ASSESSMENT OF WATER RESOURCES AT FORT CARSON MILITARY RESERVATION NEAR COLORADO SPRINGS, COLORADO

By Guy J. Leonard

U.S. GEOLOGICAL SURVEY

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CONVERSION FACTORS

Inch-pound units used in this report may be converted to International System of Units (SI) by using the following conversion factors:

Multiply	*By*	*To obtain*
acre	0.4047	hectares
acre-foot (acre-ft)	1,233	cubic meter
acre-foot per square mile (acre-ft/mi²)	476.1	cubic meter per square kilometer
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year
cubic foot	0.02832	cubic meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
gallon	0.2118	cubic meter
gallon per minute (gal/min)	0.00353	cubic meter per second
gallon per minute per foot [(gal/min)/ft]	0.1014	cubic meter per second per meter
inch (in.)	25.4	millimeter
inch per year (in./yr)	2.54	centimeter per year
micromho per centimeter (µmho)	1	microsiemens per centimeter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer

National Geodetic Vertical Datum of 1929 (NGVD of 1929).--A geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada, formerly called mean sea level. NGVD of 1929 is referred to as sea level in this report.

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ABSTRACT

The Fort Carson Military Reservation adjoins the Colorado Springs metropolitan area. Fort Carson purchases an average of 3,400 acre-feet of treated water annually from the city of Colorado Springs. Locally available surface-water resources are limited and are fully appropriated. The occurrence of precipitation and streamflow at Fort Carson is unevenly distributed in time. The streams that enter Fort Carson have an estimated average annual discharge of more than 6,240 acre-feet upstream from diversions for municipal and domestic water supplies.

Ground water is available at Fort Carson from alluvial and bedrock aquifers. The alluvial aquifer with the greatest potential for water production occurs along Little Fountain and Rock Creeks in the eastern part of Fort Carson where the alluvium is about 60 feet thick and well yields greater than 100 gallons per minute have been obtained. The bedrock aquifer with the greatest potential for water production is the Dakota-Purgatoire aquifer which underlies most of Fort Carson. The Dakota-Purgatoire aquifer, which is exposed at the surface in the southwestern part of Fort Carson, dips steeply to the south and east and is 1,500 to 2,000 feet below the land surface along the eastern boundary of Fort Carson. Well yields greater than 100 gallons per minute have been obtained in the southern part of Fort Carson where the bedrock units have been structurally deformed.

The quality of surface water in streams entering Fort Carson is suitable for irrigation and generally is suitable for drinking with treatment for biological contaminants. The quality of water in streams deteriorates eastward across Fort Carson. Concentrations of dissolved solids from 49 to 292 milligrams per liter observed in streamflow from Fort Carson increase to 121 to 1,470 milligrams per liter downstream at the eastern and southern boundaries of Fort Carson.

Water from the alluvial aquifers along the western side of Fort Carson generally is acceptable for most intended uses. Water from the alluvial aquifer along Little Fountain and Rock Creeks in the eastern part of Fort Carson contains fluoride in concentrations exceeding drinking-water standards. Water from the Dakota-Purgatoire aquifer characteristically contains concentrations of naturally occurring radiochemical constituents which exceed drinking-water standards.

The potential for development of dependable water supplies at Fort Carson is good. Additional reservoir storage would be needed to provide a dependable water supply from streamflow. Integrated use of surface water and ground water with the storage capacity of the alluvial aquifer along Little Fountain and Rock Creeks could provide a dependable water supply. Significant well yields can be obtained from the Dakota-Purgatoire aquifer, but treatment will be required prior to use for drinking water.

INTRODUCTION

The Fort Carson Military Reservation encompasses 137,391 acres adjacent to and south of the Colorado Springs metropolitan area (fig. 1). Fort Carson provides training and maneuver areas for Active and Reserve units of the U.S. Army.

At present (1983), most of the water-supply needs of Fort Carson are provided by the city of Colorado Springs. The population of the Colorado Springs metropolitan area has increased rapidly since 1950. From 1960 to 1980, population more than tripled from 74,524 to 309,565 (U.S. Bureau of the Census, 1981). According to P. H. Denham (Pikes Peak Area Council of Governments, oral commun., 1980), population in the area will be approximately 550,000 by 2000. Population growth has been accompanied by increased water requirements for municipal and industrial use. The water supply available from Fountain Creek and its tributaries is fully appropriated and is augmented by water imported from the Colorado River drainage basin through the Homestake and Fryingpan-Arkansas projects. The increased demand for water has resulted in improved utilization of locally available supplies, investigations into additional sources, and stricter administration of water rights by the State of Colorado.

Purpose and Scope

An investigation of the water resources at Fort Carson was begun in 1978 by the U.S. Geological Survey, for the Fort Carson Directorate of Engineering and Housing, to provide information necessary for long-range water-resource planning and management. During the investigation, streamflow-gaging stations were installed at 10 sites on three streams and at 7 sites on surface-water diversion ditches. A stage-height recorder also was installed on Teller Reservoir (pl. 1). Existing wells and springs were inventoried, and continuous water-level monitoring equipment was installed and maintained on three wells. Water-quality samples were collected and analyzed from streams, wells, and springs.

Description of the Area

Fort Carson lies on the boundary between the Great Plains and southern Rocky Mountain physiographic provinces (Fenneman, 1928). Altitudes at Fort Carson range from about 5,400 to 6,900 ft for a total relief of 1,500 ft. The topography of the northern and eastern parts of the study area is characterized by dissected plains and terraces with local relief ranging from 10 to 50 ft. The western part is characterized by deep canyons, hills, and hogbacks of sedimentary rocks uplifted with the Front Range of the Rocky Mountains. Local relief ranges from 50 to 600 ft.

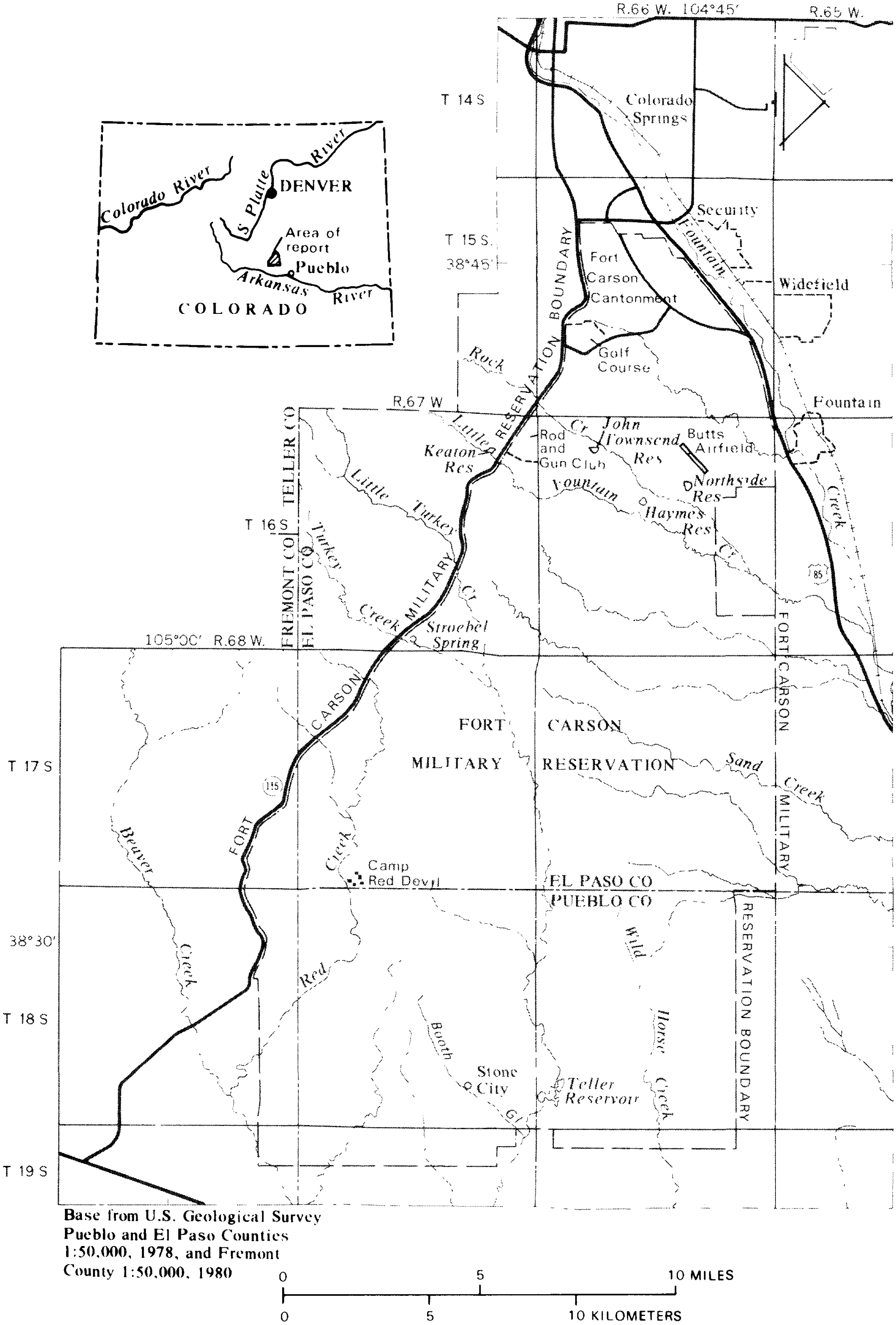


Figure 1.--Location of Fort Carson Military Reservation.
(See plate 1 for additional details.)

Fort Carson is within the Arkansas River drainage basin. The southwestern part of Fort Carson is drained by Red Creek and other smaller tributaries of Beaver Creek, the south-central part is drained by Little Turkey and Turkey Creeks, and the northern and eastern parts are drained by Little Fountain Creek, Sand Creek and other smaller tributaries of Fountain Creek. Beaver, Fountain, and Turkey Creeks are tributaries of the Arkansas River.

Acknowledgments

The author is grateful for assistance from Michael E. Halla, Environmental Program Director, and Tim Prior, Natural Resources Manager, Directorate of Engineering and Housing, Fort Carson, who provided information about wells, springs, water supplies, and water use at Fort Carson.

WATER SUPPLY, WATER USE, AND WASTEWATER DISPOSAL

Fort Carson (1980) purchases treated water from the city of Colorado Springs for domestic, industrial, and irrigation use in the area of cantonment. From 1974 through 1980, the quantity purchased averaged 3,400 acre-ft/yr (table 1).

Table 1.--*Volume of treated water purchased by Fort Carson from the city of Colorado Springs 1974-80*

[Source: Annual Reports, City of Colorado Springs, Water Division]

Year	Volume Purchased (acre-feet)
1974	3,354
1975	3,915
1976	4,090
1977	2,905
1978	3,357
1979	2,722
1980	3,456
Average	3,400

Surface water is diverted from Little Fountain, Little Turkey, Red, Rock, and Turkey Creeks for direct use in irrigation and for storage in reservoirs. Reservoirs provide flood control, regulation of diversion ditches, and opportunities for military training related to maneuvers and water purification. The reservoirs are extensively used for recreation, wildlife-habitat management, and conservation. Water from the reservoirs is used for irrigation, construction, firefighting, and domestic use at training facilities. Wells located throughout Fort Carson are used to provide water for domestic uses, military training, recreation, irrigation, fire control, dust suppression, construction, and wildlife.

Wastewater from the area of cantonment is conveyed by sewer to a wastewater-treatment plant located in sec. 23, T. 15 S., R. 66 W.; treated wastewater is released to an unnamed tributary of Fountain Creek adjacent to and south of the treatment plant. During the irrigation season, some of the wastewater is disposed by applying it on the Fort Carson golf course.

PRECIPITATION

Precipitation, occurring as rain, snow, and intermediate forms such as hail, provides runoff to streams and recharge to aquifers in the Fort Carson area. The quantity of precipitation in the study area is affected significantly by the orographic effect of the nearby Rocky Mountains and tends to increase with increasing elevation (Livingston, and others, 1976b). Mean annual precipitation at Fort Carson (fig. 2) increases toward the northwest, ranging from 12 to 16 in. (U.S. Weather Bureau, 1967). Climatological records for weather stations at and in the vicinity of Fort Carson are shown in table 2.

Precipitation is not evenly distributed from year to year at and in the vicinity of Fort Carson (fig. 3). Annual precipitation at Colorado Springs (station 2, fig. 2) averaged 15.41 in. and ranged from 8.59 to 25.43 in. during 1951-80. Cumulative departures from the mean annual precipitation at Colorado Springs indicate periods of relative drought during 1952-56, 1960-64, and 1973-75. Precipitation also is unevenly distributed during the year (fig. 4). During 1951-80, approximately 77 percent of the annual precipitation occurred between April and September.

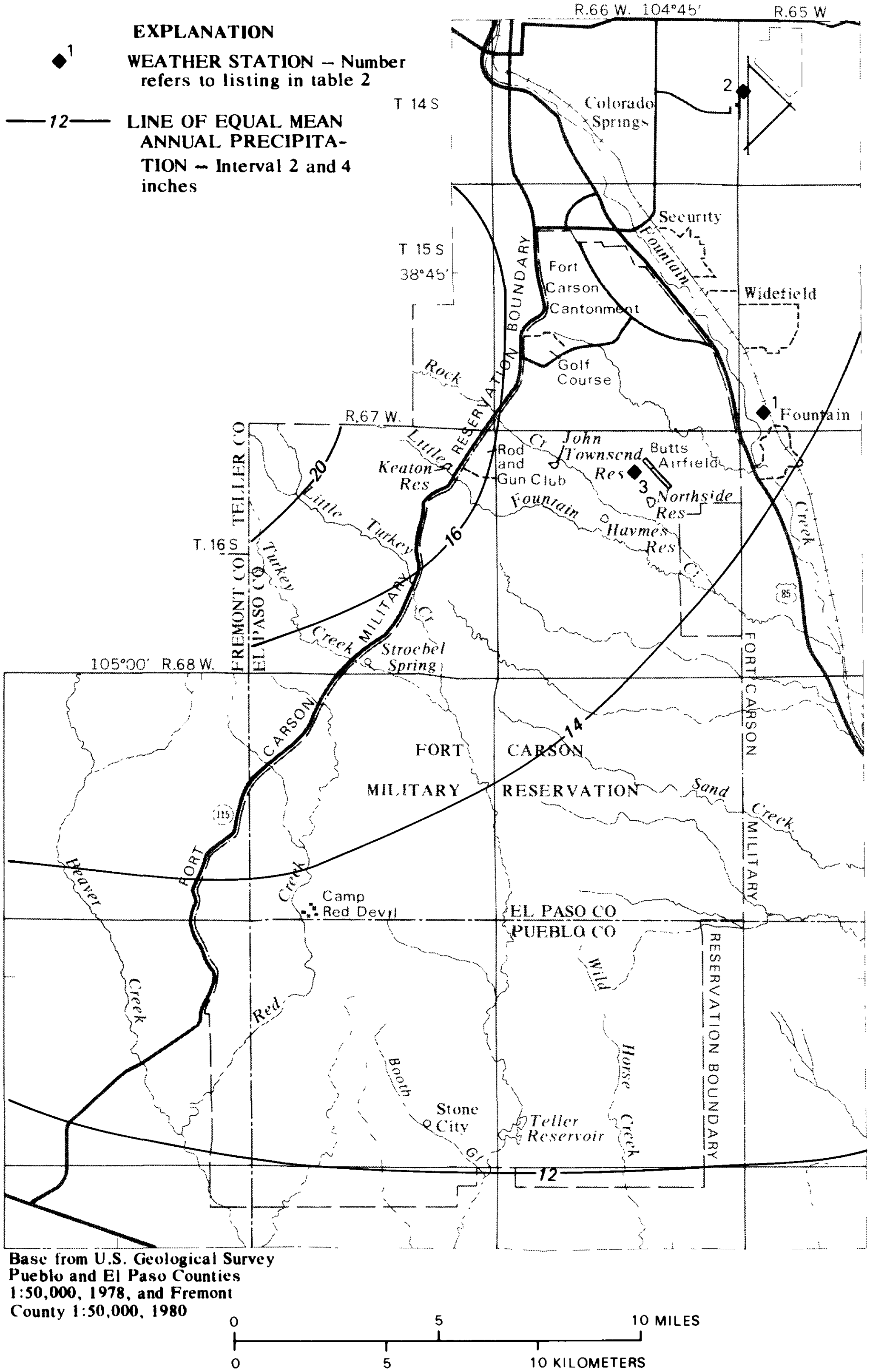


Figure 2.--Distribution of mean annual precipitation, 1931-60, and location of weather stations at and in the vicinity of Fort Carson.

Table 2.--*Summary of climatological data, Fort Carson and vicinity*

[Data from National Weather Service and U.S. Air Force Air Weather Service]

Site No.[1]	Station name and index number	Location			Altitude (feet)	Period of record	Annual precipitation 1951-80 (inches)					Normal annual precipitation[2] (inches)
		Section	Township	Range			Maximum	(year)	Minimum	(year)	Mean	
National Weather Service:												
1	Fountain (3063)[3]----------	31	15 S.	65 W.	5,546	1945-80	26.61	(1965)	8.43	(1964)	14.33	14.38
2	Colorado Springs (1778)---	19	14 S.	65 W.	6,145	1949-80	25.43	(1965)	8.59	(1964)	15.41	14.91
---	Pueblo (6740)[4]------------	25	20 S.	64 W.	4,639	1940-80	23.09	(1957)	6.27	(1966)	11.02	-----
U.S. Air Force Air Weather Service:												
3	Butts Airfield (94015)----	5	16 S.	66 W.	5,871	1969-80	21.46	[5](1980)	8.37	[5](1974)	[5]14.75	-----

[1]Site No. refers to location in figure 2.
[2]Climatological standard normals, 1931-60.
[3]Annual precipitation for 1976, 1978, and 1979 estimated by correlation.
[4]Not shown in figure 2. Station is located 15 miles southeast of study area. Station was moved 7 miles eastward during 1954.
[5]Maximum, minimum, and mean during period of record.

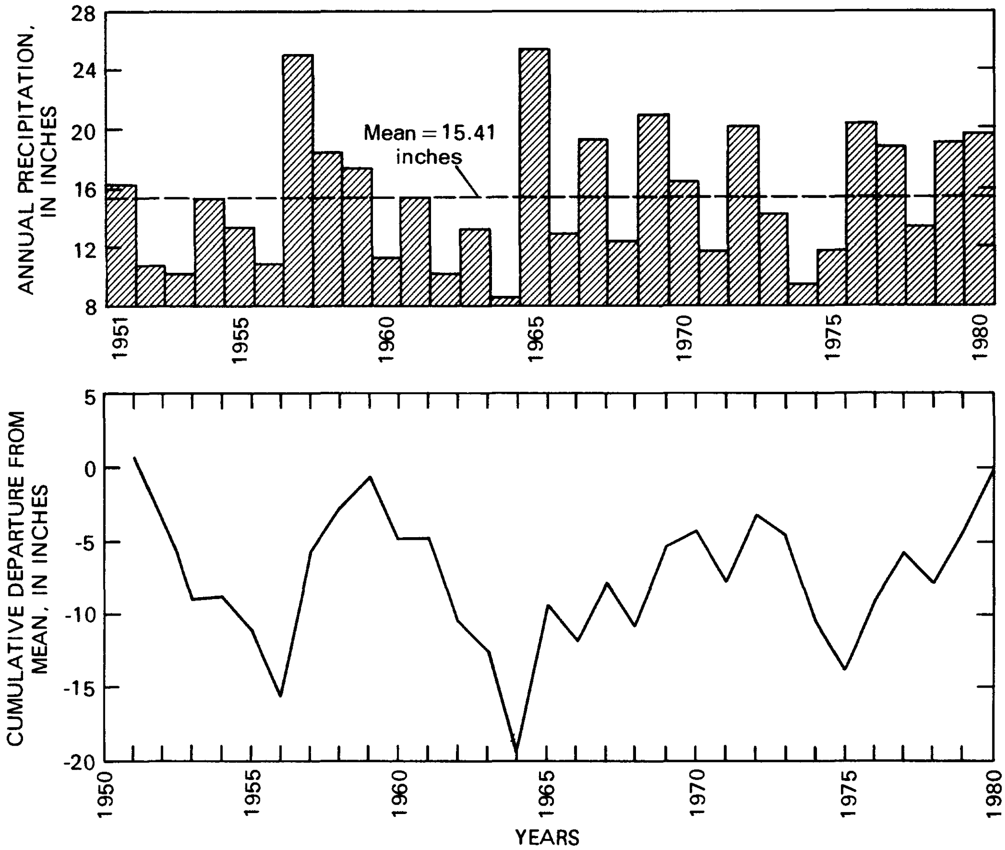


Figure 3.--Annual precipitation and cumulative departures from mean annual precipitation (1951-80) at Colorado Springs. (Source: National Weather Service, station 1778.)

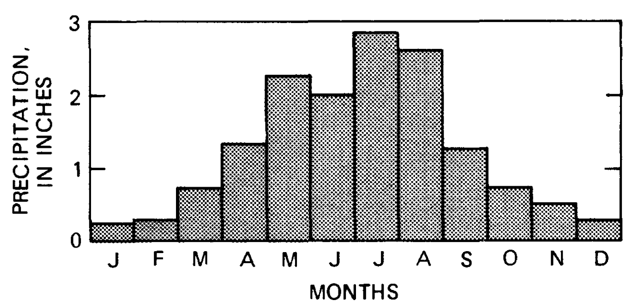


Figure 4.--Mean monthly precipitation (1951-80) at Colorado Springs. (Source: National Weather Service, station 1778)

Reservoirs and Evaporation

The decreed capacity and source of water for five adjudicated reservoirs at Fort Carson are listed in table 3. The capacities and sources were obtained from a tabulation by the Colorado State Engineer's Office (Colorado Division of Water Resources, Office of the State Engineer) of decreed water rights for the Arkansas River basin. Applications have been filed for adjudication of the water rights for eight additional reservoirs whose capacities range from 10 to 98 acre-ft. Eureka Reservoir was dry throughout this investigation. Teller Reservoir, which is partly filled with sediment, was surveyed during 1980, and its remaining capacity was determined to be slightly more than 1,780 acre-ft.

Table 3.--*Adjudicated reservoirs*

Reservoir name	Decreed capacity (acre-feet)	Source of water
Eureka------------------	98.57	Sand Creek
Haymes[1]-----------------	199.78	Rock Creek
John Townsend[1]----------	12	Little Fountain and Rock Creeks
North Side[1]-------------	32.1	Rock Creek
Teller------------------	12,866	Turkey Creek

[1]Offstream reservoir.

Regulation of streamflow with reservoirs allows for a more even and dependable supply of water downstream. A disadvantage of reservoirs is loss of water by evaporation and the resultant degradation of water quality by concentration of dissolved ions. Evaporation is a function of humidity, temperature, solar radiation, and wind. According to the U.S. Bureau of Reclamation (P. O. Abbott, oral commun., 1980), mean annual class A pan evaporation at Pueblo Reservoir (fig. 1) is 54.17 in. To apply pan-evaporation data to a free-water surface such as a reservoir, values for pan evaporation are multiplied by 0.69 (Butler, 1957, p. 233), giving an annual estimated evaporation loss in the study area of 38 in./yr.

Streamflow

All the streams entering and originating on Fort Carson are ephemeral. Streamflow is diverted for municipal water supplies by the city of Fountain from Little Fountain Creek upstream from the study area. Historically, streamflow was diverted from Little Fountain, Rock, and Turkey Creeks for irrigation of lands in the study area. Since 1978, flows in these streams and in Little Turkey Creek have been continuously monitored by the U.S. Geological Survey at 10 streamflow-gaging stations (pl. 1), which are listed in table 4.

Streamflow at Fort Carson consists of runoff from precipitation and ground-water seepage. Most of the streamflow consists of runoff from precipitation. The uneven occurrence of precipitation results in uneven annual and monthly quantities of streamflow. Less than average annual precipitation results in less than average annual streamflow. For long periods during the year, no flow occurs in most reaches of the streams. Continuous flow in Turkey Creek downstream from Teller Reservoir was observed to result from ground-water seepage near the southeast abutment of the reservoir. Ground-water seepage also results in continuous flow in Rock Creek immediately upstream from the eastern boundary of Fort Carson.

Hydrographs of streamflow (fig. 5) measured during 1979 at station 07105928, Little Fountain Creek near Fort Carson, (see "Supplemental Information" for explanation of station-numbering system) and station 07105940, Little Fountain Creek near Fountain, are typical of those measured at streamflow-gaging stations on Little Turkey, Rock, and Turkey Creeks at Fort Carson. Most streamflow occurred at these stations from April through June. From April through May, flow at these stations resulted from melting of snowpack in the mountains west of the study area. Widespread rainfall and runoff increased flow at both stations on Little Fountain Creek during June. The peak flows during July and August at the downstream station near Fountain resulted from thunderstorms.

Runoff Analysis

Flow characteristics for water years 1979 and 1980 at the 10 streamflow-gaging stations at and near Fort Carson are summarized in table 4. The short length of record precludes meaningful statistical analysis of flow durations or flood magnitudes and frequencies. Indirect methods, however, were used to estimate the average annual runoff and flood magnitudes and frequencies described in the following sections.

