FLOW CHARACTERISTICS OF STREAMS THAT DRAIN THE FORT APACHE AND SAN CARLOS INDIAN RESERVATIONS, EAST-CENTRAL ARIZONA, 1930-86

By Stanley Baldys, III, and John A. Bayles

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[Plate is in pocket]

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CONVERSION FACTORS

For readers who prefer to use metric (International System) units, the conversion factors for the inch-pound units used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
inch (in.)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
degree Fahrenheit (°F)	°C = 5/9 x (°F-32)	degree Celsius (°C)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called *Sea Level Datum of 1929*.

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ABSTRACT

An appraisal of streamflow characteristics of the Salt River and Gila River basins in the Fort Apache and San Carlos Indian Reservations, east-central Arizona, was done in response to pending adjudication of water resources in those basins. Statistical summaries were compiled for 28 streamflow-gaging stations in and near the reservations. Mean annual streamflow for 1930-86 was computed for streamflow-gaging stations with complete records for the period; for those stations with records that did not completely cover the 1930-86 period, record-extension techniques were used. Mean annual streamflow for ungaged sites on streams with gaging stations was estimated by interpolation between data points using drainage-area ratios. Two regression equations were derived to estimate mean annual streamflow at sites on ungaged natural streams. The standard error of the regression for estimation of mean annual flow for sites in the Salt River basin is -37 to +59 percent. The standard error of the regression for estimation of mean annual flow for sites in the Gila River basin is -18 to +21 percent.

INTRODUCTION

The Salt and Gila Rivers are the major surface-water drainages in east-central Arizona (fig. 1), and the rights to use water from those rivers are being claimed by agricultural, industrial, and domestic users. A general adjudication of water rights is underway for the Salt River and Gila River drainage basins to determine the rights of water users to the available supply. The Fort Apache and San Carlos Indian Reservations make up a large part of the Salt River and Gila River drainage basins (fig. 1). A better understanding of year-to-year variations in streamflows and their relation to long-term climatic conditions in the drainage basin will allow estimates to be compiled for the mean annual quantity of surface water available at various points on major streams for use in the adjudication process. As part of the adjudication process, the U.S. Geological Survey, in cooperation with the Arizona Department of Water Resources, did an appraisal of the streamflow characteristics of the Salt and Gila Rivers and their major tributaries in the Fort Apache and San Carlos Indian Reservations (fig. 1).

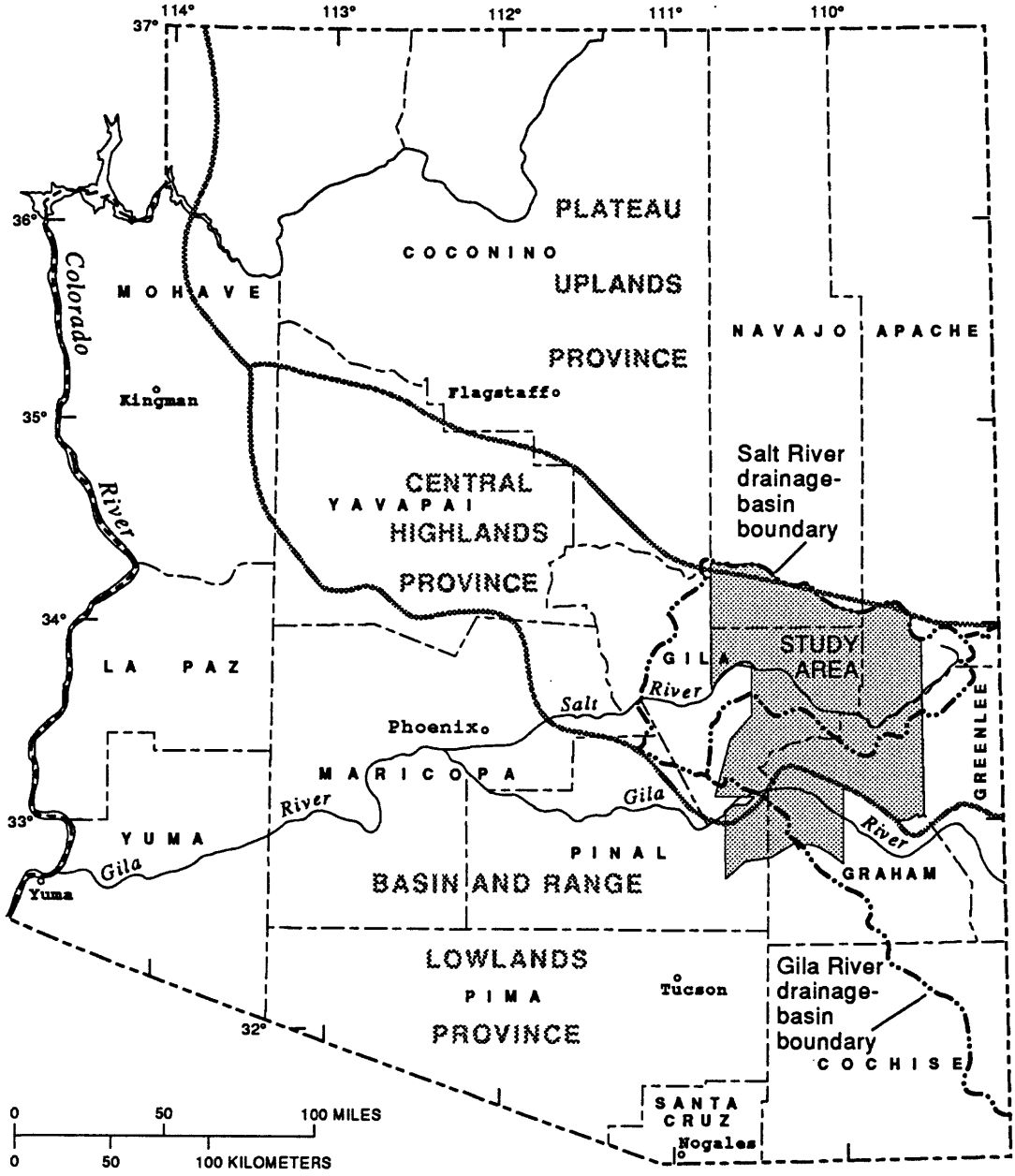


Figure 1.—Location of Salt River and Gila River drainage basins, Fort Apache and San Carlos Indian Reservations, and Arizona water provinces.

Purpose and Scope

This report presents an appraisal of characteristics of streamflow in the Fort Apache and San Carlos Indian Reservations in east-central Arizona. The first section of the report includes results of the investigation of basin and climatic characteristics at streamflow-gaging stations, analysis of data from streamflow-gaging stations, and an analysis of the stationarity of streamflow and precipitation patterns at selected sites. The second section gives selected estimates of mean annual streamflow at streamflow-gaging stations for the base period of 1930-86 and methods of estimating mean annual streamflow at ungaged sites.

Basin and climatic characteristics calculated for each streamflow-gaging station include drainage area, stream length, mean basin elevation, forested area, soil index, mean annual precipitation, precipitation intensities, and main-channel slope index. Several of these characteristics were updated from those previously calculated on the basis of new or updated 1:24,000 topographic maps and were stored in files of the U.S. Geological Survey.

Streamflow data used in this study were collected at U.S. Geological Survey streamflow-gaging stations. Statistics calculated from streamflow data include mean monthly and annual discharges, magnitude and probability of annual low and high flows, magnitude and probability of instantaneous peak flow, and duration of daily mean flow. Summaries of these statistics for 28 streamflow-gaging stations through water year 1986 are given at the end of the report.

An analysis of the stationarity of streamflow and precipitation data was made at long-term sites within or near reservation boundaries. The analysis was to determine if the base period selected for the estimation of mean annual streamflow represented long-term conditions. Stationarity of streamflow patterns was evaluated at four streamflow-gaging stations—09448500, Gila River at head of Safford Valley, near Solomon; 09468500, San Carlos River near Peridot; 09497500, Salt River near Chrysotile; and 09498500, Salt River near Roosevelt. Precipitation data used in this study are from stations operated by private individuals, corporations, or Federal agencies. The data from those stations were collected and published by the National Oceanic and Atmospheric Administration (1933-86). Major changes in precipitation patterns were investigated at three climatological stations—Globe, Whiteriver, and McNary.

Mean annual streamflow for a base period of 1930-86 was estimated for reaches of streams in the study area where sufficient data allowed a reliable estimate to be made. These estimates are shown on plate 1. Mean annual streamflow for the reach of the Gila River between Solomon and Calva was not estimated because of lack of accurate data for diversions and pumpage of water from the Gila River and problems with estimating the amount of streamflow lost to recharge and evapotranspiration. Mean annual streamflow upstream from the confluence of the San Francisco River and the upper Gila River are not shown on plate 1 because these drainages do not lie within the Fort Apache Indian Reservation or San Carlos Indian Reservation boundaries.

Description of Study Area

The study area in east-central Arizona includes the Fort Apache and San Carlos Indian Reservations, which cover 5,457 mi^2, and selected adjacent drainages that contain streamflow-gaging stations. The study area is bounded on the north by the Mogollon Rim and the White Mountains and extends southward to the Gila Mountains. The Gila Mountains form the major part of the southeast boundary of the San Carlos Reservation. Several mountain ranges, which include the Sierra Ancha and Pinal Mountains, form the west boundary. Elevations in the study area range from about 2,200 ft above sea level along the Gila River downstream from the San Carlos Reservoir to 11,403 ft at the summit of Mount Baldy in the White Mountains.

Climatic variations are controlled largely by elevation and topography of the land surface. Average annual precipitation ranges from about 15 in. in the low-lying area southwest of the San Carlos Reservoir to about 34 in. in the White Mountains and is between 15 and 25 in. throughout much of the study area (table 1). In the winter months, precipitation that results from frontal storms is widespread and light to moderate in intensity. Localized and sometimes intense rainfall is associated with convective storms in July and August. At San Carlos, which is the lowest elevation climatological station in the reservations, the average daily maximum temperature is 101 °F in July and 61 °F in January (Sellers and others, 1985). At Hawley Lake in the White Mountains, which is the highest elevation station in the reservations, the average daily maximum temperature is 75 °F in July and 41 °F in January (Sellers and others, 1985).

The Salt and Gila Rivers are the two largest rivers that drain the Fort Apache and San Carlos Indian Reservations (pl. 1). The Black and White Rivers join near the center of the study area and form the Salt River. The Black River and its continuation as the Salt River form the boundary between the two reservations. The Gila River flows in a northwesterly and westerly direction through the southern part of the San Carlos Indian Reservation. The San Carlos River drains the central part of the San Carlos Indian Reservation and joins the Gila River at San Carlos Reservoir. Some reaches of the tributary streams are perennial, but the magnitude of flow in most of these streams is unknown.

The Fort Apache and San Carlos Indian Reservations are mainly in the Central highlands water province (Harshbarger and others, 1966; fig. 1, this report). The southwestern part of the San Carlos Reservation, which includes the main channel of the Gila River through Safford Valley and its contributing drainage area, is in the Basin and Range lowlands province (Harshbarger and others, 1966).

The study area consists of drainage basins with diverse surface geology. The Black River and Big Bonito Creek in the Salt River basin head in the White Mountains, which are composed mainly of basalt (Wilson and others, 1960). Cibecue Creek and Carrizo Creek drainage basins are underlain mostly by Coconino Sandstone and Supai Formation (Wilson and others, 1959; 1960). The upper part of the White River drainage basin is underlain mainly by basalt, and the lower part of the basin is underlain mainly by the Supai Formation (Wilson and others, 1959; 1960).

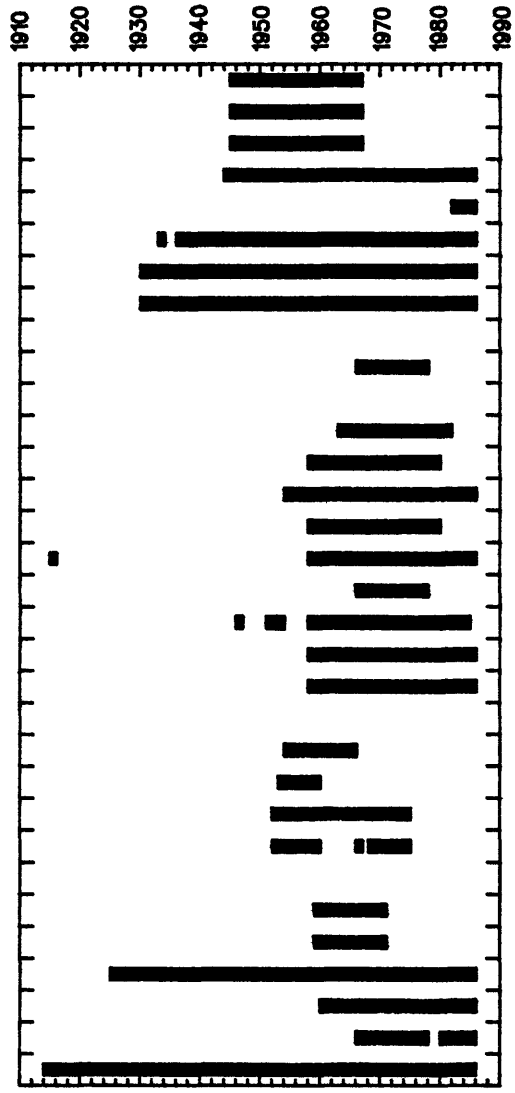
Bonita Creek drainage in the Gila River basin contains volcanic deposits at the higher elevations and sedimentary deposits in the lower elevations of the basin (Wilson and Moore, 1958). The part of the Gila River drainage basin that is within the San Carlos Indian Reservation is underlain mainly by alluvial deposits of gravel, sand, and silt. Mount Turnbull, south of San Carlos Reservoir, is composed of granite and crystalline intrusive rocks (Wilson and Moore, 1958). Eagle Creek basin generally contains volcanic rocks, although there is an area of sedimentary deposits in the Point of Pines area (Wilson and Moore, 1958). Deposits in the areas northwest and southwest of San Carlos Reservoir are a mixture of granitic, volcanic, sedimentary, and metamorphic rocks (Wilson and others, 1959; Wilson and Moore, 1958).

Most of the Salt River drainage basin south of the Salt River is volcanic in composition. The exception is the part of the Salt River basin at the west boundary of the Fort Apache Indian Reservation, which is underlain by a mixture of sandstone, quartzite, limestone, and diabase (Wilson and others, 1959).

STREAMFLOW CHARACTERISTICS

Characteristics of streamflow in the study area were determined from streamflow data collected as early as 1915; by 1930, five streamflow-gaging stations were in operation. Streamflow statistics excluding those for frequency of instantaneous peak flows were calculated from values of daily mean flow determined at 28 streamflow-gaging stations (pl. 1). Standard methods (Corbett, 1943, p. 109-115; Rantz and others, 1982a, b) were used in the measurement, collection, and computation of streamflow records. Streamflow records prior to water year 1960 were published in two compilation reports by the U.S. Geological Survey (1954; 1964). Streamflow records for the 1960-86 water years are published in the annual water-data series (U.S. Geological Survey, 1965-74, 1976-82; White and Garrett, 1984, 1988; Wilson and Garrett, 1988).

Standard statistical procedures for compiling streamflow statistics (Chow, 1964, p. 8-6 to 8-8) were used in this study except for procedures used to compute frequency of peak flows. Frequencies of instantaneous peak flows were calculated using log-Pearson Type III frequency distributions only at sites with at least 10 years of record (U.S. Interagency Advisory Committee on Water Data, 1982). The period of record for which streamflow statistics were compiled at streamflow-gaging stations used in this study except for frequencies of instantaneous peak flows is shown in figure 2. All streamflow statistics were calculated on the basis of a water year that begins on October 1 and ends on September 30, with the exception of magnitude and probability of annual low flows, which were calculated on the basis of a climatic year that begins on April 1 and ends on March 31. Different definitions of the year are used for compiling low-flow and high-flow data. The different definitions are needed in order to obtain hydrologically meaningful statistics. Streamflow in eastern Arizona is generally seasonal. Summer dry periods (low-flow events) alternate with winter-spring wet periods (high-flow events). It is the statistical characteristics of these events that are of hydrologic (and socioeconomic) importance. Compilations of low-flow and high-flow data, therefore, should reflect the occurrence of these events. Use of a water



STATION NUMBER	GAGING STATION
	GILA RIVER BASIN
	Eagle Creek:
09445500	Willow Creek near Point of Pines, near Morenci
09446000	Willow Creek near Double Circle Ranch, near Morenci
09446500	Eagle Creek near Double Circle Ranch, near Morenci
09447000	Eagle Creek above Pumping Plant near Morenci
09447800	Bonita Creek near Morenci
09448500	Gila River at Head of Safford Valley, near Solomon
09466500	Gila River at Calva
09468500	San Carlos River near Peridot
	SALT RIVER BASIN
09489070	North Fork of East Fork Black River near Alpine
	Black River:
09489100	Black River near Maverick
09489200	Pacheta Creek near Maverick
09489500	Black River below pumping plant, near Point of Pines
09489700	Big Bonito Creek near Fort Apache
09490500	Black River near Fort Apache
09490800	North Fork White River near Greer
09491000	North Fork White River near McNary
09492400	East Fork White River near Fort Apache
09494000	White River near Fort Apache
	Salt River:
09494300	Carrizo Creek above Corduroy Creek, near Show Low
09494500	Cordurory Creek above Forestdale Creek, near Show Low
09496000	Corduroy Creek near mouth, near Show Low
09496500	Carrizo Creek near Show Low
	Carrizo Creek Tributary:
09496600	Cibecue No. 1, Tributary Carrizo Creek, near Show Low
09496700	Cibecue No. 2, Tributary Carrizo Creek, near Show Low
09497500	Salt River near Chrysotile
09497800	Cibecue Creek near Chrysotile
09497980	Cherry Creek near Globe
09498500	Salt River near Roosevelt

Figure 2.—Period of record of complete years of daily discharge values at streamflow-gaging stations.

year ending September 30 helps to ensure that seasonal wet periods will be contained within a single reporting period. Use of a climatic year ending March 31 helps to ensure that seasonal dry periods will be contained within a single reporting period. Use of other reporting periods, such as the calendar year, would tend to result in an artificial splitting of hydrologic events between years. The result of such artificial splitting would be to give artificially high estimates of dry-period flows and artificially low estimates of wet-period flows. It is to avoid such artificial over- and under-estimates that the climatic and water years are used (William H. Kirby, Hydrologist, U.S. Geological Survey, written commun., 1990).

