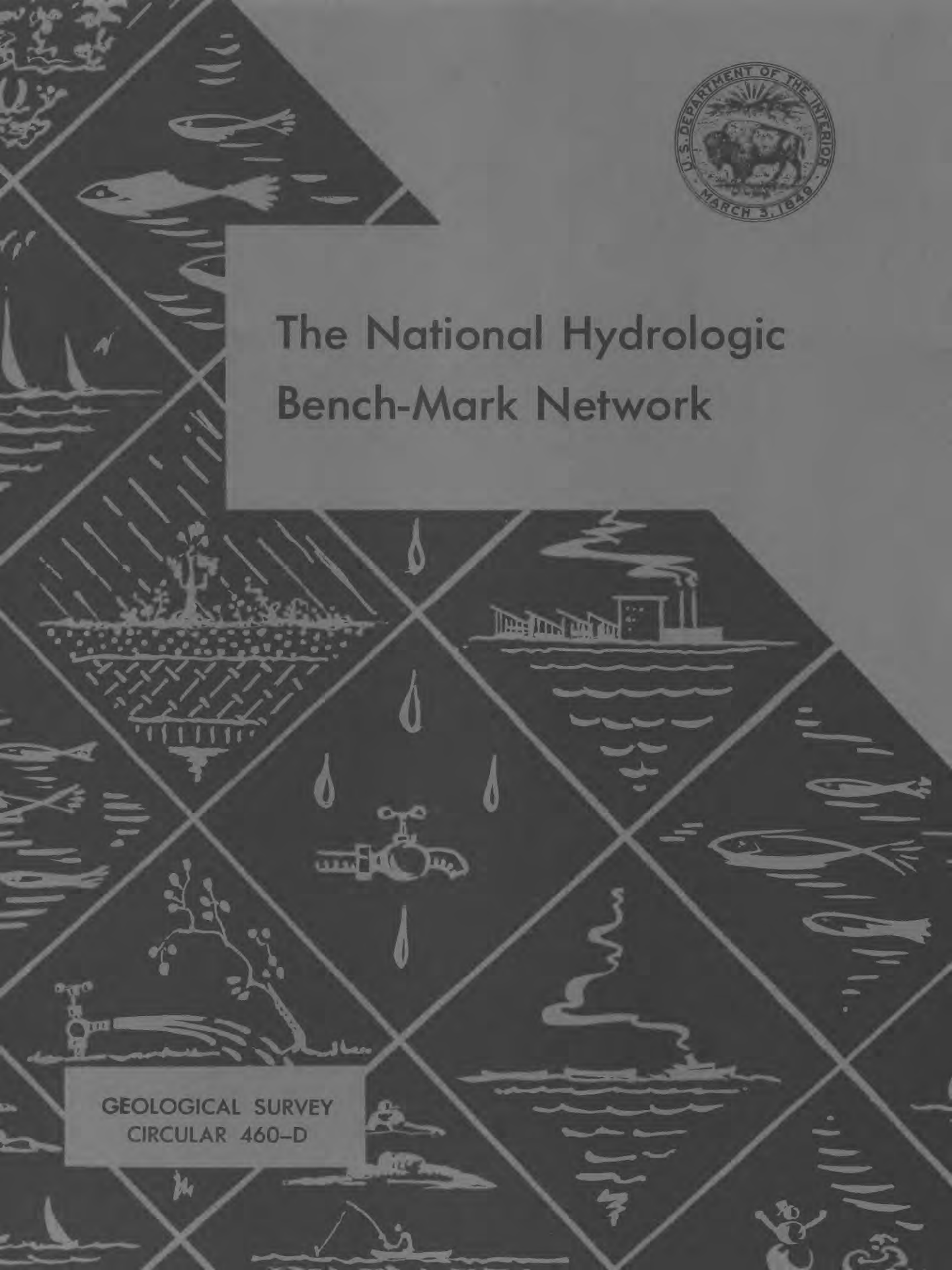

The National Hydrologic Bench-Mark Network

GEOLOGICAL SURVEY
CIRCULAR 460–D

Part D

The National Hydrologic Bench-Mark Network

By Ernest D. Cobb and J. E. Biesecker

CONSERVATION NETWORKS

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PART D

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ABSTRACT

The United States is undergoing a dramatic growth of population and demands on its natural resources. The effects are widespread and often produce significant alterations of the environment. The hydrologic bench-mark network was established to provide data on stream basins which are little affected by these changes. The network is made up of selected stream basins which are not expected to be significantly altered by man. Data obtained from these basins can be used to document natural changes in hydrologic characteristics with time, to provide a better understanding of the hydrologic structure of natural basins, and to provide a comparative base for studying the effects of man on the hydrologic environment.

There are 57 bench-mark basins in 37 States. These basins are in areas having a wide variety of climate and topography. The bench-mark basins and the types of data collected in the basins are described.

INTRODUCTION

The United States is presently struggling to maintain the quality of its environment. Dramatic growth of population and industry has drastically altered the environment of this Nation. The effects of this alteration are widespread and include modification of the characteristics of the country's water resources. Efficient utilization of these water resources requires redefining the flow and quality characteristics of the affected streams. This redefinition will be simplified by use of natural-stream records being collected on hydrologic bench marks.

The hydrologic bench-mark network is made up of selected stream basins which are expected to remain in their present or natural condition. Data will be collected indefinitely on these basins. Certain data, such as streamflow, will be collected continuously. Water quality and other types of data will be obtained at intervals as required to define the characteristics.

Hydrologic data are collected on about 7,000 streams throughout the United States by the Geological Survey. These data are collected, in part, for current use, such as the operation of dams and water-supply facilities, for planning purposes, such as the definition of streamflow, water-quality, and ground-water characteristics, and for documentation of natural changes in hydrologic characteristics in time. The hydrologic bench-mark network supplements the larger network by documenting natural hydrologic changes and by describing the relation of flow characteristics to basin characteristics under natural hydrologic environments.

The hydrologic bench-mark program was initiated in 1958. Selection of basins was guided by the following criteria:

1. No manmade storage, regulation, or diversion currently exists or is probable for many years.
2. Ground water within the basin will not be affected by pumping from wells.
3. Conditions are favorable for accurate measurement of streamflow, chemical and physical quality of water, ground-water conditions, and the various characteristics of weather, principally precipitation.
4. The probability is small of special natural changes due to such things as major ac-

tivities of beavers, overgrazing or overbrowsing by game animals, or extensive fires.

Langbein and Hoyt (1959, p. 18) and Leopold (1962) proposed that a bench-mark network for the United States should consist of about 100 basins. However, because of the limited number of basins in some areas which meet the preceding criteria, it seems that the ultimate network will reach a maximum of about 70 basins. At present (1970), data are being collected on 57 hydrologic bench marks in 37 States (fig. 1).

OBJECTIVES OF THE NETWORK

Langbein (1968) stated:

> The motivating principle behind the recommendation for the establishment of hydrological bench marks probably reflects anxiety that because the past century has been a period of settlement and of vast agricultural and industrial development in many areas of the world, there are today few gauging-station records that may be considered homogeneous. Among all the geophysical subjects—geodesy, seismology, volcanology, oceanography, and even meteorology—hydrology is the most directly and significantly affected by the hand of man. An anxious attitude in these circumstances appears justified, even though at present one may not be able to specify the uses to which posterity might put such records. One can readily argue that we should profit by the opportunity to begin such observations simply because the chances appear favorable that the records will become significant, and because of the high regard we now hold for data series that are stationary in a statistical if not a hydrological sense.
>
> At this early juncture in the programme, one might anticipate that hydrological bench marks might at least assure a stationary hydrological time series. These data could serve several purposes: (1) analyses of the hydrological structure of a natural catchment; (2) analyses of the statistical structure of hydrological time series; and (3) as a reference or comparative base for noting changes in the regime of streams whose catchment or flow are developed for use.

Interpretation of data collected in the bench-mark basins will provide valuable information concerning time trends. For instance, Landsberg (1960) noted significant temperature increases in the first half of the 20th century over much of the United States. Temperature trends could affect streamflow by altering evapotranspiration rates. Data collected over long time periods in hydrologic bench-mark basins could

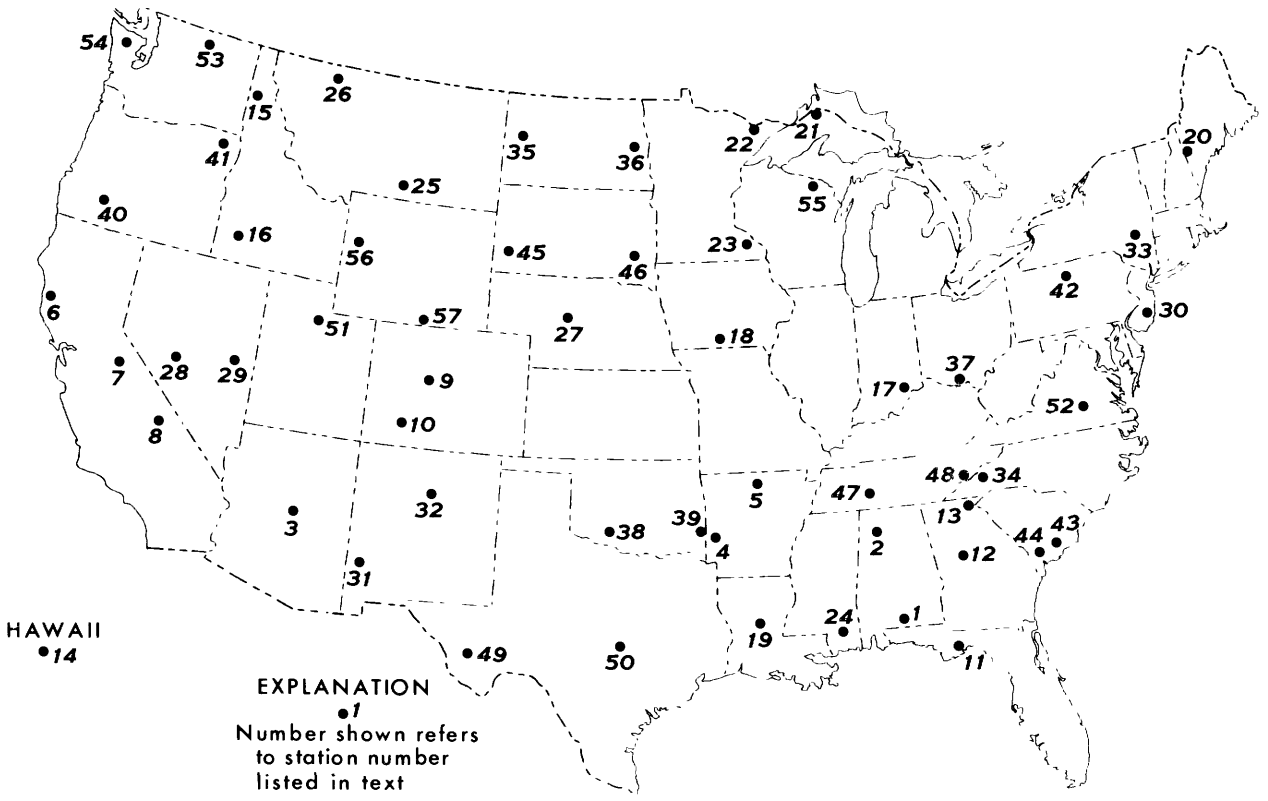


FIGURE 1.—Location of hydrologic bench-mark basins.

be used to detect and document changes of hydrologic characteristics with time.

Data from hydrologic bench marks could be used to study cause-and-effect relationships between various physiographic, meteorologic, and hydrologic variables in basins free from man's influence. For example, long continuous records of precipitation and streamflow of basins which are nearly in their natural condition have great value in the study of runoff-rainfall relations and in the evaluation of the utility of runoff-rainfall models.

In the report "Restoring the Quality of Our Environment" by the President's Science Advisory Committee, Environmental Pollution Panel (1965), it is stated:

> Pollution touches us all. We are at the same time polluters and sufferers from pollution. Today we are certain that pollution adversely affects the quality of our lives. In the future, it may affect their duration.

Among several recommendations made in that report was the suggestion that steps be taken to obtain year-by-year information on the condition of our environment—a program of baseline measurements. The hydrologic bench-mark program will provide this baseline information for the quality of the Nation's water resources.

Information on both streamflow and water quality from the bench-mark basins can be compared with concurrent data from basins which have been modified by man. This comparison should then provide a measure of the effect of the modification on the hydrology of a basin.

Hydrology—and particularly water quality—is directly and significantly affected by man-made environmental changes. In planning for the optimum utilization of the Nation's water resources, it is very important to identify the extent and rate by which man is altering water quality. Data collected at the hydrologic bench marks offers a basis for evaluating these changes. For example, radioactive fallout has occurred over most of the earth, and pesticides discharged into the atmosphere often travel great distances. Water-quality data from bench-mark basins will aid in determining the distribution and magnitude of these contaminants. With respect to these contaminants the bench marks would no longer provide baseline data; thus, data should be obtained as soon as possible even on the remote streams in order to document natural conditions.

THE PRESENT NETWORK

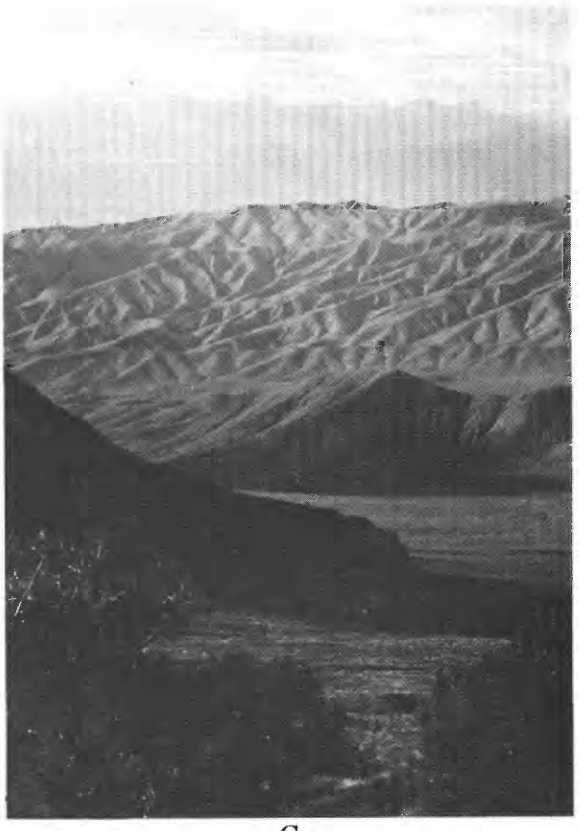
The locations of the established bench marks are shown in figure 1. The network encompasses a wide variety of natural environments (fig. 2). These include high mountain areas, the very humid Northwest, the arid and semiarid Southwest, the plains of the Midwest, the warm humid Southeast, the cold humid Northeast, and the temperate area of Hawaii. Elevations within the hydrologic bench-mark basins range from about 100 to over 14,000 feet above mean sea level. Vegetation ranges from sparse desert growths to dense coniferous forests.

