96	.6	1.31	36	.78		.86		.30				1.60
5-27-73	.05		.05		.01	26	0	35	0				T
6-03-73	1.02	7	.98	43	1.35	97	1.10		.78				2.21
6-04-73	.22		.45		.43	42	.30	130	.06	169	2720	3730	.39
6-05-73	0		0		0		0	216	0	230			.05
7-02-73	.21		.97	3	1.15		1.29		.76				1.63
7-03-73	.03		.64	4	.71	19	.16	26	0	62	61		0
7-18-73	.03		.30		.37		.96		.56				2.62
7-19-73	.06		1.25		1.83		1.47	88	1.64				2.11
7-20-73	.13	50	1.52	252	.81	240	1.21	762	.88	853	3510	10100	2.44
7-25-73	0		0		0		.01		.01	161	1470	3400	T
8-07-73	3.90		3.38		3.19		1.61		.04				.23
8-08-73	.65	930	.70	2380	.99	1980	1.23	4410	.64	3900			.42
8-09-73	.07		.54		.34		.16		.11		2590	2440	.10
9-07-73	.83		.86		.79		.96		1.12	*			.61
9-08-73	.49	46	.53	38	.54	100	.36		.63	*			.11
9-09-73	0		0		0		.02	44	.10		109	136	.04
9-16-73	1.11	6	.86	105	.70	171	.51	164	.52				.58
9-17-73	.04		.04		.04		.03		.02	163	168	*	.01
9-23-73	1.30	97	1.35	509	1.04	572	1.39	953	1.04	930			3.74
9-24-73	1.21	118	1.04	452	1.06	552	1.15	1240	1.45	2060			2.53
9-25-73	.03		0		.02		0		.02		2630	9820*	.08
9-26-73	1.86	250	2.28	881	2.36	1130	2.52	4200	2.68	4700			2.21
9-27-73	.39	237	.46	624	.49	773	.29	2270	1.22		5460		1.30
9-28-73	.07		0		0		.05		.24	2980		11000+	.44
						1974 WATER YEAR							
10-10-73	3.61	764	3.27	1400	2.60	1450	3.16		2.77				3.16
10-11-73	1.14	394	1.36	1290	1.40	1510	1.05	5310	.82	6540	7020	20800+	.88
12-04-73								1390		1890	2700	4860	1.72
4-20-74	*	452	2.79	1200	2.43	1120	2.99	3520	2.29	3720			.63
4-21-74	*		.66	793	.02		0		.01		3490	3500	0
4-29-74	*	92	1.23	177	1.29	244	2.33	901	1.30	1570			1.56
4-30-74	*		0	165	0	175	0		.01		2240	3030	T
6-05-74	*		.42		.38		.14		.34				.37
6-06-74	*	11	.89	43	.63	22	.54	42	.86	280			.90
6-07-74	*		.10		.07	25	0		0		1190	1560	T
6-08-74	*	322	2.17	884	2.31	999	.60		1.92				1.65
6-09-74	*		0		0		0	3740	.01	3150	3770	3980	T
7-03-74	*	0.2	.78		1.45	10	.41		.39				1.15

+ Backwater from Kansas River.

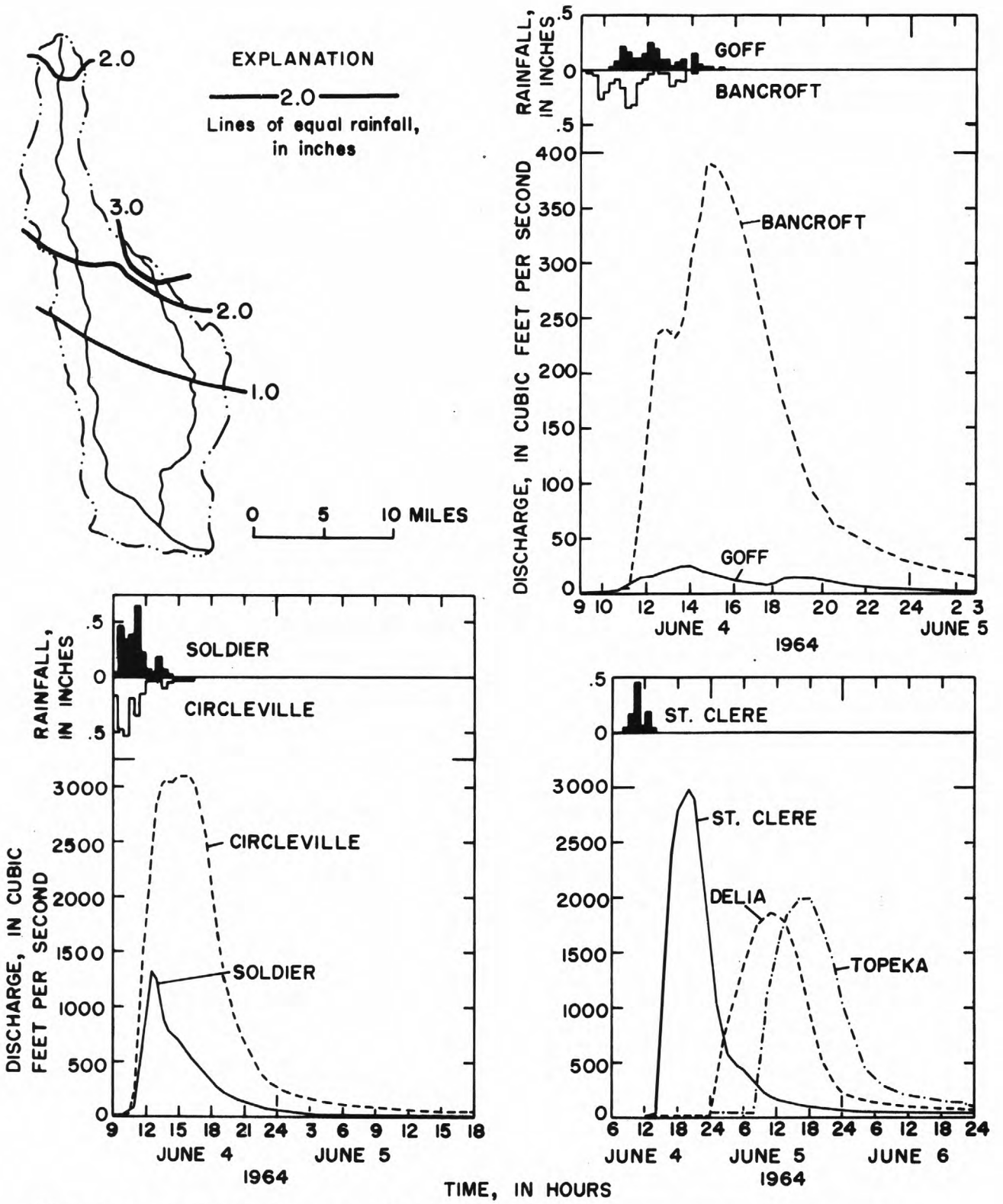


Figure 8.--Distribution of rainfall June 4, 1964, and resulting stream discharge.

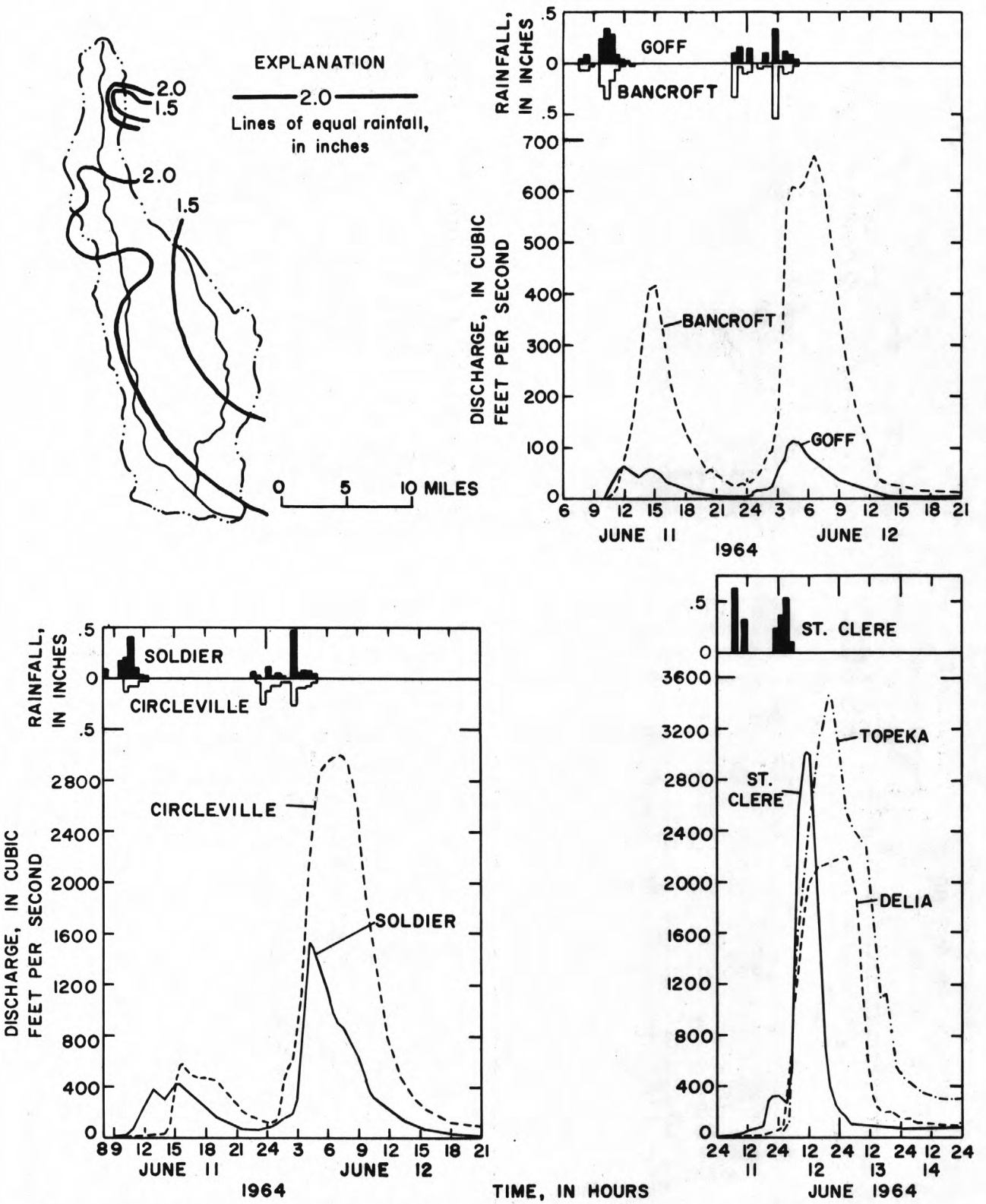


Figure 9.--Distribution of rainfall June 11-12, 1964, and resulting stream discharge.

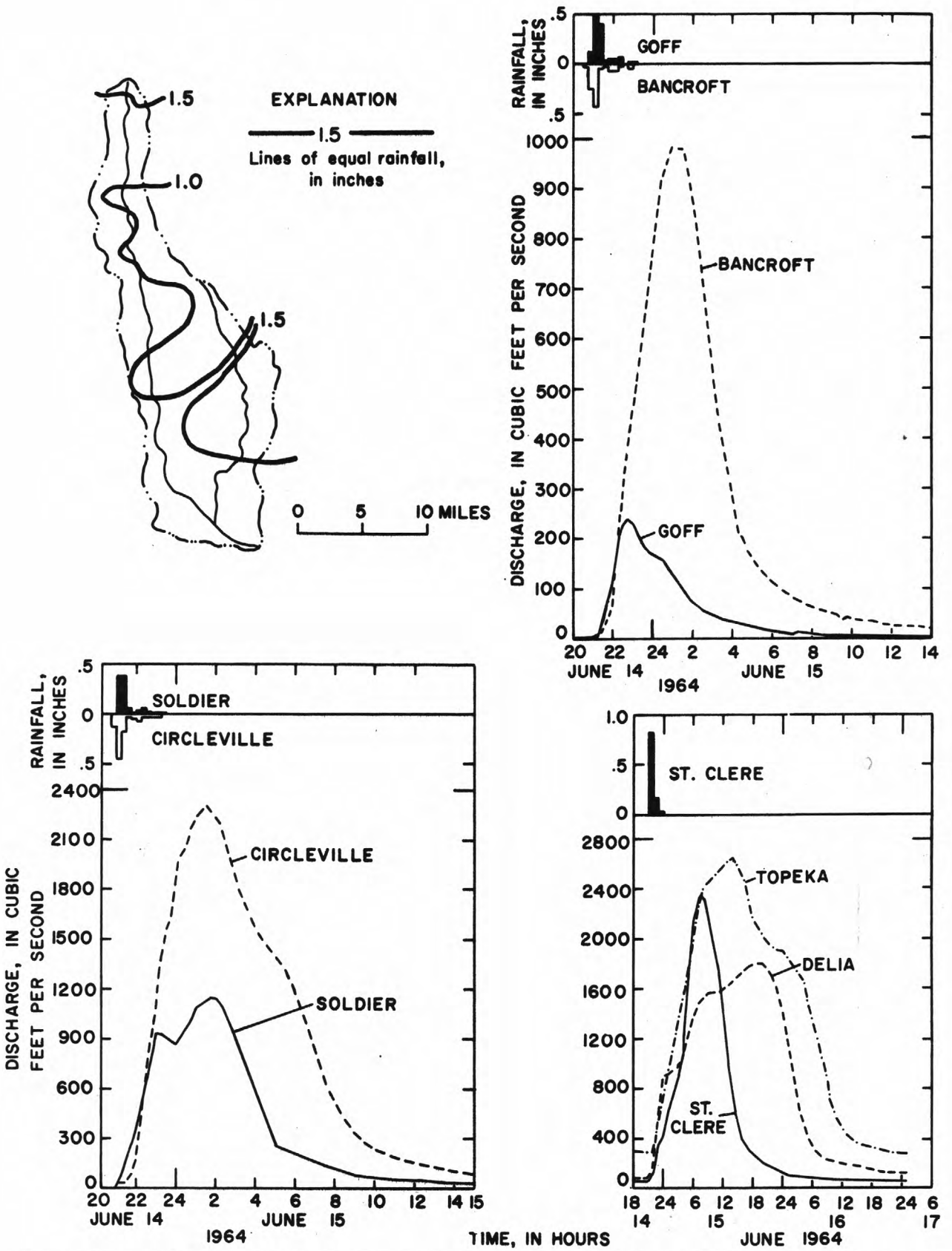


Figure 10.--Distribution of rainfall June 14-15, 1964, and resulting stream discharge.

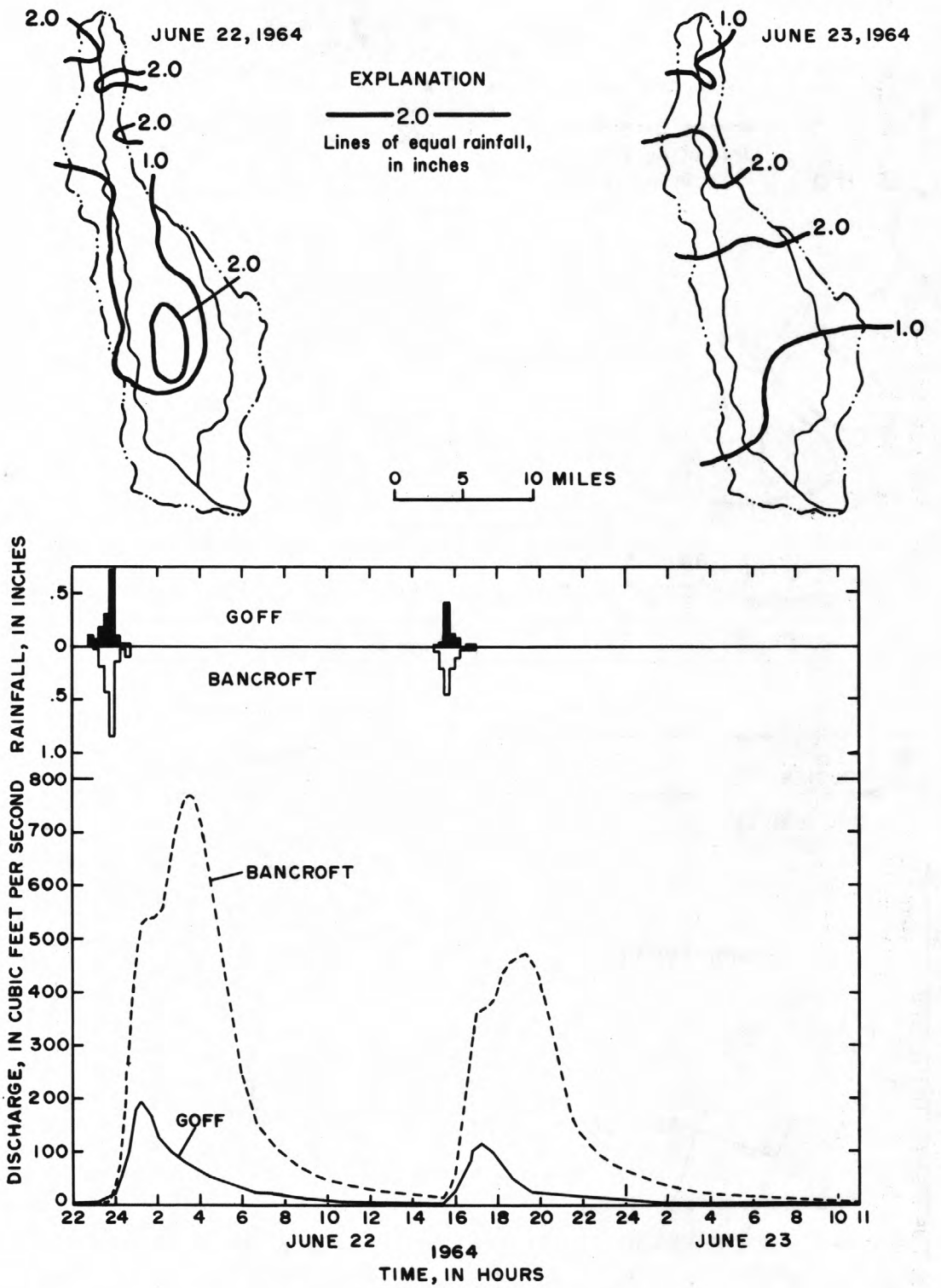
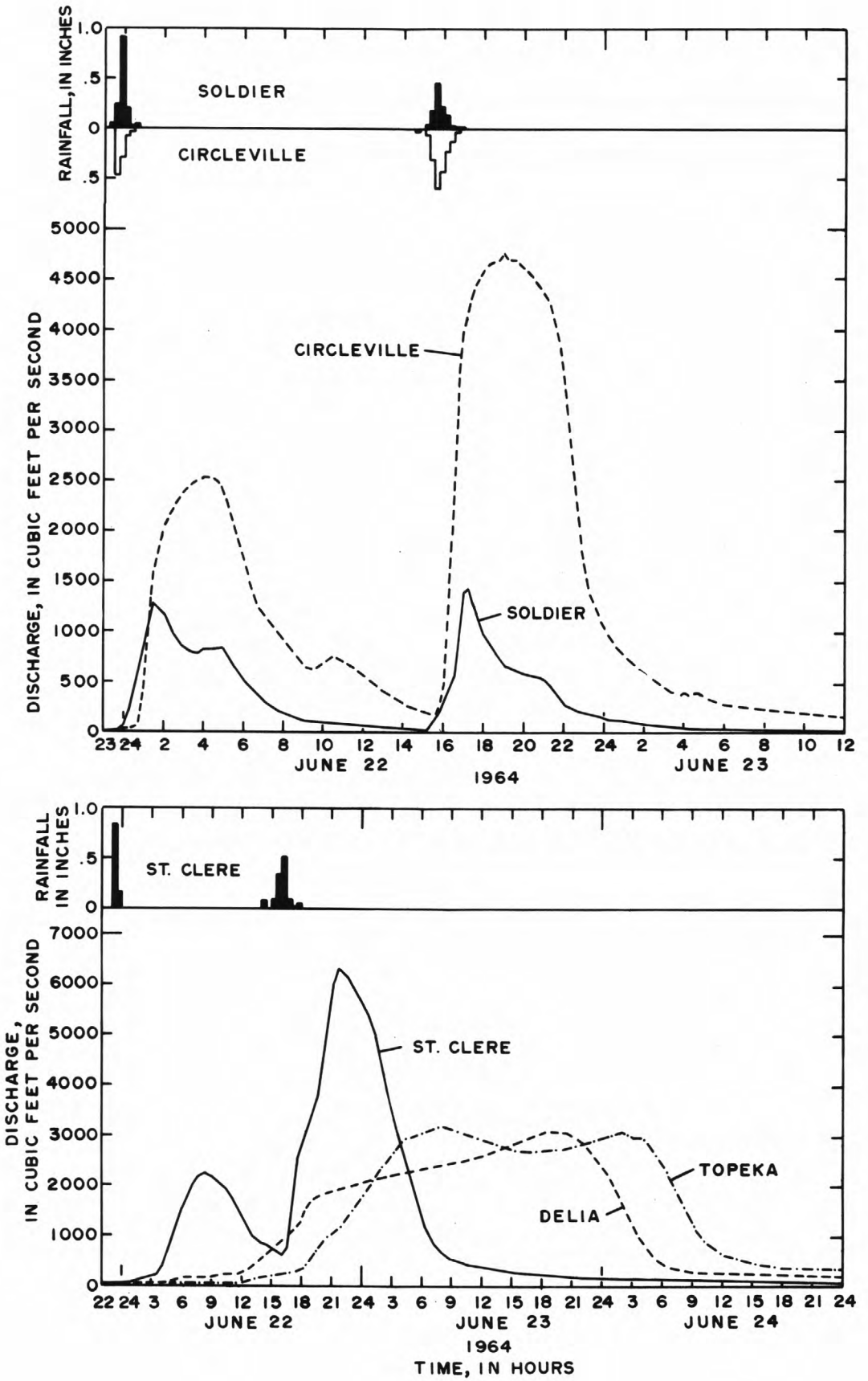


Figure 11.--Distribution of rainfall June 22-23, 1964, and resulting stream discharge.


