SURFACE WATER ENVIRONMENT IN THE AREA OF THE SAN JUAN BASIN REGIONAL URANIUM STUDY

NEW MEXICO, COLORADO, ARIZONA, AND UTAH

by

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U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 79-1499

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PREFACE

This is one of a series of reports prepared as part of the San Juan Basin Regional Uranium Study, which is under the leadership of the Bureau of Indian Affairs (BIA). The reports were used as source of material in the preparation of the Regional Study, which is available for public examination at BIA offices in Albuquerque, New Mexico, and Washington, D.C.

The reports listed below are a part of the series that was prepared by the U.S. Geological Survey. These reports have been open filed by the Survey and can be examined by the public at the Survey offices in Denver, Colorado; Albuquerque, New Mexico; and Reston, Virginia.

Water Use in the area of the San Juan Basin Regional Uranium Study, New Mexico, Colorado, Arizona, and Utah--Open File Report 79-1500

Surface-water Environment in the area of the San Juan Basin Regional Uranium Study, New Mexico, Colorado, Arizona, and Utah------------------------Open File Report 79-1499

Regional Geohydrology of the San Juan Hydrologic Basin of New Mexico, Colorado, Arizona, and Utah--Open File Report 79-1498

Reconnaissance Study of Selected Environmental Impacts on Water Resources due to the Exploration, Mining, and Milling of Uraniferous Ores in the Grants Mineral Belt, Northwest New Mexico--Open File Report 79-1497

Effects of Uranium Development on Erosion and Associated Sedimentation in Southern San Juan Basin, New Mexico----------------------------Open File Report 79-1496

Depths of Channels in the area of the San Juan Basin Regional Uranium Study, New Mexico, Colorado, Arizona, and Utah---------------------------------Open File Report 79-1526

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CONVERSION FACTORS

The inch-pound system of units is used in this report. For readers who prefer the International System of units (SI), conversion factors for the terms used in this report are listed below. Chemical concentrations are given in mg/L (milligrams per liter), or μg/L (micrograms per liter), which are (within the range of values presented) numerically equal to parts per million, or parts per billion, respectively. Specific conductance is expressed as μmhos/cm (micromhos per centimeter at 25 degrees Celsius). Radiochemical data are expressed in pCi/L (picocuries per liter).

Multiply Inch-Pound Unit	By	To Obtain SI Unit
acre	4.047×10^{-3}	km^2 (square kilometer)
acre-ft (acre-foot)	1.234×10^{3}	m^3 (cubic meter)
acre-ft/yr (acre-foot per year)	1.234×10^{3}	m^3/yr (cubic meter per year)
[(acre-ft/mi^2)/yr] (acre-foot per square mile per year)	4.762×10^{2}	[(m^3/km^2)/yr] (cubic meter per square kilometer per year)
ft (foot)	3.048×10^{-1}	m (meter)
ft^2/d (foot squared per day)	9.290×10^{-2}	m^2/d (meter squared per day)
ft^3/s (cubic foot per second)	2.832×10^{-2}	m^3/s (cubic meter per second)
[(ft^3/s)/mi^2] (cubic foot per second per square mile)	1.093×10^{-2}	[(m^3/s)/km^2] (cubic meter per second per square kilometer)
gal/min (gallon per minute)	6.309×10^{-2}	L/s (liter per second)
[(gal/min)/ft] (gallon per minute per foot)	2.070×10^{-1}	[(L/s)/m] (liter per second per meter)
Mgal/d (million gallon per day)	4.381×10^{-2}	m^3/s (cubic meter per second)
in. (inch)	2.540×10	mm (millimeter)
mi (mile)	1.609	km (kilometer)
mi^2 (square mile)	2.590	km^2 (square kilometer)
ton/d (ton per day)	9.072×10^{-1}	t/d (tonne per day)

ton/yr (ton per year)	9.072×10^{-1}	t/yr (tonne per year)
[(ton/mi^2)/yr] (ton per square mile per year)	3.503×10^{-1}	[(t/km^2)/yr] (tonne per square kilometer per year)

Temperature Conversion

Conversion of degrees Celsius (°C) to degrees Fahrenheit (°F) is based on the equation, $F = (1.8)(°C) + 32$.

SURFACE-WATER ENVIRONMENT IN THE AREA OF THE SAN JUAN BASIN REGIONAL URANIUM STUDY OF NEW MEXICO, COLORADO, ARIZONA, AND UTAH,

By Mark W. Busby

ABSTRACT

Streamflows in the lowland areas of the San Juan Basin are highly variable, responding to short-duration, high-intensity thunderstorms occurring in the late spring and summer. The thunderstorms can cause floods of large magnitude, but of localized extent. Most streams of the lowlands are ephemeral or intermittent.

Streams of the high mountain areas are much less variable. Most of their flow is from snowmelt, which results in low-intensity flood peaks with long, gradual recessions. Most large mountain streams are perennial.

Small ephemeral lakes and ponds in the low-lying areas have little effect on flood flows. Larger reservoirs in the basin have varying effects on flows of rivers, ranging from complete flow control to minor regulation.

The streams of the low-lying areas are high in dissolved solids content. Sodium, bicarbonate, and sulfate are the predominant ions. The quality of the water varies during a single-flow event and season-ally. Streams in the mountains are low in dissolved solids content.

Radiochemical constituents are fairly low in most of the natural streamflow, but concentrations are higher than in streams outside of the basin.

Sediment yield of the drainages in the low areas of the basin range from large to very large when compared to drainages of humid areas. Badlands in the basin contribute from 10 to 100 times as much sediment as non-badland areas.

INTRODUCTION

Growth of energy-related development in the Four Corners area of New Mexico, Colorado, Utah, and Arizona, is placing an ever-increasing strain on water resources. Because the area is mostly semiarid, only a limited supply of water is available for the various and often competing demands. Projections indicate that if full uranium, coal, oil, and gas development takes place and the agricultural development continues, the demand for water will exceed the available supplies by the year 2000.

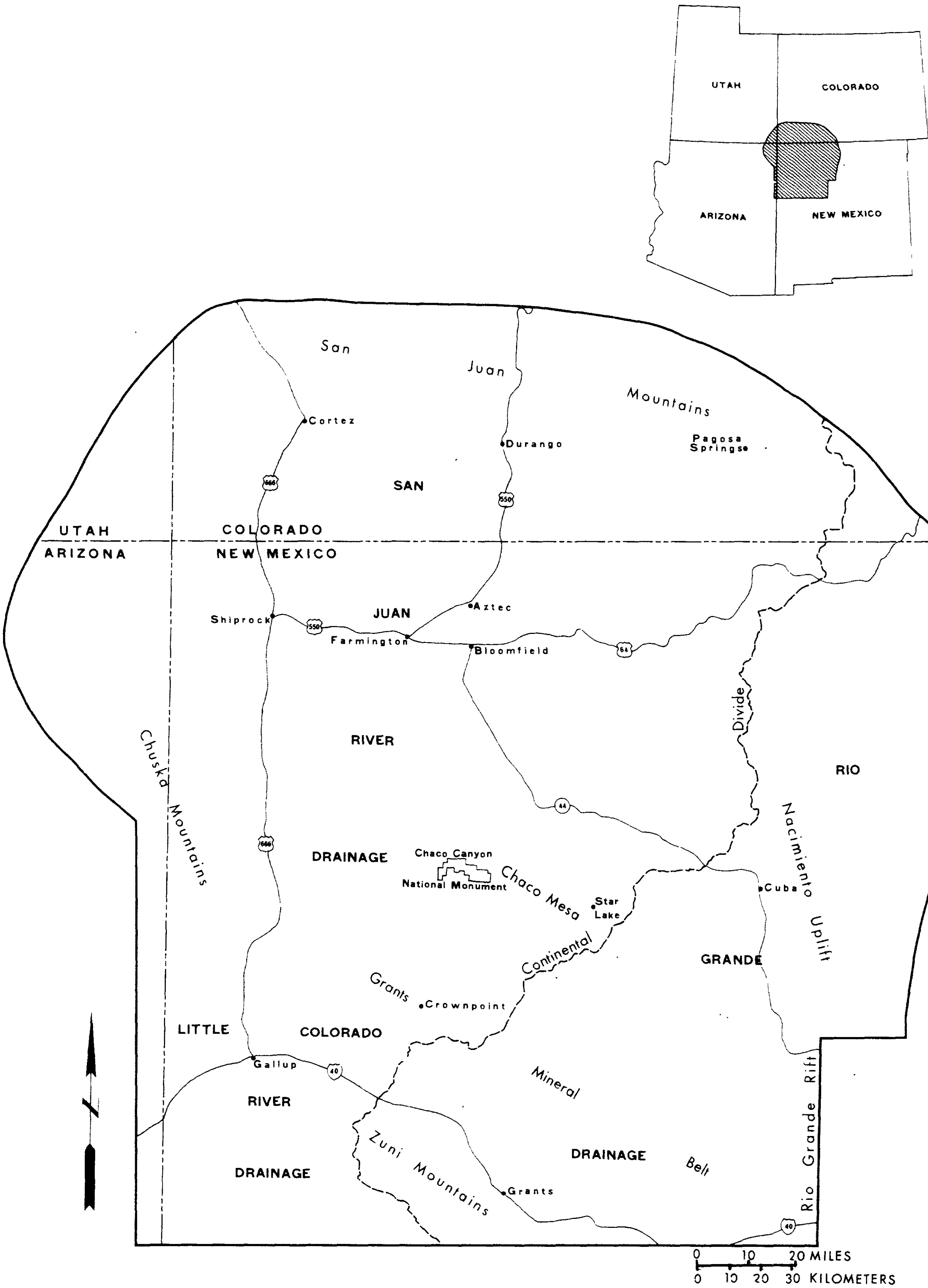


FIGURE 1.—Location of the San Juan Basin.

DESCRIPTION OF AREA

San Juan Basin (fig. 1) is defined for this study is bounded by the San Juan Mountains to the north, the Nacimiento Uplift and Rio Grande Rift to the east, the Zuni Mountains and high country paralleling Interstate 40 on the south, and the Chuska Mountains on the west. These boundaries correspond to those used for the San Juan Basin Regional Uranium Study. The 20,000 mi^2 area includes almost all the San Juan River drainage basin and parts of the Little Colorado River and Rio Grande drainage basins.

STREAMS IN THE STUDY AREA

The study area include drainage of both the Rio Grande and the Colorado River systems, along and near the Continental Divide (fig. 1). The eastern and southeastern parts of the area are drained by tributaries of the Rio Grande, the central and northern parts by the San Juan River and its tributaries, and the southwestern part by a tributary of the Little Colorado River. The principal streams are listed by tributary rank in downstream order in table 1 and are shown in figures 2-5.

Because the climate in the study area varies from semiarid to humid, the streamflow characteristics vary accordingly. The lower elevations are semiarid and subhumid; only the highest mountains are in the humid zone.

Except for streams draining the high mountains, streamflow in the study area is highly variable. Flow in most channels and washes in the basin is sporadic and results from localized, short-duration, high-intensity thunderstorms, which occur usually during late spring and summer. The channels are normally dry for the remainder of the year. Intense rainfall during thunderstorms causes flooding that may be of large magnitude but generally local in extent. Discharges of several hundred to several thousand cubic feet per second from drainages of only a few square miles are not uncommon during such floods. Winter storms, in contrast, are usually of low intensity and short duration and produce little or no runoff.

Table 1. Principal streams in the study area by tributary rank and downstream order

- Rio Grande Basin
  - Rio Chama
    - Rio Chamita
    - Rio Brazos
    - Willow Creek
    - Rio Nutrias
    - Rio Cebolla
    - Rio Gallina
    - Rio Puerco
    - Canjilon Creek
  - Jemez River
    - San Antonio Creek
    - Guadalupe River
    - Rio Salado
  - Rio Puerco
    - Arroyo Chico
      - Canada Marcelina
      - San Isidro Arroyo
      - North Fork Arroyo Chico
      - Torreon Wash
      - San Isidro Wash
      - Arroyo Piedra Lumbre
  - Rio San Jose
    - Bluewater Creek
      - Mitchell Draw
        - Casamero Draw
    - San Mateo Creek
      - Arroyo de Puerto
    - Rio Paguate
    - Arroyo Conchas
- Colorado River Basin
  - San Juan River
  - Rio Blanco
  - Navajo River
    - Amargo Creek
  - Piedra River
  - Canon Bancos
  - La Jara Creek
  - Los Pinos River
    - Vallecito Creek
  - Gobernador Canyon
  - Canon Largo
    - Canon de los Ojitos
    - Tapicito Creek
    - Carrizo Creek
      - Companero Creek
    - Blanco Wash
  - Gallegos Canyon
  - Animas River
    - Hermosa Creek
    - Florida River

Table 1. Principal streams in the study area by tributary rank and downstream order (continued)

- Colorado River Basin (Continued)
  - San Juan River (Continued)
    - Farmington Glade
    - La Plata River
    - Shumway Arroyo
    - Chaco River
      - Fajada Wash
      - Escavada Wash
        - Betonnie Tsosie Wash
        - Kimbeto Wash
      - Ah-shi-sle-pah Wash
      - Kim-me-hi-oli Wash
      - De-na-zin Wash
      - Indian Creek
      - Coyote Wash
      - Hunter Wash
      - Captain Tom Wash
      - Tacito Wash
      - Dead Mans Wash
    - Shiprock Wash
    - Red Wash
    - Mancos River
      - Navajo Wash
    - Tsitah Wash
    - McElmo Creek
      - Yellowjacket Canyon
    - Montezuma Creek
    - Chinle Wash Basin
      - Lukachukai Wash Basin
        - Lukachukai Creek
      - Walker Creek
    - Little Colorado River Basin
      - Puerco River
        - South Fork Puerco River
        - Bread Springs Wash
        - Whitewater Arroyo
        - Black Creek
      - Zuni River
        - Rio Nutria

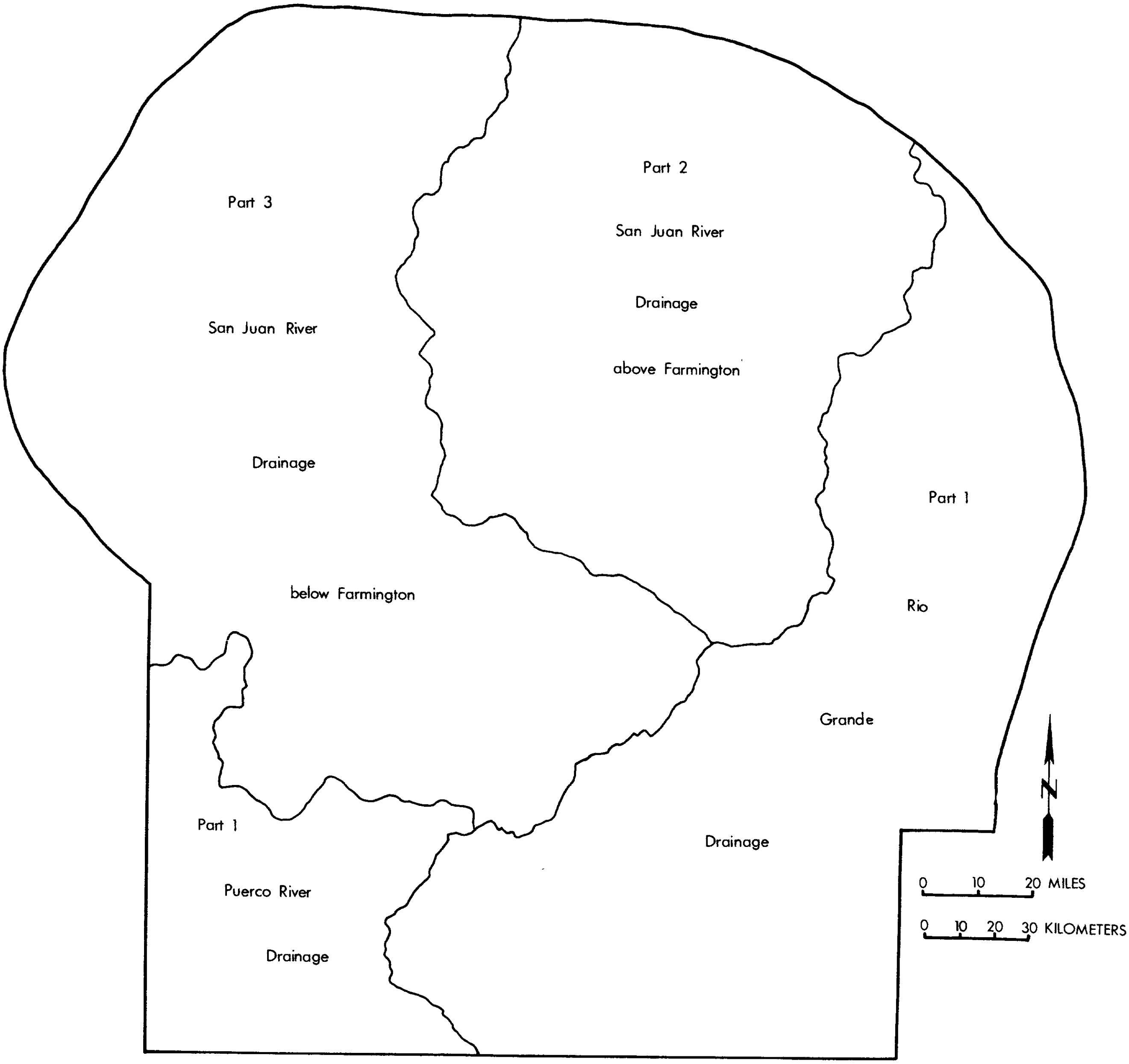
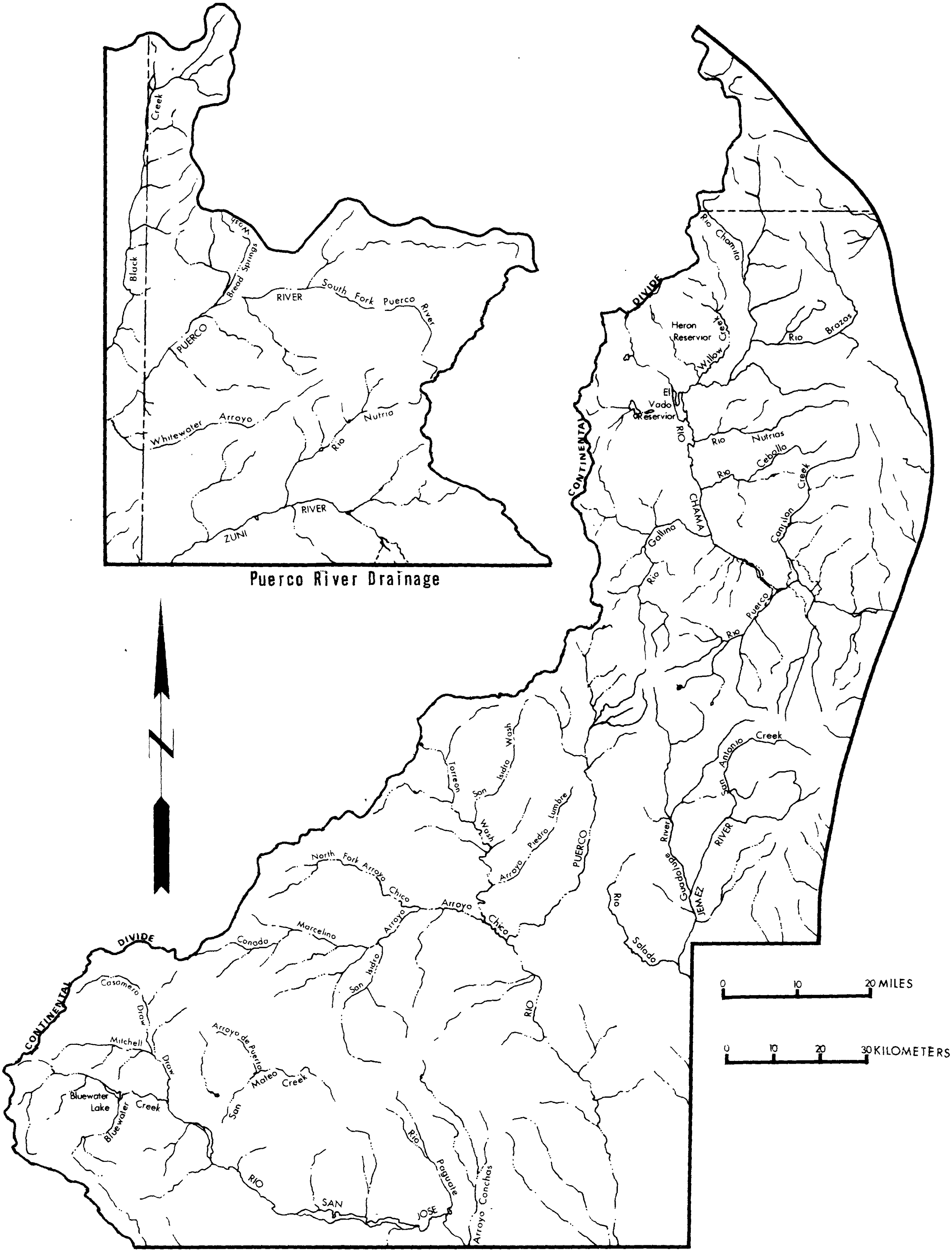
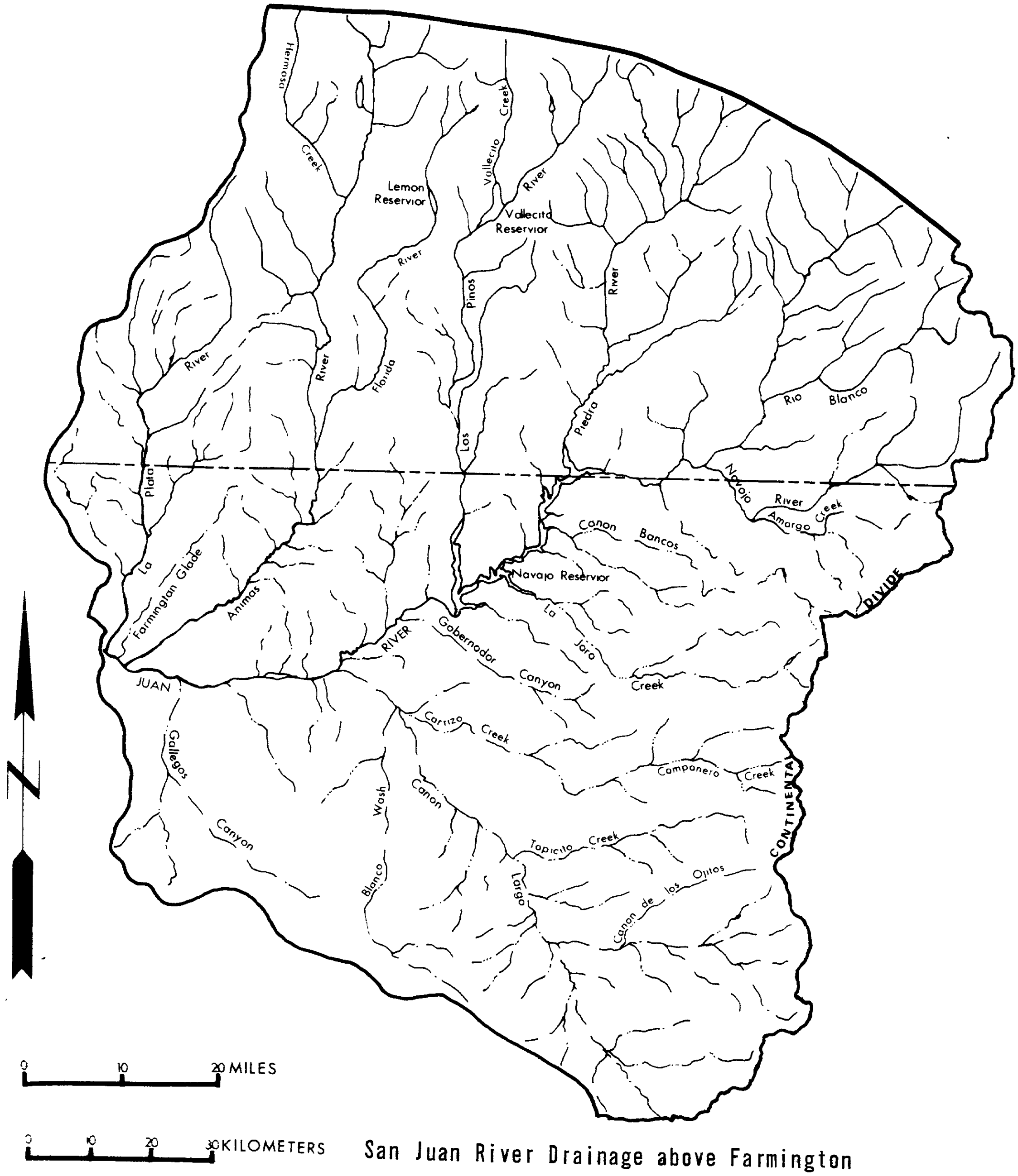