To insure a minimum of interference by man, many of the hydrologic bench marks are in national parks, wilderness areas, State parks, national forests, and in areas set aside for scientific study. Completely natural basins of suitable size no longer exist in some parts of the United States. Therefore, to attain an adequate geographical distribution of bench marks, it was necessary to modify the criterion that the selected basin be completely natural. This modification resulted in the selection, for example, of Blackwater Creek basin in the Conecuh National Forest of Alabama, where selective logging is practiced, and in the Elk Creek basin in southern Iowa, in which nearly all the land is farmed but little agricultural change is expected. Neither the selective logging nor the agricultural practices should invalidate the streamflow record as a bench-mark basin, so long as the present practices are continued.

Large drainage basins usually have some part affected by man. Very small drainage basins respond to extremely localized climatic variations. Therefore, basins in an intermediate size range were sought for the bench-mark network. The median basin size of the present network is 55 square miles. Half of the basins drain areas of from 25 to 89 square miles, and the range of basin sizes is from 2.31 to 960 square miles.

Hydrologic variables measured in the bench-mark basins include continuous streamflow records at 56 sites, observations of ground-water levels at six sites, precipitation data at 33 sites, and continuous stream temperatures at 26 sites.

A



C

B

D

FIGURE 2.—Photographs showing the variety of conditions existing in the hydrologic bench-mark network: (*A*) Merced River basin, Calif.; (*B*) Bear Den Creek basin, N. Dak. (photograph by Harlan M. Erskine); (*C*) Wildrose Creek basin, Calif. (photograph by John R. Crippen); (*D*) Wild River basin, Maine (photograph by Gordon S. Hayes).

Water-quality characteristics are measured periodically at 51 sites. Radioactivity levels and pesticide concentrations are measured in 39 basins. Data are also obtained on nutrients, biota, and on various other water-quality characteristics in many of the basins. Records of air movement, air temperature, pan evaporation, and snow-survey data are also collected at a few of the basins.

DESCRIPTION OF THE NETWORK BASINS

Descriptions of the individual hydrologic bench-mark basins are preceded by the following explanatory remarks:

Stations are listed first alphabetically by State, then by station name within the State. The number preceding the station name corresponds to its number on the map of figure 1. The number following the station name is the downstream-order number given to all Survey-operated stream-gaging stations.

Location.—The general part of the State in which the basin is located and the proximity of the basin to important geographical features.

Drainage area.—The horizontal projection of the land area within the basin limits as defined on topographical maps.

Physiographic area.—Areas defined by Fenneman (1931, 1938). Where applicable, section, province, and major division are given.

Climate.—The average annual precipitation given is the approximate average over the basin unless otherwise noted. In areas of major topograpical change, the precipitation and temperature may vary considerably in short distances. In such areas the mean precipitation and temperature are sometimes rough approximations. Most of the precipitation, temperature, and snow were taken from regionalized maps of the variables.

Topography.—The major characteristics of the terrain. In addition, basin elevations and slopes are given.

Rock type.—The characteristics of the underlying rocks that affect the hydrology of the basin. The nature of rocks in a basin influences the quality of the ground water, and their physical properties affect the ground-water discharge characteristics of a basin.

Vegetation.—The primary types of vegetation. For some basins the density of vegetation is also given.

Manmade influences.—The value of a benchmark basin is dependent on the stability of the basin's characteristics relative to man's activities. Few basins are completely free of man's influence; hence, a description of unnatural modifications of the basins is given so that present and future basin conditions can be compared.

Gage location.—The position of the streamflow gage at the downstream point in the basin.

Flow characteristics.—None of the hydrologic bench marks has been operated long enough to adequately determine all flow characteristics. Hence, only the general characteristics of the streamflow and an estimate of the average annual runoff are given. In arid areas, the estimates of the average annual runoff may be subject to large error.

Water quality.—The principal chemical constituents of the streamflow listed by cations, anions, and nonionic materials. Where data are available, estimates of the average low-flow dissolved-solids concentration and the annual sediment load are also given.

Data collected.—A brief summary of data collected and periods of collection in the hydrologic bench-mark basins. These data include those collected by other agencies such as the U.S. Forest Service, the U.S. Weather Bureau, TVA (Tennessee Valley Authority), and the U.S. Army Corps of Engineers. Most of the data items shown are self-explanatory; however, a few items are clarified below. The frequency given for discrete data observations is an average. The actual time between observations may vary somewhat. Furthermore, the measurements of water-quality characteristics will not necessarily be continued at the present intensity. Standard complete water-quality analysis includes determination of hardness and pH and the concentrations of silica, iron, magnesium, calcium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, phosphate, and dissolved solids.

The analysis for pesticides includes the determination of concentrations of substances which are often referred to as insecticides and herbicides.

Special characteristics.—Characteristics of a watershed which are of importance but which are not covered under the other headings.

1. BLACKWATER RIVER NEAR BRADLEY, ALA. (02369800)

Location.—About 50 miles inland from the Gulf of Mexico, south-central Alabama.

Drainage area.—86.8 sq mi.

Physiographic area.—East Gulf Coastal Plain section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: about 61 in. Monthly mean temperature extremes: 52° and 81°F.

Topography.—The uplands are gently rolling ridges which are somewhat broken in the central part of the basin. A few sinks and depres-

sions are scattered in the eastern basin area. Basin elevations range from 125 to 300 ft.

Rock type.—Clay, sandy clay, sand, gravel, and sandstone.

Vegetation.—About 90 percent of the basin is covered by pine and hardwood forest. The remainder is in pasture and row crops. The upland forest is predominantly longleaf pine, and there is a dense wiregrass ground cover. The lowland forest is about 90 percent pine and 10 percent bay hardwood; the undergrowth is dense.

Manmade influences.—About 60 percent of the basin is publicly owned. Sections of this land are subject to being logged every 10 years. Extensive erosion control is practiced. The remaining 40 percent is 70 percent forest and 30 percent pasture and cultivation. Not more than 10 percent of the privately owned forests are normally cut in any one year. The land in row crops may produce unproportionately high sediment yields. Three small communities are within the basin.

Gage location.—Lat 31°01'45", long 86°42'35", in SW¼ sec. 24, T. 1 N., R. 25 W., 1.2 miles southeast of Bradley.

Flow characteristics.—Stream is perennial. Average annual runoff: about 23 in.

Water quality.—No information.

Ground water.—Water-table conditions prevail. Small to moderate quantities of water are yielded to domestic wells. Springs and seeps occur in the lower basin.

Data collected.—

Type	*Period of record*
Low-flow streamflow measurements at 36 sites in the basin	Various times.
Continuous streamflow	December 1967–present.
Ground-water levels (intermittent observations in three wells)	December 1968–present.
Continuous precipitation	December 1967–present.

Special characteristics.—Blackwater Swamp in the headwaters covers about 10 percent of the basin area. The ground-water divide may not coincide with the surface divide.

2. SIPSEY FORK NEAR GRAYSON, ALA. (02450250)

Location.—Northwestern Alabama.

Drainage area.—91.3 sq mi.

Physiographic area.—Cumberland Plateau section of the Appalachian Plateaus province of the Appalachian Highlands.

Climate.—Average annual precipitation: 52 in. Monthly mean temperature extremes: 44° and 80°F.

Topography.—Gently rolling plateaus having deeply entrenched valleys. Basin elevations range from 550 to 1,050 ft. The slope of the main stream is 11 ft per mile.

Rock type.—Sandstone, shale, limestone, and chert.

Vegetation.—About 98 percent of the basin is covered with mixed pine and hardwood forest. A few ridge tops and upper slopes have been converted to all pine forest as a result of timbering practices.

Manmade influences.—Several domestic wells pump water along the northern drainage divide. The basin is in the Bankhead National Forest, and logging is practiced in such a way that not more than 10 percent of the basin will be logged in any one year. Logging is performed only on the upper parts of the basin, and erosion control is practiced. The logged areas are replanted, and logging trails are seeded with grass. Several roads traverse the basin.

Gage location.—Lat 34°17'07", long 87°23'56", in N½ sec. 8, T. 9 S., R. 8 W., 4.5 miles west of Grayson.

Flow characteristics.—Stream is perennial. Average annual runoff: about 26 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 50 mg/1.

Ground water.—The major aquifers are the Pottsville Sandstone and the Pennington and Bangor Limestones. The Bangor Limestone is capable of yielding more than 50 gpm (gallons per minute) to wells and springs while the remaining aquifers generally yield less than 10 gpm to wells and springs. The ground-water divide may not coincide with the surface divide.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1966–present.
Continuous ground-water level	March 1969–present.
Ground-water levels (intermittent observations at five wells)	May 1968.
Continuous precipitation	March 1969–present.

Type	Period of record
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

3. WET BOTTOM CREEK NEAR CHILDS, ARIZ. (09508300)

Location.—Central Arizona.

Drainage area.—36.4 sq mi.

Physiographic area.—Mexican Highland of Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: 20–30 in. Monthly mean temperature extremes: 45° and 85°F.

Topography.—Rugged and having many mesas and ridges separated by steep canyons. Basin elevations range from 2,200 to 7,450 ft. The slope of the main stream is about 200 ft per mile.

Rock type.—Mostly granite and also large outcrops of basaltic andesite.

Vegetation.—Chaparral except for piñon-juniper and pine at high elevations.

Manmade influences.—Most of the basin is in the Mazatzal Widerness Area and is completely within the Tonto National Forest. The basin is protected from manmade changes.

Gage location.—Lat 34°09′39″, long 111°41′32″, in sec. 36, T. 9½ N., R. 6 E. (unsurveyed), 13 miles south of Childs.

Flow characteristics.—Stream is intermittent. Average annual runoff: about 2 in. and annual flows are highly variable.

Water quality.—Principal constituents: calcium and sodium; bicarbonate. Low-flow dissolved-solids concentration: about 250 mg/1.

Ground water.—Small storage and movement through weathered surface and through fractures in granite.

Data collected.—

Type	Period of record
Continuous streamflow	June 1967–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (seminnual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

4. COSSATOT RIVER NEAR VANDERVOORT, ARK. (07340300)

Location.—Ouachita Mountains, west-central Arkansas.

Drainage area.—89.4 sq mi.

Physiographic area.—Ouachita Mountains section of the Ouachita province of the Interior Highlands.

Climate.—Average annual precipitation: about 52 in., of which about 5 percent occurs as snow. Monthly mean temperature extremes: 42° and 81°F.

Topography.—Hilly and having narrow valleys in the lower basin and east-west trending ridges in the upper basin. Basin elevations range from 780 to 2,240 ft. The slope of the main stream is about 22 ft per mile.

Rock type.—Shale and highly compacted sandstone in the lower basin and novaculite and slate ridges in the upper basin.

Vegetation.—Mixed coniferous and deciduous forest. Moderately thick undergrowth.

Manmade influences.—About 95 percent of the basin is in the Ouachita National Forest. Selective timber harvesting is controlled by the U.S. Forest Service. Many recreational areas are being developed in the basin.

Gage location.—Lat 34°22′46″, long 94°15′08″, in SE¼NE¼ sec. 30, T. 4 S., R. 30 W., 7.5 miles east of Vandervoort.

Flow characteristics.—Stream is perennial. Average annual runoff: about 23 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/1.

Ground water.—Small volumes of ground water under water-table conditions. Water levels are generally less than 20 ft below the land surface. There are numerous small springs in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1967–present.
Water quality:	
Standard complete (monthly)	September 1967–present.

5. NORTH SYLAMORE CREEK NEAR FIFTY SIX, ARK. (07060710)

Location.—North-central Arkansas.

Drainage area.—58.4 sq mi.

Physiographic area.—Springfield Plateau section of the Ozarks Plateaus province of the Interior Highlands.

Climate.—Average annual precipitation: about 45 in. Monthly mean temperature extremes: 38° and 80°F.

Topography.—Rugged rolling hills. Basin elevations range from 450 to 1,400 ft; a mean basin divide elevation is about 1,200 ft. The main stream slope is about 35 ft per mile.

Rock type.—Mostly limestone and some sandstone.

Vegetation.—Deciduous forest having moderately thick undergrowth.

Manmade influences.—Most of the basin is the Ozark National Forest. Selective timber harvesting is controlled by the U.S. Forest Service. Many recreational areas are being developed there.

Gage location.—Lat 35°59′30″, long 92°12′50″, in SW¼NW¼ sec. 25, T. 16 N., R. 12 W.

Flow characteristics.—Stream is perennial. Average annual runoff: about 19 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 170 mg/l.

Ground water.—Principal aquifers are the St. Peter Sandstone and the Boone Chert. Water levels are generally higher than adjacent streams.

Data collected.—

Type	*Period of record*
Continuous streamflow	December 1965–present.
Continuous precipitation	January 1968–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

6. ELDER CREEK NEAR BRANSCOMB, CALIF. (11475560)

Location.—About 150 miles north of San Francisco and 10 miles inland from the Pacific Ocean.

Drainage area.—6.50 sq mi.

Physiographic area.—California Coast Ranges section of the Pacific Border province of the Pacific Mountain System.

Climate.—Average annual precipitation: about 80 in., varying with elevation. Most of the precipitation falls during the cool months from November to March. Annual precipitation is highly variable. Monthly mean temperature extremes: 45° and 75°F.

Topography.—Narrow valleys and steep land slopes. Basin elevations range from 1,450 to 4,200 ft.

Rock type.—The underlying rocks are of sedimentary marine origin. Valleys contain thin layers of alluvium of Holocene age.

Vegetation.—The basin is covered with a virgin forest mostly of Douglas-fir but with some pines. The cover is dense.

Manmade influence.—The basin is under the control of Nature Conservancy and is protected from unnatural influences.

Gage location.—Lat 39°43′45″, long 123°38′40″, 5 miles north of Branscomb, Mendocino County.

Flow characteristics.—Stream is perennial. Average annual runoff: about 50 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 90 mg/1. Average annual sediment load: estimated to be about 3,000 tons per sq mi.

Ground water.—Numerous small springs drain the thin alluvial mantle. The dry season streamflow is maintained at about 0.5 to 1 cfs (cubic feet per second).

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1967–present.
Continuous precipitation (two gages)	April 1969–present.
Continuous surface-water temperature	October 1967–present.

Type	Period of record
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

7. MERCED RIVER AT HAPPY ISLES BRIDGE NEAR YOSEMITE, CALIF. (11264500)

Location.—Western slope of the Sierra Nevada, east-central California.

Drainage area.—181 sq mi.

Physiographic area.—Sierra Nevada section of the Cascade-Sierra Mountains province of the Pacific Mountain System.