A method described by Kendall (1975) was used at four long-term streamflow-gaging stations to test for trends in streamflow. Annual mean flow and a 5-year moving average were plotted to identify short-term trends. Tree-ring data also have been used to evaluate the historic trends in streamflow in the study area (Smith and Stockton, 1981).

Precipitation data were evaluated for stationarity by regression analysis (Alley, 1988, p. 1957) and by a test of difference between two population means (Iman and Conover, 1983, p. 268) at three climatological stations in or near the reservation boundaries. The three stations—Globe, Whiteriver, and McNary—were selected because they had the most complete precipitation record of sites in the area.

Basin and Climatic Characteristics

Basin and climatic characteristics were determined for each streamflow-gaging station (table 1) using the following criteria (U.S. Geological Survey, 1977).

- Drainage area, in square miles, is the area of a river basin above the gaging station, measured in a horizontal plane, enclosed by a topographic divide so that direct surface runoff from precipitation normally would drain by gravity into the river basin. The area on a map enclosed by the drainage-basin boundary is measured with a planimeter. Drainage areas for gaging stations in this study ranged from 11,470 mi^2 at Gila River at Calva to less than 0.06 mi^2 at Cibecue No. 2, Tributary to Carrizo Creek near Show Low.

- Stream length, in miles, is the length of the main channel, L_c, from the gaging station to the basin divide. The main channel is chosen at each bifurcation by following the fork that has the largest drainage area. Stream lengths for gaging stations on the Salt River ranged from 0.30 to 205.8 mi. Stream lengths for gaging stations on the Gila River ranged from 18.3 to 225.2 mi.

- Mean basin elevation, in feet, is the average distance above sea level of representative points in the basin. Mean basin elevation is computed as the arithmetic average of the elevation of 50 to 100 points at the intersections of equally

Table 1.--Selected basin and climatic characteristics at streamflow-gaging stations in and near the Fort Apache and San Carlos Indian Reservations

Station number	Station name	Period of record, water years[1]	Drainage area, in square miles	Stream length, in miles	Mean basin elevation, in feet	Forested area, in percent	Soil index, in inches	Mean annual precipitation, in inches	Precipitation, in inches, for 24-hour period and indicated recurrence interval, 2-year	Precipitation, in inches, for 24-hour period and indicated recurrence interval, 50-year	Main-channel slope index, in feet per mile
09445500	Willow Creek near Point of Pines, near Morenci	1945-67	102	18.3	6,340	59	3.00	19.8	2.0	4.0	73.0
09446000	Willow Creek near Double Circle Ranch, near Morenci	1945-67	149	27.5	6,310	63	3.00	19.2	2.0	3.9	77.7
09446500	Eagle Creek near Double Circle Ranch, near Morenci	1945-67	377	29.2	6,410	75	3.00	20.0	2.0	3.9	100.5
09447000	Eagle Creek above pumping plant, near Morenci	1945-86	613	52.5	6,060	64	2.79	19.2	2.0	3.8	60.9
09447800	Bonita Creek near Morenci	1982-86	302	43.2	5,310	18	1.21	18.4	2.0	3.9	38.3
09448500	Gila River at head of Safford Valley, near Solomon	1915-86	7,896	177	6,360	58	2.77	16.7	1.7	3.4	26.4
09466500	Gila River at Calva	1930-86	11,470	225	5,650	44	2.56	15.5	1.7	3.5	20.4
09468500	San Carlos River near Peridot	1930-86	1,026	56.7	4,480	10	2.03	17.2	2.1	4.0	29.4
09489070	North Fork of East Fork Black River near Alpine	1966-78	38.1	10.1	9,060	24	3.00	27.5	2.4	4.4	48.8
09489100	Black River near Maverick	1963-82	315	38.4	8,700	82	3.00	27.2	2.4	4.8	69.4
09489200	Pacheta Creek at Maverick	1958-80	14.8	14.2	8,810	88	3.00	30.3	2.2	5.2	160.4
09489500	Black River below pumping plant, near Point of Pines	1954-86	560	69.2	8,000	86	2.89	25.3	2.3	4.4	51.1
09489700	Big Bonito Creek near Fort Apache	1958-81	119	33.5	7,920	95	3.00	27.9	2.5	4.8	105.6
09490500	Black River near Fort Apache	1913-15, 1958-86	1,232	120	7,200	81	2.95	23.4	2.2	4.2	36.2

[1]See footnote at end of table.

Table 1.--Selected basin and climatic characteristics at streamflow-gaging stations in and near the Fort Apache and San Carlos Indian Reservations--Continued

Station number	Station name	Period of record, water years[1]	Drainage area, in square miles	Stream length, in miles	Mean basin elevation, in feet	Forested area, in percent	Soil index, in inches	Mean annual precipitation, in inches	Precipitation, in inches, for 24-hour period and indicated recurrence interval, 2-year	Precipitation, in inches, for 24-hour period and indicated recurrence interval, 50-year	Main-channel slope index, in feet per mile
09490800	North Fork White River near Greer	1966-78	40.2	10.1	9,520	74	3.00	34.2	2.9	5.5	216.3
09491000	North Fork White River near McNary	1946, 1951-53, 1958-85	78.2	18.5	9,320	80	3.00	32.2	2.9	5.5	152.8
09492400	East Fork White River near Fort Apache	1958-86	38.8	17.9	8,580	96	3.00	31.2	2.8	5.6	238.8
09494000	White River near Fort Apache	1958-86	632	62.5	7,400	83	3.00	25.4	2.3	4.6	76.8
09494300	Carrizo Creek above Corduroy Creek, near Show Low	1954-66	225	35.0	6,370	97	3.00	22.5	2.3	4.8	64.9
09494500	Corduroy Creek above Forestdale Creek, near Show Low	1953-60	57	19.2	6,620	96	3.00	22.5	2.1	4.5	85.3
09496000	Corduroy Creek near mouth, near Show Low	1952-75	203	31.5	6,370	93	3.00	21.7	2.1	4.5	71.2
09496500	Carrizo Creek near Show Low	1952-60, 1968-75, 1978-86	439	36.7	6,320	95	3.00	22.0	2.2	4.6	61.8
09496600	Cibecue No. 1, Tributary to Carrizo Creek, near Show Low	1959-70	0.10	0.3	5,390	100	3.00	18.0	1.9	4.1	363.6
09496700	Cibecue No. 2, Tributary to Carrizo Creek, near Show Low	1959-70	0.06	0.4	5,240	100	3.00	18.0	2.0	4.1	200.0
09497500	Salt River near Chrysotile	1925-86	2,849	155	6,730	81	2.98	22.8	2.2	4.4	31.9
09497800	Cibeque Creek near Chrysotile	1960-86	295	38.5	5,700	78	3.00	20.7	2.2	4.2	79.6
09497980	Cherry Creek near Globe	1966-86	200	36.4	5,600	81	2.90	24.0	2.6	5.0	87.9
09498500	Salt River near Roosevelt	1915-86	4,306	206	6,190	71	2.81	22.0	2.3	4.4	23.3

[1]Water years that had complete daily value records.

spaced grid lines superimposed on a map of the basin. Mean basin elevations ranged from 4,480 ft for San Carlos River near Peridot drainage basin to 9,520 ft for North Fork White River near Greer drainage basin.

- Forested area, in percent, is the percentage of drainage area shown as forested on topographic maps. Forested area is computed by planimetering the area shown as covered by forests and dividing by total drainage with a multiplication factor of 100. Drainage area covered by forested area ranged from 10 percent for the San Carlos River near Peridot drainage basin to 100 percent for Cibecue No. 1 and No. 2, Tributaries to Carrizo Creek.

- Soil index, in inches, is a numerical index of infiltration and retention characteristics of the soil. It was calculated by applying the grid system to a soils map (U.S. Soil Conservation Service, 1969) that had the drainage basin delineated on the map. The soil index ranged from 1.21 in. at Bonita Creek near Morenci to 3.00 in. at most sites.

- Mean annual precipitation, in inches, is the normal annual precipitation that falls on the drainage basin. Mean annual precipitation is determined by outlining the drainage basin on a normal annual precipitation map (University of Arizona, 1965) and summing the products of the planimetered subareas and their midrange precipitation value and dividing by total area. The grid system that was used to determine mean basin elevation and soil types also was used to determine the mean annual precipitation. Mean annual precipitation for gaging stations on the Salt River ranged from 18.0 in. at Cibecue No. 1 and No. 2, Tributaries to Carrizo Creek to 34.2 in. at North Fork White River near Greer. Mean annual precipitation for gaging stations on the Gila River ranged from 15.5 in. for Gila River at Calva to 20.0 in. for Eagle Creek near Double Circle Ranch, near Morenci.

- Precipitation, in inches, for a 24-hour storm period with recurrence intervals of 2 years and 50 years, was determined by outlining the drainage basin on a precipitation map (U.S. Weather Bureau, 1967), summing the products of planimetered subareas of a drainage basin and the midrange precipitation value, and dividing by total area. Precipitation in a 24-hour time period with a 2-year recurrence interval ranged from 1.7 in. at Gila River at head of Safford Valley, near Solomon and Gila River at Calva to 2.9 in. for the North Fork White River near Greer and North Fork White River near McNary drainage basins. Precipitation in a 24-hour time period with a 50-year recurrence interval ranged from 3.4 in. at Gila River at head of Safford Valley to 5.5 in. for the North Fork White River near Greer drainage basins.

- Main-channel slope index, in feet per mile, is an index of the slope of the main channel and was computed from the difference in streambed elevation at points that are 10 and

85 percent of the distance along the main channel from the gaging station to the basin divide. The 10 and 85 percent distance points are selected to provide an index with a relative standard error of estimate of 5 percent by excluding in the computation parts of the basin with nonuniform main-channel slope. Main-channel slope index was computed from the equation

$$S_c = \frac{(E_{85} - E_{10})}{0.75L_c},$$

where

S_c = main-channel slope index, in feet per mile;

E_{85} = elevation at 85 percent of main-channel distance, in feet;

E_{10} = elevation at 10 percent of main-channel distance, in feet; and

L_c = length of main channel, in miles.

Main-channel slope index ranged from 20.4 ft/mi for the Gila River at Calva to 363.6 ft/mi for the Cibecue No. 1, Tributary to Carrizo Creek near Show Low. In the study area, 75 percent of the drainage basins had main-channel slope indices of less than 100 ft/mi.

Explanation of Statistical Summaries

Statistical summaries of streamflow data were computed on the basis of daily mean values of flow and instantaneous peak flows and were compiled for each of the 28 streamflow-gaging stations in the study area (see statistical summaries at end of the report). Summaries were determined for mean monthly and annual discharges, magnitude and probability of annual low and high flows, magnitude and probability of instantaneous peak flow, and percent of time that a given daily mean flow was exceeded or equaled. With the exception of magnitude and probability of instantaneous peak flow, values of the streamflow characteristics were computed from water year data sets containing complete daily mean streamflow records. The calculation of the magnitude and probability of instantaneous peak flow may include a peak outside the systematic record. For example, the peak flow that occurred in the 1916 water year at Salt River near Chrysotile was included in the calculation of the magnitude and probability of instantaneous peak flow but was not used in the determination of the other streamflow characteristics for that station. Streamflow statistics for recurrence intervals greater than two times the length of record have uncertain reliability and a potential error that is caused by the extrapolation of the statistic beyond the period of record.

Statistics of mean monthly discharges show the flow distribution by month and are used to determine when the largest flow is expected. For

example, the mean monthly and annual discharge table for Salt River near Chrysotile shows that the largest quantity of flow per month can be expected to occur in April (1,740 ft^3/s) and the smallest quantity of flow per month in July (227 ft^3/s).

Low-flow magnitude and probability were calculated for 1-, 3-, 7-, 14-, 30-, 60-, 90-, 120-, and 183-day periods. High-flow magnitude and probability were calculated for 1-, 3-, 7-, 15-, 30-, 60-, and 90-day periods. These statistics indicate the non-exceedance probability for low flows and exceedance probability for high flows that have 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals. An example of these streamflow characteristics is the 7-day low- and high-flow discharge for a 50-year recurrence interval for Salt River near Chrysotile. A 2-percent chance exists that 7-day mean flows of 56 ft^3/s or less will occur in any year and a 2-percent chance that 7-day mean flows of about 19,600 ft^3/s or more will occur in any year.

Instantaneous peak-flow magnitude and probability were calculated for stations with at least 10 years of record. Instantaneous peak-flow magnitudes for the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals or 50, 20, 10, 2 and 1 percent exceedance probabilities were calculated. For example, at Salt River near Chrysotile, the probability of an instantaneous peak flow of 121,000 ft^3/s being equaled or exceeded in a given water year is 1 percent. The probability of exceedance is the chance that an instantaneous peak flow of given magnitude will be exceeded in any one year. Recurrence interval is the reciprocal of the probability of occurrence and is the average number of years between occurrences. Recurrence intervals imply no regularity of occurrence; a 50-year flood might be exceeded in consecutive years or it might not be exceeded in a 50-year period. The weighted skew, mean, and standard deviation shown in the statistical summaries section are in logarithmic units.

The percentage of time a given daily mean discharge was equaled or exceeded is expressed in terms of a duration analysis or duration table. Discharges were calculated for the 1, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 95, 98, 99, 99.5, and 99.9 percentiles. For example, at Salt River near Chrysotile, daily mean flows of 108 ft^3/s were exceeded 95 percent of the days in the period of record.

Trends in Streamflow

Trends in streamflow were studied at four of the five streamflow-gaging stations that were in operation in the study area by 1930. Data for streamflow-gaging station, Gila River at Calva, were not used in the analysis of trends because agricultural diversions upstream from the station would distort the results. Two of the five stations—Gila River at head of Safford Valley, near Solomon, and Salt River near Roosevelt—were in operation in the 1915 water year. Annual mean streamflow and 5-year moving averages (Pollard, 1977, p. 26) were computed for four of the five long-term stations—Gila River at head of Safford Valley, near Solomon; San Carlos River near Peridot; Salt River near Chrysotile; and Salt River near Roosevelt (fig. 3).