FIGURE 2–Index to drainage network for San Juan Basin



Rio Grande Drainage

FIGURE 3.—Drainage network for San Juan Basin, Part 1



San Juan River Drainage above Farmington

FIGURE 4.—Drainage network for San Juan Basin, Part 2

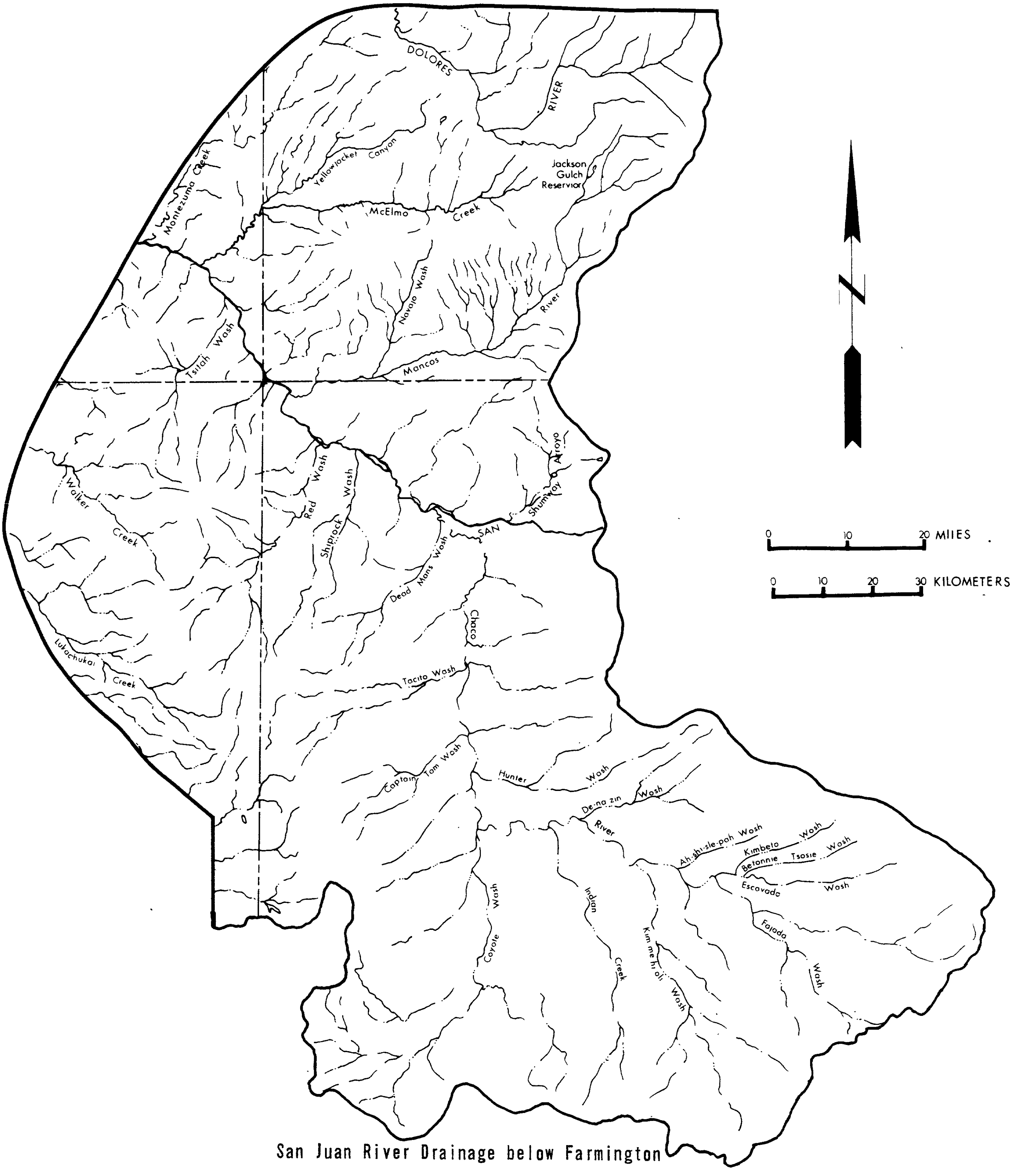


FIGURE 5.—Drainage network for San Juan Basin, Part 3

Streams draining the high mountains are much less variable than streams draining the rest of the basin; most large mountain streams are perennial. Although thunderstorms do occur in the high mountains, they are not as intense and usually do not produce large floods. Because most precipitation falls as snow in winter, the streams draining the mountains are characterized by snowmelt runoff, causing low-intensity flood peaks followed by long, gradual recessions.

Streamflows in the study area have been monitored by the U.S. Geological Survey, in cooperation with the States of Arizona, Colorado, New Mexico, and Utah, and various Federal agencies and local governments, and are published annually (U.S. Geological Survey).

Because surface waters can be transported from areas of supply to areas of demand, data for streams outside the San Juan Basin are included in this report to present a more complete picture of surface-water resources of the region. Most of the streamflow records are for large streams, such as the Rio Grande or the San Juan River, and their larger tributaries. Only in the last few years were data collected for the small streams, particularly within the San Juan Basin.

Mean annual flow, range of annual minimum daily discharge, and peak flow characteristics for selected streams are presented in table 2. Locations of the gaging stations are shown in figures 6-10. Additional streamflow data are available from the U.S. Geological Survey, Water Resources Division District Offices in Albuquerque, N. Mex., Denver, Colo., Salt Lake City, Utah, and Tucson, Ariz.

Because most streams in the San Juan Basin are ephemeral, flood peaks are the most important feature of streamflow; however, flood data are meager for most of the basin. Therefore, maximum observed peak-discharge data for streams in northwest New Mexico, which are probably applicable over the entire basin, are presented in figure 11. These data carry no connotation of probability of occurrence. The envelope curve probably represents some large but unknown flood recurrence interval. Table 3 presents peak discharges for several selected streams in northwest New Mexico for recurrence intervals of 2 to 50 years, computed using the flood-frequency analysis of Scott (1971).

A number of ephemeral lakes and many stock-watering ponds occur within the basin. These lakes and ponds are generally small (under 50 acres) and widely scattered (4 to 8 per 10 mi^2), so they should have minimal effect on control of small, and no effect on control, of large floods. There

Table 2
Streamflow characteristics for selected streams
in New Mexico, Colorado, Utah, and Arizona
(see figures 7-10 for locations of gaging stations)

Station number	Station name	Drainage area (mi²)	Records used (years)	Mean annual discharge (ft^3/s)	Range of annual minimum daily discharge (ft^3/s)	Peak discharge at selected recurrence intervals, in ft^3/s						Maximum observed peak		
						2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Date	Discharge (ft^3/s)	Unit discharge [$(ft^3/s)/mi^2$]	Remarks
08213500	Rio Grande at Thirtymile Bridge, near Creede, Colorado	163	1912-22 1928-77	211	0.1 - 74	-	-	-	-	-	-	June 28, 1927	7,500	46.0	Transmountain diversions into basin above station. Flow regulated by Rio Grande Reservoir.
08218500	Goose Creek at Wagonwheel Gap, Colorado	90	1954-77	58.2	4.5 - 20	360	540	670	850	-	-	Sep. 14, 1970	879	9.8	Several small diversions above station for irrigation. Flow slightly affected by Lake Humphreys.
08223000	Rio Grande at Alamosa, Colorado	1,710	1914-77	248	1.0 -155	-	-	-	-	-	-	July 1, 1927	14,000	8.2	Flow affected by transmountain diversions, storage reservoirs, ground-water withdrawals, and irrigation.
08279500	Rio Grande at Embudo, New Mexico	10,400	1889-75	999	130 -496	-	-	-	-	-	-	June 19, 1903	16,200	1.6	Diversions above station for irrigation of about 620,000 acres in Colorado and 40,000 acres in New Mexico.
08284200	Willow Creek above Heron Reservoir, near Parkview, New Mexico	112	1963-76	-	.0 - .24	990	1,340	1,570	-	-	-	Aug. 11, 1967	1,600	14.3	Since Nov. 1970 includes San Juan River water imported through Azotea tunnel.
08289000	Rio Ojo Caliente at La Madera, New Mexico	419	1932-75	67.1	.6 - 6.2	1,070	1,750	2,200	2,760	3,150	3,540	Apr. 21, 1958	3,140	7.5	Diversions above station for irrigation of about 3,500 acres.
08290000	Rio Chama near Chamita, New Mexico	3,144	1912-70	541	.0 - 94	5,360	8,140	10,300	13,300	-	-	May 22, 1920	15,000	4.8	Diversions above station for irrigation of about 27,600 acres above and several hundred acres below. Flow partly regulated by El Vado Reservoir and Abiquiu Reservoir.
08316000	Santa Fe River near Santa Fe, New Mexico	18.2	1913-75	8.0	.10- 2.7	77	180	280	-	-	-	Aug. 14, 1921	1,500	82.4	Flow regulated by McClure Reservoir.
08318000	Galisteo Creek at Domingo, New Mexico	640	1943-67	13.2	.0 - .0	6,400	11,200	15,000	20,400	24,800	-	Aug. 20, 1935	24,300	38.0	Diversions above station for irrigation of about 50 acres.
08321500	Jemez River below East Fork, near Jemez Springs, New Mexico	173	1959-75	28.4	3.3 - 10.0	640	1,040	1,440	2,170	-	-	Apr. 21, 1958	2,520	14.6	
08321900	Rio de las Vacas near Senorita, New Mexico	26.8	1957-75	-	-	250	410	520	680	-	-	May 23, 1958	800	29.8	Partial-record station.
08323000	Rio Guadalupe at Box Canyon near Jemez, New Mexico	235	1939-42 1950-75	36.3	3.4 - 10.0	350	790	1,340	2,600	4,500	-	Apr. 21, 1958	1,440	6.1	Transmountain diversion for irrigation of about 300 acres. Flow partly regulated by San Guesorio Reservoir.
08329000	Jemez River below Jemez Canyon Dam, New Mexico	1,038	1936-37 1943-75	54.8	.0 - 1.0	4,400	10,000	14,500	20,500	-	-	Aug. 29, 1943	16,300	15.7	Diversions above station for irrigation of about 3,000 acres. Flow partly regulated by Jemez Canyon Reservoir.
08334000	Rio Puerco above Arroyo Chico near Guadalupe, New Mexico	420	1952-75	13.8	.0 - .0	2,840	4,010	4,780	5,740	6,440	-	July 29, 1967	6,940	16.5	Diversions above station for irrigation of about 3,700 acres in past years.
08340500	Arroyo Chico near Guadalupe, New Mexico	1,390	1944-75	22.6	.0 - .0	5,480	8,500	10,200	14,000	17,200	20,500	Sep. 12, 1972	15,200	10.9	Diversions above station for irrigation of about 100 acres.

Table 2
Streamflow characteristics for selected streams
in New Mexico, Colorado, Utah, and Arizona (continued)

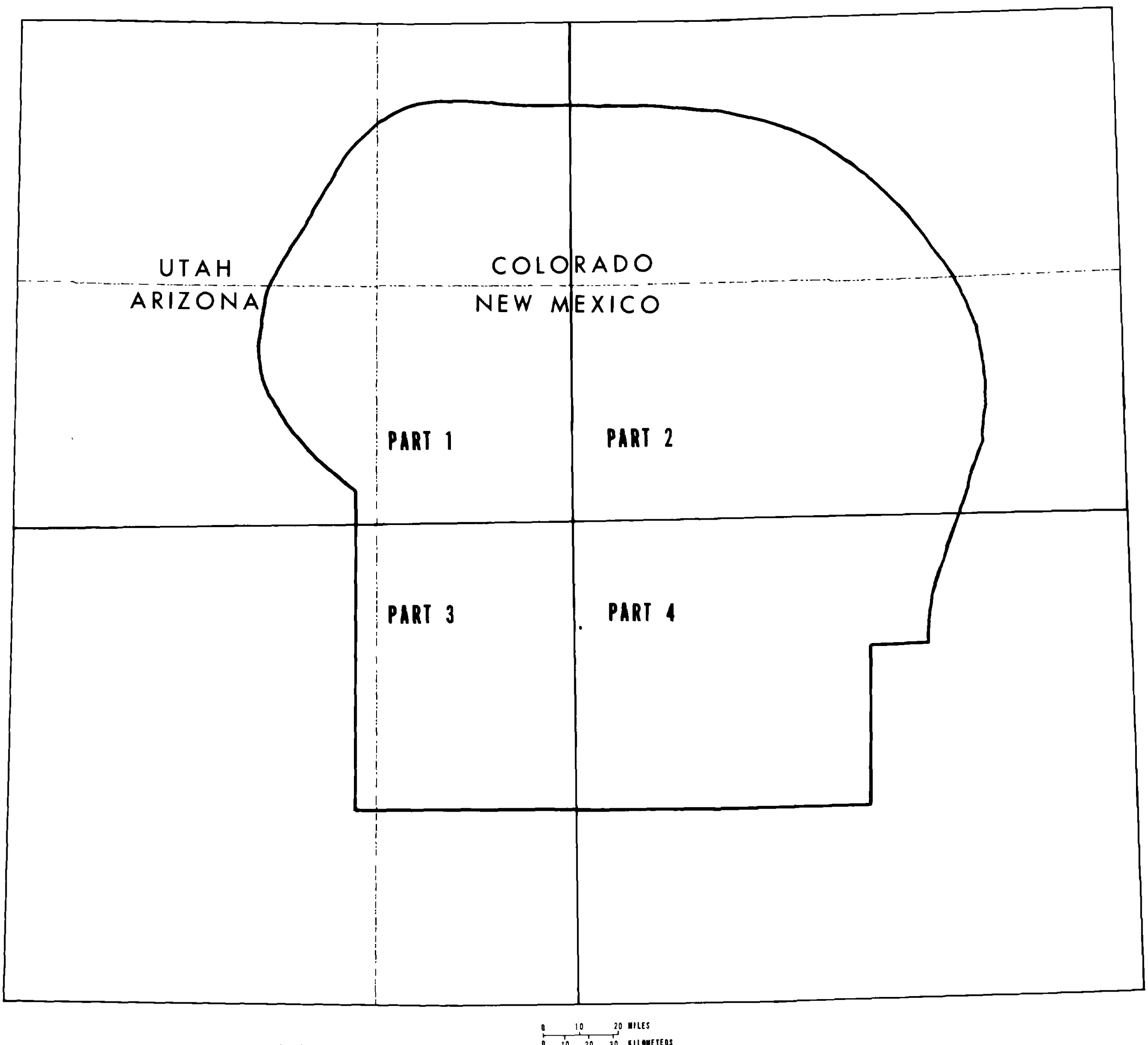
Station number	Station name	Drainage area (mi^2)	Records used (years)	Mean annual discharge (ft^3/s)	Range of annual minimum daily discharge (ft^3/s)	Peak discharge at selected recurrence intervals, in ft^3/s: 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Maximum observed peak: Date	Discharge (ft^3/s)	Unit discharge [(ft^3/s)/mi^2]	Remarks
08341300	Bluewater Creek above Bluewater Dam, near Bluewater, New Mexico	75	1953-71 1974-75	-	-	160	270	340	390	-	-	July, 1953	3,570	47.6	Partial record station.
08343100	Grants Canyon at Grants, New Mexico	13.0	1962-75	0.193	0.0 - 0.0	360	770	1,080	1,800	-	-	Aug. 26, 1963	1,550	119	
08343500	Rio San Jose near Grants, New Mexico	2,300	1936-75	6.50	2.7 - 4.6	-	-	-	-	-	-	Sep. 20, 1963	1,400	.6	Diversions and ground-water withdrawal for irrigation of about 5,100 acres above station. Flow partly regulated by Bluewater Lake.
08348500	Encinal Creek near Casa Blanca, New Mexico	6.19	1961-75	-	-	190	380	600	1,090	-	-	Sep. 9, 1967	4,330	699	Partial-record station.
08351500	Rio San Jose at Correo, New Mexico	3,660	1944-75	12.1	.0 - .0	1,920	3,690	5,420	7,690	9,890	12,400	Aug. 11, 1955	7,150	2.0	Flow regulated to some extent by Bluewater Lake. 1,130 mi^2 of area does not contribute to runoff.
08353000	Rio Puerco near Bernardo, New Mexico	7,350	1940-75	50.2	.0 - .0	4,540	8,000	10,600	14,000	16,700	19,500	Sep. 23, 1941	18,800	2.6	Diversions and ground-water withdrawal for irrigation of about 11,500 acres above station. 1,130 mi^2 of area does not contribute to runoff.
09166500	Dolores River at Dolores, Colorado	504	1896-1976	427	8.0 - 75	3,310	5,010	6,230	7,840	9,100	10,400	Oct. 5, 1911	10,000	19.8	Diversion for irrigation of about 2,000 acres above station. Flow partly regulated by Ground Hog Reservoir.
09340000	East Fork San Juan River near Pagosa Springs, Colorado	86.9	1935-76	119	5.5 - 20	920	1,350	1,650	2,050	2,360	2,670	Sep. 14, 1970	2,460	28.3	Diversions above station for irrigation of about 500 acres of hay meadows above station and a few small hay meadows below station.
09342500	San Juan River at Pagosa Springs, Colorado	298	1911-76	367	10 - 61	2,560	4,180	5,530	7,590	9,400	11,500	Oct. 5, 1911	25,000	83.9	Diversions for irrigation of large areas above station.
09346000	Navajo River at Edith, Colorado	172	1935-70	155	8.0 - 56	840	1,300	1,670	2,230	2,710	3,230	Apr. 23, 1942	2,840	16.5	Diversions for irrigation of about 1,700 acres above station.
09349500	Piedra River near Piedra, Colorado	309	1940-73		17 - 70	2,030	3,430	4,690	6,740	8,670	11,000	Sep. 6, 1970	7,980	25.8	Diversions for irrigation of about 2,240 acres above station. Diversions above station for irrigation below.
09350500	San Juan River at Rosa, New Mexico	1,990	1911-65	1,193	39 -225	6,600	10,600	13,800	18,700	23,000	28,000	June 29, 1927	25,000	12.6	Diversions above station for irrigation of about 14,000 acres.
09353500	Los Piños River near Bayfield, Colorado	270	1929-77	350	3.2 - 76	2,480	3,330	3,840	4,430	-	-	July 27, 1957	13,800	51.1	Flow regulated by Vallecito Reservoir. Transmountain diversions above station.