Table 4.--*Flow characteristics for the period of record at selected streamflow-gaging stations at and near Fort Carson*

[mi^2, square miles; ft^3/s, cubic feet per second]

Site No[1]	U.S. Geological Survey station name and number	Latitude-longitude	Elevation (feet)	Drainage area (mi^2)	Period of record	Discharge, water years (1979-80): Mean annual (ft^3/s)	Maximum (ft^3/s)	Date	Minimum (ft^3/s)	Date
1	Rock Creek above Fort Carson (07105945)	38°42'27" 104°50'46"	6,390	6.79	5/78-Present	3.27	150	5/8/80	0	Many days
2	Rock Creek near Fort Carson (07105950)	38°41'49" 104°49'39"	6,150	7.79	5/78-Present	2.75	164	5/8/80	0	Do.
3	Rock Creek near Fountain (07105960)	38°39'16" 104°44'48"	5,600	16.9	5/78-Present	2.30	131	5/8/80	0.01	Do.
4	Little Fountain Creek above Keaton Reservoir (07105920)	38°40'54" 104°51'29"	6,430	11.0	5/78-Present	5.80	199	5/8/80	0	Do.
5	Little Fountain Creek near Fort Carson (07105928)	38°40'49" 104°51'08"	6,360	11.8	5/78-Present	4.19	157	5/8/80	0	Do.
6	Little Fountain Creek near Fountain (07105940)	38°38'33" 104°44'49"	5,560	26.9	5/78-Present	4.56	1,230	5/8/80	0	Do.
7	Little Turkey Creek near Fountain (07099220)	38°37'37" 104°51'55"	6,395	9.59	5/78-Present	1.87	147	5/8/80	0	Do.
8	Turkey Creek near Fountain (07099215)	38°36'42" 104°53'39"	6,420	13.0	5/78-Present	2.49	519	8/11/80	0	Do.
9	Turkey Creek above Teller Reservoir (07099230)	38°27'37" 104°49'19"	5,520	62.5	5/78-Present	4.54	3,240	6/20/80	0	Do.
10	Turkey Creek near Stone City (07099235)	38°26'27" 104°49'31"	5,400	71.5	5/78-Present	0.32	2.6	6/20/80	0.01	Do.
	Bear Creek near Colorado Springs[2] (07105000)	38°49'13" 104°53'29"	6,615	7.56	[3]1949-1972	[3]1.63	[3]16.3	6/4/57	[3]0.20	[3]3/12/55-3/14/55

[1]Site No. refers to site location shown on plate 1.
[2]Station is located approximately 9 miles northwest of the study area.
[3]Streamflow characteristics determined from record period from 1/1949-12/1972.
(Source of data analysis: Livingston, Klein and Bingham, 1976b).

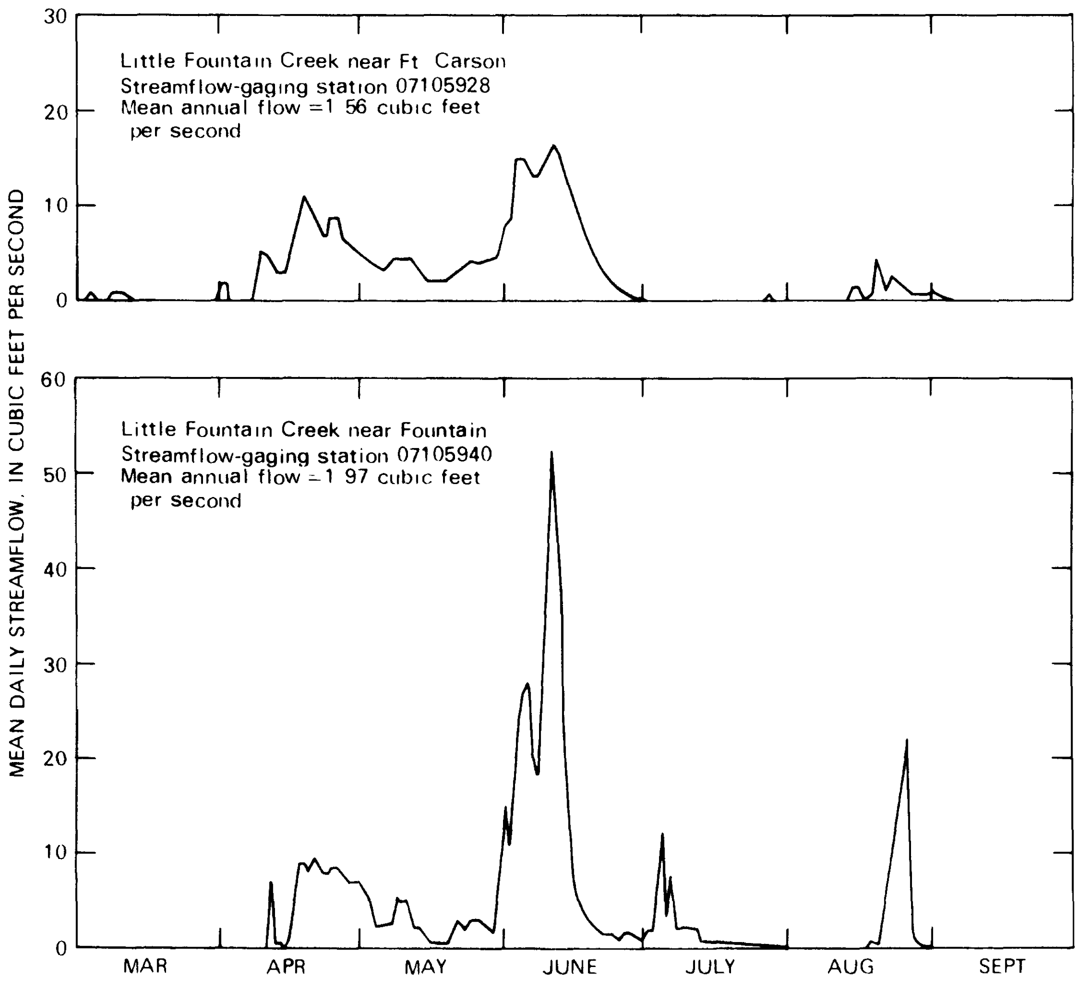


Figure 5.--Mean daily flow in Little Fountain Creek, 1979.

Annual Runoff

Livingston, and others (1976b) derived estimates of average annual streamflow at six sites in the study area (pl. 1) using regression equations based on characteristics of channel geometry. These estimates are presented in table 5.

A summary of streamflow data collected at a streamflow-gaging station on Bear Creek from 1949 through 1972 is presented in table 4. The area and terrain of the Bear Creek drainage basin are similar to those of Little Fountain, Little Turkey, Rock, and Turkey Creeks west of Fort Carson. The Bear Creek basin is dissimilar in that it is oriented to the northeast. The mean annual runoff in Bear Creek is equivalent to 155 acre-ft/mi^2.

A comparison of the measured streamflow during 1979 and 1980 in Little Fountain, Little Turkey, Rock, and Turkey Creeks with estimates of mean annual runoff based on channel-geometry techniques and estimates based on the mean annual runoff of 155 acre-ft/mi^2 in Bear Creek is shown in table 6. In each stream the volume of measured runoff greatly exceeds the volume estimated using channel-geometry techniques. Although precipitation at the Colorado Springs weather station during 1979 and 1980 exceeded the average annual precipitation by about 25 percent, the estimates based on 155 acre-ft/mi^2 are much more reasonable than those derived by channel-geometry techniques. Using an estimated average annual yield of 155 acre-ft/mi^2, the combined inflow upstream from Fort Carson of Little Fountain, Little Turkey, Rock, and Turkey Creeks is estimated to average 8.64 ft^3/s, or 6,240 acre-ft/yr. The actual inflow to Fort Carson is less than this quantity because of streamflow diversions for municipal and domestic water supplies. Pumpage of ground water from the alluvial aquifers upstream from Fort Carson also reduces the quantity of streamflow entering the study area.

Magnitude and Frequency of Floods

Intense thunderstorms at Fort Carson may generate damaging floods. McCain and Jarrett (1976) developed regression equations for estimating flood magnitudes at ungaged sites on streams in the Plains region of Colorado, using drainage-basin characteristics. These equations, presented in table 7, were used to calculate estimated flood magnitudes at recurrence intervals of 10, 50, 100, and 500 years at selected streamflow-gaging stations at and near Fort Carson. The results are summarized in table 8.

The susceptibility of housing, roads, and other features to floodflow can be approximated by determining the cross-sectional area of a stream channel required to accommodate the discharge values shown in table 8. The cross-sectional area can be estimated by extending the stage-discharge rating curves available from the U.S. Geological Survey office in Pueblo, Colo., or by using the procedures outlined in McCain and Jarrett (1976, p. 34).

Table 5.--*Estimated mean annual discharge of ungaged streams at and near Fort Carson*
(Source: Livingston and others, 1976b)

[mi^2, square miles; ft^3/s, cubic feet per second]

Site No.[1]	Name of stream site	Location: Section	Location: Township	Location: Range	Drainage area (mi^2)	Estimated mean annual discharge (ft^3/s)
1	Rock Creek at State Highway 115, near Fort Carson---------------------	31	15 S.	66 W.	6.06	0.18
2	Little Fountain Creek at State Highway 115, near Fort Carson--------	11	16 S.	65 W.	12.0	1.4
3	Little Fountain Creek near mouth, near Fountain------------------------	32	16 S.	65 W.	54.6	.05
4	Little Turkey Creek at State Highway 115, near Fort Carson------------	22	16 S.	67 W.	7.70	.01
5	Turkey Creek at State Highway 115, near Fort Carson---------------------	33	16 S.	67 W.	12.9	.08
6	Turkey Creek at El Paso County line, near Fort Carson---------------------	6	18 S.	66 W.	39.4	.22

[1]Site No. refers to site location shown on plate 1.

Table 6.--*Comparison of measured and estimated average annual runoff at selected streamflow-gaging stations at and near Fort Carson*

[acre-ft, acre-feet; acre-ft/mi², acre-feet per square mile; ft³/s, cubic feet per second]

U.S. Geological Survey station name and number	Measured mean annual runoff during water years 1979-80			Estimates of mean annual runoff: Using channel-geometry technique			Estimates of mean annual runoff: Using mean annual runoff of 155 acre-ft/mi²	
	(acre-ft)	(acre-ft/mi²)	(ft³/s)	(acre-ft)	(acre-ft/mi²)	(ft³/s)	(acre-ft)	(ft³/s)
Rock Creek above Fort Carson (07105945)	2,367	349	3.27	------	-----	----	1,052	1.45
Rock Creek near Fort Carson (07105950	1,991	256	2.75	86	11.0	.12	-----	----
Little Fountain Creek above Keaton Reservoir (07105920)	4,243	385	5.86	------	-----	----	1,705	2.36
Little Fountain Creek near Fort Carson (07105928)	5,033	257	4.19	651	55.2	.90	-----	----
Little Turkey Creek near Fountain (07099220)	1,354	141	1.87	7.24	0.76	0.01	1,486	2.05
Turkey Creek near Fountain (07099215)	1,802	139	2.49	57.9	4.46	.08	2,015	2.78

Table 7.--*Regression equations for estimating flood magnitudes of selected recurrence intervals in the Plains region*

[The equations are applicable to streams on which diversions and regulation have no significant effect on annual peak discharge]

Equation	Average standard error of estimate, in percent[1]
$Q_{10} = 144(A)^{0.528}(S_B)^{0.336}$	31
$Q_{50} = 891(A)^{0.482}(S_B)^{0.154}$	24
$Q_{100} = 1{,}770(A)^{0.463}(S_B)^{0.086}$	28
$Q_{500} = 5{,}770(A)^{0.432}$	45

Where: Q_T = discharge for recurrence interval of T years, in cubic feet per second;
A = drainage area, in square miles; and
S_B = basin slope.

[1]The standard error of estimate in percent is the percentage greater or less than the calculated regression line within which two-thirds of the data used to define the regression equation occur.

Table 8.--*Estimated flood magnitudes at 10-, 50-, 100-, and 500-year recurrence intervals at selected streamflow-gaging stations at and near Fort Carson*

[mi^2, square mile; ft^3/s, cubic foot per second]

U.S. Geological Survey station name and number	Basin slope	Basin area (mi^2)	Estimated flood magnitude (ft^3/s)[1]			
			Q_{10}	Q_{50}	Q_{100}	Q_{500}
Rock Creek above Fort Carson (07105945)---	0.08	6.79	170	1,500	3,500	13,000
Rock Creek near Fountain (07105960)-------	.04	16.9	220	2,100	5,000	20,000
Little Fountain Creek above Keaton Reservoir (07105920)-------------------	.06	11.0	200	1,800	4,200	16,000
Little Fountain Creek near Fort Carson (07105928)-----------------------------	.04	26.9	280	2,700	6,200	24,000
Little Fountain Creek near Fountain (07099220)-----------------------------	.08	9.59	200	1,800	4,100	15,000
Turkey Creek near Fountain (07099215)-----	.07	13.0	230	2,000	4,600	17,000
Turkey Creek above Teller Reservoir (07099230)-----------------------------	.02	62.5	340	3,600	8,600	34,000

[1]Estimates rounded.

Water Rights

The water rights for direct flow diversion and reservoir storage appurtenant to Fort Carson cannot be definitively described at this time. The rights are an issue in proceedings through the McCarran Amendment to adjudicate all rights of the U.S. Government to water from the Arkansas River in Colorado. The Colorado Department of Natural Resources, Division of Water Resources, Office of the State Engineer has inventoried the water rights which may be appurtenant to Fort Carson at the request of the U.S. Geological Survey. Findings of this study are contained in a report by the Colorado Division of Water Resources (1978).

GROUND-WATER HYDROLOGY

The availability, movement, and quality of ground water is largely dependent on the distribution, permeability, and composition of the rock units that comprise the aquifers. The areal distribution of rock units at the land surface in Fort Carson is shown in figure 6. Successively older sedimentary rock units uplifted with the Rocky Mountains are exposed from east to west in the study area.

Structure contours on the top of the Dakota Sandstone are shown in figure 7 and generally represent the configuration of the Cretaceous and older sedimentary rock formations underlying Fort Carson. Structural deformation of the sedimentary rock formations includes a series of approximately north-trending anticlines and synclines in the southern part of the study area. West of the Turkey Creek anticline, the regional dip is toward the south; east of the Turkey Creek anticline, the regional dip is toward the east. The dip of the Dakota Sandstone is very steep near its outcrop, and decreases to the northeast. It is buried at depths of 1,500 to 2,000 ft on the eastern side of the study area. A west-to-east geologic section beginning near the axis of the Turkey Creek anticline (fig. 8) depicts the general stratigraphic sequence and the altitude of the sedimentary rock formations in the study area.

Deposits of stream alluvium partly fill valleys eroded into the older sedimentary rocks (fig. 7). These deposits are unconsolidated and consist of materials ranging in size from clay to gravel. Terrace alluvium forms a thin blanket over older sedimentary rocks between the stream valleys.

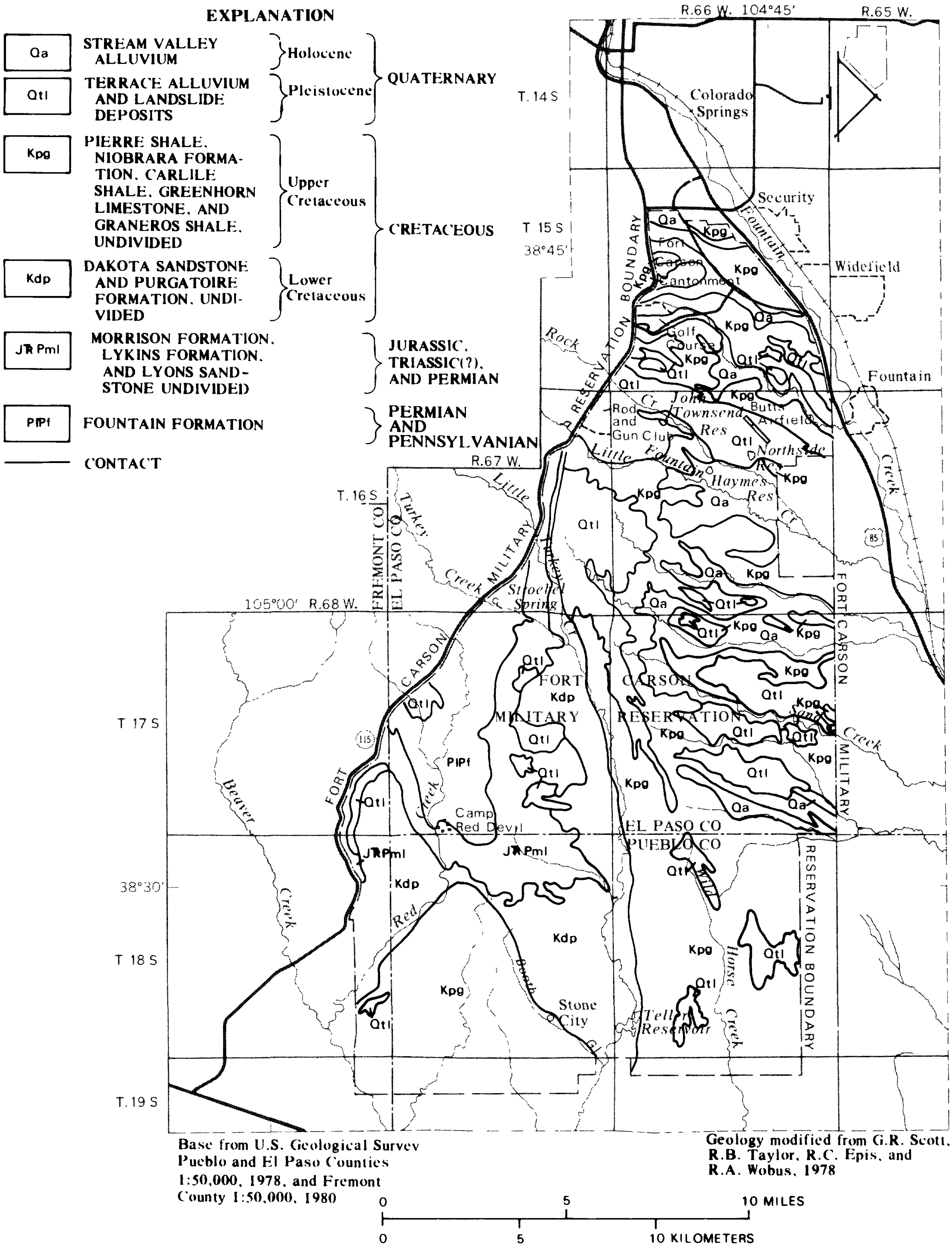


Figure 6.--Generalized geology at Fort Carson Military Reservation near Colorado Springs.

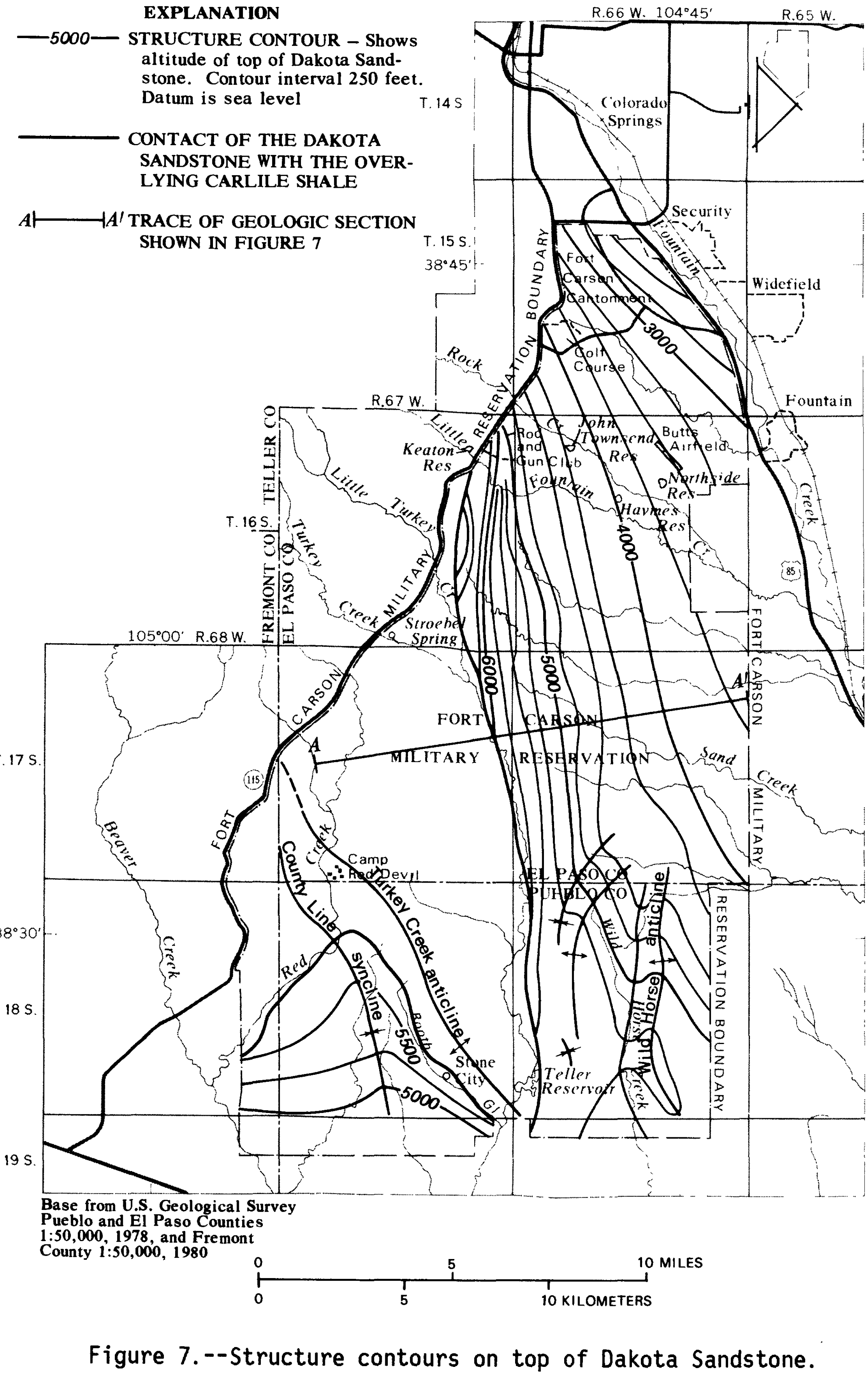


Figure 7.--Structure contours on top of Dakota Sandstone.

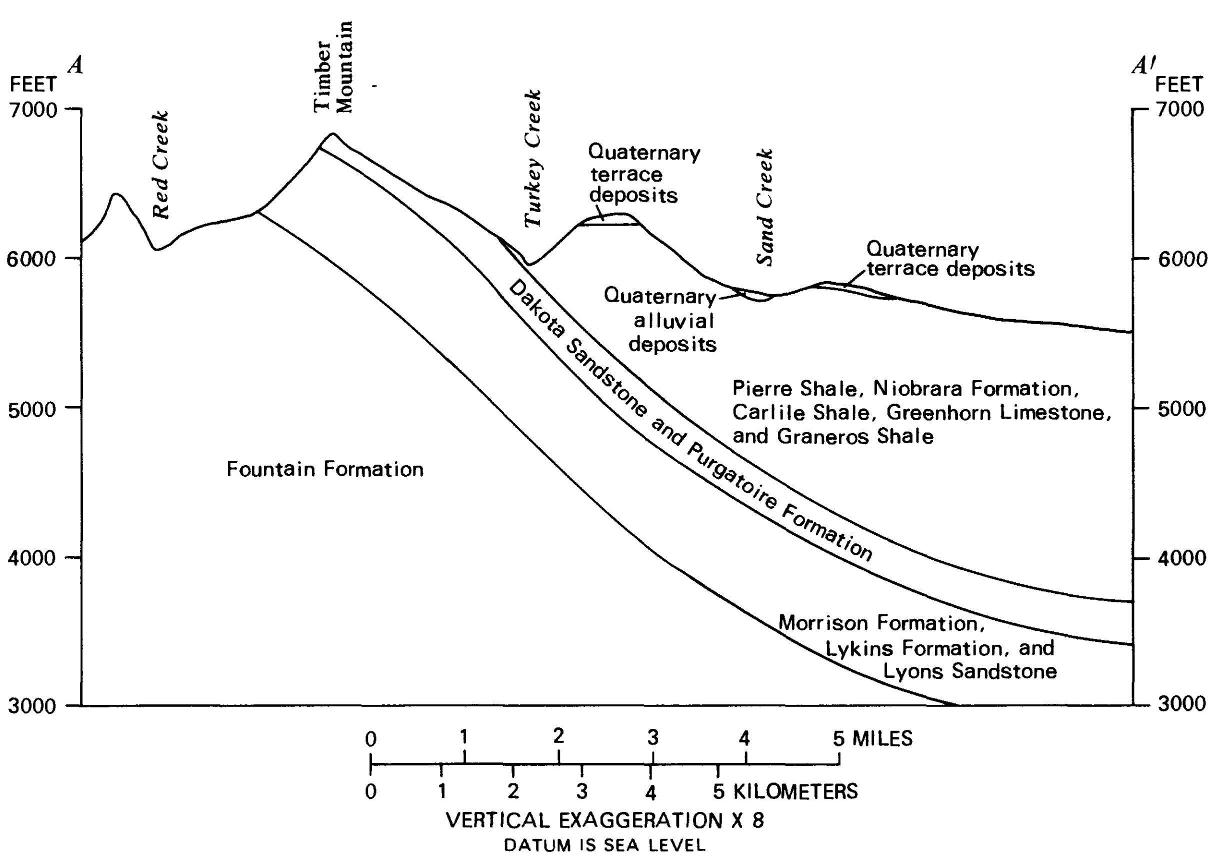


Figure 8.--Generalized geologic section. Section located in figure 7.