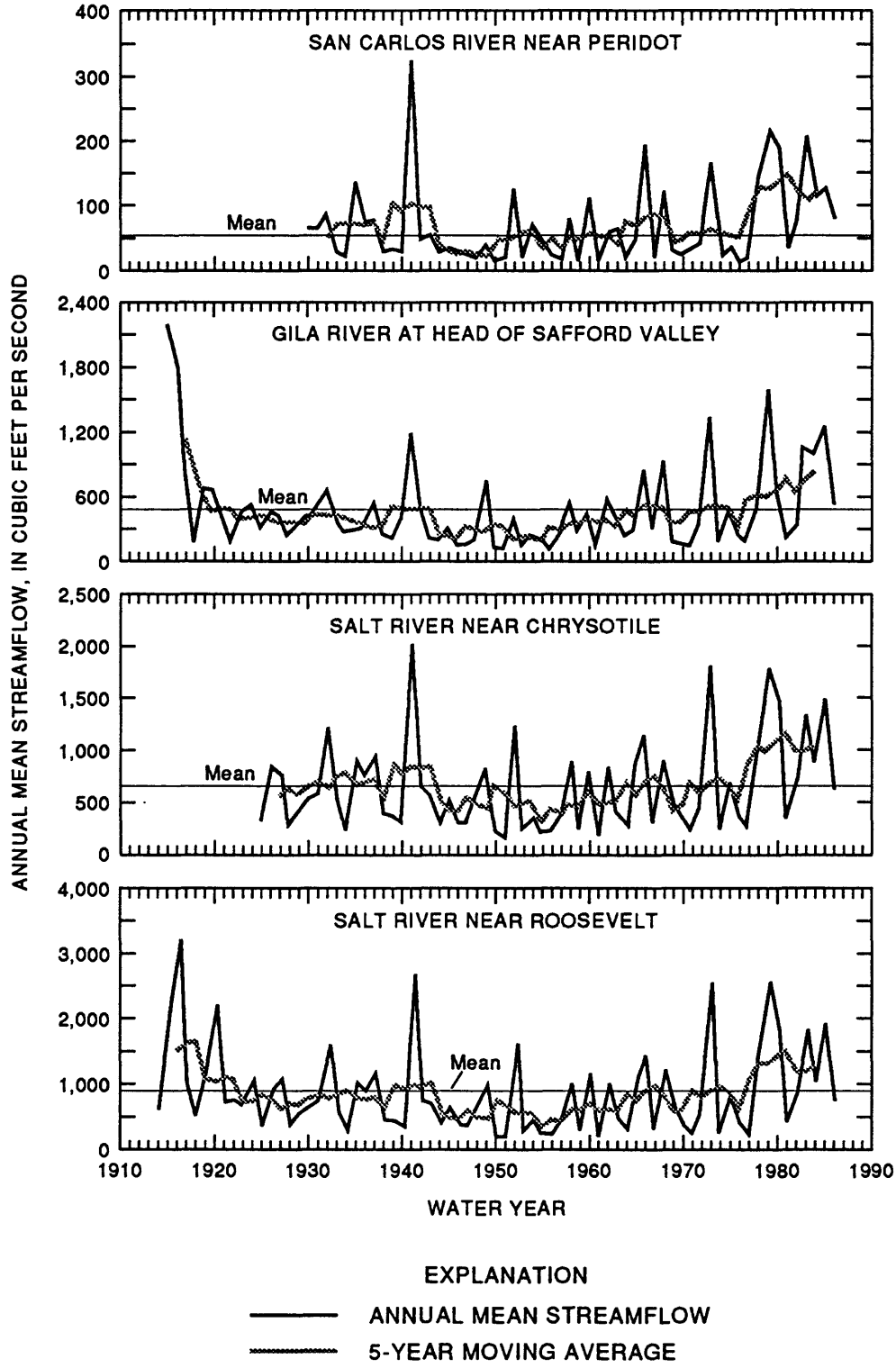


Figure 3.—Annual mean streamflow and 5-year moving average.

Annual mean streamflow data for 1915-86 for Gila River at head of Safford Valley, near Solomon, and Salt River near Roosevelt generally show higher-than-average flow conditions for 1916-20 and 1978-86 (fig. 3). The 5-year moving average of annual mean discharge for the four gaging stations indicates that 1945-55 had the smallest quantities of streamflow. A Kendall tau test (Kendall, 1975) on annual mean streamflow that uses annual precipitation as an explanatory variable did not show a constantly increasing or decreasing trend in streamflow for the period of record at any of the four streamflow-gaging stations. Instead, the 5-year moving average showed a generally decreasing trend for 1916-22, a generally increasing trend for 1970-86, and a fairly stable period for 1923-69.

Trends in Precipitation

Precipitation data at climatological stations Globe, Whiteriver, and McNary were analyzed for trends to evaluate stationarity of the data. Changes in precipitation patterns on the study area would have an affect on the runoff yield from the drainage basins. Climatological data have been collected at several other sites in the study area; however, these three sites were selected for precipitation-data analysis because of the length of record, range in elevation covered between sites, and period of record that is concurrent with the operation of streamflow-gaging stations in the study area (pl. 1). Elevations ranged from 3,550 ft at the Globe climatological station to 7,320 ft at the McNary station. Collection of precipitation data began at Globe in 1888 (systematic collection began in 1908), at Whiteriver in 1923, and at McNary in 1934. Although the records generally are continuous, periods of no data collection occurred at each site (table 2). Where gaps in records exist, precipitation data were estimated using multiple-regression analysis from one of the other two precipitation stations to provide a systematic record so that a 5-year moving average could be computed (fig. 4). Precipitation data followed the same pattern as the streamflow data. Above-average annual precipitation with a decreasing trend occurred in 1916-22 at the Globe station. Above-average annual precipitation with a generally increasing trend occurred in 1978-85 at each of the three stations. Precipitation totals for 1942-52 generally were less than average (fig. 4).

Precipitation data at the three sites for the period of data collection were evaluated for monotonic trends (significantly increasing or decreasing with time) using a linear-regression analysis of precipitation against time and analyzing the slope of the regression line (Alley, 1988, p. 1957). The parametric test, linear-regression analysis, was chosen over the Kendall tau test (a nonparametric test) because of the distribution of the precipitation data. The regression analysis did not show a statistically significant trend (95-percent confidence level) in precipitation amounts at the three sites (table 2). The slope of the three regression lines was positive and probably was influenced by the larger-than-average amounts of precipitation for 1978-85 (fig. 4). Precipitation amounts were analyzed for two separate time periods—1930-86 and from the start of data collection through 1986—using a difference between two population-means test (Iman and Conover, 1983, p. 268) to determine if annual precipitation for the two periods was different. The statistical test did not find a significant difference between the

Table 2.--Results of trend analysis on precipitation data at Globe, Whiteriver, and McNary

[Dashes indicate no data]

Climatological station	Period of record, in water years	Altitude, in feet	Difference between two population means test[1]			Regression analysis[2]	
			Average annual precipitation, in inches		Significant differences between periods	Slope of regression	Significant at a 95-percent confidence level
			Period of record	1930-86[3]			
Globe.....	1908-74, 1976-79, 1984-86	3,500	16.67	16.65	No	Increasing	No
Whiteriver...	1923-33, 1941-86	5,280	18.80	18.93	No	Increasing	No
McNary.....	1934-37, 1939, 1943-86	7,320	26.93	-----	--	Increasing	No

[1](Iman and Conover, 1983, p. 268).
[2](Iman and Conover, 1983, p. 374).
[3]Includes records estimated from regression analyses of data collected at the three sites.

precipitation amounts for Globe and Whiteriver for the two time periods (table 2). The precipitation record at McNary was not evaluated using this procedure because data collection at the site did not start until 1934.

ESTIMATION OF MEAN ANNUAL STREAMFLOW

An accurate estimate of mean annual streamflow for sites in the study area is necessary to provide the framework for the adjudication of water rights within the two reservation boundaries. This report provides estimates of streamflow for a base time period for sites on streams in the study area using one of several methods. The method available to estimate mean annual flow at a site depends on the data available near or at the site. Sites are classified as gaged sites at gaging stations, ungaged sites near gaged sites, sites on ungaged natural streams, and sites on stream reaches affected by diversions.

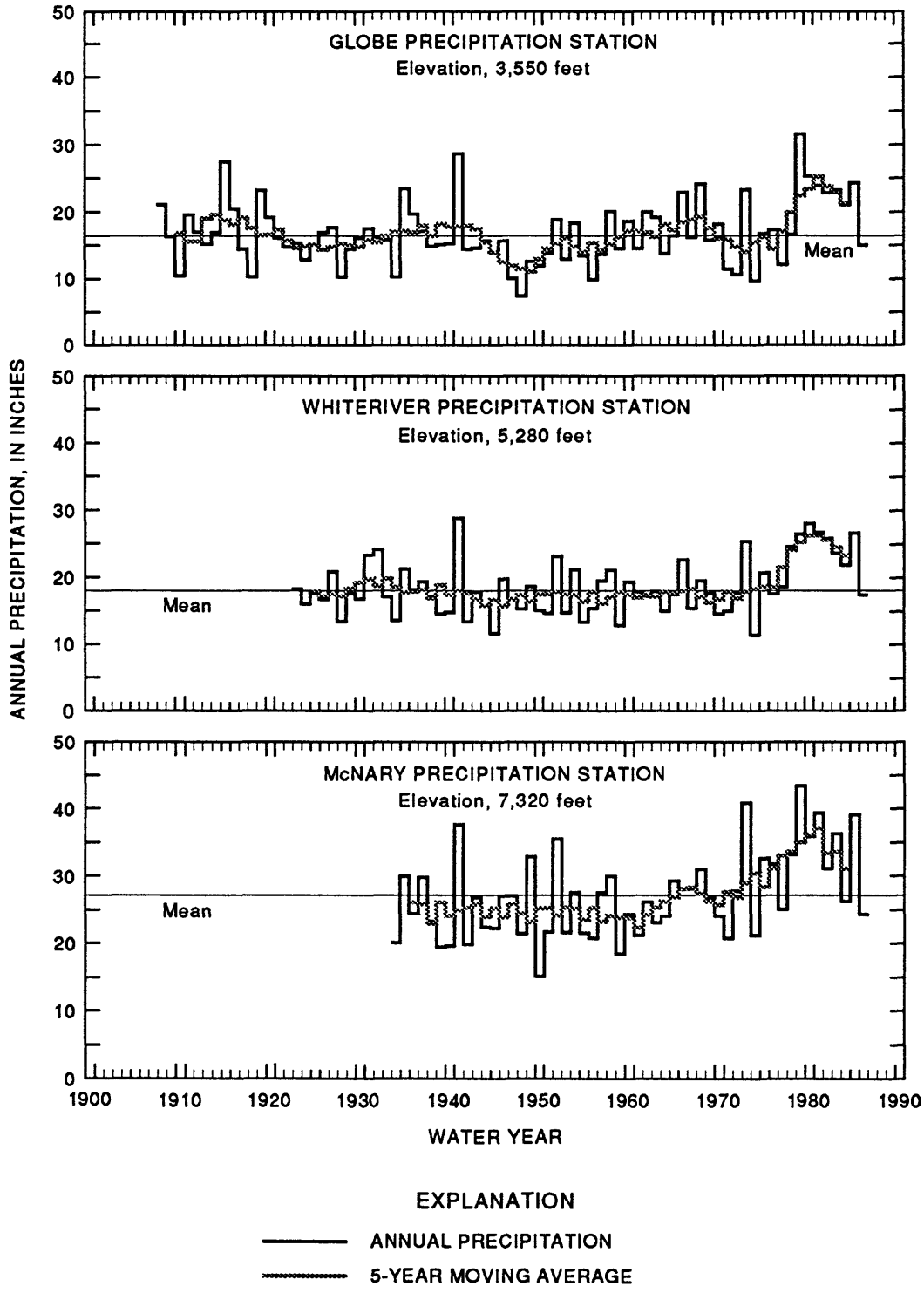


Figure 4.—Annual precipitation and 5-year moving average.

Selection of Base Period

A base period was selected so that statistics computed at various locations could be compared to define spatial relations without interference caused by temporal variations. The selection of a base period for computation of mean annual streamflow is based on two major criteria: (1) The period should encompass the range of hydrologic conditions that can be expected in the study area and (2) the period must be one in which streamflow data have been collected or can be estimated with a high degree of reliability. The base period also should be as long as possible subject to availability of data in the region and be of sufficient length to remove the effects of any short-term trends.

Time-series plots of annual streamflow data and, to a less pronounced extent, precipitation data show a u-shaped pattern with periods of larger quantities of streamflow and precipitation at the ends of the data-collection period (figs. 3 and 4). The smallest quantities of streamflow and precipitation generally occur in the center of the data sets. The exception is the 1941 water year in which larger-than-normal quantities of streamflow and precipitation were recorded.

The second criterion for the selection of a base period for computation of mean annual streamflow is based on the availability of reliable streamflow data. Daily streamflow data for an entire water year were collected in the study area as early as water year 1914 at Salt River near Roosevelt and as early as water year 1915 at Gila River at head of Safford Valley, near Solomon. Systematic streamflow-data collection began at Salt River at Chrysotile in 1925, at Gila River at Calva in 1930, and at San Carlos River near Peridot in 1930.

The reach of the Gila River between streamflow-gaging stations Gila River at head of Safford Valley, near Solomon and Gila River at Calva has several diversions of streamflow for agricultural purposes. Although these diversions were monitored from 1922 to 1931, water in excess of irrigation needs was not monitored and was returned to the Gila River to be rediverted. Streamflow measured as diverted water at an upstream diversion was remeasured again as diverted water at the next downstream diversion. Data collection at the diversions was discontinued during the 1932-35 water years. When the Gila River Decree came into effect on January 1, 1936, water diverted in excess of irrigation needs was reduced to an insignificant amount and data collection at the 12 largest diversions and direct pumping from the Gila River was resumed (U.S. Geological Survey, 1954; 1964). The problems in extending streamflow record at Gila River at Calva include inaccurate or nonexistent records of water returned to the river before 1936 and lack of diversion data for 1932-35. Both problems preclude the reliable estimation of streamflow record during periods of missing record at the Gila River at Calva gaging station before 1936.

Reliable estimation of streamflow before 1930 at San Carlos River at Peridot is difficult because of the lack of correlation with other gaging stations in the same basin. The mouth of the San Carlos River at Peridot is at the north end of San Carlos Reservoir. Coolidge Dam, which regulates the San Carlos Reservoir, was put into operation November 15, 1928. Before 1928, the closest gaging station in operation was downstream station Gila River at Kelvin. Several ungaged tributaries to the Gila

River are present in the reach between Gila River at Kelvin and San Carlos River at Peridot that preclude the use of streamflow records from Gila River at Kelvin to estimate streamflow at San Carlos River at Peridot.

The base period of 1930-86 was selected for the calculation of mean annual streamflow at sites in the study area. This period allows a reliable estimate of mean annual streamflow at points throughout both reservations using systematic streamflow data collected at five streamflow gaging stations. Three of the stations are in the Gila River drainage basin and two are in the Salt River drainage basin. All five stations were in operation throughout the period. Analysis of precipitation and streamflow data for changes in stationarity during 1930-86 did not show statistically significant long-term trends in the data sets. The 57-year period is of sufficient length to minimize the effects of short-term trends in streamflow. The base period contains periods of high flow as well as periods of drought. Periods of record that extend beyond the base period are not used, as in the record before 1930 at Salt River near Roosevelt and Gila River at head of Safford Valley, near Solomon. The period 1930-86 appears to be the most reliable base period because of the availability of data from which to define areal variations of mean annual streamflow in the study area.

Gaged Sites

Mean annual streamflow was calculated for 27 of 28 streamflow sites for 1930-86 (table 3, plate 1). Mean annual streamflow at Bonita Creek near Morenci was not calculated because streamflow data were not collected at the site for a minimum of 10 years. Streamflow data were collected for 5 years and, although correlation with downstream gaging station Gila River at head of Safford Valley, near Solomon is high, more data are needed before a reliable extension of record can be made.

For the five streamflow-gaging stations that have data sets that span the base period, calculation of the mean annual streamflow at the gaging station is a straight forward mathematical determination. Annual flows at each gaging station are summed for the base period and divided by 57.

Least-squares linear-regression techniques were used to extend the record at the short-term stations. Regression relations using streamflow data were developed between long-term and short-term gaging stations on the same stream or in an adjacent drainage basin and were used to fill in gaps of missing record at the short-term station. When gaps in the 57-year base period remained after the record had been extended by linear regression, record at the short-term station was further adjusted in proportion to flow at one of the five base stations (table 3).

For example, the short-term station, Eagle Creek near Double Circle Ranch, was in operation from 1944 to 1967 (1945 was the first full year of data collection) and mean annual streamflow for this period was 17.8 ft^3/s. The long-term downstream gaging station, Eagle Creek above pumping plant, near Morenci, was in operation from 1944 through 1986 (1945 was the first full year of data collection). Annual streamflow for the two stations was correlated using the least-squares linear-regression

Table 3.--Mean annual streamflow for period of record, period of record extension, and 1930-86 at selected streamflow-gaging stations

[Values are in cubic feet per second except as indicated; dashes indicate no data]

Station number	Station name	Period of record		Period of record extension			
		Water years[1]	Mean annual discharge	Regression equation R^2	Water years	Mean annual discharge	Adjusted mean annual discharge, 1930-86
09445500	Willow Creek near Point of Pines, near Morenci	1945-67	3.28	0.98	1968-86	6.14	6.06
09446000	Willow Creek near Double Circle Ranch, near Morenci	1945-67	5.44	.94	1967-86	9.52	9.41
09446500	Eagle Creek near Double Circle Ranch, near Morenci	1945-67	17.8	.98	1967-86	26.8	26.5
09447000	Eagle Creek above pumping plant, near Morenci	1945-86	47.4	----	-------	------	46.8
09448500	Gila River at head of Safford Valley, near Solomon	1915-86	481	----	-------	------	441
09466500	Gila River at Calva	1930-86	326	----	-------	------	326
09468500	San Carlos River near Peridot	1930-86	55.8	----	-------	------	55.8
09489070	North Fork of East Fork Black River near Alpine	1966-78 1979-86	12.7	.96	1960-65	15.0	13.2
09489100	Black River near Maverick	1963-82 1983-86	141	.96	1954-62	150.0	133
09489200	Pacheta Creek at Maverick	1958-80 1981-86	9.15	.96	1954-57	8.93	8.58
09489500	Black River below pumping plant, near Point of Pines	1954-86	226	----	-------	------	217
09489700	Big Bonito Creek near Fort Apache	1958-80 1981-86	68.5	.96	1953-57	67.1	64.5
09490500	Black River near Fort Apache	1913-15, 1958-86	423	----	-------	------	388
09490800	North Fork White River near Greer	1966-78 1979-86	24.6	.98	1960-65	27.6	24.3
09491000	North Fork White River near McNary	1946, 1951-54, 1958-85	48.7	.98	1986	48.9	46.1

See footnote at end of table.