Table 2
Streamflow characteristics for selected streams
in New Mexico, Colorado, Utah, and Arizona (continued)

ation number	Station name	Drainage area (mi²)	Records used (years)	Mean annual discharge (ft³/s)	Range of annual minimum daily discharge (ft³/s)	Peak discharge at selected recurrence intervals, in ft³/s: 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Maximum observed peak: Date	Discharge (ft³/s)	Unit discharge [(ft³/s)/mi²]	Remarks
09355700	Gobernador Canyon near Gobernador, New Mexico	19.8	1956-75	-	-	650	1,120	1,580	2,290	-	-	Aug. 6, 1963	3,450	174	Partial-record station.
09356400	Manzanares Canyon near Turley, New Mexico	3.1	1956-75	-	-	390	800	1,240	2,050	-	-	Aug. 3, 1969	2,210	713	Partial-record station.
09357200	Gallegos Canyon tributary near Nageezi, New Mexico	.2	1952-75	-	-	110	220	350	570	840	-	July 12, 1964	580	2,900	Partial-record station.
09357500	Animas River at Howardsville, Colorado	55.9	1936-76	103	9.0 - 18	970	1,260	1,470	1,740	1,950	2,165	June 18, 1949	1,980	35.4	
09361000	Hermosa Creek near Hermosa, Colorado	172	1920-28 1940-76	137	4.0 - 39	970	1,670	2,220	3,010	3,670	4,390	May 12, 1941	2,980	17.3	Diversions above station for irrigation of a few hay meadows.
09361500	Animas River at Durango, Colorado	692	1924-76	840	94 -255	4,690	6,980	8,910	11,900	14,600	17,700	Oct. 5, 1911	25,000	36.1	Diversions above station for irrigation of about 4,000 acres. Natural regulation by many lakes and regulation for power above station.
09364500	Animas River at Farmington, New Mexico	1,360	1921-75	924	2.4 -288	6,110	9,190	11,400	14,300	16,500	18,900	June 29, 1927	26,000	18.4	Diversions above station for irrigation of about 30,000 acres.
09365000	San Juan River at Farmington, New Mexico	7,240	1912-75	2,406	27 -918	13,100	22,500	30,900	44,500	57,100	72,100	June 29, 1927	68,000	9.4	Diversions above station for irrigation of about 86,000 acres. Flow partly regulated by Navajo Reservoir.
09365500	La Plata River at Hesparus, Colorado	37	1917-76	44.7	1.0 - 12	440	760	1,010	1,350	1,640	1,940	Sep. 22, 1941	1,880	50.8	Cherry Creek ditch exports water above station for irrigation of about 2,000 acres in Cherry Creek drainage.
09367500	La Plata River near Farmington, New Mexico	583	1938-75	26.0	.0 - 1.9	-	-	-	-	-	-	Sep. 10, 1939	-	-	Diversions above station for irrigation of about 24,000 acres.
09367530	Locke Arroyo near Kirtland, New Mexico	2.96	1951-75	-	-	120	270	420	710	1,010	-	Aug. 29, 1957	812	274	Partial-record station.
09367840	Yazzie Wash near Mexican Springs, New Mexico	2.1	1937-42 1953-54 1956-75	-	-	390	730	1,030	1,520	1,970	-	1941	1,390	662	Partial-record station.
09367860	Chusca Wash near Mexican Springs, New Mexico	8.7	1937-42 1953-75	-	-	1,110	2,510	3,950	6,100	8,000	-	Oct. 15, 1967	6,400	736	Partial-record station.
09367880	Catron Wash near Mexican Springs, New Mexico	26.9	1937-40 1956-75	-	-	1,710	3,420	4,650	6,220	7,600	-	Oct. 15, 1967	4,750	177	Partial-record station.
09367900	Black Springs Wash near Mexican Springs, New Mexico	7.05	1954-75	-	-	428	1,030	1,520	2,700	3,750	-	Aug. 18, 1955	2,200	312	Partial-record station.
09367950	Chaco River near Waterflow, New Mexico	4,350	1959-69	-	-	3,900	7,100	8,000	-	-	-	Sep. 20, 1969	7,300	1.7	Partial-record station.
09368000	San Juan River at Shiprock, New Mexico	12,900	1926-75	2,216	8 -1,150	14,300	25,300	35,100	51,000	65,700	83,400	Aug. 11, 1929	80,000	6.2	Diversions above station for irrigation of about 118,000 acres. Flow partly regulated by Navajo Reservoir.

Table 2
Streamflow characteristics for selected streams
in New Mexico, Colorado, Utah, and Arizona (continued)

tation number	Station name	Drainage area (mi^2)	Records used (years)	Mean annual discharge (ft^3/s)	Range of annual minimum daily discharge (ft^3/s)	Peak discharge at selected recurrence intervals, in ft^3/s						Maximum observed peak			Remarks
						2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Date	Discharge (ft^3/s)	Unit discharge [(ft^3/s)/mi^2]	
09371000	Mancos River near Towaoc, Colorado	550	1922-76	50.1	0.0 - 8.0	1,210	2,290	3,210	4,630	5,880	7,310	Oct. 14, 1941	5,300	9.6	Diversions above station for irrigation of about 10,000 acres above station and 100 acres below station. Flow regulated by Jackson Gulch Reservoir.
09372200	McElmo Creek near Bluff, Utah	720	1959-70	-	-	560	1,610	2,780	4,990	-	-	Sep. 6, 1970	13,100	18.2	Partial-record station.
09378950	Comb Wash near Blanding, Utah	10.3	1959-68	-	-	650	1,650	2,670	4,470	-	-	Aug. 1, 1968	3,430	333	Partial-record station.
09379060	Lukachukai Creek tributary near Lukachukai, Arizona	1.37	1963-75	-	-	13	44	83	160	-	-	Jan. 6, 1965	227	166	Partial-record station.
09379100	Long House Wash near Kayenta, Arizona	1.38	1962-75	-	-	320	910	1,580	2,810	-	-	July 30, 1967	2,060	1,490	Partial-record station.
09379300	Lime Creek near Mexican Hat, Utah	32	1959-73	-	-	1,440	4,500	8,170	15,400	-	-	Oct. 3, 1967	6,600	206	Partial-record station.
09379500	San Juan River near Bluff, Utah	23,000	1915-77	2,570	0 -1,310	15,800	27,100	36,600	51,300	64,300	79,300	Sep. 10, 1927	70,000	3.0	Diversions above station for irrigation of about 200,000 acres. Flow partly regulated by Navajo Reservoir.
09386900	Rio Nutria near Ramah, New Mexico	71.4	1970-75	4.63	.01- 0.05	240	590	900	-	-	-	Apr. 14, 1973	782	11.0	
09386950	Zuni River above Black Rock Reservoir, New Mexico	810	1970-75	10.2	.0 - .0	1,140	3,600	6,500	-	-	-	Aug. 4, 1974	5,200	6.4	
09387050	Galestena Canyon tributary near Black Rock, New Mexico	19	1957-75	-	-	150	350	500	750	-	-	Sep. 5, 1970	660	34.7	Partial-record station.
09395400	Milk Ranch Canyon near Fort Wingate, New Mexico	14.0	1953-75	-	-	65	170	260	410	-	-	1949	1,360	97.1	Partial-record station.
09395500	Puerco River at Gallup, New Mexico	558	1940-45 1956-75	-	-	3.280	6,140	8,130	10,600	12,300	-	July 17, 1972	12,000	21.5	Partial-record station.
09395600	Wagon Trail Wash near Gamerco, New Mexico	.38	1951-74	-	-	75	180	270	400	510		Aug. 17, 1958	437	1,150	Partial-record station.
09395850	Black Creek tributary near Window Rock, Arizona	.28	1963-75	-	-	130	145	165	180	-	-	Aug. 1968	171	611	Partial-record station.
09396400	Dead Wash tributary near Holbrook, Arizona	1.0	1963-75	-	-	200	420	600	900	-	-	Aug. 1967	743	743	Partial-record station.



EXPLANATION

3795 Partial record surface–water gaging station

3722 Daily record surface–water gaging station

3555 Daily record surface–water gaging station, with chemical quality data

3505 Daily record surface–water gaging station, withchemical quality and radiochemical data

2870 Daily record surface–water gaging station, with sediment data

A Ground–water well, with radiochemical data

Community with public water–supply system

These various symbols may be combined in different ways. Number is the gaging station identification number, letter refers to well number table.

Map Letter	Well Number
A	354145108135501
B	354332108165501
C	354345108175001
D	354514108190601
E	355415107252801
F	355425107314401
G	355558107293301
H	355534107275701
I	355702107340501
J	355723107312201
K	353534108355201
L	354342108184001
M	355302107130501
N	360313107473401
O	361008107543901
P	360941107561601
Q	360857107531001
R	360823107544001
S	360849107561801
T	360622107561601
U	361446108090801
V	361446108083701
W	350232107263701
X	350240107291201
Y	350344107391901
Z	350349107413401

Figure 6.- Index to location of stream-gaging stations, ground-water wells, and public water-supply systems. This figure and the four that follow are common to three reports supporting the San Juan Basin Regional Uranium Study, and contain more information than needed by any one of the repor s.

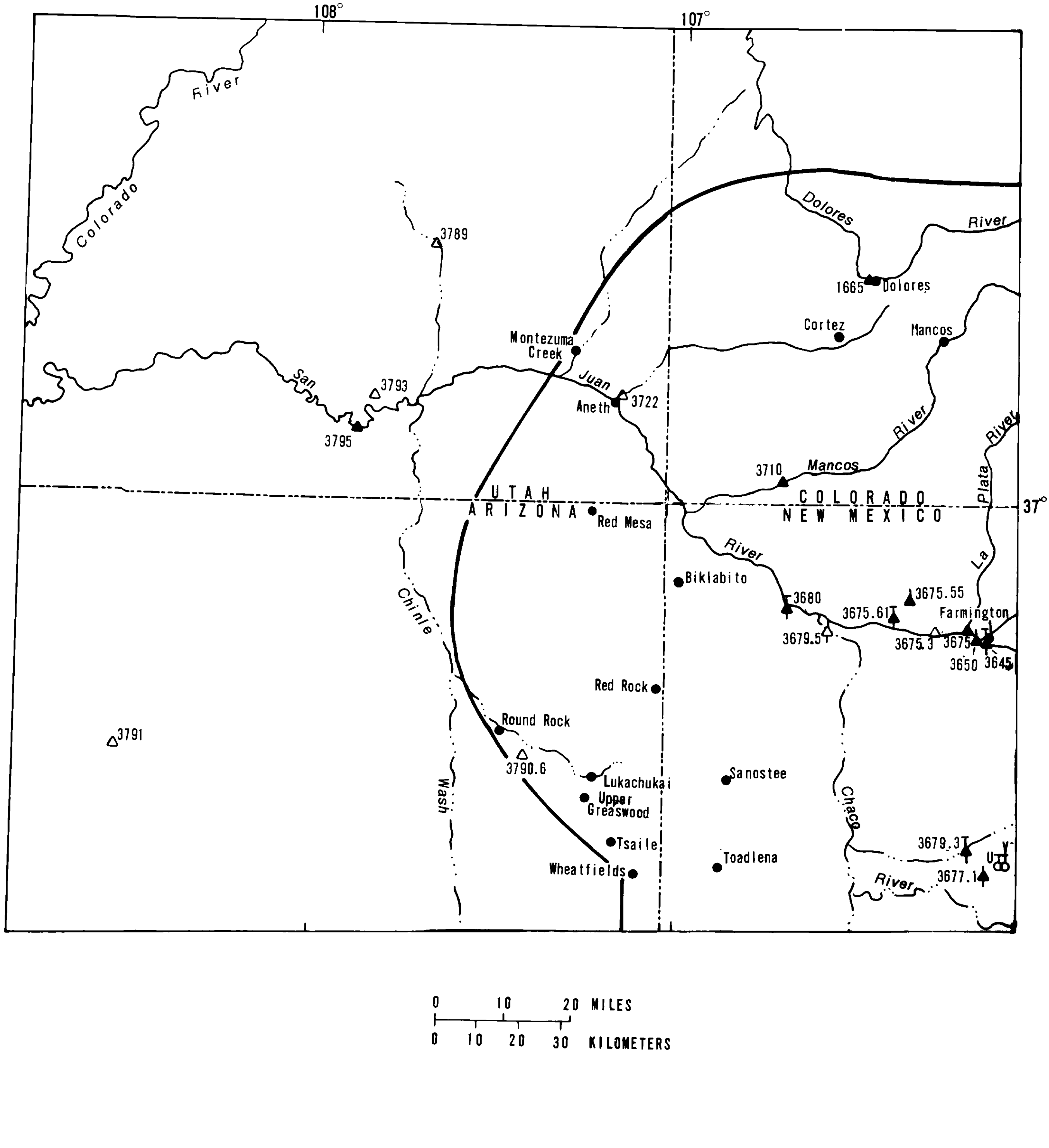


FIGURE 7 -Location of stream-gaging stations, ground-water wells, and public water-supply systems, Part 1

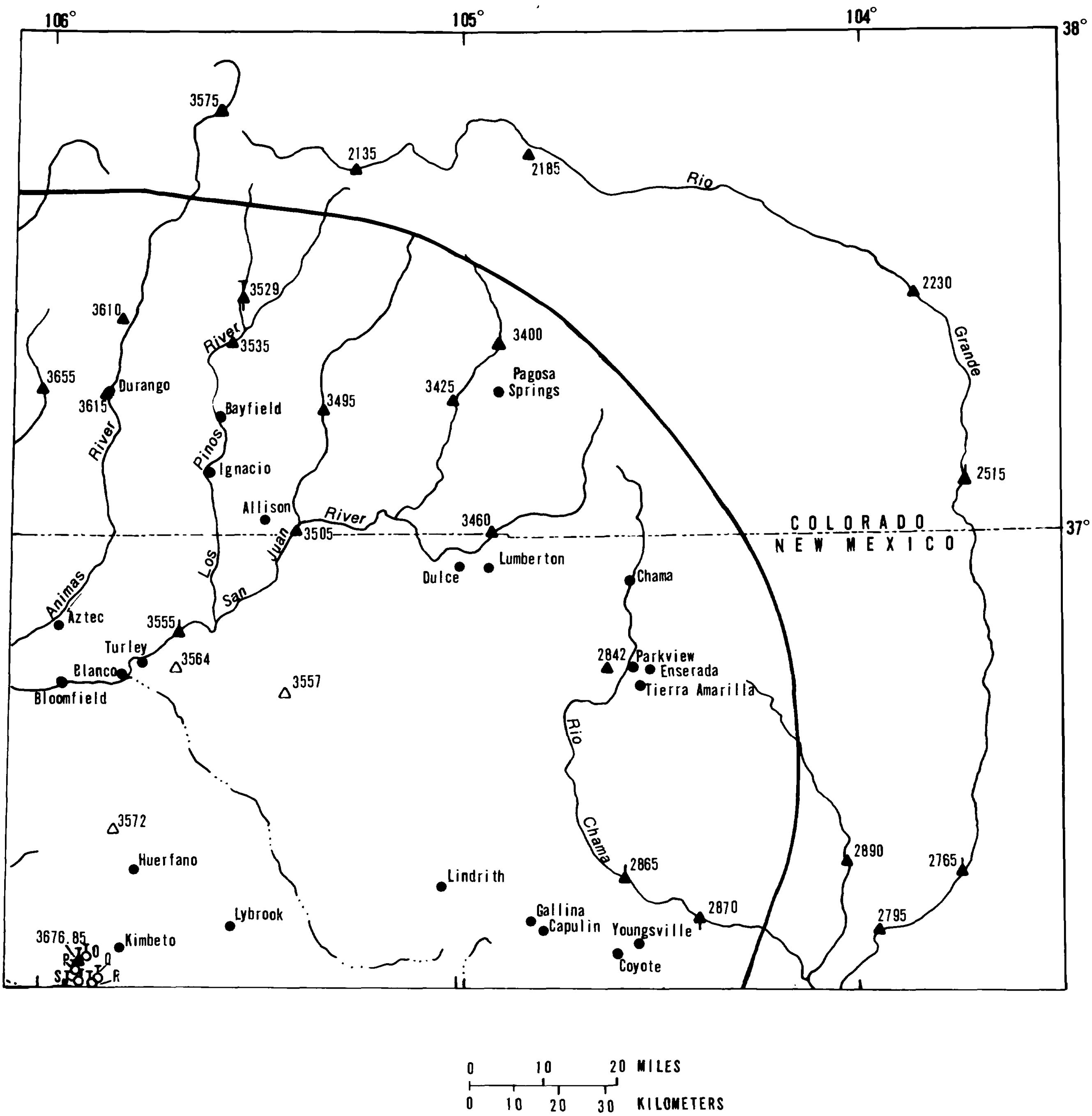


FIGURE 8 - Location of stream-gaging stations, ground-water wells, and public water-supply systems, Part 2

