STATISTICAL SUMMARY AND EVALUATION OF THE QUALITY OF SURFACE WATER IN THE COLORADO RIVER BASIN, 1973-82 WATER YEARS

By Freeman L. Andrews and Terry L. Schertz

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 85-4181

Prepared in cooperation with the COLORADO RIVER
MUNICIPAL WATER DISTRICT and the
LOWER COLORADO RIVER AUTHORITY

Austin, Texas
1986

UNITED STATES DEPARTMENT OF THE INTERIOR

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CONVERSION FACTORS

Factors for converting inch-pound units to metric equivalents are given in the following table:

From	Multiply by	To obtain
acre-foot (acre-ft)	1,233.0	cubic meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
inch (in.)	25.40	millimeter
micromhos per centimeter at 25° Celsius (µmhos)	1.000	microsiemens per centimeter at 25° Celsius
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
ton	0.9072	megagram

STATISTICAL SUMMARY AND EVALUATION OF THE QUALITY OF SURFACE WATER IN THE COLORADO RIVER BASIN, TEXAS, 1973-82 WATER YEARS

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ABSTRACT

Significant upward trends in dissolved-solids concentrations were detected with the Seasonal Kendall Test for trends at three stations in the upper basin during the study period. The increases exceeded 270 milligrams per liter per year at two stations and 165 milligrams per liter per year at the third station.

The composition of dissolved constituents in the Colorado River basin changes from predominantly sodium and chloride ions in the upper basin to predominantly calcium and bicarbonate ions in the lower basin. The U.S. Environmental Protection Agency secondary drinking-water regulations of 500 milligrams per liter for total dissolved solids was exceeded 95 percent of the time at each station on the main stem of the Colorado River in the upper basin. In the middle Colorado River basin, the Environmental Protection Agency secondary drinking-water regulations for total dissolved solids was exceeded approximately 95 percent of the time at most stations.

Nutrient concentrations in the Colorado River basin generally were low. Only one sample exceeded the level set for nitrate nitrogen, and no other nutrient species exceeded Environmental Protection Agency levels. A general upward trend was detected in organic nitrogen and total nitrogen, but concentrations still remained low.

Densities of fecal-coliform and fecal-streptococcal bacteria ranged from less than 1 colony per 100 milliliters to 26,000 colonies per 100 milliliters and 1 colony per 100 milliliters to 50,000 colonies per 100 milliliters, respectively. Fecal-coliform densities exceeded Environmental Protection Agency criteria for public water supply (2,000 colonies per 100 milliliters) at several stations during the study.

Biochemical oxygen demand concentrations ranged from 0.00 to 34 milligrams per liter. Only one mean biochemical oxygen demand concentration exceeded 8 milligrams per liter, the upper range of concentration common in moderately contaminated streams.

Trace elements and pesticides were detected in many samples throughout the basin. The concentrations generally were low, and maximum contaminant levels rarely were exceeded.

INTRODUCTION

The U.S. Geological Survey, in cooperation with the Texas Department of Water Resources, the Colorado River Municipal Water District, the Lower Colorado River Authority, and other State and local agencies, has operated a network of daily and periodic water-quality stations on streams in the Colorado River basin since the early 1940's. To supplement the information being obtained by the daily network, a cooperative Statewide reconnaissance by the Geological Survey and the Texas Department of Water Resources was begun in September 1961. During this study, samples for chemical analyses were collected periodically at numerous sites on streams throughout Texas so that some water-quality information would be available where water-development projects were likely to be built. Each major river basin in the State was studied, and Leifeste and Lansford (1968) summarized the chemical quality of surface waters in the Colorado River basin.

Before 1968, analyses of water samples from the network of daily and periodic stations usually included only the principal inorganic constituents and related properties. To supplement this information, the cooperative water-quality program of the Geological Survey with State, Federal, and local agencies was expanded in January 1968 to include the periodic determination of biochemical oxygen demand, dissolved oxygen, nutrients, and pesticides at selected sites on streams throughout Texas. Data prior to the 1973 water year have been summarized by Rawson and others (1973) and Rawson (1974).

Water-quality data have been collected on many small tributaries and on Town Lake and Lake Austin in the Colorado River basin in the Austin area as part of an urban-hydrology program. Much of this data is storm-event related and will be analyzed in a separate report and is not included in this study.

Other studies, including several on saline inflow (Rawson, 1982; U.S. Army Corps of Engineers, 1980) in the upper part of the basin, have been conducted, but no basin-wide analysis of the data has been done since 1972.

The purpose of this report is to (1) provide statistical analyses of the water-quality data collected during the 1973-82 water years, (2) define areal and temporal variations in selected water-quality constituents, (3) delineate problem areas, and (4) evaluate the adequacy of the water-quality data-collection network.

BASIN DESCRIPTION

The Colorado River basin extends from eastern New Mexico to Matagorda Bay, an arm of the Gulf of Mexico on the coast of Texas (fig. 1). The portion of the basin in Texas is about 500 mi long, ranges from about 7 to 160 mi in width, and is about 40,000 mi^2 in area, including approximately 10,000 mi^2 in western Texas that do not normally contribute runoff to streams and rivers in the basin (Rawson and others, 1973, p. 11). The topography of the Colorado River basin ranges from rolling prairie in the upper basin to the rugged hill country in central Texas and on to the Coastal Plains in the lower basin. The geography and geology of the basin have been described extensively by Mount and others (1967, p. 10-18).

page 4 follows

The principal tributaries to the mainstem Colorado River, in downstream order, are Beals Creek, Elm Creek, Concho River, Pecan Bayou, and San Saba, Llano, and Pedernales Rivers (fig. 1). The latter three are spring-fed, perennial streams.

For this report, the Colorado River basin has been divided into three physical sections that are separated by reservoirs. The upper section of the basin is the area upstream from E. V. Spence Reservoir; the middle section extends from E. V. Spence Reservoir to the highland lakes (Lake Buchanan, Lake Lyndon B. Johnson, and Lake Travis); and the lower section is the area downstream from the highland lakes. Much of the data presented in this report is discussed relative to the three sections of the basin described above.

The climate of the Colorado River basin, also described by Mount and others (1967), is characterized by hot summers and mild winters except for occasionally severe cold temperatures in the High Plains portion of the basin. Average annual precipitation ranges from less than 15 in. in the upper end of the basin to more than 40 in. near the coast. The average monthly precipitation for the period of study at selected stations in the Colorado River basin is shown in table 1.

The major uses of surface water in the basin in 1980, according to data provided by the Texas Department of Water Resources, were irrigation and municipal supply. Irrigation uses approximately 666,600 acre-ft of water annually, or 71 percent of the total surface water used in the Colorado River basin. Approximately 577,300 acre-ft, or 87 percent of the surface water used for irrigation, is used in the Coastal Plains region of the river basin. Municipal supply uses approximately 195,800 acre-ft of water annually or 21 percent of the total surface water used. Approximately 83,700 acre-ft, or 43 percent of the surface water used for municipal supply, is used by Travis County where 30 percent of the population in the river basin is located.

METHODS OF DATA ANALYSIS

Data Base Description

Water-quality data collected by the Geological Survey from October 1972 through September 1982 (1973-82 water years) for 22 streamflow stations and 10 reservoir stations throughout the Colorado River basin form the data base for this report. The list of stations and the type of data collected at each station during the study period are shown in tables 2-3. Thirteen of the streamflow stations and two of the reservoir stations are located on the mainstem Colorado River, and the remaining nine streamflow stations and eight reservoir stations are located on major tributaries (fig. 1). Water-quality data were collected and published as Colorado River at Ballinger (08126500) until September 1979. The location of sample collection was then moved upstream, and the data were stored and published as Colorado River near Ballinger (08126380) for the remaining period of record. For this report, the water-quality data for the two sites were combined and are referred to as Colorado River at Ballinger (08126500).

Some of the nutrient data and much of the trace element and pesticide data are reported by the laboratory and stored in the Geological Survey WATSTORE files as "less-than" (<) values. The "less-than" values indicate that the con-

Table 1.--Monthly precipitation at selected locations in the Colorado River basin

Month	Annual precipitation, in inches											Average for month
	Ballinger, Texas											
	1972	1973	1974	1975	1976	1977	1978	1979*	1980*	1981*	1982*	
Jan.	0.52	2.35	0.06	0.76	0.00	1.08	0.50	0.78	--	0.96	1.48	0.77
Feb.	.12	1.66	.36	1.60	.30	.75	2.00	1.59	--	1.20	1.16	.98
Mar.	.05	1.02	.45	.01	.54	1.34	.24	1.98	--	4.46	1.34	1.04
Apr.	1.72	3.15	1.30	.81	5.30	5.37	.91	2.33	--	--	--	1.09
May.	3.15	.91	3.21	1.02	.82	1.30	4.83	1.92	--	4.29	6.04	2.50
Jun.	3.98	3.63	.64	.65	.92	3.13	.84	4.69	--	--	--	1.68
Jul.	.60	3.76	.68	5.32	3.43	.90	.60	.62	0.15	--	--	1.46
Aug.	4.93	.02	3.71	.59	.69	2.13	3.81	4.09	1.04	1.39	.53	2.08
Sept.	2.26	4.65	6.43	2.35	3.79	.31	5.48	.58	14.47	--	1.98	3.85
Oct.	4.35	3.75	4.31	2.21	5.35	3.68	.34	.52	.01	7.34	1.16	3.00
Nov.	.40	.13	1.55	3.07	.62	.30	1.54	.16	--	--	1.96	.88
Dec.	.01	.14	1.51	.65	.13	.16	.04	--	1.98	.35	--	.45
Total for year	22.09	25.17	24.21	19.04	21.89	20.45	21.13	--	--	--	--	
	San Saba, Texas											
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Jan.	0.60	3.51	0.60	0.65	0.00	1.47	0.33	1.54	1.03	0.63	0.91	1.02
Feb.	.36	2.15	.72	2.52	.34	.44	2.59	2.50	1.43	1.09	1.16	1.39
Mar.	T**	.89	.42	.77	.76	2.83	.40	3.69	1.07	4.47	1.43	1.52
Apr.	3.32	4.79	.94	3.49	3.55	6.93	1.00	1.63	1.90	1.43	2.22	2.84
May.	4.66	1.16	5.85	6.69	2.98	.95	4.17	4.01	5.56	3.19	4.99	4.02
Jun.	2.18	4.69	1.39	1.61	2.38	1.94	3.98	4.17	2.88	4.37	3.41	3.00
Jul.	0.90	3.60	1.57	2.47	7.00	.00	.63	0.95	2.25	.28	.34	1.82
Aug.	3.27	.00	6.18	1.70	.23	.96	5.38	8.14	.23	2.46	.88	2.68
Sept.	3.84	4.50	5.03	1.18	3.15	.00	2.25	.08	6.61	3.30	.58	2.77
Oct.	2.16	6.52	3.22	.88	3.56	1.12	.47	1.70	.54	5.55	.56	2.39
Nov.	1.07	1.00	1.50	.92	.93	2.20	3.59	.10	2.98	1.19	3.40	1.72
Dec.	.27	.08	1.93	.54	.56	.10	.64	2.71	1.73	.06	1.90	.96
Total for year	22.63	32.89	29.35	23.42	25.44	18.94	25.43	31.22	28.21	28.02	21.78	

Table 1.--Monthly precipitation at selected locations in the Colorado River basin--Continued

Month	Annual precipitation, in inches											Average for month
	Austin, Texas											
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Jan.	1.48	3.42	2.74	1.11	1.16	2.25	0.88	2.11	0.85	2.57	0.85	1.77
Feb.	.31	2.05	.36	2.30	1.11	2.58	1.95	3.54	2.33	1.18	.80	1.68
Mar.	T**	2.92	1.34	.80	2.11	2.18	.84	3.76	3.20	3.05	1.39	1.96
Apr.	1.46	3.09	1.79	3.86	8.13	6.08	1.72	2.98	2.20	.81	4.17	3.30
May.	7.88	1.38	5.88	8.16	6.05	1.24	5.78	7.29	5.43	9.02	5.68	5.80
Jun.	2.20	4.70	.21	7.07	3.19	1.22	2.98	.83	.31	14.96	2.99	3.70
Jul.	2.55	2.95	.61	2.25	4.71	.21	1.19	10.54	.28	3.39	.13	2.62
Aug.	2.53	.06	8.90	2.54	0.80	.06	1.49	.61	13.55	.91	.77	2.93
Sept.	1.55	7.44	1.58	3.62	3.80	3.10	4.44	1.40	5.66	2.65	1.88	3.37
Oct.	2.96	11.11	3.45	2.54	5.93	1.19	1.38	.45	1.29	7.04	2.66	3.64
Nov.	2.62	.58	7.35	.52	1.78	1.69	5.48	.59	3.41	.72	3.19	2.54
Dec.	.53	.76	2.00	2.04	2.48	.34	2.84	3.40	1.24	.39	2.12	1.65
Total for year	26.07	40.46	36.21	36.81	41.25	22.14	30.97	37.50	39.75	46.69	26.63	
	Columbus, Texas											
	1972	1973*	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Jan.	3.58	3.55	6.99	2.30	1.04	2.59	5.64	6.31	3.56	2.59	1.59	3.61
Feb.	1.52	2.93	.28	1.49	.46	3.30	3.20	3.73	2.29	1.85	2.74	2.16
Mar.	6.54	4.27	1.46	2.54	2.04	1.73	.82	2.19	3.27	1.48	2.08	2.58
Apr.	1.04	8.65	1.16	6.88	6.83	7.47	1.88	6.79	1.04	4.12	2.53	4.40
May.	10.81	2.17	6.95	10.11	3.76	2.76	1.87	13.48	6.39	7.63	7.05	6.63
Jun.	1.63	16.89	1.95	4.51	3.49	3.33	3.58	2.30	.54	9.41	2.11	4.52
Jul.	4.93	6.43	1.48	2.09	3.38	.86	.83	7.90	.90	3.99	.81	3.05
Aug.	2.06	---	5.98	4.18	2.68	2.59	2.35	2.37	.86	6.58	1.76	2.86
Sept.	1.59	4.04	8.55	.96	5.15	3.12	10.33	8.03	5.34	2.47	0.28	4.53
Oct.	3.49	6.90	2.91	2.58	8.08	1.92	.84	.43	3.82	4.48	4.82	3.66
Nov.	4.22	1.56	6.23	2.72	2.32	4.60	5.16	1.42	3.14	6.32	7.73	4.13
Dec.	1.66	2.32	3.24	1.62	7.01	1.06	3.44	1.92	1.03	.82	2.71	2.44
Total for year	43.07	---	47.18	41.98	46.24	35.33	39.94	56.87	32.18	51.74	36.21	

* Information not available for every month.
** T=trace

Table 2.--Summary of the water-quality data-collection program for streamflow gaging stations in the Colorado River basin for the 1973-82 water years