Table 3.--Mean annual streamflow for period of record, period of record extension, and 1930-86 at selected streamflow-gaging stations--Continued

Station number	Station name	Period of record		Period of record extension			Adjusted mean annual discharge 1930-86
		Water years[1]	Mean annual discharge	Regression equation R^2	Water years	Mean annual discharge	
09492400	East Fork White River near Fort Apache	1958-85	37	----	-------	-------	33.1
09494000	White River near Fort Apache	1958-86	211	----	-------	-------	189
09494300	Carrizo Creek above Corduroy Creek, near Show Low	1954-66	11.9	0.89	1967-86	17.7	17.0
09494500	Corduroy Creek above Forestdale Creek, near Show Low	1953-60	3.96	.99	1961-86	8.54	8.36
09496000	Corduroy Creek near mouth, near Show Low	1952-75	22.7	.99	1976-86	23.2	22.1
09496500	Carrizo Creek near Show Low	1952-60, 1978-86	51.7	.97	1961-77	44.5	42.5
09496600	Cibecue No. 1, Tributary to Carrizo Creek, near Show Low	1959-71	.01	----	-------	-------	.01
09496700	Cibecue No. 2, Tributary to Carrizo Creek, near Show Low	1959-71	.01	----	-------	-------	.01
09497500	Salt River near Chrysotile	1925-86	659	----	-------	-------	668
09497800	Cibeque Creek near Chrysotile	1960-86	47.5	----	-------	-------	40.6
09497980	Cherry Creek near Globe	1966-86	42.6	----	-------	-------	36.4
09498500	Salt River near Roosevelt	1914-86	901	----	-------	-------	848

[1]Water years used to calculate average discharge (U.S. Geological Survey, 1954; 1964; 1960-89).

techniques for the common period of record. Streamflow for 1968-86 at Eagle Creek near Double Circle Ranch was estimated from the regression using actual streamflow data from the downstream station. Before the regression analysis was made, streamflow data for both stations was adjusted for flow diverted from the Black River into the Eagle Creek drainage. Using values of annual mean flows estimated from the regression analysis for 1968-86, mean annual streamflow for 1945-86 for Eagle Creek near Double Circle Ranch was 26.8 ft^3/s. Because available data at both gaging stations did not cover the entire base period 1930-86, mean annual streamflow values at the stations were further adjusted by comparing the quantity of flow at Gila River at head of Safford Valley, near Solomon to that of the station in question. For example, summing the annual mean flows at base station Gila River at head of Safford Valley for 1945-86 yields a figure of 18,759 ft^3/s. Repeating this procedure at the same site for 1930-86 yields a value of 25,154 ft^3/s. Summing gaged and estimated annual mean flows at Eagle Creek near Double Circle Ranch for 1945-86 yields a value of 1,125 ft^3/s, and a value, x, was assigned for a comparable figure for 1930-86 at the site. The total quantity of streamflow at Eagle Creek near Double Circle Ranch for 1930-86 was determined by using the known sums of annual mean flows at both sites and solving for x. The mean annual streamflow at the site was then determined by dividing by 57. The sum of annual mean flows for 1945-86 at Eagle Creek above pumping plant, near Morenci was used in a similar manner to determine mean annual flow for 1930-86. Therefore, adjusted mean annual streamflow for 1930-86 is 26.5 ft^3/s for Eagle Creek near Double Circle Ranch and 46.8 ft^3/s for Eagle Creek above pumping plant, near Morenci.

Two transbasin diversions occur in the study area. Forestdale diversion, in operation since May 1953, diverts flow from Show Low Creek in the Little Colorado River basin into the headwaters of Forestdale Creek, which is tributary to the Salt River. Willow Creek diversion, in operation since April 1945, diverts flow from Black River to the headwaters of Willow Creek, which is tributary to Eagle Creek. The quantity of water diverted into Forestdale Creek (and subsequently Corduroy and Carrizo Creeks) and Willow Creek (and subsequently Eagle Creek) was subtracted from the flows at the downstream gaging stations. Mean annual streamflow at gaging stations Salt River at Chrysotile, Salt River near Roosevelt, and Gila River at head of Safford Valley, near Solomon was not adjusted to reflect the diverted flow.

Ungaged Sites near Gaged Sites

Mean annual streamflow for 1930-86 for ungaged sites that are upstream from a gaging station and are not between two gaging stations is calculated by using drainage-area ratios and the mean annual streamflow at the gaging station. Equation 1 compares the contributing drainage area for an ungaged site with the contributing drainage area for a gaged site for determination of mean annual streamflow.

$$Q_u = Q_g \cdot \left(\frac{A_u}{A_g}\right)^x, \qquad (1)$$

where

Q_u = mean annual discharge, in cubic feet per second, at ungaged site;

Q_g = mean annual discharge, in cubic feet per second, at gaged site;

A_u = drainage area, in square miles, at ungaged site;

A_g = drainage area, in square miles, at gaged site; and

x = exponent.

The exponent, x, was determined by regressing the logarithm of the mean annual discharge, Q_s, for the base period against the logarithm of the drainage area, A_g, using equation, $Q_s = a(A_g)^x$ for each of two regions where a is the regression constant (Christensen and others, 1986, p. 5).

The two regions were identified by elevations. Stations with mean basin elevations that are more than 7,500 ft (all are in the Salt River basin) composed one region. Stations with mean basin elevations that are less than 7,500 ft composed the second region, which was further divided into Salt River or Gila River basins. Roeske (1978) used a similar separation of gaging stations using a 7,500-ft elevation as the division in the analysis of magnitude and frequency of floods in Arizona. The exponent, x, was 0.88 for Salt River high-elevation basins, 1.04 for Salt River low-elevation basins, and 0.97 for Gila River low-elevation basins. Equation 1, with 0.88 as the exponent, x, value, was used in the Salt River basin for sites upstream from stations 09430000, Carrizo Creek above Corduroy Creek, near Show Low; 09450000, Cibeque Creek near Chrysotile; and 09497980, Cherry Creek near Globe. Equation 1 can be applied to ungaged sites only where the ratio of the area of the ungaged site to that of the area of the gaged site is 0.75 to 1.00 (Christensen and others, 1986, p. 5).

Mean annual streamflow for sites that are between two gaging stations or on reaches where the gaging stations are on two streams that are tributary is estimated by using drainage areas and quantities of flow at the gaged sites (equation 2). This method is dependent on data from two gaging stations and has a higher degree of accuracy than equation 1. Equation 2, which relates drainage area and discharge at two sites to determine mean annual flow at an ungaged site, is as follows:

$$Q_u = \left(Q_{dg} - Q_{ug}\right)\left(\frac{A_u - A_{ug}}{A_{dg} - A_{ug}}\right) + Q_{ug}, \qquad (2)$$

where

Q_u = mean annual discharge, in cubic feet per second, at ungaged site between two gaged sites;

Q_{dg} = mean annual discharge, in cubic feet per second, at downstream gaged site;

Q_{ug} = mean annual discharge, in cubic feet per second, at upstream gaged site;

A_{dg} = drainage area, in square miles, at downstream gaged site;

A_{ug} = drainage area, in square miles, at upstream gaged site; and

A_u = drainage area, in square miles, at ungaged site.

Sites on Ungaged Natural Streams

An estimate of the mean annual streamflow for 1930-86 at a site that is not at or near a streamflow-gaging station can be made using 1 of 2 equations determined by regional-regression analyses of streamflow and basin characteristics. Separate equations were derived for the Salt River basin and the Gila River basin. In this study, the regional-regression analyses included 25 of the 28 streamflow-gaging stations listed in table 1. The equations should not be used to estimate mean annual streamflow at sites that have upstream diversions of flow or that return excess water to the river. Gaging station 09466500, Gila River at Calva, was excluded from the analyses because of upstream diversions. Gaging station 09448500, Gila River at head of Safford Valley, near Solomon, was excluded because most of the drainage basin is outside the reservation boundaries with basin characteristics dissimilar to those of the lower Gila River drainage basin. Gaging station 09447800, Bonita Creek near Morenci, was excluded because of the short length of record.

Stepwise regression was used to derive the equations by regressing basin characteristics against mean annual streamflow. In the stepwise-regression procedure, explanatory variables (basin characteristics) are added one by one to the model with the criteria that the F statistic for a variable to be added must be significant. The selected level of significance for a variable to be added to the equation was 0.10. Once a variable is added to the equation, all variables in the equation are examined and those variables that do not produce an F statistic at the 0.10 level are removed from the equation. The procedure continues by adding new variables to the equation until all variables in the model are significant and none can be added at the 0.10 level (SAS Institute, Inc., 1982, p. 102). Basin characteristics used in the regression analyses are those computed for the intervening drainage area between two gaging stations on the same stream. Following is an example of mean annual precipitation computed for the intervening basin between two stations on Willow Creek. Mean annual precipitation for the entire Willow

Creek near Double Circle Ranch drainage basin is 19.2 in. and that for upstream station Willow Creek near Point of Pines drainage basin is 19.8 in. The computed average annual precipitation assigned to the Willow Creek near Double Circle Ranch for the intervening basin between the two stations using drainage area as a weighting factor is 17.9 in. Mean annual flow quantities for a gaging station downstream from another gaging station were computed by a simple subtraction of the mean annual flow at both sites. A logarithmic base-10 transformation was used on individual basin characteristics before the stepwise regression was applied.

The relation between the computed mean annual streamflow data and drainage area for gaging stations (fig. 5) indicated that separate equations for each basin were necessary. Equation 3 was derived for the Gila River drainage basin and equation 4 was derived for the Salt River drainage basin. Drainage basins in the Salt River basin generally yield larger quantities of streamflow per square mile than do similar-sized basins in the Gila River basin. Stepwise analysis of streamflow and basin characteristics data in the Gila River basin indicates that equation 3 with one predictor variable, drainage area, can be used to estimate mean annual streamflow for sites in the basin not affected significantly by diversion or regulation and for which equations 1 or 2 could not be used.

$$Q_{log} = -1.04 + 0.945\ (A_{log}), \qquad (3)$$

where

Q_{log} = logarithm, base 10 of mean annual streamflow, in cubic feet per second, 1930-86, and

A_{log} = logarithm, base 10 of contributing drainage area, in square miles.

The coefficient of determination for equation 3 is 97.5 and the standard error of regression is 0.0866 log units (-18 to +21 percent). Following is an example of the use of equation 3 to determine the mean annual streamflow at a site on the reach of a river in the Gila River basin with no streamflow-gaging stations and no upstream diversion or regulating structure. If the site meets these requirements and has a hypothetical drainage basin size of 50 mi^2, the following calculations apply.

$$\log_{10}(50\ mi^2) = 1.6990$$

$$Q_{log} = -1.04 + 0.945(1.6990)$$

$$Q_{log} = 0.5655$$

antilog 0.5655 = 3.67 ft^3/s with a range of -18 to +21 percent.

Stepwise analysis of streamflow and basin-characteristics data in the Salt River basin indicates that equation 4 with two predictor variables, drainage area and precipitation, may be used to estimate mean

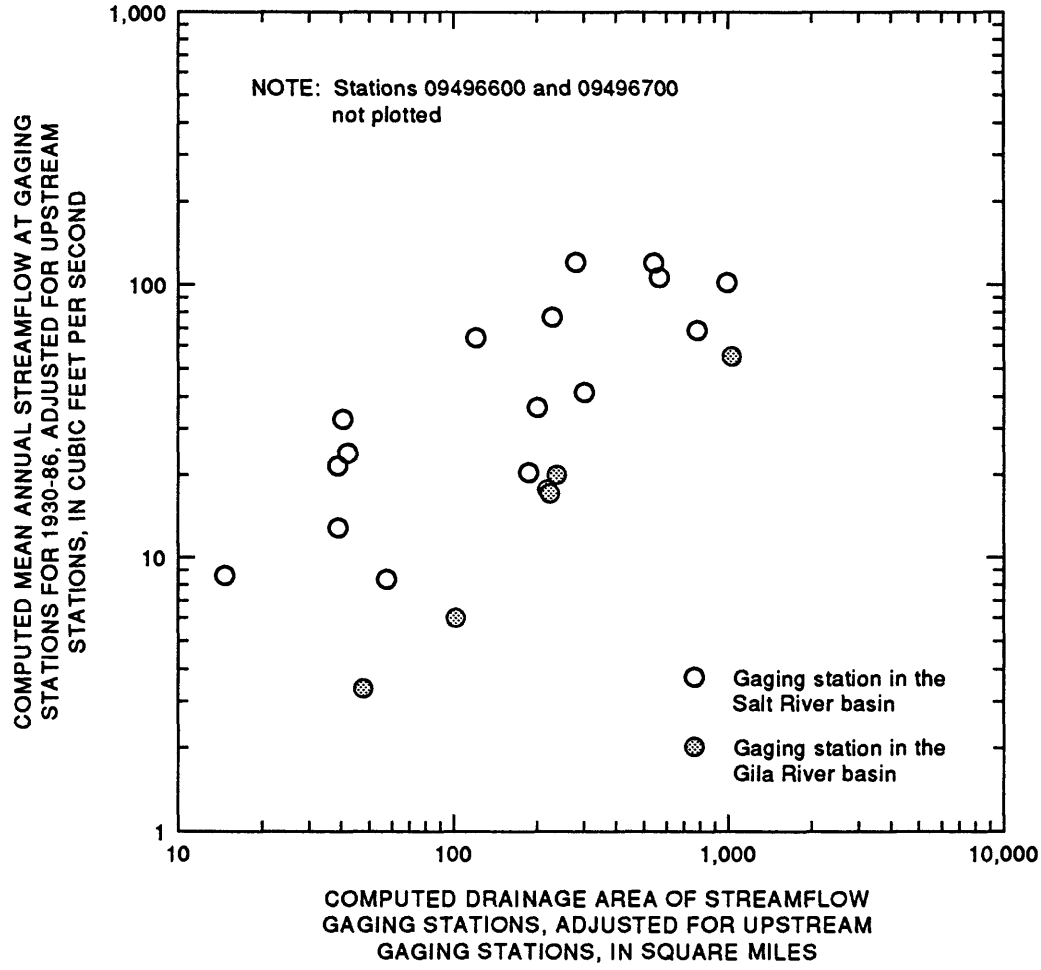


Figure 5.—Adjusted mean annual streamflow, 1930-86, and drainage areas for streamflow-gaging stations.

annual streamflow for sites in the basin not affected significantly by diversion or regulation and for which equations 1 or 2 could not be used.

$$Q_{log} = -5.71 + 0.948(A_{log}) + 3.76(P_{log}), \quad (4)$$

where

Q_{log} = logarithm, base 10 of mean annual streamflow, in cubic feet per second, 1930-86;

A_{log} = logarithm, base 10 of contributing drainage area, in square miles;

P_{log} = logarithm, base 10 of mean annual precipitation, in inches.

The coefficient of determination is 97.3 and the standard error of regression is 0.2020 log units (-37 to +59 percent). Following is an example of the use of equation 4 to determine the mean annual flow for a site on the reach of a river in the Salt River basin that has no streamflow-gaging stations and no upstream diversion or regulating structure. If the site meets these requirements, has a hypothetical drainage basin size of 20 mi^2, and has a mean basin precipitation of 25.0 in./yr, the computation is as follows:

$$\log_{10} (20\ mi^2) = 1.3010$$

$$\log_{10} (25.0\ in./yr) = 1.3979$$

$$Q_{log} = -5.71 + 0.948(1.3010) + 3.76(1.3979)$$

$$Q_{log} = 0.7795$$

$$\text{antilog } (0.7795) = 6.02\ ft^3/s \text{ with a range of -37 to +59 percent.}$$

This report presents three methods of estimating mean annual flow at ungaged sites. The first method used equation 1 to estimate flow above gaged sites. The second method used equation 2 to estimate flow between two gaged sites. Estimates of the mean annual flow for sites in the study area calculated from equations 1 and 2 are shown on plate 1. The first two methods give more accurate estimates than the method using equations 3 or 4, which estimates flow using regression analysis. Estimates of mean annual flow from equations 3 and 4 are not shown on plate 1. Ungaged sites, where values of mean annual flow are shown on plate 1, were not chosen because of socioeconomic importance but because of their location on tributaries.