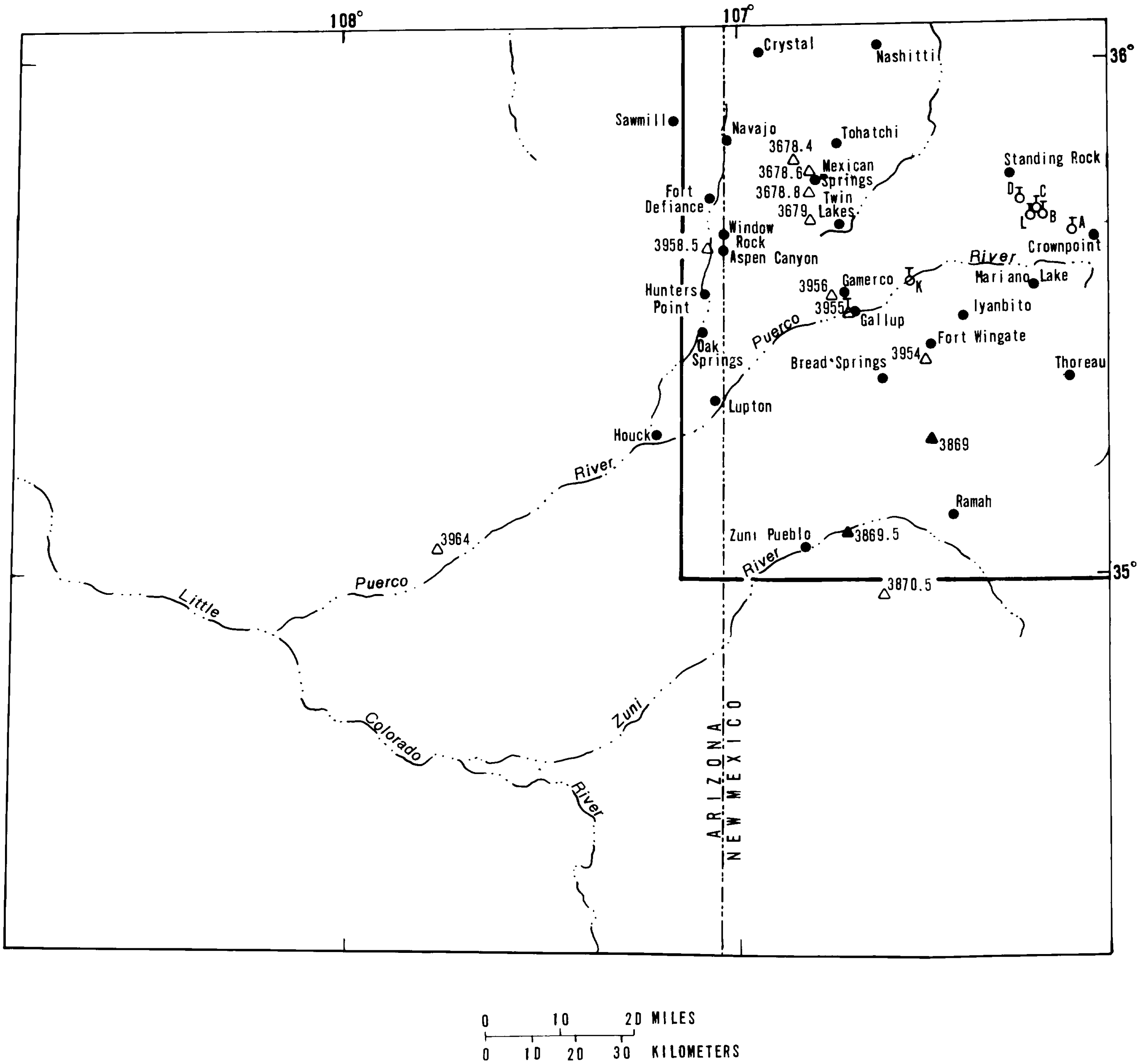


FIGURE 9 —Location of stream-gaging stations, ground-water wells, and public water-supply systems, Part 3

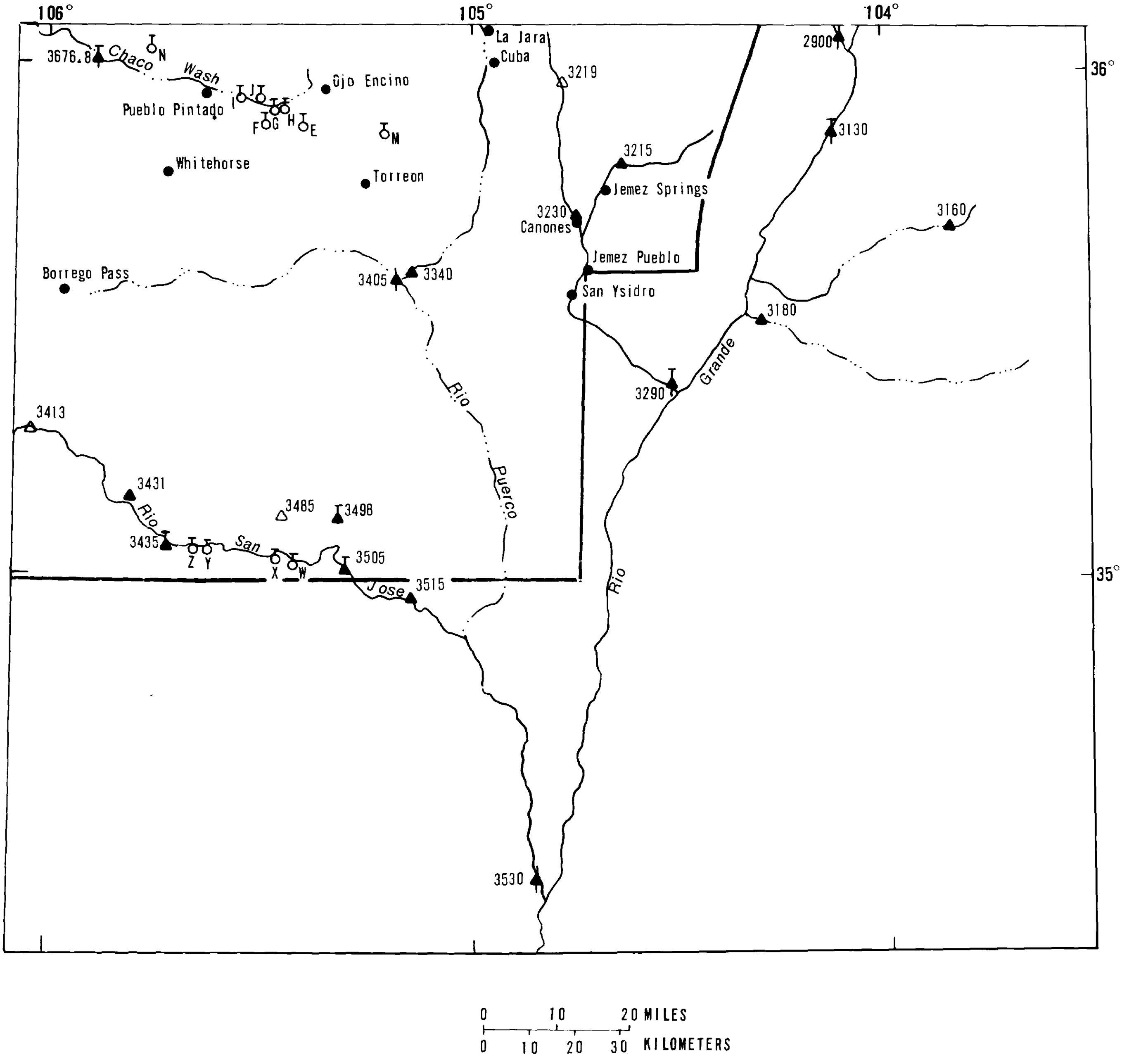


FIGURE 10-Location of stream-gaging stations, ground-water wells, and public water-supply systems, Part 4

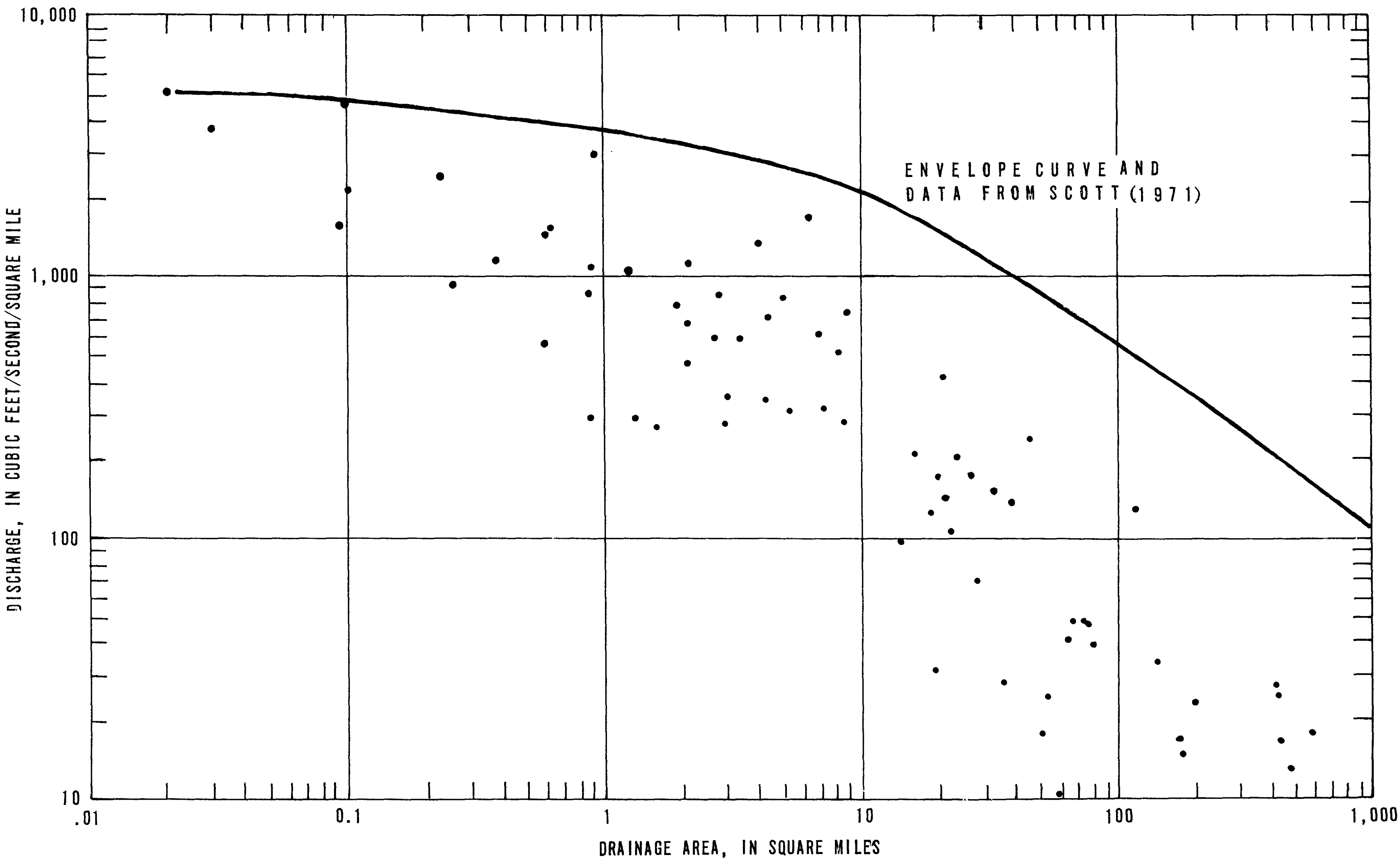


FIGURE 11.--Maximum observed discharges in Northwest New Mexico.

Table 3. Peak discharges computed for selected streams in northwest New Mexico

Stream	Drainage area (mi^2)	Mean annual discharge (ft^3/s)	Peak discharge at selected recurrence intervals, in ft^3/s				
			2-yr	5-yr	10-yr	25-yr	50-yr
Arroyo Chijuilla	66.4	2.39	770	1,900	2,900	4,300	5,300
Sandoval Arroyo	26.5	.22	570	1,300	1,900	2,800	3,400
Papers Wash	69.1	.91	860	2,100	3,000	4,400	5,500
Arroyo Piedra Lumbre	78.0	2.19	970	2,200	3,200	4,500	5,500
Arroyo de Puerto	93.8	1.12	920	2,400	3,500	5,100	6,200
La Fragua Canyon	46.4	4.54	840	1,700	2,400	3,300	4,000
Little Pump Canyon	15.2	1.13	520	1,000	1,500	2,100	2,700
Palluche Wash	40.5	1.86	780	1,600	2,400	3,700	4,800
Kutz Canyon	51.0	1.50	920	1,900	2,600	3,700	4,700
West Fork Gallegos Canyon	76.5	1.50	1,300	2,300	3,200	4,700	5,800
Hutch Canyon	8.08	.07	400	810	1,200	1,700	2,200
Arroyo Pueblo Alto	2.54	.05	180	400	590	870	1,100
Pueblo Pintado Canyon	7.06	.14	300	700	1,100	1,600	2,100
Escavada Wash	89.2	1.62	1,300	2,400	3,400	4,700	5,800
Ah-shi-sle-pah Wash	43.1	.67	770	1,700	2,600	3,800	5,000
Kim-me-ni-oli Wash tributary	34.2	.25	750	1,500	2,200	3,200	4,100
Coal Creek	51.4	1.12	840	1,800	2,800	4,200	5,400
Puerco River	277	8.90	1,400	2,800	4,100	5,900	7,400
South Fork Puerco River tributary	11.2	.57	300	660	980	1,500	1,900
Burned Death Wash	53.3	1.90	720	1,500	2,200	3,300	4,100

are also a number of small perennial lakes and ponds in the high mountains. In addition, several reservoirs within the basin, used for irrigation storage, desilting, flood control, and recreation include the Navajo Reservoir (1,708,600 acre-ft), Heron Reservoir (401,300 acre-ft), El Vado Reservoir (196,500 acre-ft), Vallecito Reservoir (126,300 acre-ft), Lemon Reservoir (40,100 acre-ft), Bluewater Lake (38,500 acre-ft), and Jackson Gulch Reservoir (10,000 acre-ft). The effects of these reservoirs, lakes, and ponds range from complete control to minor regulation of flows on the various rivers.

SURFACE WATER QUALITY

Chemical quality of surface water for most of the study area is similar to other waters in arid to semiarid regions of the southwestern United States that are underlain by Cretaceous and Tertiary sedimentary rocks. Generally, surface water in the basin is high in dissolved solids. Sodium, bicarbonate, and sulfate are the predominant ions. Only streamflow from the high mountains is low in dissolved solids.

During the initial part of a flow event, water quality is usually poor because accumulations of soluble materials on the watershed are flushed downstream. The soluble materials originate from weathered soils and rocks, animal and plant wastes, and residues from evaporation of saline water. After initial flushing, water quality improves progressively throughout the flow event, down to the final trickles, which are high in dissolved solids in seepage from bank storage. Flows during the early part of the storm season are generally of poorer quality than those later in the season.

Some surface flows are captured in small, natural depressions or behind small dams. This impounded water usually disappears quickly. Some is consumed by livestock or is used to irrigate local plots, but major losses are through infiltration and evapotranspiration.

Chemical-quality changes in water in the ponds or reservoirs result primarily from evaporation, which concentrates the more soluble constituents and precipitates the less soluble constituents. Chemical-quality changes may also occur through changes in atmospheric conditions and through biological activity. Highly concentrated solutions develop during the last stages of evaporation in the lowest parts of the reservoirs, and some infiltrate into the subsurface. Water of poor quality may enter shallow aquifers near these reservoirs or ponds; however, if infiltration rates are high in the bed of a reservoir, impounded water of fair quality would seep into the aquifers before total evaporation, resulting in better quality water being available to wells.

Water-quality parameters most likely to be impacted by the energy-related development are: turbidity (sediment), total dissolved solids, dissolved oxygen, biochemical-oxygen demand, pH, nitrogen, and the various radiochemicals. A change in one parameter may simultaneously produce changes in other parameters, due to their interactions. For example, an increase in turbidity from increased sediment may produce an increase in water temperature and a decrease in dissolved oxygen. For an extensive discussion of the complex interrelations of all water-quality parameters, refer to McKee and Wolf (1963). Hem (1970) discussed the significance of many chemical constituents in natural waters.

Indicators of the overall chemistry of a stream are specific-conductance values and dissolved-solids concentrations. Generally, the higher the specific-conductance and dissolved-solids concentrations, the poorer the quality of water. The U.S. Environmental Protection Agency (National Academy of Sciences, National Academy of Engineering, 1974) recommends that the concentration of dissolved solids not exceed 500 mg/L in drinking waters, but allows 1,000 mg/L if better water is not available. Extremes of these parameters for streams in the area having short, partial records are listed in table 4. More complete chemical-quality data collected on a regular basis for several streams in the area are listed in tables 5 and 6.

Radiochemical constituent concentrations are fairly low in most of the natural streamflow in the basin; however, because of the relatively high level of uranium occurring in the basin, the concentrations are higher than those outside the basin. Comparison of radiochemical concentrations for Vallecito Creek with those of Chaco Wash shows the difference. Vallecito Creek always meets the drinking-water standards (National Academy of Sciences, National Academy of Engineering, 1972), and Chaco Wash sometimes does not. In contrast, streams that receive waste water from the uranium mining and milling (Rio Paguate, Rio San Jose, and Puerco River) show levels of concentrations many times the standard. Radiochemical data collected at regular gaging stations are presented in table 7. Locations of all station sites are shown in figures 7-10.

Table 4. Observed specific conductance and dissolved solids for selected streams in New Mexico and Colorado

Station number (see figs. 7-10)	Station name	Specific conductance Min. (µmhos)	Specific conductance Max. (µmhos)	Dissolved solids Min. (mg/L)	Dissolved solids Max. (mg/L)
08251500	Rio Grande near Lobatos, Colorado	170	1,140	131	592
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico	150	390	127	250
08286500	Rio Chama above Abiquiu Reservoir, New Mexico	153	1,320	--	--
08340500	Arroyo Chico near Guadalupe, New Mexico	3,350		2,380	
08343500	Rio San Jose near Grants, New Mexico	1,350		829	
08349800	Rio Paguate below Jackpile Mine near Laguna, New Mexico	1,400		1,240	
09355500	San Juan River near Archuleta, New Mexico	199	480	140	171
09367555	Shumway Arroyo near Fruitland, New Mexico	700	950	449	
09367680	Chaco Wash at Chaco Canyon National Monument, New Mexico	265	720	162	469
09367710	De-na-zin Wash near Bisti Trading Post, New Mexico	480	1,500	--	--
09367950	Chaco River near Waterflow, New Mexico	805	3,250	1,110	2,640

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Part I)

(for locations of sampling sites see figs. 7-10)

Water year	Total number of samples [1]	Temperature (°C)	Turbidity (JTU)	Color (platinum-cobalt units)	Specific conductance (μmhos)	Dissolved oxygen (mg/L)	5-Day biochemical oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	pH (units)	Alkalinity as $CaCO_3$ (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hardness (mg/L)	Dissolved solids (ton/d)
08290000 Rio Chama near Chamita, New Mexico														
1961	12	2.2-26.7	--	--	--	--	--	--	--	--	--	--	--	--
1963	24	7.8-25.0	--	--	214- 697	--	--	--	7.2-8.4	--	80-222	0- 4	84- 254	--
1964	32	--	--	--	206-1,000	--	--	--	7.1-8.5	--	90-256	0- 5	86- 391	[2]1,747
1965	22	--	--	--	182- 779	--	--	--	7.1-7.8	--	82-228	[3]0	78- 370	65.7 - 595
1966	29	1.7-25.6	--	--	207- 980	--	--	--	7.1-7.9	--	97-232	0	89- 376	--
1967	44	.0-29.4	--	--	284- 924	--	--	--	7.0-8.0	--	106-264	0	111- 344	--
1968	35	1.0-26.0	--	--	211- 856	--	--	--	6.9-7.6	82-185	100-226	0	92- 310	44.6 -1,130
1969	32	.0-23.0	--	--	132- 810	8.2-11.4	0.5-2.3	--	7.1-7.7	63-190	77-232	0	72- 322	59.1 -1,060
1970	18	1.0-24.5	--	--	176- 895	--	--	--	7.3-8.3	67-165	82-201	1- 1	76- 304	110 - 829
1971	20	.0-25.0	2- 120	0- 80	206- 946	--	--	--	7.2-8.1	79-222	96-271	0	86- 390	1.81- 611
1972	36	.0-24.5	3- 300	0-100	225- 701	--	--	--	7.0-8.2	88-195	107-238	0	110- 230	21.5 - 481
1973	38	1.0-21.5	0- 380	5- 50	210- 757	--	--	--	6.9-8.2	69-138	83-168	0	84- 250	102 - 869
1974	19	1.0-25.6	--	--	277- 790	--	--	--	7.9-8.3	80-181	97-221	0	110- 300	57.0 - 530
1975 (May)[4]	9	.0-23.9	--	--	289- 740	--	--	--	7.9-8.3	171-196	209-239	0	220- 250	72.3 - 89.3
08313000 Rio Grande at Otowi Bridge, New Mexico														
1960	365	--	--	--	211- 613	--	--	--	7.5-8.5	--	89-179	0- 2	83- 276	--
1961	365	5.6-24.4	--	--	237- 749	--	--	--	7.3-8.7	--	96-211	0- 8	100- 336	178 -2,180
1962	365	--	--	--	229- 565	--	--	--	7.5-8.9	--	96-188	0-13	93- 208	--
1963	365	1.7-27.8	--	--	231-1,310	--	--	--	7.1-8.4	--	94-264	0- 8	90- 702	110 -1,590
1964	365	--	--	--	243-1,010	--	--	--	7.5-8.2	--	114-360	--	100- 332	132 -1,440
1965	365	--	--	--	255- 528	--	--	--	7.6-8.1	--	101-182	0	100- 222	166 -3,390
1966	365	4.4-26.7	--	--	261- 594	--	--	--	7.6-8.0	83-148	101-180	0	104- 224	200 -1,800
1967	365	5.0-23.3	--	--	272- 835	--	--	--	7.4-8.1	92-166	112-202	0	103- 342	215 -2,490
1968	365	3.0-25.0	--	--	225- 565	--	--	--	6.8-8.4	67-153	88-186	0	83- 228	211 -2,600
1969	365	3.0-26.0	--	--	200- 939	6.9-11.4	0.8-2.4	[2]28	7.5-8.5	76-185	93-226	0	87- 440	283 -3,680
1970	365	.0-26.0	10- 200	5- 45	200- 778	7.0-11.4	.9-4.9	3- 37	7.6-8.6	73-148	85-181	0- 4	83- 316	281 -1,670
1971	365	.5-26.0	7- 110	3- 80	254- 582	6.7-12.0	.7-4.2	3- 14	7.5-8.6	81-153	99-186	0- 8	92- 220	195 -1,120
1972	365	.0-27.0	20- 325	3- 40	274- 802	7.6-11.8	.7-2.6	4- 10	7.5-8.6	86-202	105-246	0	95- 330	200 -2,180
1973	365	.0-23.0	9- 140	5- 50	217- 502	7.4-11.2	--	--	7.0-8.9	68-141	83-172	0- 7	86- 190	174 -3,190
1974	365	.0-20.5	8- 200	--	295- 628	6.5-11.3	--	8- 14	7.4-8.9	45-135	45-164	0- 5	110- 290	188 -1,450
1975	365	.0-25.0	7- 200	--	209- 493	7.4-12.0	--	4- 39	7.9-8.7	70-168	87-180	0- 3	83- 180	273 -2,370
1976	365	.5-22.0	30- 250	--	217- 450	7.7-12.3	--	3- 59	7.7-8.6	65-121	79-141	0	79- 170	312 -1,170
1977 (Mar)[4]	182	1.0-14.0	8- 25	--	340- 450	9.8-12.8	--	3- 55	7.5-8.2	110-143	140-174	0	130- 160	234 - 402