The hydrologic properties of the geologic formations at Fort Carson (table 9, in pocket) indicate ground water is available from alluvial and bedrock aquifers. The alluvial aquifers occur in the unconsolidated deposits of stream alluvium, which are moderately permeable. Massive bedded sandstones in the Dakota Sandstone and the Lytle Sandstone Member of the Purgatoire Formation comprise the Dakota-Purgatoire aquifer, the principal bedrock aquifer at Fort Carson. Arkosic sandstones and conglomerates of the Fountain Formation comprise the Fountain aquifer. Layers of sandstone and conglomerate having negligible to moderate permeability occur in other sedimentary-rock formations but lack the thickness or permeability to be considered bedrock aquifers.

Records of selected wells completed in the alluvial and bedrock aquifers at Fort Carson are summarized in "Supplemental Information" (table 15). The alluvial aquifers are capable of providing well yields of 10 to more than 100 gal/min; however, their dependability is limited by their areal extent, thickness, and available recharge. The areally extensive bedrock aquifers are capable of providing well yields of as much as 10 gal/min for sustained periods. Locally, the permeability of the bedrock aquifers has been enhanced by fracturing and well yields greater than 200 gal/min have been obtained.

Alluvial Aquifers

Deposits of stream alluvium at Fort Carson occur along Little Fountain, Rock, and Sand Creeks, and several small, unnamed streams (fig. 6). Minor deposits of stream alluvium also occur along Red and Turkey Creeks.

Ground-water occurrence and movement in the two northernmost deposits of stream alluvium at Fort Carson have been studied intensively. Findings and data reported by Lincoln-Devore Testing Laboratory, Inc. (Meyers, 1977), from the drilling of 41 piezometer wells and observations of water levels during 1976 and 1977 indicate the alluvium ranges in thickness from 0 to 57 ft and consists predominantly of sandy clay and silty clay. Ground water in the alluvium moves eastward and southward toward Fountain Creek at gradients ranging from 0.0005 to 0.036 and averaging 0.013. Depth to ground water below the land surface ranges from less than 1 ft to more than 40 ft and averages 13 ft. The response of ground-water levels to precipitation and subsequent streamflow indicates that these are the principal sources of recharge to the alluvium. Water supplies have not been developed from these deposits. It is very doubtful they could provide significant quantities of water to wells for sustained periods due to the predominantly fine-grained materials that comprise the alluvium.

The alluvial aquifer at Fort Carson with the greatest potential for development of a water supply is the deposit of stream alluvium along Little Fountain and Rock Creeks where well yields of 170 gal/min have been obtained. A drillers' log from a well in sec. 15, T. 16 S., R. 66 E., indicates that 60 ft of stream alluvium which consisted mostly of sand and gravel were encountered above bedrock. The predominance of larger grain sizes in the alluvium may result from the extension of the watersheds of Little Fountain and Rock Creeks into the crystalline igneous and metamorphic rocks of the Front Range west of Fort Carson.

There are too few wells in the alluvial aquifer along Little Fountain and Rock Creeks to fully define ground-water conditions. An analysis of records from existing wells indicates ground water is moving eastward toward Fountain Creek at an average gradient of approximately 0.015. Depth to ground water is less than 5 ft in sec. 15, T. 16 S., R. 66 E., between Little Fountain and Rock Creeks. Several wells in this area produce artesian flow from the alluvium during years when greater than normal precipitation and streamflow occur.

Jenkins and Hurr (1969) described the alluvium along Turkey Creek to be poorly sorted, containing materials ranging in size from clay to cobbles. Geologic sections constructed from test-drilling data indicated a maximum thickness of 19 ft and a width of 900 ft. Most of the coarser grained material is within a band less than 400 ft wide. Existing wells in the aquifer were test pumped at rates of from 1 to 5.8 gal/min. To better define the hydraulic properties of the aquifer, Jenkins (1971) conducted an investigation of Stroebel Spring, which had been reported to provide water for livestock during the spring and early summer, becoming dry in late summer. Test pumping during 1970 indicated the spring capable of yielding 60 gal/min with about 4.5 ft of drawdown, giving a specific capacity of about 12.5 (gal/min)/ft.

Jenkins (1971) concluded the spring was hydraulically connected to and recharged by Turkey Creek. During periods when there is no flow in Turkey Creek, water can be pumped from the spring until the ground water in storage in the alluvial aquifer near the spring is depleted.

Waggoner (1967) described the alluvium along Red Creek to be a silty, gravelly sand which was crudely stratified and unconsolidated. The underflow in the alluvium was estimated to range from 14 to 21 gal/min. He concluded the alluvium would not produce a sustained yield of 50 gal/min for more than 1 to 2 weeks and could not be considered a dependable source of water because of the variable occurrence of precipitation and recharge. This conclusion has been verified by subsequent operation of a well completed in the alluvium along Red Creek, which supplies water to Camp Red Devil. The well is reportedly dependable only in the spring and early summer, and water is hauled to Camp Red Devil during most years from a nearby well which produces water from the Dakota-Purgatoire aquifer (Michael E. Halla, U.S. Department of the Army, Fort Carson Military Reservation, oral commun., 1980).

The response of alluvial aquifers to pumping and recharge is illustrated in figure 9, which shows a hydrograph of water levels during 1980 in a well completed in stream alluvium along Booth Gulch, a small tributary to Turkey Creek. The water level rose 0.7 ft during May following a period of intense rainfall and subsequent runoff, which recharged the aquifer. The abrupt decline and subsequent recovery of water level during January were the result of pumping the well to obtain a water sample for chemical analysis.

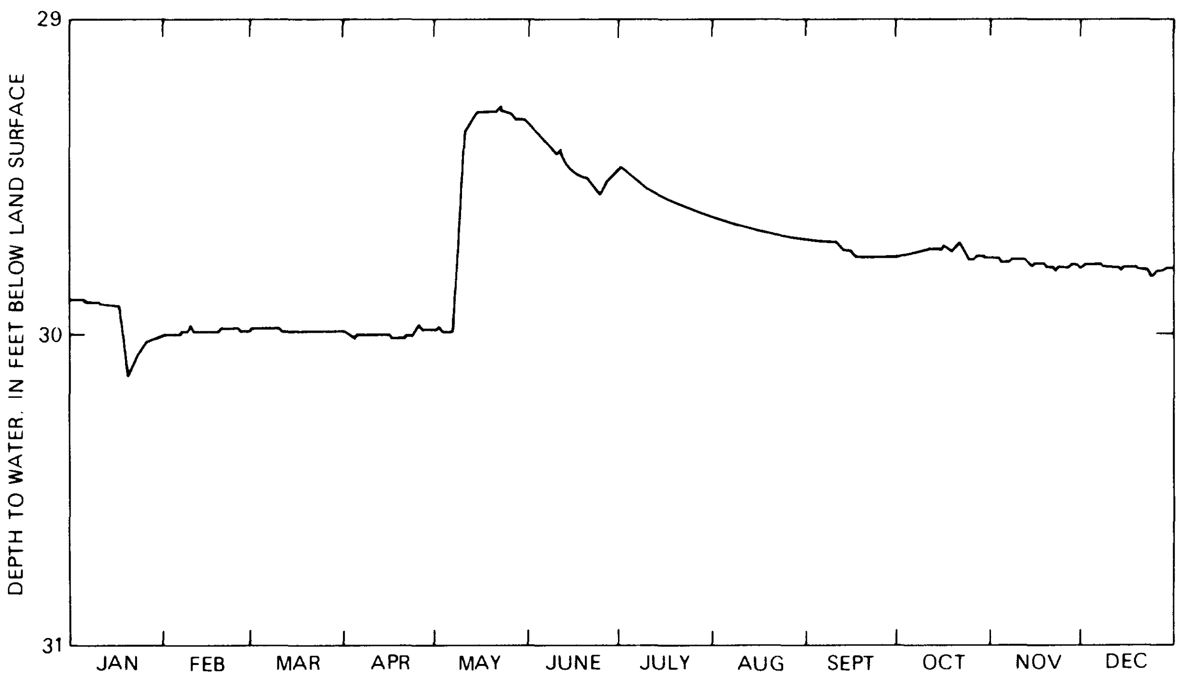


Figure 9.--Water levels in well SC18-67-27DDA completed in the alluvial aquifer in Booth Gulch, 1980.

Dakota-Purgatoire Aquifer

The Dakota-Purgatoire aquifer is the most areally extensive and potentially productive bedrock aquifer in southeastern Colorado. It yields water to many small wells for livestock and domestic use; in some areas, large-capacity wells provide water for irrigation.

The Dakota-Purgatoire aquifer consists of sandstones in the Dakota Sandstone and Lytle Member of the Purgatoire Formation which crop out in a distinctive hogback paralleling the Front Range from south-central Colorado into Wyoming. At Fort Carson, the formations are exposed along the flanks of the Turkey Creek anticline and are extensively jointed.

The Dakota Sandstone consists mostly of a well-cemented, yellowish-brown fine- to medium-grained, cross-bedded massive sandstone that locally becomes coarse-grained to conglomeratic and a middle unit of thinly bedded shale, sandstone, and clay. Drillers' and geophysical logs indicate the thickness of the formation ranges from 90 to 110 ft at Fort Carson. The Purgatoire Formation consists of the Glencairn Shale Member and the Lytle Sandstone Member. The Glencairn Shale Member, which separates the Lytle Sandstone Member from the overlying Dakota Sandstone, consists of 60 to 80 ft of dark-colored marine shale and thin-bedded sandstone. The Lytle Sandstone Member consists of 100 to 130 ft of light-colored, massive-bedded, fine-grained sandstone.

Ground water in sedimentary rocks moves through permeable rock units in the direction of the hydraulic gradient. A contour map showing the hydraulic gradient determined through measurements of water levels in wells completed in the Dakota-Purgatoire aquifer at Fort Carson is shown in figure 10. In the southern part of Fort Carson, ground water moves downgradient toward the south; in the northern part, the direction of flow probably is toward the east. The Pierre Shale, Niobrara Formation, Carlile Shale, Greenhorn Limestone, and Graneros Shale, which overlie the aquifer, are confining beds and retard vertical movement of water from the aquifer, producing artesian conditions.

Recharge to the Dakota-Purgatoire aquifer is from infiltration of precipitation and streamflow in areas where the aquifer is exposed at the land surface. Discharge occurs mostly from well pumping and leakage through overlying formations.

The yields of wells completed in the Dakota-Purgatoire aquifer in the southern part of Fort Carson range from 30 to 230 gal/min. Yields of 200 and 230 gal/min were reported (Clevenger, 1968; Thorfinnson, 1968) for two wells near the axes of anticlines where the permeability of the aquifer is probably enhanced by fracturing. The occurrence of these wells near major anticlines and synclines indicates the development of secondary permeability in the aquifer through jointing and faulting, which typically accompany structural deformation. The specific capacities of these wells were 1.45 and 1.71 (gal/min)/ft. Elsewhere in the study area, specific capacities ranged from 0.014 to 0.10 (gal/min)/ft at pumping rates ranging from 1 to 30 gal/min.

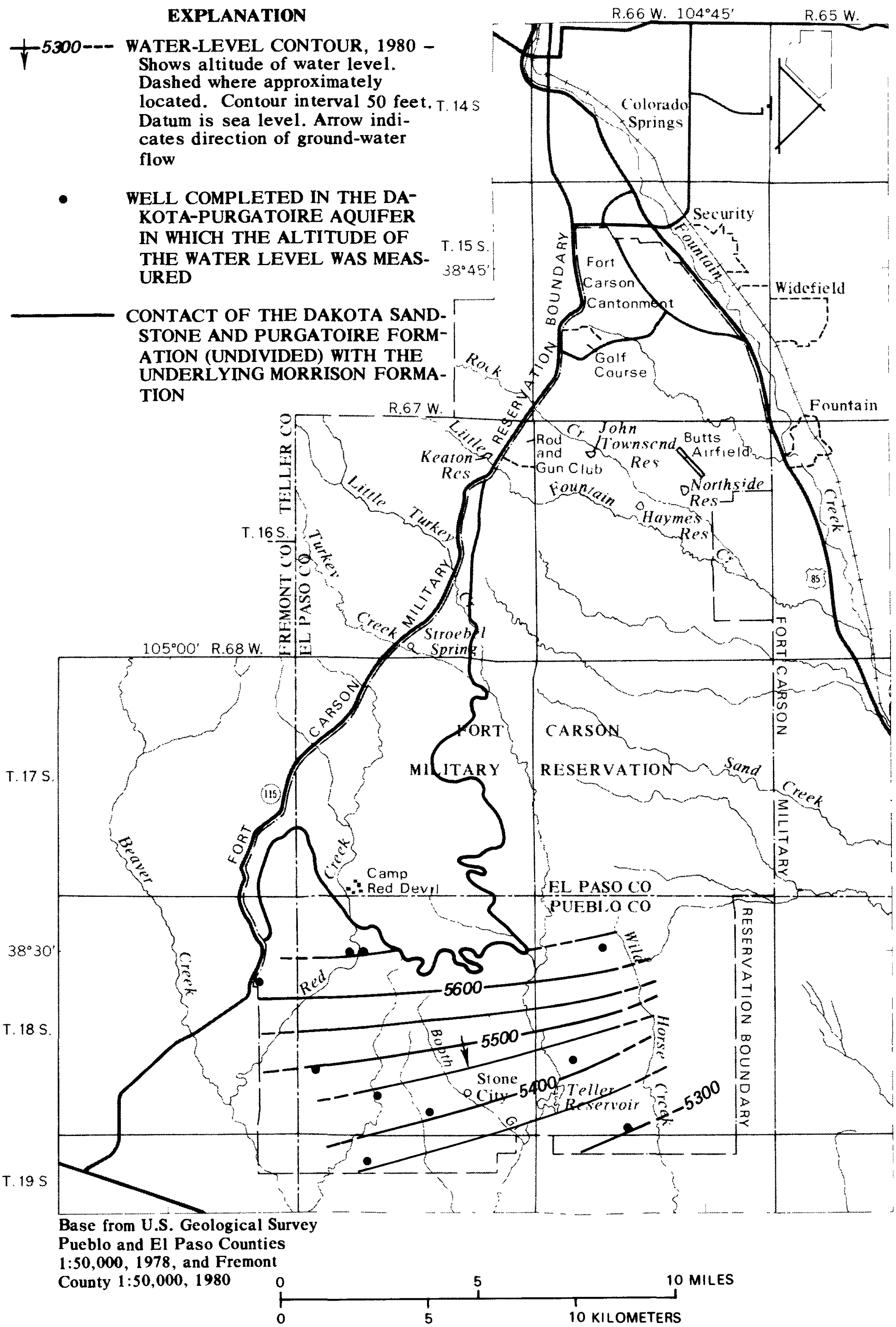


Figure 10.--Altitude of the water level in the Dakota-Purgatoire aquifer.

Fountain Aquifer

The Fountain Formation crops out almost continuously along the Front Range in Colorado from Canon City to Longmont. At Fort Carson, it is exposed over the arch of the Turkey Creek anticline and dips to the south and east. Logs of petroleum test wells indicate the Fountain Formation is 2,100 to 2,900 ft thick in the southern part of the study area. The Fountain Formation consists predominantly of poorly sorted, coarse- to fine-grained, red arkosic sandstone and conglomerate. The permeability of the formation is low because it is cemented and poorly sorted. The Lyons Sandstone, a well cemented arkosic sandstone, overlies the Fountain Formation and is in direct hydraulic contact with it. A few wells in the study area that penetrate the Fountain Formation also penetrate, and may produce small quantities of water from the Lyons Sandstone. A contour map showing the hydraulic gradient determined through measurements of water levels in wells penetrating the Fountain aquifer is shown in figure 11. Ground water in the Fountain aquifer moves down-gradient toward the south and east in the general direction of the dip. Shales, siltstones, and limestones in the younger Lykins and Morrison Formations, which overlie the Lyons Sandstone, are confining beds and retard the upward movement of water from the aquifer.

Recharge to the Fountain aquifer is from infiltration of precipitation and streamflow in outcrop areas. Recharge from infiltration is illustrated in figure 12, which shows a hydrograph of 1980 water levels in well SC17-67-10ADB that is completed in the Fountain Formation. The gradual decline in water level from January to April reflects movement of water away from the outcrop of the aquifer during a period of no recharge. The abrupt 2.2-ft rise in May corresponds to a period of intense rainfall and runoff, which recharged the aquifer. The rise in water levels from August through December may have resulted from seepage from several sediment-retention ponds near the well.

The yields of wells completed in the Fountain aquifer are very small. Jenkins and Hurr (1969) reported well yields of 1 to 3 gal/min, but concluded that yields of 5 to 10 gal/min could be expected from properly constructed wells that completely penetrate the aquifer. A well in sec. 4, T. 17 S., R. 67 E. was tested at 1 gal/min with a drawdown of 39 ft, giving a specific capacity of 0.026 (gal/min)/ft. Because of the small yields, wells have been constructed in the Fountain aquifer only in those areas of Fort Carson where the more productive Dakota-Purgatoire aquifer has been removed by erosion.

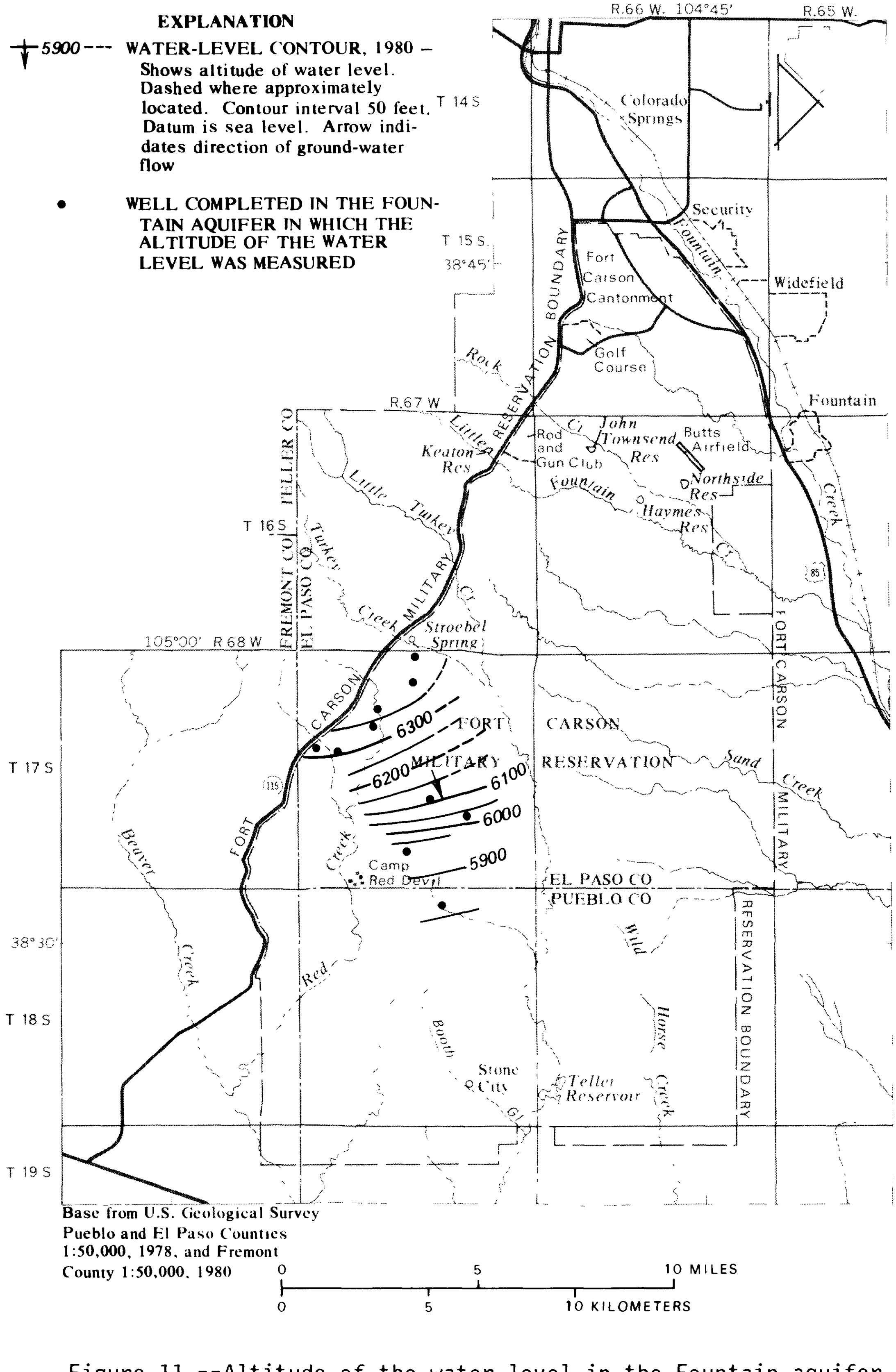


Figure 11.--Altitude of the water level in the Fountain aquifer.

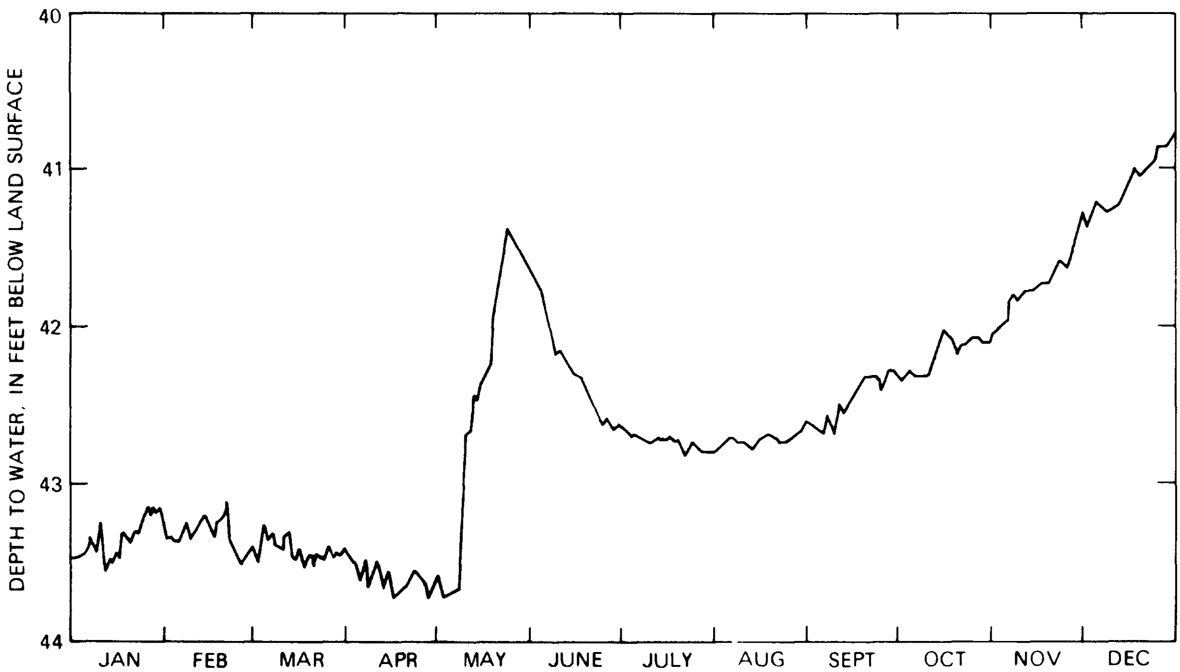


Figure 12.--Water levels in well SC17-67-10ADB completed in the Fountain aquifer, 1980.

WATER QUALITY

The quality of the water resources at Fort Carson is a major factor in water-use planning. During the investigation, water samples were collected from streams, reservoirs, and wells for laboratory analyses of chemical and biological constituents. Results of analyses are presented as Supplemental Information (tables 16, 17, and 18).

Analyses of water samples collected from streams and wells were evaluated to determine the suitability of the water for irrigation and for drinking. The analyses indicate that water from most of the streams and the alluvial aquifers along the western side of Fort Carson is suitable for irrigation and would be suitable for drinking if treated for biological contaminants. The chemical quality of water from streams and the alluvial aquifers deteriorates to the east, but the water is still suitable for irrigation with proper management practices. Water from the Dakota-Purgatoire and Fountain aquifers would require treatment to decrease the concentration of some chemical constituents prior to use for drinking water.

Surface-Water Quality

Reservoirs

The quality of water in reservoirs is dependent on interrelated physical, chemical, and biological processes which occur in the reservoir, the quality of streamflow and ground water discharged to the reservoir, and the uses of the reservoir. Physical characteristics such as morphology, light penetration, suspended sediment, and temperature affect the composition and populations of those plant and animal communities present, which in turn affect the chemical quality of water.