Sites on Stream Reaches Affected by Diversions

Mean annual streamflow for 1930-86 for ungaged sites on the reach of the Gila River between gaging stations Gila River at head of Safford Valley, near Solomon and Gila River at Calva was not estimated because of lack of accurate data for upstream diversions, direct pumpage from the Gila River, ungaged irrigation return flows prior to 1936, and unaccounted quantities of flow in this reach that may have been lost to evapotranspiration and infiltration. The magnitude of the problem can be seen by noting that tributary flow calculated by using equation 3 for the contributing drainage basin of 3,574 mi^2 between the two gaging stations is 170 to 251 ft^3/s. This quantity added to the mean annual flow of 441 ft^3/s at Gila River at head of Safford Valley would place the calculation of mean annual flow of Gila River at Calva gaging station between 611 and 692 ft^3/s; however, only 326 ft^3/s was gaged for the 1930-86 period. This poor correlation can be attributed to the factors mentioned above. In addition, the relation used to calculate mean annual streamflow for this reach was extended beyond the largest drainage basin data point of 1,000 mi^2 to 3,574 mi^2. Because of the complexities of the hydrology in Safford Valley, further study of this area would require that components of a water budget be determined for the reach of the Gila River in Safford Valley before an estimate of mean annual streamflow can be made for selected sites.

SUMMARY

Streamflow characteristics of the Salt and Gila Rivers in the Fort Apache and San Carlos Indian Reservations were appraised because of pending water-resource adjudication by the State of Arizona. Temporal changes in annual streamflow and precipitation through 1986 were evaluated by statistical analyses. The analyses of streamflow and precipitation data did not show a statistically significant long-term change. Statistics of streamflow data collected at 28 streamflow-gaging stations were computed for mean monthly and annual discharges, magnitude and probability of annual low and high flows, magnitude and probability of instantaneous peak flows, and duration of daily mean flows. Mean annual streamflow for a base period of 1930-86 was computed for 27 of the 28 gaging stations and was used to estimate the mean annual discharge throughout the study area. Two regression equations were derived that related mean annual streamflow for 1930-86 to basin characteristics. The regression equation for the Gila River basin has a coefficient of determination of 97.5 and a standard error of regression of -18 to +21 percent. The regression equation for the Salt River basin has a coefficient of determination of 97.3 and a standard error of regression of -37 to +59 percent.

SELECTED REFERENCES

Alley, W.M., 1988, Exogenous variables in testing for monotonic trends in hydrologic time series: Water Resources Research, v. 24, no. 11, November 1988, p. 1955-1961.

Brown, D.E., Carmony, N.B., and Turner, R.M., compilers, 1981, Drainage map of Arizona showing perennial streams and some important wetlands: Arizona Game and Fish Department map, scale 1:1,000,000.

Chow, V.T., 1964, Handbook of applied hydrology: New York, McGraw-Hill, 1418 p.

Christensen, R.C., Johnson, E.B., and Plantz, G.G., 1986, Manual for estimating selected streamflow characteristics of natural-flow streams in the Colorado River basin in Utah: U.S. Geological Survey Water-Resources Investigations Report 85-4297, 39 p.

Corbett, D.M., and others, 1943, Stream-gaging procedure—A manual describing methods and practices of the Geological Survey: U.S. Geological Survey Water-Supply Paper 888, 245 p.

Harshbarger, J.W., and others, 1966, Arizona water: U.S. Geological Survey Water-Supply Paper 1648, 85 p.

Hedman, E.R., 1970, Mean annual runoff as related to channel geometry of selected streams in California: U.S. Geological Survey Water-Supply Paper 1999-E, 17 p.

Hirsch, R.M., and Slack, J.R., 1984, A nonparametric trend test for seasonal data with serial dependence: Water Resources Research, v. 20, no. 6, June 1984, p. 727-732.

Iman, R.L., and Conover, W.J., 1983, A modern approach to statistics: New York, John Wiley and Sons, Inc., 497 p.

Kendall, M.G., 1975, Rank correlation methods: London, Charles Griffin & Co., Ltd., 202 p.

Kleinbaum, D.G., and Kupper, L.L., 1978, Applied regression analysis and other multivariable methods: Boston, Massachusetts, Duxbury Press, 556 p.

National Oceanic and Atmospheric Administration, 1933-86, Climatological data annual summary, Arizona, 1877-1986: Asheville, North Carolina, National Climatic Data Center, v. 1-90, no. 13, published annually.

Pollard, J.H., 1977, A handbook of numerical and statistical techniques with examples mainly from the life sciences: Cambridge, England, Cambridge University Press, 349 p.

Rantz, S.E., and others, 1982a, Measurement and computation of streamflow—Volume 1. Measurement of stage and discharge: U.S. Geological Survey Water-Supply Paper 2175, 284 p.

_____1982b, Measurement and computation of streamflow—Volume 2. Computation of discharge: U.S. Geological Survey Water-Supply Paper 2175, 347 p.

Riggs, H.C., 1973, Regional analyses of streamflow characteristics: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. B3, 15 p.

Roeske, R.H., 1978, Methods for estimating the magnitude and frequency of floods in Arizona: Arizona Department of Transportation Report ADOT-RS-115(121), 82 p.

SAS Institute, Inc., 1982, SAS users guide: Statistics, 1982 edition: Cary, North Carolina, SAS Institute, Inc., 584 p.

Sellers, W.D., Hill, R.H., and Sanderson-Rae, Margaret, eds., 1985, Arizona climate—The first hundred years: Tucson, Arizona, University of Arizona Press, 143 p.

Smith, L.P., and Stockton, C.W., 1981, Reconstructed stream flow for the Salt and Verde Rivers from tree-ring data: American Water Resources Association, Water Resources Bulletin, v. 17, no. 6, p. 939-947.

University of Arizona, 1965, Normal annual precipitation—Normal May-September precipitation—1931-1960, State of Arizona: Tucson, University of Arizona map, scale 1:500,000.

U.S. Geological Survey, 1954, Compilation of records of surface waters of the United States through September 1950, Part 9, Colorado River basin: U.S. Geological Survey Water-Supply Paper 1313, 749 p.

_____1964, Compilation of records of surface waters of the United States, October 1950 to September 1960, Part 9, Colorado River basin: U.S. Geological Survey Water-Supply Paper 1733, 586 p.

_____1965-74, Water resources data for Arizona—Part 1, Surface-water records: U.S. Geological Survey Water-Resources Data Report (published annually).

_____1976-82, Water-resources data for Arizona, water years 1975-80: U.S. Geological Survey Water-Resources Data Reports AZ-75-1 to AZ-81-1, (published annually).

_____1977, National handbook of recommended methods for water-data acquisition: U.S. Geological Survey, Office of Water Data Coordination, 2 volumes.

U.S. Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood flow frequency: U.S. Geological Survey Hydrology Subcommittee Bulletin 17B (revised and corrected), 183 p.

U.S. Soil Conservation Service, 1969, Generalized hydrologic soil map—Arizona: U.S. Soil Conservation Service map report, scale 1:1,000,000.

U.S. Weather Bureau, 1967, Arizona 50-year 24-hour precipitation: U.S. Weather Bureau map.

White, N.D., and Garrett, W.B., 1984, Water-resources data for Arizona, water year 1982: U.S. Geological Survey Water-Resources Data Reports AZ-82-1, 440 p.

_____1986, Water-resources data for Arizona, water year 1983: U.S. Geological Survey Water-Resources Data Reports AZ-83-1, 387 p.

_____1987, Water-resources data for Arizona, water year 1984: U.S. Geological Survey Water-Resources Data Reports AZ-84-1, 385 p.

_____1988, Water-resources data for Arizona, water year 1985: U.S. Geological Survey Water-Resources Data Reports AZ-85-1, 343 p.

Wilson, E.D., and Moore, R.T., 1958, Geologic map of Graham and Greenlee Counties, Arizona: Arizona Bureau of Mines County Geologic Map Series 3-4, scale 1:375,000.

Wilson, E.D., Moore, R.T., and O'Haire, R.T., 1960, Geologic map of Navajo and Apache Counties, Arizona: Arizona Bureau of Mines County Geologic Map Series 3-7, scale 1:375,000.

Wilson, E.D., Moore, R.T., and Pierce, H.W., 1959, Geologic map of Gila County, Arizona: Arizona Bureau of Mines County Geologic Map Series 3-3, scale 1:375,000.

Wilson, R.P, and Garrett, W.B., 1988, Water-resources data for Arizona, water year 1986: U.S. Geological Survey Water-Resources Data Reports AZ-86-1, 341 p.

STATISTICAL SUMMARIES

Mean monthly and annual discharges, magnitude and probability of annual low and high flows, magnitude and probability of instantaneous peak flows, and percent of time that a given daily mean flow was exceeded or equaled at selected streamflow-gaging stations in and near the Fort Apache and San Carlos Indian Reservations.

[Ft^3/s, cubic feet per second; years of record may include historic years other than those in period of record]

09445500 WILLOW CREEK NEAR POINT OF PINES, NEAR MORENCI, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1945-67

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	21	0.00	9.6	6.6	0.69	7.0
NOVEMBER	17	0.00	6.8	5.7	0.84	5.0
DECEMBER	157	0.00	11	32	2.9	8.1
JANUARY	103	0.00	12	25	2.1	8.6
FEBRUARY	33	0.00	6.1	10	1.6	4.5
MARCH	76	0.00	17	18	1.1	12.4
APRIL	21	0.00	13	5.6	0.44	9.3
MAY	19	0.00	12	4.8	0.41	8.7
JUNE	22	0.00	12	5.9	0.49	8.8
JULY	25	0.06	12	6.0	0.50	8.7
AUGUST	35	4.1	15	6.2	0.42	10.9
SEPTEMBER	19	0.00	11	6.0	0.55	7.9
ANNUAL	32	1.0	11	6.3	0.55	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1946-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1						
3						
7						
14						
30						
60						
90	0.28	0.00	0.00	0.00	0.00	0.00
120	1.7	0.17	0.00	0.00	0.00	0.00
183	5.6	2.7	1.5	0.48	0.00	0.00

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1945-67

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
678	1,370	1,970	2,890	3,710	4,620

WEIGHTED SKEW (LOGS)= -0.04
MEAN (LOGS)= 2.83
STANDARD DEV. (LOGS)= 0.36

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1945-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	108	357	710	1,560	2,660	4,380
3	63	187	360	772	1,310	2,170
7	45	115	206	409	662	1,050
15	32	72	120	225	351	540
30	25	50	77	131	191	275
60	20	36	50	71	91	113
90	19	32	42	55	66	78

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1945-67

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
66	24	20	18	17	15	13	10	6.3	0.49	0.07	0.04	0.02	0.01	0.00	0.00	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09446000 WILLOW CREEK NEAR DOUBLE CIRCLE RANCH, NEAR MORENCI, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1945-67

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	22	0.84	10	6.1	0.61	6.3
NOVEMBER	19	0.86	8.1	5.6	0.69	5.0
DECEMBER	273	0.93	18	56	3.1	11.2
JANUARY	163	0.90	19	40	2.1	11.8
FEBRUARY	36	0.86	7.9	11	1.4	4.9
MARCH	103	0.79	19	23	1.2	11.8
APRIL	23	0.76	13	5.4	0.41	8.3
MAY	19	0.59	12	4.8	0.42	7.2
JUNE	20	0.03	11	5.7	0.51	7.0
JULY	24	0.40	13	5.6	0.44	7.9
AUGUST	55	6.3	19	9.8	0.52	11.6
SEPTEMBER	20	0.43	11	5.4	0.48	7.0
ANNUAL	42	2.8	13	8.3	0.62	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1946-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	0.71	0.19	0.02	0.00	0.00	0.00
3	0.77	0.22	0.02	0.00	0.00	0.00
7	0.87	0.28	0.05	0.00	0.00	0.00
14	0.87	0.32	0.10	0.00	0.00	0.00
30	1.0	0.46	0.24	0.00	0.00	0.00
60	1.4	0.59	0.37	0.25	0.16	0.12
90	1.9	0.94	0.69	0.54	0.43	0.37
120	3.0	1.7	1.2	0.97	0.76	0.65
183	6.8	3.8	2.7	2.0	1.3	1.0

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1944-67, 1973

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1,430	2,910	4,200	6,210	7,990	10,000

WEIGHTED SKEW (LOGS)= -0.04
MEAN (LOGS)= 3.15
STANDARD DEV. (LOGS)= 0.37

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1945-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	181	593	1,150	2,400	3,930	6,200
3	96	300	582	1,250	2,100	3,430
7	63	176	326	668	1,100	1,760
15	42	106	188	374	610	975
30	31	68	114	210	326	499
60	23	45	68	112	158	222
90	20	37	54	83	113	150

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1945-67

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
83	26	21	18	16	14	12	10	7.3	2.9	1.4	0.97	0.67	0.27	0.04	0.02	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09446500 EAGLE CREEK NEAR DOUBLE CIRCLE RANCH, NEAR MORENCI, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1945-67

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	33	5.7	18	5.9	0.33	5.7
NOVEMBER	22	5.2	14	5.3	0.38	4.5
DECEMBER	502	4.7	36	103	2.9	11.6
JANUARY	310	4.7	41	76	1.8	13.3
FEBRUARY	101	4.1	22	27	1.2	7.1
MARCH	213	5.9	41	48	1.2	13.1
APRIL	89	4.3	27	18	0.64	8.9
MAY	25	5.3	18	4.3	0.24	5.7
JUNE	25	3.7	16	4.6	0.30	5.0
JULY	36	13	21	6.3	0.30	6.7
AUGUST	93	13	38	25	0.66	12.1
SEPTEMBER	42	11	20	8.8	0.45	6.4
ANNUAL	81	11	26	16	0.62	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1946-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	4.1	3.1	2.7	2.3	2.0	1.9
3	4.2	3.1	2.7	2.4	2.1	1.9
7	4.3	3.3	2.9	2.6	2.4	2.2
14	5.1	3.9	3.4	3.1	2.8	2.7
30	5.8	4.5	4.0	3.8	3.5	3.4
60	6.8	5.0	4.4	3.9	3.6	3.4
90	7.5	5.4	4.6	4.1	3.6	3.4
120	9.1	6.6	5.6	5.0	4.3	3.9
183	12	9.4	8.2	7.3	6.5	6.0

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1944-67, 1973

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
2,510	5,690	8,760	13,900	18,800	24,600

WEIGHTED SKEW (LOGS)= 0.03
MEAN (LOGS)= 3.40
STANDARD DEV. (LOGS)= 0.42

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1945-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	290	908	1,780	3,850	6,550	10,800
3	181	532	1,000	2,090	3,460	5,550
7	121	326	584	1,140	1,810	2,790
15	85	215	376	719	1,130	1,720
30	65	147	238	415	608	871
60	48	97	147	238	332	454
90	39	75	113	182	254	349

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1945-67

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
193	70	38	27	24	20	18	16	14	11	7.9	5.6	4.9	4.2	3.8	2.9	2.4

† Reliability of values in column is uncertain, and potential errors are large.

09447000 EAGLE CREEK ABOVE PUMPING PLANT, NEAR MORENCI, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1945-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	1,170	13	67	182	2.7	9.5
NOVEMBER	228	10	31	32	1.0	4.5
DECEMBER	884	11	89	176	2.0	12.7
JANUARY	1,080	11	96	185	1.9	13.7
FEBRUARY	989	11	97	180	1.9	13.7
MARCH	700	14	97	135	1.4	13.8
APRIL	214	11	50	41	0.82	7.1
MAY	81	9.2	30	16	0.52	4.3
JUNE	40	5.3	23	8.5	0.38	3.2
JULY	98	16	37	18	0.50	5.2
AUGUST	203	19	55	39	0.72	7.8
SEPTEMBER	114	13	33	19	0.56	4.7
ANNUAL	239	17	59	51	0.87	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1945-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	11	6.6	5.0	4.0	3.0	2.5
3	11	6.9	5.3	4.2	3.2	2.7
7	12	7.6	5.9	4.6	3.5	2.9
14	14	8.9	6.9	5.5	4.3	3.6
30	16	10	8.3	6.7	5.3	4.5
60	17	12	9.9	8.4	7.1	6.3
90	18	13	11	9.5	8.1	7.3
120	20	15	13	11	9.5	8.6
183	25	18	16	15	13	12

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1944-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
2,770	7,380	12,100	20,100	27,700	36,800

WEIGHTED SKEW (LOGS)= -0.19
MEAN (LOGS)= 3.43
STANDARD DEV. (LOGS)= 0.52

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1945-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	677	2,430	4,900	10,600	17,700	28,200
3	409	1,450	2,970	6,670	11,500	19,100
7	259	858	1,700	3,710	6,300	10,300
15	175	524	988	2,040	3,340	5,300
30	128	344	610	1,170	1,830	2,770
60	93	233	401	747	1,150	1,720
90	76	182	307	561	851	1,260

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1945-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
554	156	80	55	45	36	32	27	24	21	18	14	12	9.9	8.8	6.7	4.1

† Reliability of values in column is uncertain, and potential errors are large.