Climate.—Average annual precipitation over the basin ranges from about 40 to 70 in. About 85 percent of the precipitation occurs from November to April. Most of the precipitation at the higher elevations occurs as snow. Monthly mean temperature extremes: 53° and 72°F at the lower end of the basin. Temperature decreases considerably with increasing elevation.

Topography.—Alpine in character. The area has strongly glaciated valleys heading in eroded cirques. Much of the central basin has broad valleys and meadows separated by steep-sided ridges. Basin elevations range from about 4,000 to 13,090 ft; 10–12 miles of the eastern divide exceeds 11,000 ft. About 99 percent of the basin lies above 6,000 ft.

Rock type.—Almost entirely granite and also small areas of alluvium in valley bottoms.

Vegetation.—About 45 percent of the basin is bush covered or forested with fir, pine, and some sequoias. Many peaks and ridges rise above the timberline.

Manmade influences.—The basin lies completely within Yosemite National Park. Approximately 1 cfs is diverted above the streamgage for use in Yosemite Valley.

Gage location.—Lat 37°43′54″, long 119°33′28″, 2.0 miles southeast of Yosemite National Park headquarters.

Flow characteristics.—Stream is perennial. Average annual runoff: 25 in. Most high flows result from snowmelt in May and June.

Water quality.—Principal constituents: calcium and sodium; bicarbonate; and silica. Low-flow dissolved-solids concentration: About 20 mg/l. Average annual sediment load: estimated to be about 200 tons per sq mi.

Ground water.—Some ground water is in the alluvium along the streams.

Data collected.—

Type	Period of record
Continuous streamflow	August 1915–present.
Continuous surface-water temperature	September 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—Many small glacially formed lakes are in the upper part of the basin.

8. WILDROSE CREEK NEAR WILDROSE STATION, CALIF. (10250600)

Location.—Western slope of Panamint Mountains, Death Valley National Monument, southeastern California.

Drainage area.—23.7 sq mi.

Physiographic area.—Great Basin section of the Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: about 9 in. of which about 3 in. falls as snow. Monthly mean temperature extremes: 45° and 89°F. There is considerable variation in precipitation and temperature over the basin.

Topography.—Steep valleys in the uplands and a sloping bottom land filled to its present level with detritus in the lower part of the basin. Basin elevations range from 4,300 to 9,994 ft. The stream slope varies from 300 ft per mile in the lower basin to about 1,500 ft per mile near the eastern divide.

Rock type.—Primarily dense metamorphosed sedimentary rock and also some granite. The lower one-third of the basin contains deep alluvial fill.

Vegetation.—Desert scrub and chaparral in the lower basin and rather sparse stands of piñon pine with some live oak between elevations of 7,000–8,500 ft.

Manmade influences.—The basin lies entirely within Death Valley National Monument. Some mining took place during the period 1870–90. There are a few access roads into the basin.

Gage location.—Lat 36°15′55″, long 117°10′40″, 0.4 miles east of Wildrose Ranger headquarters.

Flow characteristics.—Stream is ephemeral, flowing for only a few hours after heavy rainstorms. Average annual surface runoff: about 0.02 in. Flows are quite flashy, and annual runoff is highly variable.

Water quality.—No information available.

Ground water.—There are a few small springs on the lower margins of the steep slopes, but their outflow vanishes nearby. Park headquarters pumps a small amount of ground water just above the stream gage.

Data collected.—

Type	Period of record
Continuous streamflow	October 1960–present.
Pumpage by Park Headquarters	April 1969–present.
Continuous precipitation:	
At six gages	June 1964–present.
At one gage	January 1968–present.
Continuous wind movement (two sites)	June 1964–present.
Continuous air temperature (two sites)	Do.
Continuous pan evaporation	Do.

9. HALFMOON CREEK NEAR MALTA, COLO. (07083000)

Location.—Eastern slope of the Continental Divide, central Colorado.

Drainage area.—23 sq mi.

Physiographic area.—Southern Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: about 20 in. at the lower elevation, of which 40 percent occurs as snow, and about 40 in. at the higher elevations, of which 60 percent occurs as snow. Monthly mean temperature extremes: 18° and 57°F. There is considerable variation in precipitation and temperature over the basin.

Topography.—Mountainous and having steep slopes. Basin elevations range from 9,740 to 14,431 ft. Stream slopes range from 2,000 ft per mile in the upper reaches to 100 ft per mile at the gage.

Rock type.—The upper basin is underlain by schist and the lower basin is composed of morainal material.

Vegetation.—The lower part of the basin is forested with lodgepole pine, Engelmann spruce, and fir. Much of the upper basin is above tree line.

Manmade influences.—Parts of the basin have been burned over in the past. There are a few residents in the basin, which is entirely within the San Isabel National Forest.

Gage location.—Lat 39°11′10″, long 106°22′55″, in NW¼ sec. 18, T. 10 S., R. 80 W., 3½ miles southwest of Malta.

Flow characteristics.—Stream is perennial. Average annual runoff: about 18 in. per year.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/1.

Ground water.—No major aquifers are in the basin. The lower basin morainal material may contain significant quantities of water.

Data collected.—

Type	Period of record
Continuous streamflow	July 1946–present.
Continuous precipitation (except winters)	October 1966–present.
Continuous surface-water temperature	May 1967–present.
Water quality	November 1966–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	December 1967–present.
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—The basin drains parts of Mount Elbert and Mount Massive, which are, respectively, the second and third highest peaks in the conterminous United States. There are several small natural lakes and ponds in the basin.

10. VALLECITO CREEK NEAR BAYFIELD, COLO. (09352900)

Location.—Western slope of the Continental Divide, southwestern Colorado.

Drainage area.—72.1 sq mi.

Physiographic area.—Southern Rocky Moun-

tains province of the Rocky Mountain System.

Climate.—Average annual precipitation varies over the basin from 30 in. of which 70 percent falls as snow, in the lower basin, to 50 in., of which about 80 percent falls as snow, in the upper basin. Monthly mean temperature extremes: 17° and 55°F varying considerably over the basin.

Topography.—Very mountainous and having steep slopes. Basin elevations range from 7,900 to 14,084 ft. The slope of the main stream is about 175 ft per mile.

Rock type.—The basin is underlain by metamorphic rocks.

Vegetation.—The basin is predominantly forested with Engelmann spruce and also contains scattered aspen groves. Parts of the basin are above the timberline.

Manmade influences.—The basin lies entirely within a wilderness area and is preserved in its natural state as nearly as possible.

Gage location.—Lat 37°28′45″, long 107°32′35″, in NW¼ sec. 16, T. 37 N., R. 6 W. (projected), 18 miles north of Bayfield.

Flow characteristics.—Stream is perennial. Average annual runoff: about 20 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/1.

Ground water.—Some springs occur in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1962–present.
Continuous precipitation (except winter)	Do.
Continuous air temperature	1963–68.
Continuous surface-water temperature	November 1962–present.
Intermittent water samples for:	
Suspended sediment	November 1962–May 1967.
Standard chemical analysis	October 1963–present.

Special characteristics.—There are several small lakes in the basin.

11. SOPCHOPPY RIVER NEAR SOPCHOPPY, FLA. (02327100)

Location.—About 5 miles inland from the Gulf of Mexico, northwestern Florida.

Drainage area.—97.9 sq mi.

Physiographic area.—East Gulf Coastal Plain section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: about 56 in. Monthly mean temperature extremes: 54° and 82°F.

Topography.—The basin contains numerous swamps, sloughs, and some small ponds. The drainage slopes rather uniformly downward from north to south. Basin elevations range from 50 to 110 ft.

Rock type.—Sandy limestone.

Vegetation.—Dense cypress swamps separated by sandy soil heavily covered by slash pines, scrub oaks, and undergrowth such as palmetto.

Manmade influences.—The basin is located in the Apalachicola National Forest. Several service roads and fire breaks traverse the basin. Controlled cutting of pine trees for pulp is practiced.

Gage location.—Lat 30°07′45″, long 84°29′40″, on line between secs. 13 and 24, T. 4 S., R. 3 W., 4.7 miles north of Sopchoppy.

Flow characteristics.—Stream is perennial. Average annual runoff: about 25 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate and sulfate; and silica. Low-flow dissolved-solids concentration: about 100 mg/1.

Ground water.—The major aquifer underlying the basin is the Floridan, which is artesian. Sands and sand clays overlaying the Floridan aquifer contain nonartesian water.

Data collected.—

Type	*Period of record*
Partial record, peak streamflow	January 1961–June 1964.
Continuous streamflow	June 1964–present.
Continuous ground-water level	January 1967–present.
Continuous precipitation (two gages)	February 1966–present.
Continuous surface-water temperature	June 1964–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

12. FALLING CREEK NEAR JULIETTE, GA. (02212600)

Location.—Central Georgia.

Drainage area.—72.2 sq mi.

Physiographic area.—Piedmont Upland section of the Piedmont province of the Appalachian Highlands.

Climate.—Average annual precipitation: 44 in. Monthly mean temperature extremes: 49° and 82°F.

Topography.—Rolling hills. The general elevation of the divide is about 630 ft. Basin elevations range from 370 to 700 ft. The slope of the main stream is about 33 ft per mile.

Rock type.—Gneiss and schist.

Vegetation.—The basin is covered with second-growth pine mixed with a few hardwoods except for a few small cleared areas in the vicinity of houses.

Manmade influences.—A few secondary roads are in the basin. There are several ponds in the basin, but storage is not sufficient to significantly affect runoff. Also in the basin are a few quarries, a gravel pit, and a few houses, none of which should significantly affect streamflow. The major part of the basin lies within the Oconee National Forest where controlled logging is practiced. The remainder of the basin lies within the Piedmont National Wildlife Refuge.

Gage location.—Lat 33°06′, long 83°43′, 5.1 miles east of Juliette.

Flow characteristics.—Stream is perennial. Average annual runoff: about 14 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 90 mg/1.

Ground water.—Ground water occurs mainly under water-table conditions. Wells yield sufficient water for domestic use, and a few yield enough for small towns and industries. Groundwater conditions are extremely variable in the basin. There are many wet-weather springs and some small permanent springs in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	July 1964–present.
Continuous precipitation	August 1964–present.
Continuous surface-water temperature	Do.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

13. TALLULAH RIVER NEAR CLAYTON, GA. (02178400)

Location.—Northeastern Georgia.

Drainage area.—56.5 sq mi.

Physiographic area.—Southern section of the Blue Ridge province of the Appalachian Highlands.

Climate.—Average annual precipitation: 68 in. Monthly mean temperature extremes: 42° and 74°F.

Topography.—Rugged terrain. The general elevation of the divide is about 3,500 ft. Basin elevations range from 1,880 to 5,500 ft. The slope of the main stream is about 375 ft per mile.

Rock type.—Gneiss and schist.

Vegetation.—The basin is covered by a mixture of second-growth white pine, hardwood, and laurel.

Manmade influences.—The basin lies wholly within the Chattahoochee and Nantahala National Forests where special logging procedures are practiced. A few secondary roads traverse the basin.

Gage location.—Lat 34°53′25″, long 83°31′50″, 10.3 miles west of Clayton.

Flow characteristics.—Stream is perennial. Average annual runoff: about 40 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 20 mg/1.

Ground water.—Ground water occurs mainly under water-table conditions. Wells yield sufficient water for domestic use and sometimes enough for small towns and industries. Groundwater conditions are very variable in the basin. There are many wet-weather springs and some small permanent springs in the basin.

Data collected.—

Type	Period of record
Continuous streamflow	July 1964–present.
Continuous precipitation	September 1964–present.
Continuous surface-water temperature	Do.
Water quality	May 1967–June 1968.
Standard complete (monthly)	

14. HONOLII STREAM NEAR PAPAIKOU, HAWAII (16717000)

Location.—Eastern slope of Mauna Kea on the island of Hawaii.

Drainage area.—11.6 sq mi.

Physiographic area.—Pacific Islands.

Climate.—Average annual precipitation: about 240 in. and varies considerably over the basin. Monthly mean temperature extremes: 70° and 75°F.

Topography.—The basin is composed of ridges and gulleys on the lower slope of Mauna Kea. Basin elevations range from 1,540 to 6,250 ft.

Rock type.—Basalt.

Vegetation.—Sparsely vegetated lava beds in the upper reaches, grass lands in the middle reaches, and dense tropical vegetation in the lower reaches.

Manmade influences.—No significant influences at present. About 94 percent of the basin is in a State Forest Reserve.

Gage location.—Lat 19°46′00″, long 155°09′16″, 4.1 miles west of Papaikou.

Flow characteristics.—Stream is perennial. Average annual runoff: not determined.

Water quality.—No information.

Ground water.—Small scattered bodies of perched water contribute to many springs, most of which are intermittent.

Data collected.—

Type	Period of record
Continuous streamflow	June 1911–March 1913.
	February 1967–present.

15. HAYDEN CREEK BELOW NORTH FORK, NEAR HAYDEN LAKE, IDAHO (12416000)

Location.—Northern Idaho.

Drainage area.—22.0 sq mi.

Physiographic area.—Northern Rocky Mountain province of the Rocky Mountain System.

Climate.—Average annual precipitation: 40 in. Mean annual snowfall: 1.5–2.0 ft. Monthly mean temperature extremes: about 26° and 67°F.

Topography.—Steep hills. The general elevation of the divide is about 4,000 ft. Basin elevations range from 2,200 to about 5,600 ft. The slope of the main stream is about 17 ft per mile.

Rock type.—The basin is underlain principally by quartzite and argillite. There are thin alluvial deposits along stream channels. Colluvium covers most of the bedrock.

Vegetation.—The basin is covered by second-growth pine and fir.

Manmade influences.—A few miles of secondary roads are located in the basin. Timber in the area has received some pesticide treatment.

Gage location.—Lat 47°49′22″, long 116°39′10″, in NW¼SW¼ sec. 25, T. 52 N., R. 3 W., 7.5 miles northeast of Hayden Lake Post Office.

Flow characteristics.—Stream is perennial. Average annual runoff: about 21 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 50 mg/1.

Ground water.—The quartzite and argillite yield very small supplies to wells. The alluvial deposits yield small supplies to wells in some locations.

Data collected.—

Type	Period of record
Annual maximum streamflows	September 1961–September 1965.
Continuous streamflow	April 1948–December 1953.
	October 1958–September 1959.
	October 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

16. WICKAHONEY CREEK NEAR BRUNEAU, IDAHO (13169500)

Location.—Southwestern Idaho.

Drainage area.—253 sq mi.

Physiographic area.—Payette section of the Columbia Plateaus province of the Intermontane Plateaus.

Climate.—Mean annual precipitation: 10 in. Annual snowfall varies from zero to 1.5 ft. Most of the precipitation falls during the winter. Monthly mean temperature extremes: 30° and 73°F.

Topography.—Rolling hills. The general elevation of the divide is about 5,800 ft. Basin elevations range from 3,000 to 6,000 ft. The slope of the main stream is about 10 ft per mile.