Station	Inorganic	Nutrients	Trace elements	Indicator bacteria	Pesticides	Continuous streamflow	Daily or continuous specific conductance
08118500 Bull Creek near Ira	1975-78	--	--	--	--	--	--
08119000 Bluff Creek near Ira	1975-78	--	--	--	--	--	--
08119500 Colorado River near Ira	1974-82	--	--	--	--	1973-82	1974-82
08120500 Deep Creek near Dunn	1974-78	--	--	--	--	1973-78	--
08120700 Colorado River near Cuthbert	1973-82	--	--	--	--	1973-82	1973-82
08121000 Colorado River at Colorado City	1973-82	--	--	--	--	1973-82	1973-82
08123800 Beals Creek near Westbrook	1973-82	1975-77	--	--	--	1973-82	1973-82
08123850 Colorado River above Silver (N)	1973-82	1978-82	1973-82	1973-82	1973-81	1973-82	1973-82
08126500 Colorado River at Ballinger	1973-82	--	--	--	--	1973-82	1973-82
08127000 Elm Creek at Ballinger	1973-82	--	--	--	--	1973-82	1973-82
08136500 Concho River at Paint Rock	1973-82	1973-82	1973-82	--	1973-81	1973-82	1973-82
08136700 Colorado River near Stacy	1973-82	1975-77	--	--	--	1973-82	1973-82
08138000 Colorado River at Winchell	1973-82	--	--	--	--	1973-82	1973-82
08143600 Pecan Bayou near Mullin	1973-82	--	--	--	--	1973-82	1973-82
08147000 Colorado River near San Saba (N)	1973-82	1973-82	1973-82	1973-82	1973-82	1973-82	1973-82
08151500 Llano River at LLano (N)	1979-82	1979-82	1979-82	1979-82	1979-82	1979-82	1979-81
08153500 Pedernales River nr Johnson City	1973-82	--	--	--	--	1973-82	--
08158000 Colorado River at Austin (N)	1973-82	1973-82	1973-82	1973-82	--	1973-82	1973-82
08158650 Colorado River below Austin	1973-82	1973-82	1973-82	1973-82	1975-82	--	--
08159200 Colorado River at Bastrop	1973-82	1973-82	--	--	--	1973-82	--
08161000 Colorado River at Columbus	1973-81	1973-81	--	--	--	1973-82	--
08162000 Colorado River at Wharton (N)	1973-82	1973-82	1973-82	1973-82	1973-82	1973-82	1973-82

(N)-NASQAN station

Table 3.--Summary of the water-quality data-collection program for selected reservoirs in the Colorado River basin for the 1973-82 water years

[Min, minimum; Max, maximum]

Station number	Station name	Stream	Sample collection dates: Inventory †	Sample collection dates: Comprehensive ††	Contents (acre-feet): Min	Contents (acre-feet): Max
08118000	Lake J. B. Thomas near Vincent, Texas	Colorado River	1975-82	--	7,630	70,620
08123000	Lake Colorado City near Colorado City, Texas	Morgan Creek	1975-81	--	13,800	38,690
08123600	Champion Creek Reservoir near Colorado City, Texas	Champion Creek	1975-82	--	4,490	47,060
08123950	E. V. Spence Reservoir near Robert Lee, Texas *	Colorado River	1975-77	1978-82	93,560	342,900
08125500	Oak Creek Reservoir near Blackwell, Texas	Oak Creek	1975-82	--	6,050	43,520
08131200	Twin Buttes Reservoir near San Angelo, Texas	Middle Concho River	1975-82	--	55,880	205,200
08132000	Lake Nasworthy near San Angelo, Texas	South Concho River	1975-82	--	7,280	12,930
08134500	O. C. Fisher Lake at San Angelo, Texas *	North Concho River	1975-80	1981-82	12,720	48,260
08141000	Hords Creek Lake near Valera, Texas *	Hords Creek	1975-80	1981-82	2,260	9,230
08143000	Lake Brownwood near Brownwood, Texas	Pecan Bayou	1975-82	--	59,120	167,000

† Inventory water-quality samples are taken at one location and one depth.
†† Comprehensive surveys consist of water-quality data collected at depth intervals for several sites.
* Each sampling site on the reservoir has a unique station number for comprehensive surveys.

stituent concentration at the time of analysis was less than the lower limit of detection. Because it is virtually impossible to perform statistical analysis on values reported as "less than," these values were converted to zero, for the purpose of this report, before statistical analyses were performed. Zero values in the statistical tables indicate that if the constituent was present, the concentration was less than the lower limit of detection.

Statistical Procedures

Summary statistics, linear regression, and plots were produced through the Statistical Analysis System (SAS)[1] developed by the SAS Institute of Cary, North Carolina (SAS Institute, Inc., 1982a,b). The SAS software has been interfaced with the Geological Survey's National Water Data Storage and Retrieval System (WATSTORE).

A SAS procedure based on a seasonal adaptation of the nonparametric Kendall Test, SEASKEN, and developed by the Systems Analysis Group of the Geological Survey, was used to test for trends in water-quality data. A detailed description of this procedure is presented by Crawford, Slack, and Hirsch (1983). A brief description is presented in the section "Trends in Water-Quality Constituents" in this report.

STREAMFLOW

The Geological Survey operated over 50 continuous-streamflow stations, 9 partial-record stations and 14 reservoir-content stations within the basin for 1 or more years during the 1973-82 water years. At sites where periodic samples were collected for chemical analysis, streamflow was determined at the time of sampling and stored as an instantaneous discharge measurement. The instantaneous-discharge data are summarized in table 5 for each stream station (see supplemental information). Available continuous streamflow data for stations in the Colorado River basin are summarized in table 4. The table shows the maximum, minimum, and mean discharge for each station for the period of study and mean discharge for the period of record.

Streamflow in the Colorado River is affected by regulated releases from E. V. Spence Reservoir in the upper basin and from a chain of highland lakes in the lower basin. Discharge during the 1973-82 water years in the mainstem Colorado River ranged from no flow at the Colorado River near Ira station (08119500) to 64,000 ft^3/s at the Colorado River at Columbus station (08161000). The relative magnitudes of discharge throughout the basin are shown graphically in figure 2. Mean discharge in the mainstem Colorado River above E. V. Spence Reservoir was 7.9 ft^3/s at the Colorado River near Ira station (08119500) and 40.0 ft^3/s at the Colorado River at Colorado City station (08121000). Between E. V. Spence and the highland lakes, mean discharge was 93.3 ft^3/s at the Colorado River above Silver station (08123850) and 663 ft^3/s at the Colorado River near San Saba station (08147000).

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1 Use of firm name in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

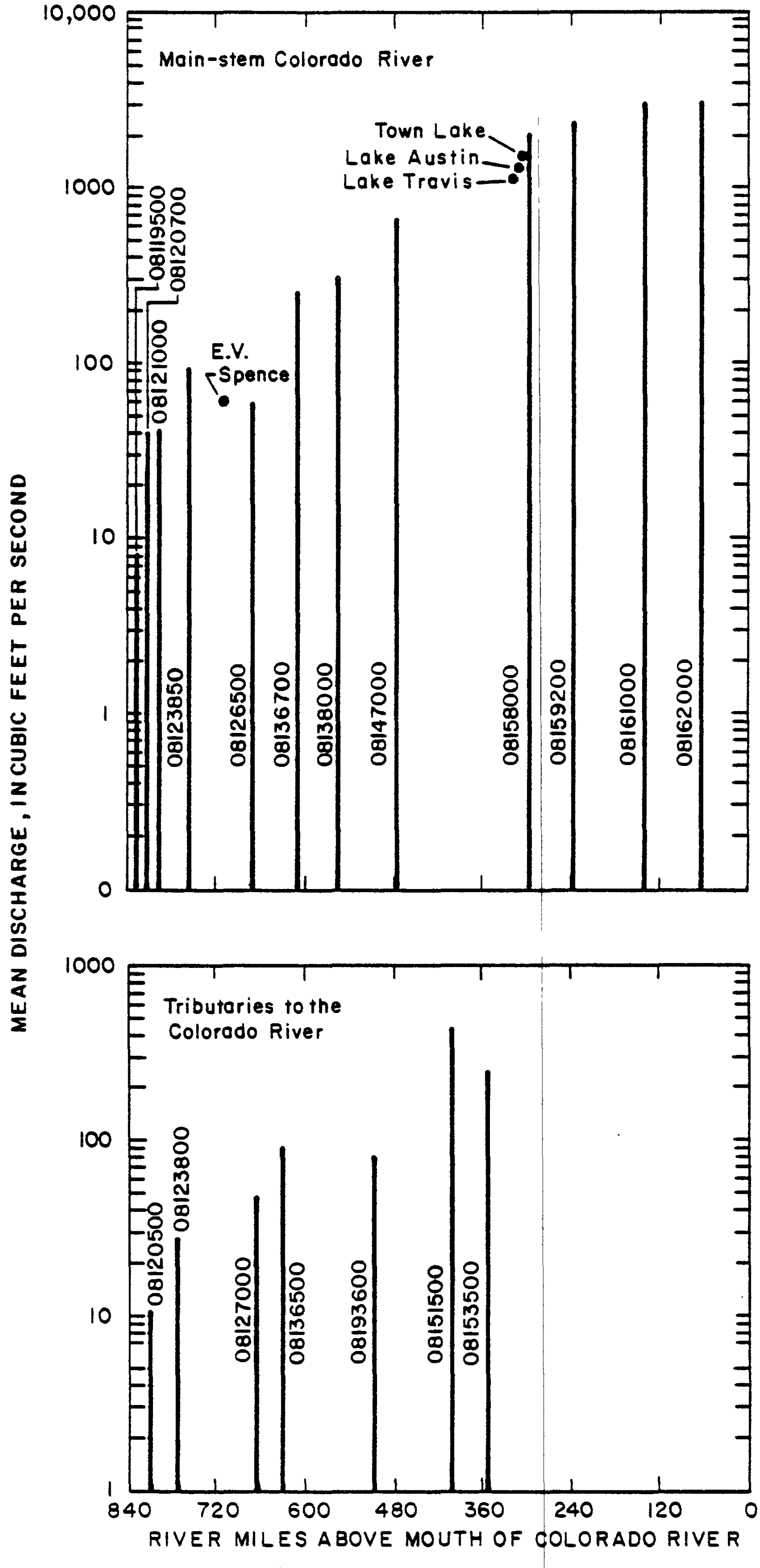

Figure 2.-Mean discharge for the Colorado River and major tributaries

Table 4.--Streamflow statistics for selected stations in the Colorado River basin for the 1973-82 water years

[ft^3/s, cubic foot per second]

Station number	Station name	1973-82 water years Mean (ft^3/s)	Maximum (ft^3/s)	Minimum (ft^3/s)	Period of record	Mean for period (ft^3/s)
08119500	Colorado River near Ira	7.9	2,900	0.00	24	10.4
08120500	Deep Creek near Dunn	11.7	5,320	.00	29	12.5
08120700	Colorado River near Cuthbert	40.2	8,770	.00	17	38.9
08121000	Colorado River at Colorado City	40.1	8,860	.00	30	40.1
08123800	Beals Creek near Westbrook	27.8	5,890	.00	24	25.0
08123850	Colorado River above Silver	93.3	15,900	.00	15	81.6
08126500	Colorador River at Ballinger	59.3	9,200	.00	14	52.5
08127000	Elm Creek at Ballinger	50.6	15,900	.00	50	47.6
08136500	Concho River at Paint Rock	94.3	23,800	.00	20	60.7
08136700	Colorado River near Stacy	246.1	31,300	.00	14	230
08138000	Colorado River at Winchell	304.5	37,500	.00	14	279
08143600	Pecan Bayou near Mullin	79.3	6,120	.00	15	119
08147000	Colorado River near San Saba	663.7	41,000	3.80	14	677
08151500	Llano River at Llano	477.1	71,200	7.30	43	363
08153500	Pedernales River near Johnson City	251.8	36,400	.50	43	179
08158000	Colorado River at Austin	1,958.6	31,500	6.70	46	2,010
08159200	Colorado River at Bastrop	2,398.5	45,000	114.00	22	2,174
08161000	Colorado River at Columbus	3,098.0	64,000	110.00	46	2,935
08162000	Colorado River at Wharton	2,970.8	57,400	284.00	44	2,712

Mean streamflow at the Colorado River at Ballinger station (08127000) was less than that at the Colorado River above Silver station (08123850) due to storage of water in E. V. Spence Reservoir. Below the highland lakes, mean discharge in the Colorado River was 1,958 ft^3/s at the Colorado River at Austin station (08158000) and 3,098 ft^3/s at the Colorado River at Columbus station (08161000). At more than 60 percent of the selected stations, mean streamflow for the selected period was slightly greater than the mean streamflow for the period of record.

Flow-duration curves for the Colorado River above Silver station (08123850), the Colorado River near San Saba station (08147000), and the Colorado River at Wharton station (08162000) are shown in figure 3. The slope of the flow-duration curve is an indication of the characteristics of streamflow at a station. When streamflow is influenced mostly by runoff, the flow-duration curve will have a steep slope. A flat slope generally is indicative of the influence of surface- or ground-water storage. In the upper Colorado River basin, the slope of the duration curve at the Colorado River above Silver station (08123850) is steep. Farther downstream, the slope of the curve at the Colorado River near San Saba station (08147000) decreased reflecting the storage of water in E. V. Spence Reservoir and other area reservoirs. At the Colorado River at Wharton station (08162000), which is downstream of all reservoirs in the study area, the lower portion of the curve is flat reflecting the large amount of water storage in the highland lakes. The difference in streamflow characteristics from the upper to lower basin and the retention and regulation of streamflow by reservoirs on the Colorado River are major influences on the water quality in the basin.

WATER QUALITY

Statistical summaries of water-quality data collected at periodic intervals from streams and rivers provide the data user with a general knowledge of the distribution of the data and a general understanding of the chemical composition of the water. The statistical summaries of water-quality data at stations in the Colorado River basin for the 1973-82 water years are given in table 5 (supplemental information).

General Factors Influencing Concentrations of Dissolved Constituents

Streamflow

Water flowing in a stream or river is a constantly changing mixture of overland runoff and ground-water discharge. The source of most flow during high-flow periods is overland runoff. Rainwater, which commonly is formed by a natural distillation process, is nearly free of dissolved minerals. Flow from overland runoff usually is low in dissolved-mineral concentration because the time that the rainwater is in contact with soluble mineral constituents is usually too short for much solution to take place. In contrast, the source of most flow during low-flow periods is ground water, which usually is higher in dissolved mineral concentrations due to longer contact with soluble mineral constituents. Natural factors such as reaction of the water with the streambed and man-made factors such as waste effluents and urbanization also affect the composition and concentrations of dissolved minerals in streams and rivers.