09447800 BONITA CREEK NEAR MORENCI, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1982-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	176	4.6	40	76	1.9	27.2
NOVEMBER	6.5	3.6	5.6	1.2	0.21	3.8
DECEMBER	30	6.3	16	9.7	0.62	10.5
JANUARY	29	6.5	15	9.3	0.62	10.3
FEBRUARY	55	4.1	23	21	0.91	15.8
MARCH	45	4.5	16	17	1.0	10.9
APRIL	7.8	3.3	4.9	1.8	0.36	3.3
MAY	6.3	2.2	4.2	1.9	0.46	2.8
JUNE	4.6	1.3	3.1	1.4	0.45	2.1
JULY	8.7	3.7	5.4	2.0	0.37	3.6
AUGUST	9.1	5.4	7.0	1.6	0.23	4.7
SEPTEMBER	11	4.6	7.2	2.3	0.33	4.9
ANNUAL	22	5.6	12	6.6	0.54	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1983-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10† 10%	20† 5%	50† 2%	100† 1%
1	1.9	1.0	0.71	0.49	0.31	0.22
3	1.9	1.1	0.76	0.54	0.35	0.26
7	2.0	1.1	0.82	0.60	0.41	0.32
14	2.1	1.4	0.91	0.72	0.51	0.41
30	2.5	1.5	1.1	0.84	0.62	0.50
60	2.9	1.7	1.2	0.91	0.65	0.52
90	3.3	2.0	1.5	1.2	0.86	0.70
120	3.9	2.7	2.2	1.9	1.5	1.3
183	5.4	4.6	4.2	3.9	3.5	3.3

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON YEARS OF RECORD

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10† 10%	25† 4%	50† 2%	100† 1%

WEIGHTED SKEW (LOGS)= ******
MEAN (LOGS)= ******
STANDARD DEV. (LOGS)= ******

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1982-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10† 10%	25† 4%	50† 2%	100† 1%
1	222	855	2,140	6,720	15,500	35,200
3	133	506	1,220	3,590	7,820	16,700
7	98	326	661	1,490	2,610	4,410
15	62	187	346	683	1,080	1,640
30	40	107	180	317	459	642
60	30	69	104	159	207	262
90	23	49	72	107	137	171

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1982-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
121	26	13	8.8	7.4	6.7	6.0	5.3	4.7	4.1	3.4	2.4	1.6	1.3	1.2	1.1	0.73

† Reliability of values in column is uncertain, and potential errors are large.

09448500 GILA RIVER AT HEAD OF SAFFORD VALLEY, NEAR SOLOMON, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1933, 1936-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	7,450	40	452	1,190	2.6	8.6
NOVEMBER	2,230	49	230	314	1.4	4.4
DECEMBER	5,800	60	538	1,040	1.9	10.2
JANUARY	3,370	93	550	761	1.4	10.4
FEBRUARY	3,870	103	732	942	1.3	13.9
MARCH	3,380	82	877	996	1.1	16.6
APRIL	2,780	64	564	638	1.1	10.7
MAY	2,040	38	291	395	1.4	5.5
JUNE	388	20	100	86	0.85	1.9
JULY	721	44	185	129	0.70	3.5
AUGUST	1,930	66	415	381	0.92	7.9
SEPTEMBER	2,080	36	347	345	1.0	6.6
ANNUAL	1,680	101	439	373	0.85	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1922-33, 1937-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	36	23	19	16	13	12
3	37	25	20	17	15	13
7	40	27	22	19	16	14
14	44	30	25	21	18	16
30	52	35	29	25	21	19
60	67	45	38	33	28	26
90	88	59	49	42	35	32
120	116	80	66	56	46	41
183	159	109	93	82	73	69

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1914-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
9,700	23,200	38,400	68,200	101,000	146,000

WEIGHTED SKEW (LOGS)= 0.51
MEAN (LOGS)= 4.02
STANDARD DEV. (LOGS)= 0.42

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1933, 1936-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	4,730	13,300	24,000	47,100	74,300	114,000
3	3,300	8,960	15,900	30,300	47,100	71,000
7	2,220	5,620	9,520	17,200	25,700	37,400
15	1,580	3,740	6,020	10,200	14,500	20,000
30	1,130	2,500	3,870	6,260	8,610	11,500
60	799	1,750	2,680	4,280	5,830	7,740
90	645	1,440	2,240	3,650	5,050	6,810

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1933, 1936-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
4,150	1,700	943	609	452	273	200	161	133	109	83	57	43	33	28	23	18

09466500 GILA RIVER AT CALVA, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1930-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	8,490	0.00	383	1,280	3.3	9.8
NOVEMBER	1,540	0.00	158	248	1.6	4.0
DECEMBER	5,650	0.00	411	945	2.3	10.5
JANUARY	3,580	22	480	760	1.6	12.2
FEBRUARY	3,550	29	646	887	1.4	16.5
MARCH	2,940	10	655	886	1.3	16.7
APRIL	2,330	1.3	349	542	1.5	8.9
MAY	2,080	1.3	175	375	2.1	4.5
JUNE	292	0.00	33	64	2.0	0.8
JULY	838	0.05	92	149	1.6	2.4
AUGUST	1,660	4.9	315	391	1.2	8.0
SEPTEMBER	1,680	0.00	225	280	1.2	5.7
ANNUAL	1,520	29	326	345	1.1	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1931-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00
14	0.12	0.00	0.00	0.00	0.00	0.00
30	1.5	0.02	0.00	0.00	0.00	0.00
60	7.0	1.6	0.59	0.16	0.00	0.00
90	16	6.0	3.4	1.7	0.00	0.00
120	32	14	8.2	4.3	0.00	0.00
183	80	36	23	16	10	7.8

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1916, 1930-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
6,510	17,400	31,300	62,100	99,900	157,000

WEIGHTED SKEW (LOGS)= 0.69
MEAN (LOGS)= 3.87
STANDARD DEV. (LOGS)= 0.47

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1930-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	4,250	11,900	21,300	41,200	64,200	96,900
3	3,090	8,600	15,200	28,700	43,900	64,900
7	2,090	5,580	9,440	16,700	24,300	34,200
15	1,420	3,620	5,910	10,000	14,100	19,100
30	947	2,340	3,750	6,200	8,580	11,500
60	635	1,560	2,500	4,150	5,780	7,790
90	495	1,240	2,010	3,420	4,830	6,620

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1930-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
3,980	1,570	728	461	315	168	100	62	39	23	11	2.0	0.07	0.03	0.01	0.01	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09468500 SAN CARLOS RIVER NEAR PERIDOT, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1930-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	519	0.20	33	90	2.8	4.9
NOVEMBER	178	2.7	18	27	1.5	2.7
DECEMBER	1,580	5.1	109	259	2.4	16.2
JANUARY	870	5.8	93	157	1.7	13.8
FEBRUARY	1,500	7.0	158	260	1.6	23.5
MARCH	1,260	4.8	138	251	1.8	20.4
APRIL	170	2.2	22	32	1.5	3.2
MAY	42	0.03	6.8	7.2	1.1	1.0
JUNE	18	0.00	2.8	3.7	1.3	0.4
JULY	85	0.00	19	19	1.0	2.8
AUGUST	294	1.6	50	56	1.1	7.4
SEPTEMBER	166	0.00	24	31	1.3	3.6
ANNUAL	278	8.2	56	56	1.0	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1931-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
7	0.07	0.00	0.00	0.00	0.00	0.00
14	0.31	0.00	0.00	0.00	0.00	0.00
30	0.65	0.00	0.00	0.00	0.00	0.00
60	1.7	0.35	0.04	0.00	0.00	0.00
90	3.1	1.4	0.88	0.58	0.35	0.24
120	6.3	3.3	2.2	1.6	1.0	0.76
183	12	6.1	4.3	3.2	2.3	1.8

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1930-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
7,490	15,300	22,200	33,200	43,100	54,600

WEIGHTED SKEW (LOGS)= 0.03
MEAN (LOGS)= 3.88
STANDARD DEV. (LOGS)= 0.37

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1930-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	1,810	5,040	8,700	15,700	23,100	32,800
3	1,000	2,870	5,070	9,420	14,200	20,600
7	561	1,550	2,690	4,880	7,230	10,300
15	327	861	1,450	2,560	3,720	5,230
30	199	510	850	1,490	2,150	3,020
60	128	325	538	935	1,350	1,880
90	95	242	403	704	1,020	1,430

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1930-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
960	148	64	37	25	15	11	8.9	6.6	4.6	2.8	0.84	0.07	0.03	0.01	0.01	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09489070 NORTH FORK OF EAST FORK BLACK RIVER NEAR ALPINE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1966-78

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	33	0.83	5.8	9.9	1.7	3.8
NOVEMBER	8.7	0.67	3.0	2.9	0.97	1.9
DECEMBER	16	0.33	2.5	4.2	1.7	1.6
JANUARY	13	0.20	1.9	3.3	1.7	1.3
FEBRUARY	15	0.20	2.7	4.1	1.5	1.8
MARCH	103	2.4	23	29	1.2	15.1
APRIL	362	1.2	83	102	1.2	54.0
MAY	134	0.49	21	37	1.8	13.5
JUNE	9.8	D.29	2.0	2.5	1.2	1.3
JULY	4.7	0.41	1.8	1.2	0.69	1.1
AUGUST	13	0.56	3.9	3.9	1.0	2.5
SEPTEMBER	13	0.38	3.0	3.5	1.2	2.0
ANNUAL	50	1.2	13	13	1.0	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1967-78

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	0.37	0.24	0.20	0.17	0.14	0.13
3	0.39	0.25	0.21	0.17	0.14	0.13
7	0.40	0.27	0.22	0.19	0.16	0.15
14	0.42	0.29	0.24	0.21	0.18	0.16
30	0.47	0.31	0.25	0.22	0.18	0.16
60	0.55	0.36	0.28	D.23	0.19	0.16
90	0.62	0.40	0.31	0.25	0.20	0.18
120	0.66	0.46	0.41	0.38	0.36	0.35
183	0.96	0.75	0.70	0.68	0.66	0.66

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1966-78

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
306	553	741	1,000	1,210	1,420

WEIGHTED SKEW (LOGS)= -0.24
MEAN (LOGS)= 2.47
STANDARD DEV. (LOGS)= 0.32

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1966-78

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25† 4%	50† 2%	100† 1%
1	150	380	592	916	1,190	1,500
3	130	340	539	858	1,140	1,460
7	105	286	462	751	1,010	1,310
15	76	217	362	607	833	1,100
30	52	157	269	465	654	880
60	34	98	164	277	384	509
90	26	71	115	186	250	321

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1966-78

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
253	53	22	12	6.7	3.4	2.2	1.5	1.2	0.91	0.66	0.46	0.33	0.26	0.23	0.21	0.20

† Reliability of values in column is uncertain, and potential errors are large.

09489100 BLACK RIVER NEAR MAVERICK, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1963-82

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	726	20	91	173	1.9	5.4
NOVEMBER	219	18	60	62	1.0	3.6
DECEMBER	609	15	72	134	1.9	4.2
JANUARY	205	18	61	60	0.99	3.6
FEBRUARY	290	21	99	86	0.87	5.8
MARCH	934	44	307	262	0.85	18.1
APRIL	1,480	32	559	462	0.83	33.0
MAY	1,330	22	224	309	1.4	13.2
JUNE	147	17	45	37	0.82	2.6
JULY	107	21	38	22	0.58	2.2
AUGUST	224	24	66	44	0.68	3.9
SEPTEMBER	274	21	72	70	0.97	4.3
ANNUAL	392	37	141	98	0.70	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1964-82

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	14	12	11	10	9.3	8.8
3	15	13	12	12	11	11
7	16	14	13	12	11	11
14	17	15	14	14	13	13
30	19	17	16	15	14	14
60	21	19	18	17	16	16
90	23	20	19	18	17	16
120	25	21	20	19	18	18
183	35	27	24	21	20	18

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1963-80, 1982, 1984

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1,620	3,860	6,220	10,500	14,900	20,500

WEIGHTED SKEW (LOGS)= 0.23
MEAN (LOGS)= 3.23
STANDARD DEV. (LOGS)= 0.43

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1963-82

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	1,030	2,220	3,380	5,350	7,250	9,580
3	925	1,900	2,770	4,140	5,360	6,770
7	791	1,510	2,080	2,890	3,550	4,260
15	647	1,270	1,780	2,520	3,140	3,810
30	512	1,040	1,490	2,170	2,750	3,400
60	373	757	1,080	1,560	1,960	2,400
90	294	597	848	1,220	1,520	1,860

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1963-82

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
1,600	633	354	224	154	84	54	40	31	27	24	20	18	16	15	13	11

† Reliability of values in column is uncertain, and potential errors are large.

09489200 PACHETA CREEK AT MAVERICK, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1958-80

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	24	0.53	3.3	5.2	1.6	3.0
NOVEMBER	12	0.35	2.5	2.5	1.0	2.2
DECEMBER	27	0.68	3.3	5.7	1.7	3.0
JANUARY	15	0.59	3.3	4.3	1.3	3.0
FEBRUARY	14	0.59	4.2	4.0	0.94	3.8
MARCH	61	1.6	17	17	1.0	15.3
APRIL	102	1.5	44	36	0.82	39.8
MAY	131	0.50	21	30	1.4	19.5
JUNE	19	0.27	3.4	4.6	1.3	3.1
JULY	6.4	0.25	2.0	1.5	0.76	1.8
AUGUST	12	0.37	2.6	2.2	0.87	2.3
SEPTEMBER	15	0.33	3.3	3.7	1.1	3.0
ANNUAL	28	0.96	9.1	7.0	0.76	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1959-80

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	0.89	0.50	0.34	0.23	0.14	0.10
3	0.89	0.50	0.34	0.23	0.14	0.10
7	0.92	0.52	0.35	0.24	0.14	0.10
14	0.95	0.55	0.38	0.26	0.16	0.11
30	0.99	0.61	0.43	0.31	0.20	0.14
60	1.1	0.69	0.50	0.37	0.25	0.18
90	1.2	0.77	0.57	0.42	0.28	0.21
120	1.4	0.86	0.63	0.47	0.32	0.24
183	1.6	0.95	0.70	0.54	0.39	0.32

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-80

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
106	180	234	308	366	426

WEIGHTED SKEW (LOGS)= -0.18
MEAN (LOGS)= 2.02
STANDARD DEV. (LOGS)= 0.28

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1958-80

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	74	146	199	265	312	356
3	66	139	191	254	298	339
7	58	127	176	235	275	312
15	48	109	155	213	255	294
30	38	89	131	187	230	273
60	26	63	94	139	175	212
90	20	47	70	103	129	157

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1958-80

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
116	49	23	14	8.4	3.9	2.4	1.9	1.6	1.4	1.2	0.83	0.56	0.31	0.26	0.23	0.21

† Reliability of values in column is uncertain, and potential errors are large.

09489500 BLACK RIVER BELOW PUMPING PLANT, NEAR POINT OF PINES, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1954-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	1,210	14	134	258	1.9	5.2
NOVEMBER	299	23	80	71	0.89	3.1
DECEMBER	915	20	124	191	1.5	4.8
JANUARY	503	27	122	125	1.0	4.8
FEBRUARY	1,040	35	220	230	1.0	8.6
MARCH	1,860	64	534	474	0.89	20.8
APRIL	2,250	44	753	677	0.90	29.3
MAY	1,930	23	310	413	1.3	12.1
JUNE	244	9.8	61	64	1.0	2.4
JULY	122	17	44	23	0.53	1.7
AUGUST	378	18	104	97	0.93	4.0
SEPTEMBER	385	9.4	86	81	0.94	3.3
ANNUAL	608	49	214	157	0.73	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1955-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	10	6.4	5.0	4.1	3.2	2.8
3	12	7.3	5.8	4.8	3.8	3.3
7	13	9.4	7.9	6.9	6.0	5.4
14	16	12	9.7	8.4	7.2	6.4
30	20	15	13	11	9.9	9.1
60	25	19	16	15	14	13
90	31	23	20	19	17	16
120	36	27	23	21	19	18
183	49	34	29	26	23	21

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1954-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
2,160	5,040	7,690	11,900	15,700	20,000

WEIGHTED SKEW (LOGS)= 0.02
MEAN (LOGS)= 3.37
STANDARD DEV. (LOGS)= 0.44

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1954-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	1,600	3,620	5,540	8,710	11,700	15,100
3	1,380	2,930	4,270	6,330	8,110	10,100
7	1,150	2,280	3,190	4,480	5,530	6,640
15	921	1,810	2,540	3,580	4,450	5,370
30	728	1,470	2,090	3,020	3,810	4,680
60	532	1,100	1,590	2,340	2,980	3,690
90	421	889	1,300	1,920	2,460	3,060

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1954-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
2,280	1,010	553	341	245	138	86	60	47	38	30	22	18	13	11	8.7	5.5

† Reliability of values in column is uncertain, and potential errors are large.