Rock type.—The basin is underlain principally by silicic volcanic rocks consisting of rhyolite welded tuff. Basalt flows cap some of the higher tablelands. Stream channels contain a minor amount of alluvium.

Vegetation.—The basin is covered by sagebrush and grass.

Manmade influences.—The basin contains many stockponds. In 1965 approximately nine sections of land were treated with herbicides, brush removed, and the land seeded with crested wheatgrass.

Gage location.—Lat 42°47'06", long 115°59'00", in NW¼SE¼ sec. 28, T. 7 S., R. 4 E., 11½ miles southwest of Bruneau.

Flow characteristics.—Stream is intermittent. Average annual runoff: about 0.1 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate. Low-flow dissolved-solids concentration: 120 mg/1.

Ground water.—Small springs are found in the middle part of the basin. Small amounts of water are contained in the alluvium. The basalt is above the water table but may contain small amounts of perched water.

Data collected.—

Type	*Period of record*
Continuous streamflow	December 1938–October 1949.
	July 1965–present.
Water quality	September 1967–present.
Standard complete (monthly)	

17. SOUTH HOGAN CREEK NEAR DILLSBORO, IND. (03276700)

Location.—Southeastern Indiana.

Drainage area.—38.2 sq mi.

Physiographic area.—Till Plains Section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: 40 in. Average annual snowfall: 15 in. Monthly mean temperature extremes: 34° and 77°F.

Topography.—Rolling hills having steep-sided valleys. The general elevation of the divide is about 950 ft. Basin elevations range from 580 to 995 ft. The main stream slope is about 17 ft per mile.

Rock type.—Thin till overlying limestone and shale.

Vegetation.—Except for small areas of forests near the streams, most of the land is pasture.

Manmade influences.—Three small communities having a combined population of about 2,000 lie almost entirely within the basin. The community of Milan obtains water from a reservoir on South Hogan Creek and disposes of its wastes in the basin. The community of Dillsboro uses ground water from the basin and disposes of its wastes outside the basin. About 2.5 percent of the basin is small ponds and lakes.

Gage location.—Lat 39°01'47", long 85°02'17", in NW¼ sec. 7, T. 4 N., R. 2 W., 1¼ miles northeast of Dillsboro.

Flow characteristics.—Stream is seasonal. Average annual runoff: about 12 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 350 mg/1.

Ground water.—Generally both the till and the underlying limestones yield less than 10 gpm to wells. However, a few wells yield up to 40 gpm. Ground water generally contains from about 300 to 1,000 mg/1 dissolved solids.

Data collected.—

Type	*Period of record*
Low-flow streamflow measurements	1960
Continuous streamflow	July 1961–present.
Ground-water level (intermittent observations at one well)	May 1958–present.
Continuous precipitation	November 1967–present.
Water quality	July 1968–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab).	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

18. ELK CREEK NEAR DECATUR CITY, IOWA (06897950)

Location.—South-central Iowa.

Drainage area.—52.5 sq mi.

Physiographic area.—Dissected Till Plains section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: about 32 in. Monthly mean temperature extremes: 25° and 78°F.

Topography.—Dissected drift plain. The land surface is fairly rugged and has moderate to steep slopes. Basin elevations range from 250 to 300 ft.

Rock type.—The basin is underlain by loess-covered glacial drift. Bedrock is predominantly shale intercalated with thin limestone beds.

Vegetation.—The upland flats and gentle slopes, which comprise about half the basin, are used for cultivated crops. The steeper areas near the streams are in pasture and timber.

Manmade influences.—One small community (1960 population, 71) is in the basin. Most domestic water is obtained from private wells. There are numerous stockponds in the basin. Several roads traverse the basin.

Gage location.—Lat 40°43'20", long 93°56'20", in SE¼ sec. 34, T. 69 N., R. 27 W., 5.5 miles southwest of Decatur City.

Flow characteristics.—Stream is intermittent. Average annual runoff: about 6 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 300 mg/1. Average annual sediment load: estimated to be 400 tons per sq mi.

Ground water.—Aquifers in the basin are alluvium and limestone. The alluvium is capable of yielding up to 10 gpm to wells. The thin intercalated limestone beds yield up to 5 gpm of highly mineralized water.

Data collected.—

Type	*Period of record*
Continuous streamflow	May 1967–present
Daily precipitation (from U.S. Weather Bureau)	1956–present.
Daily air temperature (from U.S. Weather Bureau	Do.
Water quality	July 1968–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Water quality—Continued	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—Steep slopes are subject to high erosion rates.

19. BIG CREEK AT POLLOCK, LA. (07373000)

Location.—Central Louisiana.

Drainage area.—51 sq mi.

Physiographic area.—West Gulf Coastal Plain section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: about 56 in. Monthly mean temperature extremes: 41° and 82°F.

Topography.—Rolling hills. Basin elevations range from 78 to 289 ft. The slope of the main stream is about 11 ft per mile.

Rock type.—Surficial deposits of unconsolidated sand and gravel, 75 to 100 ft thick, overlay sand and clay.

Vegetation.—Except for a few square miles of open land, the basin is covered with second-growth pine.

Manmade influences.—A community (population, 360) that has neither public water supply nor disposal system is in the upper part of the basin. There are several roads traversing the basin, and a few gravel pits and stockponds. Most of the basin is in the Kisatchie National Forest where controlled logging is practiced.

Gage location.—Lat 31°32'10", long 92°24'30", in SW¼SE¼ sec. 31, T. 7 N., R. 1 E., 0.8 mile north of Pollock.

Flow characteristics.—Stream is perennial. Average annual runoff: about 16 in.

Water quality.—Principal constituents: calcium and sodium; chloride and bicarbonate. Low-flow dissolved-solids concentration: about 50 mg/1.

Ground water.—Permeable deposits yield a high base streamflow. Springs occur locally on valley slopes.

Data collected.—

Type	*Period of record*
Continuous streamflow	January 1942–present.
Continuous precipitation (two gages)	July 1964–present.

Type	Period of record
Continuous surface-water temperature	July 1964–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

20. WILD RIVER AT GILEAD, MAINE (01054200)

Location.—Eastern slope of the White Mountains, west-central Maine.

Drainage area.—69.5 sq mi.

Physiographic area.—White Mountain section of the New England province of the Appalachian Highlands.

Climate.—Average annual precipitation: about 44 in., of which about 30 percent occurs as snow. Monthly mean temperature extremes: 18° and 67°F.

Topography.—The basin is deeply dissected. Landslopes are steep. Basin elevations range from 700 to 4,800 ft.

Rock type.—The basin is underlain by gneiss and schist. Glacial till occurs on slopes and at higher elevations.

Vegetation.—Hardwood forests cover the basin except for some small groves of coniferous trees.

Manmade influences.—About 98 percent of the basin is in the White Mountain National Forest where selective logging is practiced.

Gage location.—Lat 44°23'25", long 70°58'55", 0.4 mile west of Gilead.

Flow characteristics.—Stream is perennial. Average annual runoff: about 34 in.

Water quality.—Principal constituents: calcium and sodium; sulfate; and silica. Low-flow dissolved-solids concentration: about 25 mg/1.

Ground water.—Some springs yield small amounts of water from till deposits and from underlying bedrock.

Data collected.—

Type	Period of record
Continuous streamflow	July 1964–present.
Continuous precipitation (April–October)	Do.
Continuous surface-water temperature	Do.
Data collected by U.S. Forest Service:	
Four recording precipitation records	About 1967–present.
Snow depths at three snow courses	Do.
Windspeed	Do.
Relative humidity	Do.
Air temperature at two levels	Do.
Solar radiation	Do.
Resource surveys	
Water quality	
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

21. WASHINGTON CREEK AT WINDIGO, ISLE ROYALE, MICH. (04001000)

Location.—On the western end of Isle Royale, Lake Superior.

Drainage area.—13.6 sq mi.

Physiographic area.—Superior Upland province of the Laurentian Uplands.

Climate.—Average annual precipitation: about 28 in. Average annual snowfall: about 90 in. Monthly mean temperature extremes: 15° and 66°F.

Topography.—Pronounced northeast-southwest-trending valleys and ridges. The highlands are rugged, and the lowland areas are swampy. Basin elevations range from about 600 to 1,394 ft. The slope of the main stream is about 43 ft per mile.

Rock type.—Old lava flows interbedded with river-deposited sandstone and conglomerate underlie the basin.

Vegetation.—The interior upland part of the basin is forested primarily with sugar maple and yellow birch. The lowland areas are for-

ested primarily with white spruce and balsam fir. Small natural clearings exist on the basaltic outcrops on the ridges.

Manmade influences.—The basin is entirely within Isle Royale National Park. Limited copper mining took place prior to the 1900's, and forest fires have swept parts of the island during the first half of this century.

Gage location.—Lat 47°55'15", long 89°08' 50", in NW¼ sec. 28, T. 64 N., R. 38 W., 0.8 mile northeast of Windigo, Isle Royale National Park.

Flow characteristics.—Stream is perennial. Average annual runoff: about 13 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 150 mg/1.

Ground water.—The stream valley is composed of shallow sandy lakebed deposits which yield water to the stream except perhaps during extended dry periods. The bedrock formations contain small quantities of water.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1964–present.
Daily precipitation (May–October) at U.S. Forest Service storage gage	About 1965–present.
Continuous air temperature	October 1964–present.
Continuous surface-water temperature	Do.
Water quality	September 1967–present.
Field analysis (monthly):	
Temperature	
Specific conductance	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—There is extensive beaver activity in the basin.

22. KAWISHIWI RIVER NEAR ELY, MINN. (05124480)

Location.—In the Boundary Waters Canoe area of northeastern Minnesota.

Drainage area.—253 sq mi.

Physiographic area.—Superior Upland province of the Laurentian Upland.

Climate.—Average annual precipitation: 28 in. Average annual snowfall: 60 in. Monthly mean temperature extremes: 8° and 68°F.

Topography.—The general surface of the land is rolling. The Kawishiwi River passes through many lakes and swamps. The average divide elevation is about 1,800 ft. Basin elevations range from 1,450 to 2,110 ft. The main stream drops from an elevation of 1,640 to 1,450 ft in a distance of about 40 miles.

Rock type.—The basin is part of the Canadian Shield. The rocks are crystalline and consist mostly of gabbro, granite, and greenstone.

Vegetation.—The basin is covered by Great Lakes pine forest.

Manmade influences.—The basin is almost entirely in the Superior National Forest. There are just a few roads in the basin. Camping, fishing, and boating are man's primary influence on the area, which has been logged in past years near the edge of the basin; however, present logging operations consist of selective cutting of mature trees only.

Gage location.—Lat 47°55'22", long 91°32' 06", in SE¼ sec. 24, T. 63 N., R. 10 W., 14 miles east of Ely.

Flow characteristics.—Stream is perennial. Average annual runoff: about 10 in.

Water quality.—Principal constituents: calcium, magnesium, and sodium; sulfate; and silica. Low-flow dissolved-solids concentration: about 50 mg/l. Average annual sediment load: less than 10 tons per sq mi.

Ground water.—Ground water occurs in fractures in the crystalline rocks and in the sand and gravel that occupies the lower areas between bedrock hills.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1966–present.
Continuous surface-water temperature	July 1967–present.
Data collected by U.S. Forest Service:	
Five recording precipitation records	1966–present.
Eight nonrecording precipitation records	Do.
Water content of snow at three snow pillows	About 1967–present.
Snow depths at three snow courses	Do.
Wind speed	1967–present.
Relative humidity	Do.

Type	Period of record
Data collected by U.S. Forest Service:	
Air temperature at two levels	1967–present.
Solar radiation	Do.
Air pressure	About 1967–present.
Intermittent levels at eight lakes	1967–present.
Resource surveys	
Water quality at seven surveillance sites	
Water quality	September 1967–present.
Standard complete (monthly)	

Special characteristics.—The many lakes and swamps in the basin provide considerable natural storage.

23. NORTH FORK WHITEWATER RIVER NEAR ELBA, MINN. (05376000)

Location.—Southeastern Minnesota.

Drainage area.—101 sq mi.

Physiographic area.—Dissected Till Plains section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: 30 in. Average annual snowfall: 40 in. Monthly mean temperature extremes: 18° and 75°F.

Topography.—The land surface in the upper 80 percent of the basin is gently rolling farmland. The lower 20 percent of the basin is characterized by high steep bluffs. The average elevation of the divide is about 1,100 ft. Basin elevations range from 730 to 1,300 ft. The slope of the main stream is about 15 ft per mile.

Rock type.—Sedimentary formations consisting largely of sandstone and dolomite.

Vegetation.—The upper 80 percent is agricultural, and the lower 20 percent is generally maple-basswood forests.

Manmade influences.—Three small communities are located wholly or partly within the upper part of the basin. Total population in the basin is less than 2,500. There are several roads crossing the basin. Man's major influence is due to agricultural use of the land. Part of the basin is in the Minnesota Memorial Hardwood State Forest.

Gage location.—Lat 44°05'30", long 92°03'57", in sec. 7, T. 107 N., R. 10 W., 2.4 miles west of Elba.

Flow characteristics.—Stream is perennial. Average annual runoff: about 4 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 260 mg/l. Average annual sediment load: less than 40 tons per sq mi.

Ground water.—Ground water of good quality is abundant in the sedimentary rocks. Many seeps and springs occur along valley walls where different rock types are in contact.

Data collected.—

Type	Period of record
Continuous streamflow	May 1939–September 1941. July 1967–present.
Daily precipitation (from U.S. Weather Bureau)	February 1941–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

24. CYPRESS CREEK NEAR JANICE, MISS. (02479155)

Location.—Southeastern Mississippi.

Drainage area.—52.2 sq mi.

Physiographic area.—East Gulf Coastal Plain section of Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: 60 in. Monthly mean temperature extremes: 54° and 82°F.

Topography.—The land surface is generally rolling and has half-mile wide flood plains along the main stream. Swamps cover about 2 sq mi in the upper part of the basin. Basin elevations range from 110 to 330 ft.

Rock type.—Sand and gravel deposits form the ridges, and sand and clay underlie the remainder of the basin.

Vegetation.—Most of the basin is covered with second-growth pine. A few acres along the divide are cultivated, and there are some deciduous trees along the streams.

Manmade influences.—About 60 percent of the basin is in Camp Shelby Military Reservation, and the remaining 40 percent is in De Soto National Forest. Logging is practiced on a sus-

tained-yield basis. A few families occupy land along the drainage divide.

Gage location.—Lat 31°01'30", long 89°01' 00" in NE¼ sec. 29, T. 1 N., R. 10 W., 1.3 miles east of Janice.

Flow characteristics.—Stream is perennial. Average annual runoff about 20 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate and chloride; and silica. Low-flow dissolved-solids concentration: about 30 mg/1. Average annual sediment load: 60 tons per sq mi.