RAINFALL, IN INCHES
1.0
.5
0
.5
SOLDIER
CIRCLEVILLE
DISCHARGE, IN CUBIC FEET PER SECOND
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
CIRCLEVILLE
SOLDIER
23 24 2 4 6 8 10 12 14 16 18 20 22 24 2 4 6 8 10 12
JUNE 22
JUNE 23
1964
RAINFALL IN INCHES
1.0
.5
0
ST. CLERE
DISCHARGE, IN CUBIC FEET PER SECOND
7000
6000
5000
4000
3000
2000
1000
0
ST. CLERE
TOPEKA
DELIA
22 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24
JUNE 22
JUNE 23
JUNE 24
1964
TIME, IN HOURS

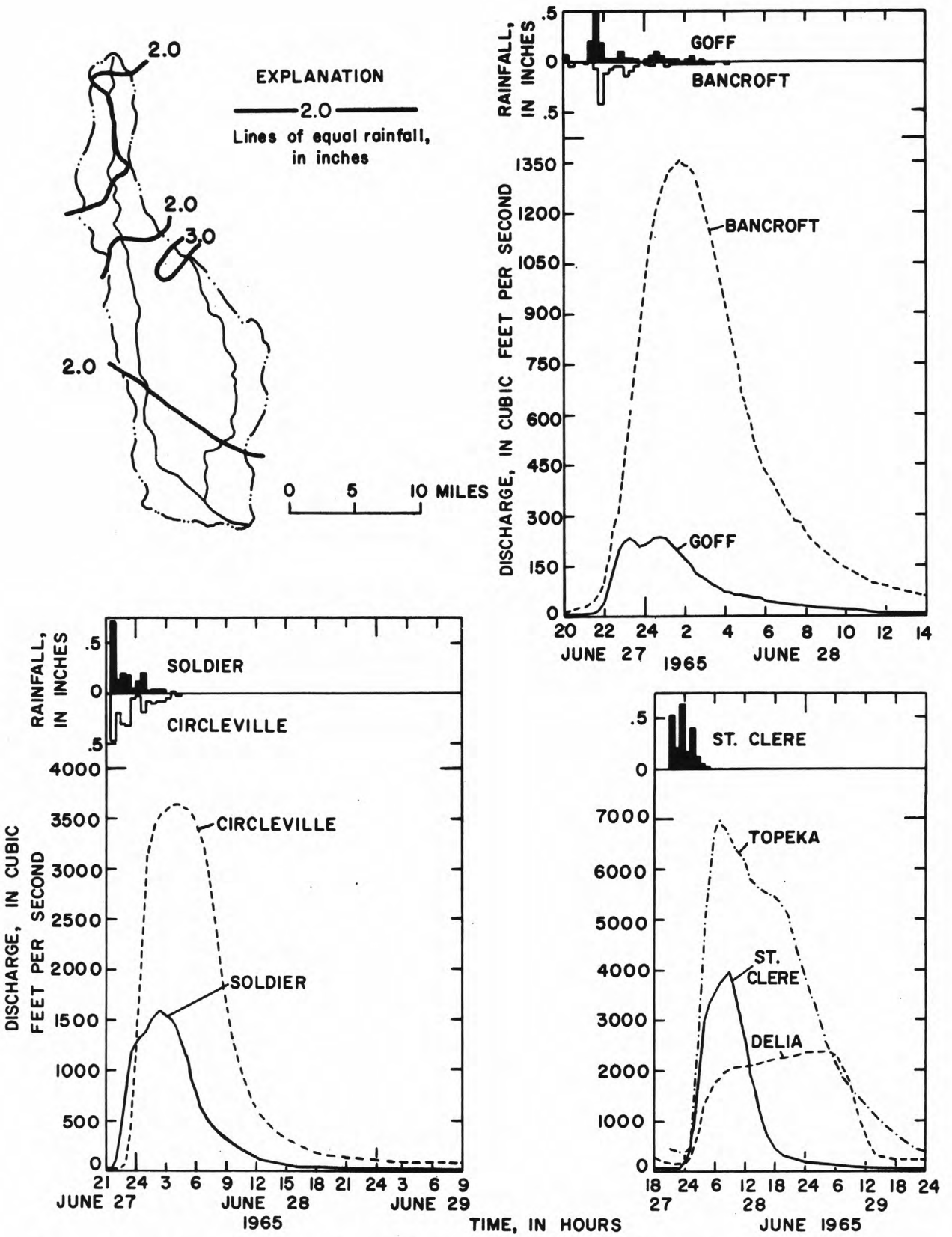


Figure 12.--Distribution of rainfall June 27-28, 1965, and resulting stream discharge.

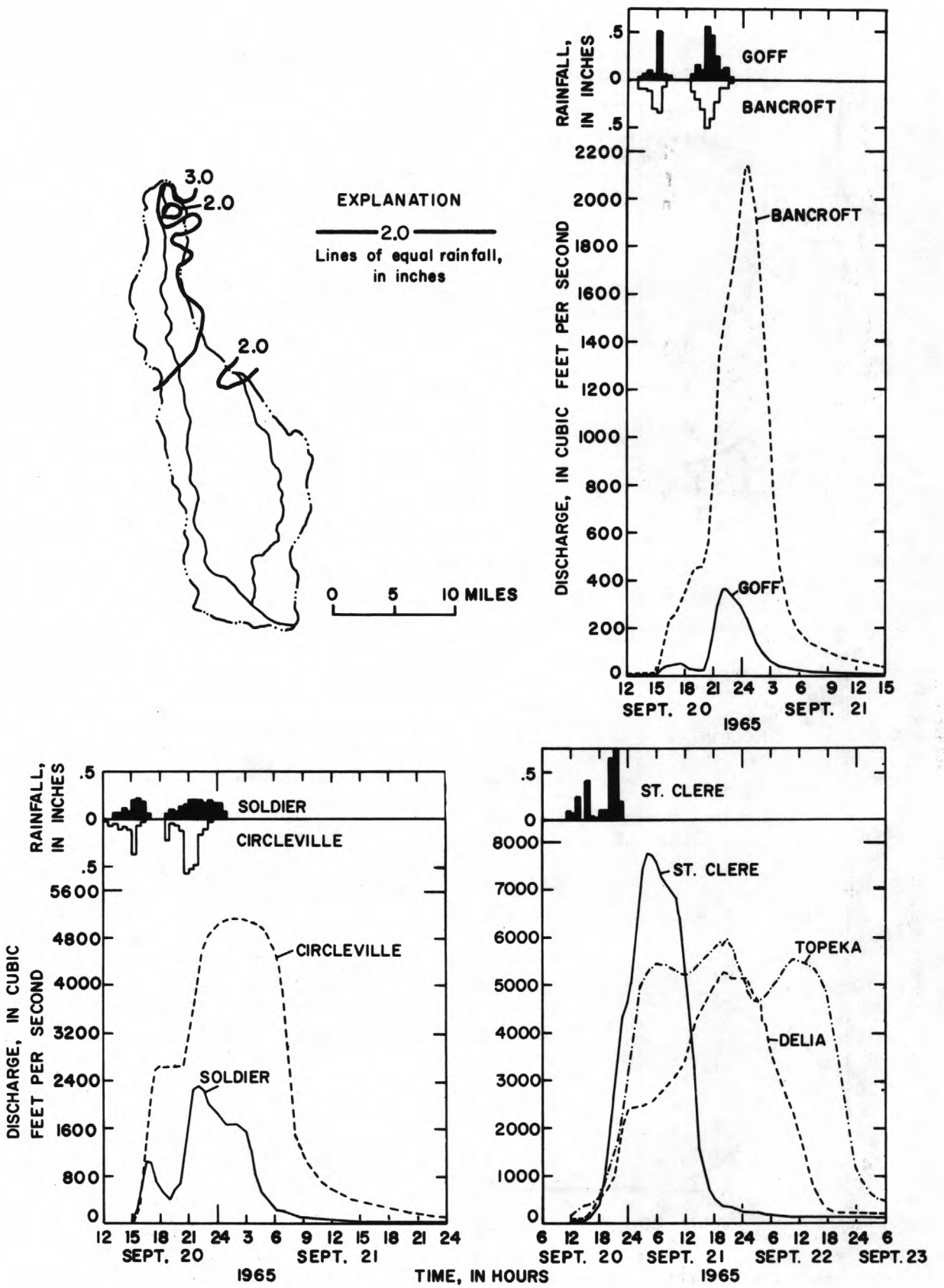


Figure 13.--Distribution of rainfall September 20-21, 1965, and resulting stream discharge.

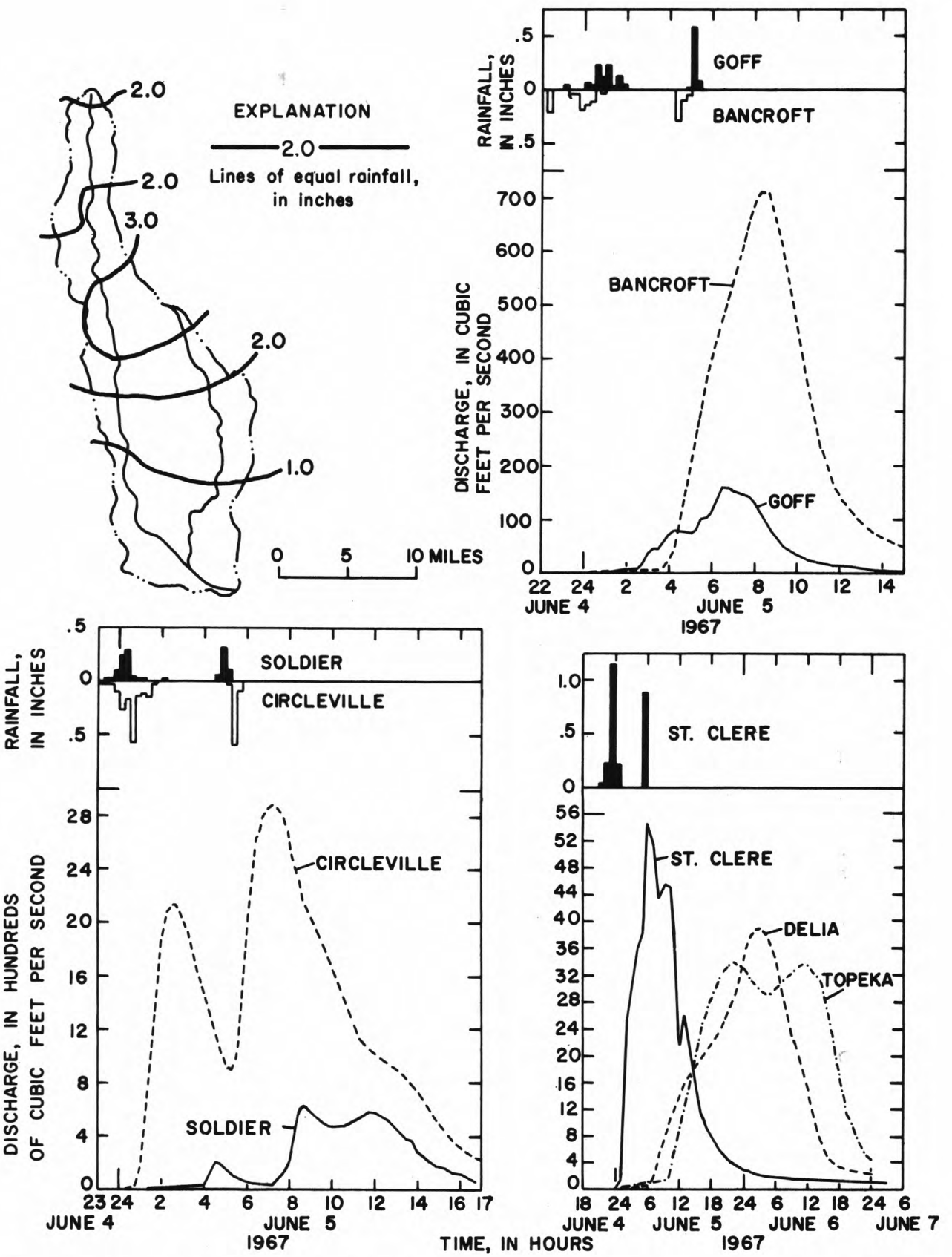


Figure 14.--Distribution of rainfall June 4-5, 1967, and resulting stream discharge.

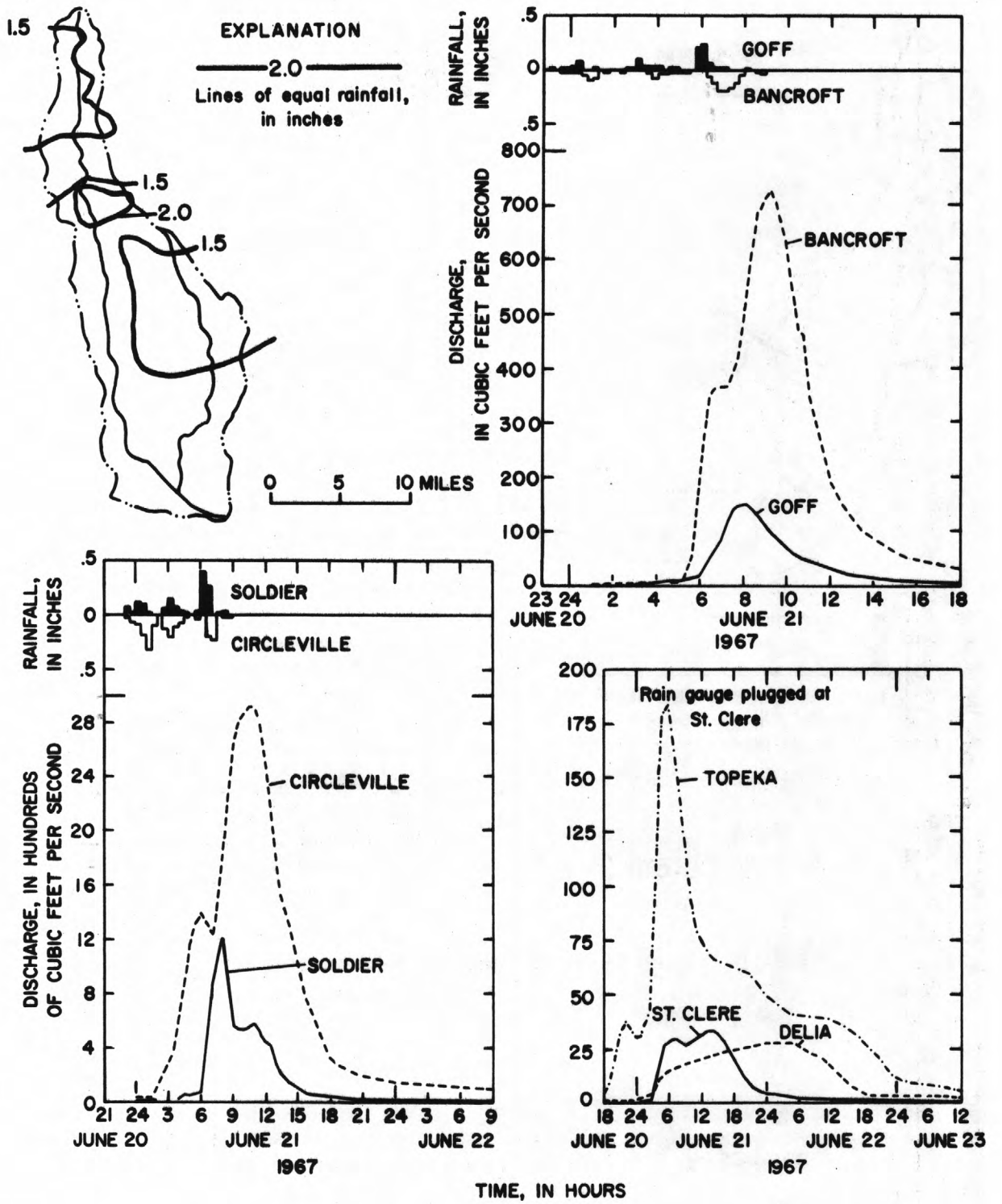


Figure 15.--Distribution of rainfall June 20-21, 1967, and resulting stream discharge.