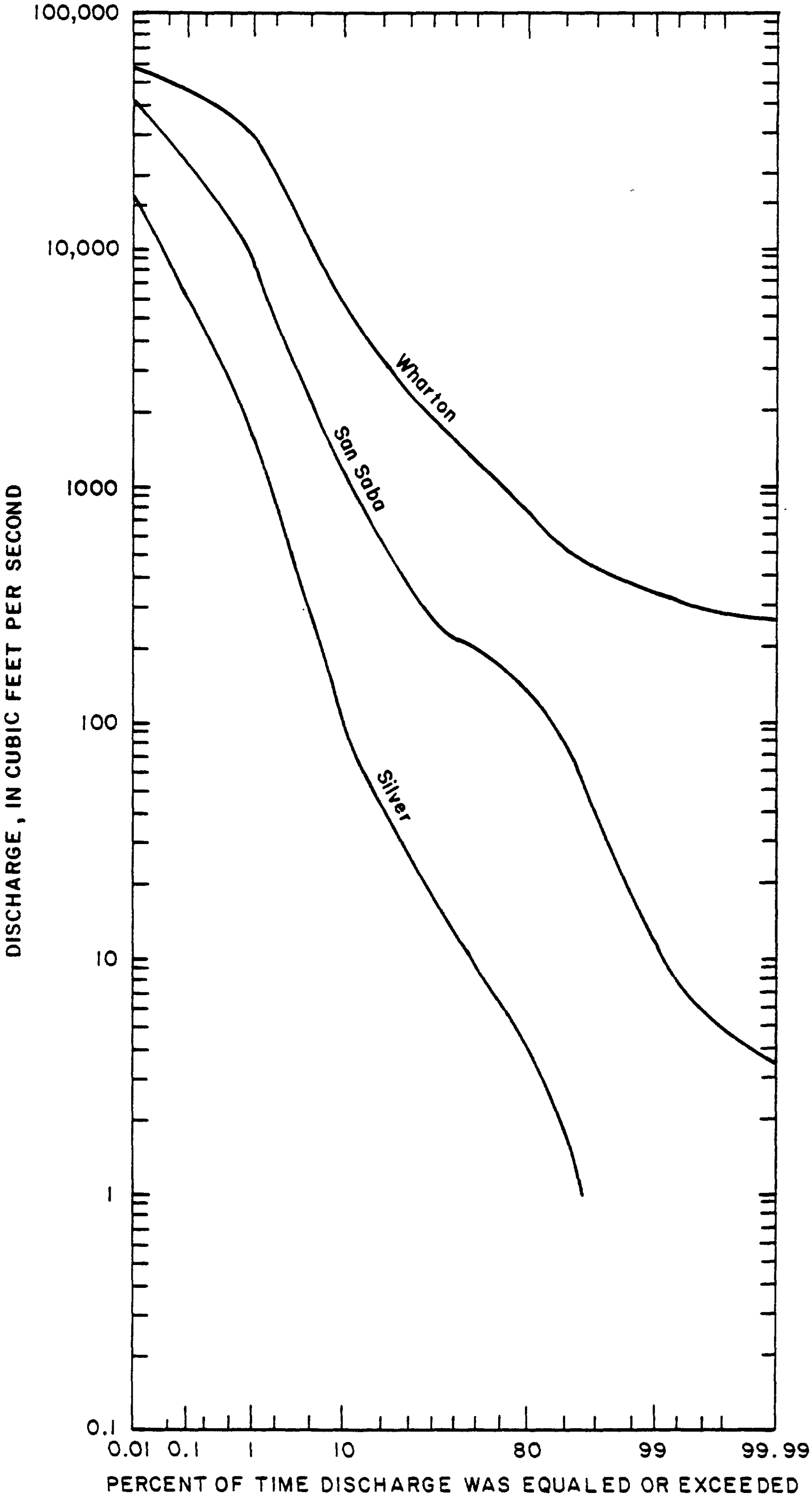

Figure 3.-Duration curve of daily streamflow at selected stations in the Colorado River basin for the 1973-82 water years

Reservoirs

Impoundment of water within a reservoir also may result in significant changes in the quality of the water. Reservoirs represent a holding and mixing basin for streamflow. Mixing of surface-water inflow often is not complete, and water in one area of the reservoir may be greatly different in composition and properties than in other areas. The quality of water in a reservoir can be influenced particularly by periods of high inflow. Large quantities of dilute runoff, whether it is impounded or passed through, can greatly alter the overall composition of the water in the reservoir.

Other changes in the quality of water in reservoirs can be related to thermal stratification--layering of water due to temperature-induced density differences. Thermal stratification may assume many patterns, depending upon the geographical location, climatological conditions, depth, surface area, and configuration of the lake or reservoir. During the winter, many deep reservoirs in the temperate zone are characteristically isothermal, that is, the water has a uniform temperature and density and circulates freely. With the onset of spring, solar heating warms the incoming water and the water at the reservoir surface and causes a decrease in density. This warm surface water overlies the colder, more dense water. As the surface becomes progressively warmer, the density gradient steepens and the depth to which the wind can mix the water is diminished. Thus, water in the reservoir during spring and summer often is separated into three fairly distinct strata: (1) The epilimnion, a warm, freely circulating surface stratum, (2) the metalimnion, a middle stratum characterized by a rapid decrease in temperature, and (3) the hypolimnion, a cold, stagnant lower stratum.

Thermal stratification in deep reservoirs usually persists until fall, when a decrease in atmospheric temperature cools both the surface water in the reservoir and inflow from streams. When the temperatures and densities of the epilimnion and the metalimnion approach those of the hypolimnion, the resistance to mixing is reduced, and wind action produces a complete mixing or overturn of the water in the lake or reservoir and isothermic conditions return.

Major Dissolved Constituents

Variations in Dissolved-Solids Composition and Concentration

The dissolved-solids concentration of most waters is predominantly silica, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, and sulfate. Dissolved-solids concentrations are used widely in evaluating water quality and comparing waters. The variation in composition of dissolved solids in the Colorado River basin is demonstrated in figure 4 with pie diagrams that represent the relative magnitude, in percent, of the major ions at each station. The composition of dissolved constituents is predominantly sodium and chloride in the upper basin, which reflects the influence of saline ground water. The terrain and influence of ground water gradually shift throughout the basin to produce a calcium and bicarbonate water type in the streams in the lower basin.

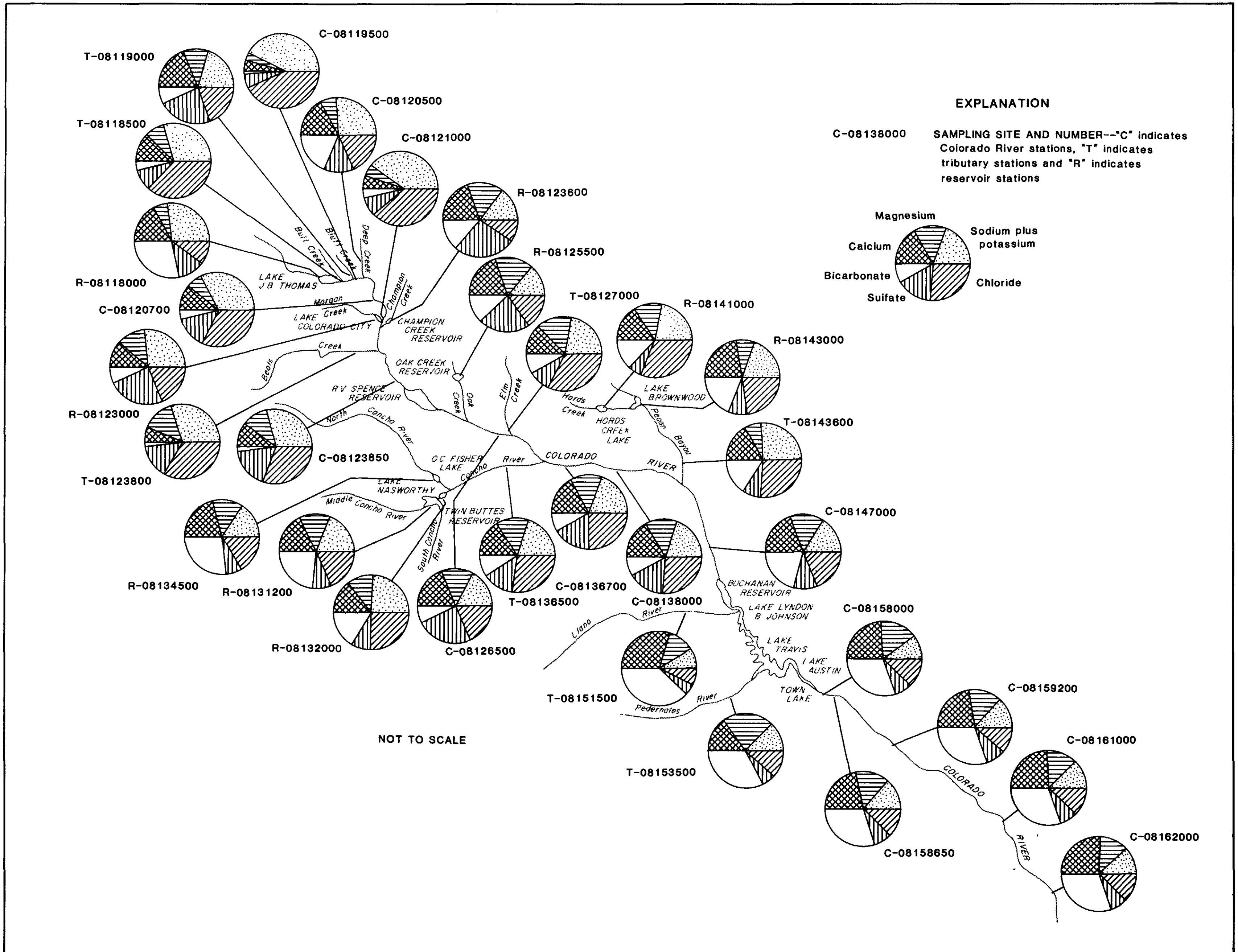

Figure 4.-Variations in the composition of dissolved constituents in the Colorado River basin

The concentration of dissolved constituents in the Colorado River basin also varies from the upper reach to the lower reach. Figure 5 shows the variations in dissolved-solids concentrations, the calculated sum of dissolved potassium, calcium, magnesium, sodium, alkalinity (as $CaCO_3$), fluoride, sulfate, chloride, and silica. The mean concentration in the upper basin is as large as 10,540 mg/L (milligrams per liter) and gradually decreases throughout the basin to a mean concentration of approximately 300 mg/L in the lower basin. The large concentration in the upper basin can be attributed to the inflow of the more mineralized ground water to a low discharge area. The inflow of ground water does not contribute a significant amount of the total streamflow (fig. 3), but dominates the chemical composition of the water. As streamflow increases in the mainstem Colorado River from the discharge of less mineralized tributaries, the concentration of dissolved solids is diluted. Figure 6 shows the mean concentration of the five major ions at stations on the mainstem Colorado River. As shown in figure 4, sodium and chloride are the dominant dissolved ions in the upper basin. The concentration of all ions except bicarbonate decrease downstream. Bicarbonate concentration remains about the same but becomes the dominant ion in the lower basin.

Upper Colorado River basin

The composition of dissolved solids in the upper Colorado River basin is predominantly sodium and chloride ions. Combined, the two ions constitute 60-80 percent of the dissolved constituents in the mainstem Colorado River (table 6). In the High Plains region of the basin, the Colorado River basin is greatly influenced by inflow of more mineralized ground water and dilution by less mineralized tributaries. Low flow contains a higher percentage of sodium and chloride ions than high flow due to the greater influence of ground water during low flow (fig. 7).

Sulfate and calcium ions constitute anywhere from 10 to 25 percent of the dissolved constituents in the Colorado River in this section of the basin, magnesium ions constitute 3 to 10 percent, and bicarbonate ions generally account for less than 5 percent. Calcium, magnesium, sulfate, and bicarbonate are more predominant in many of the tributaries and reservoirs in the upper portion of the basin and generally are more predominant during periods of high flow (fig. 7). Tributary inflow and release of water from reservoirs on the tributaries account for much of the gradual decrease in the composition of sodium and chloride noted between the Colorado River at Ira station (08119500) and Colorado River above Silver station (08123850).

Concentrations of dissolved solids in the mainstem of the Colorado River upstream from Silver ranged from 113 to 34,800 mg/L (table 5). The U.S. Environmental Protection Agency (EPA, 1977a) has set secondary drinking water regulations of 500 mg/L for dissolved solids (table 7). Concentrations of dissolved solids at each station in the mainstem of the upper Colorado River exceeded that level approximately 95 percent of the time. Chloride and sulfate also exceeded the EPA secondary drinking-water regulations of 250 mg/L approximately 95 percent of the time at the same stations. The statistics from table 5 show that the concentration of dissolved solids at the Colorado River near Ira station (08119500) can be classified as very saline (table 8) 50 percent of the time. The rest of the stations in the upper basin generally fall into the slightly to moderately saline categories.

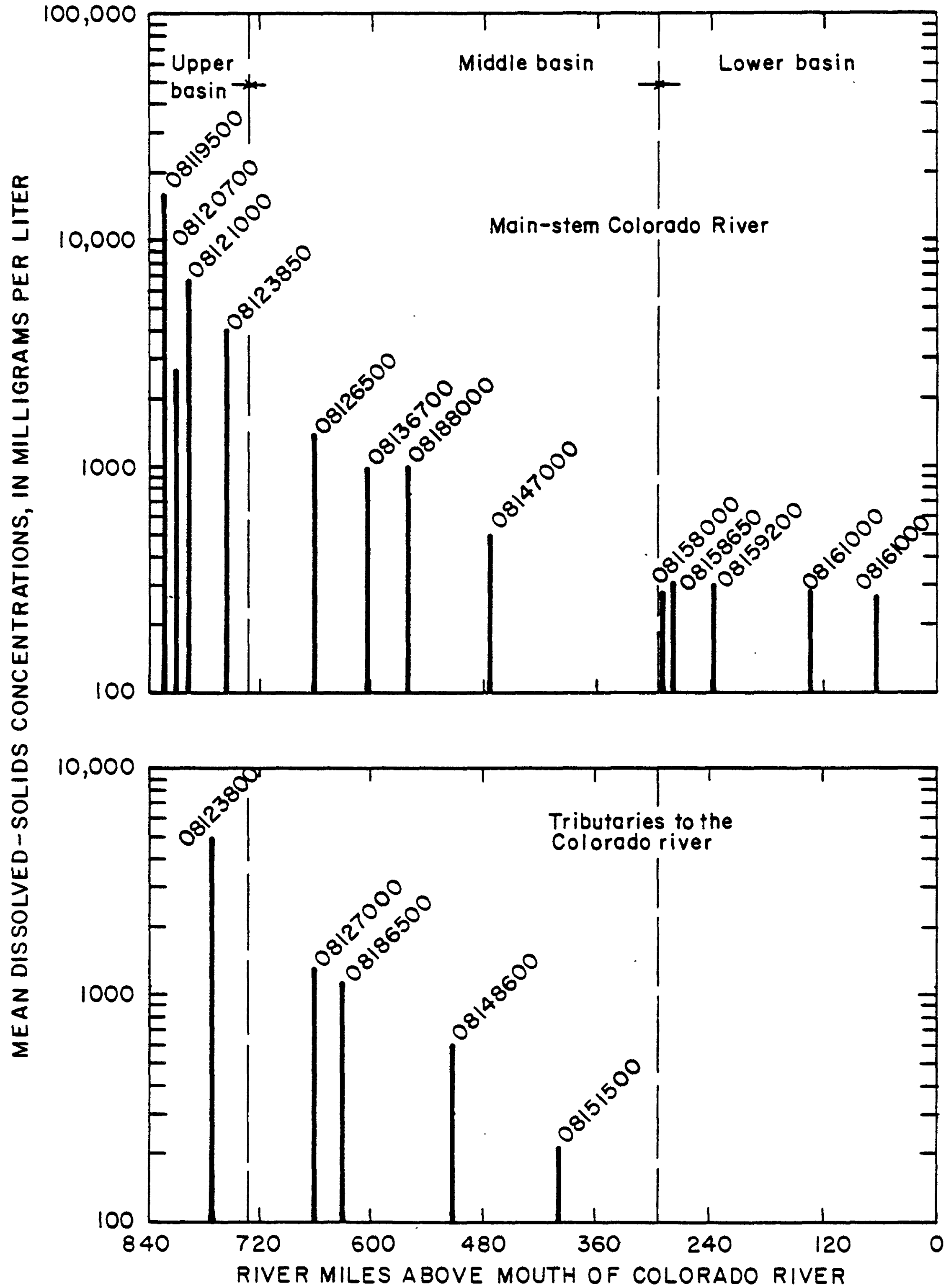

Figure 5.-Variations in mean dissolved-solids concentrations in the Colorado River basin for the 1973-82 water years