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)

Water year	Total number of samples[1]	Temperature (°C)	Turbidity (JTU)	Color (platinum-cobalt units)	Specific conductance (µmhos)	Dissolved oxygen (mg/L)	5-Day biochemical oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	pH (units)	Alkalinity as $CaCO_3$ (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hardness (mg/L)	Dissolved solids (ton/d)
					08329000 Jemez River below Jemez Canyon Dam, New Mexico									
1966	5	--	--	--	630-1,720	--	--	--	7.4-7.7	--	195-330	0	134- 236	--
1967	13	0.0-24.4	--	--	1,080-3,540	--	--	--	7.2-8.2	--	232-582	0	168-1,220	--
1968	12	.0-31.0	--	--	456-2,630	--	--	--	7.3-7.9	98-266	119-324	0	115- 664	17.3 -3,430
1969	12	5.0-21.0	--	--	457-2,830	--	--	--	7.5-8.1	101-264	123-322	0	128- 810	3.0 - 244
1970	6	8.0-25.0	--	--	1,010-3,030	--	--	--	7.6-8.2	84-234	103-344	0	162- 985	5.22-1,200
1972	10	.0-13.0	--	--	612-1,545	--	--	--	7.9-8.4	152-251	185-306	0- 8	160- 280	4.68- 61
1973	23	.5-29.5	200-1,900	8- 10	305-1,390	--	--	--	7.4-8.2	84-254	104-310	0	85- 300	15.9 -5,390
1974	38	.0-24.5	84- 210	--	564-3,090	--	--	--	7.7-8.4	131-294	160-361	0	130- 410	2.74- 331
1975	23	.0-24.0	--	--	339-2,320	--	--	--	7.7-8.3	96-417	117-509	0	89- 400	13.5 - 360
1976	9	5.0-17.0	--	--	840-4,700	--	--	--	7.6-8.4	171-272	207-332	0- 4	130- 890	3.39- 92.9
1977 (Jan)[4]	4	.0- 8.5	--	--	2,320-2,700	--	--	--	7.7-8.0	240-386	287-470	0	270- 390	23.7 - 107
					08353000 Rio Puerco near Bernardo, New Mexico									
1961	15	12.8-23.9	--	--	1,730-3,050	--	--	--	7.2-7.8	--	171-201	--	410- 672	40.1 -4,340
1963	18	5.6-26.1	--	--	1,610-4,980	--	--	--	7.1-7.6	--	150-275	--	452-1,570	37.0 -4,320
1964	7	--	--	--	1,020-3,440	--	--	--	6.9-7.7	--	225-324	0	260-1,100	43.6 -2,877
1966	20	13.9-25.6	--	--	1,000-3,880	--	--	--	7.0-7.6	--	120-343	0	425-1,580	--
1967	--	15.5-26.6	--	--	435-4,920	--	--	--	7.2-7.7	--	144-446	0	170-1,330	--
1968	--	14.0-25.0	--	--	964-11,400	--	--	--	7.3-7.8	131-239	160-292	0	250-2,000	6.74-6,560
1969	--	8.0-30.0	--	--	503-3,740	--	--	--	7.3-8.2	108-302	132-368	0	118-1,100	41.6 -2,420
1970	31	16.0-29.5	--	--	722-4,490	--	--	--	7.2-8.2	100-290	122-354	0	150-1,360	16.5 -11,100
1971	20	5.0-25.0	--	--	1,250-4,240	--	--	--	7.4-7.9	146-353	178-430	0	390-1,500	20.4 -1,230
1972	33	.0-25.5	--	--	823-3,400	--	--	--	7.4-8.2	124-282	151-344	0	220-1,200	48.9 -11,500
1973	--	8.0-24.0	--	--	541-3,210	--	--	--	6.8-8.2	94-215	104-262	0	130- 850	16.7 -1,920
1974	17	15.0-20.0	--	--	437-3,200	--	--	--	6.9-8.3	79-214	96-261	0	97-1,100	6.19-7,700
1975	--	9.0-26.5	--	--	754-3,730	--	--	--	6.7-8.3	95-209	116-255	0	170-1,100	3.50-3,280
1976	10	23.0-27.0	--	--	492-2,960	--	--	--	7.0-8.4	102-285	124-347	0	160-1,200	[2]1.71

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part I)

Water year	Total number of samples[1]	Temperature (°C)	Turbidity (JTU)	Color (platinum-cobalt units)	Specific conductance (µmhos)	Dissolved oxygen (mg/L)	5-Day biochemical oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	pH (units)	Alkalinity as $CaCO_3$ (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hardness (mg/L)	Dissolved solids (ton/d)
					09352900 Vallecito Creek near Bayfield, Colorado									
1963	2	--	--	--	68	--	--	--	7.4	--	30	--	35	22
1964	14	0.0-10.6	--	--	48- 99	--	--	--	6.6-7.5	--	22- 43	--	22- 43	1.2 - 27.5
1965	13	.0-10.0	--	--	45- 84	--	--	--	--	--	--	--	--	--
1966	13	.0-10.6	--	--	43- 88	--	--	--	6.7-7.5	16- 29	19- 40	0	20- 41	13.6
1967	9	1.1-5.0	--	--	42- 88	--	--	--	7.0-7.3	16- 36	20- 44	0	22- 44	4.7
1968	10	0 -11.0	--	--	42- 87	--	--	--	6.9-7.4	16- 34	19- 42	0	22- 42	1.4 - 91.8
1969	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1970	2	--	--	--	68	--	--	--	7.8	23	28	0	28	6.4
1971	19	0 -11.0	--	--	41- 100	8.2-14.2	0.1-1.4	--	7.2-8.6	16- 43	19- 52	0	16- 40	1.8 - 51.7
1972	19	0 -12.0	--	--	55- 98	9.0-12.2	0 -3.6	--	6.5-9.6	18- 39	22- 47	0	20- 48	2.1 - 45.1
1973	20	0 -11.0	--	--	33- 120	8.4-11.8	0 -2.0	--	6.6-8.9	16- 37	19- 45	0	15- 50	4.0 - 66.6
1974	16	0 -15.0	--	--	42- 94	6.8-10.4	--	--	7.2-8.2	14- 38	17- 46	0	18- 43	2.1 - 37.5
1975	16	0 -13.0	--	--	41- 89	9.4-11.2	--	--	7.8-8.4	13- 34	16- 41	0	18- 41	1.7 - 83.1
1976	11	0 -14.0	--	--	55- 120	7.5- 9.9	--	--	7.8-8.5	11- 37	14- 45	0	12- 71	.8 - 40.5
1977	13	0 - 9.0	--	--	49- 100	8.0-11.5	--	--	6.5-8.4	16- 43	19- 52	0	23- 54	1.4 - 20.6
1978	13	0 - 9.0	--	--	47- 90	8.3-10.8	--	--	7.3-8.6	14- 26	24- 32	0	23- 37	1.3 - 46.4
					09364500 Animas River at Farmington, New Mexico									
1960	365	1.1-15.6	--	--	220-1,090	--	--	--	7.0-8.3	--	65-223	0- 2	89- 420	83.4 -2,910
1961	365	1.1-26.1	--	--	222-1,340	--	--	--	7.1-8.0	--	71-209	--	92- 608	118 -1,360
1962	365	--	--	--	216-1,150	--	--	--	7.2-8.2	--	60-216	--	88- 418	156 -1,340
1963	365	5.6-24.4	--	--	239-1,160	--	--	--	7.0-8.4	--	72-228	0- 6	102- 425	115 -1,170
1964	365	--	--	--	220- 959	--	--	--	7.3-8.1	--	68-240	--	93- 400	184 -1,340
1965	365	--	--	--	219- 944	--	--	--	7.6-8.0	--	74-208	0	94- 378	209 -3,231
1966	365	5.6-27.8	--	--	266- 921	--	--	--	7.4-8.1	74-166	90-202	0	104- 326	235 -1,340
1967	365	6.7-23.3	--	--	292- 898	--	--	--	7.3-8.2	74-220	90-238	0	124- 380	161 -1,530
1968	365	4.0-22.0	--	0- 15	214- 871	--	--	--	7.0-8.0	54-180	76-220	0	90- 362	192 -1,930
1969	365	5.0-25.0	--	3- 5	227- 931	--	--	--	7.5-8.4	66-187	80-228	0- 6	99- 360	229 -1,180
1970	--	.0-20.0	17- 225	0- 25	273- 765	7.4-12.4	.8-2.5	0- 16	7.6-8.6	75-171	91-208	0	117- 320	286 -3,820
1971	18	1.5-26.5	14- 35	5- 15	231- 920	8.3-12.5	.8-1.4	5- 9	7.4-8.7	64-177	78-216	0- 3	98- 350	108 -1,170
1972	18	1.0-27.5	15- 320	3- 10	364- 912	8.0-12.2	.6-2.8	3- 8	7.6-8.6	83-196	101-239	0	140- 370	278 - 810
1973	21	.0-20.5	10- 150	<3	255- 676	7.6-11.7	--	--	7.3-8.8	79-169	96-206	0	110- 280	273 -1,930
1974	16	.5-25.0	--	--	354-1,030	--	--	--	7.7-8.9	79-186	96-227	0	160- 410	41.5 -1,800
1975	22	.5-21.0	3-3,400	--	205- 833	7.1-12.4	--	2-210	7.9-8.9	53-175	65-213	0	82- 350	347 -1,700
1976	13	2.5-24.0	0-1,800	--	260- 895	9.1-13.0	--	1-110	7.8-8.6	69-189	82-230	0	100- 370	291 -1,320
1977 (Feb)[4]	5	.0-10.5	6- 15	--	750- 950	11.2-12.6	--	0-110	7.9-8.3	135-191	164-233	0	290- 370	259 - 362

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part I)

Water year	Total number of samples[1]	Temperature (°C)	Turbidity (JTU)	Color (platinum-cobalt units)	Specific conductance (μmhos)	Dissolved oxygen (mg/L)	5-Day biochemical oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	pH (units)	Alkalinity as $CaCO_3$ (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hardness (mg/L)	Dissolved solids (ton/d)
					09365000 San Juan River at Farmington, New Mexico									
1962	--	--	--	--	164- 950	--	--	--	7.5-8.0	--	63-184	--	65- 260	291 -2,450
1963	365	--	--	--	340-1,540	--	--	--	7.4-8.0	--	82-334	--	124- 404	302 -4,090
1964	365	--	--	--	266-1,140	--	--	--	7.4-8.0	--	84-276	--	108- 376	400 **-18,970**
1965	365	--	--	--	207-1,020	--	--	--	7.4-8.0	--	72-208	0	84- 264	495 -6,430
1966	365	--	--	--	266-1,840	--	--	--	7.5-7.9	66-277	80-388	0	96- 464	439 -3,580
1967	365	--	--	--	335-1,850	--	--	--	7.3-8.0	79-236	98-288	0	118- 400	432 **-16,630**
1968	365	--	--	--	252-1,580	--	--	--	6.9-7.8	61-239	74-292	0	104- 820	416 **-10,600**
1969	365	0.0-24.0	--	--	259-1,220	5.4-11.7	0.4-2.0	10- 22	7.1-8.6	75-185	92-226	0-16	104- 300	467 -5,440
1970	365	2.0-22.5	29- 300	3- 20	279-2,290	6.8-12.0	.6-4.9	6- 21	7.0-8.7	68-220	83-268	0-12	111- 565	458 **-10,400**
1971	365	3.5-27.0	12- 85	3- 55	265- 930	6.6-12.1	.4-2.6	1- 22	6.9-8.6	71-200	87-254	0	90- 370	400 -2,460
1972	365	7.5-26.0	20- 850	3- 10	360-1,580	7.9-12.2	.5-3.2	2- 8	6.9-8.5	84-274	102-334	0	130- 390	345 -3,240
1973	365	3.0-18.0	10-2,000	3- 60	263- 946	8.2-10.8	--	--	7.4-8.4	75-226	92-276	0	100- 290	537 **-10,800**
1974	365	2.5-23.0	--	--	318-2,050	6.9-11.6	--	--	7.6-8.6	77-302	94-368	0- 2	110- 490	441 -4,370
1975	365	.0-**19.0**	[2]4,600	--	255-1,050	7.2-12.5	--	[2]340	7.2-8.4	63-203	77-247	0	100- 240	825 -4,020
1976	365	7.5-34.0	[2]25	--	307-1,000	6.4-11.0	--	[2]2	7.5-8.5	80-158	92-193	0- 4	110- 320	0.12-4,200
1977 (Feb)[4]	--	.0-14.0	[2]85	-	400- 911	10.4-11.4	--	[2]16	7.5-8.3	92-110	113-134	0	140- 210	682 -2,150
					09367561 Shumway Arroyo near Waterflow, New Mexico									
1974	5	15.0-24.0	--	--	2,190-**11,900**	--	--	--	7.9-**10.4**	44-142	54-173	0	650-4,400	[2]31.6
1975	52	.0-33.0	8- 130	--	3,330-**12,200**	6.3-11.2	--	25- 49	2.4-**10.4**	0-260	0-317	0-42	250-3,600	0.67- 12.9
1976	16	.0-30.5	2- 200	--	3,500-**16,300**	7.0-12.1	--	24- 68	6.6-9.2	8-332	10-405	0-12	620-3,600	0 - 24.5
1977 (Mar)[4]	14	.0-31.0	5- 420	--	1,300-**15,000**	7.9-11.0	--	18-170	7.0-8.8	26-273	32-333	0-20	500-3,200	3.60- 37.3
					09367930 Hunter Wash at Bisti Trading Post, New Mexico									
1974	4	[2]14.5	--	--	--	--	--	--	--	--	--	--	--	--
1975	37	14.0-31.0	--	--	482-1,780	--	--	--	7.5-9.8	92-166	65-202	0-23	18- 120	.0 - **280,000**
1976	22	[2]30.0	310- 550	--	435-2,500	--	--	--	6.9-8.4	0-275	0-335	0	27- 300	.33- 14.7

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part I)

Water year	Total number of samples[1]	Temperature (°C)	Turbidity (JTU)	Color (platinum-cobalt units)	Specific conductance (µmhos)	Dissolved oxygen (mg/L)	5-Day biochemical oxygen demand (mg/L)	Chemical oxygen demand (mg/L)	pH (units)	Alkalinity as $CaCO_3$ (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hardness (mg/L)	Dissolved solids (ton/d)
					09368000 San Juan River at Shiprock, New Mexico									
1960	365	0.0-22.2	--	--	201-1,870	--	--	--	7.1-8.5	--	66-240	0-11	76- 570	271-20,680
1961	365	--	--	--	231-1,330	--	--	--	7.2-8.4	--	74-304	0- 6	87- 580	363-11,450
1962	365	--	--	--	244-2,340	--	--	--	6.9-9.1	--	20-229	0-16	86- 695	364- 6,450
1963	365	2.8-28.9	--	--	403-2,490	--	--	--	7.0-8.2	--	92-322	--	164- 780	148-11,840
1964	365	--	--	--	358-1,690	--	--	--	7.2-8.2	--	70-308	--	136- 718	362-18,000
1965	365	--	--	--	253-1,360	--	--	--	7.4-8.1	--	78-220	0	96- 540	775-23,440
1966	365	6.1-25.6	--	--	372-1,710	--	--	--	7.4-8.1	80-218	98-266	0	134- 490	620- 4,380
1967	365	--	--	--	493-1,750	--	--	--	7.2-8.2	46-235	56-286	0	178- 560	377-18,630
1968	365	3.0-29.0	--	--	304-1,430	--	--	--	6.8-8.2	66-233	80-284	0	118- 364	605-13,700
1969	365	.0-25.0	--	--	303-1,220	[2]5.0	1.4-2.3	--	7.1-8.3	48-231	58-282	0- 6	120- 386	967- 7,540
1970	365	3.0-28.5	60- 530	3- 10	307-1,890	6.0-11.5	1.2-6.6	1- 20	7.3-8.4	67-230	82-280	0- 4	124- 600	489-20,000
1971	365	4.5-30.0	14- 90	3- 35	350-1,700	7.5-10.8	.6-1.4	2- 14	7.3-8.7	21-199	25-243	0	140- 610	513- 5,950
1972	365	.0-21.5	20-2,000	5- 15	343-2,660	7.7-12.1	.8-2.1	4- 11	7.2-8.7	32-238	39-290	0	120- 800	272- 8,510
1973	365	.5-19.5	1-2,600	4- 25	278-1,190	7.7-12.0	--	--	7.4-8.6	78-223	94-272	0- 7	110- 330	816-12,300
1974	365	1.0-25.0	--	--	418-1,550	7.7-11.1	--	[2]11	7.5-9.0	48-236	48-288	0- 5	120- 420	357- 4,490
1975	365	.0-28.0	20-7,200	--	280-1,030	7.9-12.8	--	6-400	7.5-8.9	62-215	76-262	0-11	110- 340	1,090-10,300
1976	365	3.0-18.0	14- 13,000	--	315-6,860	7.8-12.2	--	1-200	7.5-9.0	49-220	48-220	0- 7	120- 400	598- 5,730
1977 (Feb)[4]	212	1.5- 7.5	20- 150	--	552- 990	10.8-14.5	--	17-100	7.2-8.2	109-139	125-171	0	190- 320	852- 1,620
					09395500 Puerco River at Gallup, New Mexico									
1975	30	3.0-29.5	--	--	493-1,030	--	--	--	[2]7.6	101-277	123-338	0	45- 250	[2]3.66
1976	365	[2]21.5	--	--	587-1,030	--	--	--	7.5-8.9	141-290	141-353	0-15	52- 170	--
1977 (Mar)[4]	243	[2]11.0	--	--	652- 962	--	--	--	7.7-8.2	193-258	235-315	0	71- 140	--

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part II)