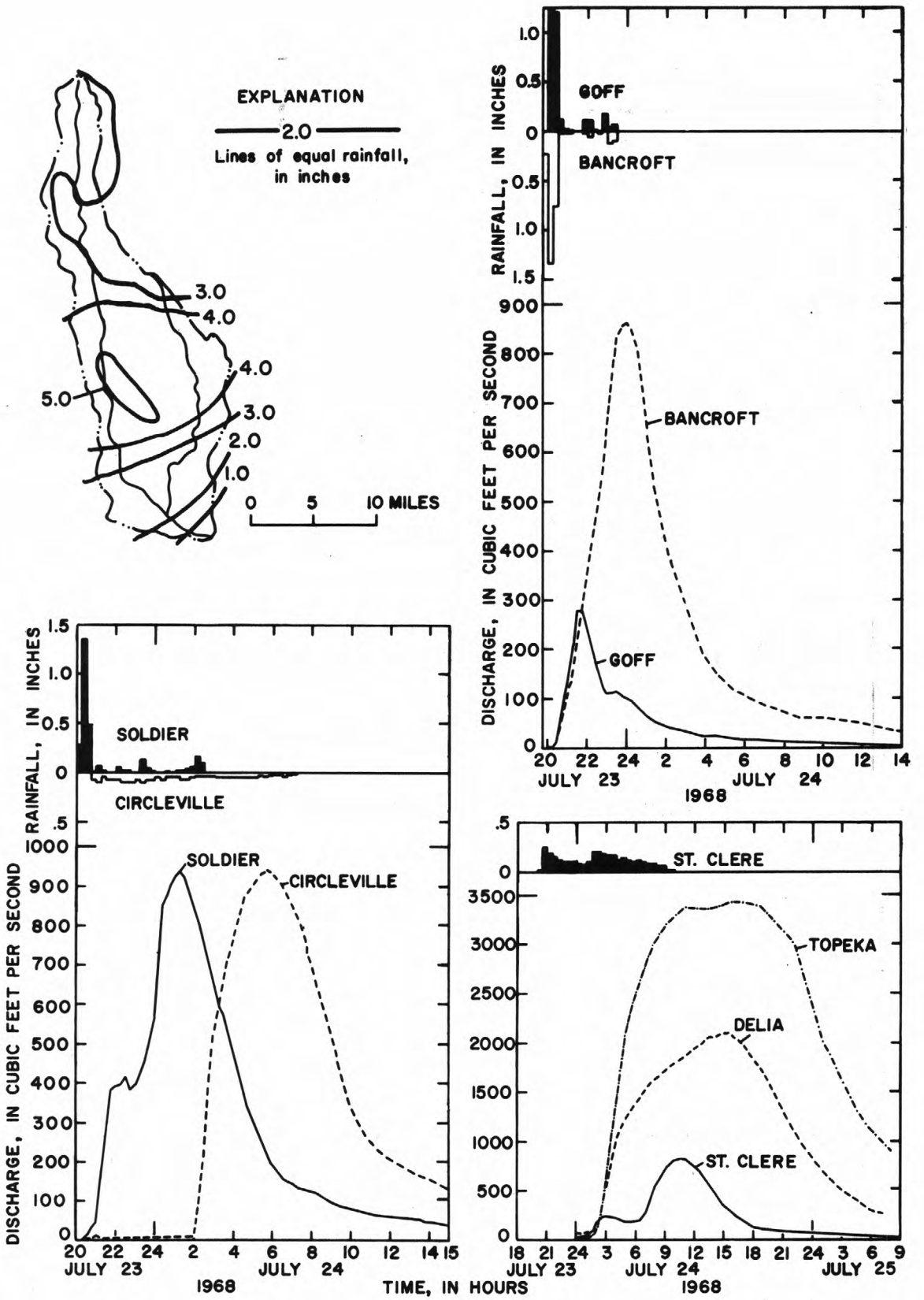


Figure 16.--Distribution of rainfall July 23-24, 1968, and resulting stream discharge.

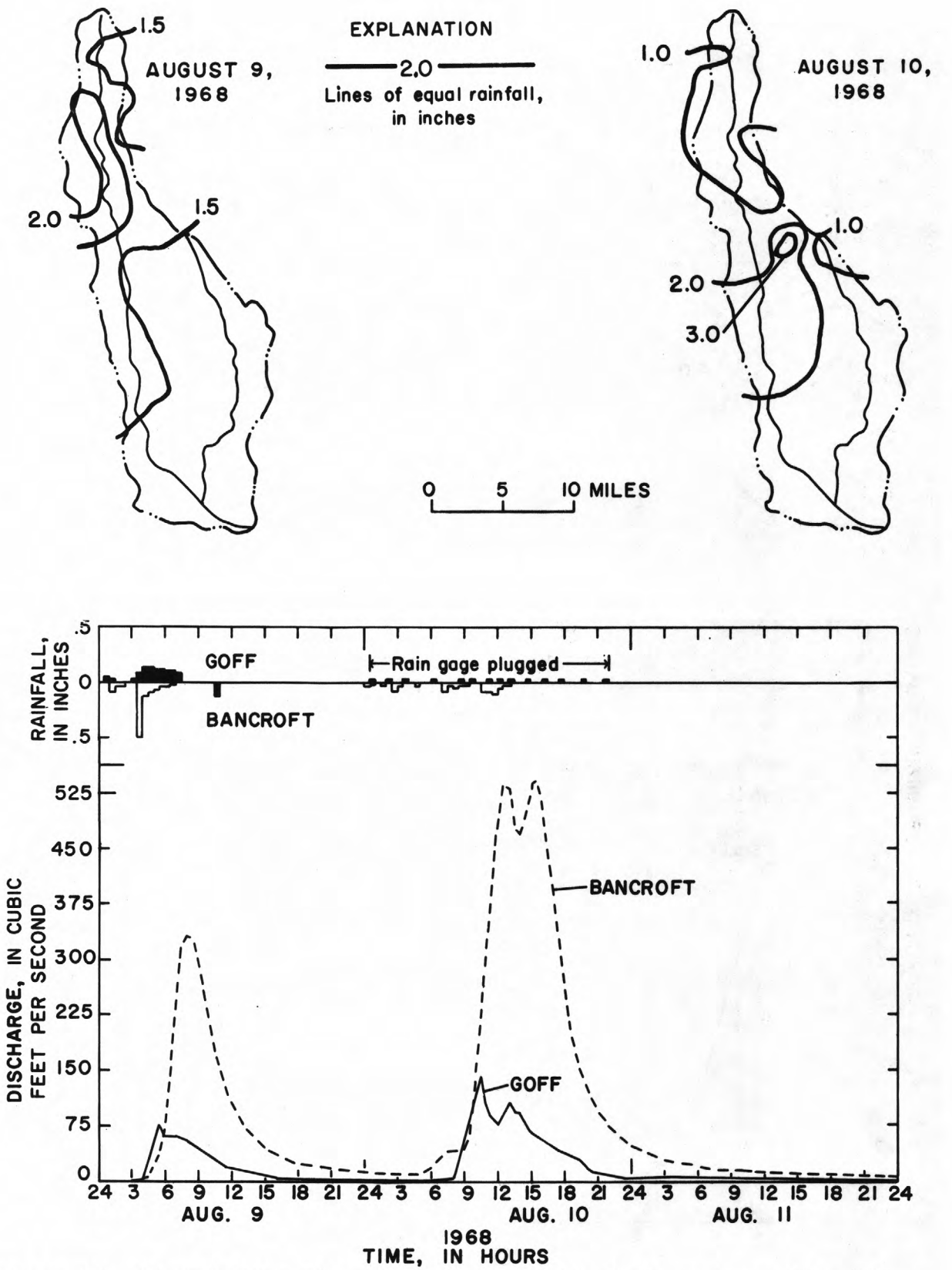
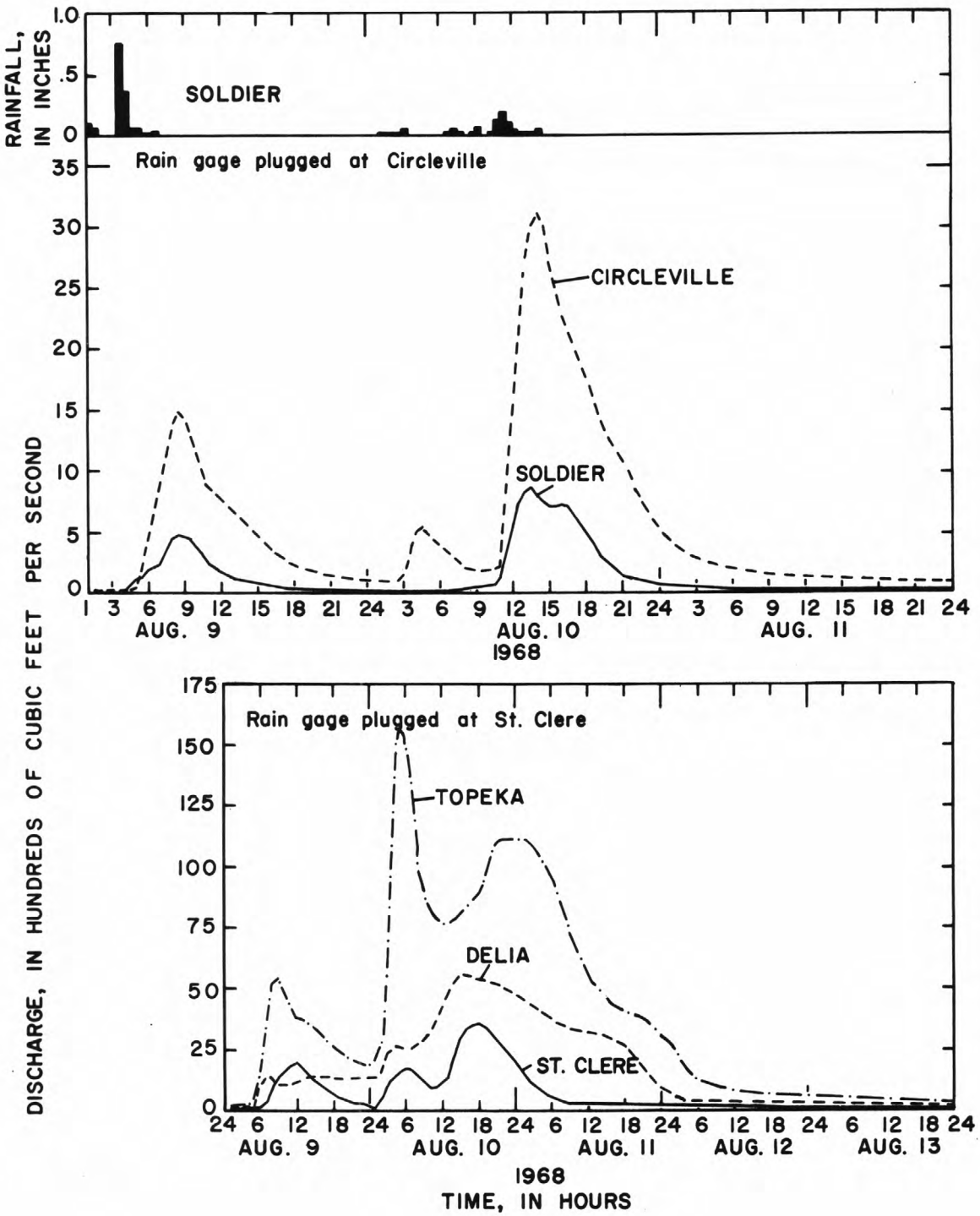


Figure 17.--Distribution of rainfall August 9-10, 1968, and resulting stream discharge.


RAINFALL, IN INCHES
1.0
.5
0
SOLDIER
Rain gage plugged at Circleville
DISCHARGE, IN HUNDREDS OF CUBIC FEET PER SECOND
35
30
25
20
15
10
5
0
CIRCLEVILLE
SOLDIER
1 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24
AUG. 9
AUG. 10
AUG. 11
1968
175
150
125
100
75
50
25
0
Rain gage plugged at St. Clere
TOPEKA
DELIA
ST. CLERE
24 6 12 18 24 6 12 18 24 6 12 18 24 6 12 18 24 6 12 18 24
AUG. 9
AUG. 10
AUG. 11
AUG. 12
AUG. 13
1968
TIME, IN HOURS

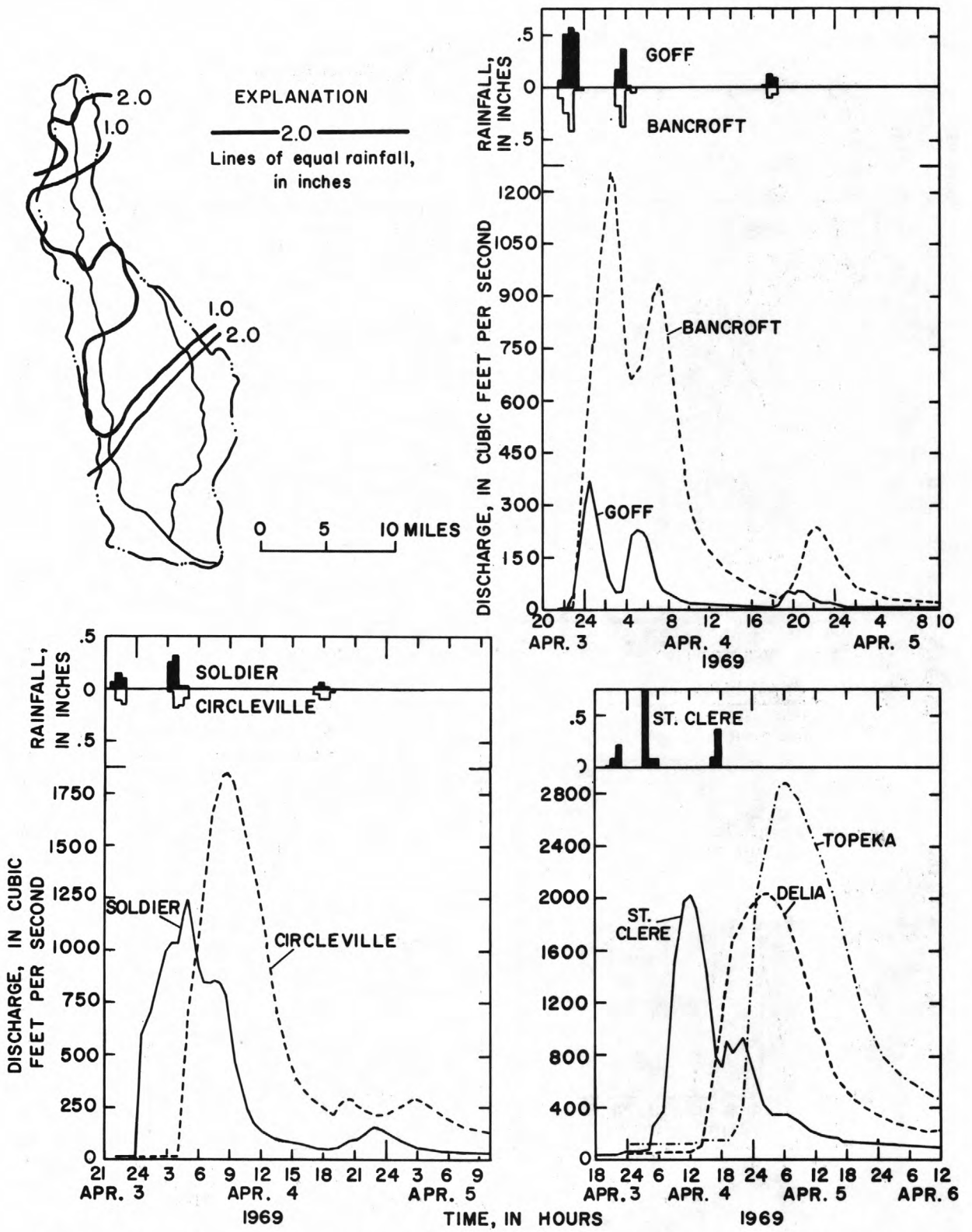


Figure 18.--Distribution of rainfall April 3-4, 1969, and resulting stream discharge.

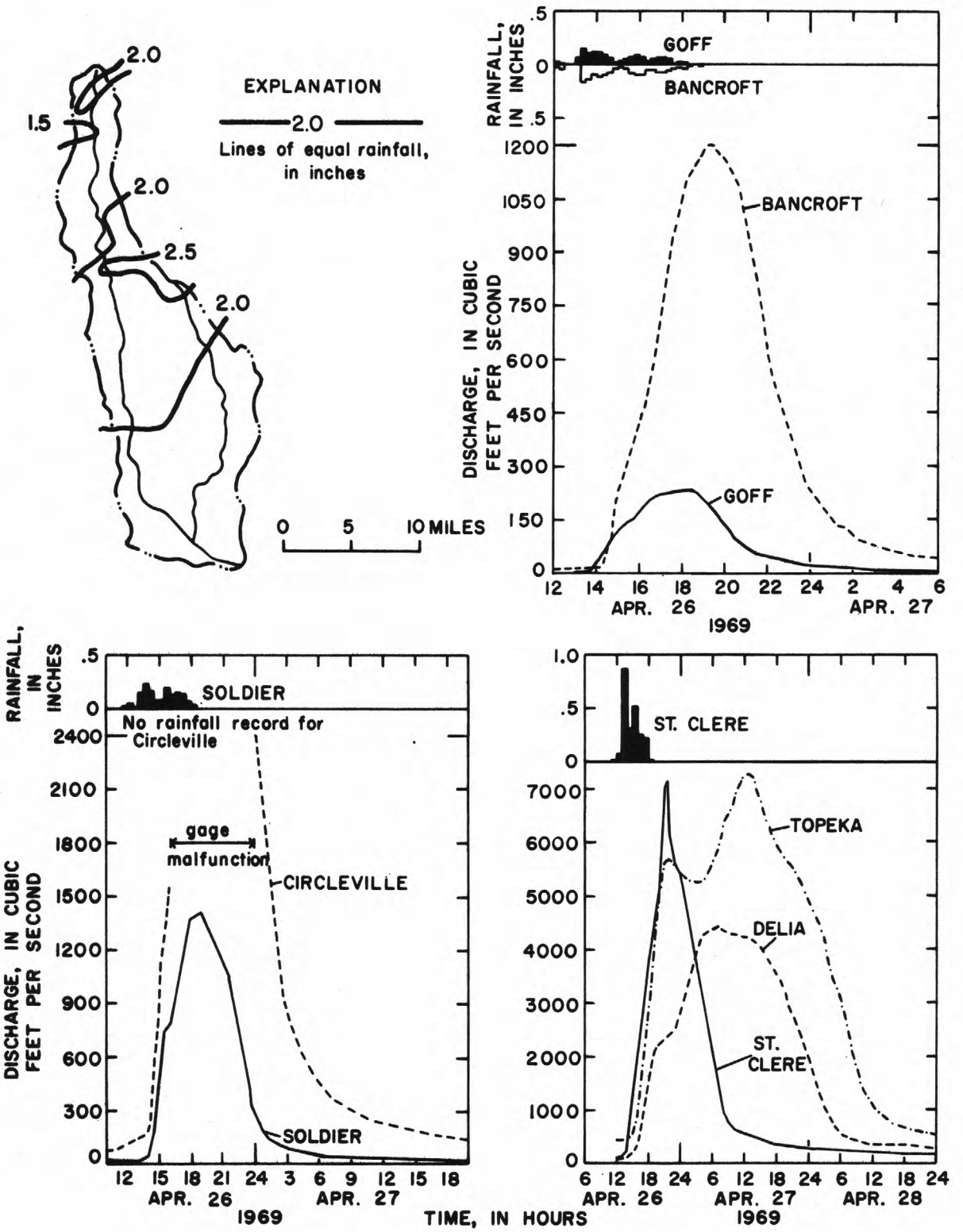


Figure 19.--Distribution of rainfall April 26, 1969, and resulting stream discharge.