Ground water.—The Citronella Formation is a shallow aquifer which supplies most of the base flow to Cypress Creek. The Pascagoula Formation contributes little water to streams but is an important artesian aquifer to the south and to some extent within the basin. Deeper artesian aquifers contain fresh water to a depth of about 1,200 ft.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1966–present.
Data collected by U.S. Forest Service:	
Daily precipitation	About 1965–present.
Relative humidity	Do.
Daily air temperature	Do.
Wind velocity	Do.
Wind direction	Do.
Percent cloud cover	Do.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)

25. BEAUVAIS CREEK NEAR ST. XAVIER, MONT. (06288200)

Location.—Near the northern end of the Big Horn Mountains, south-central Montana.

Drainage area.—100 sq mi.

Physiographic area.—Missouri Plateau, unglaciated, section of the Great Plains province of the Interior Plains.

Climate.—Average annual precipitation: about 14 in. Average annual snowfall: 30–40 in. Monthly mean temperature extremes: 20° and 70°F.

Topography.—Primarily rolling hills. Basin elevations range from 3,350 to about 6,000 ft.

Rock type.—Sandstone and shale are the principal rocks, the shale being predominant. Undissected upland surfaces have a thin veneer of pediment gravels.

Vegetation.—Rather sparse native grasses cover the basin. A few trees and bushes grow in ravines and dense brush occurs along perennial streams.

Manmade influences.—The entire basin lies within the Crow Indian Reservation. There are approximately 300 acres of land used for dryland wheat farming and about 200 irrigated acres used for hay land. One stock pond is in the basin. The area is lightly used for grazing.

Gage location.—Lat 45°29', long 108°00', on west line of sec. 15, T. 4 S., R. 30 E., 14 miles west of St. Xavier.

Flow characteristics.—Stream is perennial. Average annual runoff: 2–3 in.

Water quality.—Principal constituents: calcium; sulfate. Low-flow dissolved-solids concentration: about 1,300 mg/1.

Ground water.—The Amsden and Sundance Formations and the Tensleep Sandstone are the major subsurface aquifers. The Cloverly Formation aquifer crops out in the valley walls. Some ground water occurs in the alluvium near the streams. Several springs occur in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	July 1967–present.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)

26. SWIFTCURRENT CREEK AT MANY GLACIER, MONT. (05014500)

Location.—Eastern side of the Continental Divide, northwestern Montana.

Drainage area.—31.4 sq mi.

Physiographic area.—Northern Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: 80 in., of which about 60 percent occurs as snow. Monthly mean temperature extremes: 20° and 60°F. There is considerable variation in precipitation and temperature over the basin.

Topography.—Steep mountains having many nearly vertical rock exposures. The valleys have been modified by glaciers. Lakes make up about 5 percent of the basin area. Basin elevations range from 5,000 to about 10,000 ft. Steep stream gradients are interrupted by four small natural lakes in the basin.

Rock type.—Rocks in the basin consist of varicolored argillite, quartzite, and limestone; there are minor amounts of basalt in the headwaters near the Continental Divide.

Vegetation.—Coniferous trees, aspen, and various shrubs inhabit the basin. There is very little grass cover. Much of the basin is sparsely covered for lack of a soil mantle.

Manmade influences.—The basin is entirely within Glacier National Park. Park administrative and tourist facilities are about 1 mile upstream from the gage. Water supply for these facilities, amounting to about 20 million gallons per year, is taken from the basin upstream from the gage. Sewage-disposal facilities are downstream from the gage.

Gage location.—Lat 48°48'10", long 113°39'20", in SE¼ sec. 11, T. 35 N., R. 16 W. (unsurveyed), in Glacier National Park, 11 miles southwest of Babb.

Flow characteristics.—Stream is perennial. Average annual runoff: 64 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/l.

Ground water.—Alluvium and glacial till probably constitute the only productive aquifers. Springs are small but probably fairly numerous.

Data collected.—

Type	*Period of record*
Intermittent streamflow monthly only for same periods)	June 1912–1958.
Continuous streamflow	1959–present.
Continuous streamflow on Grinnel Creek (upstream tributary)	August 1949–present.
Daily precipitation at U.S. Weather Bureau gage	August 1967–present.
Continuous precipitation at Grinnel Creek gage (May–October only)	May 1956–present.
Precipitation at:	
Storage gage 1	August 1949–present.
Storage gage 2	August 1955–present.
Continuous air temperature at:	
Grinnel Creek gage	July 1955–July 1965.
U.S. Weather Bureau gage	August 1967–present.
Continuous surface-water temperature	October 1966–present.
Snow surveys	May 1960–present.
Water quality	July 1967–June 1968.
Standard complete (monthly)	

Special characteristics.—Several small glaciers near the Continental Divide form the headwaters of Swiftcurrent Creek. Rocks of the basin are very resistant to erosion and produce very little sediment.

27. DISMAL RIVER NEAR THEDFORD, NEBR. (06775900)

Location.—Central Nebraska.

Drainage area.—960 sq mi, approximately, of which about 30 sq mi, contributes directly to surface runoff.

Physiographic area.—High Plains section of the Great Plains province of the Interior Plains.

Climate.—Average annual precipitation: 20 in. Average annual snowfall: 39 in. Monthly mean temperature extremes: 23° and 76°F.

Topography.—Rolling to hilly sand hills. The upper end of the basin contains many small lakes. The general elevation of the divide is about 3,600 ft. Basin elevations range from 2,800 to 4,000 ft. The slope of the main stream is about 6 ft per mile.

Rock type.—Sand and siltstone.

Vegetation.—The basin is almost entirely rangeland. A few native trees grow along the river, and some windbreak tree plantings have been established.

Manmade influences.—A few roads and trails traverse the basin. Some sand and gravel is pumped from areas along the river.

Gage location.—Lat 41°46'45", long 100°31'30", in SE¼NW¼ sec. 23, T. 21 N., R. 28 W., 14 miles south of Thedford.

Flow characteristics.—Stream is perennial. Variations in streamflow are extremely small. Average annual runoff: about 3 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 150 mg/1.

Ground water.—The river is primarily spring fed from an abundant supply of ground water. Deep wells, run by windmills, furnish stock water and water for domestic use in the lower part of the basin. The many lakes in the upper part of the basin indicate the shallow groundwater table in that area.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1966–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—Only 30 sq mi of the 960-sq-mi drainage area contributes directly to surface runoff. The remainder of the basin contributes by way of the groundwater system.

28. SOUTH TWIN RIVER NEAR ROUND MOUNTAIN, NEV. (10249300)

Location.—Central Nevada.

Drainage area.—20 sq mi, approximately.

Physiographic area.—Great Basin section of the Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: unknown, but about 75 percent occurs as snow. Monthly mean temperature extremes: 29° and 72°F.

Topography.—Very rough mountainous terrain that has protruding cliffs and steep slopes. Basin elevations range from 6,400 to 11,788 ft. Stream slope is about 500 ft per mile.

Rock type.—Consolidated limestone, shales, and undifferentiated intrusives.

Vegetation.—Thin cover of piñon pine and grass. Dense willow thickets grow along the streams.

Manmade influences.—Only very limited cattle grazing is in the lower part of the basin.

Gage location.—Lat 38°53'00", long 117°14'35", in SE¼ sec. 22, T. 12 N. R. 42 E., 15 miles northwest of Round Mountain.

Flow characteristics.—Stream is perennial. Average annual runoff: estimated to be about 3 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 100 mg/1.

Ground water.—The primary aquifer is the narrow shallow alluvial fill adjacent to the stream channel. A few small springs are associated with the underlying bedrock.

Data collected.—

Type	*Period of record*
Intermittent streamflow measurements	1964–65.
Continuous streamflow	August 1965–present.
Continuous surface-water temperature	April 1966–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

29. STEPTOE CREEK NEAR ELY, NEV. (10244950)

Location.—East-central Nevada.

Drainage area.—11.1 sq mi.

Physiographic area.—Great Basin section of the Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: unknown, but about 70–80 percent occurs as snow. Monthly mean temperature extremes: 23° and 67°F.

Topography.—Steep mountainous terrain. Basin elevations range from 7,300 to 10,900 ft. Stream slope is about 260 ft per mile.

Rock type.—Formations are primarily limestone and also some dolomite.

Vegetation.—Piñon pines and grass.

Manmade influences.—Sheep graze on parts of the upper basin. One gravel road is in the basin.

Gage location.—Lat 39°12'05", long 114°41'15", in NW¼SW¼ sec. 32, T. 16 N., R. 65 E., 11 miles east-southeast of Ely.

Flow characteristics.—Stream is perennial. Average annual runoff: about 5 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 175 mg/1.

Ground water.—The major aquifer is the narrow shallow alluvial fill adjacent to the stream channel. Several springs are associated with the underlying bedrock.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1966–present.
Continuous surface-water temperature	October 1966–present.
Water quality	September 1967–present.
Standard complete (monthly)	

30. McDONALDS BRANCH IN LEBANON STATE FOREST, N.J. (01466500)

Location.—Southern New Jersey.

Drainage area.—2.31 sq mi.

Physiographic area.—Embayed section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: 44 in. Average annual snowfall: about 15–20 in. Monthly mean temperature extremes: 33° and 75°F.

Topography.—Rather flat. Basin divides are low, narrow, and interrupted. Basin elevations range from 113 to 210 ft. The mean elevation is 152 ft. The main stream slope is about 12 ft per mile.

Rock type.—Underlying material consists of about 90 percent sand and gravel and about 10 percent clay and silt.

Vegetation.—The upper 94 percent of the basin is covered with oak and pine. The lower 6 percent of the basin is covered with southern white-cedar and swamp hardwoods.

Manmade influences.—Occasional logging is practiced in the basin. A railroad track and a few roads traverse the basin. One gravel pit is operated in the basin. Herbicide treatments are used to reduce roadside growth.

Gage location.—Lat 39°53'05", long 74°30'20", 7 miles southeast of Browns Mills.

Flow characteristics.—Stream is perennial. Average annual runoff: about 13 in. Flow is fairly uniform.

Water quality.—Principal constituents: calcium, and sodium; silica. Low-flow dissolved-solids concentration: about 30 mg/1. Average annual sediment load: about 25 tons per sq mi.

Ground water.—The aquifer underlying the basin is undisturbed by man. Ground water occurs at shallow depths. The most important chemical constituent of the ground water is iron.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1953–present.
Continuous ground-water levels at:	
One site	August 1955–present.
Two sites	August 1955–December 1967.
Ground-water information at 53 sites	October 1955–December 1967.
Weekly precipitation	August 1955–December 1966.
Continuous precipitation at:	
Gage 1	August 1955–present.
Gage 2	August 1955–December 1966.
Continuous air temperature	May 1963–present.
Continuous surface-water temperature	October 1960–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—About 40 percent of the basin was burned in April 1963. The groundwater divide does not coincide with the topographic divide.

31. MOGOLLON CREEK NEAR CLIFF, N. MEX. (09430600)

Location.—In the Mogollon Mountains, southwestern New Mexico.

Drainage area.—69 sq mi.

Physiographic area.—Mexican Highland section of the Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: 13 in., of which about 10 percent occurs as snow. Monthly mean temperature extremes: 30° and 65°F.

Topography.—Steep and mountainous. Basin elevations range from 5,500 to 10,778 ft. The stream slope varies from 30 ft per mile at the gage to about 1,000 ft per mile upstream from the gage.

Rock type.—Volcanic and quartz latites.

Vegetation.—Pine and spruce occur at the higher elevations, while juniper, cottonwood and willow occur at lower elevations. The cover is moderately dense in the upper elevations and very sparse in the lower elevations.

Manmade influences.—There are no significant effects by man on the basin. Most of the basin is in the Gila Wilderness Area.

Gage location.—Lat 33°09'50", long 108°38'55", in NE¼ sec. 24, T. 13 S., R. 18 W., 14.2 miles north of Cliff.

Flow characteristics.—Stream is perennial except during prolonged dry periods when the stream will dry up. Average annual runoff: about 3.5 in.

Water quality.—Principal constituents: calcium, magnesium, and sodium; bicarbonate and sulfate; and silica. Low-flow dissolved-solids concentration: about 90 mg/1.

Ground water.—No significant ground-water producing formation is in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	March 1967–present.
Water quality	July 1968–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	July–present.
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity semiannual)	

32. RIO MORA NEAR TERERRO, N. MEX. (08377900)

Location.—The Sangre De Cristo Mountains, north-central New Mexico.

Drainage area.—53.2 sq mi.

Physiographic area.—Southern Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: 24 in., of which about 30 percent occurs as snow. Monthly mean temperature extremes: 27° and 60°F.

Topography.—Mountainous. Basin elevations range from 8,000 to 12,944 ft. Stream slope varies from 100 ft per mile in open areas to about 300 ft per mile in canyon sections.

Rock type.—Beds of siltstone, sandstone, shale, and limestone crop out on the slopes of the basin. Coarse alluvium consisting mainly of pebbles and boulders of igneous and metamorphic rocks has accumulated near the mouth of the basin.

Vegetation.—About 80 percent of the basin is covered by pine, spruce, and fir. Some large aspen groves occur in the basin. The south slopes of the lower reaches are covered with scrub oak. There are a few high mountain meadows in the upper parts of the basin.

Manmade influences.—Several pack trails traverse the basin. Spruce groves were given areal treatment with pesticides around 1965 to control budworm infestation of spruce. There is limited cattle grazing by permit. About 90 percent of the basin is in the Pecos Wilderness Area.

Gage location.—Lat 35°46'38", long 105°39'26", in E½NE¼ sec. 22, T. 18 N., R. 12 E., 3.1 miles north of Terrero.

Flow characteristics.—Stream is perennial. Average annual runoff: about 7 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved solids concentration: about 70 mg/1.

Ground water.—Many springs occur in the upper parts of the basin. The coarse alluvium can transmit large amounts of water.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1963–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

Special characteristics.—Some beaver dams are in the upper parts of the basin.

33. ESOPUS CREEK AT SHANDAKEN, N.Y. (01362198)

Location.—Catskill Mountains, southeastern New York.

Drainage area.—59.5 sq mi.

Physiographic area.—Catskill section of the Appalachian Plateaus province of the Appalachian Highlands.

Climate.—Average annual precipitation: about 40–45 inches of which about 25 percent occurs as snow. Monthly mean temperature extremes: 20° and 70°F.

Topography.—Mountainous. Basin elevations range from 1,017 to 3,760 ft. Stream slopes vary from 73 to 350 ft per mile.

Rock type.—The basin is underlain by a reddish, nonmarine sandstone. Except in the narrow stream valleys, glacial till, 10 to several tens of feet in thickness, covers the sandstone. The valleys contain a variety of glacial and alluvial deposits of Holocene age as much as 200 ft or more in thickness.

Vegetation.—Except for a quarter-mile cleared strip in the valley of the main stream and the two principal tributaries, the basin is densely forested with conifers and hardwoods.