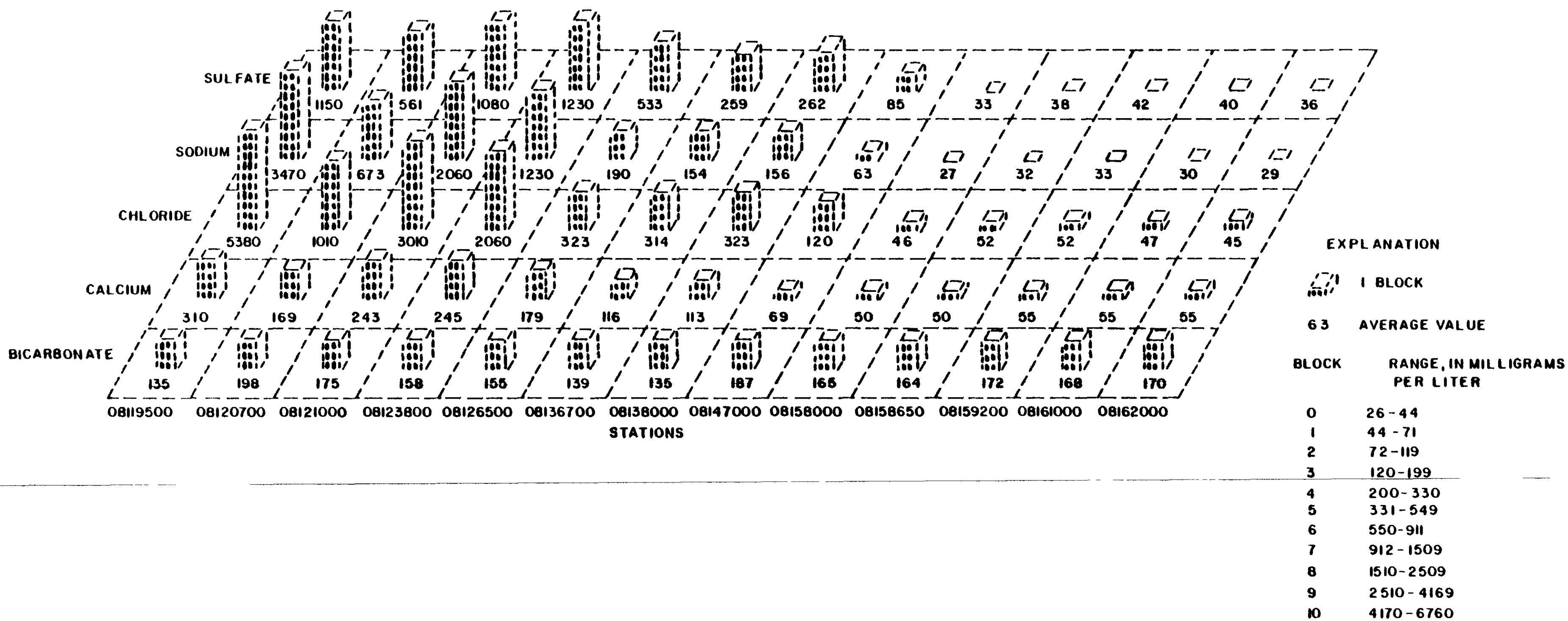

Figure 6.-Mean concentrations of major ions at stations in the Colorado River basin

[Cl = Chloride; Na = Sodium; Mg = Magnesium; Ca = Calcium; SO_4 = Sulfate, HCO = BICARBONATE; CFS = Cubic feet per second]

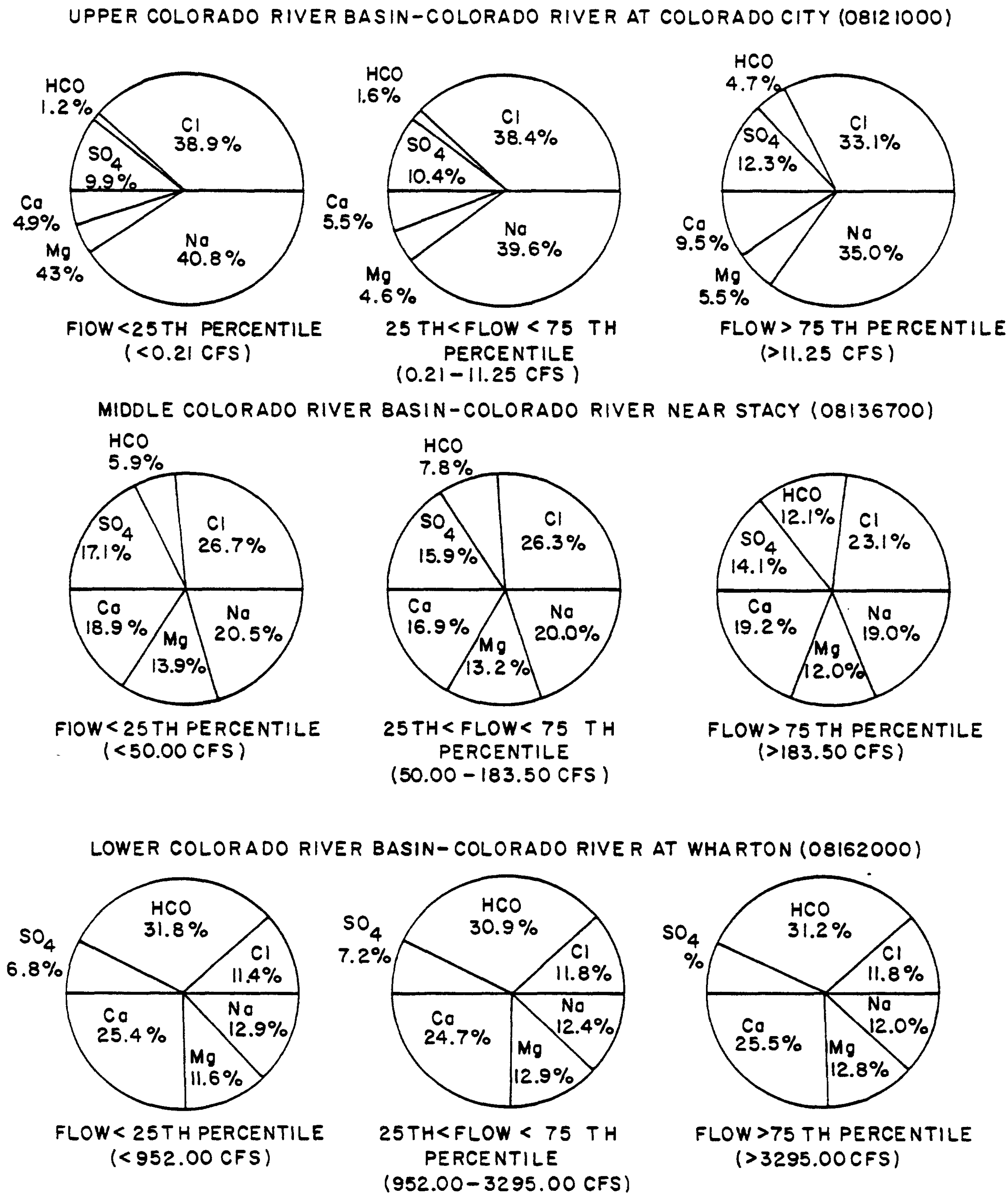

Figure 7.-Composition of dissolved solids for high, average and low flow at selected stations in the Colorado River basin

Table 6.--Relative magnitudes of major ions for selected stations in the Colorado River basin for the 1973-82 water years

Station number	Station name	Percent sodium	Percent calcium	Percent magnesium	Percent chloride	Percent sulfate	Percent bicarbonate
08118000	Lake J. B. Thomas near Vincent	27.4	16.3	6.4	10.7	10.8	28.4
08118500	Bull Creek near Ira	30.2	11.9	7.9	47.1	9.4	3.5
08119000	Bluff Creek near Ira	21.1	18.5	10.5	20.0	23.1	6.8
08119500	Colorado River near Ira	42.5	4.4	3.0	42.6	6.7	0.8
08120500	Deep Creek near Dunn	26.6	16.8	6.9	17.5	13.6	18.6
08120700	Colorado River near Cuthbert	33.4	9.7	6.8	32.0	13.5	4.6
08121000	Colorado River at Colorado City	39.8	5.5	4.5	38.3	10.3	1.6
08123000	Lake Colorado City near Colorado City	26.5	11.4	11.8	19.9	24.1	6.3
08123600	Champion Creek Reservoir near Colorado City	15.5	19.6	15.1	10.2	26.2	13.4
08123800	Beals Creek near Westbrook	30.3	7.1	12.6	33.5	14.8	1.7
08123850	Colorado River above Silver	29.7	9.9	10.4	31.2	16.9	1.9
08125500	Oak Creek Reservoir near Blackwell	14.8	19.5	15.6	14.5	23.4	12.2
08126500	Colorado River at Ballinger	17.6	19.1	13.4	19.2	24.2	6.5
08127000	Elm Creek at Ballinger	21.6	13.1	15.6	28.4	13.6	7.7
08131200	Twin Buttes Reservoir near San Angelo	19.1	17.4	13.4	19.4	7.7	23.0
08132000	Lake Nasworthy near San Angelo	24.5	14.4	11.2	25.5	8.2	16.2
08134500	O.C. Fisher Lake at San Angelo	15.7	21.5	13.0	17.5	6.4	25.9
08136500	Concho River at Paint Rock	20.4	16.3	13.7	28.8	12.0	8.8
08136700	Colorado River near Stacy	20.0	17.0	13.2	25.9	15.9	8.0
08138000	Colorado River at Winchell	20.3	16.5	13.2	26.3	15.8	7.9
08141000	Hords Creek Lake near Valera	22.1	16.2	12.0	32.0	5.1	12.6
08143000	Lake Brownwood near Brownwood	19.6	21.9	8.5	23.9	7.6	18.5
08143600	Pecan Bayou near Mullin	26.2	17.1	6.8	26.6	7.7	15.6
08147000	Colorado River near San Saba	16.2	19.5	14.4	18.9	9.8	21.2
08151500	Llano River at Llano	8.7	22.5	19.6	8.6	4.2	36.4

Table 7.--Summary of regulations for selected water-quality constituents and properties for public water systems

[µg/L, microgram per liter; mg/L, milligram per liter]

DEFINITIONS

Contaminant.--Any physical, chemical, biological, or radiological substance or matter in water.

Public water system.-A system for the provision of piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.

Maximum contaminant level.-The maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Maximum contaminant levels are those levels set by the U.S. Environmental Protection Agency (1976) in the National Interim Primary Drinking Water Regulations. These regulations deal with contaminants that may have a signicant direct impact on the health of the consumer and are enforceable by the Environmental Protection Agency.

Secondary maximum contaminant level.--The advisable maximum level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Secondary maximum contaminant levels are those levels proposed by the Environmental Protection Agency (1977a) in the National Secondary Drinking Water Regulations. These regulations deal with contaminants that may not have a significant direct impact on the health of the consumer, but their presence in excessive quantities may affect the esthetic qualities and discourage the use of a drinking-water supply by the public.

INORGANIC CHEMICALS AND RELATED PROPERTIES

Contaminant	Maximum contaminant level	Secondary maximum contaminant level
Arsenic (As)	50 µg/L	--
Barium (Ba)	1,000 µg/L	--
Cadmium (Cd)	10 µg/L	--
Chloride (Cl)	--	250 mg/L
Chromium (Cr)	50 µg/L	--
Copper (Cu)	--	1,000 µg/L
Iron (Fe)	--	300 µg/L
Lead (Pb)	50 µg/L	--
Manganese (Mn)	--	50 µg/L
Mercury (Hg)	2 µg/L	--
Nitrate (as N)	10 mg/l	--
pH	--	6.5 - 8.5
Selenium (Se)	10 µg/L	--
Silver (Ag)	50 µg/L	--
Sulfate (SO_4)	--	250 mg/L
Zinc (Zn)	--	5,000 µg/L
Dissolved solids	--	500 mg/l

Fluoride.--The maximum contamination level for fluoride depends on the annual average of the maximum daily air temperatures for the location in which the community water system is situated. A range of annual averages of maximum daily air temperatures and corresponding maximum contamination level for fluoride are given in the following tabulation.

Average of maximum daily air temperatures (degrees Celsius)	Maximum contaminant level for fluoride (mg/L)
12.0 and below	2.4
12.1 - 14.6	2.2
14.7 - 17.6	2.0
17.7 - 21.4	1.8
21.5 - 26.2	1.6
26.3 - 32.5	1.4

ORGANIC CHEMICALS

Chlorinated Hydrocarbons

Contaminant	Maximum contaminant level (µg/L)
Endrin	0.2
Lindane	4
Methoxychlor	100
Toxaphene	5

Chlorophenoxys

Contaminant	Maximum contaminant level (µg/L)
2,4-D	100
Silvex	10

Table 8.--Source and significance of selected constituents and properties commonly reported in water analyses 1/

[mg/L, milligram per liter; µg/L, microgram per liter; micromhos, micromhos per centimeter at 25° Celsius]

Constituent or property	Source or cause	Significance
Silica (SiO_2)	Silicon ranks second only to oxygen in abundance in the Earth's crust. Contact of natural waters with silica-bearing rocks and soils usually results in a concentration range of about 1 to 30 mg/L; but concentrations as large as 100 mg/L are common in waters in some areas.	Although silica in some domestic and industrial water supplies may inhibit corrosion of iron pipes by forming protective coatings, it generally is objectionable in industrial supplies, particularly in boiler feedwater, because it may form hard scale in boilers and pipes or deposit in the tubes of heaters and on steam-turbine blades.
Iron (Fe)	Iron is an abundant and widespread constituent of many rocks and soils. Iron concentrations in natural waters are dependent upon several chemical equilibria processes including oxidation and reduction; precipitation and solution of hydroxides, carbonates, and sulfides; complex formation especially with organic material; and the metabolism of plants and animals. Dissolved-iron concentrations in oxygenated surface waters seldom are as much as 1 µg/L. Some ground waters, unoxygenated surface waters such as deep waters of stratified lakes and reservoirs, and acidic waters resulting from discharge of industrial wastes or drainage from mines may contain considerably more iron. Corrosion of iron casings, pumps, and pipes may add iron to water pumped from wells.	Iron is an objectionable constituent in water supplies for domestic use because it may adversely affect the taste of water and beverages and stain laundered clothes and plumbing fixtures. According to the National Secondary Drinking Water Regulations proposed by the U.S. Environmental Protection Agency (1977a), the secondary maximum contamination level of iron for public water systems is 300 µg/L. Iron also is undesirable in some industrial water supplies, particularly in waters used in high-pressure boilers and those used for food processing, production of paper and chemicals, and bleaching or dyeing of textiles.
Calcium (Ca)	Calcium is widely distributed in the common minerals of rocks and soils and is the principal cation in many natural freshwaters, especially those that contact deposits or soils originating from limestone, dolomite, gypsum, and gypsiferous shale. Calcium concentrations in freshwaters usually range from zero to several hundred milligrams per liter. Larger concentrations are not uncommon in waters in arid regions, especially in areas where some of the more soluble rock types are present.	Calcium contributes to the total hardness of water. Small concentrations of calcium carbonate combat corrosion of metallic pipes by forming protective coatings. Calcium in domestic water supplies is objectionable because it tends to cause incrustations on cooking utensils and water heaters and increases soap or detergent consumption in waters used for washing, bathing, and laundering. Calcium also is undesirable in some industrial water supplies, particularly in waters used by electroplating, textile, pulp and paper, and brewing industries and in water used in high-pressure boilers.
Magnesium (Mg)	Magnesium ranks eight among the elements in order of abundance in the Earth's crust and is a common constituent in natural water. Ferromagnesian minerals in igneous rock and magnesium carbonate in carbonate rocks are two of the more important sources of magnesium in natural waters. Magnesium concentrations in freshwaters usually range from zero to several hundred milligrams per liter; but larger concentrations are not uncommon in waters associated with limestone or dolomite.	Magnesium contributes to the total hardness of water. Large concentrations of magnesium are objectionable in domestic water supplies because they can exert a cathartic and diuretic action upon unacclimated users and increase soap or detergent consumption in waters used for washing, bathing, and laundering. Magnesium also is undesirable in some industrial supplies, particularly in waters used by textile, pulp and paper, and brewing industries and in water used in high-pressure boilers.
Sodium (Na)	Sodium is an abundant and widespread constituent of many soils and rocks and is the principal cation in many natural waters associated with argillaceous sediments, marine shales, and evaporites and in sea water. Sodium salts are very soluble and once in solution tend to stay in solution. Sodium concentrations in natural waters vary from less than 1 mg/L in stream runoff from areas of high rainfall to more than 100,000 mg/L in ground and surface waters associated with halite deposits in arid areas. In addition to natural sources of sodium, sewage, industrial effluents, oilfield brines, and deicing salts may contribute sodium to surface and ground waters.	Sodium in drinking water may impart a salty taste and may be harmful to persons suffering from cardiac, renal, and circulatory diseases and to women with toxemias of pregnancy. Sodium is objectionable in boiler feedwaters because it may cause foaming. Large sodium concentrations are toxic to most plants; and a large ratio of sodium to total cations in irrigation waters may decrease the permeability of the soil, increase the pH of the soil solution, and impair drainage.