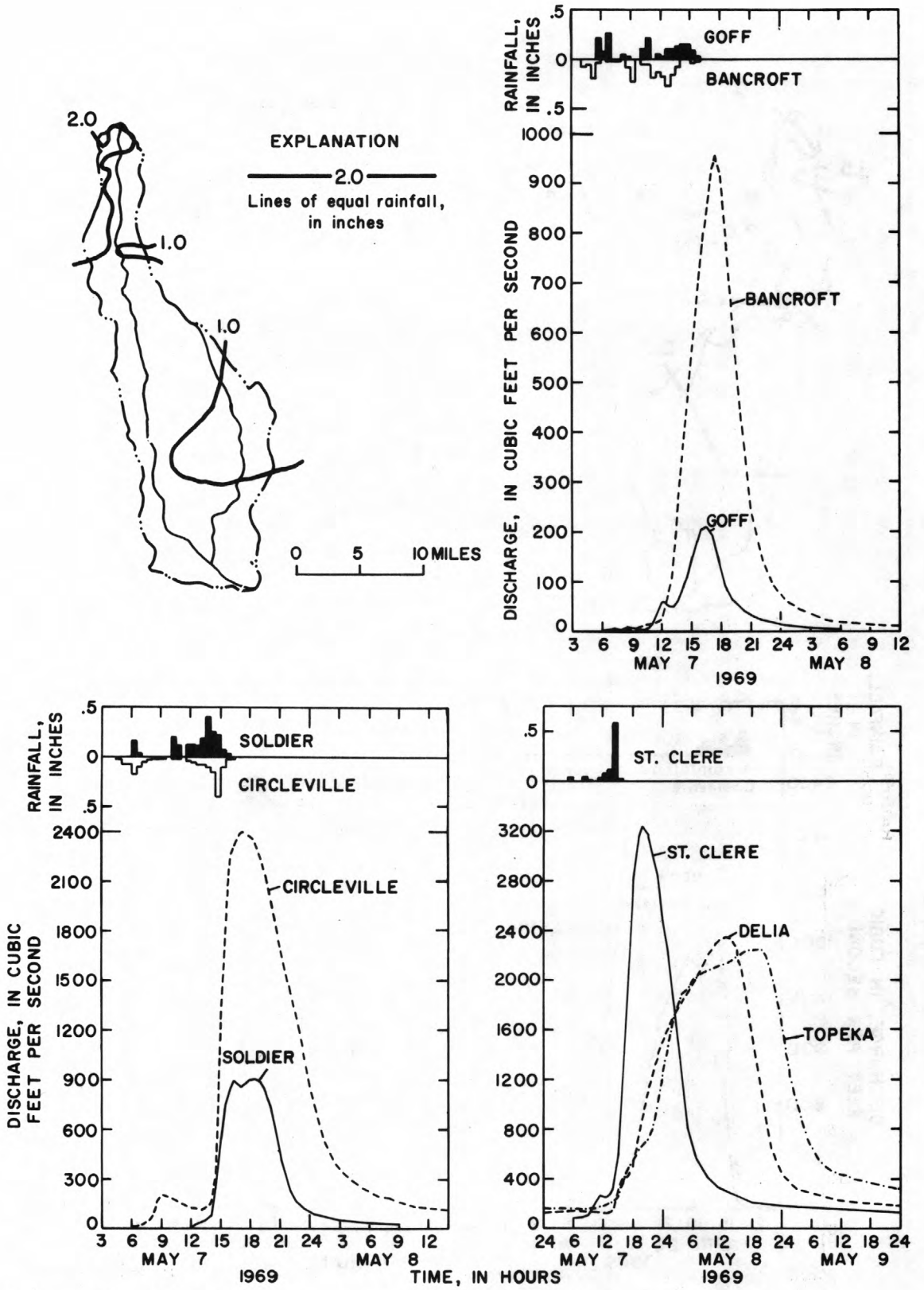


Figure 20.--Distribution of rainfall May 7, 1969, and resulting stream discharge.

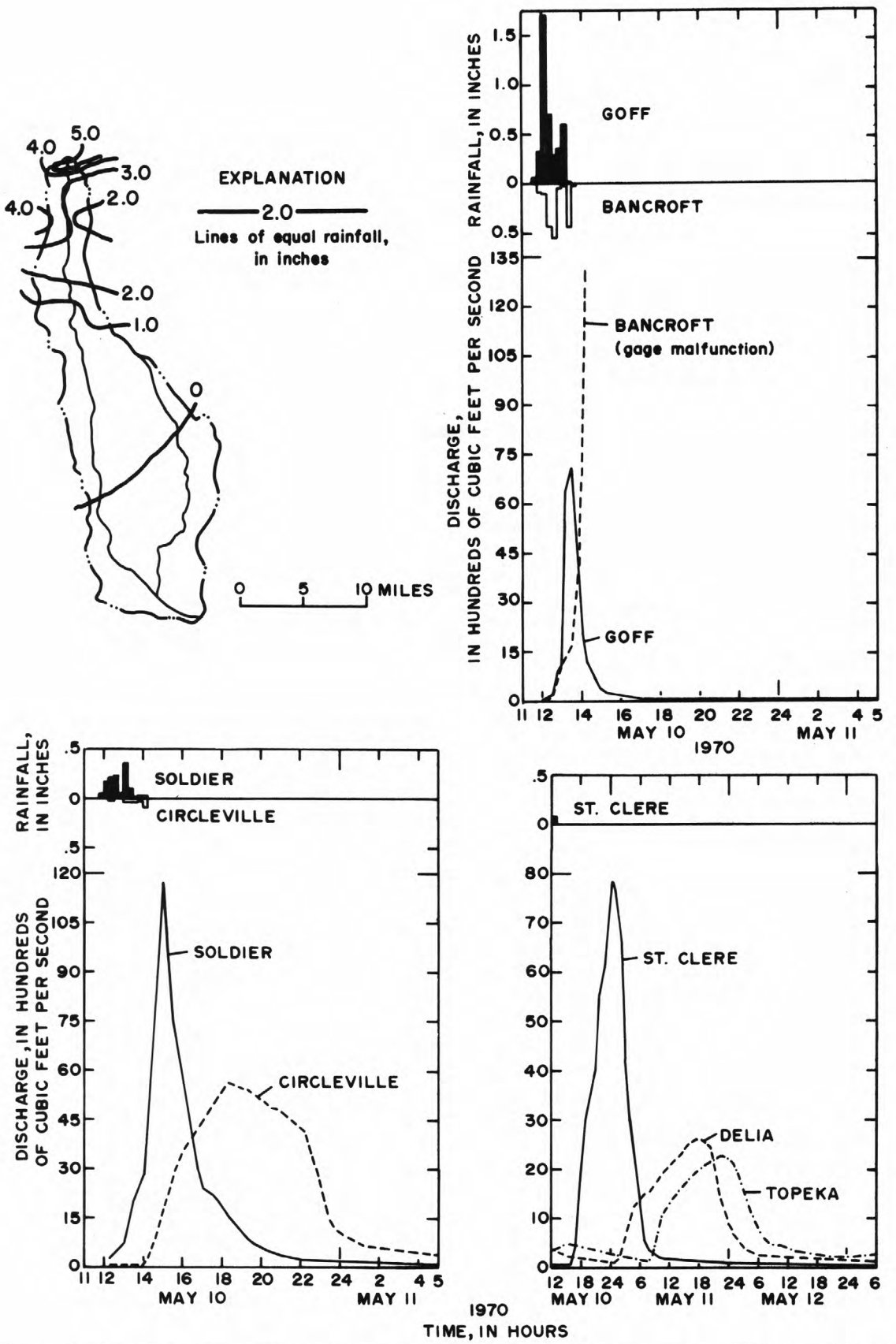


Figure 21.--Distribution of rainfall May 10, 1970, and resulting stream discharge.

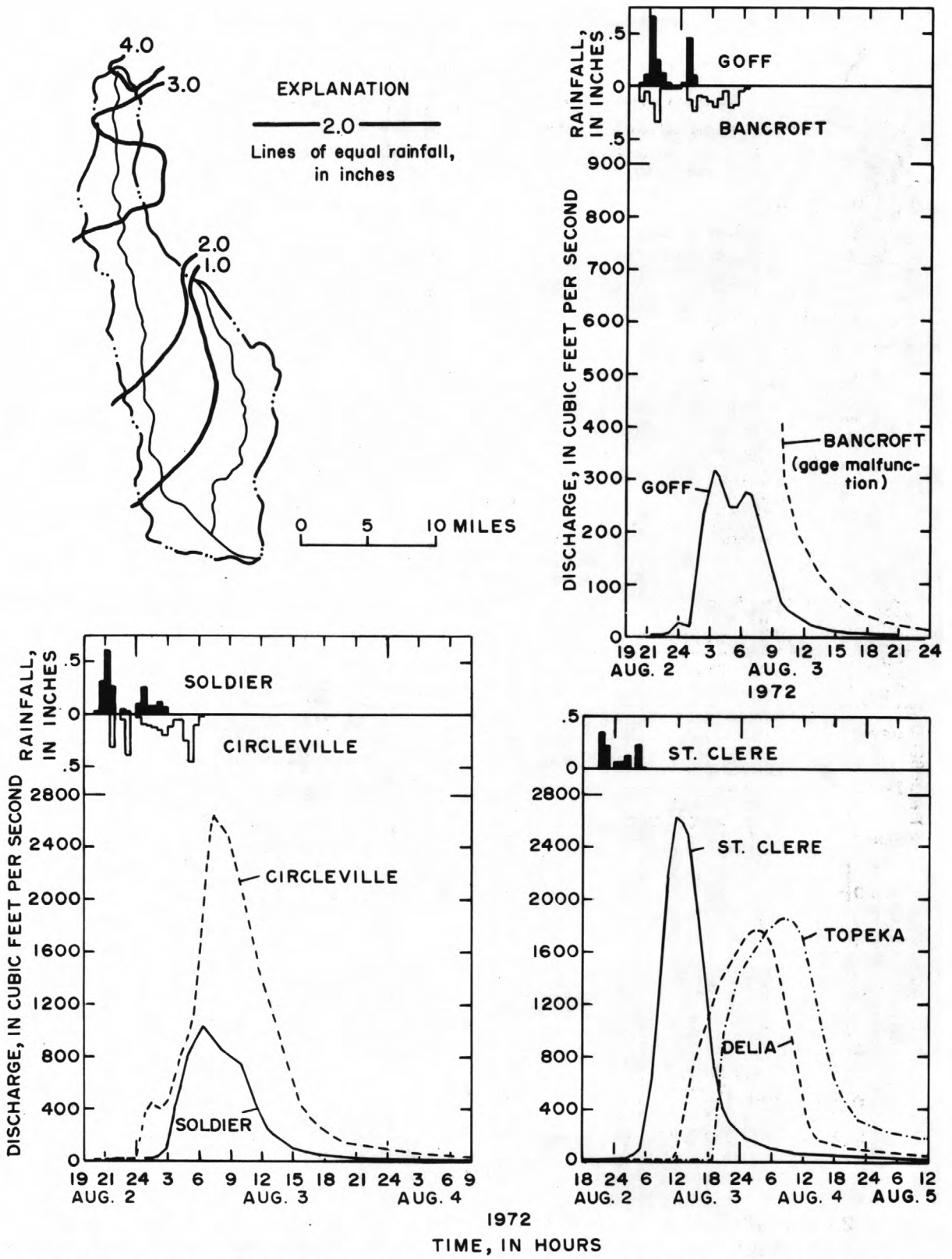


Figure 22.--Distribution of rainfall August 2-3, 1972, and resulting stream discharge.

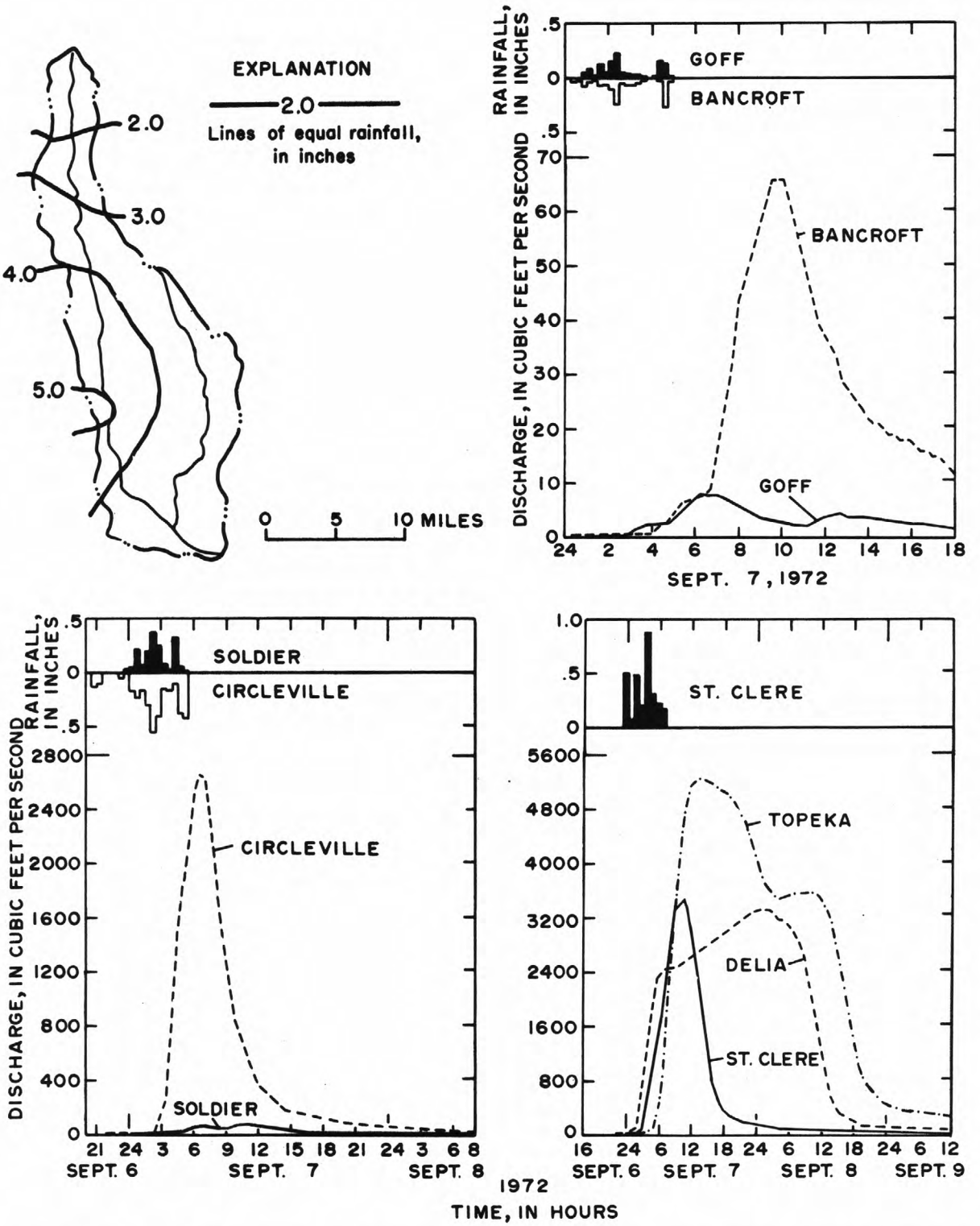


Figure 23.--Distribution of rainfall September 6-7, 1972, and resulting stream discharge.

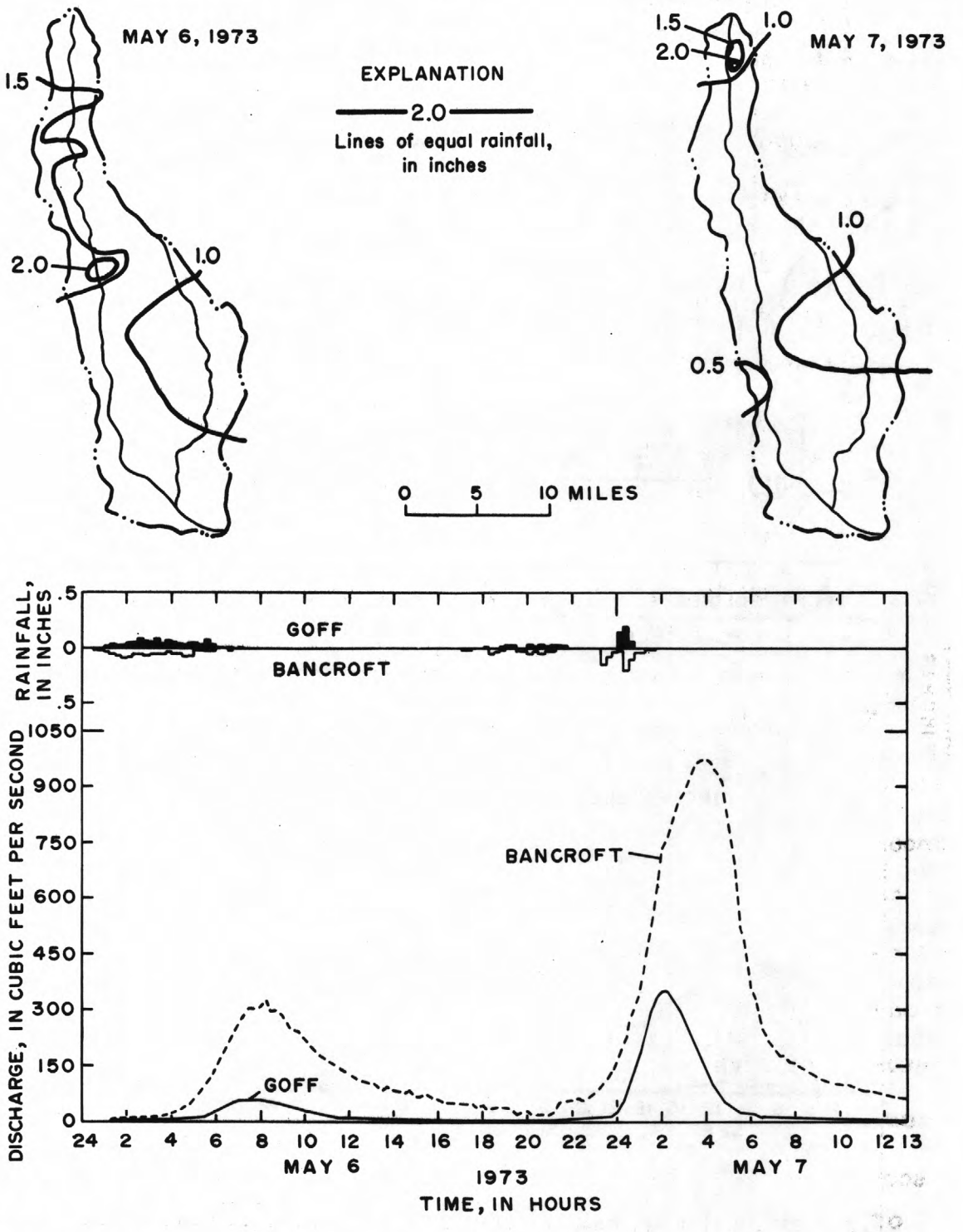
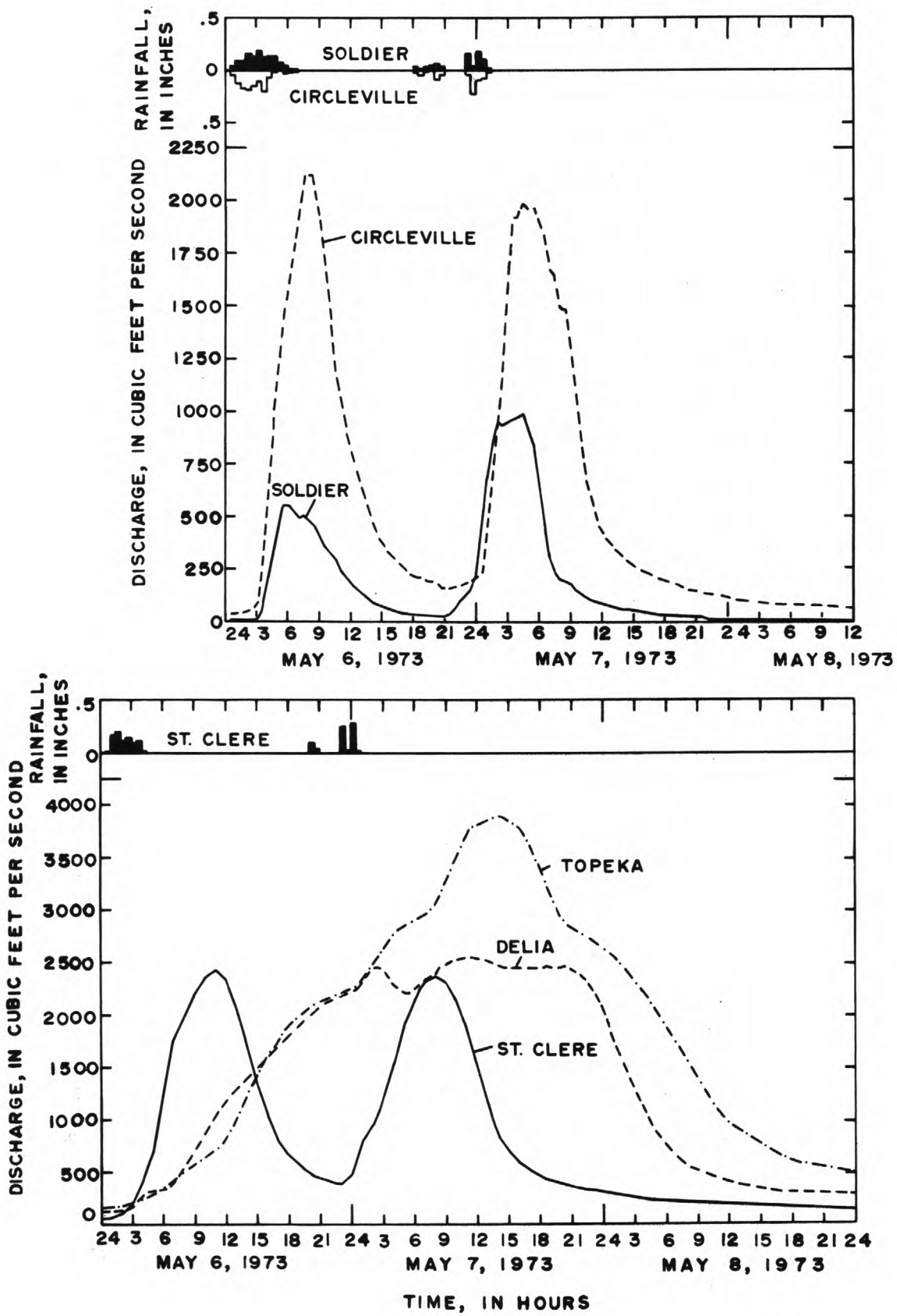


Figure 24.--Distribution of rainfall May 6-7, 1973, and resulting stream discharge.