Water year	Dissolved calcium (mg/L)	Dissolved magnesium (mg/L)	Dissolved sodium (mg/L)	Dissolved potassium (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)	Dissolved fluoride (mg/L)	Dissolved silica (mg/L)	Dissolved iron (µg/L)	Total nitrogen (mg/L)	Total phosphorus (mg/L)	Fecal coliform (col./100 mL)	Streptococci (col./100 mL)
08290000 Rio Chama near Chamito, New Mexico													
1961	--	--	--	--	--	--	--	--	--	--	--	--	--
1963	--	--	--	--	3.0- 19	--	--	--	--	--	--	--	--
1964	[2]128	--	11 - 73	[2]5.0	2.2- 35	25 - 182	0.2-0.5	[2]16	[2]150	--	--	--	--
1965	26 - 81	3.2- 20	7.2- 58	1.6- 4.6	1.8- 21	22 - 196	.1- .4	10 -19	10- 60	--	--	--	--
1966	30 -106	3.4- 27	7.6- 74	1.8- 4.4	1.8- 24	22 - 314	.1- .5	11 -20	0- 20	--	--	--	--
1967	36 - 98	4.4- 24	9.2- 85	1.8- 3.8	2.6- 24	34 - 265	.2- .5	13 -22	0- 10	--	--	--	--
1968	31 - 94	3.5- 22	7.4- 19	2.2- 3.3	1.8- 20	20 - 273	.2- .4	14 -21	[2]0	--	--	--	--
1969	24 - 90	2.4- 24	15 - 25	2.4- 3.0	1.9- 16	23 - 230	.0- .5	13 -21	[2]70	--	--	< 1- 200	<1- 300
1970	25 - 95	3.3- 18	39 - 46	3.0- 3.4	1.2- 14	18 - 252	.2- .5	12 -20	10- 80	--	--	--	--
1971	28 -130	4.5- 16	10 - 59	1.7- 5.3	2.8- 20	31 - 360	.1- .5	15 -24	[2]60	--	--	--	--
1972	33 - 71	5.7- 14	10 - 65	1.6- 4.2	3.0- 18	24 - 160	.1- .5	13 -23	10- 180	--	--	--	--
1973	26 - 72	4.7- 18	8.8- 65	1.8- 3.7	2.1- 11	36 - 240	.1- .5	12 -20	9- 50	--	--	--	--
1974	35 - 81	5.7- 23	11 - 53	2.0- 3.8	2.5- 21	49 - 220	.0- .9	14 -18	5- 40	--	--	--	--
1975 (May)[4]	69 - 73	12 - 17	50 - 58	3.5- 4.6	14 - 24	120 - 350	.3- .5	18 -23	[2]10	--	--	--	--
08313000 Rio Grande at Otowi Bridge, New Mexico													
1960	28 - 78	3.0- 13	9.7- 37	[2]3.2	3.2- 12	25 - 171	[2]0.8	19 -36	[2]10	--	--	--	--
1961	36 -113	2.4- 13	9.8- 54	--	2.6- 14	27 - 230	--	2.7-60	--	--	--	--	--
1962	32 - 71	3.2- 11	9.5- 49	[2]5.1	2.6- 15	26 - 129	--	18 -32	--	--	--	--	--
1963	30 -258	2.2- 15	11 - 50	--	3.0- 14	2.2- 602	--	17 -34	--	--	--	--	--
1964	9.8-159	3.6- 16	11 - 63	[2]2.8	3.0- 10	2.0- 366	[2].5	16 -44	--	--	--	--	--
1965	34 - 75	2.2- 10	10 - 32	2.3- 3.4	3.2- 9.9	36 - 119	--	17 -30	--	--	--	--	--
1966	35 - 64	3.4- 16	13 - 41	[2]4.2	4.0- 12	36 - 159	[2].8	19 -27	[2]30	--	--	--	--
1967	33 -114	5.0- 16	17 - 52	[2]3.9	5.0- 13	38 - 282	[2].5	17 -28	[2]10	--	--	--	--
1968	27 - 77	3.8- 9.6	10 - 25	[2]3.2	2.3- 12	28 - 126	[2].4	18 -29	[2]100	--	--	--	--
1969	30 -150	2.9- 23	[2]30	[2]3.4	1.3- 14	27 - 374	[2].5	16 -27	[2]110	--	--	< 1- 15,000	<1- 70
1970	26 -105	2.2- 14	11 - 35	1.8- 4.2	.0- 36	32 - 249	.3- .8	15 -30	0- 30	[2]0.57	[2]0.06	< 10- 3,880	<10- 150
1971	27 - 60	5.3- 12	11 - 44	2.5- 4.9	3.5- 44	33 - 130	.3- .9	18 -31	[2]180	[2].55	[2].40	10- 540	10- 320
1972	29 -110	5.6- 14	14 - 49	2.3- 5.0	3.7- 33	3.7- 260	.3- .7	17 -32	10- 170	0.38- 0.81	0.18- 0.49	0- 2,300	0- 70
1973	27 - 61	3.7- 10	9.7- 36	2.3- 4.0	2.4- 9.2	29 - 120	.2- .7	11 -26	20- 60	.20- 1.2	.08- .52	3- 8,200	--
1974	34 - 98	5.6- 11	14 - 31	2.3- 3.9	3.8- 10	43 - 230	.2-1.1	12 -28	0- 890	.39- 1.1	.07- .32	20- 6,400	15- 420
1975	26 - 56	4.4- 11	9.7- 34	1.7- 4.5	2.6- 11	28 - 120	.2- .7	15 -27	10- 830	.10- 1.6	.04- .23	60- 2,300	48- 2,500
1976	22 - 51	4.6- 10	12 - 27	1.8- 3.5	2.7- 9.8	31 - 110	.2- .5	12 -23	0- 530	.36- 1.5	.10- .52	270- 12,000	100- 1,450
1977 (Mar)[4]	39 - 49	7.4- 8.6	23 - 28	3.0- 3.7	7.2- 13	49 - 72	.4- .7	20 -27	10- 20	.36- .81	.06- .12	[2]223	55- 8,128

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued) (Part II)

Water year	Dissolved calcium (mg/L)	Dissolved magnesium (mg/L)	Dissolved sodium (mg/L)	Dissolved potassium (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)	Dissolved fluoride (mg/L)	Dissolved silica (mg/L)	Dissolved iron (µg/L)	Total nitrogen (mg/L)	Total phosphorus (mg/L)	Fecal coliform (col./100 mL)	Streptococci (col./100 mL)
08329000 Jemez River below Jemez Canyon Dam, New Mexico													
1966	46 - 79	4.6- 9.5	81 - 278	[2]15	77 - 228	40 - 266	[2]1.5	25 -39	[2]10	--	--	--	--
1967	56 -423	6.9- 40	165 - 438	1.9- 18	102 - 306	84 -1,500	0.7-2.0	17 -43	0- 100	--	--	--	--
1968	40 -232	3.6- 22	49 - 164	5.0- 11	35 - 308	38 - 712	.6-1.4	20 -43	0- 50	--	--	--	--
1969	41 -284	5.4- 25	55 - 344	5.7- 17	42 - 270	44 -1,020	.5-1.8	8.3-40	20- 60	--	--	--	--
1970	57 -335	4.9- 36	[2]146	[2]2.9	134 - 236	96 -1,200	[2]1.2	21 -35	[2]10	--	--	--	--
1972	34 - 94	4.5- 11	82 - 230	9.1- 14	71 - 210	59 - 240	.8-1.5	27 -38	0- 20	--	--	--	--
1973	29 -100	3.0- 15	26 - 270	4.0- 16	19 - 230	32 - 360	.2-1.2	20 -35	9- 20	--	--	--	--
1974	43 -140	5.7- 15	98 - 440	8.8- 18	66 - 486	66 - 640	.9-2.3	28 -44	[2]20	--	--	--	--
1975	31 -130	2.7- 18	31 - 370	4.3- 22	26 - 340	31 - 480	.3-1.6	16 -52	0- 20	--	--	--	--
1976	42 -300	6.5- 33	130 - 770	11 - 25	110 - 610	99 -1,500	.9-1.5	20 -36	[2]0	--	--	--	--
1977 (Jan)[4]	87 -110	13 - 27	320 - 400	16 - 21	310 - 370	340 - 410	1.0-1.7	29 -37	[2]0	--	--	--	--
08353000 Rio Puerco near Bernardo, New Mexico													
1961	124 -199	17 - 43	210 - 473	6.8- 15	33 - 298	730 -1,050	.7-1.0	7.1-17	0- 20	--	--	--	--
1963	142 -512	24 - 71	163 - 720	7.4- 17	41 - 398	667 -2,340	.6-1.2	11 -16	10- 30	--	--	--	--
1964	196 -299	--	275 - 417	4.5- 12	30 - 108	178 -1,660	.6- .8	14 -16	20- 40	--	--	--	--
1966	74 -472	10 - 98	81 -1,230	7.6- 9.0	31 - 975	651 -2,630	[2].7	11 -18	[2]10	--	--	--	--
1967	53 -444	9.2- 90	33 - 712	[2]8.6	17 - 572	22 -1,690	.8-1.2	11 -22	0- 30	--	--	--	--
1968	73 -612	17 -115	213 - 319	4.4- 11	43 -1,800	283 -4,100	.7-1.0	12 -20	50- 130	--	--	--	--
1969	37 -302	6.2- 98	256 - 381	[2]6.2	40 - 202	77 -1,600	[2].7	13 -23	90- 300	--	--	--	--
1970	42 -390	9.7- 94	171 - 427	[2]7.5	32 - 145	186 -2,270	[2].8	11 -19	[2]20	--	--	--	--
1971	120 -430	21 - 94	130 - 500	8.4- 11	37 - 350	460 -2,200	.3- .9	11 -19	[2]10	--	--	--	--
1972	70 -370	12 - 72	93 - 390	5.6- 12	39 - 260	200 -1,500	.6-1.2	6.3-18	[2]40	--	--	--	--
1973	130 -240	6.3- 80	59 - 440	4.8- 11	29 - 290	140 -1,300	.5-1.3	7.7-15	[2]40	--	--	--	--
1974	32 -330	4.2- 64	45 - 400	5.4- 16	20 - 170	86 -1,500	.5-1.0	8.8-24	--	--	--	--	--
1975	54 -280	8.5- 87	74 - 520	6.4- 13	33 - 260	210 -1,700	.5-1.1	7.0-15	[2]20	--	--	--	--
1976	51 -340	6.7- 76	41 - 320	5.6- 11	23 - 130	86 -1,500	.5-1.2	7.8-16	[2]210	--	--	--	--

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part II)

Water year	Dissolved calcium (mg/L)	Dissolved magnesium (mg/L)	Dissolved sodium (mg/L)	Dissolved potassium (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)	Dissolved fluoride (mg/L)	Dissolved silica (mg/L)	Dissolved iron (μg/L)	Total nitrogen (mg/L)	Total phosphorus (mg/L)	Fecal coliform (col./100 mL)	Streptococci (col./100 mL)
09352900 Vallecito Creek near Bayfield, Colorado													
1963	11	1.8	0.8	0.4	2.0	9.0	0.2	3.2	--	--	--	--	--
1964	10 - 14	1.9- 3.2	0.3- 6.7	0.2- 0.6	0.6- 3.0	3.1- 14	0.1-0.2	3.3- 4.0	0- 150	--	--	--	--
1965	--	--	--	--	--	--	--	--	--	--	--	--	--
1966	8.0	2.2	.8	.4	.4- 2.1	7.3	.2	3.3	--	--	--	--	--
1967	10	1.6	1.2	.6	.4	9.9	.3	3.6	--	--	--	--	--
1968	6.4- 12	.5- 3.9	.5- 1.7	.2- .8	.8- 1.5	5.0- 10	.2- .4	2.4- 3.9	--	--	--	--	--
1969	--	--	--	--	--	--	--	--	--	--	--	--	--
1970	8.6	1.6	.8	.6	.9	5.2	.3	3.1	--	--	--	--	--
1971	4.9- 12	1.0- 2.4	.5- 1.8	.2- 3.9	0 - 1.9	4.5- 10	.1- .5	2.6- 5.0	0- 120	0.08- 0.2 0	- 1.3	0- 16	0- 40
1972	6.0- 13	1.3- 2.7	.1- 5.1	.3- 1.0	.1 - 10	6.1- 18	.1- .3	2.7- 5.0	0- 180	.06- .22	--	0- 2	0- 7
1973	4.6- 14	.8- 3.6	.7- 3.1	.4- 1.1	.1 - 2.2	4.3- 14	0 - .4	2.3- 4.6	9- 70	.01- .22	--	0- 4	0- 18
1974	5.3- 13	1.1- 2.6	.2- 2.9	.7- 1.1	.1 - 2.6	6.4- 9.9	.2- .6	2.6-24	0- 340	.03- .12	--	0- 34	0- 46
1975	6.2- 13	.5- 2.8	0 - 2.2	.5- 1.0	0 - 2.0	4.1- 10	.1- .3	2.7- 4.5	0- 100	--	--	0- 67	0- 62
1976	3.6- 24	.8- 3.2	.5- 1.6	.5- .8	.2 - 1.1	4.4- 14	.2- .3	2.3- 3.8	0- 120	.07- .21	--	0- 6	0- 4
1977	6.9- 16	1.5- 4.0	.8- 3.5	.5- 1.0	.3 - 1.2	7.1- 46	.2- .4	2.8- 4.3	0- 90	.15- .35	--	0- 7	0- 41
1978	6.9- 12	1.3- 2.4	.3- 1.1	.3- .8	.4 - 14	3.6- 17	.2- .4	2.7- 4.9	50- 210	.07- .24 0	- .02	0- 8	0- 55
09364500 Animas River at Farmington, New Mexico													
1960	28 -136	4.6- 20	8.3- 81	1.7- 5.9	6.4 - 42	61 - 264	.3- .6	7.9-11	0- 60	--	--	--	--
1961	34 -211	1.7- 20	1.1- 98	1.6- 5.2	6.0 - 42	41 - 324	.3- .6	6.0-10	10- 40	--	--	--	--
1962	30 -131	3.2- 22	5.7- 98	1.7- 4.2	7.6 - 41	52 - 226	.2- .7	7.3-12	0- 10	--	--	--	--
1963	36 -138	2.9- 20	6.3- 92	1.1- 6.2	4.4 - 42	49 - 368	.4- .6	6.0-13	0- 20	--	--	--	--
1964	38 -133	3.2- 17	5.7- 64	1.2- 4.6	3.4 - 41	43 - 274	.3- .5	5.8-15	0- 110	--	--	--	--
1965	31 -118	3.0- 20	4.1- 59	1.4- 4.3	2.7 - 34	49 - 281	.2- .7	6.9-11	0- 120	--	--	--	--
1966	24 -105	3.9- 21	6.2- 76	1.8- 6.4	8.4 - 31	83 - 228	.3- .5	6.4- 9.4	0- 10	--	--	--	--
1967	42 -124	4.6- 21	2.3- 61	2.0- 3.4	7.5 - 31	71 - 226	.3- .4	7.0-11	0- 20	--	--	--	--
1968	29 -120	3.8- 20	5.8- 53	2.1- 4.0	2.7 - 32	90 - 224	.3- .5	8.2-12	0- 60	--	--	--	--
1969	35 -119	2.8- 55	6.6- 47	1.3- 4.3	1.8 - 28	37 - 258	.3- .6	4.9-15	0- 40	--	--	--	--
1970	38 -105	3.9- 19	6.9- 339	.9- 3.4	2.7 - 22	53 - 225	.3- .7	5.0-17	0- 50	--	.0 - .04	10- 1,520	<10- 90
1971	32 -110	4.3- 18	7.9- 53	1.1- 3.7	4.0 - 24	54 - 260	.1- .6	5.5- 9.0	10- 120	[2]0.33	.02- .08	[2]40	[2]50
1972	52 -120	6.7- 18	14 - 52	1.8- 4.4	7.7 - 30	84 - 250	.3- .5	6.4- 9.6	10- 600	.13- .72	.06- .16	--	--
1973	36 -990	5.1- 16	6.4- 36	1.0- 3.2	3.7 - 21	47 - 170	.2- .6	5.6- 8.8	0- 60	.17- 4.4	.05- .51	--	--
1974	48 -130	6.3- 21	12 - 64	1.7- 4.7	7.6 - 33	78 - 320	.3- .6	6.1-10	10- 80	.32- 16	.01- 1.9	--	--
1975	26 -110	4.2- 18	5.0- 50	1.0- 4.7	2.8 - 29	36 - 240	.2- .6	4.9- 9.2	10- 50	.28- 7.4	.03- 2.8	--	--
1976	37 -120	4.4- 17	5.8- 73	1.3- 3.8	3.8 - 28	44 - 300	.3- .7	5.5- 8.8	0- 130	.05- 5.1	.0 - .87	--	--
1977 (Feb)[4]	92 -120	15 - 18	39 - 49	3.2- 4.1	22 - 31	220 - 250	.4- .5	6.3- 8.9	0- 160	.11- .90	.01- .07	--	--

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part II)

Water year	Dissolved calcium (mg/L)	Dissolved magnesium (mg/L)	Dissolved sodium (mg/L)	Dissolved potassium (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)	Dissolved fluoride (mg/L)	Dissolved silica (mg/L)	Dissolved iron (μg/L)	Total nitrogen (mg/L)	Total phosphorus (mg/L)	Fecal coliform (col./100 mL)	Streptococci (col./100 mL)
09365000 San Juan River at Farmington, New Mexico													
1962	21 - 88	2.7- 11	7.6- 113	[2]2.4	2.0- 26	25 - 318	[2]0.3	7.8-15	[2]10	--	--	--	--
1963	42 -136	1.6- 22	10 - 210	2.3- 4.2	5.6- 48	61 - 537	[2].4	5.4-22	--	--	--	--	--
1964	39 -124	1.9- 16	10 - 186	2.4- 4.1	3.5- 31	55 - 532	--	6.4-23	--	--	--	--	--
1965	29 - 90	2.8- 13	8.1- 134	--	2.1- 17	39 - 342	--	5.9-15	--	--	--	--	--
1966	30 -148	3.6- 23	15 - 269	2.6- 4.2	3.1- 18	50 - 691	--	6.1-24	--	--	--	--	--
1967	5.1-168	.3- 19	5.0- 290	--	2.6- 22	77 - 810	--	6.0-19	--	--	--	--	--
1968	34 -276	4.5- 32	8.4- 209	--	2.8- 28	46 - 706	--	6.0-23	--	--	--	--	--
1969	36 -108	2.2- 12	11 - 150	1.8- 3.8	1.3- 17	48 - 406	[2].5	6.7-15	[2]110	--	--	<1-120,000	<10- 14,100
1970	34 -192	3.9- 23	9.8- 332	1.6- 3.4	2.6- 17	54 -1,000	0.2-0.7	5.9-27	0- 1,700	--	0.03- 0.23	20- 98,800	<10- 4,000
1971	27 -130	4.5- 13	10 - 100	1.2- 5.3	2.4- 20	49 - 270	.0- .8	6.0-16	20- 60	--	.18- .49	10- 50,000	10- 1,500
1972	40 -130	5.6- 17	19 - 200	1.8- 5.2	3.6- 50	83 - 550	.1- .7	4.5-17	10- 60	0.09- 0.76	.05- .44	<10-110,000	<10- 24,000
1973	32 -100	4.9- 13	11 - 96	1.3- 4.3	2.9- 17	48 - 270	.2-3.0	3.5-12	20- 50	.32- 4.0	.06- 2.0	27- 29,000	--
1974	34 -160	5.6- 21	20 - 300	1.7- 4.9	2.5- 19	56 - 330	.1- .5	4.5-33	10- 500	.38- 4.9	.03- 1.8	10- 31,000	--
1975	33 - 77	4.9- 12	10 - 140	.2- 4.9	2.7- 17	49 - 280	.1-1.2	4.7-23	0- 30	[2]4.2	[2]4.0	--	--
1976	34 -110	5.6- 10	12 - 140	1.4- 6.3	2.7- 16	56 - 430	.2- .6	5.9-11	0- 80	[2].35	[2].03	--	--
1977 (Feb)*	45 - 68	7.2- 11	25 - 120	1.9- 2.7	5.0- 160	96 - 190	.2- .3	8.0-10	0- 20	[2].92	[2].09	--	--
09367561 Shumway Arroyo near Waterflow, New Mexico													
1974	140 -470	74 -810	270 -1,900	6.1-23	99 - 620	940 -7,200	.7-1.1	.6-12	[2]0	--	--	--	--
1975	72 -680	16 -620	160 -2,000	6.8-29	28 - 830	390 -6,400	.6-2.0	.0-37	0-16,000	5.8 -26	.17- 1.5	0- 410	0- 1,000
1976	180 -510	42 -580	400 -3,400	10 -22	160 -1,900	1,700 -6,200	.6-1.3	3.5-11	0- 3,400	3.9 -29	.06- .78	0- 300	5- 4,700
1977	150 -480	31 -510	290 -1,700	7.0-21	54 - 690	870 -5,200	.4-1.9	4.1-47	0- 190	3.5 -21	.23- 4.5	0- 2,200	30- 520
09367930 Hunter Wash at Bisti Trading Post, New Mexico													
1974	--	--	--	--	--	--	--	--	--	--	--	--	--
1975	4.7- 41	.9- 4.2	98 -340	2.9- 6.3	6.2- 21	92 - 710	.7-1.5	12 -21	--	--	--	--	--
1976	8.1-100	.5- 12	91 -270	3.9-13	6.3- 18	52 - 460	.3-2.2	12 -27	20-16,000	--	--	--	--