Table 8.--Source and significance of selected constituents and properties commonly reported in water analyses--Continued

Constituent or property	Source or cause	Significance
Potassium (K)	Although potassium is only slightly less common than sodium in igneous rocks and is more abundant in sedimentary rocks, the concentration of potassium in most natural waters is much smaller than the concentration of sodium. Potassium is liberated from silicate minerals with greater difficulty than sodium and is more easily adsorbed by clay minerals and reincorporated into solid weathering products. Concentrations of potassium more than 20 mg/L are unusual in natural freshwaters, but much larger concentrations are not uncommon in brines or in water from hot springs.	Large concentrations of potassium in drinking water may impart a salty taste and act as a cathartic, but the range of potassium concentrations in most domestic supplies seldom cause these problems. Potassium is objectionable in boiler feedwaters because it may cause foaming. In irrigation water, potassium and sodium act similarly upon the soil, although potassium generally is considered less harmful than sodium.
Alkalinity	Alkalinity is a measure of the capacity of a water to neutralize a strong acid, usually to pH of 4.5, and is expressed in terms of an equivalent concentration of calcium carbonate ($CaCO_3$). Alkalinity in natural waters usually is caused by the presence ob bicarbonate and carbonate ions and to a lesser extent by hydroxide and minor acid radicals such as borates, phosphates, and silicates. Carbonates and bicarbonates are common to most natural waters because of the abundance of carbon dioxide and carbonate minerals in nature. Direct contribution to alkalinity in natural waters by hydroxide is rare and usually can be attributed to contamination. The alkalinity of natural waters varies widely but rarely exceeds 400 to 500 mg/L as $CaCO_3$.	Alkaline waters may have a distinctive unpleasant taste. Alkalinity is detrimental in several industrial processes, especially those involving the production of food and carbonated or acid-fruit beverages. The alkalinity in irrigation waters in excess of alkaline earth concentrations may increase the pH of the soil solution, leach organic material and decrease permeability of the soil, and impair plant growth.
Sulfate (SO_4)	Sulfur is a minor constituent of the Earth's crust but is widely distributed as metallic sulfides in igneous and sedimentary rocks. Weathering of metallic sulfides such as pyrite by oxygenated water yields sulfate ions to the water. Sulfate is dissolved also from soils and evaporite sediments containing gypsum or anhydrite. The sulfate concentration in natural freshwaters may range from zero to several thousand milligrams per liter. Drainage from mines may add sulfate to waters by virtue of pyrite oxidation.	Sulfate in drinking water may impart a bitter taste and act as a laxative on unacclimated users. According to the National Secondary Drinking Water Regulations proposed by the Environmental Protection Agency (1977a) the secondary maximum contaminant level of sulfate for public water systems is 250 mg/L. Sulfate also is undesirable in some industrial supplies, particularly in waters used for the production of concrete, ice, sugar, and carbonated beverages and in waters used in high-pressure boilers.
Chloride (Cl)	Chloride is relatively scarce in the Earth's crust but is the predominant anion in sea water, most petroleum-associated brines, and in many natural freshwaters, particularly those associated with marine shales and evaporites. Chloride salts are very soluble and once in solution tend to stay in solution. Chloride concentrations in natural waters vary from less than 1 mg/L in stream runoff from humid areas to more than 100,000 mg/L in ground and surface waters associated with evaporites in arid areas. The discharge of human, animal, or industrial wastes and irrigation return flows may add significant quantities of chloride to surface and ground waters.	Chloride may impart a salty taste to drinking water and may accelerate the corrosion of metals used in water-supply systems. According to the National Secondary Drinking Water Reguations proposed by the Environmental Protection Agency (1977a), the secondary maximum contaminant level of chloride for public water systems is 250 mg/L. Chloride also is objectionable in some industrial supplies, particularly those used for brewing and food processing, paper and steel production, and textile processing. Chloride in irrigation waters generally is not toxic to most crops but may be injurious to citrus and stone fruits.
Fluoride (F)	Fluoride is a minor constituent of the Earth's crust. The calcium fluoride mineral fluorite is a widespread constituent of resistate sediments and igneous rocks, but its solubility in water is negligible. Fluoride commonly is associated with volcanic gases, and volcanic emanations may be important sources of fluoride in some areas. The	Fluoride in drinking water decreases the incidence of tooth decay when the water is consumed during the period of enamel calcification. Excessive quantities in drinking water consumed by children during the period of enamel calcification may cause a characteristic discoloration (mottling) of the teeth. According to the

Table 8.--Source and significance of selected constituents and properties commonly reported in water analyses--Continued

Constituent or property	Source or cause	Significance
Fluoride--Cont.	fluoride concentration in fresh surface waters usually is less than 1 mg/L; but larger concentrations are not uncommon in saline water from oil wells, ground water from a wide variety of geologic terranes, and water from areas affected by volcanism.	National Interim Primary Drinking Water Regulations established by the Environmental Protection Agency (1976) the maximum contaminant level of fluoride in drinking water varies from 1.4 to 2.4 mg/L, depending upon the annual average of the maximum daily air temperature for the area in which the water system is located. Excessive fluoride is also objectionable in water supplies for some industries, particularly in the production of food, beverages, and pharmaceutical items.
Nitrogen (N)	A considerable part of the total nitrogen of the Earth is present as nitrogen gas in the atmosphere. Small amounts of nitrogen are present in rocks, but the element is concentrated to a greater extent in soils or biological material. Nitrogen is a cyclic element and may occur in water in several forms. The forms of greatest interest in water in order of increasing oxidation state, include organic nitrogen, ammonia nitrogen (NH_4-N), nitrite nitrogen (NO_2-N) and nitrate nitrogen (NO_3-N). These forms of nitrogen in water may be derived naturally from the leaching of rocks, soils, and decaying vegetation; from rainfall; or from biochemical conversion of one form to another. Other important sources of nitrogen in water include effluent from wastewater treatment plants, septic tanks, and cesspools and drainage from barnyards, feed lots, and fertilized fields. Nitrate is the most stable form of nitrogen in an oxidizing environment and is usually the dominant form of nitrogen in natural waters and in polluted waters that have undergone self-purification or aerobic treatment processes. Significant quantities of reduced nitrogen often are present in some ground waters, deep unoxygenated waters of stratified lakes and reservoirs, and waters containing partially stabilized sewage or animal wastes.	Concentrations of any of the forms of nitrogen in water significantly greater than the local average may suggest pollution. Nitrate and nitrite are objectionable in drinking water because of the potential risk to bottle-fed infants for methemoglobinemia, a sometimes fatal illness related to the impairment of the oxygen-carrying ability of the blood. According to the National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1976), the maximum contaminant level of nitrate (as N) in drinking water is 10 mg/L. Although a maximum contaminant level for nitrite is not specified in the drinking water regulations, Appendix A to the regulations (U.S. Environmental Protection Agency, 1976) indicates that waters with nitrite concentrations (as N) greater than 1 mg/L should not be used for infant feeding. Excessive nitrate and nitrite concentrations are also objectionable in water supplies for some industries, particularly in waters used for the dyeing of wool and silk fabrics and for brewing.
Phosphorus	Phosphorus is a major component of the mineral apatite, which is widespread in igneous rock and marine sdiments. Phosphorus also is a component of household detergents, fertilizers, human and animal metabolic wastes, and other biological material. Although small concentrations of phosphorus may occur naturally in water as a result of leaching from rocks, soils, and decaying vegtation, larger concentrations are likely to occur as a result of pollution.	
Dissolved solids	Theoretically, dissolved solids are anhydrous residues of the dissolved substance in water. In reality, the term "dissolved solids" is defined by the method used in the determination. In most waters, the dissolved solids consist predominantly of silica, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, and sulfate with minor or trace amounts of other inorganic and organic constituents. In regions of high rainfall and relatively insoluble rocks, waters may contain dissolved-solids concentrations of less than 25 mg/L; but saturated sodium chloride brines in other areas may contain more than 300,000 mg/L.	Dissolved-solids values are used widely in evaluating water quality and in comparing waters. The following classification based on the concentrations of dissolved solids commonly is used by the Geological Survey (Winslow and Kister, 1956). Classification — Dissolved-solids concentration (mg/L) Fresh — <1,000 Slightly saline — 1,000 - 3,000 Moderately saline — 3,000 - 10,000 Very saline — 10,000 - 35,000 Brine — >35,000 The National Secondary Drinking Regulations (U.S. Environmental Protection Agency, 1977a)

Table 8.--Source and significance of selected constituents and properties commonly reported in water analyses--Continued

Constituent or property	Source or cause	Significance
Dissolved solids--Cont.		set a dissolved-solids concentration of 500 mg/L as the secondary maximum contaminant level for public water systems. This level was set primarily on the basis of taste thresholds and potential physiological effects, particularly the laxative effect on unacclimated users. Although drinking waters containing more than 500 mg/L are undesirable, such waters are used in many areas where less mineralized supplies are not available without any obvious ill effects. Dissolved solids in industrial water supplies can cause foaming in boilers; interfere with clearness, color, or taste of many finished products; and accelerate corrosion. Uses of water for irrigation also are limited by excessive dissolved-solids concentrations. Dissolved solids in irrigation water may adversely affect plants directly by the development of high osmotic conditions in the soil solution and the presence of phytoxins in the water or indirectly by their effect on soils.
Specific conductance	Specific conductance is a measure of the ability of water to transmit an electrical current and depends on the concentrations of ionized constituents dissolved in the water. Many natural waters in contact only with granite, well-leached soil, or other sparingly soluble material have a conductance of less than 50 micromhos. The specific conductance of some brines exceed several hundred thousand micromhos.	The specific conductance is an indication of the degree of mineralization of a water and may be used to estimate the concentration of dissolved solids in the water.
Hardness as $CaCO_3$	Hardness of water is attributable to all polyvalent metals but principally to calcium and magnesium ions expressed as $CaCO_3$ (calcium carbonate). Water hardness results naturally from the solution of calcium and magnesium, both of which are widely distributed in common minerals of rocks and soils. Hardness of waters in contact with limestone commonly exceeds 200 mg/L. In waters from gypsiferous formations, a hardness of 1,000 mg/L is not uncommon.	Hardness values are used in evaluating water quality and in comparing waters. The following classification is commonly used by the Geological Survey. Hardness (mg/L as $CaCO_3$) — Classification 0 - 60 — Soft 61 - 120 — Moderately hard 121 - 180 — Hard >180 — Very hard Excessive hardness of water for domestic use is objectionable because it causes incrustations on cooking utensils and water heaters and increased soap or detergent consumption. Excessive hardness is undesirable also in many industrial supplies. (See discussions concerning calcium and magnesium.)
pH	The pH of a solution is a measure of its hydrogen ion activity. By definition, the pH of pure water at a temperature of 25°C is 7.00. Natural waters contain dissolved gases and minerals, and the pH may deviate significantly from that of pure water. Rainwater not affected significantly by atmospheric pollution generally has a pH of 5.6 due to the solution of carbon dioxide from the atmosphere. The pH range of most natural surface and ground waters is about 6.0 to 8.5. Many natural waters are slightly basic (pH >7.0) because of the prevalence of carbonates and bicarbonates, which tend to increase the pH.	The pH of a domestic or industrial water supply is significant because it may affect taste, corrosion potential, and water-treatment processes. Acidic waters may have a sour taste and cause corrosion of metals and concrete. The National Secondary Drinking Water Regulations (U.S. Environmental Protection Agency, 1977a) set a pH range of 6.5 to 8.5 as the secondary maximum contaminant level for public water systems.

1/ Most of the material in this table has been summarized from several references. For a more thorough discussion of the source and significance of these and other water-quality properties and constituents, the reader is referred to the following additional references: American Public Health Association and others (1975); Hem (1970); McKee and Wolf (1963); National Academy of Sciences, National Academy of Engineering (1973); National Technical Advisory Committee to the Secretary of the Interior (1968); and U.S. Environmental Protection Agency (1977b).

The upper Colorado River basin is an area of extensive oil-field operations. Contamination of ground water probably occurred from the open-pit disposal of oil-field brines (Mount and others, 1967) before this practice was banned in 1969. It is possible that some ground water contaminated from the brines continues to move through the ground-water systems. Rawson (1982) concluded that part of the salinity resulted from oil-field brines, but preponderant evidence indicates that the major part of the salinity is of natural origin.

Middle Colorado River basin

The composition of dissolved solids in the middle section of the Colorado River basin shifts from sodium and chloride dominance to more equal contributions from sodium, chloride, calcium, and sulfate. The trapping and mixing of water from the upper basin in E. V. Spence Reservoir is partially responsible for the change. The bedrock lithology in the basin changes from sandstones, clays, and evaporites in the upper basin (Mount and others, 1967) to predominantly dolomite and limestone in the middle basin, which commonly yield calcium, magnesium, and bicarbonate ions. Bicarbonate increases from approximately 6 percent to more than 20 percent of the dissolved-solids concentration in the mainstem Colorado River in the middle section of the basin. Magnesium ranges from 13 to 15 percent in the mainstem Colorado River and increases to more than 20 percent in a few tributaries. Sulfate, which probably is introduced into the water by dissolution of the evaporites in the upper basin, gradually decreases in the middle part of the basin from 24 to about 10 percent of the total-dissolved constituents.