Manmade influences.—Some small communities and several scattered homes are along the streams in the basin. One community maintains a sewage-treatment plant. There is considerable recreational use of water in the basin including the development of offstream pools and ponds for recreation. One small reservoir exists on Birch Creek.

Gage location.—Lat 42°06′59″, long 74°23′20″ at Shandaken.

Flow characteristics.—Stream is perennial. Average annual runoff: about 25 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate and sulfate. Low-flow dissolved-solids concentration: about 35 mg/l.

Ground water.—Numerous springs supply water for domestic use and small resort communities. The Esopus Creek flood plain is underlain by water-bearing coarse sand and gravel. Glacial clays fill the remainder of the bedrock valleys. Wells tapping the underlying bedrock are usually artesian.

Data collected.—

Type	Period of record
Continuous streamflow	October 1963–present.
Daily precipitation (two gages by U.S. Weather Bureau)	February 1943–present. July 1940–present.
Continuous precipitation (from U.S. Weather Bureau)	January 1953–present.
Continuous surface-water temperature	October 1963–present.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)

34. CATALOOCHEE CREEK NEAR CATALOOCHEE, N.C. (03460000)

Location.—Eastern side of the Great Smoky Mountains, eastern North Carolina.

Drainage area.—49.2 sq mi.

Physiographic area.—Southern section of the Blue Ridge province of the Appalachian Highlands.

Climate.—Average annual precipitation: about 49 in., of which about 3 percent occurs as snow. Monthly mean temperature extremes: 39° and 74°F.

Topography.—Mountainous. Basin elevations range from 2,457 to 6,122 ft. Stream slope is about 270 ft per mile.

Rock type.—Underlying rocks are mainly metamorphosed sandstone and shale. The stream heads in coarse-grained sandstone and crosses alternating beds of feldspathic quartzite, sandstone, and phyllite.

Vegetation.—The entire basin is covered with forest. Second-growth oaks, hickory, tulip, hemlock, spruce, and balsam are the dominant trees in the basin. The undergrowth is mainly rhododendron and mountain-laurel. The cover over the entire basin is very dense.

Manmade influences.—The entire basin lies within the Great Smoky Mountains National Park. The basin was logged and some mining was done during the 1920's.

Gage location.—Lat 35°40'02", long 83°04'23", 2 miles north of Cataloochee.

Flow characteristics.—Stream is perennial. Average annual runoff: about 30 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 20 mg/1.

Ground water.—Many small springs occur in the basin. Much water from upland fractured rocks moves almost everywhere as diffuse seepage to the streams. Fractures are abundant down to depths no greater than about 100 ft. Wells in the fractured rock yield from 1 to 75 gpm.

Data collected.—

Type	*Period of record*
Continuous streamflow (monthly discharge only for some periods)	October 1933–September 1952. October 1962–present.
Daily precipitation	October 1964–present.
Continuous wind movement (except during winter)	Do.
Daily air temperature	Do.
Daily pan evaporation (except during winter)	Do.
Continuous surface-water temperature	October 1962–present.
Water quality	September 1967–present.
Field analysis (monthly): Specific conductance; Temperature; Dissolved oxygen; Coliform and BOD (for completion in lab.)	
Samples collected for: Standard complete (monthly); Suspended sediment (monthly and during storm runoff); Minor elements (semiannual); Pesticides (semiannual); Radioactivity (semiannual)	

35. BEAR DEN CREEK NEAR MANDAREE, N. DAK. (06332515)

Location.—Western North Dakota.

Drainage area.—74 sq mi.

Physiographic area.—Missouri Plateau, glaciated, section of the Great Plains province of the Interior Plains.

Climate.—Average annual precipitation: about 15 in., of which about 20 percent occurs as snow. Monthly mean temperature extremes: 8° and 70°F.

Topography.—Most of the basin has rather steep land slopes. The upper part of the basin has gently rolling land surfaces. Basin elevations range from 1,950 to 2,850 ft. The divide elevation is generally between 2,400 and 2,700 ft.

Rock type.—Generally thin interbedded layers of sandy silt, sandstone, silt and clay, and lignite.

Vegetation.—About 90 percent of the basin is covered with fairly dense sod formed by native grasses. Small trees occur in rather small areas in the basin. A small part of the basin is used for the cultivation of grains.

Manmade influences.—The eastern two-thirds of the basin is used for cattle grazing. Cultivation in the western part of the basin is on less than 10 percent of the drainage area. There are a few impoundments for stock water in the basin. A few roads are in the area. About 10 oil wells are located in the northwest corner of the basin. About half the basin is in the Fort Berthold Indian Reservation.

Gage location.—Lat 47°47', long 102°46', in NW¼ sec. 30, T. 150 N., R. 94 W., 5.5 miles northwest of Mandaree.

Flow characteristics.—Stream is perennial. Base flow is rather constant. Average annual runoff: about 1 in.

Water quality.—Principal constituents: sodium; bicarbonate, and sulfate. Low-flow dissolved-solids concentration: about 2,500 mg/1.

Ground water.—Ground water occurs in lenses of sand and sometimes in fractured lignite beds. Yields are small, and the water quality is generally poor.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1966–present.
Water quality	September 1967–present.
Standard complete (monthly)	

36. BEAVER CREEK NEAR FINLEY, N. DAK. (05064900)

Location.—Eastern North Dakota.

Drainage area.—160 sq mi, approximately.

Physiographic area.—Western lake section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: 19 in. Average annual snowfall: about 35 in. Monthly mean temperature extremes: 5° and 70°F.

Topography.—Flat to gently rolling terrain. Basin elevations range from 1,170 to 1,525 ft.

The slope of the main stream is about 15 ft per mile.

Rock type.—Clay-rich glacial till covers the shale bedrock to a depth of from 50 to 150 ft in nearly all parts of the basin. Soils are generally very limy loam or clay loam.

Vegetation.—Most of the land is under cultivation, and small grain crops predominate. Other crops such as corn and potatoes are also raised in the basin. Trees are generally limited to groves around farmsteads and windbreaks along some of the fields. The natural cover is a moderately dense growth of prairiegrass.

Manmade influences.—Most of the basin is under cultivation. There are several roads in the basin. Only a few stock-water impoundments and a few gravel or borrow pits are in the basin.

Gage location.—Lat 47°36′, long 97°43′, in NE¼ sec. 31, T. 148 N., R. 55 W., 7 miles northeast of Finley.

Flow characteristics.—Stream is intermittent. Average annual runoff: less than 1 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate and sulfate. Low-flow dissolved-solids concentration: about 800 mg/1.

Ground water.—Ground-water discharge is very small. No major aquifers or springs are known.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1964–present.
Continuous precipitation	August 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

37. UPPER TWIN CREEK AT McGAW, OHIO (03237280)

Location.—Southern Ohio.

Drainage area.—12.8 sq mi.

Physiographic area.—Kanawha section of the Appalachian Plateaus province of the Appalachian Highlands.

Climate.—Average annual precipitation: 43 in., of which about 10 percent occurs as snow. Monthly mean temperature extremes: 32° and 77°F.

Topography.—Except for a narrow flood plain, the general land surface is extremely hilly. Basin elevations range from 520 to 1,290 ft. The slope of the main stream is about 58 ft per mile.

Rock type.—Shales and sandstones outcrop in the basin. Soils are very thin. Valley fill consists of rock and gravel deposits.

Vegetation.—The basin generally is covered with a dense second-growth hardwood forest. There are some cultivated lands on the narrow flood plain and on a few scattered farms.

Manmade influences.—About 90 percent of the basin is on State Forest land. Parts of the basin are sometimes logged in accordance with regulations established by the Ohio Division of Forestry and Reclamation; some logging is also practiced on private land. Logged areas in State-owned lands are sprayed with 2–4–5–T in fuel oil. Roadsides are sprayed with 2–4–5–T in water during summer and early fall. A few scattered farms are in the basin. One road follows the stream valley.

Gage location.—Lat 38°38′15″, long 83°13′30″, 2 miles northeast of Buena Vista.

Flow characteristics.—Stream is perennial except during drought periods. Average annual runoff: 15 in.

Water quality.—Principal constituents: calcium, magnesium, and sodium; bicarbonate and sulfate. Low-flow dissolved-solids concentration: about 80 mg/1. Average annual sediment load: about 300 tons per sq mi.

Ground water.—Dry-weather streamflow is from a shallow water table.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1963–present.
Continuous precipitation (two gages)	Do.
Continuous surface-water temperature	October 1963–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	

Type
Water quality—Continued
Samples collected for:
Standard complete (monthly)
Suspended sediment (monthly and during storm runoff)
Minor elements (semiannual)
Pesticides (semiannual)
Radioactivity (semiannual)

38. BLUE BEAVER CREEK NEAR CACHE, OKLA. (07311200)

Location.—In the Wichita Mountains, southwestern Oklahoma.

Drainage area.—24.6 sq mi.

Physiographic area.—Osage Plains section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: 29 in. Average annual snowfall: about 6 in. Monthly mean temperature extremes: 40° and 84°F.

Topography.—Most of the basin is composed of numerous low granite mountains and narrow valleys. Undulating plains form the lower part of the watershed. Basin elevations range from 1,210 to 2,400 ft; the elevation of a mean basin divide is about 1,900 ft. The slope of the main stream is about 60 ft per mile in the mountains and about 25 ft per mile on the plains.

Rock type.—Crystalline rocks, principally granite, underlie the basin. Gabbro and rhyolite are also found in the basin. These rocks are fractured and show exfoliation effects. Large boulder fields cover parts of the basin. Areas of bare rock and boulder fields having no vegetation cover small parts of the drainage.

Vegetation.—Most of the watershed is covered with native grass. The basin also contains scattered areas of mostly blackjack and post oak.

Manmade influences.—Most of the basin is in the Wichita Mountain Wildlife Refuge and Fort Sill Military Reservation. Some roads traverse the basin. The main stream contains three small reservoirs having a combined surface area of 130 acres. Evaporation losses are expected to affect the average natural runoff by 10–15 percent. Low flows will be most seriously affected by the reservoirs. The military area is used for artillery practice.

Gage location.—Lat 34°37′24″, long 98°33′48″, in NE¼NE¼ sec. 28, T. 2 N., R. 13 W., 4 miles east of Cache.

Flow characteristics.—Stream is intermittent. Average annual runoff: estimated at about 3–4 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate and sulfate. Low-flow dissolved-solids concentration: about 125 mg/1.

Ground water.—There are no known springs in the area. The amount of ground water in the basin is probably insignificant.

Data collected.—

Type	Period of record
Continuous streamflow	July 1964–present.
Water quality	September 1967–present.
Standard complete (monthly)	

39. KIAMICHI RIVER NEAR BIG CEDAR, OKLA. (07335700)

Location.—Western Ouachita Mountains, southeastern Oklahoma.

Drainage area.—40.1 sq mi.

Physiographic area.—Ouachita Mountains section of the Ouachita province of the Interior Highlands.

Climate.—Average annual precipitation: 56 in. Mean annual snowfall: about 4 in. Monthly mean temperature extremes: 42° and 81°F.

Topography.—The general surface of the land consists of a half-mile wide valley between parallel mountain ridges. Basin elevations range from 890 to 2,660 ft. The main stream slope is about 60 ft per mile.

Rock type.—The underlying formations consist of dark slaty shale, siliceous beds, and well-cemented dark sandstones. The rocks are strongly folded and faulted.

Vegetation.—Except for a few square miles of grassland in the valley, the area is covered with pine and hardwood forest of moderate density.

Manmade influences.—The entire basin lies within the Ouachita National Forest. There is a small amount of logging in the basin. A few rural residences are scattered along the valley. Farming in the basin consists of raising cattle and pigs, and corn is grown in a few small areas. Some roads traverse the basin.

Gage location.—Lat 34°38′20″, long 94°36′40″, in SW¼SE¼ sec. 18, T. 2 N., R. 26 E., 2.1 miles east of Big Cedar.

Flow characteristics.—Stream is intermittent. Average annual runoff: estimated to be about 20–25 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 25 mg/1.

Ground water.—Dug wells and a few wet-weather springs yield very small amounts of ground water. Alluvial deposits in the valley could provide a minimal supply of domestic water.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

40. CRATER LAKE NEAR CRATER LAKE, OREG. (11492200)

Location.—Cascade Range, southwestern Oregon.

Drainage area.—26.2 sq mi, of which 20.5 sq mi is lake area at an elevation of 6,176 ft.

Physiographic area.—Middle Cascades Mountains section of the Cascade-Sierra Mountains province of the Pacific Mountain System.

Climate.—Average annual precipitation: 67.4 in. Annual snowfall ranges from 200 to 500 in. Monthly mean temperature extremes: 26° and 56°F.

Topography.—Crater Lake occupies the caldera of prehistoric Mount Mazama. The elevation of the crater rim ranges from 6,650 to 8,156 ft, and the lake elevation is about 6,170 ft. The walls of the crater are generally very steep.

Rock type.—The entire area is underlain by volcanic rocks. The principal types are andesitic lava, basaltic lava, and pumiceous volcanic-flow breccias and tuffs, largely of andesitic composition.

Vegetation.—The land area is sparsely covered with various types of pine.

Manmade influences.—The basin is entirely within Crater Lake National Park. A highway circles the lake.

Gage location.—Lat 42°58'45", long 122°04'45", 6 miles north of Crater Lake Post Office.

Lake characteristics.—The lake elevation has been observed to vary from 6,163.2 ft to 6,179.1 ft above mean sea level during the period 1878–1967.

Water quality.—Principal constituents: calcium, magnesium, and sodium; fluoride, nitrate, potassium, silica, sodium, and sulfate. Dissolved-solids concentration: about 80 mg/1.

Ground water.—Ground water occurs under perched and water-table conditions. Numerous springs drain from the perched ground water. Ground-water conditions are very complex because of subsurface geologic structures.

Data collected.—

Type	*Period of record*
Lake elevations (fragmentary)	1878–September 1961.
Continuous lake elevation	October 1961–present.
Daily precipitation (from U.S. Weather Bureau)	October 1919–October 1941.
Continuous precipitation (from U.S. Weather Bureau)	September 1949–present.
Precipitation–storage gage	November 1964–present.
Daily air temperature	October 1919–present.
Continuous lake temperature	October 1963–present.
Water quality	September 1967–present.
Standard complete (monthly)	

Special characteristics.—Seepage from the lake was computed as 92 cfs in a study made during 1961–62.

41. MINAM RIVER AT MINAM, OREG. (13331500)

Location.—Northeastern Oregon.

Drainage area.—240 sq mi, approximately.

Physiographic area.—Blue Mountain section of the Columbia Plateaus province of the Intermontane Plateaus.

Climate.—Average annual precipitation: varies from 21 in. in the lower basin to 60 in. at the higher elevations. Annual snowfall occasionally exceeds 100 in. at the higher elevations. Monthly mean temperature extremes: 24° and 64°F.