Evaluation of the trophic status, or degree of nutrient enrichment and filling by sediment of a reservoir, is a means of evaluating its overall quality of a water body on the basis of physical, chemical, and biological criteria. The trophic status of a reservoir passes through three stages between initial filling and final extinction (Britton and others, 1975). The first stage, oligotrophy, is characterized by large concentrations of dissolved oxygen and small concentrations of dissolved substances--small nutrient concentrations limit plant production. The second stage, mesotrophy, is characterized by increased concentrations of dissolved substances and nutrients, and increased plant production. The final stage, eutrophy, is characterized by large concentrations of dissolved substances and nutrients and by excessive plant production. Dissolved-oxygen concentrations fluctuate considerably and may be depleted by bacterial decomposition of organic matter to the extent that fish kills may result.

Teller, Haymes, Townsend, and North Side Reservoirs at Fort Carson were evaluated for trophic status on the basis of concentrations of dissolved oxygen, nutrients, and phytoplankton (Britton and Wentz, 1980). Using criteria based on these factors (table 10), Teller and Haymes Reservoirs were found to be oligotrophic, and Townsend and North Side Reservoirs were found to be mesotrophic (table 11). All these reservoirs were oligotrophic on the basis of criteria for dissolved nitrogen and eutrophic on the basis of criteria for dissolved phosphorus. Eureka Reservoir was not evaluated because it was dry during the investigation.

Table 10.--*Criteria for determining trophic status of reservoirs*

[mg/L, milligrams per liter; cells/mL, cells per milliliter]

Criteria	Trophic status	
	Oligotrophic	Eutrophic
Dissolved oxygen in the hypolimnion[1] [2]	>4.0 mg/L	≦4.0 mg/L
Dissolved nitrogen (ammonia, nitrate, and nitrite)[3]	≦0.3 mg/L	>0.3 mg/L
Dissolved phosphorus[3]	≦0.01 mg/L	>0.01 mg/L
Phytoplankton[4]	≦1,000 cells/mL	>1,000 cells/mL

[1]The hypolimnion is the deepest and coldest lake layer.
[2]U.S. Environmental Protection Agency, 1977a.
[3]Sawyer, 1947.
[4]Lee, 1970.

Table 11.--*Tropic status of reservoirs*

[O, oligotrophic; M, mesotrophic; E, eutrophic]

Reservoir	Dissolved oxygen	Nitrogen	Phosphorus	Phyto- plankton	Trophic status[1]
Haymes	O	O	E	O	O
North Side	O	O	E	E	M
Teller	O	O	E	O	O
Townsend	E	O	E	O	M

[1]Trophic status: Three or four oligotrophic criteria, oligotrophic; three or four eutrophic criteria, eutrophic; and criteria equally divided, mesotrophic.

Streams

The quality of water in streams in the study area is affected by ground water, precipitation, evapotranspiration, and water use. Ground water contains larger concentrations of dissolved solids than precipitation runoff. Evapotranspiration concentrates dissolved solids in streamflow and in ground water. Diversion of water for irrigation and other uses reduces the rate of streamflow. Ground-water seepage and evapotranspiration then have a greater effect on the quality of the remaining streamflow. Combined, these factors result in a downstream deterioration in water quality in the study area and in an inverse relationship between rate of stream discharge and measured concentration of dissolved solids.

Evaluation of laboratory analyses of water samples collected from streams indicate that, despite the increase in dissolved solids, the proportions of individual constituents remains reasonably constant in surface water entering and leaving Fort Carson. All the water-quality samples from streams were collected at streamflow-gaging stations during routine visits or by automated samplers. In the following discussion of the quality of water in streams, comparisons are made between the upstream and downstream stations.

The relation between concentration of dissolved solids and specific conductance in surface-water samples collected at streamflow-gaging stations in the study area is shown in figure 13. The inverse relation between specific conductance and rate of discharge is shown in figure 14. Large values of specific conductance were measured at small and moderate rates of discharge at the downstream stations. Specific conductance at the downstream stations decreases toward values measured at the upstream stations during rapid rates of discharge because of dilution by runoff from precipitation. At the upstream stations, values of specific conductance are virtually independent of stream discharge, indicating that very small quantities of water are discharged to the streams from alluvial aquifers or lost through evapotranspiration. This interpretation is supported by the upstream occurrence of areally limited deposits of stream alluvium and long stream reaches in narrow bedrock canyons.

At the upstream gaging stations, the concentrations of dissolved solids ranged from 49 to 292 mg/L (milligrams per liter). Calcium and bicarbonate were the predominant ions. Linear relations between specific conductance and selected chemical constituents in samples from the upstream stations are shown in table 12. When shown graphically, the relations summarized in table 12 would appear similar to the relation between dissolved solids and specific conductance shown in figure 13. To estimate the concentration of a constituent, multiply a given specific conductance by the value listed for slope and add the value listed for the intercept.

Concentrations of fecal coliform bacteria in water at the upstream stations generally exceed the 1 colony per 100 mL (milliliter) limit specified by the State of Colorado primary drinking-water standards (Colorado Department of Health, 1977). The Colorado standards also delineate a maximum contaminant level for fluoride of 2.0 mg/L (milligrams per liter) in the Colorado Springs area. Fluoride concentrations ranging from 2.4 to 3.6 mg/L were observed in water samples from Little Fountain Creek upstream from the study area.

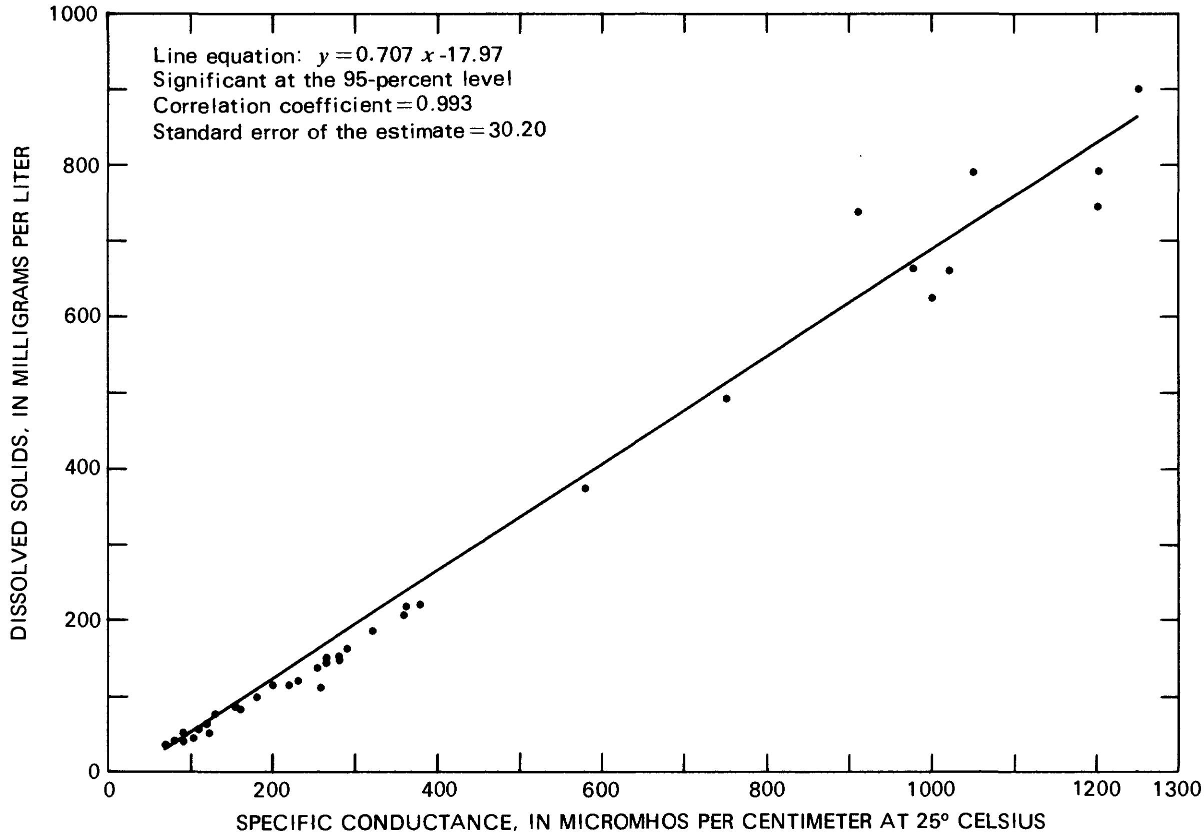


Figure 13.--Relation between dissolved solids and specific conductance in streamflow at and near Fort Carson.

The classification of the suitability of water from the upstream gaging stations for irrigation according to their specific conductance and sodium-adsorption ratio (U.S. Salinity Laboratory Staff, 1954) is shown in figure 15A. Analyses of water samples from the upstream stations indicated low and medium classes of salinity hazard and low class of alkali hazard. Water in the medium class of salinity hazard may be used for irrigation if a moderate degree of leaching occurs.

The concentration of dissolved solids in samples from the downstream stations ranged from 121 to 1,470 mg/L. Calcium and bicarbonate were the predominant ions in this water. Linear relation between concentrations of selected chemical constituents and specific conductance in samples from the downstream stations are shown in table 12.

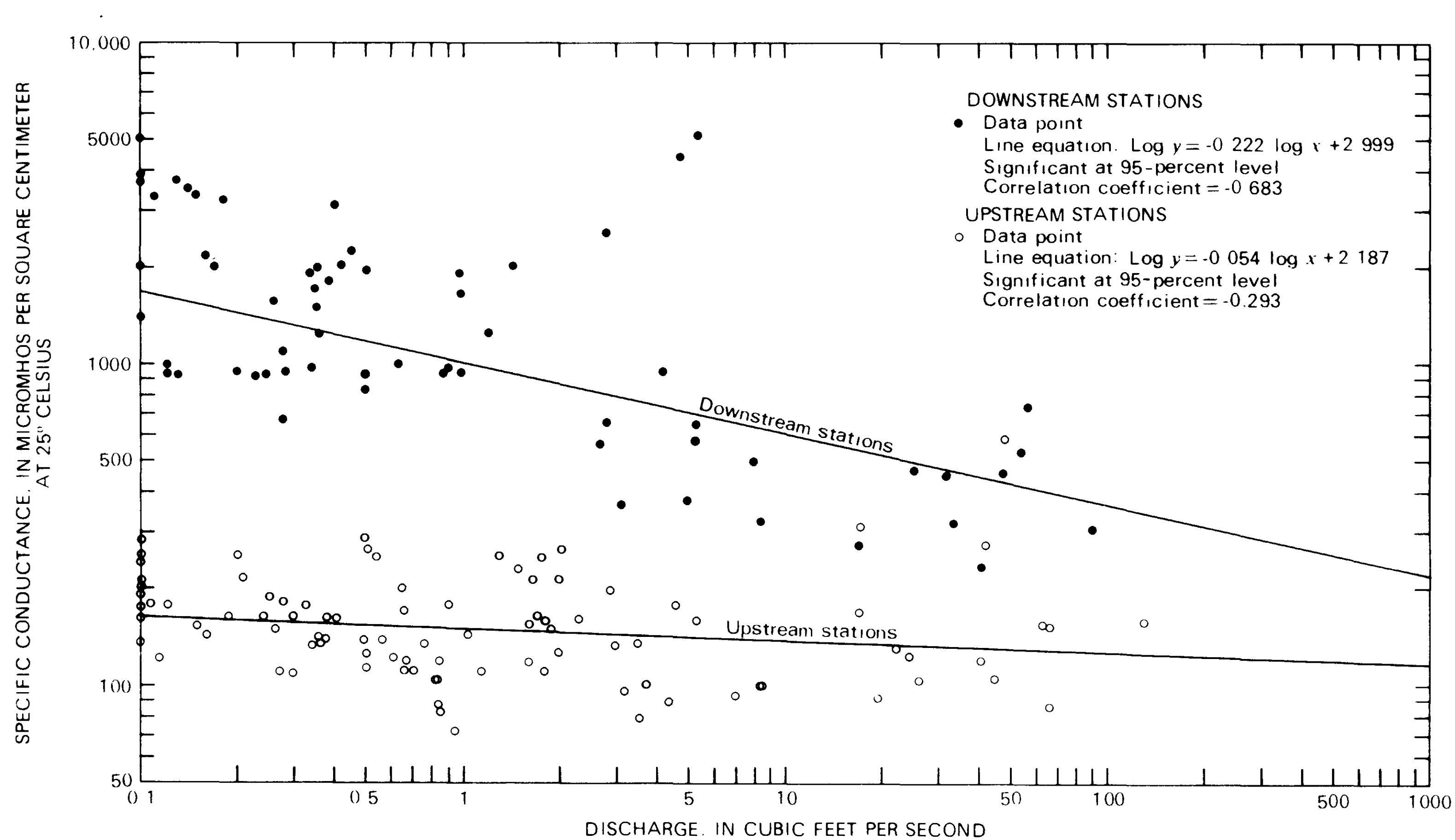


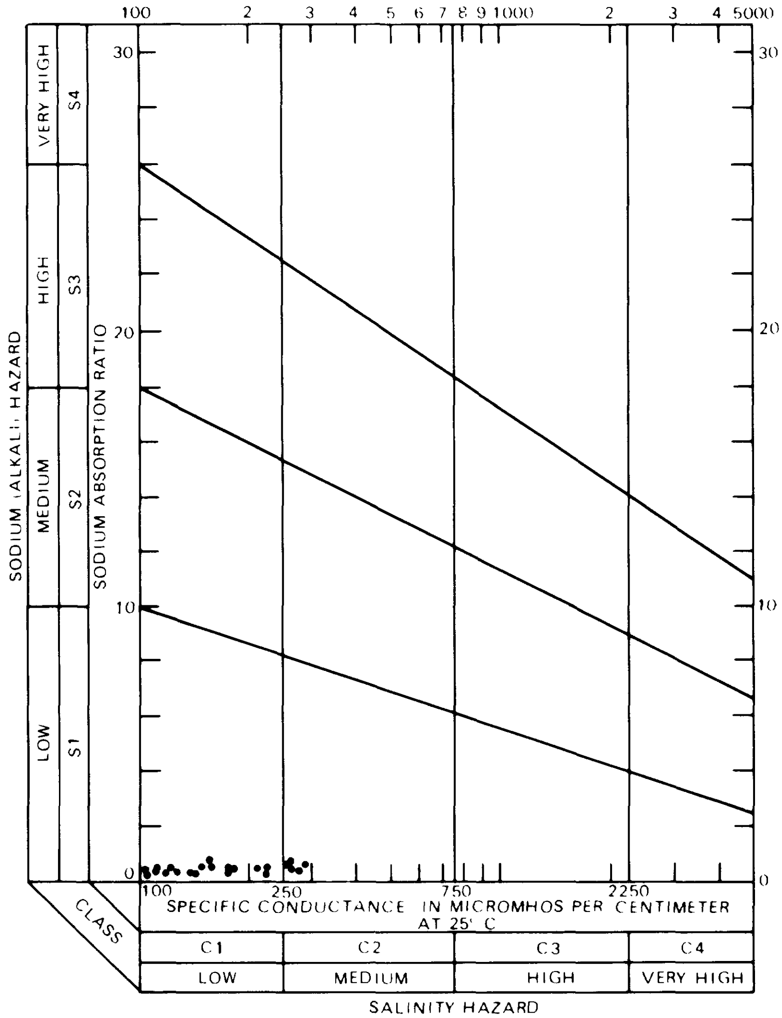
Figure 14.--Relation between specific conductance and discharge at upstream and downstream streamflow-gaging stations at and near Fort Carson.

Table 12.--*Regression coefficients for estimating the concentrations of selected chemical constituents from measured specific conductance at upstream and downstream gaging stations at and near Fort Carson*

Constituent	Upstream gaging stations				Downstream gaging stations			
	Regression coefficients		Correlation coefficient	Standard error of estimate[1]	Regression coefficients[2]		Correlation coefficient	Standard error of estimate
	Slope	Intercept			Slope	Intercept		
Calcium-------	0.107	-0.51	0.95	1.06	0.119	-11.7	0.93	11.7
Magnesium-----	.035	-1.23	.97	0.30	.037	-4.41	.96	2.74
Sodium--------	.039	1.45	.87	.72	.091	-12.5	.90	10.7
Potassium-----	.004	1.07	.64	.16	--not significant at 95-percent level--			
Chloride------	.017	-.11	.58	.75	.013	1.27	.65	3.85
Sulfate-------	.130	.55	.92	1.77	.50	-123.	.95	41.6
Fluoride------	-.009	3.26	.61	.36	--not significant at 95-percent level--			

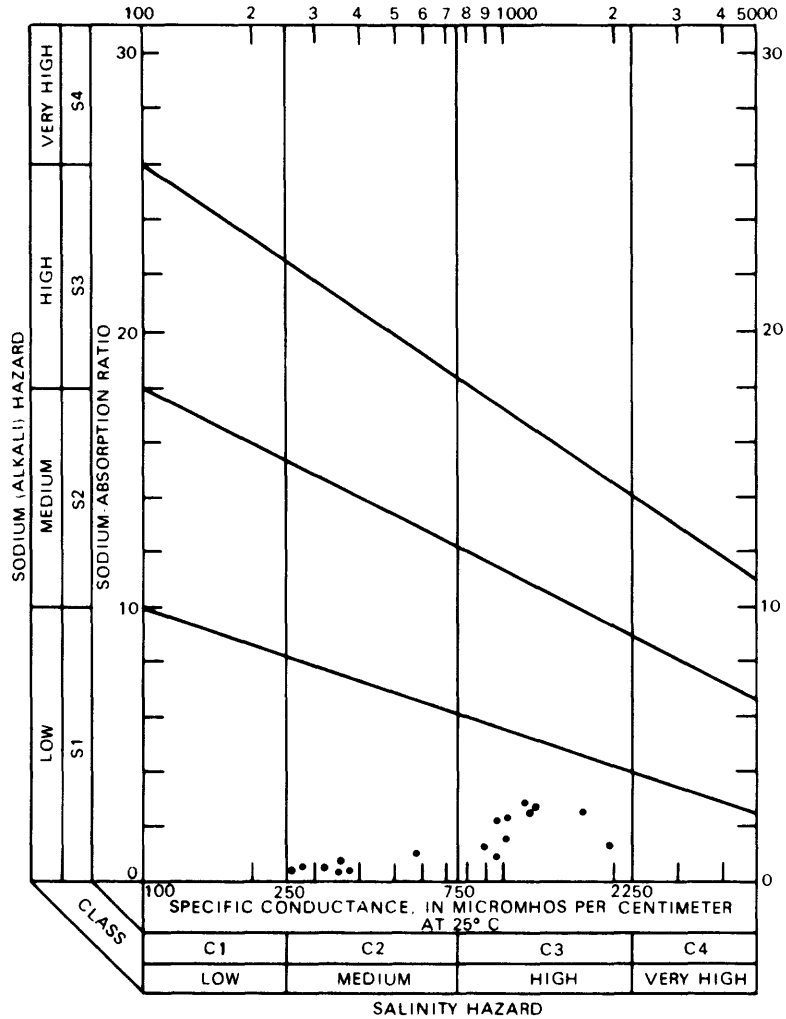
[1]The standard error of estimate is the value greater or less than the calculated regression line within which two-thirds of the data used to define the regression equation occur.

[2]Except as noted, all regression coefficients were significant at the 95-percent level.



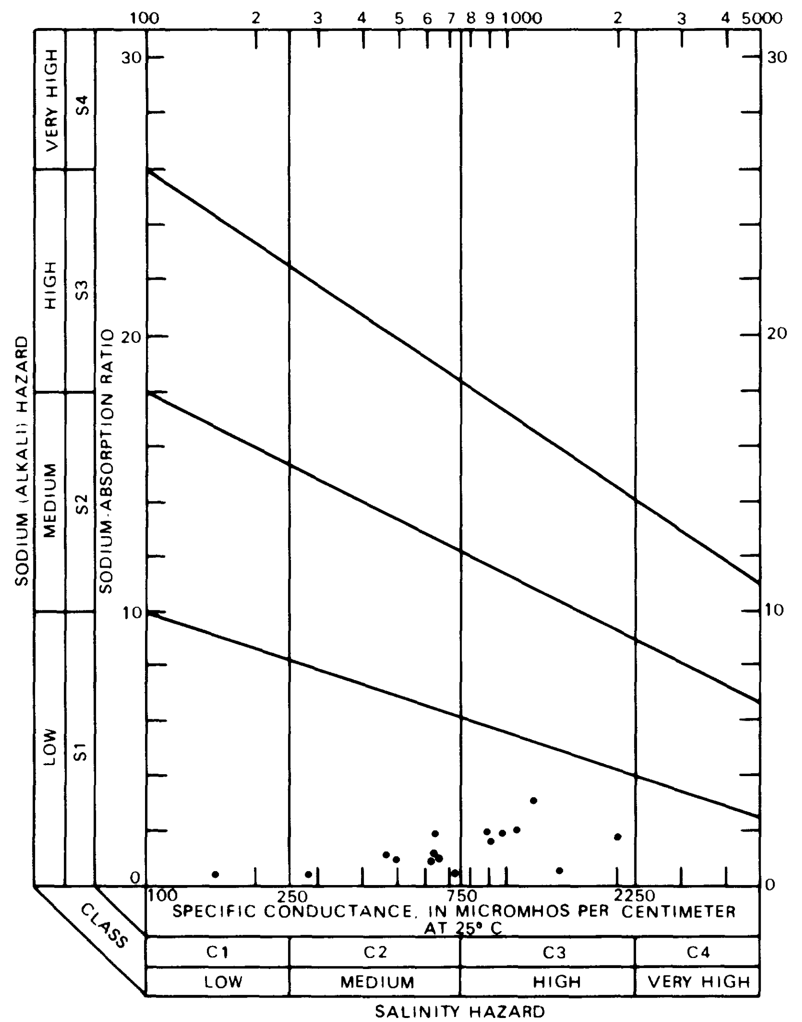
A. Upstream streamflow-gaging stations

Figure 15.--Classification of the suitability for irrigation of water from streams and wells at and near Fort Carson.



B. Downstream streamflow-gaging stations

Figure 15.--Classification of the suitability for irrigation of water from streams and wells at and near Fort Carson--Continued.



C. Wells completed in alluvial aquifers

Figure 15.--Classification of the suitability for irrigation of water from streams and wells at and near Fort Carson--Continued.

Concentrations of fecal coliform bacteria in water at the downstream stations generally exceeded Colorado primary drinking-water standards and were much greater than concentrations in water observed at the upstream stations. Concentrations of fluoride greater than the Colorado primary standard of 2.0 mg/L were observed in 10 of 13 samples from Little Fountain and Rock Creeks. Water samples from the downstream stations generally contain concentrations greater than National secondary drinking-water standards (U.S. Environmental Protection Agency, 1977b): Dissolved solids, 500 mg/L; sulfate, 250 mg/L; and manganese, 50 µg/L (micrograms per liter).

The classification of the suitability of water samples from the downstream stations for irrigation is shown in figure 15*B*. The analyses indicated a medium to high class of salinity hazard and a low class of alkali hazard. As previously noted, water in the medium class of salinity hazard may be safely used for irrigation if a moderate degree of leaching occurs. Water in the high class of salinity hazard should only be used on well-drained soils for plants with good salt tolerance (U.S. Salinity Laboratory Staff, 1954).

Concentrations of fluoride and of fecal coliform bacteria that exceeded maximum contaminant levels specified in the Colorado primary drinking-water standards were reported in analyses of water from both the upstream and downstream stations. Fluoride is a common constituent in ground water, but is rarely found in significant concentrations in surface water (Hem, 1970). Fluoride is mobilized by the dissolution or leaching of fluorite and other minerals containing fluoride that commonly occur in sedimentary and igneous rocks. Fluoride in the concentrations identified at Fort Carson can cause dental fluorosis--mottling of teeth (U.S. Environmental Protection Agency, 1977a). The presence of fecal coliform bacteria indicates contamination by human or animal waste. Common sources include septic tanks, feedlots, and discharges of improperly treated wastewater. Fecal coliform bacteria are considered a health hazard because of their common association with disease-causing bacteria and viruses (McKee and Wolf, 1971).

Ground-Water Quality

Hydrologic and geologic factors affecting the dissolution of materials from soils and aquifers by ground water include the quantity and quality of recharge; the chemical and mineral composition of the soils and rocks that comprise aquifers; the rate of ground-water movement, temperature and pressure in the aquifer; and distance of ground-water movement. Chemical processes of ion exchange, oxidation and reduction, and adsorption and desorption further affect the quality of ground water. These factors result in significant areal variations of water quality in an aquifer and between aquifers.

Alluvial Aquifers

Water samples from the alluvial aquifers contained concentrations of dissolved solids ranging from 96 to 1,630 mg/L; however, concentrations in most of the samples ranged from of 290 to 800 mg/L. Water from the aquifers along the western boundary of Fort Carson predominantly is a calcium bicarbonate type. Downgradient to the east or south, the water is predominantly a calcium sulfate type.

The location of wells completed in the alluvial aquifers from which water samples were collected is shown in figure 16. Also shown are the concentrations of dissolved solids and those chemical constituents present in concentrations which exceed limits specified in the Colorado primary and National secondary drinking-water standards. Analyses indicate the concentrations of dissolved solids increase downgradient to the east along Rock Creek and to the south along Turkey Creek. Similar downgradient deterioration of water quality probably occurs along Little Fountain and Red Creeks. The greatest concentrations of dissolved solids in water from wells completed in stream alluvium were in samples collected from wells adjacent to Booth Gulch and Wild Horse Draw (fig. 16), small drainages that originate in Fort Carson. Water from the alluvial aquifers along the western side of Fort Carson is chemically suitable for drinking; however, none of the samples were analyzed for biological contaminants.