The mean concentration of total dissolved solids is about 1,400 mg/L at the Colorado River at Ballinger station (08126500), decreases to about 1,000 mg/L at the Colorado River near Stacy station (08136700) and the Colorado River at Winchell station (08138000), and decreases further to about 500 mg/L at the Colorado River near San Saba station (08147000) (table 5). Mean streamflow increases by approximately 80 percent from the Ballinger station to the Stacy and Winchell stations and by approximately 54 percent from the Winchell station to the San Saba station (table 4). The increase is due to inflow from the intervening drainage area and three major tributaries, Elm Creek, Concho River, and Pecan Bayou. The inflow is generally less mineralized than the water in the mainstem Colorado River and causes a dilution of the dissolved-solids concentration. The concentrations of dissolved solids in the mainstem Colorado River in the middle section of the basin exceed the EPA secondary drinking-water regulations of 500 mg/L (table 7) approximately 95 percent of the time at all stations except the Colorado River near San Saba station (08147000) where the concentrations of dissolved solids exceed the standard only 50 percent of the time (table 5). Sulfate and chloride concentrations exceed EPA secondary drinking-water regulations 50 percent of the time in the mainstem Colorado River except at the Colorado River near San Saba station (08147000) where the concentrations have never exceeded the limit. Chloride concentrations exceed the limit 75 percent of the time at the Concho River near Paint Rock station (08136500).

Lower Colorado River basin

The composition of dissolved solids in the lower Colorado River basin is predominantly calcium and bicarbonate ions. Bicarbonate ions constitute more than 30 percent and calcium ions constitute about 25 percent of the total dissolved solids at all stations in the lower Colorado River. The Llano River and Pedernales River, which flow through limestone, dolomite and some igneous and metamorphic rocks and enter the Colorado River in the highland lakes area, are both predominantly bicarbonate-type water. Dissolved-solids concentrations in both of these major tributaries consist of 30 percent or more bicarbonate ions and 15-20 percent calcium ions, which contribute to the shift in water type of the mainstem Colorado River. Magnesium ions remain between 12 percent and 15 percent, despite the presence of dolomite in the bedrock. Sodium and chloride ions constitute about 12 percent each, and sulfate decreases to less than 10 percent of the total dissolved-solids concentrations in the lower Colorado River due to the lack of a prominent source for the three ions.

The mean concentration of dissolved solids was consistently around 300 mg/L throughout the lower basin due to the regulating influence of the highland lakes and the absence of inflow of more mineralized water. A statistical summary of the data from the lower basin (table 5) showed that the maximum concentrations of dissolved solids, dissolved chloride, and dissolved sulfate did not exceed the EPA secondary drinking-water regulations during the study period.

Discharge-Weighted Average Concentrations of Dissolved Constituents in the Basin

Discharge-weighted average concentrations for a specific time period are computed by multiplying daily discharges by daily concentrations and dividing by the total discharge for the time period. The discharge-weighted average concentration represents the chemical character of the water for the specific time period if all the water were impounded in a reservoir and mixed with no adjustment for rainfall, evaporation, or chemical changes that may occur during storage. The calculated averages, per water year, for stations in the three sections of the Colorado River basin with available continuous or daily records for specific conductance and discharge are shown in table 9.

Because discharge-weighted concentrations strongly emphasize the composition of water during periods of high flow when concentrations of dissolved constituents generally are low, discharge-weighted average concentrations of dissolved constituents generally are lower than simple average concentrations. The yearly discharge-weighted average concentrations of dissolved constituents for stations in the upper and middle sections of the basin generally fluctuate in accordance with the average annual streamflow.

Years of greater than average streamflow generally are lower in discharge-weighted average concentrations of dissolved constituents. Stations downstream from the highland lakes are very consistent from year to year in dissolved-solids concentrations. Although the Geological Survey has a limited sampling program in the highland lakes, it is evident that the lakes act as a mixing basin for the dissolved constituents and absorb most large fluctuations in concentrations of dissolved constituents entering the lakes from upstream. Also, discharge from the lakes is regulated and generally controls large fluctuations in streamflow at stations downstream.

Table 9.--Yearly discharge-weighted average concentrations of dissolved constituents for selected stations in the Colorado River basin

[mg/L, milligram per liter; ft^3/s, cubic foot per second]

Year	Dissolved solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L)	Streamflow (ft^3/s)
08119500 Colorado River near Ira, Texas					
1973	2,900	1,500	340	400	1,632
1974	1,800	910	210	250	700
1975	830	420	97	120	5,810
1976	1,300	670	150	180	2,259
1977	2,400	1,200	280	330	1,675
1978	2,800	1,400	320	380	699
1979	2,700	1,400	310	370	816
1980	400	200	46	55	7,319
1981	3,100	1,600	360	420	853
1982	810	410	94	110	5,584
08120700 Colorado River near Cuthbert, Texas					
1973	1,900	700	420	530	7,618
1974	1,400	520	320	400	2,966
1975	1,000	360	230	290	12,240
1976	1,300	480	310	390	8,225
1977	1,100	390	260	320	13,723
1978	1,400	500	320	400	4,622
1979	810	280	200	240	9,522
1980	360	130	84	110	38,052
1981	1,400	540	330	410	13,828
1982	660	230	160	200	28,205
08121000 Colorado River at Colorado City, Texas					
1973	2,100	870	420	420	7,834
1974	1,200	520	240	240	2,035
1975	980	400	200	200	12,091
1976	1,300	530	260	260	6,356
1977	1,400	590	290	290	10,147
1978	2,000	850	380	380	2,530
1979	970	400	210	200	9,746
1980	540	220	110	110	35,907
1981	1,800	760	370	370	18,827
1982	780	320	160	160	31,961

Table 9.--Yearly discharge-weighted average concentrations of dissolved constituents for selected stations in the Colorado River basin--Continued

Year	Dissolved solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L)	Streamflow (ft^3/s)
		08123800 Beals Creek near Westbrook, Texas			
1973	2,200	900	540	750	8,244
1974	1,100	440	270	390	5,703
1975	1,800	690	420	600	20,994
1976	2,200	860	520	730	5,972
1977	3,300	1,300	800	1,100	5,112
1978	2,900	1,200	700	990	2,388
1979	2,200	890	540	750	6,229
1980	860	340	200	290	25,110
1981	4,100	1,700	990	1,400	9,510
1982	2,100	820	490	700	10,164
		08123850 Colorado River above Silver, Texas			
1973	1,900	700	520	660	31,969
1974	850	300	230	290	14,356
1975	1,300	460	350	440	39,329
1976	1,800	630	480	600	14,206
1977	1,900	690	520	660	17,851
1978	2,300	820	620	770	7,070
1979	1,400	520	390	490	20,494
1980	580	200	160	200	71,683
1981	1,800	660	500	620	103,773
1982	830	300	230	290	58,045
		08126500 Colorado River near Ballinger, Texas			
1973	960	240	310	490	15,347
1974	450	120	130	220	21,658
1975	790	200	250	400	36,102
1976	1,200	290	430	640	7,758
1977	1,100	270	380	570	10,596
1978	460	110	150	230	15,201
1979	770	180	270	400	7,062
1980	1,200	260	470	640	10,958
1981	720	180	230	360	17,177
1982	420	110	120	210	55,420
		08127000 Elm Creek at Ballinger, Texas			
1973	980	330	210	490	16,947
1974	470	150	95	230	18,997
1975	920	310	190	460	30,890
1976	660	220	140	330	7,795
1977	860	290	180	430	10,709
1978	200	60	36	98	23,910
1979	500	160	100	250	9,980
1980	330	100	64	160	5,433
1981	1,100	390	250	550	4,251
1982	340	110	69	170	51,182

Table 9.--Yearly discharge-weighted average concentrations of dissolved constituents for selected stations in the Colorado River basin--Continued

Year	Dissolved solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L)	Streamflow (ft^3/s)
		08136500 Concho River at Paint Rock, Texas			
1973	1,500	530	310	770	11,653
1974	1,200	430	240	620	7,835
1975	540	180	92	270	93,767
1976	1,100	390	220	580	22,544
1977	740	260	130	380	61,551
1978	760	270	150	390	23,924
1979	1,200	420	240	610	13,248
1980	340	120	58	170	57,080
1981	1,100	400	230	590	22,030
1982	950	330	180	490	28,820
		08136700 Colorado River near Stacy, Texas			
1973	1,000	330	270	530	58,301
1974	630	200	150	330	56,608
1975	650	200	150	330	189,911
1976	940	300	240	490	47,494
1977	750	230	180	390	97,685
1978	480	150	110	250	77,706
1979	840	260	210	430	39,481
1980	330	100	68	170	113,838
1981	910	290	220	470	61,469
1982	510	160	120	270	139,237
		08143600 Pecan Bayou near Mullin, Texas			
1973	510	160	68	230	8,620
1974	300	86	42	150	22,364
1975	320	82	45	170	116,021
1976	620	200	81	260	8,472
1977	340	95	47	170	25,838
1978	620	220	79	240	4,242
1979	420	120	58	200	15,938
1980	370	110	50	170	10,921
1981	580	180	77	250	5,643
1982	280	70	39	150	59,413
		08147000 Colorado River near San Saba, Texas			
1973	580	150	110	340	122,739
1974	250	49	30	170	336,657
1975	470	110	75	290	496,068
1976	500	130	92	290	145,399
1977	430	100	68	270	301,598
1978	360	86	59	220	144,309
1979	430	99	67	270	122,869
1980	230	43	26	150	233,096
1981	500	130	89	300	147,469
1982	350	78	52	220	318,738

Table 9.--Yearly discharge-weighted average concentrations of dissolved constituents for selected stations in the Colorado River basin--Continued

Year	Dissolved solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Hardness (mg/L)	Streamflow (ft^3/s)
		08158000 Colorado River at Austin, Texas			
1973	290	47	33	210	451,906
1974	290	46	33	210	737,769
1975	270	42	31	190	1532,364
1976	290	47	33	210	500,445
1977	280	45	32	200	985,951
1978	310	51	36	220	446,215
1979	290	47	34	210	437,217
1980	270	42	31	200	405,117
1981	270	42	30	190	819,779
1982	250	39	29	180	683,578
		08162000 Colorado River at Wharton, Texas			
1973	230	34	29	160	974,674
1974	240	35	30	170	1,253,560
1975	250	37	31	170	2,244,611
1976	270	41	33	190	730,765
1977	260	38	32	180	1,500,644
1978	300	45	36	210	426,763
1979	220	33	28	150	1,037,917
1980	270	41	34	190	438,701
1981	230	35	29	160	1,136,432
1982	230	34	29	160	954,031

Discharge-weighted average concentrations can be used to indicate the type of water impounded in a reservoir and to show the influence of inflow to a reservoir. Impoundment of water in E. V. Spence Reservoir began in 1968. Volume-weighted average concentrations of selected dissolved constituents were computed for the reservoir from data obtained during comprehensive water-quality surveys during 1978-82 (table 10). Monthly discharge-weighted average concentrations of dissolved solids were computed for the Colorado River above Silver station (08123850) which is immediately upstream from E. V. Spence Reservoir. These data are shown in figure 8 along with average monthly reservoir content. The figure shows that prior to September 1980, the discharge-weighted average concentrations of dissolved solids in the Colorado River were only 360 mg/L. The large inflow of relatively dilute water in September and October 1980 increased reservoir content from 100,000 to about 235,000 acre-ft and resulted in a 35-percent reduction in the volume-weighted average concentration of dissolved solids in the reservoir. Figure 8 also shows that most significant increases in reservoir content in E. V. Spence Reservoir occurred when the discharge-weighted average concentrations of dissolved solids in the Colorado River upstream from the reservoir were less than 1,000 mg/L.

The volume-weighted average dissolved-solids concentration in a proposed reservoir downstream of the Colorado River near Stacy station (08136700) could be expected to be greater than 500 mg/L because the yearly discharge-weighted average concentrations of dissolved solids at Colorado River near Stacy are generally greater than 500 mg/L (table 9). However, the quality of the water in the reservoir would be dependent on when the majority of the water would be impounded because the yearly discharge-weighted average concentrations of dissolved solids in the Colorado River near Stacy ranged from 330 to 1,000 mg/L during the 10 years included in this study.

The water quality of a proposed reservoir near the Columbus area generally would be very good with respect to dissolved constituents. Although the data are not available to compute discharge-weighted average concentrations of dissolved constituents for the Colorado River at Columbus station (08161000), they have been computed for the Colorado River at Wharton station (08162000) immediately downstream from the Columbus station. The data at this station indicate that the yearly discharge-weighted average concentrations of dissolved solids in the Colorado River are consistently less than 300 mg/L and often less than 250 mg/L (table 9).

Loads and Yields of Dissolved Constituents

Dissolved-constituent loads are the product of the dissolved-constituent concentration and the water discharge and represent the total weight of a dissolved constituent passing a point in a specific time period. Loads may be computed from the following equation:

$$\text{LOADS} = QC\ (0.0027)$$

where LOADS = loads in tons per day,
Q = discharge in cubic feet per second,
C = concentration in milligrams per liter, and
0.0027 = factor for converting the product of Q and C to tons per day.

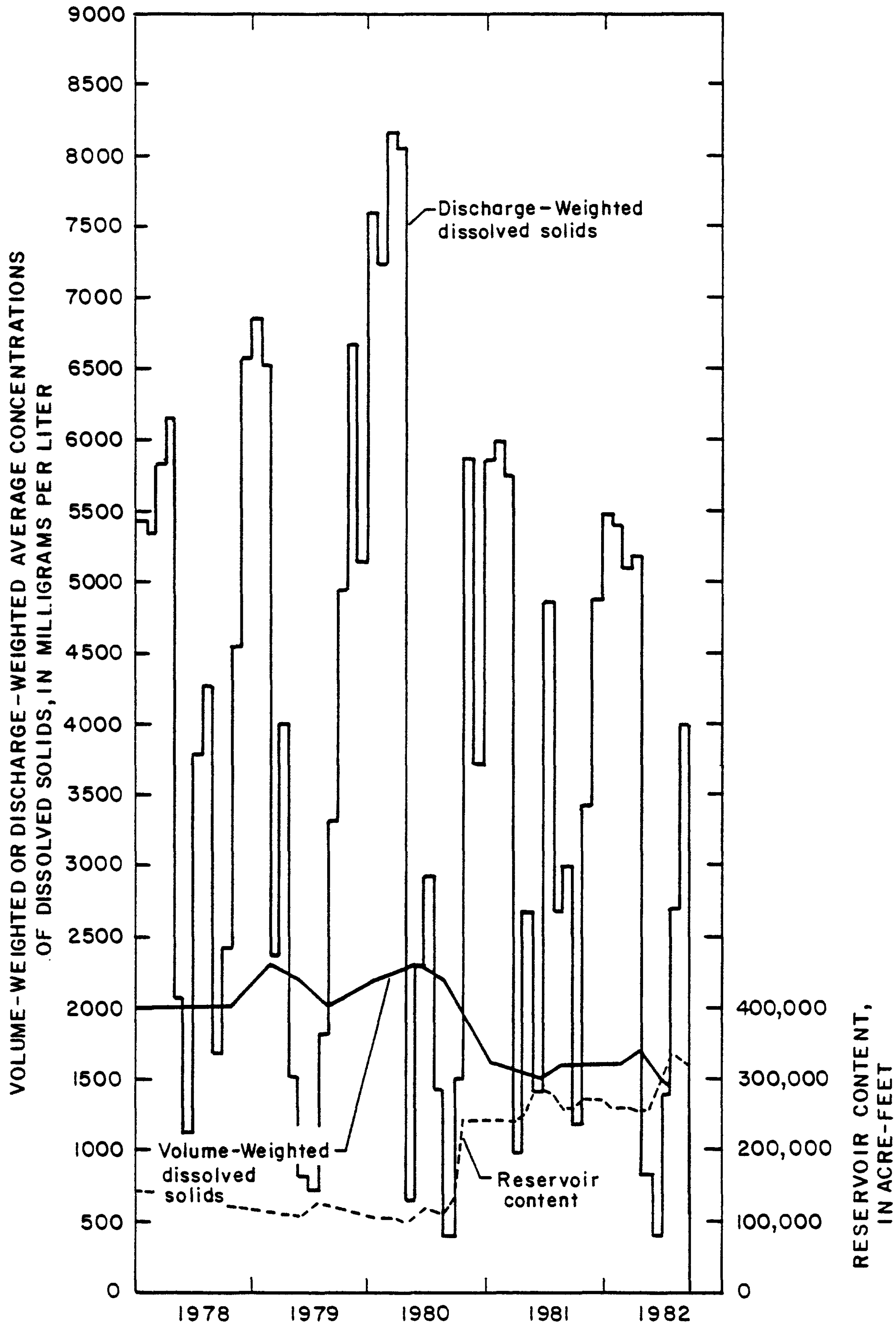

Figure 8.-Volume-weighted average concentrations of dissolved solids and mean monthly reservoir contents in E.V. Spence Reservoir and discharge-weighted average concentrations of dissolved solids for the Colorado River above Silver station (08123850)