09489700 BIG BONITO CREEK NEAR FORT APACHE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1958-80

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	157	9.2	30	40	1.3	3.7
NOVEMBER	69	10	28	19	0.71	3.3
DECEMBER	251	11	39	57	1.5	4.8
JANUARY	115	11	40	35	0.86	4.9
FEBRUARY	316	10	65	68	1.0	7.9
MARCH	521	21	133	119	0.90	16.2
APRIL	540	23	224	168	0.75	27.2
MAY	610	11	138	149	1.1	16.8
JUNE	148	6.3	34	39	1.1	4.1
JULY	50	6.5	20	11	0.56	2.4
AUGUST	122	7.8	40	29	0.73	4.9
SEPTEMBER	112	7.0	31	26	0.83	3.8
ANNUAL	167	17	69	43	0.62	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1959-81

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	6.2	4.8	4.2	3.8	3.4	3.1
3	6.7	5.3	4.6	4.1	3.7	3.4
7	7.2	5.6	4.9	4.3	3.8	3.5
14	7.8	6.3	5.6	5.0	4.5	4.1
30	9.0	7.3	6.4	5.8	5.1	4.7
60	11	9.0	8.0	7.1	6.3	5.7
90	13	10	9.3	8.6	7.8	7.3
120	14	11	10	9.7	9.3	9.0
183	19	14	12	11	9.4	8.7

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-81

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
629	1,440	2,200	3,470	4,650	6,040

WEIGHTED SKEW (LOGS)= -0.04
MEAN (LOGS)= 2.80
STANDARD DEV. (LOGS)= 0.43

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1958-80

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	453	969	1,440	2,190	2,860	3,640
3	391	791	1,140	1,670	2,130	2,650
7	328	623	859	1,190	1,470	1,760
15	269	503	684	937	1,140	1,350
30	219	416	576	806	997	1,200
60	172	330	456	638	786	945
90	140	271	375	520	638	761

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1958-80

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
597	293	177	122	87	53	34	24	18	15	12	9.9	8.1	6.4	5.6	5.1	4.4

† Reliability of values in column is uncertain, and potential errors are large.

09490500 BLACK RIVER NEAR FORT APACHE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1915, 1958-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	2,730	31	276	579	2.1	5.3
NOVEMBER	565	37	146	134	0.92	2.8
DECEMBER	2,450	38	435	680	1.6	8.3
JANUARY	1,070	37	354	343	0.97	6.7
FEBRUARY	3,150	57	610	661	1.1	11.6
MARCH	3,860	90	1,060	959	0.91	20.1
APRIL	4,420	75	1,270	1,090	0.85	24.3
MAY	3,110	39	560	678	1.2	10.7
JUNE	448	17	117	123	1.0	2.2
JULY	763	30	92	131	1.4	1.8
AUGUST	659	35	185	166	0.90	3.5
SEPTEMBER	501	31	139	117	0.85	2.6
ANNUAL	1,220	78	436	321	0.74	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1915, 1959-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	23	17	14	13	11	11
3	24	18	16	14	13	12
7	26	19	17	15	14	13
14	29	21	19	17	15	14
30	33	25	22	19	18	16
60	41	31	28	27	25	24
90	50	38	34	31	29	28
120	60	43	37	34	31	29
183	80	55	48	44	41	40

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
6,670	19,300	32,600	55,900	78,300	105,000

WEIGHTED SKEW (LOGS)= -0.23
MEAN (LOGS)= 3.80
STANDARD DEV. (LOGS)= 0.57

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1915, 1958-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	4,090	11,500	19,500	33,800	48,000	65,600
3	3,120	8,000	13,000	21,500	29,800	39,800
7	2,250	5,050	7,570	11,500	14,900	18,700
15	1,750	3,630	5,150	7,350	9,130	11,000
30	1,360	2,710	3,770	5,230	6,400	7,600
60	1,030	2,100	2,950	4,120	5,050	6,010
90	859	1,790	2,520	3,530	4,320	5,130

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1915, 1958-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
4,210	1,910	1,210	789	511	268	164	110	81	64	51	38	31	24	21	18	13

† Reliability of values in column is uncertain, and potential errors are large.

09490800 NORTH FORK WHITE RIVER NEAR GREER, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1966-78

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	54	8.7	20	15	0.76	6.7
NOVEMBER	27	6.6	13	7.4	0.55	4.5
DECEMBER	25	6.1	11	5.3	0.49	3.7
JANUARY	19	6.0	9.6	3.3	0.35	3.3
FEBRUARY	21	6.0	10	3.7	0.35	3.5
MARCH	54	9.8	21	13	0.62	7.0
APRIL	97	17	52	28	0.53	17.6
MAY	233	14	63	57	0.90	21.4
JUNE	152	7.9	39	39	0.98	13.3
JULY	44	8.4	17	9.5	0.55	5.9
AUGUST	47	9.9	20	9.9	0.49	6.9
SEPTEMBER	43	9.0	18	10	0.57	6.2
ANNUAL	57	13	25	12	0.47	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1967-78

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	6.4	5.3	4.8	4.3	3.9	3.6
3	6.5	5.5	5.0	4.6	4.2	4.0
7	6.7	5.8	5.3	4.9	4.5	4.3
14	6.8	6.1	5.7	5.4	5.1	4.9
30	7.6	6.9	6.5	6.1	5.8	5.5
60	8.1	7.3	6.8	6.4	5.9	5.5
90	8.6	7.6	7.0	6.5	5.9	5.5
120	8.9	8.0	7.6	7.4	7.0	6.8
183	11	9.5	9.1	8.8	8.5	8.3

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1966-78

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
183	266	325	405	469	535

WEIGHTED SKEW (LOGS)= 0.17
MEAN (LOGS)= 2.27
STANDARD DEV. (LOGS)= 0.19

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1966-78

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	113	172	221	295	360	434
3	98	155	202	274	338	412
7	84	137	181	249	308	377
15	73	121	159	216	265	321
30	64	107	141	192	235	283
60	55	93	126	175	218	268
90	47	79	104	142	175	211

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1966-78

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
193	79	59	42	32	22	17	14	12	10	8.9	7.9	7.2	6.4	6.0	5.3	4.7

† Reliability of values in column is uncertain, and potential errors are large.

09491000 NORTH FORK WHITE RIVER NEAR MCNARY, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1946, 1951-54, 1958-85

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	213	9.4	31	39	1.3	5.2
NOVEMBER	49	8.4	21	10	0.48	3.6
DECEMBER	98	7.5	21	17	0.81	3.7
JANUARY	78	6.4	20	15	0.72	3.5
FEBRUARY	41	8.7	19	7.7	0.40	3.3
MARCH	170	14	45	33	0.74	7.7
APRIL	282	28	127	79	0.62	21.7
MAY	454	17	134	104	0.78	23.0
JUNE	293	10	72	72	0.99	12.4
JULY	80	10	27	17	0.62	4.7
AUGUST	82	14	33	15	0.47	5.6
SEPTEMBER	123	9.5	33	25	0.74	5.7
ANNUAL	108	16	49	25	0.51	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1947, 1952-54, 1959-85

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	9.8	7.8	7.1	6.6	6.2	6.0
3	10	8.0	7.2	6.8	6.3	6.1
7	10	8.2	7.4	6.8	6.3	6.1
14	11	8.7	7.8	7.2	6.6	6.3
30	12	9.6	8.7	8.1	7.5	7.2
60	13	11	9.7	9.0	8.4	8.0
90	14	12	11	9.9	9.2	8.8
120	16	12	11	10	9.7	9.3
183	18	14	13	12	11	11

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1946, 1948-85

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
407	742	1,030	1,460	1,850	2,280

WEIGHTED SKEW (LOGS)= 0.16
MEAN (LOGS)= 2.62
STANDARD DEV. (LOGS)= 0.30

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1946, 1951-54, 1958-85

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	294	542	766	1,130	1,460	1,860
3	254	458	624	868	1,070	1,300
7	216	377	495	652	774	899
15	178	309	402	524	616	708
30	147	258	340	449	534	621
60	121	214	286	384	461	543
90	99	175	233	314	378	447

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1946, 1951-54, 1958-85

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
388	189	121	77	58	40	30	23	20	17	15	12	10	8.4	7.6	6.7	5.9

† Reliability of values in column is uncertain, and potential errors are large.

09492400 EAST FORK WHITE RIVER NEAR FORT APACHE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1958-85

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	128	8.7	25	28	1.1	5.6
NOVEMBER	41	8.2	16	8.1	0.50	3.6
DECEMBER	57	7.8	17	12	0.72	3.8
JANUARY	34	7.7	15	8.2	0.53	3.5
FEBRUARY	66	7.8	20	12	0.61	4.5
MARCH	103	9.9	37	24	0.65	8.4
APRIL	182	19	81	44	0.55	18.3
MAY	284	13	107	70	0.65	24.3
JUNE	172	6.2	53	52	0.98	11.9
JULY	46	7.7	19	10	0.54	4.3
AUGUST	71	11	28	15	0.55	6.3
SEPTEMBER	66	7.8	24	14	0.57	5.5
ANNUAL	72	15	37	17	0.45	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1959-85

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	6.3	5.3	4.9	4.6	4.4	4.3
3	6.7	5.8	5.4	5.3	5.1	5.1
7	7.2	6.1	5.8	5.5	5.3	5.2
14	7.8	6.7	6.4	6.2	6.0	6.0
30	8.4	7.4	7.2	7.0	6.9	6.9
60	9.0	8.2	8.0	7.9	7.9	7.9
90	10	8.9	8.5	8.4	8.2	8.2
120	12	9.7	9.0	8.5	8.1	7.8
183	14	11	10	9.8	9.3	9.1

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
276	510	718	1,050	1,360	1,730

WEIGHTED SKEW (LOGS)= 0.33
MEAN (LOGS)= 2.46
STANDARD DEV. (LOGS)= 0.30

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1958-85

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	196	366	517	758	980	1,240
3	172	293	388	526	642	768
7	151	243	308	394	460	527
15	131	204	253	315	361	406
30	111	175	219	276	320	363
60	93	151	193	248	292	336
90	76	125	160	206	241	276

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1958-85

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
245	137	94	64	48	32	24	19	15	13	11	8.9	8.0	7.0	6.6	5.9	5.0

† Reliability of values in column is uncertain, and potential errors are large.

09494000 WHITE RIVER NEAR FORT APACHE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1958-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	774	31	125	171	1.4	4.9
NOVEMBER	210	35	85	54	0.64	3.4
DECEMBER	715	35	129	161	1.2	5.1
JANUARY	333	32	114	88	0.77	4.5
FEBRUARY	787	33	163	152	0.93	6.4
MARCH	1,160	49	352	289	0.82	13.9
APRIL	1,450	77	611	408	0.67	24.2
MAY	2,070	31	479	445	0.93	18.9
JUNE	602	10	170	176	1.0	6.7
JULY	187	3.9	76	48	0.63	3.0
AUGUST	388	27	122	75	0.61	4.8
SEPTEMBER	262	20	104	66	0.64	4.1
ANNUAL	486	54	211	124	0.59	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1959-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	19	8.6	5.0	2.4	0.00	0.00
3	20	9.7	5.9	3.1	0.00	0.00
7	26	10	6.5	3.6	1.0	0.52
14	29	13	7.1	4.1	2.1	1.2
30	32	17	11	7.3	4.5	3.2
60	39	24	18	14	11	8.9
90	43	32	28	26	23	22
120	50	38	34	31	29	28
183	65	47	41	38	35	34

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
3,420	6,110	8,350	11,700	14,600	17,900

WEIGHTED SKEW (LOGS)= 0.13
MEAN (LOGS)= 3.54
STANDARD DEV. (LOGS)= 0.29

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1958-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	1,430	2,910	4,300	6,640	8,870	11,600
3	1,170	2,270	3,230	4,730	6,070	7,600
7	959	1,730	2,320	3,160	3,830	4,540
15	789	1,380	1,830	2,430	2,910	3,400
30	649	1,150	1,530	2,050	2,470	2,910
60	514	923	1,230	1,650	1,990	2,330
90	426	772	1,030	1,370	1,630	1,900

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1958-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME

1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
1,600	821	547	396	291	178	124	91	69	54	45	34	26	15	9.9	7.2	1.5

† Reliability of values in column is uncertain, and potential errors are large.

09494300 CARRIZO CREEK ABOVE CORDUROY CREEK, NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1954-66

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	6.8	0.12	2.8	2.2	0.77	2.0
NOVEMBER	54	0.87	7.8	14	1.8	5.5
DECEMBER	301	2.0	35	85	2.4	24.6
JANUARY	135	3.5	25	39	1.6	17.5
FEBRUARY	46	3.5	15	14	0.94	10.3
MARCH	94	3.8	29	30	1.0	20.1
APRIL	44	3.2	12	12	1.0	8.2
MAY	8.8	1.3	4.1	2.7	0.65	2.9
JUNE	3.5	0.01	1.2	1.3	1.1	0.8
JULY	9.7	0.00	2.0	2.9	1.4	1.4
AUGUST	31	0.00	6.4	8.3	1.3	4.5
SEPTEMBER	10	0.00	3.1	3.4	1.1	2.2
ANNUAL	40	3.1	12	13	1.1	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1955-67

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1						
3						
7						
14						
30	0.01	0.00	0.00	0.00	0.00	0.00
60	0.38	0.00	0.00	0.00	0.00	0.00
90	0.82	0.34	0.16	0.00	0.00	0.00
120	1.6	0.72	0.40	0.23	0.11	0.06
183	3.1	1.8	1.1	0.71	0.37	0.22

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1954-67

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1,870	3,580	5,020	7,220	9,140	11,300

WEIGHTED SKEW (LOGS)= 0.01
MEAN (LOGS)= 3.27
STANDARD DEV. (LOGS)= 0.33

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1954-66

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	269	918	1,800	3,760	6,140	9,620
3	144	511	1,020	2,160	3,540	5,570
7	83	267	503	1,010	1,590	2,430
15	51	153	279	538	834	1,250
30	33	97	179	359	574	889
60	21	61	109	213	334	507
90	16	46	85	169	271	421

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1954-66

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
144	37	17	9.7	7.0	5.4	4.4	3.7	2.8	1.7	0.63	0.07	0.04	0.01	0.01	0.00	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09494500 CORDUROY CREEK ABOVE FORESTDALE CREEK, NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1953-60

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	2.9	0.00	0.44	1.0	2.3	0.9
NOVEMBER	51	0.00	6.5	18	2.8	13.7
DECEMBER	46	0.00	5.8	16	2.8	12.2
JANUARY	53	0.00	7.4	18	2.5	15.5
FEBRUARY	13	0.00	3.9	5.0	1.3	8.2
MARCH	43	0.09	19	19	0.99	41.0
APRIL	11	0.00	1.7	3.7	2.1	3.6
MAY	0.26	0.00	0.09	0.09	1.0	0.2
JUNE	0.00	0.00	0.00	0.00		0.0
JULY	5.1	0.00	0.83	1.7	2.1	1.7
AUGUST	4.2	0.00	1.3	1.5	1.2	2.7
SEPTEMBER	0.38	0.00	0.07	0.13	1.8	0.2
ANNUAL	17	0.22	4.0	5.5	1.4	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1954-61

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20† 5%	50† 2%	100† 1%
1						
3						
7						
14						
30						
60						
90						
120						
183	0.17	0.12	0.09	0.07	0.05	0.04

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON YEARS OF RECORD

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25† 4%	50† 2%	100† 1%

WEIGHTED SKEW (LOGS)= ******
MEAN (LOGS)= ******
STANDARD DEV. (LOGS)= ******

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1953-60

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25† 4%	50† 2%	100† 1%
1	101	402	841	1,870	3,140	5,050
3	63	228	438	863	1,320	1,930
7	41	138	249	455	662	918
15	27	78	127	202	266	334
30	17	52	84	134	175	218
60	9.7	30	49	78	102	127
90	6.6	22	39	66	91	119

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1953-60

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
74	15	3.9	1.4	0.57	0.16	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09496000 CORDUROY CREEK NEAR MOUTH, NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1952-75

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	161	1.6	13	36	2.8	4.6
NOVEMBER	94	1.8	11	24	2.2	4.0
DECEMBER	347	1.2	35	80	2.3	12.7
JANUARY	434	1.8	45	94	2.1	16.3
FEBRUARY	260	2.0	40	72	1.8	14.7
MARCH	429	2.0	65	91	1.4	23.9
APRIL	191	1.8	27	43	1.6	9.8
MAY	72	1.3	12	16	1.4	4.3
JUNE	28	1.3	7.8	9.2	1.2	2.8
JULY	31	1.4	7.8	8.8	1.1	2.8
AUGUST	24	1.6	7.5	6.4	0.85	2.7
SEPTEMBER	18	1.5	3.6	3.5	0.98	1.3
ANNUAL	115	2.3	23	27	1.2	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1953-75

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	1.3	1.0	0.90	0.80	0.70	0.63
3	1.3	1.0	0.91	0.81	0.69	0.62
7	1.3	1.1	0.95	0.85	0.74	0.67
14	1.4	1.2	1.0	0.94	0.84	0.77
30	1.6	1.3	1.2	1.1	0.98	0.90
60	1.7	1.5	1.4	1.3	1.2	1.1
90	1.9	1.7	1.6	1.5	1.5	1.4
120	2.1	1.8	1.7	1.7	1.6	1.5
183	2.4	2.0	1.9	1.8	1.8	1.8

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1952-75

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1,070	3,650	6,980	14,000	22,000	33,200

WEIGHTED SKEW (LOGS)= 0.05
MEAN (LOGS)= 3.03
STANDARD DEV. (LOGS)= 0.63

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1952-75

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	287	1,290	2,830	6,510	11,200	18,100
3	179	745	1,540	3,280	5,310	8,130
7	110	441	893	1,860	2,950	4,460
15	71	270	532	1,080	1,700	2,540
30	49	186	368	756	1,200	1,800
60	34	123	240	482	754	1,120
90	27	98	191	388	612	919

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1952-75

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
364	80	35	26	20	7.6	3.2	2.6	2.3	2.1	1.8	1.6	1.4	1.2	1.1	0.98	0.78

† Reliability of values in column is uncertain, and potential errors are large.