Maximum levels for selected constituents under Colorado primary and National secondary drinking-water standards are shown in table 13 with results of analyses of water from wells completed in the stream alluvium which had one or more constituents in concentrations greater than the standards. Selenium in concentrations greater than the primary standard was observed in samples from a well near Booth Gulch and from a well near Red Creek, which supplies water for Camp Red Devil.

Colorado primary standards for drinking water specify maximum concentrations for gross alpha of 15 pCi/L (picocuries per liter), excluding radon and uranium, and 5 pCi/L for radium 226 plus radium 228. The standard for beta particle and photon radioactivity from manmade radionuclides is the equivalent of an annual dose to the total body or any internal organ of 4 millirems per year. An alert concentration of 50 pCi/L for gross beta is specified; at greater concentrations, additional analyses of specific beta-emitting radionuclides are required. Approximately 50 percent of the samples of ground water collected in the study area were analyzed for selected radiochemical constituents; however, no analyses were made of radon, radium 228, or specific beta-emitting radionuclides. Gross alpha values corrected for uranium that exceed 15 pCi/L, radium-226 values exceeding 5 pCi/L, and gross beta values exceeding 50 pCi/L are listed in table 13. Also listed are values of gross alpha that exceeded 15 pCi/L but which could not be corrected for uranium because uranium was not analyzed. Concentrations of gross alpha greater than the limits described above occurred in water samples from wells near Booth Gulch and Red Creek. Water from these wells was previously noted to have concentrations of selenium that exceed the primary standard.

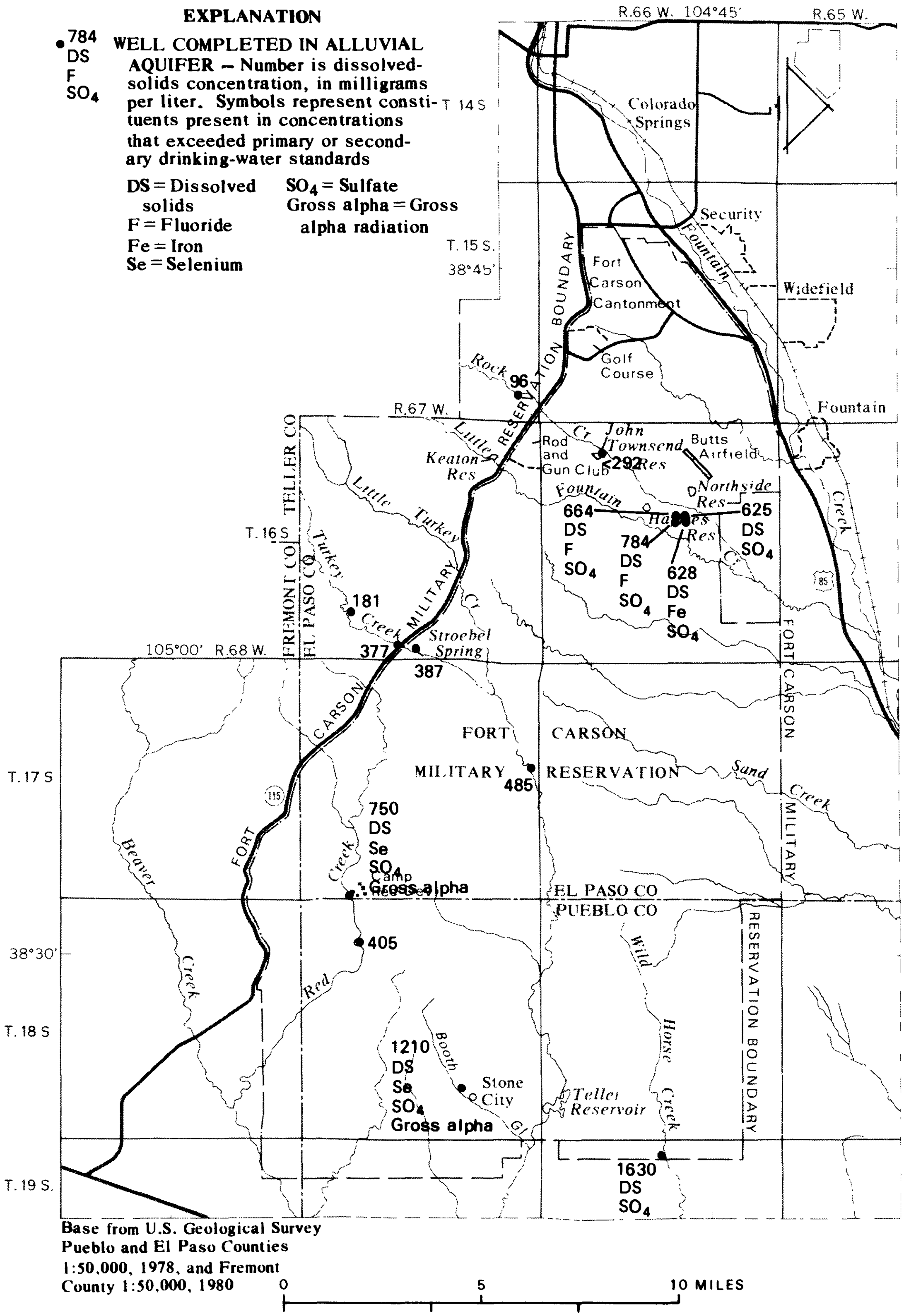


Figure 16.--Concentration of dissolved solids, and other constituents that exceeded drinking-water standards in water from wells completed in the alluvial aquifers at and near Fort Carson.

Table 13.--*Selected Colorado primary and National secondary drinking-water standards and constituent concentrations exceeding the standards in water samples from wells*

[µg/L, micrograms per liter; mg/L, milligrams per liter; cols/100mL, colonies per 100 milliliters; pCi/L, picocuries per liter]

		Primary drinking-water standards (Colorado Department of Health, 1977)						Secondary drinking-water standards (U.S. Environmental Protection Agency, 1977)			
	Location	Selenium 10 µg/L	Fluoride[1] 2.0 mg/L	Coliform bacteria 1 cols/ 100mL	Radium-226 and radium-228[2] 5 pCi/L	Gross alpha 15 pCi/L	Gross beta (3)	Dissolved solids 500 mg/L	Sulfate 250 mg/L	Manganese 50 µg/L	Iron 300 µg/L
Alluvial aquifers	SC16-66-15ACC1	--	--	(4)	--	--	--	625	260	--	--
	SC16-66-15DBA1	--	--	(4)	(4)	(4)	(4)	628	290	--	670
	SC16-66-15DBBB	(4)	2.1	(4)	(4)	(4)	(4)	664	300	--	--
	SC16-66-15DBB2	(4)	2.2	(4)	(4)	(4)	(4)	784	450	--	--
	SC17-67-32CDB1	11	--	(4)	--	20.1	--	750	350	--	--
	SC18-67-27DDA1	15	--	(4)	--	[5]31	--	1,210	670	--	--
	SC19-66-03BCC	(4)	--	(4)	(4)	(4)	(4)	1,630	920	--	--
Niobrara Formation	SC17-66-33BDDA	(4)	(4)	(4)	(4)	(4)	(4)	2,350	1,600	120	340
Dakota-Purgatoire aquifer	SC18-66-20CCC1	--	--	(4)	27	56.3	--	559	--	--	1,800
	SC18-66-33CDA1	--	--	(4)	6.5	23.2	--	--	--	--	550
	SC18-67-06CAD	--	--	[6]4	8.9	[5]51	--	2,290	1,500	90	--
	SC18-67-08ACB1	--	--	(4)	6.7	66.3	--	837	430	--	--
	SC18-67-0BBDB	(4)	--	(4)	(4)	(4)	--	--	--	60	--
	SC18-67-33BBB	--	--	(4)	56	428	140	640	280	--	3,300
	SC18-67-34CAB1	--	--	(4)	--	<17.3	--	1,940	940	60	1,400
	SC19-67-05DAC	--	--	--	360	792	200	--	--	--	--
Fountain aquifer	SC17-67-05DBD	(4)	2.3	(4)	(4)	(4)	(4)	--	--	--	--
	SC17-67-18ADDC	(4)	--	(4)	(4)	(4)	(4)	755	340	--	--
	SC17-67-18BDCC	(4)	--	(4)	(4)	(4)	(4)	--	--	--	590
	SC17-67-33ABA	56	--	[6]2	--	[5]75	66	3,500	2,300	80	--
	SC18-67-03ACC	(4)	--	(4)	(4)	(4)	(4)	1,570	940	--	--
		15	--	(4)	--	[5]54	--	1,560	900	--	3,300
		17	--	--	--	[5]95	--	1,610	970	--	--

[1]Standard based on mean annual temperature of 61.4°F at Colorado Springs weather station.
[2]Values shown for samples are for radium-226 only.
[3]No specific standard. Values shown that exceed 50 pCi/L as discussed in text.
[4]Constituent not determined in analyses.
[5]Value shown is not corrected for uranium.
[6]Value is not an ideal colony count.

The probable source of the radiochemical constituents found in the water from the alluvial aquifers is upward leakage from the Dakota-Purgatoire and possibly the Fountain aquifers. The presence of moderate to large concentrations of such constituents in water from the Dakota Sandstone in southwestern Pueblo County, Colo., has been thoroughly documented by Felmlee and Cadigan (1979) and by sampling and chemical analyses of water from the Dakota-Purgatoire and Fountain aquifers at Fort Carson, discussed later in this report. Other sources may include erosion and deposition or leaching of uranium-bearing minerals from the Dakota Sandstone.

The suitability of water from the alluvial aquifers for irrigation is shown in figure 15*C*. Most of the samples are in the medium and high classes of salinity hazard, and all are in the low class of alkali hazard.

Dakota-Purgatoire Aquifer

Water from the Dakota-Purgatoire aquifer is predominantly a calcium sulfate type west of Turkey Creek and a calcium bicarbonate type east of Turkey Creek. Concentrations of dissolved solids ranged from 264 to 2,290 mg/L.

The location of wells completed in the Dakota-Purgatoire aquifer from which water samples were collected is shown in figure 17. Also shown are the concentrations of dissolved solids and chemical constituents present in concentrations which exceed Colorado primary and National secondary drinking-water standards. Large concentrations of dissolved solids were observed in water samples collected to the northwest and west of Teller Reservoir. Upward leakage of water from the underlying Fountain aquifer may account for the large dissolved-solids and sulfate concentrations in water from the Dakota-Purgatoire aquifer.

Water in the Dakota-Purgatoire aquifer characteristically contains large concentrations of gross alpha, radium-226, and other radiochemical constituents. Those wells that contained water with chemical constituents in concentrations greater than Colorado primary and National secondary drinking-water standards are listed in table 13. Concentrations of radium-226 of 360 pCi/L, gross alpha of 792 pCi/L, and gross beta of 200 pCi/L were observed in water from well SC19-67-05DAC. These concentrations exceed the Colorado primary standards by several orders of magnitude and warrant serious consideration prior to development of water supplies from the Dakota-Purgatoire aquifer at Fort Carson.

Felmlee and Cadigan (1979) conclude that large concentrations of radiochemical constituents in water from the Dakota-Purgatoire aquifer are the result of the leaching of uranium-bearing minerals from discontinuous zones of secondary enrichment. As previously discussed, leakage of water from this aquifer through overlying sedimentary rocks most probably is the source of radiochemical constituents observed in water from the alluvial aquifers.

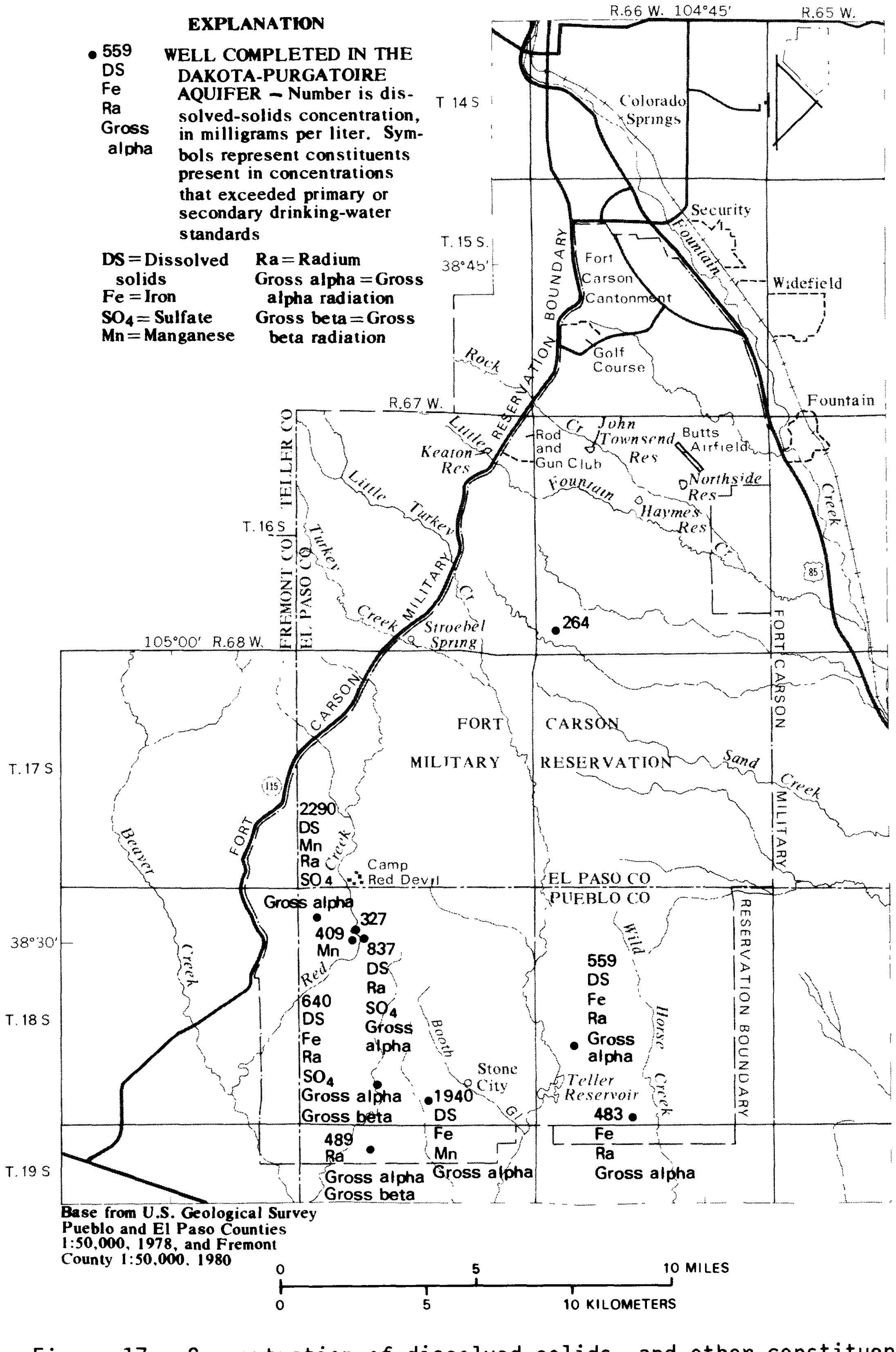


Figure 17.--Concentration of dissolved solids, and other constituents that exceeded drinking-water standards in water from wells completed in the Dakota-Purgatoire aquifer.

Fountain Aquifer

Water from the Fountain aquifer varies from a sodium sulfate to a calcium or sodium bicarbonate type. Dissolved-solids concentrations in the water samples ranged from 327 to 3,500 mg/L.

The location of wells in the Fountain aquifer from which water samples were collected is shown in figure 18. Also shown are the concentrations of dissolved solids and those chemical constituents present in concentrations which exceed the Colorado primary and National secondary drinking-water standards. The concentration of dissolved solids increases downgradient to the east and south from the western boundary of the study area. Of six wells sampled, concentrations greater than the Colorado primary drinking-water standards for selenium were observed in water samples from two wells and for fluoride in a sample from one well. Large concentrations of gross alpha occurred in water samples from two of the three wells from which samples were analyzed for radiochemical constituents. Concentrations of dissolved solids and sulfate greater than the National secondary drinking-water standards were observed in samples from three wells.

SEDIMENT YIELD

During the design of Pueblo Reservoir, the rate of sediment accumulation in Teller Reservoir from the 78.5-mi^2 inflow drainage basin of Turkey Creek was investigated by the U.S. Bureau of Reclamation (P.O. Abbott, written commun., 1965). A comparison of the profile of the reservoir bottom in 1965 with the topography of the reservoir bottom in 1911 indicated that sediment had been accumulating at the rate of 42.7 acre-ft/yr. A similar investigation during 1971 indicated sediment accumulation at the rate of 59 acre-ft/yr (Patterson, 1971). The reservoir was surveyed during 1980, and its capacity was calculated to slightly exceed 1,780 acre-ft. Continued sediment accumulation at rates of 42.7 to 59 acre-ft/yr will result in the reservoir becoming filled with sediment within 30 to 41 years after 1980.

SURFACE-WATER/GROUND-WATER RELATIONS

The quantity and quality of the surface-water and ground-water resources at Fort Carson are interrelated. Precipitation causes streamflow and provides recharge directly to the alluvial aquifers and to the bedrock aquifers where they are exposed at the surface. The alluvial aquifers and streams are hydraulically connected and interchange water. The bedrock aquifers receive recharge from streams crossing the areas where they are exposed at the surface.

The net change in streamflow in Little Fountain, Rock, and Turkey Creeks across Fort Carson is given in table 14. Rock Creek generally gains flow from July through December and January through March; the stream generally loses flow during April, May, and June. The gains during July and August are largely attributable to runoff from local precipitation. The gains during the winter months result from discharge of ground water to the stream. The continuous flow of Rock Creek upstream from the eastern boundary of Fort Carson is the result of these gains. The losses during April, May, and June result

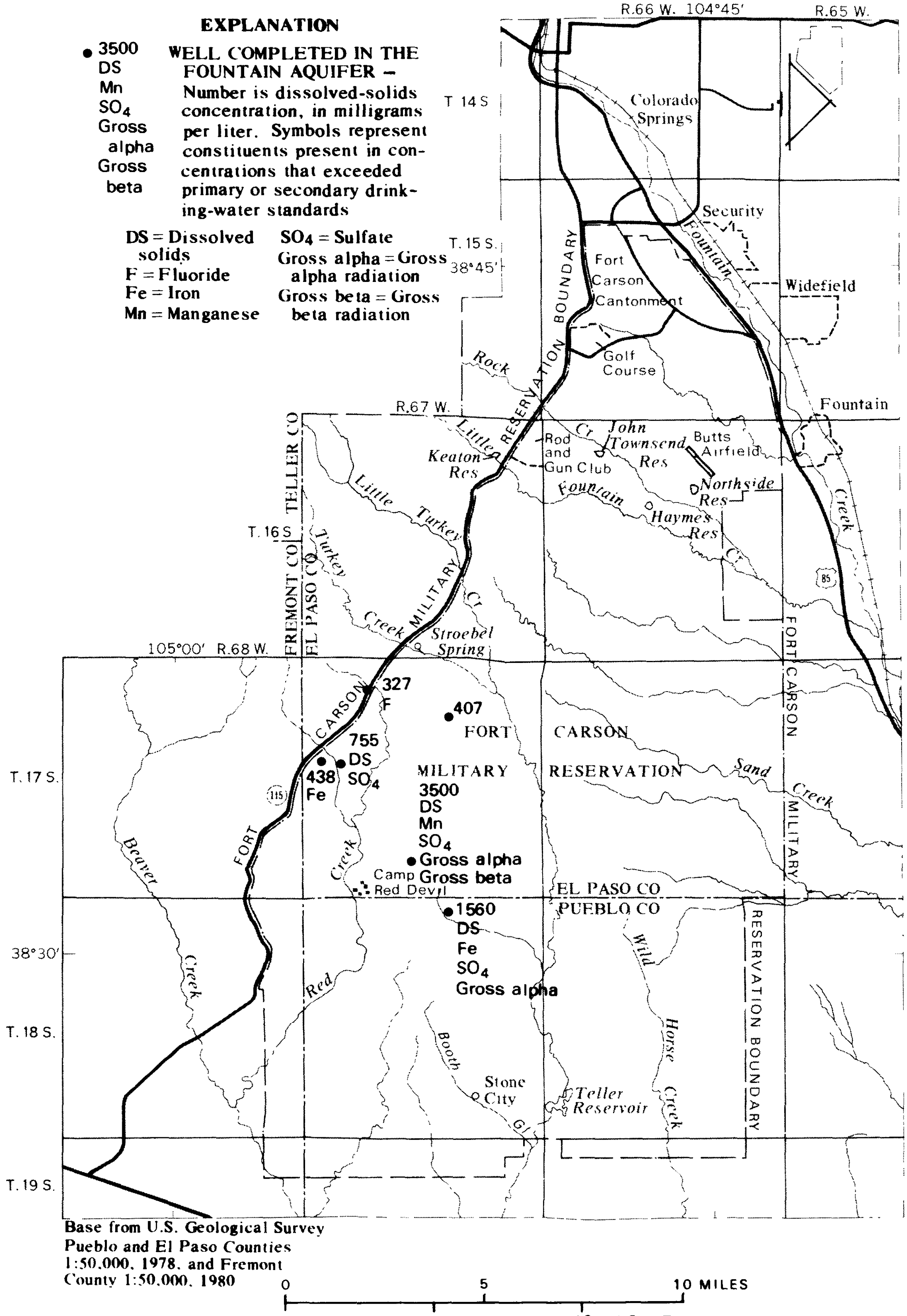


Figure 18.--Concentration of dissolved solids, and other constituents that exceeded drinking-water standards in water from wells completed in the Fountain aquifer at and near Fort Carson.

Table 14.--*Streamflow gain and loss in selected streams*

Date	Rock Creek (acre-feet)	Little Fountain Creek (acre-feet)	Turkey Creek (acre-feet)
1978			
June---------	-1.3	0.6	6.7
July---------	2.9	.6	-.5
August-------	2.2	0	40.5
September----	1.5	0	0
October------	3.9	0	0
November-----	4.0	0	0
December-----	3.7	0	0
1979			
January------	5.4	0	0
February-----	5.7	0	0
March--------	3.9	-17.0	-.5
April--------	-278.0	-48.0	-190.0
May----------	-160.0	-42.0	-246.0
June---------	-160.0	331.0	-264.0
July---------	20.0	97.0	6.2
August-------	10.0	2.0	5.9
September----	1.9	-7.2	4.1
October------	9.2	-1.8	2.1
November-----	13.0	-7.9	.4
December-----	16.0	-7.1	0
1980			
January------	14.0	0	4.3
February-----	15.0	-2.9	17.0
March--------	20.0	-17.9	19.0
April--------	-150.0	-127.0	-144.0
May----------	-140.0	160.0	110.0
June---------	35.0	157.0	792.0
July---------	27.0	74.0	51.0
August-------	30.0	19.0	41.0
September----	26.0	-24.0	49.0
October------	32.0	4.0	25.0
November-----	27.0	12.9	51.0
December-----	21.0	4.7	48.0

from recharge of the alluvial aquifers, evapotranspiration, and diversions to storage in reservoirs. A similar pattern of gains and losses occurs along Little Fountain and Turkey Creeks. Little Fountain Creek, which does not receive continuous ground-water discharge, lost streamflow during September 1979 through March 1980 while Rock and Turkey Creeks gained flow. During September through December 1980, Little Fountain Creek gained less flow than Rock or Turkey Creeks.

The interchange of water between the alluvial aquifers and streams is evident in the deterioration of water quality in streams crossing Fort Carson. Increased values of specific conductance measured at the downstream gaging stations during periods of low flow are largely attributable to ground-water discharge.

WATER-RESOURCE DEVELOPMENT POTENTIAL

The availability of water resources at Fort Carson indicates that there is potential for development of dependable water supplies from surface- and ground-water resources. Future development will, however, be subject to State laws which govern the right to develop and use a water supply.

The combined outflow of surface water from Fort Carson in Little Fountain and Rock Creeks during 1979 and 1980 averaged 5,034 acre-ft. During these years, Fort Carson purchased about 3,000 acre-ft of treated water annually. Given the variability in the quantity of surface water which flows into Fort Carson each year and the occurrence of much of the streamflow during the spring, additional reservoir storage would be needed to develop a dependable, year-round water supply. An alternative to constructing additional reservoir storage would be to use the available ground water in storage and the potential for additional ground-water storage capacity in the stream alluvium along Little Fountain and Rock Creeks. Integrated use of ground water from the alluvium combined with a program of surface-water recharge potentially could provide a dependable water supply. Continued streamflow monitoring and drilling of test wells, accompanied by extensive aquifer testing, would be required to quantify areal variations in aquifer characteristics, surface-water availability, and stream-aquifer interconnection. These factors are needed to quantify adequately ground-water inflow, outflow, and changes in storage and thus determine the quantity of water available for ground-water recharge and the quantity available on a sustained basis from wells in the alluvium. Water samples from wells in the alluvium indicate treatment may be needed prior to use for drinking water.