Topography.—Complex mountains and dissected volcanic plateaus. Several small lakes occur in the headwaters of the basin. The total surface area of these lakes is about 200 acres. Basin elevations range from 2,540 to about

8,900 ft. The slope of the main stream is about 65 ft per mile.

Rock type.—Predominately basalt.

Vegetation.—Ponderosa pine is the predominant species in the area to an elevation of 5,500 ft. Above 5,500 ft the forest changes to a mixture of ponderosa pine, lodgepole pine, white fir, and western larch.

Manmade influences.—Minam Lake at the upper end of the basin has been developed for irrigation use in the Lostine River valley to the east of Minam River. The lake surface area is about 60 acres, and the storage capacity is 440 acre-ft. The drainage area into Minam Lake is less than 1 sq mi. There is a private hunting lodge and a landing strip in midbasin. Access by road is limited to the lower 10 miles of the basin. The major portion of the basin is wilderness area.

Gage location.—Lat 45°37'12", long 117°43'32", in SW¼SW¼ sec. 29, T. 2 N., R. 41 E., 0.3 mile west of Minam.

Flow characteristics.—Stream is perennial. Average annual runoff: about 25 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 50 mg/l. Average annual sediment load: less than 1 ton per sq mi.

Ground water.—The average contribution to streamflow from ground water is estimated to be about 40 cfs.

Data collected.—

Type	*Period of record*
Continuous streamflow (monthly discharge only for some periods)	June 1912–March 1914. September 1965–present.
Continuous surface-water temperature	October 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

42. YOUNG WOMANS CREEK NEAR RENOVO, PA. (01545600)

Location.—North-central Pennsylvania.

Drainage area.—46.2 sq mi.

Physiographic area.—Allegheny Mountain section of the Appalachian Plateaus province of the Appalachian Highlands.

Climate.—Average annual precipitation: 38 in. Average annual snowfall: 40 in. Monthly mean temperature extremes: 27° and 71°F.

Topography.—Broad, flat mountains and narrow, steep-sided valleys. The general elevation of the divide is about 1,800 ft. Basin elevations range from 780 to 2,160 ft. The slope of the main stream is about 60 ft per mile.

Rock type.—Predominantly sandstone and shale. Some unconsolidated glacial outwash lines the creek bottom.

Vegetation.—The area is covered with northern hardwoods, namely ash, beech, birch, cherry, and maple.

Manmade influences.—Two secondary roads and some fire trails traverse the basin. The area is very sparsely populated except during hunting season when lodges are occupied by hunters. Some logging is done privately but under State supervision. About 95 percent of the basin is publicly owned.

Gage location.—Lat 41°23'22", long 77°41'28", 5 miles northeast of Renovo.

Flow characteristics.—Stream is perennial. Average annual runoff: about 17 in.

Water quality.—Principal constituents: calcium; bicarbonate and sulfate; and silica. Low-flow dissolved-solids concentration: about 35 mg/l. Average annual sediment load: 50 tons per sq mi.

Ground water.—The shallow deposit of unconsolidated sand and gravel in the stream valley yields suitable water for domestic supplies. The bedrock is capable of supplying large yields of water of good quality to wells at moderate depth. Locally, some deep wells may yield salty water.

Data collected.—

Type	*Period of record*
Continuous streamflow	December 1964–present.
Continuous precipitation	Do.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	

Type
Water quality—Continued
Field analysis (monthly):
Dissolved oxygen
Coliform and BOD (for completion in lab.)
Samples collected for:
Standard complete (monthly)
Suspended sediment (monthly and during storm runoff)
Minor elements (semiannual)
Pesticides (semiannual)
Radioactivity (semiannual)

43. SCAPE ORE SWAMP NEAR BISHOPVILLE, S.C. (02135300)

Location.—Central South Carolina.

Drainage area.—70 sq mi, approximately.

Physiographic area.—Sea Island section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: about 45 in. Monthly mean temperature extremes: 48° and 81°F.

Topography.—The general surface of the land is composed of sand hills. The general elevation of the divide is about 300 ft. Basin elevations range from 220 to 400 ft. The slope of the main stream is about 6 ft per mile.

Rock type.—The basin is almost completely in sand hills.

Vegetation.—About 50 percent of the basin is covered with pine and hardwood forest, and about 50 percent is pasture, orchards, or cultivated land.

Manmade influences.—About 50 percent of the basin is used for agriculture. There are several small ponds in the basin. A few surfaced roads traverse the basin.

Gage location.—Lat 34°09′02″, long 80°18′18″, 5.8 miles southwest of Bishopville.

Flow characteristics.—Stream is perennial. Average annual runoff: estimated to be between 15 and 20 in.

Water quality.—No information.

Ground water.—Springs of good sustained flow occur throughout the basin.

Data collected.—

Type	Period of record
Continuous streamflow	July 1968–present.

44. UPPER THREE RUNS NEAR NEW ELLENTON, S.C. (02197300)

Location.—Southwestern South Carolina.

Drainage area.—87 sq mi.

Physiographic area.—Sea Island section of the Coastal Plain province of the Atlantic Plain.

Climate.—Average annual precipitation: 44 in. Monthly mean temperature extremes: 50° and 81°F.

Topography.—The general surface of the land is composed of sand hills. The general elevation of the divide is about 400 ft. Basin elevations range from 230 to 500 ft. The slope of the main stream is about 15 ft per mile.

Rock type.—A sand formation containing layers of clay underlies the entire basin.

Vegetation.—About 50 percent of the basin is covered with pine and hardwood forests, and about 50 percent is pasture, orchards, or cultivated land.

Manmade influences.—About 50 percent of the basin is used for agriculture. There are several small ponds in the basin. A few surfaced roads traverse the basin.

Gage location.—Lat 33°23′05″, long 81°37′00″, 4.6 miles southeast of New Ellenton.

Flow characteristics.—Stream is perennial. Average annual runoff: estimated about 14 in.

Water quality.—Principal constituents: calcium and sodium; bicarbonate and chloride; and silica. Low-flow dissolved-solids concentration: about 15 mg/1. Average annual sediment load: about 14 tons per sq mi.

Ground water.—Springs of good sustained flow occur throughout the basin.

Data collected.—

Type	Period of record
Continuous streamflow	June 1966–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

45. CASTLE CREEK ABOVE DEERFIELD RESERVOIR, NEAR HILL CITY, S. DAK. (06409000)

Location.—The Black Hills, southwestern South Dakota.

Drainage area.—83 sq mi, approximately.

Physiographic area.—Black Hills section of the Great Plains province of the Interior Plains.

Climate.—Average annual precipitation: about 20 in., of which about 20 percent occurs as snow. Monthly mean temperature extremes: 20° and 65°F.

Topography. — Maturely dissected domed mountains. Basin elevations range from 5,910 to about 7,130 ft. The main stream slope is about 65 ft per mile.

Rock type.—Slate and mica schist high in iron.

Vegetation.—About 90 percent of the basin is covered by a moderately dense forest of predominantly ponderosa pine. There are also some spruce, aspen, and willows, as well as other small types of trees and brush, particularly in the valley areas.

Manmade influences.—Mature timber has been harvested one or more times throughout the basin. Hay and sometimes oats are grown in some of the narrow valley meadows. Grazing is practiced throughout the basin. A few stock-water ponds are in the drainage area. Several roads or trails are in the basin. The basin is in the Black Hills National Forest.

Gage location.—Lat 44°00'50", long 103°49'25", in SW¼ sec. 25, T. 1 N., R. 2 E., 14 miles northwest of Hill City.

Flow characteristics.—Stream is perennial. Average annual runoff: 1.5 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 240 mg/l.

Ground water.—There are no significant aquifers and very little valley alluvium.

Data collected.—

Type	*Period of record*
Continuous streamflow	June 1948–present.
Precipitation (two storage gages)	May 1964–present.
Continuous precipitation at three gages (no record in winter)	Do.
Continuous surface-water temperature	Do.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)

46. LITTLE VERMILLION RIVER NEAR SALEM, S. DAK. (06478540)

Location.—Southeastern South Dakota.

Drainage area.—51 sq mi, approximately.

Physiographic area.—Western lake section of the Central Lowland province of the Interior Plains.

Climate.—Average annual precipitation: about 21 in., of which about 15 percent occurs as snow. Monthly mean temperature extremes: 14° and 71°F.

Topography.—Rather flat, young glaciated plain. Basin elevations range from 1,530 to 1,630 ft. The slope of the main stream is about 6 ft per mile.

Rock type.—Thin alluvium in valley over glacial till. The bedrock is quartzite beneath about 200 ft of drift.

Vegetation.—About 10 percent of the basin is covered with a moderately dense growth of prairiegrass. About 90 percent of the basin is under cultivation, grains being the main crops. The only trees of significance are shelterbelts associated with farmsteads.

Manmade influences.—The entire basin is devoted to agriculture. Grain crops are grown on about 90 percent of the basin, and the remainder is used for grazing. A few stock ponds, generally having a capacity of less than one-half acre-foot each, are in the basin. Many graded roads traverse the basin.

Gage location.—Lat 43°47'40", long 97°22'00", in SW¼ sec. 19, T. 104 N., R. 54 W., 5.2 miles northeast of Salem.

Flow characteristics.—Stream is intermittent. Average annual runoff: estimated about 1 in.

Water quality.—No information.

Ground water.—Shallow aquifers in the glacial drift supply water for farm and domestic uses.

Data collected.—

Type	*Period of record*
Continuous streamflow	September 1966–present.

47. BUFFALO RIVER NEAR FLAT WOODS, TENN. (03604000)

Location.—Western Tennessee.

Drainage area.—447 sq mi.

Physiographic area.—Highland Rim section of the Interior Low Plateaus province of the Interior Plains.

Climate.—Average annual precipitation: 52

in. Monthly mean temperature extremes: 40° and 77°F.

Topography.—Buffalo River meanders in an alluvial valley, one-quarter mile to 1 mile in width. Valley slopes are moderately steep. Basin elevations range from 514 to about 1,000 ft.

Rock type.—The principal surface rock is chert. In the stream valleys downstream from Grinder's Creek, there are small outcrops of limestone, shale, and sandstone.

Vegetation.—About 30 percent of the basin is forested principally with scrub hardwoods and a scattering of pine and cedar. The forest is very dense in ravines and valleys and moderately dense to sparse along the ridges. About 20 percent of the area is cleared land, mostly in the wider valleys. The cleared land is equally split between row crops and pasturage.

Manmade influences.—The town of Waynesboro (population, 1,521) is near the headwaters of the Green River (tributary to Buffalo River). Hohenwald (population, 3,151) is on the northern divide. Several smaller communities are also in the basin. Waynesboro gets its water supply from one well and returns it, after secondary treatment, to the Green River. The Hohenwald water supply is from a spring, and sewage is discharged into a Buffalo River tributary after treatment. Two small impoundments, Laurel Hill Lake near the south divide and Napier Lake in the middle of the basin, are in the basin. Several roads traverse the basin.

Gage location.—Lat 35°29'45", long 87°49'58", 1.3 miles north of Flat Woods.

Flow characteristics.—Stream is perennial. Average annual runoff: 22 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/l.

Ground water.—The Fort Payne Chert is the principal aquifer in the basin. There are many small springs and three larger springs in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	May 1920–present.
Precipitation (several daily records from gages in or on the edge of the basin by Tennessee Valley Authority)	1940–present.
Continuous precipitation:	
Tennessee Valley Authority	1940–present.
U.S. Weather Bureau	About 1885–present.
Daily air temperature (U.S. Weather Bureau)	Do.
Continuous surface-water temperature (TVA)	1964–present.
Water quality	July 1967–June 1968.
	July 1968–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

48. LITTLE RIVER ABOVE TOWNSEND, TENN. (03497300)

Location.—The western side of Great Smoky Mountains National Park, eastern Tennessee.

Drainage area.—106 sq mi.

Physiographic area.—Southern section of the Blue Ridge province of the Appalachian Highlands.

Climate.—Average annual precipitation: 58 in., of which about 18 percent occurs as snow. Monthly mean temperature extremes: 39° and 74°F.

Topography. — Mountainous. Divides are high, and valleys are generally narrow. Basin elevations range from 1,110 to 6,642 ft.

Rock type.—Partly metamorphosed shale, siltstone, sandstone, and conglomerate.

Vegetation.—The basin is completely forested in mixed hardwoods up to about 5,000 ft. Above this elevation, a forest of spruce and fir dominates.

Manmade influences.—Several permanent residences, a 180-man Job Corps camp, a 370-site campground, and two small picnic areas are in the basin. One highway and a few access roads traverse the basin, which is entirely within the Great Smoky Mountains National Park.

Gage location.—Lat 35°39'52", long 83°42'41", 2.2 miles southeast of Townsend.

Flow characteristics.—Stream is perennial. Average annual runoff: about 36 in.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 20 mg/1.

Ground water.—Ground water occurs in the overburden and in openings along joints, faults, and bedding planes. Springs are common, but flows are generally less than 50 gpm.

Data collected.—

Type	Period of record
Continuous streamflow	October 1963–present.
Continuous surface-water temperature	Do.
Water quality	July 1967–June 1968.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

49. LIMPIA CREEK ABOVE FORT DAVIS, TEX. (08431700)

Location.—Southwestern Texas.

Drainage area.—52.4 sq mi.

Physiographic area.—Mexican Highland section of the Basin and Range province of the Intermontane Plateaus.

Climate.—Average annual precipitation: varies from about 19 in. at the lower elevations to about 24 in. at the higher elevations. Monthly mean temperature extremes: 37° and 73°F.

Topography.—Mountainous. The general elevation of the divide is about 7,500 ft. Basin elevations range from 5,200 to 8,300 ft. The slope of the main stream is about 118 ft per mile.

Rock type.—The area is underlain by volcanic rocks, most of which are andesites and basalts. Thin alluvial deposits of boulders, gravel, and sand occur in the stream channel.

Vegetation.—Phreatophytes—such as cottonwood, willow, and saltcedar—occur along the stream channels. Oak, hackberry, and other trees sparsely cover the higher parts of the basin. Cactus, weeds, and native grasses cover most of the basin.

Manmade influences.—A few roads traverse the basin.

Gage location.—Lat 30°36'55", long 104°00' 10", 6.8 miles west of Fort Davis.

Flow characteristics.—Stream is intermittent. Average annual runoff: about 0.15 in.

Water quality.—Prinncipal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 150 mg/1.

Ground water.—Ground water occurs in small quantities in both the volcanic rocks and in the alluvium. Water-table conditions generally prevail; however, artesian conditions may occur locally. A few small springs occur along the main channels of the streams.

Data collected.—

Type	Period of record
Continuous streamflow	October 1965–present.
Continuous precipitation	Do.
Water quality	June 1967–present.
Standard complete (monthly)	

50. SOUTH FORK ROCKY CREEK NEAR BRIGGS, TEX. (08103900)

Location.—Central Texas.