Table 5. Ranges of physical and chemical properties of surface water in northwestern New Mexico and southwestern Colorado (Continued)
(Part II)

Water year	Dissolved calcium (mg/L)	Dissolved magnesium (mg/L)	Dissolved sodium (mg/L)	Dissolved potassium (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)	Dissolved fluoride (mg/L)	Dissolved silica (mg/L)	Dissolved iron (μg/L)	Total nitrogen (mg/L)	Total phosphorus (mg/L)	Fecal coliform (col./100 mL)	Streptococci (col./100 mL)
						09368000 San Juan River at Shiprock, New Mexico							
1960	32 -147	2.7- 51	9.3- 218	--	2.8- 74	38 - 729	--	9.0-20	--	--	--	--	--
1961	27 -208	1.1- 30	12 - 200	--	3.8- 61	46 - 720	--	9.2-21	--	--	--	--	--
1962	28 -171	4.6- 65	11 - 293	1.7- 5.3	3.8- 196	41 - 944	--	5.0-16	[2]78,000	--	--	--	--
1963	49 -202	4.1- 77	23 - 325	4.1- 6.9	8.7- 112	111 -1,080	--	3.0-23	--	--	--	--	--
1964	53 -238	3.9- 37	18 - 207	3.3- 3.8	5.7- 46	83 - 762	--	4.0-25	--	--	--	--	--
1965	25 -196	3.9- 21	13 - 162	--	3.2- 28	52 - 542	--	7.9-20	--	--	--	--	--
1966	41 -167	5.8- 21	21 - 260	[2]2.4	5.2- 25	92 - 642	0.2-0.7	6.1-19	0- 10	--	--	--	--
1967	52 -160	5.1- 43	39 - 291	2.9- 4.5	9.8- 44	135 - 702	.2- .9	3.3-18	0- 10	--	--	--	--
1968	38 -118	4.4- 24	15 - 68	2.1- 4.5	3.4- 34	62 - 494	.3- .7	1.9-19	0- 10	--	--	--	--
1969	1 -124	6.3- 23	20 - 86	1.7- 4.6	1.6- 25	64 - 412	.2- .7	8.3-20	10- 20	--	--	<[2]10	<[2]10
1970	36 -202	5.8- 23	3.5- 66	.8- 3.3	2.8- 86	62 - 702	.1- .7	3.6-19	0- 40	--	[2]0.07	<10- 51,000	<10- 780
1971	42 -200	4.8- 28	17 - 250	1.4- 6.0	5.9- 49	86 - 690	.1-1.0	.9-16	[2]50	[2]0.68	[2].23	100- 3,000	10- 180
1972	33 -240	6.9- 49	24 - 310	1.7- 9.7	7.4- 72	110 -1,200	.1-1.8	.4-23	0- 40	0.26- 4.1	0.11- 0.96	90- 16,000	<10- 530
1973	34 - 99	5.6- 20	11 - 160	1.4- 6.3	3.4- 24	56 - 370	.2- .7	2.9-15	9- 90	.48- 4.8	.10-33	220- 6,200	
1974	31 -140	7.9- 23	23 - 190	1.8- 6.6	7.6- 27	110 - 520	.2-1.3	2.2-15	0- 40	.61- 6.0	.04- 2.5	180- 13,000	
1975	33 -110	5.7- 18	12 - 140	1.5- 5.1	3.6- 23	58 - 330	.2-1.3	3.9-37	0- 40	.30-15	.08- 6.4	63- 19,000	110- 8,200
1976	24 -120	6.0- 36	15 - 180	1.6- 6.8	4.4- 44	65 - 550	.2- .7	.2-11	0- 80	.40- 6.8	.07- 1.2	34- 7,900	5- 2,700
1977 (Mar)[4]	59 - 99	11 - 19	38 - 67	2.3- 3.2	12 - 22	140 - 300	.3- .6	6.8-12	0- 150	.92- 1.6	.05- .20	10- 750	0- 320
						09395500 Puerco River at Gallup, New Mexico							
1975	14 - 80	2.5- 13	78 - 210	1.8- 6.3	14 - 31	100 - 260	.6-1.0	4.7-14	0- 10	--	--	--	--
1976	12 - 61	5.3- 10	100 - 200	2.0- 6.6	12 - 51	120 - 260	.4- .9	2.5-15	0- 90	--	--	--	--
1977 (Mar)[4]	21 - 40	4.5- 9.1	120 - 170	2.7- 4.2	22 - 42	100 - 190	.5- .7	11 -15	0- 130	--	--	--	--

[1]Properties shown in table were not analyzed in all samples
[2]Only one analysis made in all samples
[3] 0 - Property not detected in samples
[4]Denotes end month of record compilation

Table 6. Trace elements in surface water, northwestern New Mexico
(Average values, in milligrams per liter)
(for locations of sampling sites see figs. 7-10)

Water year	Total number of samples analyzed	Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Lead	Lithium	Manganese	Nickel	Strontium	Zinc
					08290000 Rio Chama near Chamita, New Mexico									
1964	1	--	--	--	140	--	--	--	--	--	--	--	--	--
1965	5	--	--	--	71	--	--	--	--	--	--	--	--	--
1966	5	--	--	--	74	--	--	--	--	--	--	--	--	--
1967	2	--	--	--	45	--	--	--	--	--	--	--	--	--
1968	2	--	--	--	15	--	--	--	--	--	--	--	--	--
1969	2	--	--	--	65	--	--	--	--	--	--	--	--	--
1970	3	--	--	--	60	--	--	--	--	--	--	--	--	--
1971	3	--	0	--	53	--	--	--	--	--	--	--	--	--
1972	4	38	<1	102	52	1	<10	3	<5	30	7	<5	525	<425
1973	4	80	2	72	41	<1	<5	3	<5	33	6	9	382	<245
1974	3	31	2	77	35	<3	<2	2	<4	17	4	<2	337	4
1975 (May)[1]	--	--	--	--	37	--	--	--	--	--	--	--	--	--
					08313000 Rio Grande at Otowi Bridge, New Mexico									
1960	1	--	--	--	80	--	--	--	--	--	--	--	--	--
1961	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1962	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1963	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1964	1	--	--	--	--	--	--	--	--	--	1,040	--	--	--
1965	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1966	2	--	--	--	90	--	--	--	--	--	--	--	--	--
1967	1	--	--	--	100	--	--	--	--	--	--	--	--	--
1968	2	--	--	--	35	--	--	--	--	--	--	--	--	--
1969	2	--	--	--	75	--	--	--	--	--	--	--	--	--
1970	4	--	--	--	77	--	--	--	--	--	--	--	--	--
1971	2	--	3	--	15	--	--	<4	<4	--	--	--	--	5
1972	5	--	--	--	56	--	--	--	--	--	--	--	--	--
1973	11	--	--	--	49	--	--	5	--	--	--	--	--	10
1974	3	--	2	--	54	<1	0	2	0	20	12	--	--	15
1975	4	--	1	--	55	<1	<5	3	<1	--	2	--	--	4
1976	4	--	2	--	42	<1	<1	2	3	--	7	--	--	2
1977 (Mar)[1]	2	--	2	--	50	1	0	<1	2	--	20	--	--	10
					08329000 Jemez River below Jemez Canyon Dam, New Mexico									
1966	1	--	--	--	2,900	--	--	--	--	--	--	--	--	--
1967	3	--	--	--	1,267	--	--	--	--	--	--	--	--	--
1968	2	--	--	--	365	--	--	--	--	--	--	--	--	--
1969	2	--	--	--	660	--	--	--	--	--	--	--	--	--
1970	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1972	2	--	--	--	785	--	--	--	--	--	--	--	--	--
1973	3	--	--	--	657	--	--	--	--	--	--	--	--	--
1974	7	--	40	--	1,173	--	--	--	--	1,117	0	--	--	--
1975	11	--	22	--	1,337	--	--	--	--	877	--	--	--	--
1976	1	--	30	--	1,500	--	--	--	--	--	--	--	--	--
1977 (Jan)[1]	1	--	50	--	1,600	--	--	--	--	--	--	--	--	--

Table 6. Trace elements in surface water, northwestern New Mexico (Continued)
(Average values, in milligrams per liter)

Water year	Total number of samples analyzed	Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Lead	Lithium	Manganese	Nickel	Strontium	Zinc
08353000 Rio Puerco near Bernardo, New Mexico														
1961	4	--	--	--	312	--	--	--	--	--	--	--	--	--
1963	7	--	--	--	377	--	--	--	--	--	--	--	--	--
1964	3	--	--	--	263	--	--	--	--	--	--	--	--	--
1966	2	--	--	--	235	--	--	--	--	--	--	--	--	--
1967	2	--	--	--	430	--	--	--	--	--	--	--	--	--
1968	2	--	--	--	310	--	--	--	--	--	--	--	--	--
1969	2	--	--	--	320	--	--	--	--	--	--	--	--	--
1970	1	--	--	--	220	--	--	--	--	--	--	--	--	--
1971	2	--	--	--	410	--	--	--	--	--	--	--	--	--
1972	1	--	--	--	200	--	--	--	--	--	--	--	--	--
1973	1	--	--	--	570	--	--	--	--	--	--	--	--	--
1974	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1975	1	--	--	--	510	--	--	--	--	--	--	--	--	--
1976	1	--	--	--	260	--	--	--	--	--	--	--	--	--
09364500 Animas River at Farmington, New Mexico														
1960	4	--	--	--	82	--	--	--	--	--	--	--	--	--
1961	5	--	--	--	66	--	--	--	--	--	--	--	--	--
1962	5	--	--	--	72	--	--	--	--	--	--	--	--	--
1963	4	--	--	--	85	--	--	--	--	--	--	--	--	--
1964	4	--	--	--	95	--	--	--	--	--	--	--	--	--
1965	4	--	--	--	50	--	--	--	--	--	--	--	--	--
1966	4	--	--	--	225	--	--	--	--	--	--	--	--	--
1967	4	--	--	--	118	--	--	--	--	--	--	--	--	--
1968	4	--	--	--	125	--	--	--	--	--	--	--	--	--
1969	4	--	--	--	100	--	--	--	--	--	--	--	--	--
1970	10	--	--	--	106	--	--	--	--	--	--	--	--	--
1971	9	--	--	--	78	--	--	--	--	--	--	--	--	--
1972	12	--	<1	50	67	1	<5	4	<5	--	15	<5	460	150
1973	9	--	3	200	60	0	--	6	74	--	20	--	--	20
1974	11	--	1	0	134	0	--	3	<100	--	45	--	--	17
1975	12	--	1	--	54	0	10	4	<1	--	0	--	--	15
1976	13	--	1	--	139	0	0	2	<1	--	90	--	--	7
1977 (Feb)[1]	5	--	0	--	84	0	0	5	3	--	0	--	--	10
09365000 San Juan River at Farmington, New Mexico														
1962	1	--	--	--	60	--	--	--	--	--	--	--	--	--
1963	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1964	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1965	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1966	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1967	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1968	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1969	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1970	5	--	--	--	90	--	--	--	--	--	--	--	--	--
1971	1	--	--	--	20	--	--	--	--	--	--	--	--	--
1972	32	--	--	--	59	--	--	--	--	--	--	--	--	--
1973	46	--	--	--	45	--	--	--	--	--	--	--	--	--
1974	36	--	1	0	52	0	--	2	100	--	12	--	--	10
1975	37	--	1	--	40	0	0	4	0	--	0	--	--	30
1976	23	--	2	--	38	0	0	1	1	--	10	--	--	0
1977 (Feb)[1]	11	--	2	--	38	1	0	2	2	--	20	--	--	30

Table 6 . Trace elements in surface water, northwestern New Mexico (Continued)
(Average values, in milligrams per liter)

Water year	Total number of samples analyzed	Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Copper	Lead	Lithium	Manganese	Nickel	Strontium	Zinc
09367561 Shumway Arroyo near Waterflow, New Mexico														
1974	3	--	2	--	603	--	--	--	--	--	--	--	--	--
1975	25	--	5	--	792	0	15	31	2	260	430	--	--	62
1976	16	--	8	--	626	1	18	11	< 1	--	90	--	--	23
1977 (Mar)[1]	6	--	3	--	617	< 1	0	8	2	--	150	--	--	35
09367930 Hunter Wash at Bisti Trading Post, New Mexico														
1974	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1975	8	--	--	--	151	--	--	--	--	--	--	--	--	--
1976	11	--	--	300	147	--	--	--	--	33	930	--	1,400	--
09368000 San Juan River at Shiprock, New Mexico														
1960	60	--	--	--	77	--	--	--	--	--	--	--	--	--
1961	60	--	--	--	92	--	--	--	--	--	--	--	--	--
1962	56	--	--	--	86	--	--	--	--	--	--	--	24,400	--
1963	69	--	--	--	105	--	--	--	--	--	--	--	--	--
1964	56	--	--	--	119	--	--	--	--	--	--	--	--	--
1965	44	--	--	--	74	--	--	--	--	--	--	--	--	--
1966	2	--	--	--	90	--	--	--	--	--	--	--	--	--
1967	2	--	--	--	110	--	--	--	--	--	--	--	--	--
1968	5	--	--	--	108	--	--	--	--	--	--	--	--	--
1969	3	--	--	--	63	--	--	--	--	--	--	--	--	--
1970	4	--	< 100	--	75	3	--	< 10	< 40	--	< 20	< 20	--	10
1971	1	--	--	--	40	--	--	--	--	--	--	--	--	--
1972	36	--	--	--	202	--	--	--	--	--	--	--	--	--
1973	47	28	--	72	68	< 110	< 8	6	< 6	10	< 5	< 8	780	< 490
1974	39	--	2	--	100	0	0	2	0	--	2,100	--	--	--
1975	42	--	< 1	--	78	0	< 10	6	0	--	2	--	--	12
1976	39	--	1	--	134	0	2	2	< 1	--	15	--	--	2
1977 (Mar)[1]	18	--	< 1	--	188	0	0	4	2	--	15	--	--	--
09395500 Puerco River at Gallup, New Mexico														
1975	6	--	--	--	143	--	--	--	--	--	--	--	--	--
1976	16	--	--	--	124	--	--	--	--	--	5	--	--	--
1977 (Mar)[1]	9	--	--	--	112	--	--	--	--	--	--	--	--	--

[1]Denotes end month of record compilation

Table 7. Radiochemical properties of surface water in northwest New Mexico and southwest Colorado (for locations of sampling sites see figs. 7-10)

Water year	Date	Dissolved gross alpha as U-Nat. (μg/L)	Suspended gross alpha as U-Nat. (μg/L)	Dissolved gross beta as CS-137 (pCi/L)	Suspended gross beta as CS-137 (pCi/L)	Dissolved gross beta as SR90 /Y90 (pCi/L)	Suspended gross beta as SR90 /Y90 (pCi/L)	Dissolved RA-226 (radon method) (pCi/L)	Dissolved uranium (U) (μg/L)
			08313000 Rio Grande at Otowi Bridge, New Mexico						
1975	Oct. 23	17	8.7	--	--	5.0	3.4	--	--
	Mar. 12	15	10	--	--	4.9	6.3	--	--
1976	Nov. 6	3.0	12	5.5	7.8	4.4	6.2	0.06	0.90
	May 5	5.1	64	4.1	22	3.3	20	.04	--
1977	Oct. 6	5.8	4.9	4.9	3.2	4.0	2.7	.60	4.2
	Apr. 5	18	5.5	4.4	4.3	3.8	3.4	.09	3.4
1978	Oct. 5	<4.7	12	4.9	3.7	4.1	3.3	.11	1.8
	Nov. 2	4.5	1.4	4.4	2.1	3.5	1.8	.15	3.4
	Apr. 5	10	9.4	4.3	5.3	3.9	4.7	.08	4.3
1979	Oct. 12	6.9	.7	4.3	.8	4.0	.8	.05	3.4
			08329000 Jemez River below Jemez Canyon Dam, New Mexico						
1975	Dec. 23	25	22	23	14	18	12	.17	4.1
			08343500 Rio San Jose near Grants, New Mexico						
1977	Jan. 21	17	<.4	13	1.2	10	1.1	.10	3.8
			08349800 Rio Paguate below Jackpile Mine near Laguna, New Mexico						
1977	Jan. 24	120	150	20	56	17	47	1.7	72
1978	Apr. 18	77	28	23	16	22	16	3.2	78
			08350500 Rio San Jose near Laguna, New Mexico						
1977	Jan. 24	140	6.0	21	30	16	24	.11	91
			09352900 Vallecito Creek near Bayfield, Colorado						
1971	Oct. 8	1.0	<.4	2.2	<.4	1.8	<.4	.09	.46
1972	Oct. 6	1.3	<.4	2.2	<.4	1.8	<.4	.04	.40
1973	Nov. 8	.7	<.4	2.3	<.4	1.9	<.4	.05	.40
1974	Oct. 4	1.7	<.4	2.0	<.4	1.6	<.4	.04	.41
	Aug. 28	1.5	<.4	1.9	<.4	1.5	<.4	.07	.37
1975	Sept. 30	.8	<.4	1.7	<.4	1.4	<.4	.06	.4
1976	Sept. 21	1.1	<.4	1.4	<.4	1.1	<.4	.06	.4
1977	Sept. 27	.6	<.4	2.7	<.4	2.2	<.4	.11	.38
1978	Sept. 26	<.5	<.4	.9	<.4	.8	<.4	.06	<.4
			09364500 Animas River at Farmington, New Mexico						
1972	Nov. 16	14	61	5.2	43	4.1	34	0.09	2.2
	May 24	4.3	13	4.2	8.1	3.4	6.4	.08	1.2
1973	Jan. 4	<7.4	2.6	6.2	2.1	5.7	1.7	.06	2.2
	May 1	6.4	25	4.0	26	3.2	22	.10	1.4
1974	Oct. 30	12	<.4	5.1	.6	4.2	.5	.08	3.1
	Apr. 2	7.7	12	7.3	18	6.1	15	.08	2.1
1978	Feb. 24	<5.3	7.1	4.2	3.7	--	--	.14	1.6
			09367561 Shumway Arroyo near Waterflow, New Mexico						
1975	Dec. 18	<89	2.4	65	1.1	55	.9	.11	12
1978	May 25	<29	99	12	67	--	--	.19	1.1
	Aug. 17	<61	2.5	<22	1.0	<20	1.1	.06	--

Table 7. Radiochemical properties of surface water in northwest New Mexico and southwest Colorado (Continued)