Wells that penetrate the Dakota-Purgatoire aquifer should yield a minimum of 10 gal/min in most areas in Fort Carson; however, water samples from wells completed in the aquifer indicate that treatment and careful, detailed monitoring would be required prior to use of the water for drinking. Well yields of 200 gal/min have been obtained from wells drilled in areas in the southern part of Fort Carson where the permeability of the aquifer appears to have been enhanced by fracturing caused by faulting and jointing. The construction of additional wells having yields greater than 100 gal/min is feasible in the southern part of Fort Carson.

SUMMARY

The Fort Carson Military Reservation adjoins the rapidly growing Colorado Springs metropolitan area. Locally available water supplies are limited and subject to strict administration by the State of Colorado. Fort Carson purchased an average of 3,400 acre-ft per year of treated water from the city of Colorado Springs from 1974 to 1980.

The major streams entering Fort Carson from the west have an estimated average annual discharge of 6,240 acre-ft per year. The quantity of streamflow actually entering Fort Carson is less than this quantity because some streamflow is diverted upstream from Fort Carson for municipal and domestic water supplies. The annual and long-term stream discharge is not evenly distributed and, thus, not dependable as a large or sole source of water without reservoir storage. Presently (1980), the status of water rights owned by Fort Carson is uncertain, and the results of court action may significantly affect water-supply development.

Ground water is available at Fort Carson from alluvial and bedrock aquifers. Properly constructed and developed wells with yields of more than 100 gal/min can be expected from the alluvial aquifer along Little Fountain and Rock Creeks and from the Dakota-Purgatoire aquifer in the southern part of Fort Carson. Integrated use of ground water from alluvial aquifers combined with a program of surface-water recharge and reservoir storage could provide a dependable water supply.

The quality of surface water entering Fort Carson generally is suitable for irrigation and would be suitable for drinking if treated for biological contaminants. The quality of water in streams does, however, deteriorate significantly eastward across Fort Carson. Water from the alluvial aquifer along Little Fountain and Rock Creeks is suitable for drinking at the western boundary of Fort Carson, but also may require treatment for biological contaminants. In the eastern part of Fort Carson, where the alluvial aquifer is capable of yielding greater quantities of water, the water contains fluoride in concentrations exceeding limits specified in the Colorado primary drinking-water standards. Water from the Dakota-Purgatoire aquifer at Fort Carson characteristically contains concentrations of radiochemical constituents in excess of Colorado primary drinking-water standards.

Additional monitoring of the streams entering Fort Carson is needed to enable a more accurate determination of the average annual surface-water runoff. This information, together with clarification of the water rights appurtenant to Fort Carson, private individuals, and public agencies, will provide the basis for determining the quantity of surface water that could be developed.

Additional test drilling, installation of piezometers, and aquifer testing will be required to accurately define a water balance along Little Fountain and Rock Creeks, and thus properly evaluate the potential for developing a water supply from the alluvial aquifer. Based on water-quality findings, an investigation is needed to determine the appropriate water-treatment techniques, related costs, and feasibility of providing drinking water from this aquifer and from the Dakota-Purgatoire aquifer.

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SUPPLEMENTAL INFORMATION

System of Numbering Streamflow-Gaging Stations

Streamflow-gaging station numbers are assigned in downstream order. Station numbers on tributaries are assigned between station numbers on the mainstream and in the order in which those tributaries enter the mainstream. The station number is the file-identification number used in storage and retrieval of station information and streamflow data from the U.S. Geological Survey.

System of Numbering Wells and Miscellaneous Streamflow-Gaging Stations

Wells and streamflow-gaging stations where discharge measurements are made or water-quality samples are intermittently collected are assigned site-identification numbers based on the grid system of latitude and longitude. The number consists of 15 digits. The first 13 digits denote latitude and longitude in degrees, minutes, and seconds; the last two digits sequentially number sites in a 1-second grid (fig. 19). The site-identification number is the file-identification number used in storage and retrieval of data for wells and miscellaneous streamflow-gaging stations from the U.S. Geological Survey.

System of Well-Location Numbering

Well locations given in this report (identified as the local identifier or local number in tables) are assigned numbers based on the U.S. Bureau of Land Management system of land subdivision and show the well locations by quadrant, township, range, section, and position in the section.

The first letter of the location number indicates which principal meridian governs the area in which the well is located; S indicates the sixth principal meridian and N indicates the New Mexico principal meridian. The second letter indicates the quadrant in which the well is located. Four quadrants are formed by the intersection of the base line and the principal meridian; A indicates the northeast quadrant, B the northwest, C the southwest, and D the southeast. The first number indicates the township; the second, the range; and the third, the section in which the well is located. The letters following the section number indicate the location of the well within the section. The first letter denotes the quarter section; the second, the quarter-quarter section; and the third, the quarter-quarter-quarter section. The letters are assigned within the section in a counterclockwise direction, beginning with A in the northeast quarter. Letters are assigned within each quarter section and within each quarter-quarter section in the same manner. Where two or more locations are within the smallest subdivision, consecutive numbers, beginning with 1, are added in the order in which the wells are inventoried. For example, SC18-66-20CCC indicates a well in the SW¼SW¼SW¼ sec. 20, T. 18 S., R. 66 W. (fig. 20).

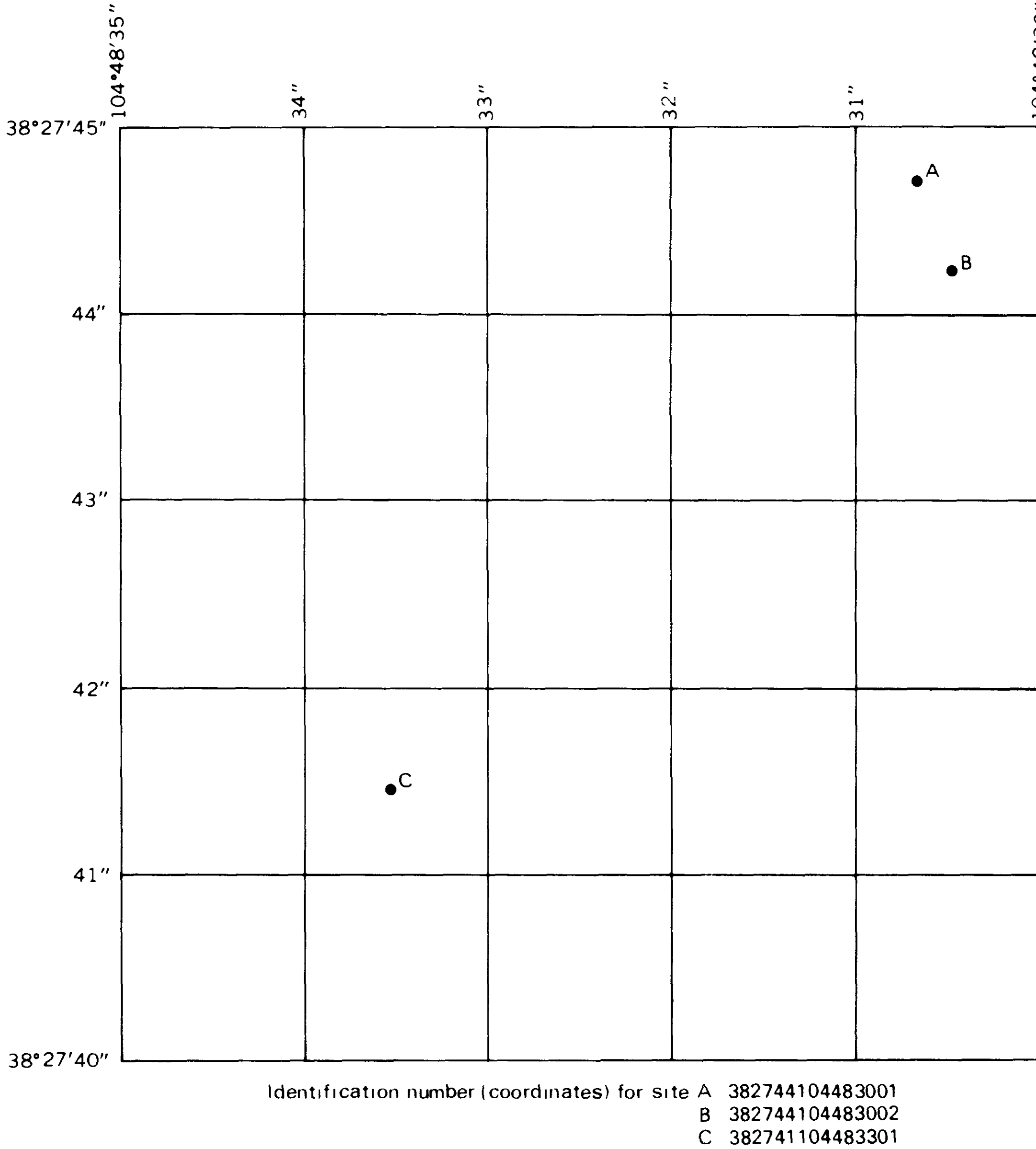

Figure 19.--System of numbering wells and miscellaneous sites, using latitude and longtitude.

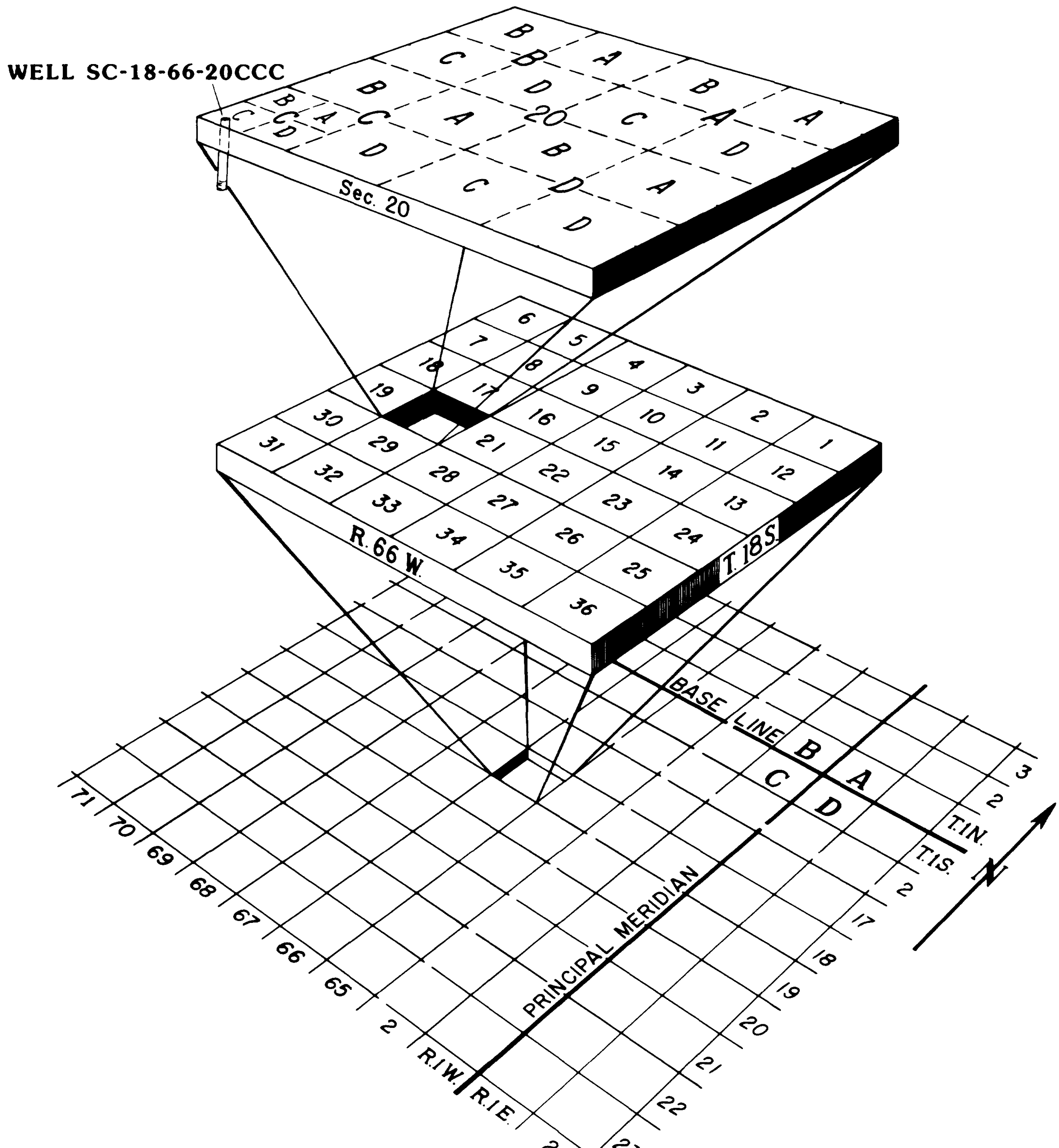

Figure 20.--System of numbering wells, using township, range, and section.

Table 15.--*Records of selected wells at and near Fort Carson*

[Aquifer: 111ALFP, alluvium; 210DKOT, Dakota-Purgatoire aquifer; 317FNTN, Fountain aquifer; 211NBRR, Niobrara Formation. GPM/FT, gallons per minute per foot of drawdown. Use of water: H, domestic; I, irrigation; P, public supply]

SITE NUMBER[1]	SITE IDENTIFICATION NUMBER	LOCAL NUMBER	AQUIFER	ALTITUDE OF LAND SURFACE (FEET)	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED	DISCHARGE (GALLONS PER MINUTE)	DRAW-DOWN	SPECIFIC CAPACITY (GPM/FT)	USE OF WATER
1	384218104503401	SC01506736BAC	111ALFP	6360	24.00	--	--	12	--	--	H
2	384056104475601	SC01606605DCA1	111ALFP	5890	9.80	0.30	12/ 9/1980	170	--	--	P
3	383900104441001	SC01606613CCC	111ALFP	5625	85.00	18.83	05/26/1978	--	--	--	H
4	383926104444301	SC01606614ACC1	111ALFP	5618	42.00	13.20	03/25/1974	--	--	--	U
5	383938104455101	SC01606615ABCC	111ALFP	5662	10.00	3.69	12/10/1980	--	--	--	--
6	383927104454501	SC01606615ACC	111ALFP	5653	45.00	-0.72	03/27/1979	--	--	--	I
7	383921104454301	SC01606615DBAD	111ALFP	5645	39.00	4.52	07/14/1979	11	--	0.3	I
8	383924104455201	SC01606615DBBB	111ALFP	5660	60.00	4.24	03/25/1974	45	--	--	I
9	383923104455301	SC01606615DBB2	111ALFP	5660	16.70	0.81	07/12/1979	--	--	--	P
10	383746104550301	SC01606729BDC	111ALFP	6390	36.00	7.32	--	20	--	--	H
11	383643104534501	SC01606733CAD	111ALFP	6460	21.00	--	--	--	--	--	H
12	383641104532501	SC01606733DAC1	111ALFP	6390	12.00	4.68	05/24/1978	70	4.5	12.5	S
13	383407104500701	SC01706713DBDA	111ALFP	5992	22.00	9.87	07/24/1979	--	--	--	U
14	383400104500301	SC01706713DDBC	111ALFP	5992	14.00	11.37	06/06/1978	--	--	--	U
15	382701104520401	SC01806727DDA	111ALFP	5550	42.10	30.09	03/29/1979	--	--	--	U
16	383119104550401	SC01706732CDB	111ALFP	5880	13.80	13.78	08/07/1979	25	--	3.5	P
17	383010104545501	SC01806708BAAC	111ALFP	5780	--	FLOWING	--	--	--	--	--
18	382532104461702	SC01906603BCC	111ALFP	5417	20.05	19.17	03/30/1979	--	--	--	S
19	383700104485801	SC01606631ACAB	210DKOT	6040	1272.00	466.00	11/18/1978	6.5	4.78	.01	P
20	383008104475301	SC01806608ABDC	210DKOT	5838	385.00	185.00	05/17/1961	5.0	--	--	S
21	382744104483001	SC01806620CCC1	210DKOT	5558	542.00	145.37	07/31/1979	200	138	1.5	P
22	382607104470301	SC01806633CDA1	210DKOT	5550	804.00	247.40	08/01/1979	30	312	0.1	P
23	383030104563001	SC01806706CAD	210DKOT	6040	300.00	169.00	03/28/1974	--	--	--	S
24	383802104544201	SC01806708ACB1	210DKOT	5760	338.00	105.60	08/01/1979	230	134	1.7	P
25	382958104550101	SC01806708BDB	210DKOT	5800	262.00	119.92	07/26/1979	--	--	--	S
26	382723104555401	SC01806730BAA	210DKOT	5730	285.00	DRY	07/26/1979	--	--	--	U
27	382649104541201	SC01806733BBB	210DKOT	5540	215.00	99.50	12/08/1980	--	--	--	S
28	382622104524001	SC01806734CAB1	210DKOT	5473	140.00	63.29	03/29/1979	--	--	--	S
29	382925104573501	SC01806814AAA	210DKOT	5790	173.00	164.20	06/21/1978	--	--	--	S
30	382522104542501	SC01906705DAC	210DKOT	5418	468.00	7.79	06/14/1978	--	--	--	S

Table 15.--*Records of selected wells at and near Fort Carson*--Continued

SITE NUM-BER[1]	SITE IDENTIFICATION NUMBER	LOCAL NUMBER	AQUIFER	ALTITUDE OF LAND SURFACE (FEET)	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WATER LEVEL MEASURED	DISCHARGE (GALLONS PER MINUTE)	DRAW-DOWN	SPECIFIC CAPACITY (GPM/FT)	USE OF WATER
31	383633104380501	SC01606734CCC	317FNTN	6330	203.00	9.52	08/09/1979	2.5	--	--	H
32	383626104531101	SC01706704AAA	317FNTN	6480	256.00	103.65	08/10/1979	1.0	39	.03	U
33	383545104531101	SC01706704DDAA	317FNTN	6395	191.00	23.35	03/26/1974	10	--	--	S
34	383539104543601	SC01706705DBD	317FNTN	6500	250.00	--	--	--	--	--	--
35	383457104551001	SC01706708CBD	317FNTN	6381	189.00	9.88	07/18/1979	--	--	--	U
36	383448104542001	SC01706708DDAD	317FNTN	6430	300.00	100.85	03/26/1974	--	--	--	U
37	383502104541501	SC01706709BCC	317FNTN	6420	380.00	44.24	03/26/1974	--	--	--	U
38	383520104522001	SC01706710ADBB	317FNTN	6280	90.00	38.00	03/01/1974	--	--	--	--
39	383414104552801	SC01706718ADDC	317FNTN	6340	140.00	31.00	03/26/1974	--	--	--	U
40	383412104560301	SC01706718BDDC	317FNTN	6420	143.00	106.18	07/19/1979	--	--	--	S
41	383313104524701	SC01706722CACD	317FNTN	6190	193.00	45.70	03/27/1974	--	--	--	S
42	383249104514801	SC01706726BACB	317FNTN	6060	181.00	23.12	03/27/1974	--	--	--	U
43	383224104525501	SC01706733ABAA	317FNTN	6042	196.00	19.85	03/27/1974	--	--	--	S
44	383049104522801	SC01806703ACCA	317FNTN	5870	240.00	FLOWING	--	--	--	--	S
45	383143104470201	SC01706633BDDA	211NBRR	5620	23.00	22.05	03/28/1974	--	--	--	S

[1]Number refers to location shown on plate 1.

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*

[UMHO, micromhos per centimeter at 25° Celsius; DEG C, degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; PCI/L, picocuries per liter; COLS/100 ML, colonies per 100 milliliters; K, colony count not ideal; ND, constituent not detected]

STATION NUMBER	LOCAL IDENT- I- FIER	GEO- LOGIC UNIT	SITE	DATE OF SAMPLE	SPE- CIFIC CON- DUCT- ANCE (UMHO) (00095)	TEMPER- ATURE (DEG C) (00010)	PH (UNITS) (00400)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)
07099215	TURKEY CREEK NEAR FOUNTAIN	--	SW	79-04-12	265	6.0	7.7	161	14
		--	SW	79-04-30	200	11.0	7.2	127	12
		--	SW	79-05-02	230	9.0	7.0	132	8.8
		--	SW	79-05-30	160	9.0	7.3	106	11
		--	SW	79-07-09	290	28.0	7.8	173	15
		--	SW	81-08-24	205	19.0	8.0	--	8.0
07099220	LITTLE TURKEY CREEK NEAR FOUNTAIN	--	SW	79-05-02	230	9.0	7.0	132	8.8
			SW	79-05-31	180	10.0	7.4	112	8.6
		--	SW	79-07-06	265	24.5	8.4	157	11
		--	SW	81-09-03	193	17.3	7.9	117	7.8
07099230	TURKEY CREEK ABOVE TELLER RESERVOIR NEAR STONE CITY	--	SW	79-06-05	361	21.5	7.7	227	16
		--	SW	79-06-06	380	16.0	7.6	230	15
		--	SW	79-07-10	977	19.0	7.8	675	42
		--	SW	79-08-09	910	20.5	8.1	752	63
		--	SW	79-09-11	580	16.5	--	--	--
		--	SW	80-05-05	321	9.5	--	196	14
		--	SW	80-06-20	370	--	--	--	--
		--	SW	80-06-20	370	--	--	--	--
07099235	TURKEY CREEK NEAR STONE CITY	--	SW	79-03-09	1300	5.0	--	--	--
		--	SW	79-03-27	1380	11.5	--	--	--
		--	SW	79-04-24	1270	20.0	--	--	--
		--	SW	79-07-10	1320	20.5	--	--	--
		--	SW	79-08-16	1000	19.0	--	--	--
		--	SW	79-09-11	1500	17.0	--	--	--
		--	SW	79-10-11	1000	16.0	--	--	--
		--	SW	79-11-15	1590	10.5	--	--	--
		--	SW	79-12-12	1610	6.0	--	--	--
		--	SW	80-01-28	1590	3.0	--	--	--
		--	SW	80-02-28	1600	8.5	--	--	--
		--	SW	80-03-21	1575	14.0	--	--	--
		--	SW	80-05-19	390	14.0	--	--	--
		--	SW	80-06-17	435	17.5	--	--	--
		--	SW	80-07-18	440	19.5	--	--	--
		--	SW	80-08-20	470	20.0	--	--	--
07105920	LITTLE FOUNTAIN CREEK ABOVE KEATON RESERVOIR	--	SW	78-04-21	121	10.0	7.0	61	5.7
		--	SW	79-03-08	190	2.0	--	--	--
		--	SW	79-03-28	180	4.0	--	--	--
		--	SW	79-04-04	112	.0	7.8	72	6.7
		--	SW	79-05-01	81	6.5	6.5	50	4.1
		--	SW	79-05-29	70	9.5	8.0	49	3.8

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90) (80050)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L) (09511)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)
80-04-18	--	--	--	--
80-04-20	--	--	--	--
80-05-14	--	--	--	--
80-06-19	--	--	--	--
80-07-15	--	--	--	--
80-08-13	--	--	--	--
81-09-03	--	--	--	34
79-04-03	--	--	--	--
79-04-13	--	--	--	--
79-04-26	--	--	--	K2
79-05-22	--	--	--	--
79-06-29	--	--	--	53
79-09-10	--	--	--	--
80-04-17	--	--	--	K4
80-05-01	2.6	2.4	--	--
78-05-23	--	--	--	--
78-07-13	11	10	16	--
78-09-01	--	--	--	--
79-03-07	--	--	--	--
79-03-29	--	--	--	--
79-04-12	--	--	--	--
79-04-25	--	--	--	K8
79-05-22	--	--	--	--
79-06-04	--	--	--	--
79-06-27	--	--	--	K12
79-08-14	--	--	--	--
79-08-26	8.5	7.4	--	--
79-09-10	--	--	--	--
80-04-17	--	--	--	K8
80-05-07	2.1	2.1	--	K100
80-08-27	--	--	--	K110
80-08-27	--	--	--	K110