RAINFALL, IN INCHES
.5
0
.5
SOLDIER
CIRCLEVILLE
DISCHARGE, IN CUBIC FEET PER SECOND
2250
2000
1750
1500
1250
1000
750
500
250
0
CIRCLEVILLE
SOLDIER
24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12
MAY 6, 1973
MAY 7, 1973
MAY 8, 1973
RAINFALL, IN INCHES
.5
0
ST. CLERE
DISCHARGE, IN CUBIC FEET PER SECOND
4000
3500
3000
2500
2000
1500
1000
500
0
TOPEKA
DELIA
ST. CLERE
24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24
MAY 6, 1973
MAY 7, 1973
MAY 8, 1973
TIME, IN HOURS

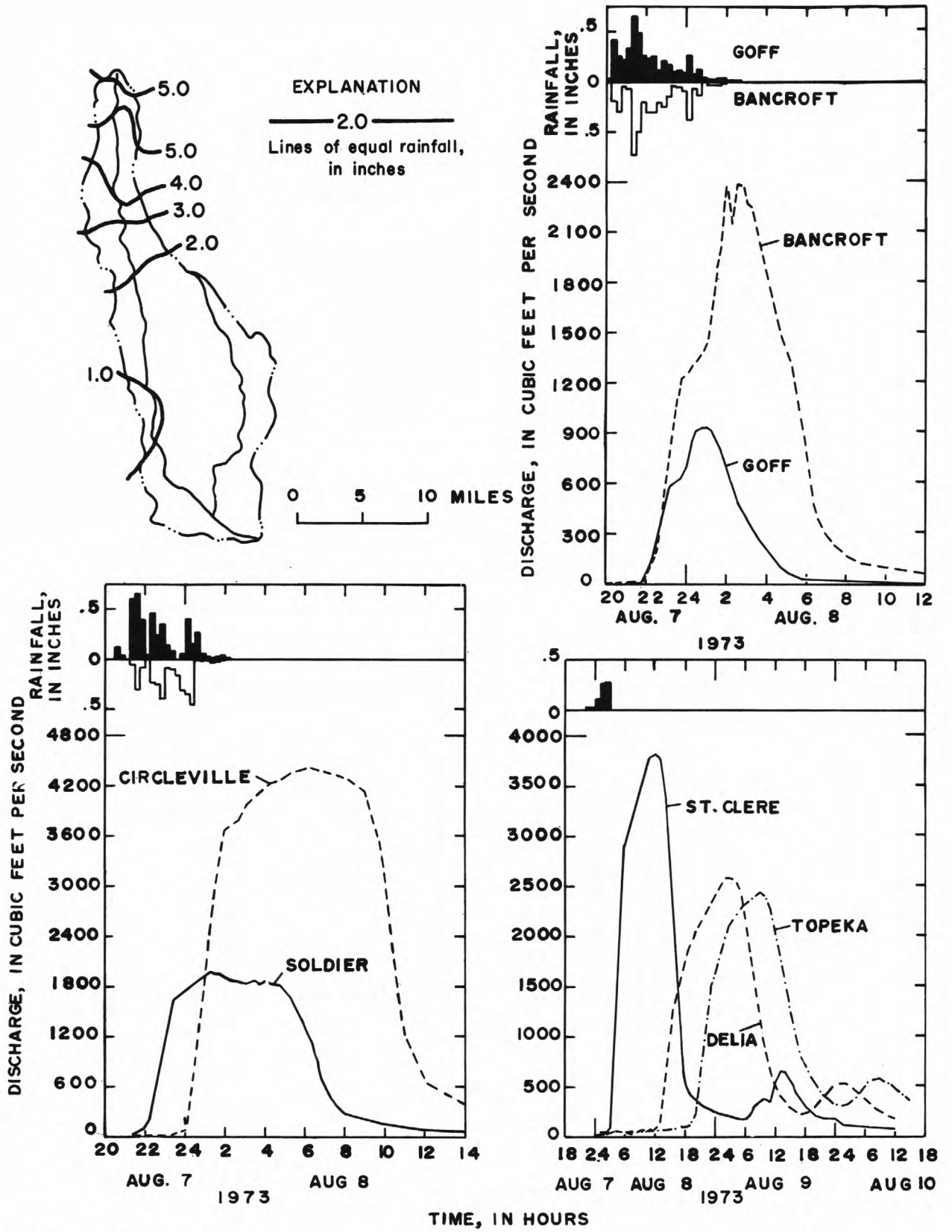


Figure 25.--Distribution of rainfall August 7-8, 1973, and resulting stream discharge.

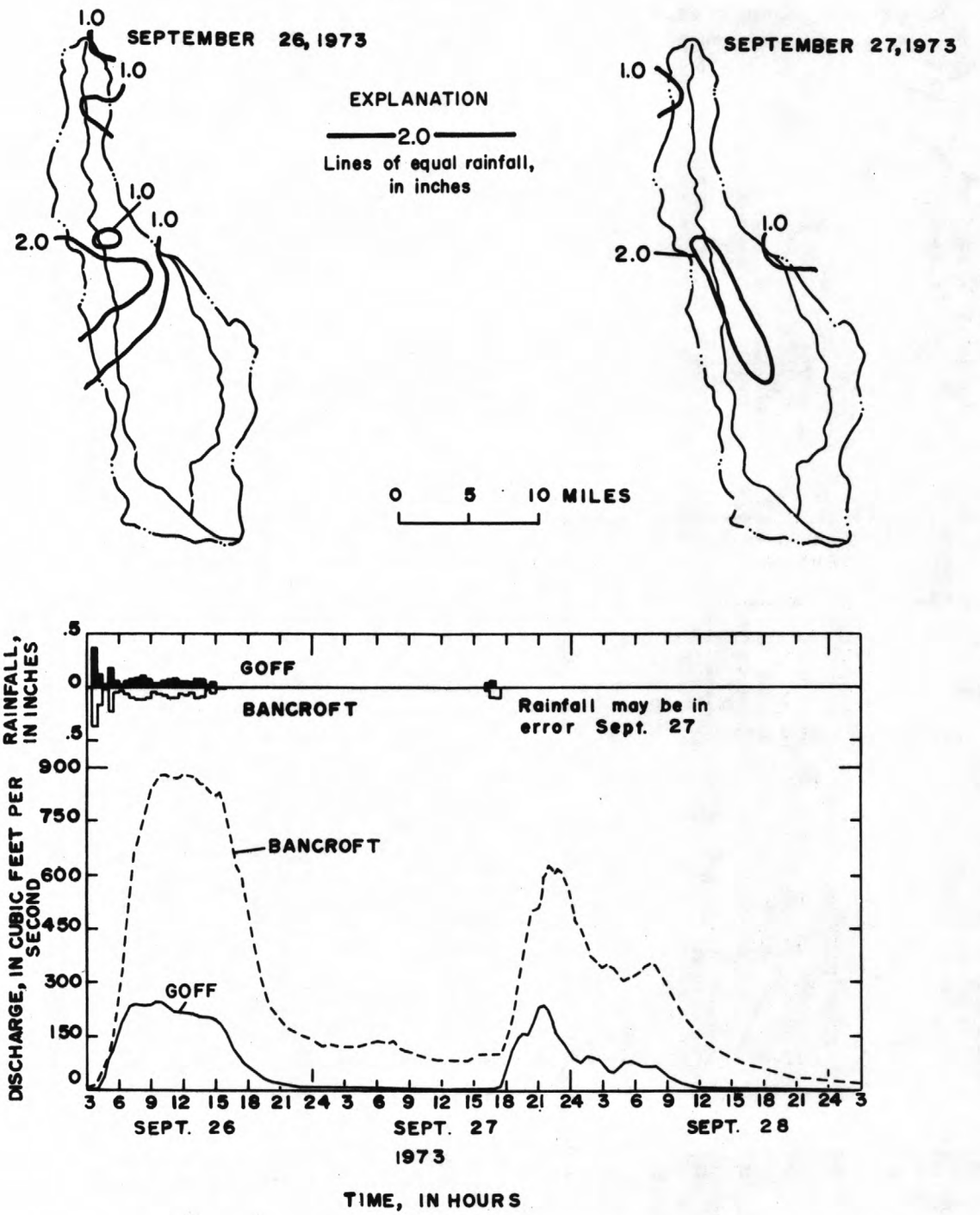
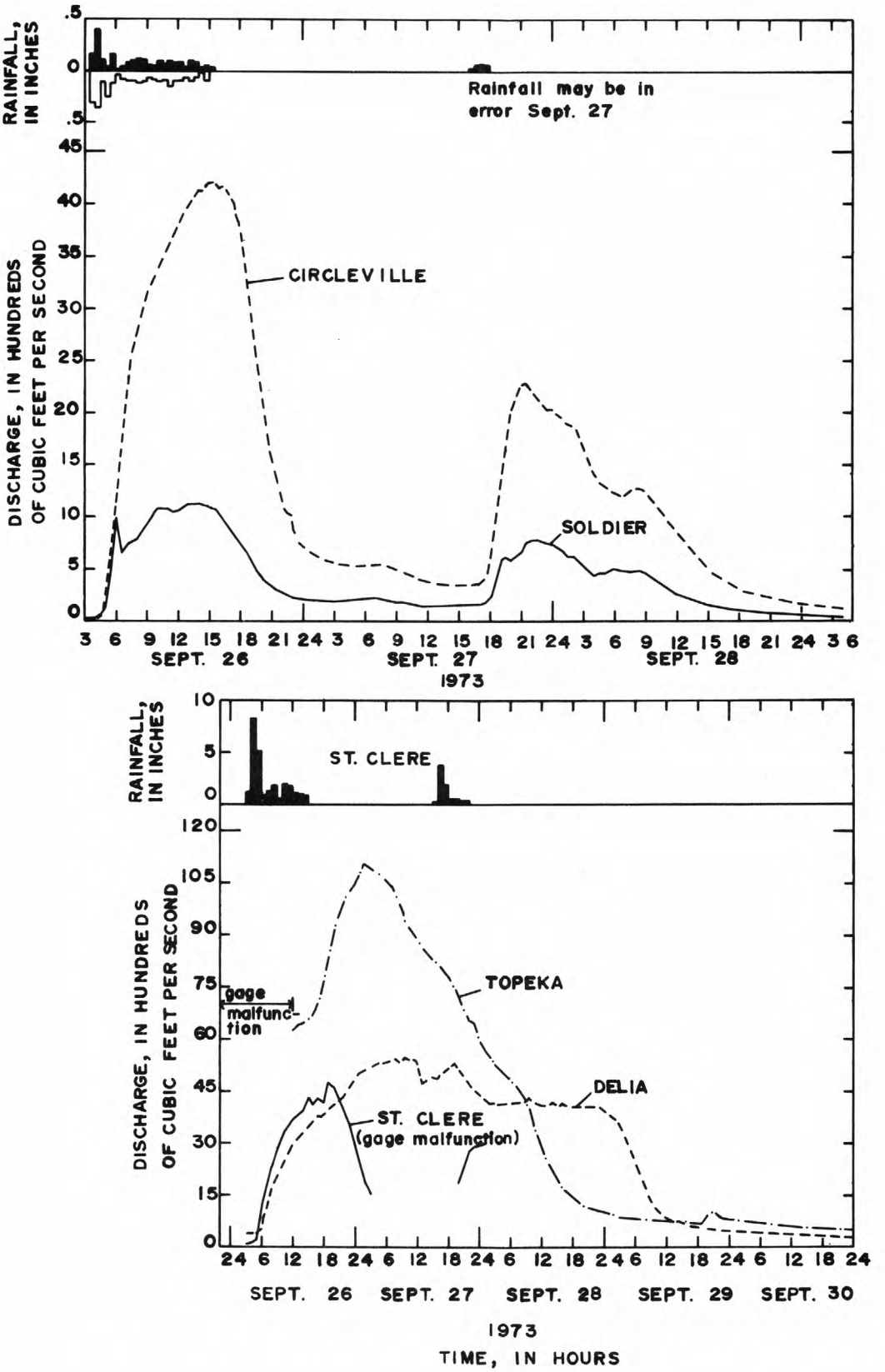


Figure 26.--Distribution of rainfall September 26-27, 1973, and resulting stream discharge.


RAINFALL, IN INCHES
.5
0
.5
Rainfall may be in error Sept. 27
DISCHARGE, IN HUNDREDS OF CUBIC FEET PER SECOND
45
40
35
30
25
20
15
10
5
0
CIRCLEVILLE
SOLDIER
3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6
SEPT. 26
SEPT. 27
SEPT. 28
1973
RAINFALL, IN INCHES
10
5
0
ST. CLERE
DISCHARGE, IN HUNDREDS OF CUBIC FEET PER SECOND
120
105
90
75
60
45
30
15
0
gage malfunction
TOPEKA
DELIA
ST. CLERE (gage malfunction)
24 6 12 18 24 6 12 18 24 6 12 18 24 6 12 18 24 6 12 18 24
SEPT. 26
SEPT. 27
SEPT. 28
SEPT. 29
SEPT. 30
1973
TIME, IN HOURS

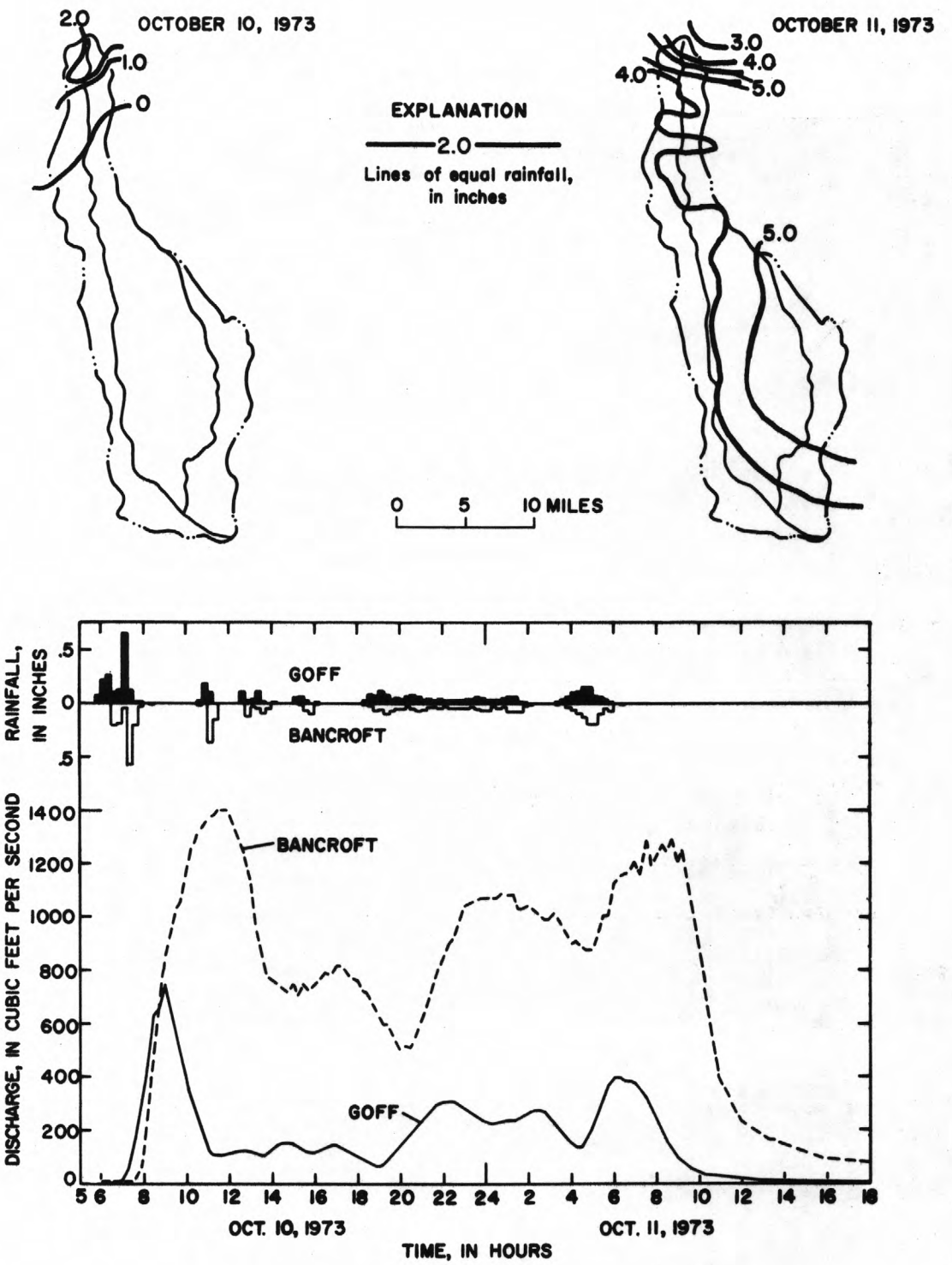
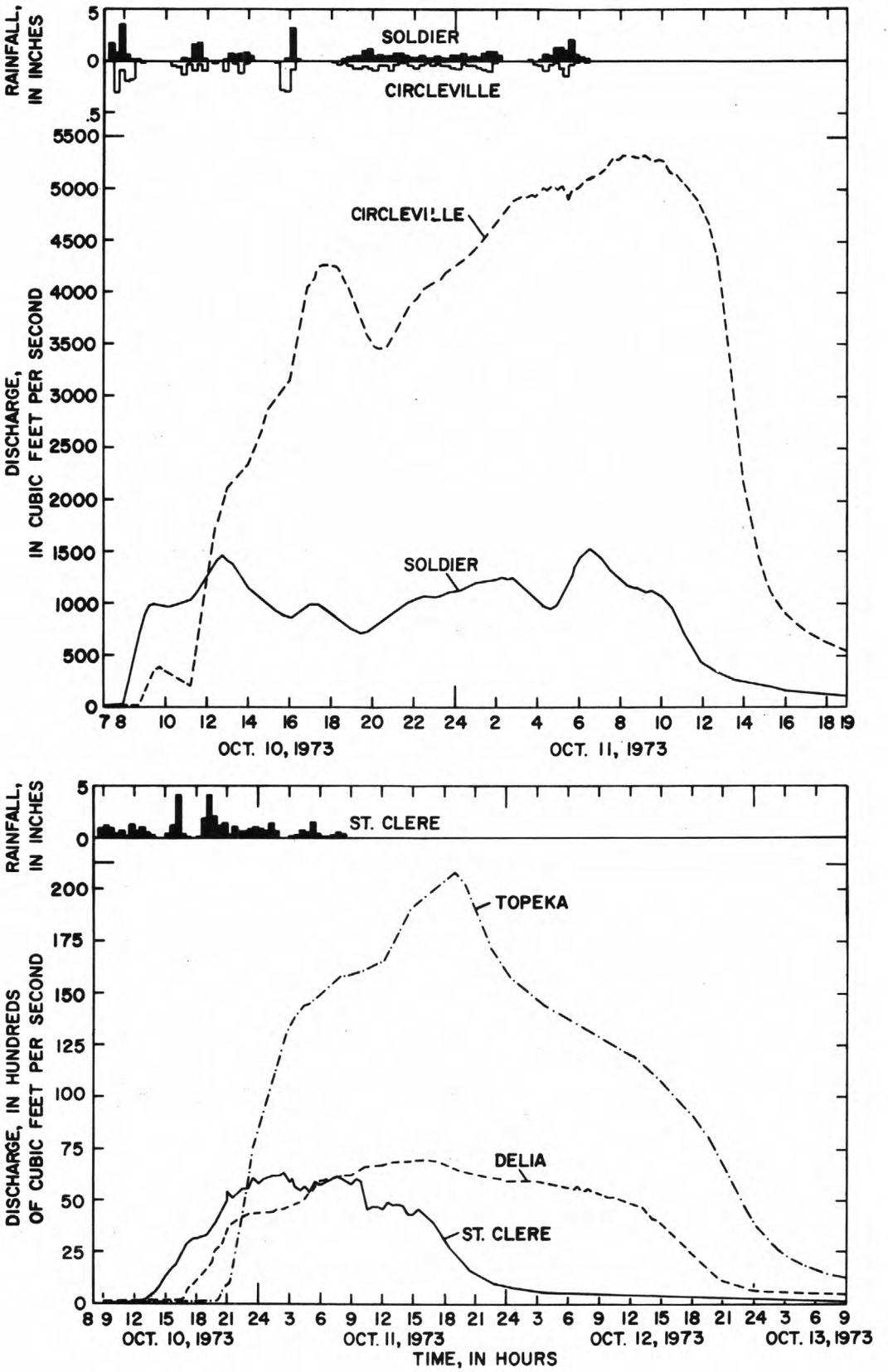


Figure 27.--Distribution of rainfall October 10-11, 1973, and resulting stream discharge.