09496500 CARRIZO CREEK NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1952-60, 1966, 1968-75, 1978-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	397	1.6	37	86	2.3	5.4
NOVEMBER	147	2.5	25	38	1.5	3.7
DECEMBER	762	3.9	111	200	1.8	16.4
JANUARY	758	5.4	89	158	1.8	13.1
FEBRUARY	965	6.3	120	206	1.7	17.7
MARCH	698	6.1	162	185	1.2	23.8
APRIL	350	5.3	56	80	1.4	8.3
MAY	154	2.4	23	30	1.3	3.3
JUNE	41	0.87	14	12	0.90	2.0
JULY	41	1.3	15	13	0.85	2.2
AUGUST	42	3.2	17	11	0.61	2.6
SEPTEMBER	30	0.91	10	8.1	0.78	1.5
ANNUAL	201	5.8	57	54	0.96	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1953-61, 1969-75, 1979-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	1.5	0.60	0.38	0.26	0.18	0.13
3	1.6	0.67	0.44	0.32	0.22	0.18
7	1.7	0.79	0.54	0.40	0.29	0.23
14	2.0	0.94	0.65	0.48	0.35	0.29
30	2.7	1.3	0.89	0.65	0.46	0.37
60	4.1	2.1	1.4	1.0	0.74	0.58
90	5.4	2.9	2.1	1.6	1.2	1.0
120	6.4	3.7	2.8	2.3	1.8	1.5
183	8.4	5.6	4.7	4.1	3.6	3.3

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1951-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
3,220	7,460	11,800	19,600	27,400	37,300

WEIGHTED SKEW (LOGS)= 0.22
MEAN (LOGS)= 3.52
STANDARD DEV. (LOGS)= 0.42

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1952-60, 1966, 1968-75, 1978-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	1,020	3,560	6,820	13,600	21,200	31,600
3	681	2,280	4,150	7,630	11,200	15,500
7	414	1,310	2,330	4,180	6,020	8,290
15	251	766	1,330	2,350	3,350	4,580
30	167	489	834	1,440	2,030	2,740
60	115	324	538	898	1,230	1,630
90	91	261	435	729	1,000	1,320

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1952-60, 1966, 1968-75, 1978-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
745	220	89	51	37	27	18	12	7.9	6.3	4.7	2.6	1.6	0.98	0.72	0.56	0.41

† Reliability of values in column is uncertain, and potential errors are large.

09496600 CIBECUE No. 1, TRIBUTARY TO CARRIZO CREEK, NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1959-71

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	0.05	0.00	0.01	0.02	1.6	9.5
NOVEMBER	0.01	0.00	0.00	0.01	1.1	3.6
DECEMBER	0.07	0.00	0.01	0.02	2.4	6.5
JANUARY	0.00	0.00	0.00	0.00		0.0
FEBRUARY	0.00	0.00	0.00	0.00		0.0
MARCH	0.00	0.00	0.00	0.00		0.0
APRIL	0.00	0.00	0.00	0.00		0.0
MAY	0.00	0.00	0.00	0.00		0.0
JUNE	0.00	0.00	0.00	0.00		0.0
JULY	0.27	0.00	0.04	0.08	1.8	34.5
AUGUST	0.13	0.00	0.04	0.04	1.0	32.1
SEPTEMBER	0.06	0.00	0.02	0.02	1.0	13.7
ANNUAL	0.03	0.00	0.01	0.01	1.1	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1960-71

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1						
3						
7						
14						
30						
60						
90						
120						
183						

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-71

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
44	92	133	195	248	307

WEIGHTED SKEW (LOGS)= -0.18
MEAN (LOGS)= 1.64
STANDARD DEV. (LOGS)= 0.40

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1959-71

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	1.08	1.93	2.63	3.67	4.55	5.54
3	0.41	0.75	1.02	1.39	1.69	2.02
7	0.22	0.41	0.56	0.78	0.96	1.15
15	0.12	0.24	0.35	0.54	0.73	0.97
30	0.07	0.13	0.20	0.32	0.44	0.60
60	0.04	0.07	0.11	0.17	0.24	0.33
90	0.03	0.05	0.08	0.12	0.17	0.23

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1959-71

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
0.36	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09496700 CIBECUE No. 2, TRIBUTARY TO CARRIZO CREEK, NEAR SHOW LOW, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1959-71

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	0.05	0.00	0.01	0.01	1.6	9.0
NOVEMBER	0.01	0.00	0.00	0.00	1.6	3.0
DECEMBER	0.09	0.00	0.01	0.03	2.2	11.9
JANUARY	0.03	0.00	0.00	0.01	2.8	3.0
FEBRUARY	0.00	0.00	0.00	0.00		0.0
MARCH	0.01	0.00	0.00	0.00	3.6	0.7
APRIL	0.00	0.00	0.00	0.00		0.0
MAY	0.00	0.00	0.00	0.00		0.0
JUNE	0.00	0.00	0.00	0.00		0.0
JULY	0.13	0.00	0.02	0.04	1.8	18.7
AUGUST	0.21	0.00	0.04	0.06	1.5	36.6
SEPTEMBER	0.06	0.00	0.02	0.02	1.1	17.2
ANNUAL	0.03	0.00	0.01	0.01	0.93	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1960-71

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1						
3						
7						
14						
30						
60						
90						
120						
183						

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1958-71

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
43	69	88	116	138	161

WEIGHTED SKEW (LOGS)= 0.06
MEAN (LOGS)= 1.63
STANDARD DEV. (LOGS)= 0.25

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1959-71

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	0.77	1.27	1.70	2.38	2.99	3.71
3	0.32	0.52	0.67	0.89	1.08	1.28
7	0.16	0.29	0.41	0.59	0.76	0.95
15	0.09	0.18	0.25	0.35	0.44	0.55
30	0.06	0.10	0.15	0.22	0.29	0.37
60	0.03	0.06	0.09	0.13	0.17	0.22
90	0.03	0.05	0.06	0.10	0.13	0.18

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1959-71

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
0.29	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

† Reliability of values in column is uncertain, and potential errors are large.

09497500 SALT RIVER NEAR CHRYSOTILE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1925-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	3,780	79	361	599	1.7	4.6
NOVEMBER	1,300	112	260	200	0.77	3.3
DECEMBER	3,980	113	498	802	1.6	6.3
JANUARY	4,250	130	554	722	1.3	7.0
FEBRUARY	6,180	145	853	1,040	1.2	10.8
MARCH	6,030	187	1,430	1,220	0.85	18.1
APRIL	4,850	181	1,740	1,300	0.75	21.9
MAY	5,070	106	934	954	1.0	11.8
JUNE	1,190	74	318	262	0.82	4.0
JULY	547	91	227	104	0.46	2.9
AUGUST	1,250	135	406	233	0.58	5.1
SEPTEMBER	1,180	69	336	239	0.71	4.2
ANNUAL	2,010	185	659	436	0.66	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1926-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	100	76	66	59	53	49
3	102	78	68	60	53	49
7	106	81	71	63	56	52
14	114	87	76	68	60	55
30	126	97	85	76	68	63
60	144	112	99	91	83	78
90	160	128	116	108	101	97
120	175	140	128	121	115	111
183	212	163	147	137	130	126

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1916, 1925-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2	5	10	25	50	100
50%	20%	10%	4%	2%	1%
10,000	24,200	38,700	64,300	89,600	121,000

WEIGHTED SKEW (LOGS)= 0.08
MEAN (LOGS)= 4.01
STANDARD DEV. (LOGS)= 0.45

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1925-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2	5	10	25	50	100
	50%	20%	10%	4%	2%	1%
1	5,720	14,500	23,800	40,700	57,800	79,600
3	4,320	10,000	15,900	26,200	36,600	49,500
7	3,090	6,430	9,560	14,700	19,600	25,400
15	2,350	4,520	6,370	9,200	11,700	14,500
30	1,860	3,420	4,670	6,460	7,950	9,560
60	1,430	2,650	3,650	5,110	6,350	7,710
90	1,200	2,260	3,140	4,450	5,570	6,810

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1925-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
5,170	2,560	1,550	1,060	782	490	350	262	213	182	158	128	108	87	77	71	61

09497800 CIBECUE CREEK NEAR CHRYSOTILE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1960-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	277	11	41	56	1.4	7.2
NOVEMBER	186	9.1	30	34	1.1	5.3
DECEMBER	368	11	66	87	1.3	11.6
JANUARY	209	11	51	50	0.98	8.9
FEBRUARY	550	11	77	107	1.4	13.4
MARCH	477	12	108	122	1.1	19.0
APRIL	274	11	63	64	1.0	11.0
MAY	131	5.6	26	26	1.0	4.6
JUNE	40	5.0	14	8.8	0.61	2.5
JULY	69	6.6	25	14	0.55	4.4
AUGUST	106	13	36	21	0.58	6.3
SEPTEMBER	85	13	33	20	0.60	5.8
ANNUAL	133	16	47	32	0.67	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1961-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100† 1%
1	8.1	5.6	4.8	4.2	3.6	3.3
3	8.2	5.7	4.8	4.2	3.7	3.3
7	8.4	6.0	5.1	4.5	3.9	3.6
14	8.9	6.4	5.4	4.8	4.2	3.9
30	9.7	6.9	5.9	5.2	4.5	4.1
60	12	8.1	6.7	5.7	4.8	4.2
90	13	9.6	8.0	6.9	5.9	5.3
120	16	12	10	8.9	7.6	6.8
183	20	15	13	12	11	11

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1959-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
4,400	8,030	10,900	15,000	18,300	21,900

WEIGHTED SKEW (LOGS)= -0.15
MEAN (LOGS)= 3.64
STANDARD DEV. (LOGS)= 0.32

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1960-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100† 1%
1	869	1,930	2,970	4,760	6,490	8,610
3	467	1,000	1,550	2,510	3,470	4,690
7	268	558	852	1,380	1,920	2,610
15	175	359	543	868	1,190	1,610
30	125	254	376	584	784	1,030
60	94	182	260	386	501	636
90	78	152	217	321	416	527

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1960-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
436	160	95	63	48	32	24	20	17	14	12	9.6	7.7	6.3	5.4	4.9	4.3

† Reliability of values in column is uncertain, and potential errors are large.

09497980 CHERRY CREEK NEAR GLOBE, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1966-78, 1980-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	296	4.6	32	67	2.1	6.9
NOVEMBER	101	4.5	19	24	1.3	4.1
DECEMBER	537	4.8	73	131	1.8	15.6
JANUARY	179	6.7	45	48	1.1	9.6
FEBRUARY	568	6.0	102	139	1.4	21.9
MARCH	423	6.1	101	131	1.3	21.7
APRIL	195	5.3	31	44	1.4	6.7
MAY	66	4.9	13	14	1.0	2.9
JUNE	18	4.4	7.7	3.4	0.44	1.7
JULY	23	5.6	10	4.5	0.44	2.2
AUGUST	35	5.5	14	7.4	0.51	3.1
SEPTEMBER	151	3.6	18	32	1.8	3.8
ANNUAL	130	8.2	39	32	0.84	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1967-78, 1981-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50† 2%	100† 1%
1	5.2	4.1	3.7	3.4	3.2	3.0
3	5.3	4.3	3.9	3.6	3.4	3.2
7	5.4	4.4	4.0	3.7	3.4	3.3
14	5.6	4.6	4.1	3.8	3.6	3.4
30	5.9	4.9	4.5	4.1	3.8	3.7
60	6.5	5.2	4.7	4.4	4.0	3.8
90	6.9	5.6	5.0	4.6	4.3	4.0
120	7.4	6.2	5.7	5.4	5.1	4.9
183	9.1	7.3	6.6	6.2	5.8	5.5

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1966-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
2,220	5,340	8,460	13,800	19,000	25,300

WEIGHTED SKEW (LOGS)= 0.02
MEAN (LOGS)= 3.35
STANDARD DEV. (LOGS)= 0.45

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1966-78, 1980-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50† 2%	100† 1%
1	801	2,350	3,920	6,520	8,880	11,600
3	521	1,400	2,210	3,440	4,470	5,580
7	323	815	1,260	1,920	2,480	3,080
15	206	506	777	1,190	1,550	1,930
30	134	326	505	788	1,040	1,320
60	93	222	341	531	700	892
90	72	168	256	395	518	658

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1966-78, 1980-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
562	151	66	38	26	14	11	9.1	7.9	7.1	6.2	5.4	4.8	4.3	4.1	4.0	3.0

† Reliability of values in column is uncertain, and potential errors are large.

09498500 SALT RIVER NEAR ROOSEVELT, AZ

MEAN MONTHLY AND ANNUAL DISCHARGES, 1914-86

MONTH	MAXIMUM (FT^3/S)	MINIMUM (FT^3/S)	MEAN (FT^3/S)	STANDARD DEVIATION (FT^3/S)	COEFFICIENT OF VARIATION	PERCENT OF ANNUAL RUNOFF
OCTOBER	4,830	86	466	797	1.7	4.3
NOVEMBER	2,150	122	372	362	0.97	3.4
DECEMBER	6,330	127	796	1,290	1.6	7.3
JANUARY	16,000	161	1,000	2,060	2.1	9.3
FEBRUARY	9,070	168	1,370	1,790	1.3	12.6
MARCH	10,400	220	1,970	1,950	0.99	18.2
APRIL	6,280	212	2,050	1,570	0.77	18.9
MAY	5,930	127	1,060	1,060	1.0	9.7
JUNE	1,370	79	370	303	0.82	3.4
JULY	3,280	78	345	397	1.2	3.2
AUGUST	3,610	151	596	484	0.81	5.5
SEPTEMBER	1,850	78	454	334	0.74	4.2
ANNUAL	3,250	236	902	663	0.74	100

MAGNITUDE AND PROBABILITY OF ANNUAL LOW FLOW, BASED ON CLIMATIC YEARS 1915-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND NON-EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	20 5%	50 2%	100 1%
1	125	92	78	68	59	53
3	128	94	80	70	60	54
7	133	97	82	72	62	56
14	142	103	87	76	65	58
30	157	114	97	84	72	65
60	185	136	116	102	89	81
90	209	158	138	125	113	105
120	231	174	155	143	132	127
183	285	207	182	166	152	145

MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1388, 1924-86

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
14,500	37,500	62,100	107,000	153,000	211,000

WEIGHTED SKEW (LOGS)= 0.09
MEAN (LOGS)= 4.17
STANDARD DEV. (LOGS)= 0.48

MAGNITUDE AND PROBABILITY OF ANNUAL HIGH FLOW, BASED ON WATER YEARS 1914-86

PERIOD (CONSECUTIVE DAYS)	DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL, IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	9,790	26,000	43,200	74,100	105,000	144,000
3	6,980	17,500	28,500	48,600	68,900	94,600
7	4,680	10,600	16,400	26,700	36,700	49,200
15	3,240	6,750	10,100	15,700	21,000	27,500
30	2,470	4,840	6,930	10,200	13,200	16,700
60	1,870	3,600	5,100	7,440	9,530	11,900
90	1,550	3,050	4,380	6,500	8,400	10,600

DURATION TABLE OF DAILY MEAN FLOW, WATER YEARS 1914-86

DISCHARGE, IN FT^3/S, WHICH WAS EQUALED OR EXCEEDED FOR INDICATED PERCENT OF TIME																
1%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
7,270	3,390	2,060	1,390	1,010	637	451	340	272	233	197	156	128	101	89	79	66