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM ADSORPTION RATIO (00931)	HARDNESS (MG/L AS CACO3) (00900)	HARDNESS, NONCARBONATE (MG/L CACO3) (00902)	ALKALINITY FIELD (MG/L AS CACO3) (00410)	BICARBONATE (MG/L AS HCO3) (00440)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)
79-04-12	1.6	24	8.9	.6	97	13	84	--	3.5	37	.6	--
79-04-30	2.1	18	6.7	.6	73	20	53	--	3.9	30	.6	--
79-05-02	2.4	26	6.5	.4	92	26	66	--	2.7	33	--	--
79-05-30	1.6	17	5.8	.6	66	15	51	--	3.5	21	.7	--
79-07-09	2.2	28	10	.6	110	12	99	--	3.1	31	.6	--
81-08-24	1.6	15	5.3	.5	59	--	--	--	2.2	<5.0	.5	--
79-05-02	2.4	26	6.5	.4	92	26	66	--	2.7	33	.5	--
79-05-31	2.1	21	5.8	.4	76	14	62	--	2.4	22	.5	--
79-07-06	2.6	30	8.0	.5	110	13	95	--	4.1	27	.6	--
81-09-03	2.1	22	6.3	.4	81	--	--	--	1.6	<5.0	.5	--
79-06-05	3.9	40	10	.6	140	52	89	--	5.5	68	.6	--
79-06-06	2.9	43	11	.5	150	62	91	--	4.8	80	.6	.33
79-07-10	3.5	120	32	.9	430	240	190	--	15	330	.8	--
79-08-09	3.4	130	34	1.3	460	260	200	--	12	370	.8	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
80-05-05	2.6	36	9.7	.5	130	46	84	--	6.5	57	.7	.61
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
79-03-09	--	--	--	--	--	--	--	--	--	--	--	--
79-03-27	--	--	--	--	--	--	--	--	--	--	--	--
79-04-24	--	--	--	--	--	--	--	--	--	--	--	--
79-07-10	--	--	--	--	--	--	--	--	--	--	--	--
79-08-16	--	--	--	--	--	--	--	--	--	--	--	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
79-10-11	--	--	--	--	--	--	--	--	--	--	--	--
79-11-15	--	--	--	--	--	--	--	--	--	--	--	--
79-12-12	--	--	--	--	--	--	--	--	--	--	--	--
80-01-28	--	--	--	--	--	--	--	--	--	--	--	--
80-02-28	--	--	--	--	--	--	--	--	--	--	--	--
80-03-21	--	--	--	--	--	--	--	--	--	--	--	--
80-05-19	--	--	--	--	--	--	--	--	--	--	--	--
80-06-17	--	--	--	--	--	--	--	--	--	--	--	--
80-07-18	--	--	--	--	--	--	--	--	--	--	--	--
80-08-20	--	--	--	--	--	--	--	--	--	--	--	--
78-04-21	1.3	9.9	2.0	.4	33	4	29	35	1.3	10	3.2	.24
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-04	1.2	11	2.5	.5	38	11	27	--	4.2	15	2.6	--
79-05-01	1.3	8.0	1.8	.3	27	13	14	--	1.1	8.7	3.0	--
79-05-29	1.1	8.5	.9	.3	25	9	16	--	1.2	11	2.9	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, DISSOLV (MG/L AS N) (00602)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P) (00671)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P) (00666)	ALUM-INUM, DIS-SOLVED (UG/L AS AL) (01106)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE) (01010)	BORON, DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)
79-04-12	1.5	--	.040	.010	--	--	--	--	--	--	--	--
79-04-30	1.3	--	--	.020	--	--	--	--	--	--	--	--
79-05-02	.33	--	--	.030	--	--	--	--	--	--	--	--
79-05-30	.29	--	--	.050	--	--	--	--	--	--	--	--
79-07-09	1.3	--	--	.010	--	--	--	--	--	--	--	--
81-08-24	.35	--	--	.040	--	--	--	--	--	--	--	--
79-05-02	.33	--	--	.030	--	--	--	--	--	--	--	--
79-05-31	.11	--	--	.040	--	--	--	--	--	--	--	--
79-07-06	.05	--	--	.030	--	--	--	--	--	--	--	--
81-09-03	.04	--	--	.040	--	--	--	--	--	--	--	--
79-06-05	.55	--	--	.050	--	--	--	--	--	--	--	--
79-06-06	.54	.87	--	.030	--	--	--	--	--	--	--	--
79-07-10	.08	--	--	.010	--	--	--	--	--	--	--	--
79-08-09	.02	--	--	<.010	--	--	--	--	--	--	--	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
80-05-05	.38	.99	--	.030	--	--	--	--	--	--	--	--
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
79-03-09	--	--	--	--	--	--	--	--	--	--	--	--
79-03-27	--	--	--	--	--	--	--	--	--	--	--	--
79-04-24	--	--	--	--	--	--	--	--	--	--	--	--
79-07-10	--	--	--	--	--	--	--	--	--	--	--	--
79-08-16	--	--	--	--	--	--	--	--	--	--	--	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
79-10-11	--	--	--	--	--	--	--	--	--	--	--	--
79-11-15	--	--	--	--	--	--	--	--	--	--	--	--
79-12-12	--	--	--	--	--	--	--	--	--	--	--	--
80-01-28	--	--	--	--	--	--	--	--	--	--	--	--
80-02-28	--	--	--	--	--	--	--	--	--	--	--	--
80-03-21	--	--	--	--	--	--	--	--	--	--	--	--
80-05-19	--	--	--	--	--	--	--	--	--	--	--	--
80-06-17	--	--	--	--	--	--	--	--	--	--	--	--
80-07-18	--	--	--	--	--	--	--	--	--	--	--	--
80-08-20	--	--	--	--	--	--	--	--	--	--	--	--
78-04-21	<.10	--	<.010	<.010	<100	2	300	<10	4	ND	ND	ND
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-04	.15	--	.020	<.010	--	--	--	--	--	--	--	--
79-05-01	.03	--	--	.010	--	--	--	--	--	--	--	--
79-05-29	<.10	--	--	.010	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	URANIUM DIS- SOLVED, EXTRAC- TION (UG/L) (80020)	GROSS ALPHA, DIS- SOLVED (PCI/L AS U-NAT) (01515)	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)
79-04-12	<10	--	6	--	--	--	--	--	--	--	--	--
79-04-30	20	--	7	--	--	--	--	--	--	--	--	--
79-05-02	30	--	<10	--	--	--	--	--	--	--	--	--
79-05-30	<10	--	<10	--	--	--	--	--	--	--	--	--
79-07-09	<10	--	6	--	--	--	--	--	--	--	--	--
81-08-24	570	--	41	--	--	--	--	--	--	--	--	--
79-05-02	30	--	<10	--	--	--	--	--	--	--	--	--
79-05-31	30	--	<10	--	--	--	--	--	--	--	--	--
79-07-06	40	--	30	--	--	--	--	--	--	--	--	--
81-09-03	32	--	12	--	--	--	--	--	--	--	--	--
79-06-05	140	--	20	--	--	--	--	--	--	--	--	--
79-06-06	<10	--	<10	--	--	--	--	--	--	--	5.9	8.7
79-07-10	<10	--	120	--	--	--	--	--	--	--	--	--
79-08-09	40	--	70	--	--	--	--	--	--	--	--	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
80-05-05	100	--	7	--	--	--	--	--	--	--	7.5	11
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
80-06-20	--	--	--	--	--	--	--	--	--	--	--	--
79-03-09	--	--	--	--	--	--	--	--	--	--	--	--
79-03-27	--	--	--	--	--	--	--	--	--	--	--	--
79-04-24	--	--	--	--	--	--	--	--	--	--	--	--
79-07-10	--	--	--	--	--	--	--	--	--	--	--	--
79-08-16	--	--	--	--	--	--	--	--	--	--	--	--
79-09-11	--	--	--	--	--	--	--	--	--	--	--	--
79-10-11	--	--	--	--	--	--	--	--	--	--	--	--
79-11-15	--	--	--	--	--	--	--	--	--	--	--	--
79-12-12	--	--	--	--	--	--	--	--	--	--	--	--
80-01-28	--	--	--	--	--	--	--	--	--	--	--	--
80-02-28	--	--	--	--	--	--	--	--	--	--	--	--
80-03-21	--	--	--	--	--	--	--	--	--	--	--	--
80-05-19	--	--	--	--	--	--	--	--	--	--	--	--
80-06-17	--	--	--	--	--	--	--	--	--	--	--	--
80-07-18	--	--	--	--	--	--	--	--	--	--	--	--
80-08-20	--	--	--	--	--	--	--	--	--	--	--	--
78-04-21	<10	ND	<10	<.1	<1	2	<1	ND	ND	.49	--	<.5
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-04	<10	--	2	--	--	--	--	--	--	--	--	--
79-05-01	50	--	5	--	--	--	--	--	--	--	--	--
79-05-29	40	--	<10	--	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90) (80050)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L) (09511)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)
79-04-12	--	--	--	--
79-04-30	--	--	--	K4
79-05-02	--	--	--	--
79-05-30	--	--	--	90
79-07-09	--	--	--	K140
81-08-24	--	--	--	--
79-05-02	--	--	--	76
79-05-31	--	--	--	K120
79-07-06	--	--	--	280
81-09-03	--	--	--	K34
79-06-05	--	--	--	--
79-06-06	4.2	3.9	--	--
79-07-10	--	--	--	--
79-08-09	--	--	--	68
79-09-11	--	--	--	--
80-05-05	2.9	2.8	--	K100
80-06-20	--	--	--	--
80-06-20	--	--	--	--
79-03-09	--	--	--	--
79-03-27	--	--	--	--
79-04-24	--	--	--	--
79-07-10	--	--	--	--
79-08-16	--	--	--	--
79-09-11	--	--	--	--
79-10-11	--	--	--	--
79-11-15	--	--	--	--
79-12-12	--	--	--	--
80-01-28	--	--	--	--
80-02-28	--	--	--	--
80-03-21	--	--	--	--
80-05-19	--	--	--	--
80-06-17	--	--	--	--
80-07-18	--	--	--	--
80-08-20	--	--	--	--
78-04-21	1.9	1.8	.88	--
79-03-08	--	--	--	--
79-03-28	--	--	--	--
79-04-04	--	--	--	--
79-05-01	--	--	--	K2
79-05-29	--	--	--	K8

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

STATION NUMBER	LOCAL IDENT-I-FIER	GEO-LOGIC UNIT	SITE	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (UMHO) (00095)	TEMPER-ATURE (DEG C) (00010)	PH (UNITS) (00400)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)
07105920	LITTLE FOUNTAIN CREEK ABOVE KEATON RESERVOIR	--	SW	79-07-03	98	16.0	7.2	62	4.5
		--	SW	79-08-15	110	14.0	7.8	66	5.6
		--	SW	79-09-12	120	15.0	7.1	74	6.0
		--	SW	80-04-17	93	6.0	7.2	55	4.7
		--	SW	80-08-28	145	18.0	7.2	84	6.3
		--	SW	81-07-13	88	18.0	7.3	69	4.7
		--	SW	81-09-03	65	12.9	7.1	59	3.9
07105928	LITTLE FOUNTAIN CREEK NEAR FORT CARSON	--	SW	78-05-24	180	17.0	--	--	--
		--	SW	79-03-08	240	7.0	--	--	--
		--	SW	79-03-28	335	11.5	--	--	--
		--	SW	79-04-03	180	1.0	6.4	111	6.8
		--	SW	79-05-01	90	7.0	7.2	54	4.4
		--	SW	79-05-23	80	9.5	7.1	53	4.3
		--	SW	79-07-05	280	17.0	--	--	--
		--	SW	79-07-05	280	17.0	7.1	165	7.9
		--	SW	79-08-17	205	18.5	--	--	--
07105940	LITTLE FOUNTAIN CREEK NEAR FOUNTAIN	--	SW	79-04-12	1050	8.0	8.0	802	77
		--	SW	79-04-25	359	9.5	7.9	218	19
		--	SW	79-05-21	580	18.0	8.2	386	37
		--	SW	79-06-07	280	12.5	7.7	169	13
		--	SW	79-06-28	1750	23.5	8.1	1450	170
		--	SW	79-08-17	2400	23.5	--	--	--
		--	SW	79-08-27	2350	23.0	--	--	--
		--	SW	80-05-01	750	7.5	--	503	52
		--	SW	80-08-27	1870	22.0	7.5	1470	100
07105945	ROCK CREEK ABOVE FORT CARSON	--	SW	78-04-21	154	11.0	7.2	96	8.9
		--	SW	78-05-19	140	10.5	--	--	--
		--	SW	79-03-08	300	5.0	--	--	--
		--	SW	79-03-28	220	3.0	--	--	--
		--	SW	79-04-03	182	5.0	--	--	--
		--	SW	79-04-26	100	7.0	7.1	65	5.6
		--	SW	79-05-23	90	8.0	7.2	63	5.2
		--	SW	79-06-29	130	15.0	6.7	87	6.4
		--	SW	79-08-15	155	13.5	7.6	96	8.2
		--	SW	79-09-12	180	14.5	--	--	--
		--	SW	79-10-10	168	10.5	--	--	--
		--	SW	79-11-14	138	3.5	--	--	--
		--	SW	79-12-13	142	2.0	--	--	--
		--	SW	80-01-17	140	2.0	--	--	--
		--	SW	80-02-20	143	2.0	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM ADSORPTION RATIO (00931)	HARDNESS (MG/L AS CACO3) (00900)	HARDNESS, NONCARBONATE (MG/L CACO3) (00902)	ALKALINITY FIELD (MG/L AS CACO3) (00410)	BICARBONATE (MG/L AS HCO3) (00440)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	NITROGEN,AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)
79-07-03	1.4	9.7	2.3	.3	34	14	20	--	1.4	15	2.9	--
79-08-15	1.6	11	2.4	.4	37	7	30	--	1.1	11	2.9	--
79-09-12	2.0	12	2.4	.4	40	10	30	--	1.2	16	3.0	--
80-04-17	1.2	9.0	2.2	.4	32	12	20	--	1.0	10	2.9	--
80-08-28	1.8	15	3.8	.4	53	10	43	--	1.7	14	2.6	--
81-07-13	1.6	10	2.0	.4	33	--	--	--	.9	15	2.6	--
81-09-03	1.4	9.5	1.9	.3	32	--	--	--	1.2	<5.0	2.9	--
78-05-24	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	1.3	23	4.3	.3	75	19	56	--	2.2	22	2.4	--
79-05-01	1.3	9.0	2.0	.3	31	15	16	--	1.6	9.3	2.9	--
79-05-23	1.2	9.3	1.9	.3	31	11	20	--	1.0	10	3.0	--
79-07-05	--	--	--	--	--	--	--	--	--	--	--	--
79-07-05	1.7	36	7.4	.3	120	33	87	--	2.1	39	2.6	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	5.0	120	38	1.6	460	340	120	--	11	460	2.1	--
79-04-25	1.7	37	8.6	.7	130	75	53	--	3.4	99	2.8	--
79-05-21	2.1	62	18	1.1	230	150	80	--	5.0	200	3.0	--
79-06-07	1.7	31	6.7	.6	110	56	49	--	2.3	69	2.7	<.10
79-06-28	3.5	190	75	2.6	780	590	190	--	15	870	2.6	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-05-01	4.2	68	27	1.4	280	210	71	--	3.2	290	2.0	1.3
80-08-27	9.2	270	61	1.4	930	830	97	--	14	940	1.0	--
78-04-21	1.5	16	3.7	.5	55	9	47	57	2.7	21	1.8	.15
78-05-19	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	--	--	--	--	--	--	--	--	--	--	--	--
79-04-26	1.8	10	2.5	.4	35	15	20	--	1.8	15	1.7	--
79-05-23	1.5	10	2.4	.4	35	11	24	--	1.4	14	.8	--
79-06-29	1.7	15	3.6	.4	52	18	34	--	1.4	22	1.8	--
79-08-15	1.9	16	3.8	.5	56	8	48	--	1.5	20	1.7	--
79-09-12	--	--	--	--	--	--	--	--	--	--	--	--
79-10-10	--	--	--	--	--	--	--	--	--	--	--	--
79-11-14	--	--	--	--	--	--	--	--	--	--	--	--
79-12-13	--	--	--	--	--	--	--	--	--	--	--	--
80-01-17	--	--	--	--	--	--	--	--	--	--	--	--
80-02-20	--	--	--	--	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, DISSOLV (MG/L AS N) (00602)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P) (00671)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P) (00666)	ALUM-INUM, DIS-SOLVED (UG/L AS AL) (01106)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE) (01010)	BORON, DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)
79-07-03	<.10	--	--	<.010	--	--	--	--	--	--	--	--
79-08-15	.04	--	--	<.010	--	--	--	--	--	--	--	--
79-09-12	<.10	--	<.010	<.010	--	--	--	--	--	--	--	--
80-04-17	.06	--	--	.010	--	--	--	--	--	--	--	--
80-08-28	.00	--	--	.000	--	--	--	--	--	--	--	--
81-07-13	.04	--	--	.030	--	--	--	--	--	--	--	--
81-09-03	.01	--	--	.010	--	--	--	--	--	--	--	--
78-05-24	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	.87	--	.050	.010	--	--	--	--	--	--	--	--
79-05-01	.09	--	--	<.010	--	--	--	--	--	--	--	--
79-05-23	<.10	--	--	.010	--	--	--	--	--	--	--	--
79-07-05	--	--	--	--	--	--	--	--	--	--	--	--
79-07-05	.23	--	--	.010	--	--	--	--	--	--	--	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	1.7	--	<.010	.010	--	--	--	--	--	--	--	--
79-04-25	.25	--	--	.010	--	--	--	--	--	--	--	--
79-05-21	.22	--	--	.010	--	--	--	--	--	--	--	--
79-06-07	.07	.07	--	.010	--	--	--	--	--	--	--	--
79-06-28	.11	--	--	<.010	--	--	--	--	--	--	--	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-05-01	.42	1.7	--	.020	--	--	--	--	--	--	--	--
80-08-27	1.8	--	--	.020	--	--	--	--	--	--	--	--
78-04-21	.08	--	.020	.030	<100	1	200	<10	<20	<2	ND	ND
78-05-19	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	--	--	--	--	--	--	--	--	--	--	--	--
79-04-26	.07	--	--	.010	--	--	--	--	--	--	--	--
79-05-23	.01	--	--	.020	--	--	--	--	--	--	--	--
79-06-29	<.10	--	--	.010	--	--	--	--	--	--	--	--
79-08-15	.05	--	--	.020	--	--	--	--	--	--	--	--
79-09-12	--	--	--	--	--	--	--	--	--	--	--	--
79-10-10	--	--	--	--	--	--	--	--	--	--	--	--
79-11-14	--	--	--	--	--	--	--	--	--	--	--	--
79-12-13	--	--	--	--	--	--	--	--	--	--	--	--
80-01-17	--	--	--	--	--	--	--	--	--	--	--	--
80-02-20	--	--	--	--	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L) (80020)	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT) (01515)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT) (80030)
79-07-03	<10	--	<1	--	--	--	--	--	--	--	--	--
79-08-15	40	--	<10	--	--	--	--	--	--	--	--	--
79-09-12	<10	--	2	--	--	--	--	--	--	--	--	--
80-04-17	20	--	1	--	--	--	--	--	--	--	--	--
80-08-28	30	--	1	--	--	--	--	--	--	--	--	--
81-07-13	70	--	4	--	--	--	--	--	--	--	--	--
81-09-03	48	--	5	--	--	--	--	--	--	--	--	--
78-05-24	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	20	--	3	--	--	--	--	--	--	--	--	--
79-05-01	70	--	2	--	--	--	--	--	--	--	--	--
79-05-23	20	--	<10	--	--	--	--	--	--	--	--	--
79-07-05	--	--	--	--	--	--	--	--	--	--	--	--
79-07-05	<10	--	<1	--	--	--	--	--	--	--	--	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	90	--	40	--	--	--	--	--	--	--	--	--
79-04-25	60	--	<10	--	--	--	--	--	--	--	--	--
79-05-21	<10	--	30	--	--	--	--	--	--	--	--	--
79-06-07	<10	--	8	--	--	--	--	--	--	--	2.4	3.6
79-06-28	<10	--	70	--	--	--	--	--	--	--	--	--
79-08-17	--	--	--	--	--	--	--	--	--	--	--	--
79-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-05-01	40	--	20	--	--	--	--	--	--	--	<3.7	<5.5
80-08-27	60	--	130	--	--	--	--	--	--	--	--	--
78-04-21	<10	<2	<10	<.1	<1	2	<1	ND	ND	.76	--	1.7
78-05-19	--	--	--	--	--	--	--	--	--	--	--	--
79-03-08	--	--	--	--	--	--	--	--	--	--	--	--
79-03-28	--	--	--	--	--	--	--	--	--	--	--	--
79-04-03	--	--	--	--	--	--	--	--	--	--	--	--
79-04-26	70	--	1	--	--	--	--	--	--	--	--	--
79-05-23	<10	--	<10	--	--	--	--	--	--	--	--	--
79-06-29	<10	--	<1	--	--	--	--	--	--	--	--	--
79-08-15	80	--	<10	--	--	--	--	--	--	--	--	--
79-09-12	--	--	--	--	--	--	--	--	--	--	--	--
79-10-10	--	--	--	--	--	--	--	--	--	--	--	--
79-11-14	--	--	--	--	--	--	--	--	--	--	--	--
79-12-13	--	--	--	--	--	--	--	--	--	--	--	--
80-01-17	--	--	--	--	--	--	--	--	--	--	--	--
80-02-20	--	--	--	--	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	CROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)
79-07-03	--	--	--	K2
79-08-15	--	--	--	--
79-09-12	--	--	--	K12
80-04-17	--	--	--	K1
80-08-28	--	--	--	K16
81-07-13	--	--	--	--
81-09-03	--	--	--	K6
78-05-24	--	--	--	--
79-03-08	--	--	--	--
79-03-28	--	--	--	--
79-04-03	--	--	--	--
79-05-01	--	--	--	<2
79-05-23	--	--	--	K4
79-07-05	--	--	--	--
79-07-05	--	--	--	100
79-08-17	--	--	--	--
79-04-12	--	--	--	--
79-04-25	--	--	--	K100
79-05-21	--	--	--	K40
79-06-07	2.6	2.5	--	--
79-06-28	--	--	--	130
79-08-17	--	--	--	--
79-08-27	--	--	--	--
80-05-01	4.8	4.8	--	K150
80-08-27	--	--	--	K50
78-04-21	2.5	2.3	.17	--
78-05-19	--	--	--	--
79-03-08	--	--	--	--
79-03-28	--	--	--	--
79-04-03	--	--	--	--
79-04-26	--	--	--	K2
79-05-23	--	--	--	K8
79-06-29	--	--	--	41
79-08-15	--	--	--	K10
79-09-12	--	--	--	--
79-10-10	--	--	--	--
79-11-14	--	--	--	--
79-12-13	--	--	--	--
80-01-17	--	--	--	--
80-02-20	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

STATION NUMBER	LOCAL IDENT-I-FIER	GEO-LOGIC UNIT	SITE	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (UMHO) (00095)	TEMPER-ATURE (DEG C) (00010)	PH (UNITS) (00400)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)
07105945	ROCK CREEK ABOVE FORT CARSON	--	SW	80-04-18	135	8.0	--	--	--
		--	SW	80-04-20	140	2.5	--	--	--
		--	SW	80-05-14	92	--	--	--	--
		--	SW	80-06-19	140	14.0	--	--	--
		--	SW	80-07-15	175	21.0	--	--	--
		--	SW	80-08-13	180	17.5	--	--	--
		--	SW	81-09-03	104	13.8	7.1	78	5.7
07105950	ROCK CREEK NEAR FORT CARSON	--	SW	79-04-03	158	.5	--	96	8.8
		--	SW	79-04-13	255	8.0	6.9	149	12
		--	SW	79-04-26	160	9.0	7.1	93	8.8
		--	SW	79-05-22	150	11.0	--	--	--
		--	SW	79-06-29	180	13.0	6.8	111	9.9
		--	SW	79-09-10	245	13.0	--	--	--
		--	SW	80-04-17	218	10.5	--	125	10
		--	SW	30-05-01	108	5.0	--	71	4.9
07105960	ROCK CREEK NEAR FOUNTAIN	--	SW	78-05-23	1230	12.0	--	--	--
		--	SW	78-07-13	258	13.0	7.1	121	7.1
		--	SW	78-09-01	1200	13.0	--	--	--
		--	SW	79-03-07	1200	14.0	--	--	--
		--	SW	79-03-29	1240	9.5	--	--	--
		--	SW	79-04-12	1200	9.0	7.8	756	120
		--	SW	79-04-25	1200	12.0	7.5	803	120
		--	SW	79-05-22	1100	15.5	--	--	--
		--	SW	79-06-04	240	16.0	--	--	--
		--	SW	79-06-27	1000	16.0	7.4	637	95
		--	SW	79-08-14	1030	13.0	--	--	--
		--	SW	79-08-26	--	--	--	--	--
		--	SW	79-09-10	840	16.0	--	--	--
		--	SW	80-04-17	1020	13.0	7.7	672	97
		--	SW	80-05-07	230	8.5	--	--	--
		--	SW	80-08-27	--	--	--	--	--
		--	SW	80-08-27	1250	20.5	7.6	913	130