RAINFALL, IN INCHES
5
0
SOLDIER
CIRCLEVILLE
.5
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
DISCHARGE, IN CUBIC FEET PER SECOND
CIRCLEVILLE
SOLDIER
7 8 10 12 14 16 18 20 22 24 2 4 6 8 10 12 14 16 18 19
OCT. 10, 1973
OCT. 11, 1973
RAINFALL, IN INCHES
5
0
ST. CLERE
200
175
150
125
100
75
50
25
0
DISCHARGE, IN HUNDREDS OF CUBIC FEET PER SECOND
TOPEKA
DELIA
ST. CLERE
8 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9 12 15 18 21 24 3 6 9
OCT. 10, 1973
OCT. 11, 1973
OCT. 12, 1973
OCT. 13, 1973
TIME, IN HOURS

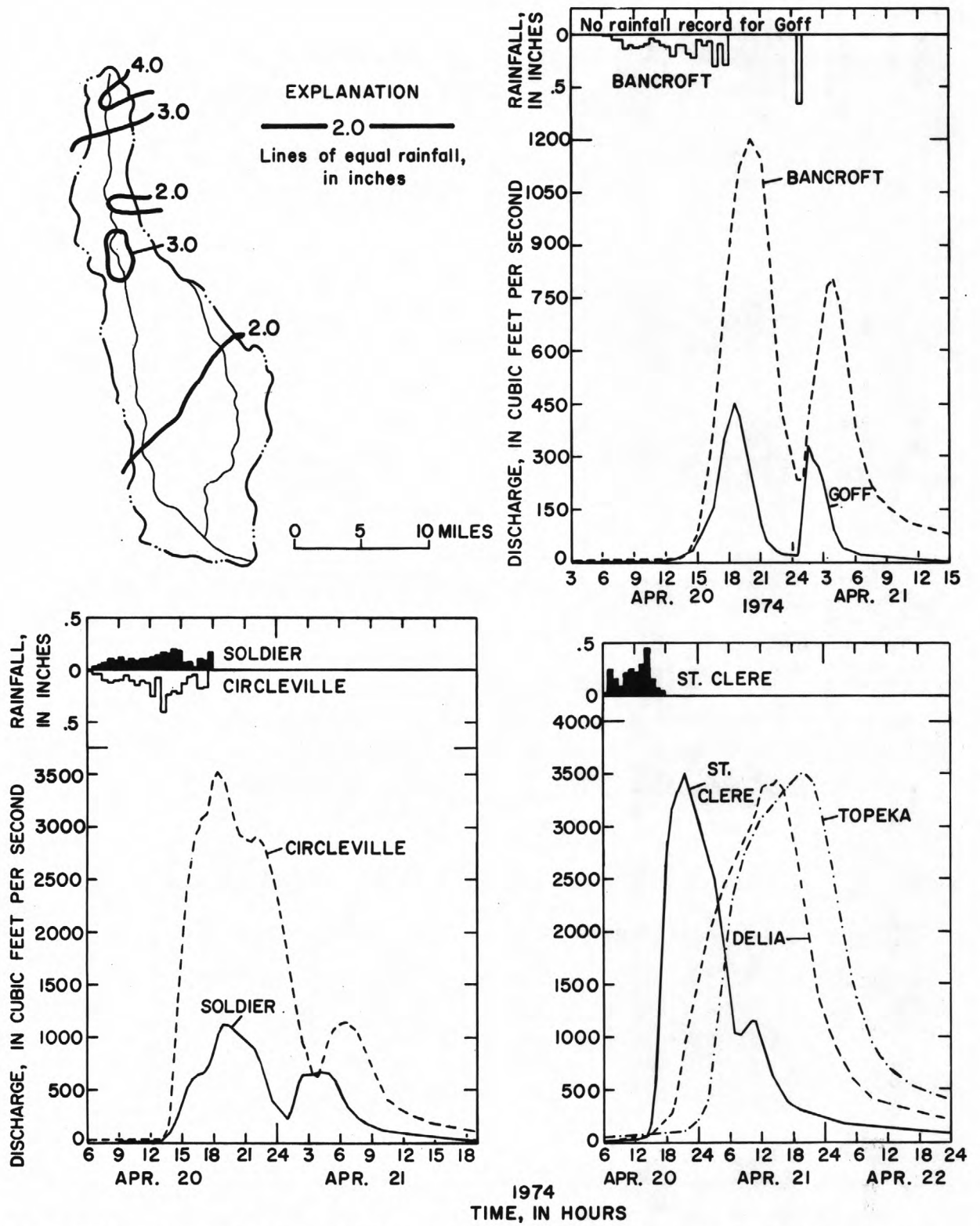


Figure 28.--Distribution of rainfall April 20, 1974, and resulting stream discharge.

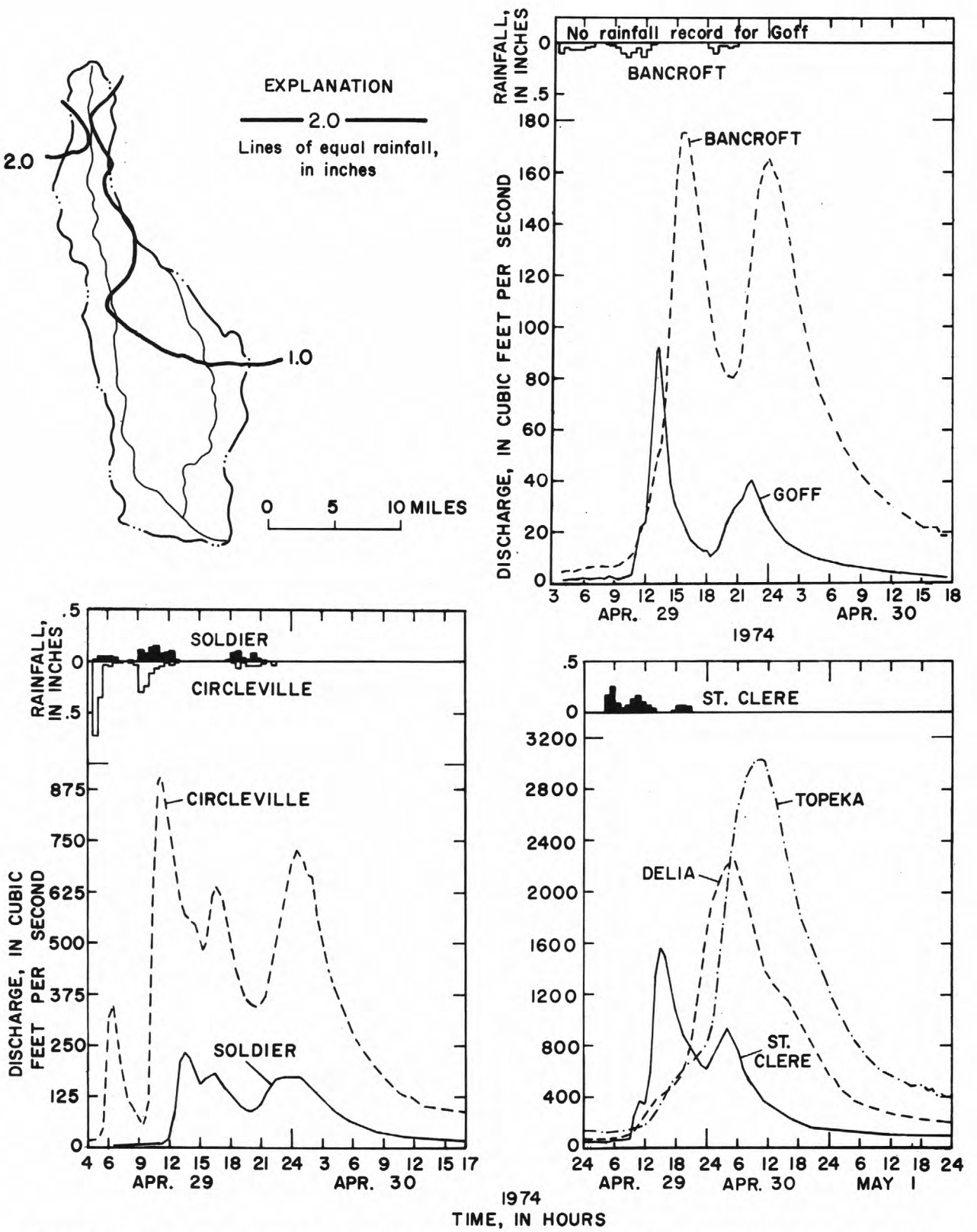


Figure 29.--Distribution of rainfall April 29, 1974, and resulting stream discharge.

SUPPLEMENTARY DATA

Water Quality

Water in the basin generally may be classed, on the basis of predominant ions, as a calcium-bicarbonate type. A series of chemical-quality analyses of water from Soldier Creek near Delta (November 1967 through August 1968) are listed in table 4. The suspended-sediment data collected in the basin during the 1968 water year are shown in table 5. The data tabulated in tables 4 and 5 are intended to provide sufficient data for the reader to determine if the inclusion of water-quality data from Soldier Creek will be beneficial to his study.

Seepage-Salinity Investigations

Main-stem sites included in the investigations are shown in figure 6. A graphic comparison of discharges measured at these sites (fig. 30) is included only to show the different flow conditions during the investigations. A similar comparison of dissolved-solids concentrations in water at each site (fig. 31) show the difference in chemical quality relative to those flow conditions.

Ground Water

Water-level fluctuations at the observation-well sites generally reflect streamflow fluctuations. Figure 32 presents hydrographs of water levels in observation well 8-13E-1CCD4 and in Soldier Creek at the St. Clere gaging station for the period March through September 1974. The difference in water levels during this period generally would indicate the contribution of ground water to streamflow.

[Chemical Analyses in Milligrams per Liter, 1968 Water Year]

DATE	DISCHARGE (ft^3/s)	SILICA (SiO_2)	DISSOLVED IRON (FE)	MANGANESE (MN)	CALCIUM (CA)	MAGNESIUM (MG)	SODIUM (NA)	POTASSIUM (K)	BICARBONATE (HCO_3)	CARBONATE (CO_3)	SULFATE (SO_4)	CHLORIDE (CL)
Nov.												
02...	19	9.8	--	--	118	25	27	4.8	398	0	93	33
22...	15	5.4	--	--	114	29	25	3.6	393	0	98	25
Dec.												
23...	21	6.2	--	--	118	23	25	2.6	381	0	108	20
Jan.												
25...	45	12	--	--	72	16	16	3.0	254	0	58	11
Feb.												
24...	16	6.5	--	--	107	26	24	1.9	356	0	100	23
Mar.												
27...	11	2.2	--	--	93	32	25	2.6	327	0	105	27
Apr.												
18...	32	13	.05	.08	85	25	23	3.6	303	0	89	15
May												
21...	16	10	--	--	86	18	19	4.0	315	0	56	14
July												
09...	3.4	12	--	--	69	21	29	3.6	273	0	62	21
Aug.												
10...	5560	18	--	--	24	2.9	4.0	3.6	88	0	8.2	1.0
11...	3270	29	--	--	32	3.9	4.8	4.0	117	0	11	1.0

DATE	FLUORIDE (F)	NITRATE (NO_3)	PHOSPHATE (PO_4)	BORON (B)	DISSOLVED SOLIDS (RESIDUE AT 180° C)	HARDNESS (CA,MG)	NONCARBONATE HARDNESS	SODIUM ADSORPTION RATIO	SPECIFIC CONDUCTANCE (MICROMHOS)	PH
Nov.										
02...	.3	.9	.20	.18	510	398	72	.6	820	7.6
22...	.3	1.3	.10	.18	502	404	82	.5	780	7.9
Dec.										
23...	.3	1.3	.20	.16	500	389	77	.6	780	7.6
Jan.										
25...	.3	3.1	.20	.20	315	246	38	.4	500	7.7
Feb.										
24...	.2	.9	.10	.10	456	374	82	.5	730	7.8
Mar.										
27...	.2	.4	.10	.13	472	364	96	.6	740	7.9
Apr.										
18...	.4	3.5	.20	.10	402	315	67	.6	660	7.7
May										
21...	.3	.9	.10	.12	378	288	30	.5	600	7.9
July										
09...	.3	.9	.20	--	362	258	34	.8	580	8.1
Aug.										
10...	.5	5.3	1.7	.12	123	72	0	.2	160	7.1
11...	.4	4.0	.60	.10	153	96	0	.2	210	7.1

Table 5.--Suspended-sediment concentrations and particle-size distribution at selected sites on Soldier Creek during 1968 water year.

DATE OF COLLECTION	TIME	WATER TEMPERATURE (C)	WATER DISCHARGE (ft^3/s)	SEDIMENT CONCENTRATION (MG/L)	SUSPENDED SEDIMENT PERCENT FINER THAN SIZE INDICATED, IN MILLIMETERS .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00
SOLDIER CREEK NEAR GOFF															
July 16, 1968	0420	--	49	4990											
July 23.....	2105	--	216	1330											
Aug. 09.....	0500	--	49	13300											
Aug. 10.....	0935	--	117	419											
Aug. 10.....	0945	22	132	2830											
Aug. 10.....	1025	22	150	1770											
Aug. 11.....	1040	18	1.9	166											
Sept. 25.....	1035	15	.31	123											
SOLDIER CREEK NEAR BANCROFT															
July 16, 1968	0730	--	72	3230						--	--	--	--	--	--
July 23.....	2245	--	423	5940						--	--	--	--	--	--
July 23.....	2345	--	792	3700						--	--	--	--	--	--
Aug. 02.....	1355	20	1380	17200						10	14	17	34	82	100
Aug. 03.....	2030	--	63	3460						--	--	--	--	--	--
Aug. 03.....	2300	--	395	2090						--	--	--	--	--	--
Aug. 10.....	1355	21	479	1900	17	21		37		60	63	65	73	99	100
Sept. 19.....	1616	21	.62	98						--	--	--	--	--	--
SOLDIER CREEK NEAR SOLDIER															
July 23, 1968	2200	--	242	2180											
July 24.....	0040	--	740	2350											
Aug. 03.....	2120	--	328	8860											
Aug. 03.....	2135	--	750	10300											
Aug. 03.....	2200	--	1360	438											
Aug. 09.....	0740	--	328	398											
Aug. 11.....	0845	18	236	202											
Aug. 11.....	1325	--	18	228											
Sept. 19, 1968	1415	22	1.1	77											
SOLDIER CREEK NEAR CIRCLEVILLE															
Oct. 06, 1967	2345	--	687	268											
May 13, 1968	2200	--	159	775											
Aug. 02.....	1955	21	1140	5040	18	24		45		79	83	84	87	93	100
Aug. 09.....	0445	--	142	3890											
Aug. 09.....	0555	--	672	3900											
Aug. 10.....	1120	--	1620	1500											
Sept. 03.....	1900	--	142	5280											
Sept. 04.....	0020	--	1620	9500											
Sept. 04.....	1650	19	100	726											
Sept. 19.....	1135	17	6.8	30											
SOLDIER CREEK NEAR ST. CLERE															
Oct. 07, 1967	0100	--	588	2260	--	--		--		--					
Oct. 07.....	0205	--	1110	7180	--	--		--		--					
July 30, 1968	0920	--	1110	2840	--	--		--		--					
July 30.....	1150	--	1800	501	--	--		--		--					
July 31.....	1155	--	3110	1940	--	--		--		--					
Sept. 03.....	2320	--	680	6670	22	30		57		100					
Sept. 04.....	0535	--	1860	5110	26	36		62		99	100				
Sept. 04.....	1450	19	321	2000	20	36		74		100					
Sept. 18.....	1600	19	22	56	--	--		--		--					
SOLDIER CREEK NEAR DELIA															
Oct. 07, 1967	1300	--	1000	4310	--	--		--		--					
Oct. 07.....	1420	--	1220	1340	--	--		--		--					
Apr. 16, 1968	0830	--	1000	13800	36	45		77		100					
Apr. 16.....	0855	--	1220	12700	36	47		75		100					
July 24.....	0340	--	881	3710	--	--		--		--					
July 24.....	0420	--	1120	60600	--	--		--		--					
July 24.....	0605	--	1440	84100	--	--		--		--					
Sept. 17.....	1430	18	28	131	--	--		--		--					

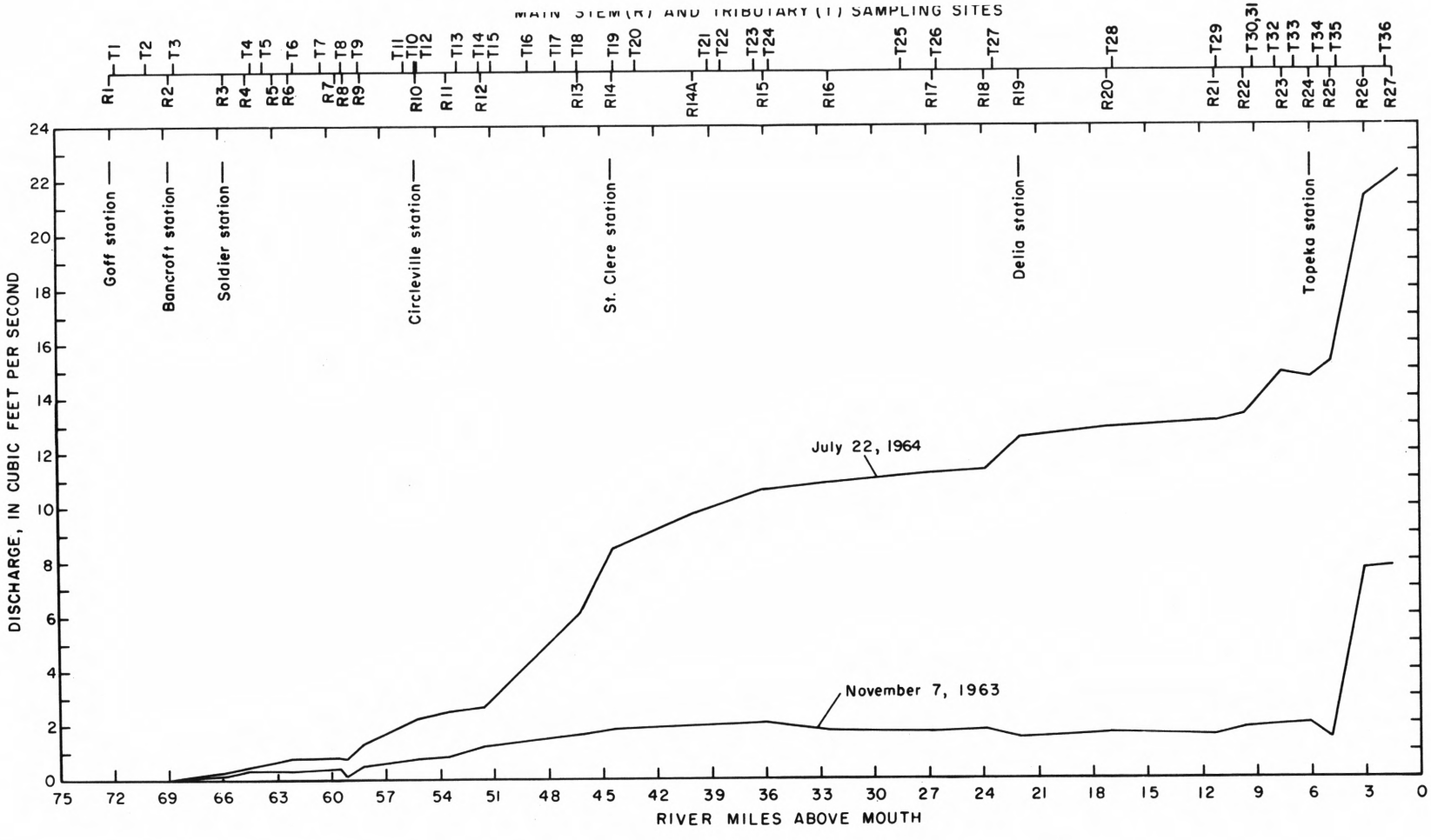


Figure 30.--Water discharges at main-stem sites along Soldier Creek.