Water year	Date	Dis-solved gross alpha as U-Nat. (μg/L)	Sus-pended gross alpha as U-Nat. (μg/L)	Dis-solved gross beta as CS-137 (pCi/L)	Sus-pended gross beta as CS-137 (pCi/L)	Dis-solved gross beta as SR90 /Y90 (pCi/L)	Sus-pended gross beta as SR90 /Y90 (pCi/L)	Dis-solved RA-226 (radon method) (pCi/L)	Dis-solved uranium (U) (μg/L)
09367680 Chaco Wash at Chaco Canyon National Monument, New Mexico									
1977	Feb. 14	4.4	350	3.8	130	3.1	100	.02	1.2
	Feb. 17	7.4	19	3.4	8.4	2.7	6.7	.05	2.2
	Mar. 9	8.0	120	4.9	130	4.4	110	.13	2.9
	July 16	17	12,000	13	3,100	10	2,500	.31	7.8
1978	Feb. 8	7.1	1,800	5.4	710	4.8	620	.04	2.4
	May 7	7.8	510	5.9	410	5.4	380	.06	7.2
	Aug. 30	5.2	890	6.6	460	6.1	400	.56	2.3
09367685 Ah-shi-sle-pah Wash near Kimbeto, New Mexico									
1978	Feb. 8	<6.2	880	14	420	12	370	.06	1.0
09367930 Hunter Wash at Bisti Trading Post, New Mexico									
1975	Sept. 4	11	2,100	8.5	690	6.9	550	.06	3.4
1976	Sept. 28	81	470	26	300	21	250	.20	4.0
09368000 San Juan River at Shiprock, New Mexico									
1970	Oct. 15	--	--	3.0	17	--	--	.1	2.1
	Nov. 19	--	--	6.0	7.0	--	--	.1	3.2
	Dec. 10	--	--	3.0	6.0	--	--	.1	3.4
	Jan. 13	--	--	6.0	4.0	--	--	.0	4.5
	Feb. 10	--	--	5.0	3.0	--	--	.0	6.2
	Mar. 10	--	--	2.0	5.0	--	--	.0	2.2
	Apr. 14	--	--	19	9.0	--	--	.2	5.0
	May 12	--	--	7.0	25	--	--	.0	3.4
	June 9	--	--	6.2	15	--	--	.1	4.2
	July 14	--	--	6.0	7.1	--	--	.1	3.6
1971	Oct. 14	--	--	2.0	9.6	--	--	.0	1.0
	Jan. 21	--	--	3.2	11	--	--	.0	1.1
	Apr. 20	--	--	6.3	4.2	--	--	.0	1.7
1972	Nov. 16	13	170	6.8	82	5.5	67	.15	2.9
	Apr. 18	12	2.7	6.0	2.9	5.0	2.3	.08	3.2
	Aug. 30	<6.7	470	11	140	8.8	120	.2	2.8
1973	Oct. 25	8.0	460	8.4	190	7.1	160	.07	2.2
	Nov. 29	9.2	13	5.7	9.4	5.0	7.5	.08	2.5
	May 2	7.0	110	5.0	59	4.0	47	.07	1.8
1974	Oct. 30	6.3	1.5	3.7	1.7	3.0	1.5	.03	1.4
	Apr. 3	5.6	4.3	5.0	5.7	4.2	4.9	.07	1.7
	Sept. 26	16	290	9.4	170	7.6	140	.10	2.6
1975	Mar. 12	8.3	120	6.5	50	5.2	43	.06	2.3
1976	Nov. 12	14	35	6.9	19	5.5	15	.07	2.7
	May 19	<6.6	43	23	22	19	19	.08	1.5
1977	Oct. 27	15	28	3.4	15	2.7	12	.11	3.1
1978	Oct. 19	<6.9	31	7.3	16	6.3	14	.10	2.2
	May 24	3.0	18	2.1	9.4	--	--	.09	1.5
1979	Oct. 18	<8.3	1.4	4.5	2.1	4.2	2.0	.09	3.7
09395500 Puerco River at Gallup, New Mexico									
1975	Sept. 1	500	2,300	63	1,100	50	850	.38	230
1976	Oct. 16	1,200	970	140	540	110	430	.52	610
	Apr. 1	2,800	1,700	390	1,000	310	800	.84	930
	May 1	1,700	950	200	410	160	330	.39	1,500
	June 1	3,500	1,100	160	520	130	460	.77	880
1977	Oct. 6	2,800	1,400	460	520	390	410	.84	1,200
	Nov. 1	2,100	860	200	540	160	480	.44	800
	June 13	3,400	48	200	330	160	280	.49	1,600

SEDIMENT

Sediment is fragmented material transported by, suspended in, or deposited by water (fluvial) or air (eolian). Only fluvial sediment is discussed in this report. Sediment in streamflow is a result of erosional processes.

Sediment yield is primarily dependent upon: (1) Surficial geology--soil or rock type, decomposition rate of geological formations, and, where soil exists, its stability or ability to stand against water and wind; (2) climate--temperature extremes and storm frequency, intensity, and duration; (3) ground cover--vegetation and land use (cultivated, grazed, roads, forest, and so forth); and (4) upland erosion--rills and gullies, landslides, wind erosion, and headcutting of streams.

Once sediment reaches a stream channel, its transport is dependent upon the hydraulic characteristics of the stream and the size distribution of material available for transport. The major hydraulic characteristics related to sediment transport are width, depth, slope, velocity, resistance to flow, temperature, discharge, and concentration of fine material.

The streams in the low semiarid and arid parts of the basin carry large to exceptionally large sediment loads compared with streams in humid areas of the U.S.

Highest sediment yields are from areas of badland topography, such as the badlands near Bisti Trading Post, south of Farmington, New Mexico, where the soils are much more easily eroded. The highest concentration of sediment in streams occurs during floods, when high flow energy is available to collect and transport sediment.

One indicator of sediment movement from a drainage area is the amount of suspended sediment in the stream. Suspended-sediment concentrations and discharges for streams where only a few instantaneous observations are available for the period of record and for selected stations where daily values are collected, are listed in tables 8 and 9, respectively. Locations of these stations are shown in figures 7-10.

Based on 20 years of record, the Rio Puerco near Bernardo, New Mexico, which drains the southeastern part of the San Juan Basin, yields 75 percent of the sediment discharge and only 5 percent of the water to Elephant Butte Reservoir. The Chaco River and Canon Largo are the major contributors of sediment to the San Juan River immediately above Shiprock. By subtracting sediment yields for the San Juan River at Bloomfield and the Animas River at Farmington from the Shiprock records, average sediment yield for the Chaco River and several smaller arroyos can be approximated at 2,880,000 ton/yr, or 0.38 acre-ft/mi^2/yr for the 4,350 mi^2 of the Chaco basin. Data from stations operated on Arroyo Chico at

Table 8. Ranges of observed instantaneous suspended-sediment concentrations and discharges for selected streams in New Mexico and Colorado

Station number (see figs. 7-10)	Station name	Suspended-sediment concentration (mg/L)	Suspended-sediment discharge (ton/d)
08287000	Rio Chama below Abiquiu Dam, New Mexico	0-107,000	0 -214,000
08352900	Vallecito Creek near Bayfield, Colorado	0- 50	0 - 140
09367561	Shumway Arroyo near Waterflow, New Mexico	15-182,000	.01-124,000
09367680	Chaco Wash at Chaco Canyon National Monument, New Mexico	0-131,000	0 -417,000
09367710	De-na-zin Wash near Bisti Trading Post, New Mexico	0-168,000	0 -420,000
09367930	Hunter Wash at Bisti Trading Post, New Mexico	0-273,000	0 -280,000
09367950	Chaco River near Waterflow, New Mexico	2-280,000	9.6 -810,000

Table 9. Suspended-sediment data for selected streams in New Mexico (for locations of sampling sites see figs. 7-10)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration Min. (mg/L)	Daily mean suspended-sediment concentration Max. (mg/L)	Suspended-sediment discharge, Daily mean Min. (ton/d)	Suspended-sediment discharge, Daily mean Max. (ton/d)	Suspended-sediment discharge, Annual (thousands of ton/yr)	Suspended-sediment discharge, Annual unit [(ton/mi^2)/yr]
08290000 Rio Chama near Chamita, New Mexico							
1948	359	0	25,000	0	83,700	2,165	689
1949	428	0	27,100	0	65,900	1,650	525
1950	304	0	40,900	0	46,400	1,085	345
1951	144	0	31,400	0	43,500	580	184
1952	567	0	31,000	0	139,000	3,391	1,079
1953	167	0	31,100	0	36,300	611	194
1954	177	12	36,700	.5	46,600	1,062	338
1955	142	0	57,700	0	150,000	1,663	529
1956	146	9	11,500	.5	12,800	538	171
1957	523	10	39,600	.5	209,000	3,344	1,064
1958	561	8	21,700	.5	167,000	5,468	1,739
1959	237	18	39,000	2	68,900	1,021	325
1960	364	19	16,800	.5	38,000	1,466	466
1961	245	12	54,900	.5	143,000	1,635	520
1962	412	20	26,200	.5	62,100	2,018	642
1963	270	20	26,500	.5	36,000	613	195
1964	147	20	34,700	.5	90,000	703	224
1965	422	170	34,700	4	110,000	2,283	726
1966	386	20	34,600	.5	39,000	2,227	708
1967	209	20	61,400	.5	340,000	3,017	960
1968	279	30	17,500	.28	60,700	2,013	640
1969	417	10	19,700	.10	43,400	984	313
1970	265	20	33,000	1.8	34,700	678	216
1971	188	25	62,800	.16	59,800	488	155
1972	170	20	29,700	1.1	25,000	319	101
1973	438	30	10,000	7.1	46,400	653	208
1974	338	10	6,950	3.5	15,300	213	68

Table 9. Suspended-sediment data for selected streams in New Mexico (Continued)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration		Suspended-sediment discharge			
				Daily mean			
		Min. (mg/L)	Max. (mg/L)	Min. (ton/d)	Max. (ton/d)	Annual (thousands of ton/yr)	Annual unit [(ton/mi²)/yr]
08329000 Jemez River below Jemez Canyon Dam, New Mexico							
1949	54.9	0	57,200	0	48,600	503	485
1950	10.2	0	69,400	0	98,100	256	247
1951	13.8	0	147,000	0	167,000	790	761
1952	33.0	0	69,400	0	48,100	515	496
1953	7.64	0	--	0	--	61.7	59.4
1954	20.2	0	53,000	0	150,000	691	666
1955	19.7	0	127,000	0	90,600	768	740
1956	13.3	0	70,200	0	94,400	228	220
1957	35.0	0	68,100	0	46,600	319	307
1958	111	0	101,000	0	78,800	688	663
08340500 Arroyo Chico near Guadalupe, New Mexico							
1948	4.95	0	97,200	0	121,000	--	--
1949	17.5	0	121,000	0	473,000	2,088	1,502
1950	10.4	0	113,000	0	744,000	1,573	1,132
1951	12.6	0	138,000	0	245,000	1,439	1,035
1952	8.83	0	216,000	0	142,000	1,187	854
1953	21.1	0	198,000	0	1,220,000	3,157	2,271
1954	37.3	0	92,800	0	480,000	4,562	3,282
1955	37.0	0	113,000	0	679,000	1,367	983
1956	10.2	0	49,100	0	5,570	13.7	9.86

Table 9. Suspended-sediment data for selected streams in New Mexico (Continued)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration Min. (mg/L)	Daily mean suspended-sediment concentration Max. (mg/L)	Suspended-sediment discharge, Daily mean Min. (ton/d)	Suspended-sediment discharge, Daily mean Max. (ton/d)	Annual (thousands of ton/yr)	Annual unit [(ton/mi²)/yr]
08313000 Rio Grande at Otowi Bridge near San Ildefonso, New Mexico							
1948	1,362	100	5,620	65	86,000	4,306	301
1949	1,304	0	20,500	0	176,400	3,681	257
1950	663	81	32,800	57	184,000	1,733	121
1951	395	82	47,400	57	55,400	901	63
1952	1,378	111	20,900	108	132,000	4,473	313
1953	549	18	20,600	9	37,200	732	51.2
1954	451	14	35,100	11	73,700	1,329	92.9
1955	432	74	43,500	769	239,000	2,431	170
1956	377	34	9,530	13	17,000	714	49.9
1957	1,297	40	17,300	16	158,000	4,557	319
1958	1,526	42	26,700	29	362,000	7,562	529
1959	510	37	36,700	16	140,000	1,424	99.6
1960	821	14	9,760	8	42,700	2,074	145
1961	676	24	30,700	16	366,000	1,972	138
1962	1,040	40	11,500	24	83,600	3,253	227
1963	560	11	9,290	3	28,000	862	60.3
1964	384	22	40,200	8	130,000	947	66.2
1965	1,178	78	23,200	49	140,000	3,378	236
1966	945	90	12,100	55	42,000	2,256	158
1967	581	55	26,500	36	290,000	2,651	185
1968	856	130	15,400	99	120,000	2,574	180
1969	1,038	102	9,450	124	52,700	1,824	128
1970	906	310	19,900	259	77,400	1,939	136
1971	579	50	32,500	61	164,000	1,106	77.3
1972	514	105	17,200	60	58,200	1,464	102
1973	1,394	35	6,320	61	126,000	3,881	271
1974	687	11	12,100	18	26,400	654	45.7
1975	1,066	29	12,500	20	52,200	1,526	107
1976	936	62	35,500	123	170,000	1,840	129
1977	436	53	17,500	41	73,200	897	62.7

Table 9. Suspended-sediment data for selected streams in New Mexico (Continued)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration		Suspended-sediment discharge			
				Daily mean			
		Min. (mg/L)	Max. (mg/L)	Min. (ton/d)	Max. (ton/d)	Annual (thousands of ton/yr)	Annual unit [(ton/mi²)/yr]
			08353000 Rio Puerco near Bernardo, New Mexico				
1948	10.5	0	174,000	0	195,000	1,634	222
1949	28.3	0	245,000	0	985,000	5,760	784
1950	12.0	0	209,000	0	895,000	2,753	375
1951	23.1	0	293,000	0	814,000	4,613	628
1952	13.4	0	354,000	0	313,000	2,953	402
1953	31.2	0	277,000	0	1,160,000	6,953	946
1954	78.3	0	193,000	0	1,740,000	14,780	2,011
1955	85.3	0	233,000	0	2,120,000	18,320	2,493
1956	12.3	0	228,000	0	1,320,000	3,424	466
1957	86.0	0	267,000	0	2,240,000	18,050	2,456
1958	44.2	0	168,000	0	1,510,000	8,070	1,098
1959	21.5	0	243,000	0	977,000	5,039	686
1960	17.6	0	246,000	0	1,000,000	4,157	566
1961	28.3	0	222,000	0	716,000	4,548	618
1962	10.2	0	176,000	0	138,000	1,449	197
1963	19.9	0	178,000	0	330,000	3,026	412
1964	18.6	0	190,000	0	580,000	2,917	397
1965	30.4	0	214,000	0	519,000	3,808	518
1966	19.3	0	245,000	0	406,000	3,529	480
1967	77.6	0	230,000	0	970,000	12,260	1,668
1968	27.6	0	192,000	0	713,000	4,941	672
1969	26.2	0	215,000	0	1,000,000	4,919	669
1970	26.7	0	188,000	0	744,000	2,822	384
1971	9.13	0	218,000	0	1,320,000	1,889	257
1972	61.5	0	217,000	0	1,220,000	9,490	1,291
1973	60.3	0	216,000	0	229,000	5,913	804
1974	6.10	0	175,000	0	594,000	2,820	384
1975	39.2	0	246,000	0	728,000	6,829	929
1976	7.95	0	203,000	0	423,000	1,734	236
1977	24.0	0	196,000	0	506,000	4,356	593

Table 9. Suspended-sediment data for selected streams in New Mexico (Continued)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration		Suspended-sediment discharge			
				Daily mean			
		Min. (mg/L)	Max. (mg/L)	Min. (ton/d)	Max. (ton/d)	Annual (thousands of ton/yr)	Annual unit [(ton/mi^2)/yr]
			09364500 Animas River at Farmington, New Mexico				
1952	935	16	7,180	6	64,000	1,036	762
1953	374	9	194,000	1	40,500	370	272
1954	376	14	36,800	2	337,000	1,274	937
1955	413	13	22,800	.5	50,200	827	608
1956	365	1	4,400	.5	22,000	504	371
1957	970	3	18,200	.5	121,000	1,876	1,379
1958	913	1	13,600	.5	46,900	1,440	1,059
1959	278	2	12,000	.5	32,900	236	174
1960	609	2	14,700	.5	37,200	1,129	830
1961	489	9	19,500	3	37,400	496	365
1962	578	5	19,200	1	40,000	571	420
1963	376	5	9,790	.5	22,000	291	232
1964	306	11	22,100	4	66,000	454	334
1965	851	15	20,200	4	82,000	1,109	815
1966	540	4	--	2	20,000	411	302
1967	315	5	12,100	3	59,000	426	313
1968	546	13	17,200	4.5	59,900	518	381
1969	611	8	13,400	5.1	31,900	504	371
1970	608	11	20,200	8.9	125,000	830	610
1971	477	14	17,200	8.6	24,600	272	200
1972	391	13	14,300	.21	293,000	513	377
1973	1,176	8	6,400	6.4	55,000	1,499	1,102
1974	308	1	13,800	.02	84,100	400	294
1975	877	15	13,300	4.8	112,000	1,710	1,257
1976	450	13	7,320	8.1	38,800	344	253
1977	246	24	22,500	.25	84,700	410	301
			09367950 Chaco River near Waterflow, New Mexico				
1977	27.1	700	108,000	14	389,000	1,882	433

Table 9. Suspended-sediment data for selected streams in New Mexico (Continued)

Water year	Annual mean water discharge (thousands of acre-ft/yr)	Daily mean suspended-sediment concentration Min. (mg/L)	Daily mean suspended-sediment concentration Max. (mg/L)	Suspended-sediment discharge, Daily mean Min. (ton/d)	Suspended-sediment discharge, Daily mean Max. (ton/d)	Suspended-sediment discharge, Annual (thousands of ton/yr)	Suspended-sediment discharge, Annual unit [(ton/mi^2)/yr]
		09368000 San Juan River at Shiprock, New Mexico					
1952	2,482	20	33,900	31	369,000	11,190	867
1953	873	14	51,400	16	317,000	2,235	173
1954	943	28	101,000	36	1,330,000	11,630	902
1955	956	75	91,200	46	1,200,000	12,030	933
1956	860	25	86,200	2	490,000	5,094	395
1957	2,500	101	49,400	13	1,700,000	21,790	1,689
1958	2,363	43	43,300	44	571,000	16,750	1,298
1959	624	6	61,600	1	528,000	2,300	178
1960	1,697	30	64,800	11	1,290,000	14,780	1,146
1961	1,183	14	85,600	5	1,360,000	7,261	563
1962	1,442	7	48,300	1	286,000	3,873	300
1963	508	2	61,400	1	1,000,000	4,440	344
1964	694	39	77,700	23	1,400,000	9,549	740
1965	1,934	90	39,800	98	1,110,000	8,444	655
1966	1,751	54	63,800	160	346,000	3,956	307
1967	810	38	114,000	15	2,000,000	14,790	1,146
1968	888	90	65,400	146	890,000	6,397	496
1969	1,534	350	44,100	657	473,000	13,260	1,028
1970	1,366	78	52,200	62	1,730,000	8,849	686
1971	1,021	74	82,600	92	888,000	4,617	358
1972	879	19	59,600	7.3	1,020,000	3,798	294
1973	2,480	35	27,200	207	187,000	7,344	569
1974	1,019	13	66,100	7.8	870,000	3,642	282
1975	1,745	71	59,500	66	87,000	10,350	802
1976	1,131	29	28,700	20	187,000	2,261	175
1977	4,984	13	76,600	1.8	831,000	5,468	424

its mouth and the Rio San Jose at Correo show average sediment yields of 1.3 and 0.15 acre-ft/mi^2/yr, respectively. Because some areas within these basins have low sediment yields and local deposition, yield from other areas must be excessive. For example, sediment yield for Hunter Wash near Bisti Trading Post, which includes a badlands area, is about 2.0 acre-ft/mi^2/yr (1 year of record). Fragmentary data from a small tributary to Hunter Wash indicate that the badlands area yields possibly 10 times more water and 10 to 100 times more sediment from sheet erosion alone, than does the silty soil in the northern and eastern parts of Hunter Wash. Sediment yield (from less than 7 in. annual precipitation and less than 1 in. for any one storm event) from the badlands area of Hunter Wash is about 4.5 acre-ft/mi^2/yr.

Showen (1970) estimated sediment yields ranging from 0.05 to 3.0 acre-ft/mi^2/yr for the Chaco drainage near Star Lake. The lower yields are from drainages with no incised channel and good vegetal cover (for the San Juan Basin). Higher yields are from badlands that are comprised of clay and decomposed shale. Sediment yield that originates from other than headcuts or erosion of incised channels or badlands is probably less than 0.2 acre-ft/mi^2/yr. Silty, unstable soils and rugged topography create a condition sensitive to erosion from headcutting. Headcuts and incised channel degradation are difficult to evaluate but can produce sediment yields much greater than other parts of a drainage basin. Flow in an active channel involving a headcut may reach its sediment-transport capacity in a relatively short distance, sometimes within the headcut itself. Then, as channel slope decreases downstream, carrying capacity of the flow decreases and deposition occurs, which further decreases slope and carrying capacity. The downstream incised channel fills with sediment and forms a braided channel, which widens into a swale having no defined channel, as the headcut moves up the drainage basin. This type of sediment moves in steps and, after a long period, reaches a major perennial stream, such as the San Juan River.

In the arid to semiarid part of the basin a very fine clay commonly remains in suspension down to the last bit of streamflow. These fine clays may affect the chemical quality of the water, particularly in the ephemeral streams, through ion exchange on the clay surfaces.

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