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM AD-SORP-TION RATIO (00931)	HARD-NESS (MG/L AS CACO3) (00900)	HARD-NESS, NONCAR-BONATE (MG/L CACO3) (00902)	ALKA-LINITY FIELD (MG/L AS CACO3) (00410)	BICAR-BONATE (MG/L AS HCO3) (00440)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	NITRO-GEN,AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)
80-04-18	--	--	--	--	--	--	--	--	--	--	--	--
80-04-20	--	--	--	--	--	--	--	--	--	--	--	--
80-05-14	--	--	--	--	--	--	--	--	--	--	--	--
80-06-19	--	--	--	--	--	--	--	--	--	--	--	--
80-07-15	--	--	--	--	--	--	--	--	--	--	--	--
80-08-13	--	--	--	--	--	--	--	--	--	--	--	--
81-09-03	1.9	14	2.8	.4	47	--	--	--	1.1	<5.0	1.7	--
79-04-03	1.5	14	3.5	.5	49	10	39	--	3.4	27	1.7	--
79-04-13	2.0	24	6.9	.6	88	40	48	--	11	36	1.4	--
79-04-26	2.6	15	4.1	.5	54	26	28	--	3.6	28	1.6	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-29	2.0	18	5.4	.5	67	19	48	--	2.9	25	1.6	--
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	1.8	20	6.0	.5	75	23	52	--	5.0	33	1.7	--
80-05-01	1.7	12	2.9	.3	42	18	24	--	1.3	18	1.3	.90
78-05-23	--	--	--	--	--	--	--	--	--	--	--	--
78-07-13	11	14	3.6	.4	50	0	90	110	4.1	19	.5	1.8
78-09-01	--	--	--	--	--	--	--	--	--	--	--	--
79-03-07	--	--	--	--	--	--	--	--	--	--	--	--
79-03-29	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	2.1	90	32	2.8	360	97	260	--	31	310	2.1	--
79-04-25	1.9	120	30	2.5	420	160	260	--	31	330	2.2	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-04	--	--	--	--	--	--	--	--	--	--	--	--
79-06-27	2.2	79	28	2.3	310	93	220	--	17	270	2.3	--
79-08-14	--	--	--	--	--	--	--	--	--	--	--	--
79-08-26	--	--	--	--	--	--	57	--	--	--	--	--
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	1.9	87	28	2.3	330	100	230	--	16	290	2.5	--
80-05-07	--	--	--	--	--	--	--	--	--	--	--	--
80-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-08-27	2.5	110	40	2.7	440	220	220	--	34	450	2.1	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, DISSOLV (MG/L AS N) (00602)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P) (00671)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P) (00666)	ALUM-INUM, DIS-SOLVED (UG/L AS AL) (01106)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE) (01010)	BORON, DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)
80-04-18	--	--	--	--	--	--	--	--	--	--	--	--
80-04-20	--	--	--	--	--	--	--	--	--	--	--	--
80-05-14	--	--	--	--	--	--	--	--	--	--	--	--
80-06-19	--	--	--	--	--	--	--	--	--	--	--	--
80-07-15	--	--	--	--	--	--	--	--	--	--	--	--
80-08-13	--	--	--	--	--	--	--	--	--	--	--	--
81-09-03	.00	--	--	.090	--	--	--	--	--	--	--	--
79-04-03	.28	--	.070	.030	--	--	--	--	--	--	--	--
79-04-13	3.0	--	.020	.010	--	--	--	--	--	--	--	--
79-04-26	.35	--	--	.020	--	--	--	--	--	--	--	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-29	.25	--	--	<.010	--	--	--	--	--	--	--	--
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	.47	--	--	.010	--	--	--	--	--	--	--	--
80-05-01	.15	1.1	--	.040	--	--	--	--	--	--	--	--
78-05-23	--	--	--	--	--	--	--	--	--	--	--	--
78-07-13	.61	2.4	.260	.420	530	2	200	<10	100	3	ND	11
78-09-01	--	--	--	--	--	--	--	--	--	--	--	--
79-03-07	--	--	--	--	--	--	--	--	--	--	--	--
79-03-29	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	.04	--	.050	<.010	--	--	--	--	--	--	--	--
79-04-25	<.10	--	--	.010	--	--	--	--	--	--	--	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-04	--	--	--	--	--	--	--	--	--	--	--	--
79-06-27	.01	--	--	.010	--	--	--	--	--	--	--	--
79-08-14	--	--	--	--	--	--	--	--	--	--	--	--
79-08-26	--	--	--	--	--	--	--	--	--	--	--	--
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	.02	--	--	.010	--	--	--	--	--	--	--	--
80-05-07	--	--	--	--	--	--	--	--	--	--	--	--
80-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-08-27	.18	--	--	.000	--	--	--	--	--	--	--	--

Table 16.--*Chemical and biological analyses of water from streams at and near Fort Carson*--Continued

DATE OF SAMPLE	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L) (80020)	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT) (01515)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT) (80030)
80-04-18	--	--	--	--	--	--	--	--	--	--	--	--
80-04-20	--	--	--	--	--	--	--	--	--	--	--	--
80-05-14	--	--	--	--	--	--	--	--	--	--	--	--
80-06-19	--	--	--	--	--	--	--	--	--	--	--	--
80-07-15	--	--	--	--	--	--	--	--	--	--	--	--
80-08-13	--	--	--	--	--	--	--	--	--	--	--	--
81-09-03	28	--	4	--	--	--	--	--	--	--	--	--
79-04-03	<10	--	<1	--	--	--	--	--	--	--	--	--
79-04-13	<10	--	1	--	--	--	--	--	--	--	--	--
79-04-26	60	--	<10	--	--	--	--	--	--	--	--	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-29	<10	--	<1	--	--	--	--	--	--	--	--	--
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	<10	--	1	--	--	--	--	--	--	--	--	--
80-05-01	170	--	3	--	--	--	--	--	--	--	1.4	2.0
78-05-23	--	--	--	--	--	--	--	--	--	--	--	--
78-07-13	160	6	20	<.1	<1	10	<1	ND	20	.60	--	3.0
78-09-01	--	--	--	--	--	--	--	--	--	--	--	--
79-03-07	--	--	--	--	--	--	--	--	--	--	--	--
79-03-29	--	--	--	--	--	--	--	--	--	--	--	--
79-04-12	40	--	20	--	--	--	--	--	--	--	--	--
79-04-25	30	--	20	--	--	--	--	--	--	--	--	--
79-05-22	--	--	--	--	--	--	--	--	--	--	--	--
79-06-04	--	--	--	--	--	--	--	--	--	--	--	--
79-06-27	20	--	40	--	--	--	--	--	--	--	--	--
79-08-14	--	--	--	--	--	--	--	--	--	--	--	--
79-08-26	--	--	--	--	--	--	--	--	--	--	<1.5	<2.2
79-09-10	--	--	--	--	--	--	--	--	--	--	--	--
80-04-17	20	--	130	--	--	--	--	--	--	--	--	--
80-05-07	--	--	--	--	--	--	--	--	--	--	2.2	3.2
80-08-27	--	--	--	--	--	--	--	--	--	--	--	--
80-08-27	30	--	20	--	--	--	--	--	--	--	--	--

Table 17.--*Chemical analyses of water from reservoirs*

[UMHO, micromhos per centimeter at 25° Celsius; DEG C, degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter]

STATION NUMBER	LOCAL IDENT-I-FIER	GEO-LOGIC UNIT	SITE	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (UMHO) (00095)	TEMPER-ATURE (DEG C) (00010)	PH (UNITS) (00400)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SODIUM DIS-SOLVED (MG/L AS NA) (00930)
382641104492300	TELLER RESERVOIR	--	LK	79-09-24	1900	17.5	9.6	1460	47
383945104464400	HAYMES RESERVOIR	--	LK	79-09-24	520	16.0	7.4	329	39
384052104481300	TOWNSEND RESERVOIR	--	LK	79-09-19	390	16.5	9.4	237	31
		--	LK	79-09-19	400	10.0	7.7	238	30
384004104453500	NORTHSIDE RESERVOIR	--	LK	79-09-24	350	16.0	9.5	211	35

Table 17.--*Chemical analyses of water from reservoirs*--Continued

DATE OF SAMPLE	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM ADSORPTION RATIO (00931)	HARDNESS (MG/L AS CACO3) (00900)	HARDNESS, NONCARBONATE (MG/L CACO3) (00902)	ALKALINITY FIELD (MG/L AS CACO3) (00410)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)	PHOSPHORUS, DISSOLVED (MG/L AS P) (00666)
79-09-24	22	290	66	.6	1000	970	26	11	1000	1.1	<.10	.030
79-09-24	2.5	48	18	1.2	190	44	150	6.1	110	1.7	.02	.050
79-09-19	1.9	40	11	1.1	150	5	140	5.0	51	1.6	<.10	.020
79-09-19	1.9	40	11	1.1	150	0	170	4.7	29	1.5	<.10	.130
79-09-24	2.5	20	15	1.4	110	12	100	5.0	70	1.6	<.10	.040

Table 17.--*Chemical analyses of water from reservoirs*--Continued

DATE OF SAMPLE	IRON, DIS-SOLVED (UG/L AS FE) (01046)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)
79-09-24	60	20
79-09-24	20	1
79-09-19	50	1
79-09-19	210	2100
79-09-24	120	5

Table 18.--*Chemical and biological analyses of water from wells at and near Fort Carson*

[Geologic unit: 111ALFP, stream alluvium; 317FNTN, Fountain aquifer; 210DKOT, Dakota-Purgatoire aquifer; 211NBRR, Niobrara Formation. UMHO, micromhos per centimeter at 25° Celsius; DEG C, degrees Celsius; MG/L, milligrams per liter; UG/L, micrograms per liter; PCI/L, picocuries per liter; COLS/100 ML, colonies per 100 milliliters]

STATION NUMBER	LOCAL IDENT-I-FIER	GEO-LOGIC UNIT	SITE	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHO) (00095)	TEMPER-ATURE, WATER (DEG C) (00010)	PH FIELD (UNITS) (00400)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)
384218104503401	SC15-67-36BAC	111ALFP	GW	73-12-06	156	8.0	7.4	96	7.4
384056104475601	SC16-66-05DCA1	111ALFP	GW	79-09-07	480	18.0	6.8	<292	35
383927104454501	SC16-66-15ACC1	111ALFP	GW	79-07-11	900	15.0	7.6	625	82
383921104454301	SC16-66-15DBA1	111ALFP	GW	77-07-14	925	11.5	7.2	628	69
383924104455201	SC16-66-15DBBB	111ALFP	GW	74-03-25	987	11.0	7.3	664	79
383923104455301	SC16-66-15DBB2	111ALFP	GW	79-07-13	1100	21.5	7.5	784	97
383746104550301	SC16-67-29BDC	111ALFP	GW	73-12-06	289	7.0	7.2	181	8.9
383643104534501	SC16-67-33CAD	111ALFP	GW	73-12-06	635	9.0	7.2	377	31
383641104532501	SC16-67-33DAC1	111ALFP	GW	74-03-26	660	10.0	7.3	387	35
		111ALFP	GW	79-09-11	500	13.5	6.8	<302	27
383407104500701	SC17-67-13DBDA	111ALFP	GW	74-03-28	740	11.5	7.5	485	20
383119104550401	SC17-67-32CDB1	111ALFP	GW	79-09-06	1120	17.0	7.1	750	120
383010104545501	SC18-67-08BAAC	111ALFP	SP	74-03-28	637	8.0	7.8	405	35
382701104520401	SC18-67-27DDA1	111ALFP	GW	80-01-18	1400	10.0	6.8	1210	34
382532104461702	SC19-66-03BCC	111ALFP	GW	72-08-24	2040	13.0	7.6	1630	120
383539104543601	SC17-67-05DBD	317FNTN	GW	73-12-05	552	7.0	7.8	327	76
383520104522001	SC17-67-10ADBB	317FNTN	GW	74-03-27	634	13.0	7.5	389	15
		317FNTN	GW	80-01-16	600	12.0	8.3	407	15
383414104552801	SC17-67-18ADDC	317FNTN	GW	74-03-26	1200	13.0	8.3	755	230
383412104560301	SC17-67-18BDCC	317FNTN	GW	74-03-27	713	4.0	8.6	438	160
383240104525501	SC17-67-33ABA	317FNTN	GW	80-01-09	5000	5.0	7.8	3500	850
383049104522801	SC18-67-03ACC	317FNTN	GW	74-03-28	2100	14.0	7.6	1570	310
		317FNTN	GW	78-10-25	2000	11.0	7.3	1560	330
		317FNTN	GW	80-01-22	2050	12.0	7.7	1610	310
383700104485801	SC16-66-31ACAB	210DKOT	GW	79-09-07	450	18.0	7.0	264	37
383008104475301	SC18-66-08ABDC	210DKOT	GW	74-03-28	544	16.0	7.6	327	19
382744104483001	SC18-66-20CCC1	210DKOT	GW	79-09-05	780	18.0	7.3	559	35
382607104470301	SC18-66-33CDA1	210DKOT	GW	79-09-05	730	20.0	7.2	483	46
383030104563001	SC18-67-06CAD	210DKOT	GW	80-01-14	4000	14.0	8.2	2290	300
383802104544201	SC18-67-08ACB1	210DKOT	GW	79-09-06	1200	17.0	7.3	837	51
382958104550101	SC18-67-08BDB	210DKOT	GW	74-01-24	668	13.5	7.7	409	24
382649104541201	SC18-67-33BBB	210DKOT	GW	78-10-24	950	15.0	7.5	640	42
382622104524001	SC18-67-34CAB1	210DKOT	GW	78-10-24	1950	14.5	6.9	1940	320
382522104542501	SC19-67-05DAC	210DKOT	GW	80-01-10	800	12.0	7.6	489	46
383143104470201	SC17-66-33BDDA	211NBRR	GW	74-03-28	2530	10.0	7.2	2350	24

Table 18.--*Chemical and biological analyses of water from wells at and near Fort Carson*--Continued

DATE OF SAMPLE	POTASSIUM, DISSOLVED (MG/L AS K) (00935)	CALCIUM DISSOLVED (MG/L AS CA) (00915)	MAGNESIUM, DISSOLVED (MG/L AS MG) (00925)	SODIUM ADSORPTION RATIO (00931)	HARDNESS (MG/L AS CACO3) (00900)	HARDNESS, NONCARBONATE (MG/L CACO3) (00902)	ALKALINITY (MG/L AS CACO3) (00410)	BICARBONATE (MG/L AS HCO3) (00440)	CHLORIDE, DISSOLVED (MG/L AS CL) (00940)	SULFATE DISSOLVED (MG/L AS SO4) (00945)	FLUORIDE, DISSOLVED (MG/L AS F) (00950)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)
73-12-06	1.9	17	4.1	.4	59	8	52	63	2.0	18	1.3	--
79-09-07	3.5	44	16	1.1	180	0	190	--	5.0	58	1.7	.55
79-07-11	2.3	88	30	1.9	340	140	200	--	28	260	1.8	.17
77-07-14	2.0	86	33	1.6	350	150	210	250	9.1	290	1.8	--
74-03-25	2.4	96	33	1.8	380	160	214	261	8.4	300	2.1	--
79-07-13	1.7	85	45	2.1	400	260	140	--	9.7	450	2.2	--
73-12-06	2.0	37	9.9	.3	130	21	112	137	2.9	33	.1	--
73-12-06	3.8	70	26	.8	280	19	262	320	26	44	.7	--
74-03-26	4.0	67	26	.9	270	23	251	306	32	54	.8	--
79-09-11	2.6	52	19	.8	210	8	200	--	13	44	.7	.46
74-03-28	3.5	98	28	.5	360	150	207	252	8.8	180	.9	--
79-09-06	3.4	98	10	3.1	290	96	190	--	9.4	350	.8	.07
74-03-28	3.6	79	12	1.0	250	85	162	197	8.5	150	.4	--
80-01-18	5.7	260	58	.5	890	660	230	--	7.9	670	1.0	.52
72-08-24	3.7	310	53	1.7	990	720	276	337	16	920	.8	--
73-12-05	10	21	17	3.0	120	0	249	304	7.1	33	2.3	--
74-03-27	2.0	69	31	.4	300	110	188	229	23	100	.5	--
80-01-16	2.1	69	32	.4	300	120	180	--	23	120	.5	.60
74-03-26	6.2	14	9.3	12	73	0	225	274	12	340	1.4	--
74-03-27	3.7	2.3	.5	25	8	0	288	333	17	57	.4	--
80-01-09	8.3	240	21	14	690	600	84	--	10	2300	1.1	.37
74-03-28	4.3	170	7.2	6.3	450	260	194	237	6.5	940	1.4	--
78-10-25	3.7	170	6.7	6.8	460	270	190	--	7.5	900	1.4	.36
80-01-22	3.8	180	7.4	6.2	480	290	190	--	7.3	970	1.4	.32
79-09-07	3.5	39	9.1	1.4	130	0	170	--	1.6	60	.7	.01
74-03-28	2.1	69	18	.5	250	36	210	256	8.9	71	.8	--
79-09-05	2.4	110	30	.8	400	140	260	--	11	200	.8	.45
79-09-05	3.8	79	28	1.1	310	73	240	--	11	160	.8	.50
80-01-14	14	270	89	4.0	1000	980	61	--	67	1500	.5	.54
79-09-06	5.9	140	49	.9	550	320	230	--	7.7	430	.9	.02
74-01-24	3.5	84	22	.6	300	110	195	238	5.6	140	.7	--
78-10-24	3.6	100	43	.9	430	190	240	--	9.9	280	.5	.05
78-10-24	7.1	200	91	4.7	880	350	530	--	33	940	.6	.81
80-01-10	4.6	65	35	1.1	310	86	220	--	5.2	190	.5	.22
74-03-28	20	580	44	.3	1600	1600	78	95	6.2	1600	.8	--

Table 18.--*Chemical and biological analyses of water from wells at and near Fort Carson*--Continued

DATE OF SAMPLE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)	NITROGEN, DISSOLVED (MG/L AS N) (00602)	PHOSPHORUS, ORTHOPHOSPHATE DISSOL. (MG/L AS P) (00671)	PHOSPHORUS, DISSOLVED (MG/L AS P) (00666)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	BORON, DISSOLVED (UG/L AS B) (01020)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)
73-12-06	.11	--	.020	--	10	--	--	--	--	--	--	--
79-09-07	.07	.62	.010	<.010	--	1	60	<1	70	<2	ND	--
79-07-11	.11	.28	--	.010	<100	1	<100	<10	90	ND	ND	--
77-07-14	.35	--	.010	--	--	<1	--	--	80	--	--	--
74-03-25	.26	--	<.010	--	20	--	--	--	--	--	--	--
79-07-13	<.10	--	--	.020	--	--	--	--	--	--	--	--
73-12-06	.26	--	.060	--	10	--	--	--	--	--	--	--
73-12-06	.02	--	.050	--	10	--	--	--	--	--	--	--
74-03-26	.06	--	.030	--	20	--	--	--	--	--	--	--
79-09-11	.65	1.1	.010	.010	--	1	70	<1	50	2	ND	--
74-03-28	.22	--	.020	--	30	--	--	--	--	--	--	--
79-09-06	6.5	6.6	.010	.020	--	1	40	<1	100	<2	<20	--
74-03-28	1.3	--	.040	--	20	--	--	--	--	--	--	--
80-01-18	2.7	3.2	--	.410	--	3	40	<1	160	<1	0	--
72-08-24	5.0	--	.010	--	0	--	--	--	--	--	--	--
73-12-05	.37	--	.020	--	10	--	--	--	--	--	--	--
74-03-27	3.6	--	.010	--	10	--	--	--	--	--	--	--
80-01-16	3.9	4.5	--	.010	--	2	70	<1	40	<1	0	--
74-03-26	.31	--	.030	--	30	--	--	--	--	--	--	--
74-03-27	1.3	--	<.010	--	20	--	--	--	--	--	--	--
80-01-09	3.1	3.5	--	.020	--	0	9	<1	280	<1	0	--
74-03-28	1.1	--	.010	--	20	--	--	--	--	--	--	--
78-10-25	1.0	--	<.010	<.010	<100	2	<100	<10	170	ND	ND	ND
80-01-22	1.0	1.3	--	.010	--	2	9	1	160	1	0	--
79-09-07	.08	.09	<.010	<.010	--	<1	40	<1	<20	2	<20	--
74-03-28	.03	--	<.010	--	20	--	--	--	--	--	--	--
79-09-05	.01	.46	.010	<.010	--	<1	30	<1	50	<2	<20	--
79-09-05	.02	.52	.010	<.010	--	1	30	<1	50	<2	<20	--
80-01-14	.06	.60	--	.010	--	0	0	0	130	1	0	--
79-09-06	.39	.41	<.010	<.010	--	1	40	<1	100	<2	<20	--
74-01-24	.02	--	.010	--	--	--	--	--	--	--	--	--
78-10-24	.02	--	<.010	<.010	10	<1	<100	<10	70	<2	ND	ND
78-10-24	.72	--	<.010	<.010	10	<1	<100	<10	370	<2	ND	ND
80-01-10	.09	.31	--	.000	--	0	20	<1	40	<1	0	--
74-03-28	6.3	--	<.010	--	30	--	--	--	--	--	--	--

Table 18.--*Chemical and biological analyses of water from wells at and near Fort Carson*--Continued

DATE OF SAMPLE	COPPER, DIS-SOLVED (UG/L AS CU) (01040)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	LITHIUM DIS-SOLVED (UG/L AS LI) (01130)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	STRON-TIUM, DIS-SOLVED (UG/L AS SR) (01080)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)
73-12-06	--	80	--	--	20	--	--	--	--	--	--	--
79-09-07	2	<10	ND	--	30	<.1	<10	ND	<1	ND	--	40
79-07-11	ND	190	<2	--	20	<.1	1	ND	1	ND	--	<20
77-07-14	--	670	--	--	20	--	--	--	1	--	--	--
74-03-25	--	150	--	--	<10	--	--	--	--	--	--	--
79-07-13	--	20	--	--	6	--	--	--	--	--	--	--
73-12-06	--	90	--	--	<10	--	--	--	--	--	--	--
73-12-06	--	<10	--	--	<10	--	--	--	--	--	--	--
74-03-26	--	110	--	--	<10	--	--	--	--	--	--	--
79-09-11	ND	<10	ND	--	2	<.1	<10	ND	1	ND	--	6
74-03-28	--	90	--	--	40	--	--	--	--	--	--	--
79-09-06	21	<10	3	--	<1	<.1	12	ND	11	ND	--	60
74-03-28	--	30	--	--	<10	--	--	--	--	--	--	--
80-01-18	0	10	0	--	4	.0	<10	1	15	0	--	20
72-08-24	--	60	--	--	0	--	--	--	--	--	--	--
73-12-05	--	20	--	--	<10	--	--	--	--	--	--	--
74-03-27	--	40	--	--	<10	--	--	--	--	--	--	--
80-01-16	0	20	0	--	50	.0	<10	6	8	0	--	290
74-03-26	--	130	--	--	40	--	--	--	--	--	--	--
74-03-27	--	590	--	--	<10	--	--	--	--	--	--	--
80-01-09	0	100	0	--	80	.0	30	0	56	0	--	530
74-03-28	--	20	--	--	<10	--	--	--	--	--	--	--
78-10-25	ND	3300	4	70	40	<.1	12	3	15	ND	3900	20
80-01-22	0	80	0	--	30	.0	10	2	17	0	--	40
79-09-07	13	<10	ND	--	50	<.1	14	<2	<1	ND	--	230
74-03-28	--	50	--	--	<10	--	--	--	--	--	--	--
79-09-05	ND	1800	ND	--	30	<.1	11	ND	<1	ND	--	300
79-09-05	ND	550	ND	--	40	<.1	<10	ND	<1	ND	--	340
80-01-14	0	0	0	--	90	.0	4	0	0	0	--	1400
79-09-06	ND	190	ND	--	20	<.1	17	ND	7	ND	--	100
74-01-24	--	160	--	--	60	--	--	--	--	--	--	--
78-10-24	ND	3300	5	30	40	<.1	5	<2	<1	ND	1600	130
78-10-24	ND	1400	5	210	60	<.1	1	13	10	ND	9000	100
80-01-10	0	<10	0	--	<1	.0	<10	4	0	0	--	<3
74-03-28	--	340	--	--	120	--	--	--	--	--	--	--

Table 18.--*Chemical and biological analyses of water from wells at and near Fort Carson*--Continued

DATE OF SAMPLE	URANIUM DIS-SOLVED, EXTRAC-TION (UG/L) (80020)	GROSS ALPHA, DIS-SOLVED (PCI/L AS U-NAT) (01515)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT) (80030)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90) (80050)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L) (09511)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)
73-12-06	--	--	--	--	--	--	--
79-09-07	2.8	--	<5.9	5.9	5.9	.38	--
79-07-11	24	--	32	11	11	.14	--
77-07-14	--	--	--	--	--	--	--
74-03-25	--	--	--	--	--	--	--
79-07-13	--	--	--	--	--	--	--
73-12-06	--	--	--	--	--	--	--
73-12-06	--	--	--	--	--	--	--
74-03-26	--	--	--	--	--	--	--
79-09-11	3.3	--	<6.6	4.3	4.3	.16	--
74-03-28	--	--	--	--	--	--	--
79-09-06	32	--	62	24	22	.49	--
74-03-28	--	--	--	--	--	--	--
80-01-18	--	31	46	17	15	.29	--
72-08-24	--	--	--	--	--	--	--
73-12-05	--	--	--	--	--	--	--
74-03-27	--	--	--	--	--	--	--
80-01-16	--	<4.1	<6.1	<2.9	<2.8	.10	--
74-03-26	--	--	--	--	--	--	--
74-03-27	--	--	--	--	--	--	--
80-01-09	--	75	110	66	63	.09	K2
74-03-28	--	--	--	--	--	--	--
78-10-25	60	--	140	12	11	.10	--
80-01-22	--	95	140	27	24	.02	<1
79-09-07	.04	--	15	8.8	8.0	1.5	--
74-03-28	--	--	--	--	--	--	--
79-09-05	15	--	99	25	25	27	--
79-09-05	2.3	--	37	19	20	6.5	--
80-01-14	--	51	75	36	34	8.9	K4
79-09-06	11	--	110	30	30	6.7	--
74-01-24	--	--	--	--	--	--	--
78-10-24	51	--	690	140	130	56	--
78-10-24	4.2	--	<30	18	16	.85	--
80-01-10	18	820	1200	200	180	360	<1
74-03-28	--	--	--	--	--	--	--

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