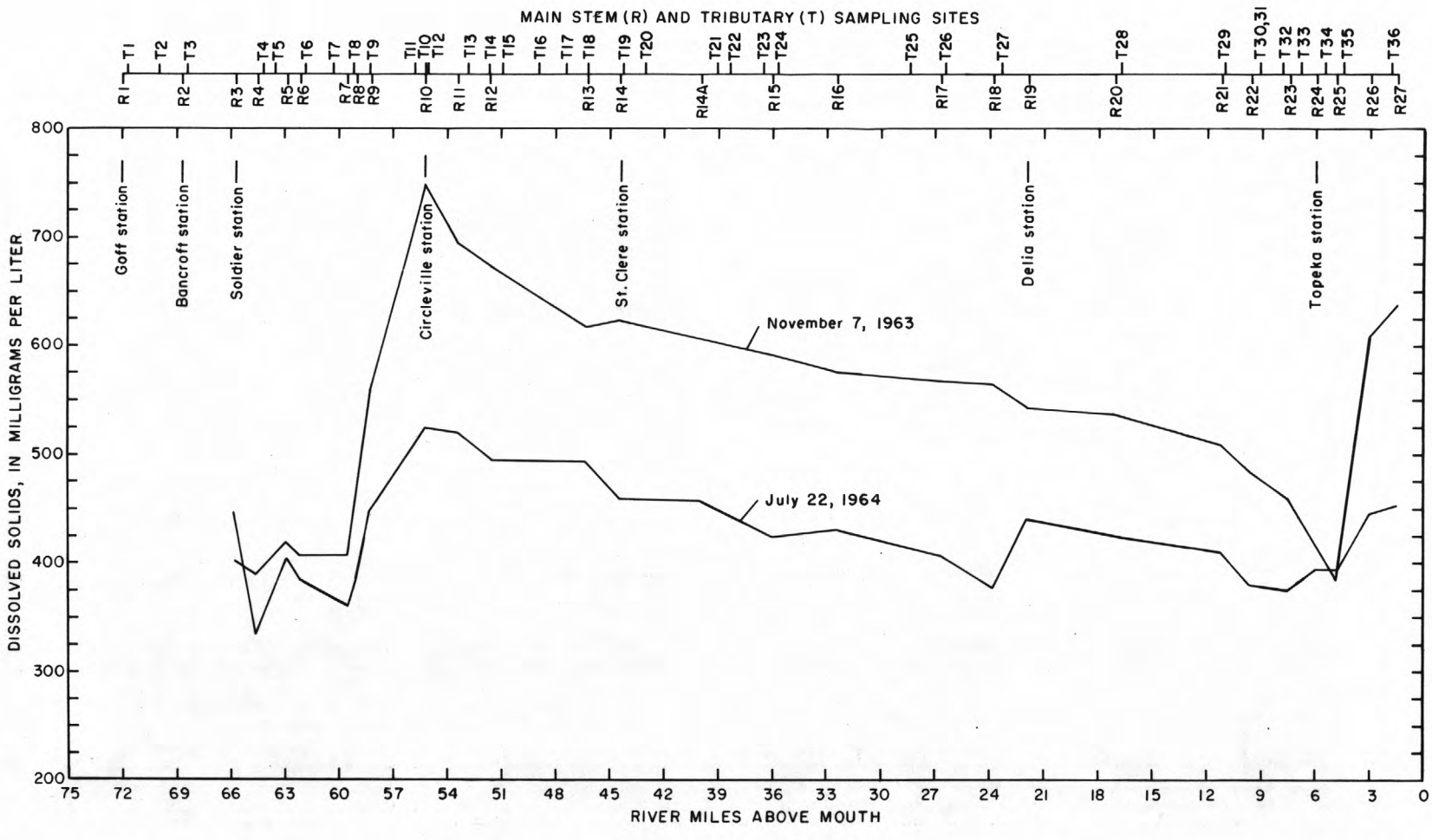


Figure 31.--Dissolved-solids concentrations at main-stem sites along Soldier Creek.

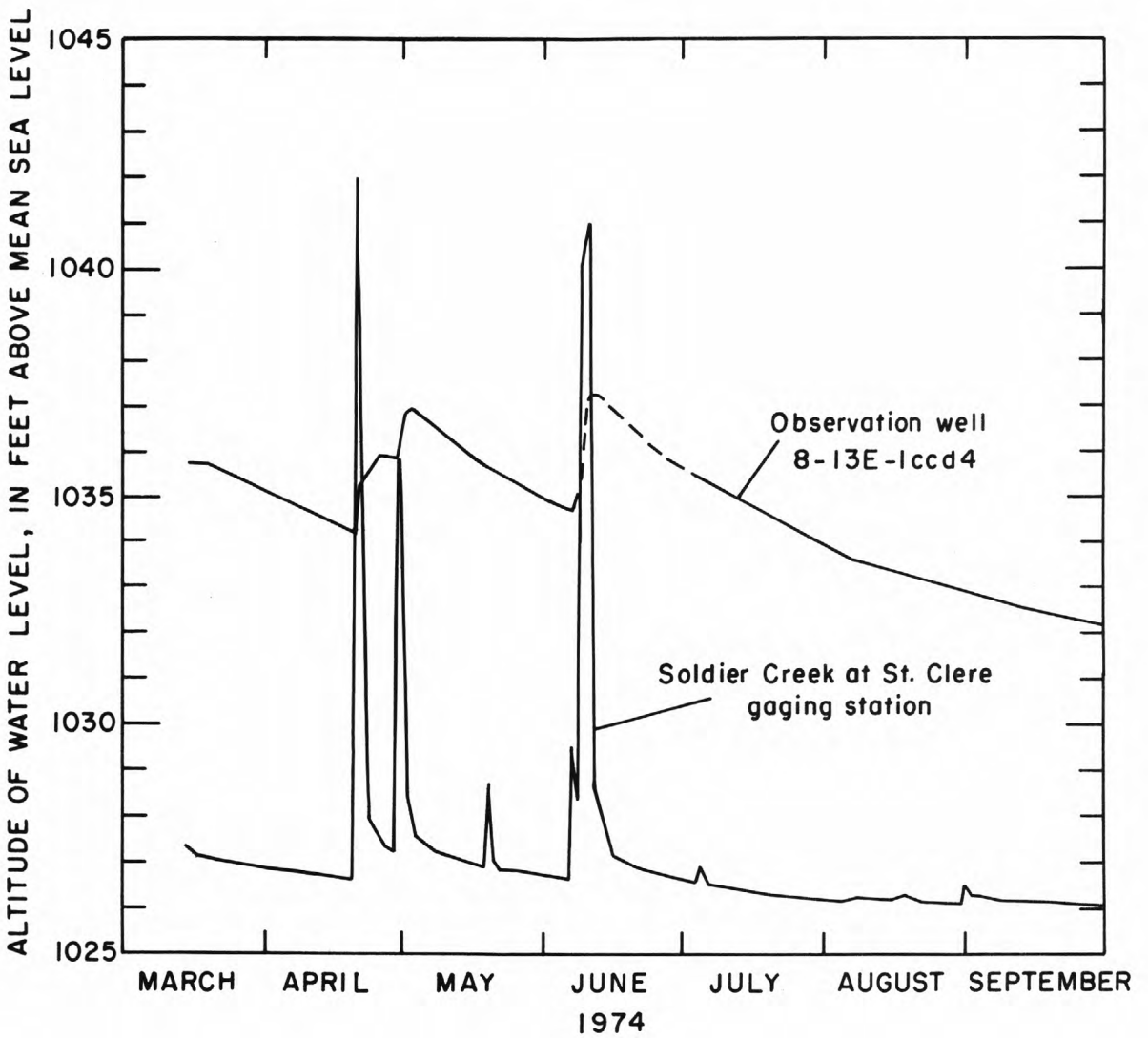


Figure 32.--Hydrographs of water levels in observation well 8-13E-1CCD4 and in Soldier Creek near St. Clere gaging station.

SUMMARY

Soldier Creek basin is a long, narrow basin encompassing an area of about 290 square miles almost directly north of Topeka, Kansas. A wide range of hydrologic data has been collected in the basin since the spring of 1964. These data include rainfall, stream discharge, sediment concentrations, chemical quality of water, and ground-water altitudes.

The data collection system consists of 7 recording streamflow stations, 5 recording rainfall stations, 51 nonrecording rainfall stations, and 31 ground-water observation wells. Sediment and chemical quality of water samples were collected intermittently at selected sites.

A synopsis of the time and space distribution of rainfall and peak flow are provided in graphic and tabular form for selected events of rainfall and peak flow. Peak discharges associated with graphic presentations of rainfall and resulting hydrographs range from 7,080 ft^3/s at the smallest drainage to 20,800 ft^3/s at the largest drainage. Representative data concerning the chemical quality of water and the fluvial sediment also are included. Selected ground-water and seepage-investigation data are depicted graphically.

The data-collection system and a synopsis of the data which it produced are discussed in sufficient detail to permit a potential user to decide if the data will fit his needs. These data will provide a wealth of information for a wide range of hydrologic studies.

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Hershfield, D. M., 1961, Rainfall frequency atlas of the United States: U.S. Weather Bureau Tech. Paper No. 40, 115 p.

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Walters, K. L., 1953, Geology and ground-water resources of Jackson County, Kansas: Kansas Geol. Survey Bull. 101, 90 p.

Ward, John R., 1974, Geohydrology of Nemaha County, northeastern Kansas: Kansas Geol. Survey Ground Water Series No. 2, 19 p.

APPENDIX A

Definition of Terms for Basin Characteristics

Main-channel slope - In feet per mile, computed by the 85- to 10-percent method described by Benson (1962).

Slope at site - In feet per mile, is the stream slope computed from two or more contour crossings from 1: 24,000 scale topographic maps.

Stream length - In miles, measured along channel from gage to basin divide.

Valley length - In miles, measured along general path of flood plain from gage to basin divide.

Mean basin elevation - In feet above mean sea level, measured from topographic maps by transparent grid sampling method (40 to 80 points in the basin were sampled).

Basin perimeter - In miles, is the length of divide around the drainage basin above the site, as measured on 1: 250,000 scale maps.

Storage - Area of lakes, ponds, and swamps in percent of contributing drainage area, measured by the grid sampling method.

Forest - Forested area in percent of contributing drainage area, measured by grid sampling method.

Mean annual precipitation - In inches, at centroid of basin, for period 1941-70. Obtained from written communication by L. D. Bark, Kansas Agricultural Experiment Station, Manhattan, Kansas.

I 24,2 - Precipitation intensity for 24-hour rainfall, in inches, expected at centroid of basin on the average of once each 2 years. Estimated from U.S. Weather Bureau Technical Paper 40.

I 24,50 - Precipitation intensity for 24-hour rainfall, in inches, expected at centroid of basin on the average of once each 50 years. Estimated from U.S. Weather Bureau Technical Paper 40.

Streamflow Station Descriptions and Selected Basin Characteristics

06889100 Soldier Creek near Goff, KS

Location.--Lat 39°37'27", long 95°57'57", in NW¼NW¼NE¼ sec.16, T.5 S., R.13 E., Nemaha County, Hydrologic Unit 10270102, 20 feet downstream from county road, 3.3 miles southwest of Goff, and at river mile 71.9.

Drainage area.--2.06 square miles, as measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--March 1, 1964, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on left bank at downstream side of bridge. Auxiliary equipment includes a graphical recorder.
Datum of gage is 1,297.10 feet above NGVD of 1929.

History.--Nov. 19, 1963 - Graphical recorder was started in operation. Gage-height record only collected through the winter months.
March 1, 1964 -Regular gaging station established as part of a small streams investigation project.

Channel and control.--The channel near the gage is cut in glacial till. The low-water control is a riffle on glacial sand and gravel 10 feet downstream from the orifice. The high-water control is normally at a sharp bend 150 feet downstream from the bridge. The stream traverses a heavily timbered area near the gage. Right-bank overflow starts at about 9 feet and left-bank overflow at about 13 feet.

Historic Floods.--No flood information available prior to establishment of gage.

Regulation and diversion.--No irrigation or diversion upstream is known.

Maps.--Station is located on the Goff, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	25.1 ft/mi
Slope at site	29.3 ft/mi
Stream length	2.94 mi
Valley length	2.67 mi
Mean basin elevation	1,360 ft
Basin perimeter	6 mi
Storage	0.2 percent
Forest	1.7 percent
Mean annual precipitation	34.8 in
I 24,2	3.30 in
I 24,50	6.55 in

06889120 Soldier Creek near Bancroft, KS

Location.--Lat 39°35'42", long 95°58'17", in NE¼NW¼NW¼ sec.28, T.5 S., R.13 E., Nemaha County, Hydrologic Unit 10270102, at downstream side of highway bridge, 4.0 miles west of Bancroft, and at river mile 68.7.

Drainage area.--10.5 square miles, all but 0.7 square miles of which was measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--March 1, 1964, U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on right bank at downstream side of bridge. Auxiliary equipment includes a graphical recorder.
Datum of gage is 1,239.50 feet above NGVD of 1929.

History.--Nov. 19, 1963 - Graphical recorder was started in operation. Gage-height record only collected through the winter months.

March 1, 1964 - Regular gaging station established as part of a small streams investigation project.

Channel and control.--The channel near the gage is alluvium about 2 feet thick over bedrock and is not stable. The low-water control is usually a sand riffle at different locations within about 50 feet of the gage. Both banks are heavily wooded. Right-bank overflow begins at about 9.5 feet and left-bank overflow at about 11 feet.

Historic Floods.--Francis Swartz (rainfall observer, first house east on north side of road) states that before the road and bridge were raised (about 1961), water was often over the road.

Regulation and diversion.--No irrigation is known above the station. Gravel quarry operation in SW¼ sec.5, T.5 S., R.13 E., at times may affect flow at gage. This is commonly accompanied by a rust color in the water. Beavers are known to frequent the area.

Maps.--Station is located on Soldier, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	18.0 ft/mi
Slope at site	8.1 ft/mi
Stream length	6.24 mi
Valley length	4.96 mi
Mean basin elevation	1,350 ft
Basin perimeter	9 mi
Storage	0.2 percent
Forest	5.8 percent
Mean annual precipitation	34.9 in
I 24,2	3.30 in
I 24,50	6.55 in

06889140 Soldier Creek near Soldier, KS

Location.--Lat 39°33'57", long 95°57'45", in NW¼NE¼NE¼ sec.4, T.6 S., R.13 E., Jackson County, Hydrologic Unit 10270102, at downstream side of highway bridge, 2.0 miles north of Soldier and at river mile 65.7.

Drainage area.--16.9 square miles, all but 0.7 square miles of which was measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--March 1, 1964, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by a 50-foot-range bubble gage in a 4x4x8-foot steel-covered shelter on left downstream side of bridge. Auxiliary equipment includes a graphical recorder.

Datum of gage is 1,206.00 feet above NGVD of 1929.

History.--Nov. 19, 1963 - Graphical recorder was started in operation. Gage-height record only collected through the winter months.

March 1, 1964 - Regular gaging station established as part of a small streams investigation project.

Channel and control.--The channel near the gage is a thin covering of alluvium over bedrock and is not stable. The bridge at the gage is of recent construction, and considerable scouring and shifting of the channel can be expected until it reaches equilibrium. The low-water control is usually a sand-gravel riffle at different locations within 200 feet of the gage. Both banks are heavily wooded. Right-bank overflow begins at about 12 feet and is about 300 feet wide. Left-bank overflow begins at about 13 feet and may be as much as 1,000 feet wide.

Historic Floods.--No flood information available prior to establishment of gage.

Regulation and diversion.--No irrigation is known above the station. Beavers are known to frequent the area and may cause some regulation during low-flow periods.

Maps.--Station is located on Soldier, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	14.6 ft/mi
Slope at site	12.0 ft/mi
Stream length	9.29 mi
Valley length	7.33 mi
Mean basin elevation	1,340 ft
Basin perimeter	16 mi
Storage	0.2 percent
Forest	7.0 percent
Mean annual precipitation	34.9 in
I 24,2	3.32 in
I 24,50	6.57 in

06889160 Soldier Creek near Circleville, KS

Location.--Lat 39°27'47", long 95°57'00", in NW¼NW¼NE¼ sec.10, T.7 S., R.13 E., Jackson County, Hydrologic Unit 10270102, 160 feet downstream from bridge on State highway 16, 5.8 miles southwest of Circleville, and at river mile 55.2.

Drainage area.--49.3 square miles, almost all of which was measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--March 1, 1964, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on right bank at downstream side of the bridge. Auxiliary equipment includes a graphical recorder.

Datum of gage is 1,094.58 feet above NGVD of 1929.

History.--Nov. 19, 1963 - Graphical A-35 recorder was started in operation. Gage-height record only collected through the winter months.

March 1, 1964 - Regular gaging station established as part of a small streams investigation project.

Channel and control.--The channel near the gage is in alluvium and is not stable. The low-water control is a gravel riffle about 200 feet downstream from the bridge. Both banks are wooded. Right-bank overflow starts at about 15 feet, but probably is not a rating factor because the channel runs along the right side of the valley wall downstream from the gage. Left-bank overflow begins at about 16 feet, but may not be significant until about 17 feet owing to a low dike along the left bank.

Beaver dams are a serious nuisance in low-flow periods during the late summer, fall, and winter months.

Historic Floods.--Jesse Cowger (first house west of gage on north side) stated that the 1951 flood left a high-water mark at the edge of the pavement at the entrance to the field on the north side of the road west of the gage. This is the highest that Soldier Creek has ever been in his lifetime (born in 1908) or his father's lifetime (Oscar Cowger, born 1883). The high-water mark was found to be 25.5 feet above gage datum and is considered to be of good reliability.