Drainage area.—34.2 sq mi.

Physiographic area.—Central Texas section of the Great Plains province of the Interior Plains.

Climate.—Average annual precipitation: about 30 in. Monthly mean temperature extremes: 48° and 84°F.

Topography.—Rough topography. There are flat ridges and sloping canyon walls that in places rise on a 1:10 ft slope for more than 100 ft above the streambeds. Basin elevations range from 956 to about 1,150 ft. The stream slope is about 35 ft per mile.

Rock type.—The area is underlain by alternating beds of limestone and marl. The bedrock is covered in places by a thin mantle of black clay soil. There are alluvial deposits, less than 15 ft thick, in the stream valley.

Vegetation.—Approximately 80 percent of the basin has a grass cover and 2 percent contains crops. The remainder is wooded with oak, elm, hackberry, willow, and sycamore trees principally along the streams and valley floors. Dense brush occurs along the smaller tributaries.

Manmade influences.—About 2 percent of the basin is cultivated. There are 30 farm and ranch houses and five county roads in the basin. Some water for domestic and stock supplies is obtained from wells.

Gage location.—Lat 30°54'40", long 98°02' 10", 7 miles west of Briggs.

Flow characteristics.—Stream is intermittent. Average annual runoff: estimated to be about 3 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 290 mg/1.

Ground water.—The Trinity Sand, which underlies limestone and marl, is pumped for domestic and stock-water supplies. Depth to water ranges from 15 to 165 ft. Small springs or seeps issue from the limestone beds; however, these cease to flow during the summer months. A few wells tap the alluvial deposits in the stream valley.

Data collected.—

Type	*Period of record*
Continuous streamflow	April 1963–present.
Continuous precipitation (three gages)	Do.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

51. RED BUTTE CREEK AT FORT DOUGLAS, NEAR SALT LAKE CITY, UTAH (10172200)

Location.—Western slopes of the Wasatch Mountians, north-central Utah.

Drainage area.—7.25 sq mi.

Physiographic area.—Middle Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: about 25 in. Monthly mean temperature extremes: 25° and 70°F. There is considerable variation in temperature and precipitation over the basin.

Topography.—Mountainous. Slopes are steep and have few rock outcrops. Basin elevations range from 5,400 to 8,240 ft. The slope of the main stream is about 250–300 ft per mile.

Rock type.—The basin is underlain by southeastward-dipping beds of limestone, shale, and sandstone. Alluvium occurs along the streams but is only a few feet thick in most places.

Vegetation.—The basin is thickly covered with oak brush, a few scattered clumps of evergreens, and a few small clumps of aspen. A thick growth of weeds, willows, and small maples inhabit the stream banks.

Manmade influences.—The watershed is preserved to furnish water for Fort Douglas. A fire-control road, one cabin, and a rock quarry, which is no longer used, are in the basin. Timber cutting was stopped prior to 1900. Grazing was stopped before 1900 except on a small part of the upper basin which is privately owned.

Gage location.—Lat 40°46′50″, long 111°48′20″, in NW¼ sec. 35, T. 1 N., R. 1 E., 1.5 miles northeast of Fort Douglas and 5 miles east of Salt Lake City Post Office.

Flow characteristics.—Stream is perennial. Average annual runoff: about 9–10 in.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 400 mg/1.

Ground water.—Some ground water occurs under water-table conditions in the unconsolidated alluvial deposits along the streams in the basin. Little is known about the ground-water conditions in the bedrock. Several springs do occur in the upper canyon.

Data collected.—

Type	*Period of record*
Monthly streamflow	January 1942–September 1963.
Continuous streamflow	October 1963–present.
Precipitation at:	
Three storage gages by U.S. Corps of Engineers	November 1941–May 1965.
One storage gage by U.S. Corps of Engineers	October 1945–May 1965.
Continuous precipitation (three gages)	June 1965–present.
Continuous surface-water temperature	April 1964–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

52. HOLIDAY CREEK NEAR ANDERSONVILLE, VA. (02038850)

Location.—Central Virginia.

Drainage area.—8.53 sq mi.

Physiographic area.—Piedmont Upland section of the Piedmont province of the Appalachian Highlands.

Climate.—Average annual precipitation: 43 in. Average annual snowfall: 15 in. Monthly mean temperature extremes: 40° and 78°F.

Topography.—Rolling hills. The general elevation of the divide is about 700 ft. Basin elevations range from 475 to 920 ft. The slope of the main stream is about 60 ft per mile.

Rock type.—The basin is underlain by metamorphosed sedimentary rocks, primarily kyanite schist and kyanite quartzite.

Vegetation.—A managed hardwood forest covers most of the basin. A few stands of pine have been recently planted.

Manmade influences.—The basin is part of the Appomatox-Buckingham State Forest. There have been selective cutting and planting operations throughout the basin. Several roads and fire trails traverse the basin.

Gage location.—Lat 37°24′55″, long 78°38′10″, 5.2 miles southwest of Andersonville.

Flow characteristics.—Stream is perennial. Average annual runoff: estimated to be about 13–14 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 45 mg/1.

Ground water.—The main aquifer is the fractured rock underlying the basin. Yields from the aquifer are generally low. A few small springs occur in the basin.

Data collected.—

Type	Period of record
Continuous streamflow	April 1966–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

53. ANDREWS CREEK NEAR MAZAMA, WASH. (12447390)

Location.—Cascade Mountains, north-central Washington.

Drainage area.—22.1 sq mi.

Physiographic area. — Northern Cascade Mountains section of the Sierra-Cascade Mountains province of the Pacific Mountain System.

Climate.—Average annual precipitation: estimated between 30 and 40 in., much of which occurs as snow. Monthly mean temperature extremes: about 15° and 60°F.

Topography.—Rugged mountains. Basin elevations range from 4,300 to 8,700 ft. The slope of the main stream is steep and consists of a continuous series of rapids and small waterfalls.

Rock type.—Largely granitic rocks overlain by fluvioglacial sediments.

Vegetation.—The basin is covered with a moderately dense forest of fir, cedar, hemlock, and undergrowth.

Manmade influences.—The entire drainage is within the boundaries of the North Cascades Primitive Area. Two forest trails traverse the basin.

Gage location.—Lat 48°49′30″, long 120°08′40″, in NE¼ sec. 1, T. 38 N., R. 21 E., 20 miles northeast of Mazama.

Flow characteristics.—Stream is perennial. Average annual runoff: not yet determined. A large part of the runoff is from the spring snowmelt.

Water quality.—No information.

Ground water.—Several springs occur in the basin.

Data collected.—

Type	Period of record
Continuous streamflow	June 1968–present.

54. NORTH FORK QUINAULT RIVER NEAR AMANDA PARK, WASH. (12039300)

Location.—The Olympic Mountains, western Washington.

Drainage area.—74.1 sq mi.

Physiographic area.—Olympic Mountains section of the Pacific Border province of the Pacific Mountain System.

Climate.—Average annual precipitation: as much as 200 in. in parts of the basin, much of which occurs as snow. Monthly mean temperature extremes: 20° and 60°F.

Topography.—Rugged mountains. Basin elevations range from 620 to 6,246 ft. The slope of the main stream is about 200 ft per mile.

Rock type.—Dark-gray massive or poorly bedded slate is overlain on the north side of the channel by glacial deposits and a thick mantle of soil.

Vegetation.—Heavy to moderate stands of virgin hemlock, fir, spruce, and cedar grow to an elevation of about 3,500 ft. Alpine-type growth occurs between 3,500 and 5,000 ft. Bare rock is predominant above 5,000 ft.

Manmade influences.—The basin lies entirely within Olympic National Park. Two trails traverse the basin.

Gage location.—Lat 47°35′45″, long 123°37′25″, in SW¼ sec. 6, T. 24 N., R. 7 W., 18 miles northeast of Amanda Park.

Flow characteristics.—Stream is perennial. Average annual runoff: about 145 in. Runoff from snowfields is a factor, especially in the early warm summer months.

Water quality.—Principal constituents: calcium; bicarbonate. Low-flow dissolved-solids concentration: about 60 mg/1.

Ground water.—Characteristics unknown.

Data collected.—

Type	*Period of record*
Continuous streamflow	November 1964–present.
Precipitation (two storage gages)	March 1965–present. September 1965–present.
Continuous surface-water temperature	March 1965–present.
Water quality	September 1967–present.
Field analysis (monthly):	
Specific conductance	
Temperature	
Dissolved oxygen	
Coliform and BOD (for completion in lab.)	
Samples collected for:	
Standard complete (monthly)	
Suspended sediment (monthly and during storm runoff)	
Minor elements (semiannual)	
Pesticides (semiannual)	
Radioactivity (semiannual)	

55. POPPLE RIVER NEAR FENCE, WIS. (04063700)

Location.—Northeastern Wisconsin.

Drainage area.—131 sq mi.

Physiographic area.—Superior Upland province of the Laurentian Upland.

Climate.—Average annual precipitation: 29 in. Annual snowfall ranges from 33 to 86 in. Monthly mean temperature extremes: 14° and 66°F.

Topography.—Gently rolling terrain that has some flat terraces. Basin elevations range from 1,406 to 1,600 ft. The slope of the main stream is fairly flat, and there are occasional riffles at rock outcrops.

Rock type.—Glacial deposits are underlain by igneous and metamorphic crystalline rocks, generally granite, schist, and greenstone. The glacial drift ranges in thickness from 0 to 80 ft and is primarily composed of outwash sand and sandy gravel.

Vegetation.—Rather dense coniferous and deciduous forest covers about 95 percent of the basin. The forest is primarily made up of aspen, northern hardwoods, pine, and swamp trees. The remainder of the basin consists of scattered active or abandoned farms and the area in and around the community of Newald.

Manmade influences.—The community of Newald (population, about 175) is near the south-central part of the basin. Newald has neither public water-supply nor public waste-disposal systems. A small amount of farming is practiced in the basin. Several roads traverse the basin. The Popple River basin is part of a State wild-river area.

Gage location.—Lat 45°45′50″, long 88°27′50″, in NW¼ sec. 23, T. 38 N., R. 16 E., 2.6 miles northwest of Fence.

Flow characteristics.—Stream is perennial. Average annual runoff: about 12 in.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 145 mg/1. Average annual sediment load: about 6 tons per sq mi.

Ground water.—Water-table conditions prevail throughout the basin. The glacial drift is recharged directly from local precipitation. Expected depth to water table ranges from 0 to 30 ft. Springs and seeps abound in the upper part of the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1963–present.
Ground-water levels (intermittent observation on two wells)	December 1966–May 1968.
Continuous precipitation	1965–present

Type	Period of record
Continuous surface-water temperature	June 1964–present.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)
- Lake levels at
  - Morgan and Mud Lakes — November 1966–May 1968.

Special characteristics.—There are about 10 very small lakes scattered over the basin, most of which seem to have no surface outlet and are connected to the ground-water system. Approximately 25 percent of the basin is in marshes, swamps, and other surface waters.

56. CACHE CREEK NEAR JACKSON, WYO. (13018300)

Location.—West-central Wyoming.

Drainage area.—10 sq mi, approximately.

Physiographic area.—Middle Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: about 30 in., most of which falls as snow. Monthly mean temperature extremes: about 12° and 58°F.

Topography.—Mountains and canyons. The general divide elevation is about 9,000 ft. Basin elevations range from 6,800 to 10,304 ft. The slope of the main stream is about 300 ft per mile.

Rock type.—Sandstone and shale are covered with alluvium in the lower valleys.

Vegetation.—Forests of pine, fir, and spruce cover about 80 percent of the north slopes and about 50 percent of the south slopes. Grass and brush covers the remaining area up to timberline.

Manmade influences.—The area is used seasonally for recreation. One road enters the basin, and one pack trail traverses the basin.

Gage location.—Lat 43°26'50", long 110°41'50", in S½ sec. 1, T. 40 N., R. 116 W., 4½ miles southeast of Jackson.

Flow characteristics.—Stream is perennial. Average annual runoff: about 19 in. Much of the runoff occurs during the early summer from snowmelt.

Water quality.—Principal constituents: calcium and magnesium; bicarbonate. Low-flow dissolved-solids concentration: about 200 mg/1. Average annual sediment load: estimated to be about 150 tons per sq mi.

Ground water.—Numerous seep springs occur in the basin. Aquifers are generally of low yield except in the valley alluvium where greater yields can be expected.

Data collected.—

Type	Period of record
Continuous streamflow	June 1962–present.
Intermittent snow surveys	October 1967–present.
Water quality	September 1967–present.

Field analysis (monthly):
- Specific conductance
- Temperature
- Dissolved oxygen
- Coliform and BOD (for completion in lab.)

Samples collected for:
- Standard complete (monthly)
- Suspended sediment (monthly and during storm runoff)
- Minor elements (semiannual)
- Pesticides (semiannual)
- Radioactivity (semiannual)

57. ENCAMPMENT RIVER ABOVE HOG PARK CREEK, NEAR ENCAMPMENT, WYO. (06623800)

Location.—South-central Wyoming.

Drainage area.—72.7 sq mi.

Physiographic area.—Southern Rocky Mountains province of the Rocky Mountain System.

Climate.—Average annual precipitation: about 30 in., most of which falls as snow. Monthly mean temperature extremes: about 15° and 55°F.

Topography.—Mountainous. The general divide elevation is about 10,000 ft. Basin elevations range from 8,270 to over 11,400 ft. The slope of the main stream is about 100 ft per mile.

Rock type.—Crystalline rock, chiefly granite, and lesser amounts of metasedimentary rocks are in the basin.

Vegetation.—Most of the basin is covered with forest consisting primarily of lodgepole pine, fir, and spruce. Part of the basin is bare ground above timberline. The remainder of the basin consists of grass-covered openings and meadows in the valleys.

Manmade influences.—The basin is used for seasonal recreation. Jeep and pack trails traverse the basin.

Gage location.—Lat 41°01'25", long 106°49'27", in NE¼SW¼ sec. 10, T. 12 N., R. 84 W., 13 miles south of Encampment.

Flow characteristics.—Stream is perennial. Average annual runoff: about 16–18 in. Much of the runoff occurs during the early summer months from snowmelt.

Water quality.—Principal constituents: calcium; bicarbonate; and silica. Low-flow dissolved-solids concentration: about 50 mg/l. Average annual sediment load: estimated to be about 50 tons per sq mi.

Ground water.—Aquifers are generally composed of crystalline rocks and alluvium. The aquifers are shallow except in glaciated valleys where deeper aquifers exist. Numerous small springs occur in the basin.

Data collected.—

Type	*Period of record*
Continuous streamflow	October 1964–present.
Intermittent snow surveys	December 1964–present.
Data collected by U.S. Forest Service	About 1966–present.
Windspeed	
Relative humidity	
Air temperature at two levels	
Solar radiation	
Water quality	October 1967–present.
Standard complete (monthly)	

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