Table 10.--Volume-weighted average concentrations of dissolved constituents in E.V. Spence Reservoir

Date	Total dissolved solids (mg/L)	Hardness (mg/L)	Dissolved chloride (mg/L)	Dissolved sulfate (mg/L)
Jan. 7, 1978	2,000	630	740	470
Jun. 8, 1978	2,000	630	730	470
Oct. 6, 1978	2,000	650	760	480
Feb. 27, 1979	2,300	740	880	550
May 2, 1979	2,200	700	830	520
Aug. 8, 1979	2,000	630	740	470
Jan. 15, 1980	2,200	700	830	530
May 1, 1980	2,300	730	870	550
Aug. 13, 1980	2,200	700	830	520
Jan. 29, 1981	1,600	520	590	390
Jun. 24, 1981	1,500	490	560	360
Aug. 13, 1981	1,600	510	580	380
Feb. 10, 1982	1,600	520	590	380
Apr. 26, 1982	1,700	540	610	400
Jul. 29, 1982	1,400	470	530	340

Although the relationship between dissolved-solids concentrations and discharge is generally inverse, the relationship between dissolved-solids loads and discharge is generally direct. Dissolved-solids loads are also cumulative and increase in a downstream direction except where water is diverted or delayed by reservoir storage. Because of this additive property of loads, tributaries or stream reaches which are major contributors to loads may be identified by the following equation:

$$L_{ds} = L_{us} + L_{ids}$$

where L_{ds} = loads at a downstream station,
L_{us} = loads at an upstream station, and
L_{ids} = loads from the intervening drainage area.

Yield, in tons per square mile, is the quotient of the loads at a station divided by the contributing drainage area to that station. An area which is identified as a major contributor of loads to a river generally will be a high yield area. High yield may be due to large amounts of streamflow or large dissolved-solids concentrations from a relatively small drainage area, or both.

The yearly mean loads of selected dissolved constituents at stations in the Colorado River basin are shown in table 11, and the yearly mean yields for the same stations are shown in table 12. The data also are shown graphically in figures 9-11.

The upper Colorado River basin is influenced primarily by the inflow of saline ground water, as explained in previous sections. The large increase in dissolved-constituent loads between the Colorado River near Ira station (08119500) and the Colorado River near Cuthbert station (08120700) is paralleled by the large increase in discharge due to inflow from three tributaries. The relatively high yield of dissolved constituents throughout the remainder of the upper basin probably is directly related to the inflow of saline ground water. Although a diversion dam is located between the Colorado River near Cuthbert station (08120700) and the Colorado River at Colorado City station (08121100), the effect it has on dissolved-constituent loads is not immediately evident. The diversion of streamflow during periods of low flow and an area of ground-water seepage near the downstream station tend to mask any beneficial effects of the diversion dam.

The dissolved-constituent loads decrease downstream from E. V. Spence Reservoir by 75 percent. During the period of study, mean daily discharge was 36 percent greater at the Colorado River above Silver station (08123850) immediately upstream from the reservoir than the mean discharge at the Colorado River at Ballinger station (08126500) immediately downstream. This indicates that a large portion of the water was being trapped in the reservoir and resulted in the decrease in loads at the downstream location. However, in September 1980, a large volume of relatively dilute water entered E. V. Spence Reservoir. This large quantity of dilute water greatly altered the composition of water in the reservoir.

The dissolved-constituent loads in the middle section of the Colorado River basin are affected by the two tributaries, Elm Creek and Concho River. The data from the Elm Creek near Ballinger station (08127000) show Elm Creek to be a high yield area for dissolved constituents. The particularly large

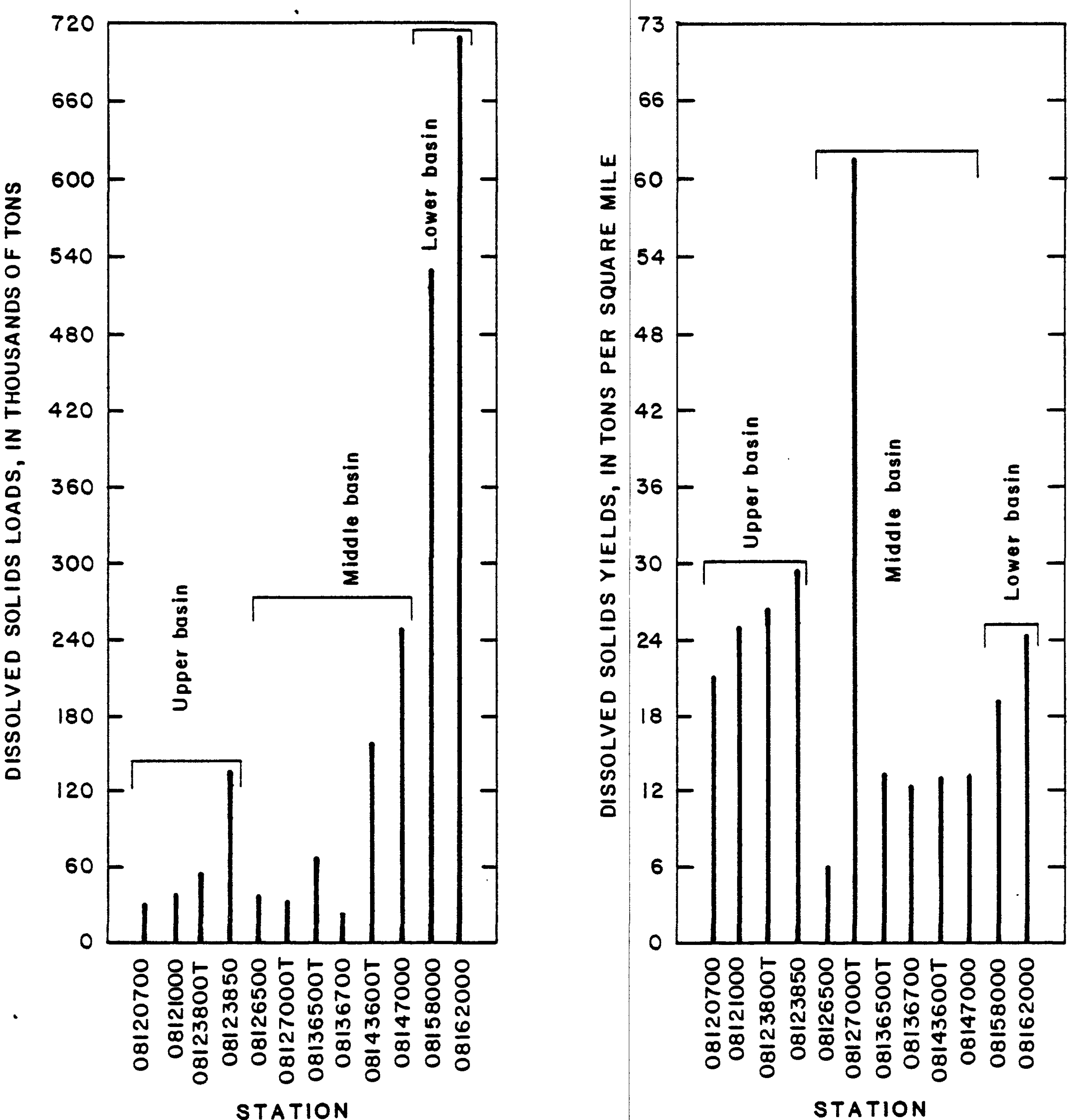

Figure 9.-Mean annual loads and yields of dissolved solids for the 1973-82 water years

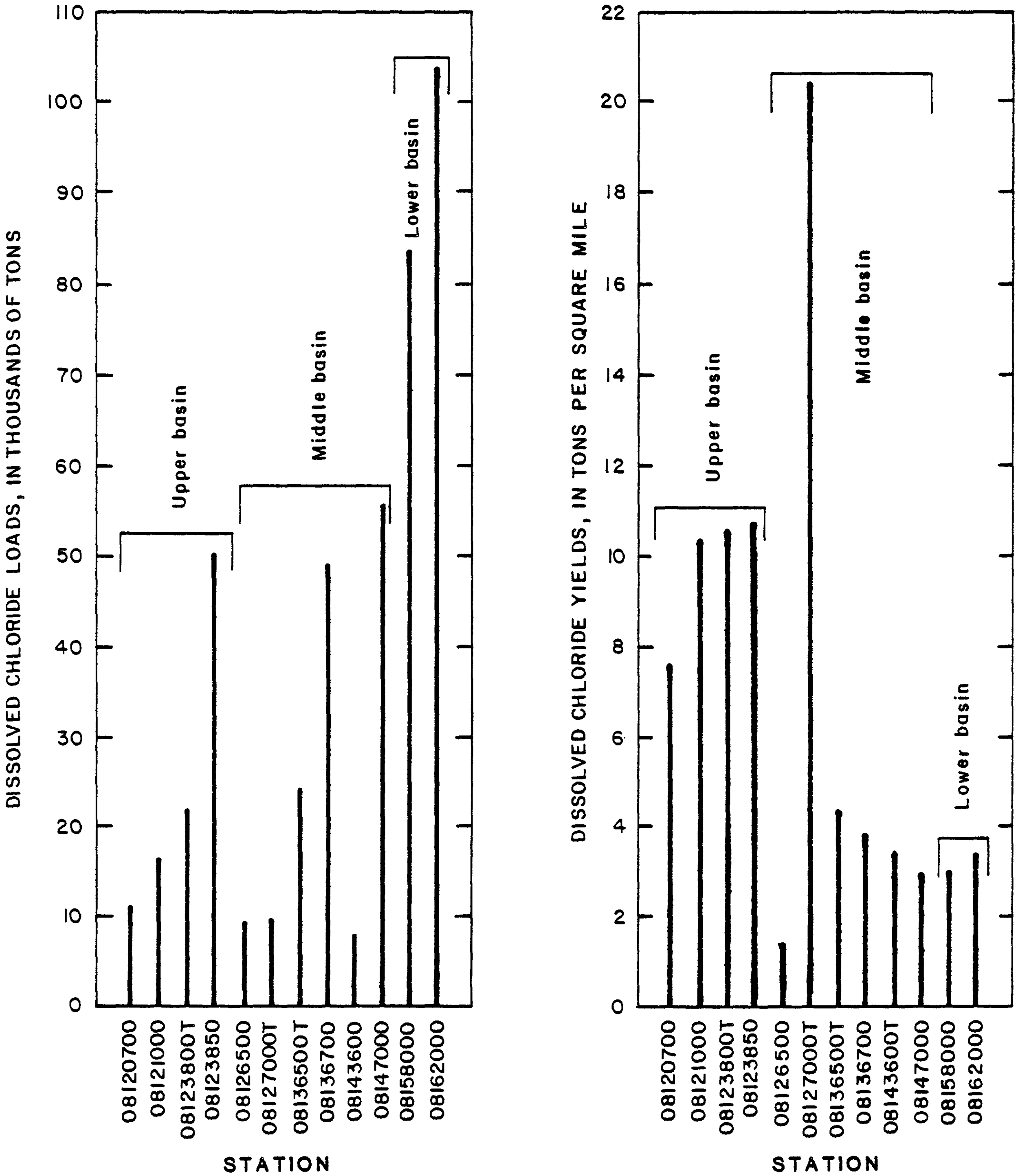

Figure 10.-Mean annual loads and yields of dissolved chloride for the 1973-82 water years

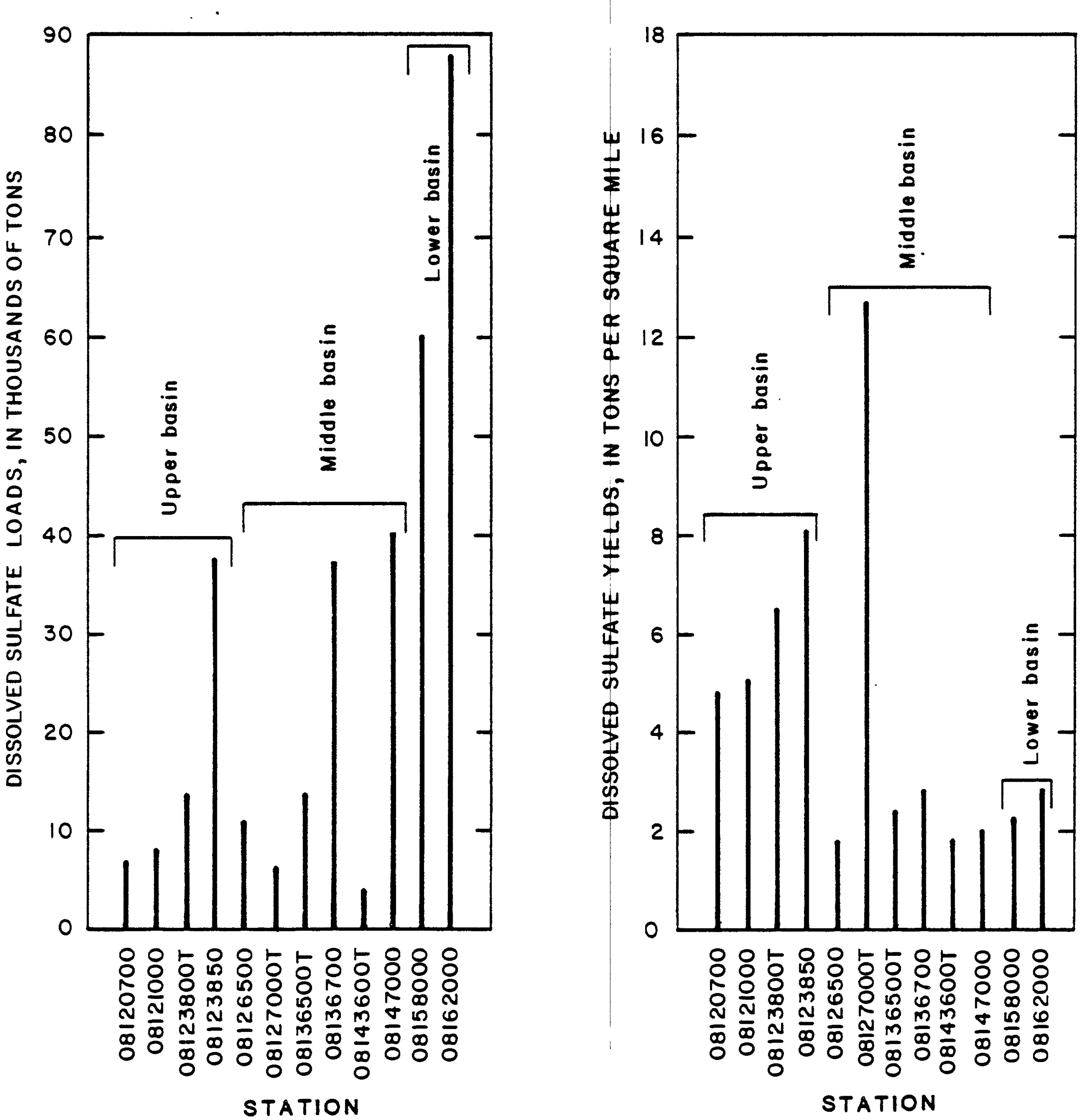

Figure 11.–Mean annual loads and yields of dissolved sulfate for the 1973–82 water years