Jesse Cowger has lived in Soldier Creek basin all of his life and at this location since 1945. A flood in the spring of 1945 was the second highest since he has been at this location and was about 21.1 feet. This mark was at the top board of a gate near his barn and is of fair reliability.

Both of these marks were on the upstream side of the bridge; however, Mr. Cowger thought the fall through the bridge to be 0.5 foot or less.

Regulation and diversion.--No irrigation upstream is known. Beaver activity upstream occasionally may regulate low flow.

Maps.--Station is located on the Soldier Creek NW, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	10.8 ft/mi
Slope at site	6.73 ft/mi
Stream length	20.2 mi
Valley length	15.9 mi
Mean basin elevation	1,287 ft
Basin perimeter	24 mi
Storage	0.2 percent
Forest	8.0 percent
Mean annual precipitation	35.0 in
I 24, 2	3.35 in
I 24,50	6.60 in

06889180 Soldier Creek near St. Clere, KS

Location.--Lat 39°22'33", long 95°55'05", NW¼NE¼NW¼ sec.12, T.8 S., R.13 E., Jackson County, Hydrologic Unit 10270102, at upstream side of highway bridge, 7.8 miles east of St. Clere, and at river mile 44.5.

Drainage area.--80 square miles, almost all of which was measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--March 1, 1964, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on right bank at downstream side of bridge. Auxiliary equipment includes a graphical recorder.
Datum of gage is 1,023.04 feet above NGVD of 1929.

History.--Nov. 18, 1963 - Graphical recorder was started in operation. Gage-height record only collected through winter months.
March 1, 1964 - Regular gaging station established as part of a small streams investigation project.
Apr. 2, 1964 - Stage and rain gage digital recorders installed.

Channel and control.--The channel near the gage is in alluvium and is not stable. The low-water control is commonly formed by debris jams or remains of beaver dams at different locations within about 1,000 feet of the gage. Both banks are high and heavily wooded. Right- and left-bank overflow starts at about 19 feet and extends about 1,000 feet on each bank over cultivated land at about 21 feet.

Historic Floods.--No flood information at this site prior to establishment of gage.

Regulation and diversion.--No consequential irrigation upstream is known. Beaver activity upstream occasionally causes regulation during low-flow periods.

Maps.--Station is located on Soldier Creek NW, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	9.20 ft/mi
Slope at site	3.60 ft/mi
Stream length	31.2 mi
Valley length	22.6 mi
Mean basin elevation	1,250 ft
Basin perimeter	42 mi
Storage	0.2 percent
Forest	8.0 percent
Mean annual precipitation	35.1 in
I 24,2	3.40 in
I 24,50	6.65 in

06889200 Soldier Creek near Delia, KS

Location.--Lat 39°12'08", long 95°52'25", in NE¼NW¼NE¼ sec.8, T.10 S., R.14 E., Shawnee County, Hydrologic Unit 10270102, at upstream side of highway bridge, 5.1 miles upstream from Walnut Creek and 5.5 miles southeast of Delia, and at river mile 21.9.

Drainage area.--157 square miles, measured on 1953 Shawnee, Jackson, and Nemaha County highway maps. These planimetric maps (1 inch = 2 miles) have excellent drainage details and horizontal control.

Establishment.--October 1, 1958, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on right bank at downstream side of bridge. Auxiliary equipment includes a graphical recorder.

Datum of gage is 931.34 feet above NGVD of 1929.

History.--No other gages have been operated in the vicinity. The graphical recorder was installed September 22, 1958, but published records began October 1, 1958.

March 20, 1964 - Digital recorder installed.

Channel and control.--The channel is a straight artificial cut through clay where the channel was straightened when the bridge was built. Both banks are brush and willow covered. Right-bank overflow starts at about 16.5 feet over a cultivated field and may be one-half mile wide at 20-foot stage.

The left bank is about the same height as the right, below the junction of the old and new channels (dead water only in old channel), but the left flood plain ranges in width from zero to as much as a few hundred feet.

The low-water control is a rock low-water crossing for heavy equipment, approximately 1,500 feet below the gage.

Historic Floods.--Levels were run to the floor of the Clarence Anderson residence 600 feet upstream from gage and to a point just below the sill of the storm shelter. The floor, which was just reached by the 1951 flood, was at elevation 24.28 feet, and the shelter point, reached by the second highest flood, was at 24.03 feet. High-water marks painted on a shed door at the Simecka residence 2.5 miles north and 2 miles west of gage were dated "6-21-51" for the highest mark, "9-4-51" for a mark 0.6 foot lower, and "7-19 [or 18, or 13] -51" for a mark 0.7 feet below the middle mark. Mr. Simecka stated that he neglected to mark the second highest flood, which his son thought occurred in 1942 (probably April 23, 1944), and that the flood of "6-21-51" was the highest in his memory (since 1909). Another local resident stated that notable floods also occurred in 1915, 1903, and 1907, in order of descending magnitude.

The change in road fill and bridge in 1954 may have changed the high-water rating so that reliable figures of discharge can never be determined from past stage values.

Regulation and diversion.--Unknown amount of pumpage from stream for supplemental irrigation.

Maps.--Station is located on the Grove, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	6.56 ft/mi
Slope at site	3.52 ft/mi
Stream length	54.7 mi
Valley length	35.1 mi
Mean basin elevation	1,170 ft
Basin perimeter	70 mi
Storage	0.2 percent
Forest	8.0 percent
Mean annual precipitation	35.2 in
I 24,2	3.44 in
I 24,50	6.70 in

06889500 Soldier Creek near Topeka, KS

Location.--Lat 39°06'00", long 95°43'27", in SW¼NW¼NW¼ sec.14, T.11 S., R.15 E., Shawnee County, Hydrologic Unit 10270102, at downstream side of highway bridge, 1.5 miles upstream from Halfday Creek, 2.1 miles northwest of Topeka, and at river mile 6.0.

Drainage area.--290 square miles, all but 3 square miles of which was measured on U.S. Geological Survey 7½-minute quadrangle sheets.

Establishment.--May 23, 1929, by U.S. Geological Survey, Kansas District.

Gage.--Digital-punch recorder, 15-minute interval, driven by 50-foot-range bubble gage in 4x4x8-foot steel-covered shelter on right bank at downstream side of bridge. Auxiliary equipment consists of a graphical recorder.

Datum of gage is 862.95 feet above NGVD of 1929.

History.--May 23, 1929 - Chain gage installed at site 2 miles downstream from present site at different datum.

July 27, 1935 - Wire-weight gage installed at present site on bridge, now destroyed, at datum 4.00 feet higher.

June 17, 1958 - Water-stage recorder installed at present site on bridge, now destroyed, at datum 4.00 feet higher.

May 25, 1960 - Wire-weight gage installed at site 1.1 miles downstream at datum 1.79 feet lower.

June 9, 1961 - Bubble gage and graphical recorder installed at present site and datum.

April 15, 1964 - Digital-punch recorder added to existing equipment.

Channel and control.--The low-water channel is composed of mud and sand. The gage site is in a reach of manmade channel that is part of the flood protection system for North Topeka. Both banks are leveed in vicinity of gage and are not subject to overflow. The tops of levees at the gage are 34.5 feet above gage datum.

Historic floods.--No flood information at this site prior to establishment of gage.

Regulation and diversion.--Unknown amount of pumpage from stream for supplemental irrigation.

Maps.--Station is located on Topeka, Kansas, U.S. Geological Survey 7½-minute quadrangle, topographic map.

Selected climatic and physiographic basin parameters.--

Main-channel slope	5.55 ft/mi
Slope at site	3.54 ft/mi
Stream length	71.1 mi
Valley length	46.9 mi
Mean basin elevation	1,120 ft
Basin perimeter	92 mi
Storage	0.3 percent
Forest	8.15 percent
Mean annual precipitation	35.2 in
I 24,2	3.48 in
I 24,50	6.75 in

APPENDIX B

Ground-Water Well Descriptions

(Altitude of land surface given in feet above NGVD of 1929)

5-13E-9CDD. Observation well located 392 feet west of center of bridge at Goff streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 25.5 feet. Measuring point, top of pipe, 2.5 feet above land surface.
Altitude of land surface 1,312.75 feet.
Highest water level, 1.55 feet below LSD, Apr. 23, 1973.
Lowest water level, 15.10 feet below LSD, Nov. 2, 1964.
Records available 1963-76.

5-13E-9DCC. Observation well located 114 feet west of center of bridge at Goff streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 29.4 feet. Measuring point, top of pipe, 3.5 feet above land surface.
Altitude of land surface 1,308.06 feet.
Highest water level, 6.70 feet below LSD, Apr. 22, 1969.
Lowest water level, 15.70 feet below LSD, Nov. 3, 1964.
Records available 1963-70, 1974.

5-13E-16ABB. Observation well located 42 feet east of center of bridge at Goff streamflow gage (destroyed 1970). Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 34.0 feet. Measuring point, top of pipe, 2.0 feet above land surface.
Altitude of land surface 1,311.99 feet.
Highest water level, 6.73 feet below LSD, Apr. 22, 1969.
Lowest water level, 15.00 feet below LSD, Mar. 13, 1967.
Records available 1963-70.

5-13E-21CCD. Observation well located 332 feet east of center of bridge at Bancroft streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 29.0 feet. Measuring point, top of pipe, 3.4 feet above land surface.
Altitude of land surface 1,257.73 feet.
Highest water level, 7.28 feet below LSD, May 22, 1969.
Lowest water level, 15.33 feet below LSD, Mar. 13, 1967.
Records available 1963-70, 1974.

5-13E-28BBA. Observation well located 92 feet west of center of bridge at Bancroft streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 22.5 feet. Measuring point, top of pipe, 6.2 feet above land surface.
Altitude of land surface 1,250.51 feet.
Highest water level, 0.77 foot below LSD, Oct. 15, 1970.
Lowest water level, 10.50 feet below LSD, July 3, 1963.
Records available 1963-76.

5-13E-28BBB. Observation well located 642 feet west of center of bridge at Bancroft streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 22.6 feet. Measuring point, top of pipe, 5.7 feet above land surface.
Altitude of land surface 1,253.11 feet.
Highest water level, 3.05 feet above LSD, Dec. 27, 1973.
Lowest water level, 7.51 feet below LSD, Oct. 2, 1964.
Records available 1963-76.

5-13E-33DDC. Observation well located 44 feet east of center of bridge at Soldier streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 17.5 feet. Measuring point, top of pipe, 3.5 feet above land surface.
Altitude of land surface 1,221.02 feet.
Highest water level, 10.04 feet below LSD, June 15, 1964.
Lowest water level, dry.
Records available 1963-70, 1974.

5-13E-33DDC2. Observation well located 504 feet east of center of bridge at Soldier streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 21.0 feet. Measuring point, top of pipe, 4.0 feet above land surface.
Altitude of land surface 1,220.16 feet.
Highest water level, 0.43 foot above LSD, Mar. 23, 1973.
Lowest water level, 10.72 below LSD, July 24, 1963.
Records available 1963-76.

6-13E-4ABA. Observation well located 72 feet west of center of bridge at Soldier streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 22.5 feet. Measuring point, top of pipe, 5.7 feet above land surface.
Altitude of land surface 1,223.59 feet.
Highest water level, 13.39 feet below LSD, May 22, 1969.
Lowest water level, 16.38 feet below LSD, Nov. 17, 1969.
Records available 1963-70, 1974.

6-13E-4ABA2. Observation well located 444 feet west of center of bridge at Soldier streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 16.5 feet. Measuring point, top of pipe, 2.3 feet above land surface.
Altitude of land surface 1,231.02 feet.
Highest water level, 12.63 feet below LSD, Jan. 19, 1970.
Lowest water level, dry.
Records available 1963-70, 1974.

7-13E-3CDD. Observation well located 530 feet west of center of bridge at Circleville streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 23.0 feet. Measuring point, top of pipe, 3.4 feet above land surface. (Top of pipe, 1.1 feet above LSD in 1974.)
Altitude of land surface 1,132.90 feet.
Highest water level, 3.49 feet below LSD, May 21, 1969.
Lowest water level, 9.44 feet below LSD, Nov. 3, 1964.
Records available 1963-70, 1974.

7-13E-3DCC. Observation well located 66 feet west of center of bridge at Circleville streamflow gage. Well destroyed in 1970. Well bored in alluvial deposits; 1.00-inch pipe installed to measure watertable altitudes. Depth (1963) 36.5 feet. Measuring point, top of pipe, 4.0 feet above land surface.
Altitude of land surface 1,110.81 feet.
Highest water level, 1.56 feet below LSD, May 26, 1970.
Lowest water level, 12.18 feet below LSD, Apr. 13, 1968.
Records available 1963-70.

7-13E-3DCC2. Observation well located 122 feet east of center of bridge at Circleville streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 18.5 feet. Measuring point, top of pipe, 2.5 feet above land surface.
Altitude of land surface 1,110.28 feet.
Highest water level, 9.68 feet below LSD, July 9, 1964.
Lowest water level, dry.
Records available 1963-70, 1974.

7-13E-3DCD. Observation well located 710 feet east of center of bridge at Circleville streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 23.1 feet. Measuring point, top of pipe, 2.5 feet above land surface.
Altitude of land surface 1,122.68 feet.
Highest water level, 11.38 feet below LSD, Mar. 26, 1973.
Lowest water level, dry.
Records available 1963-76.

8-13E-1CCC. Observation well located 1,080 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 14.0 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 1,043.66 feet.
Highest water level, 1.28 feet below LSD, June 18, 1969.
Lowest water level, 13.49 feet below LSD, Nov. 24, 1964.
Records available 1963-70, 1974.

8-13E-1CCD. Observation well located 556 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 42.2 feet. Measuring point, top of pipe, 4.0 feet above land surface.
Altitude of land surface 1,045.05 feet.
Highest water level, 4.60 feet below LSD, June 18, 1969.
Lowest water level, 14.83 feet below LSD, Apr. 15, 1964.
Records available 1963-70, 1974.

8-13E-1CCD2. Observation well located 98 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 43.5 feet. Measuring point, top of pipe, 3.5 feet above land surface.
Altitude of land surface 1,043.14 feet.
Highest water level, 4.25 feet LSD, Nov. 24, 1964.
Lowest water level, 15.22 feet below LSD, Apr. 15, 1964.
Records available 1963-70, 1974.

8-13E-1CCD3. Recording observation well located 410 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1963) 36.2 feet. Measuring point, top of pipe, (1964 to November 1970) 3.0 feet above land surface, (November 1970 to present) 1.7 feet above land surface.
Altitude of land surface 1,042.76 feet.
Highest water level, 0.30 foot below LSD, Oct. 17, 1968.
Lowest water level, 13.34 feet below LSD, May 26, 1964.
Records available 1964-76.

8-13E-1CCD4. Recording observation well located 80 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 5-inch pipe installed to measure water-table altitudes. Depth (1963) 36.2 feet. Measuring point, top of pipe, 3.6 feet above land surface.
Altitude of land surface 1,043.00 feet.
Highest water level, 4.02 feet below LSD, June 21, 1967.
Lowest water level, 19.97 feet below LSD, Oct. 15, 1968.
Records available 1964-69, 1976.

8-13E-1CCD5. Observation well located 305 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1974) 39.6 feet. Measuring point, top of pipe, 1.4 feet above land surface.
Altitude of land surface 1,042.77 feet.
Highest water level, 3.95 feet below LSD, June 18, 1969.
Lowest water level, 13.58 feet below LSD, Mar. 13, 1967.
Records available 1965-70, 1974.

8-13E-1CCD6. Observation well located 275 feet west of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth (1974) 36.2 feet. Measuring point, top of pipe, 1.6 feet above land surface.
Altitude of land surface 1,042.74 feet.
Highest water level, 3.56 feet below LSD, June 18, 1969.
Lowest water level, 13.12 feet below LSD, Feb. 13, 1967.
Records available 1965-70, 1974.

8-13E-1CDC. Observation well located 62 feet east of center of bridge at St. Clere streamflow gage. Well destroyed as of 1974. Well bored in alluvial deposits; 1.00-inch pipe installed to measure watertable altitudes. Depth (1963) 27.0 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 1,043.77 feet.
Highest water level, 2.72 feet below LSD, June 20, 1967.
Lowest water level, 18.83 feet below LSD, Jan. 4, 1965.
Records available 1963-70.

8-13E-1CDC2. Observation well located 662 feet east of center of bridge at St. Clere streamflow gage. Well destroyed as of 1965. Well bored in alluvial deposits; 1.00-inch pipe installed to measure watertable altitudes. Depth (1963) 36.5 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 1,044.26 feet.
Highest water level, 7.85 feet below LSD, Sept. 24, 1963.
Lowest water level, 16.48 feet below LSD, Apr. 15, 1964.
Records available 1963-65.

8-13E-1DCC. Observation well located 1,226 feet east of center of bridge at St. Clere streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 30.1 feet. Measuring point, top of pipe, 3.5 feet above land surface.
Altitude of land surface 1,043.58 feet.
Highest water level, 7.12 feet below LSD, July 24, 1963.
Lowest water level, 18.81 feet below LSD, Apr. 15, 1964.
Records available 1963-70, 1974.

10-14E-5CDC. Observation well located 2,157 feet west of center of bridge at Delta streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 23.5 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 956.52 feet.
Highest water level, 0.19 foot below LSD, Nov. 2, 1967.
Lowest water level, 7.16 feet below LSD, Mar. 14, 1967.
Records available 1963-70, 1974.

10-14E-5DCD. Observation well located 5 feet east of center of bridge at Delta streamflow gage. Well destroyed as of 1968. Well bored in alluvial deposits; 1.25-inch pipe installed to measure water-table altitudes. Depth unknown. Measuring point, top of pipe, used 0.0 feet above land surface since sandy streambed is subject to frequent shifting.
Altitude of land surface 937.73 feet.
Highest water level, 0.05 foot below LSD, Apr. 18, 1968.
Lowest water level, 5.53 feet below LSD, Oct. 13, 1966.
Records available 1965-68.

10-14E-5DDD. Observation well located 1,400 feet east of center of bridge at Delta streamflow gage. Well destroyed in 1964. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth 31.6 feet. Measuring point, top of pipe, 4.7 feet above land surface.
Altitude of land surface 958 feet.
Highest water level, 11.68 feet below LSD, Sept. 24, 1963.
Lowest water level, 14.88 feet below LSD, Dec. 5, 1963.
Records available 1963.

10-14E-8AAB. Observation well located 150 feet east of center of bridge at Delta streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963 - 24.3 feet) 35.5 feet measured in 1974. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 949.77 feet.
Highest water level, 3.90 feet below LSD, June 26, 1967.
Lowest water level, 18.03 feet below LSD, Mar. 13, 1964.
Records available 1963-70, 1974.

10-14E-8AAB2. Observation well located 660 feet east of center of bridge at Delta streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 26.1 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 957.78 feet.
Highest water level, 9.58 feet below LSD, May 20, 1969.
Lowest water level, 18.25 feet below LSD, Apr. 11, 1967.
Records available 1963-70, 1974.

10-14E-8ABA. Observation well located 220 feet west of center of bridge at Delta streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 48.3 feet. Measuring point, top of pipe, 3.0 feet above land surface.
Altitude of land surface 947.76 feet.
Highest water level, 0.23 foot below LSD, June 26, 1967.
Lowest water level, 14.31 feet below LSD, Mar. 13, 1964.
Records available 1963-72, 1974.

10-14E-8ABB. Observation well located 957 feet west of center of bridge at Delta streamflow gage. Well bored in alluvial deposits; 1.00-inch pipe installed to measure water-table altitudes. Depth (1963) 38.8 feet. Measuring point, top of pipe, 3.3 feet above land surface.
Altitude of land surface 952.85 feet.
Highest water level, 0.85 foot below LSD, June 15, 1969.
Lowest water level, 13.43 feet below LSD, Mar. 14, 1967.
Records available 1963-70, 1974.

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