Table 11.--Yearly-mean loads of dissolved constituents for selected stations in the Colorado River basin, 1973-82 water years

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

Station number	Station name	Contributing drainage area (mi^2)	Discharge (ft^3/s)	Dissolved solids loads (tons)	Chloride loads (tons)	Sulfate loads (tons)
		Upper basin				
08119500	Colorado River near Ira	2,371	7.9	8,689	4,374	1,001
08120700	Colorado River near Cuthbert	1,531	40.2	33,180	12,020	7,730
08121000	Colorado River at Colorado City	1,585	40.1	39,353	16,320	8,089
08123800	Beals Creek near Westbrook	1,988	27.8	52,635	20,830	12,570
08123850	Colorado River above Silver	4,650	93.3	136,908	49,179	37,200
		Middle basin				
08126500	Colorado River at Ballinger	6,098	59.3	34,855	8,809	10,959
08127000	Elm Creek at Ballinger	450	50.6	27,566	9,120	5,708
08136500	Conch River at Paint Rock	5,443	94.3	68,432	23,769	12,842
08136700	Colorado River near Stacy	12,802	246.1	154,240	48,318	36,683
08143600	Pecan Bayou near Mullin	2,073	79.3	25,853	7,061	3,578
08147000	Colorado River near San Saba	19,819	663.7	251,048	58,363	39,722
		Lower basin				
08158000	Colorado River at Austin	27,606	1,958.6	521,676	83,191	60,102
08162000	Colorado River at Wharton	30,600	2,970.8	707,259	105,203	88,154

Table 12.--Yearly-mean yields of dissolved constituents for selected stations in the Colorado River basin, 1973-82 water years

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

Station number	Station name	Contributing drainage area (mi^2)	Discharge (ft^3/s)	Dissolved solids yield ($tons/mi^2$)	Chloride yield ($tons/mi^2$)	Sulfate yield ($tons/mi^2$)
		Upper basin				
08119500	Colorado River near Ira	2,371	7.9	3.66	1.84	0.42
08120700	Colorado River near Cuthbert	1,531	40.2	21.67	7.85	5.09
08121000	Colorado River at Colorado City	1,585	40.1	24.83	10.30	5.10
08123800	Beals Creek near Westbrook	1,988	27.8	26.48	10.48	6.40
08123850	Colorado River above Silver	4,650	93.3	29.44	10.58	8.00
		Middle basin				
08126500	Colorado River at Ballinger	6,098	59.3	5.72	1.44	1.80
08127000	Elm Creek at Ballinger	450	50.6	61.26	20.27	12.68
08136500	Conch River at Paint Rock	5,443	94.3	12.57	4.37	2.36
08136700	Colorado River near Stacy	12,802	246.1	12.05	3.77	2.87
08143600	Pecan Bayou near Mullin	2,073	79.3	12.47	3.41	1.73
08147000	Colorado River near San Saba	19,819	663.7	12.67	2.94	2.00
		Lower basin				
08158000	Colorado River at Austin	27,606	1,958.6	19.00	3.01	2.18
08162000	Colorado River at Wharton	30,600	2,970.8	23.11	3.44	2.88

dissolved-chloride yield of Elm Creek could be attributed to oil-field activity very near Elm Creek as shown in Leifeste and Lansford (1968). Also, the mean discharge from Elm Creek for the period of study was only slightly less than that at the Colorado River at Ballinger station (08126500), and loads of dissolved constituents increase below the inflow of Elm Creek due to an increase in discharge. The data from the Concho River at Paint Rock station (08136500) show the Concho River to have a larger contributing drainage area than Elm Creek, but a considerably lower yield. The mean discharge for the period of study from Concho River was 37 percent more than that at the Colorado at Ballinger station (08126500). The two tributaries and intervening drainage area increase the total dissolved solids in the mainstem Colorado River by 77 percent between the Colorado River at Ballinger (08126500) and the Colorado River near Stacy station (08136700). Downstream from this area, the available data show gradual increases of dissolved-constituent loads through the lower section of the basin, but no indication of any unusually high yield areas.

Nutrients

Nitrogen and phosphorus are nutrients of primary interest because of their ability to promote or limit growth of bacteria and other aquatic organisms. The major species of nitrogen and phosphorus commonly are found in all waters at low concentrations. Significant concentrations of nitrogen and phosphorus usually are the result of the addition of municipal or industrial wastewater or runoff from agricultural areas. The Geological Survey periodically has measured total organic nitrogen, total ammonia nitrogen, total nitrite nitrogen, total nitrate, and total phosphorus at many stations in the Colorado River basin since the 1973 water year. The variations in nutrient concentrations at selected stations in the Colorado River basin during the period of study are shown in figure 12.

Nitrogen

Numerous species of nitrogen are found in natural waters. The most common forms are organic nitrogen, ammonia (NH_4) nitrogen, nitrite (NO_2) nitrogen, and nitrate (NO_3) nitrogen. In oxygenated water, organic nitrogen and ammonia are converted by nitrifying bacteria to nitrite and then rapidly to nitrate. Laboratory analyses of many samples for total nitrogen include the determination of the concentrations of total organic nitrogen, total ammonia nitrogen, total nitrite nitrogen, and total nitrate nitrogen. At some stations, dissolved concentrations were determined for ammonia, nitrite, and nitrite plus nitrate. However, in this report, discussion will be limited to the total concentrations mentioned previously.

According to the National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1976), the maximum contaminant level for nitrate nitrogen (as N) in drinking water is 10 mg/L (table 7).

The concentrations of nitrogen species in the upper Colorado River were based on the Beals Creek at Westbrook station (08123800) and the Colorado River above Silver station (08123850). At the Beals Creek station, concentrations of organic nitrogen ranged from 0.78 to 5.68 mg/L and ammonia concentrations ranged from 0.00 to 1.50 mg/L. Mean concentrations for these constituents at

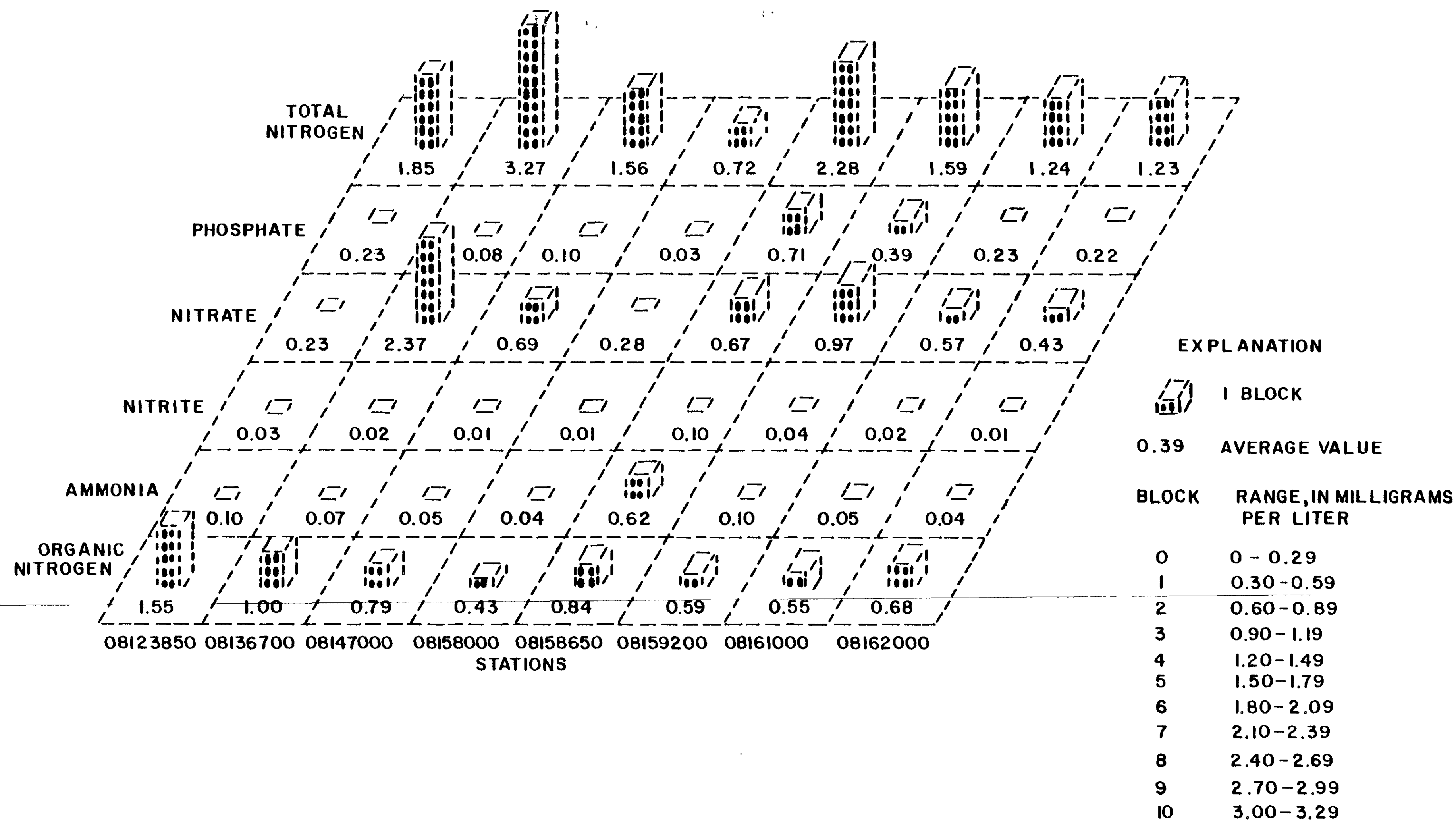

Figure 12.-Variations in mean nutrient concentrations at selected stations in the Colorado River basin during the 1973-82 water years

each station were no greater than 1.90 and 0.31 mg/L, respectively. Nitrite and nitrate concentrations ranged from 0.00 to 4.80 mg/L. Mean concentrations for both constituents were no greater than 0.88 mg/L as N. At the Silver station concentrations of organic nitrogen ranged from 0.64 to 3.90 mg/L and ammonia concentrations ranged from 0.00 to 0.35 mg/L. Mean concentrations for these constituents were 1.55 and 0.10 mg/L, respectively. Nitrite and nitrate concentrations at the Silver station ranged from 0.00 to 1.24 mg/L. Mean concentrations for nitrite and nitrate were 0.03 and 0.23 mg/L as N, respectively.

Nitrogen species concentration data in the middle Colorado River basin included the Colorado River at Stacy station (08136700) and the Colorado River near San Saba station (08147000). Organic nitrogen concentrations in the middle Colorado River basin ranged from 0.00 to 3.32 mg/L and ammonia concentrations ranged from 0.00 to 0.56 mg/L. The mean concentration of organic nitrogen was approximately 1.0 mg/L, and the mean ammonia nitrogen concentration was approximately 0.07 mg/L. Nitrite concentrations ranged from 0.00 to 0.11 mg/L and nitrate concentrations ranged from 0.00 to 9.40 mg/L. Mean concentrations of nitrite were below 0.03 mg/L, but concentrations of nitrate did reach 2.37 mg/L at the Stacy station. Even though nitrate concentrations at Stacy did approach levels of concern, maximum contaminant levels for drinking water were not exceeded. The elevated nitrate concentrations at the Stacy station are the result of high nitrate inflows from the Concho River tributary. Nitrate concentrations ranged from 0.01 to 17.9 mg/L and averaged 5.80 mg/L, and nitrite concentrations ranged from 0.00 to 0.33 mg/L and averaged 0.08 mg/L at the Concho River station. Concentrations of organic nitrogen and ammonia from the Concho station were below those for the Stacy and San Saba stations, which averaged 1.05 and 0.06 mg/L, respectively. In a downstream tributary, the Llano River at Llano station (08151500), concentrations of organic nitrogen ranged from 0.15 to 3.44 mg/L and ammonia concentrations ranged from 0.00 to 0.11 mg/L. Mean concentrations for both constituents were 0.66 and 0.04 mg/L, respectively. Nitrite and nitrate concentrations ranged from 0.00 mg/L to 0.18 mg/L. Mean concentrations for both constituents did not exceed 0.08 mg/L as N.

The concentrations of nitrogen species in the lower Colorado River Basin included the Colorado River at Austin station (08158000), the Colorado River below Austin station (08158650), the Colorado River at Bastrop station (08159200), the Colorado River at Columbus station (08161000), and the Colorado River at Wharton station (08162000). Except for the Colorado River below Austin station (08158650), few of the nitrogen species ranges and averages were large enough for concern. At the Colorado River below Austin station (08158650), organic nitrogen ranged from 0.00 to 9.30 mg/L and averaged 0.84 mg/L, and ammonia nitrogen ranged from 0.00 to 3.70 mg/L and averaged about 0.62 mg/L. This was the highest value for ammonia found in the basin. Due to the transient nature of ammonia nitrogen, the presence of substantial concentrations (greater than 0.5 mg/L) is considered indicative of contamination by human or animal wastes or by fertilizers (Harned, 1980). This station is located downstream from one of Austin's sewage treatment plants. Nitrite concentrations ranged from 0.00 to 0.66 mg/L and averaged 0.10 mg/L and nitrate values ranged from 0.08 to 3.90 mg/L and averaged 0.67 mg/L. Even with the high concentration for nitrate noted, the maximum contaminant level of 10 mg/L set by EPA was not exceeded.

Phosphorus

Phosphorus is contributed by many of the sources that contribute nitrate. Phosphate fertilizers, some detergents, and domestic and industrial sewage effluents contain considerable amounts of phosphorus.

There are no criteria for maximum concentrations of phosphorus in natural waters. However, concentrations of 0.01 to 0.3 mg/L (as P) have been known to promote eutrophication (U.S. Environmental Protection Agency, 1977b). Phosphorus concentrations were determined for at least one station in the upper, middle, and lower sections of the Colorado River Basin. Total phosphorus concentrations ranged from 0.00 to 4.90 mg/L for the 1973-82 water years (table 5). The highest mean concentration of 0.71 mg/L occurred at Colorado River below Austin (fig. 12). High phosphorus concentrations downstream from Austin can be attributed to municipal waste effluents discharged into the river.

Figure 12 also shows phosphorus concentrations above and below the highland lakes. These data reflect the areas of maximum and minimum concentration in the basin. Impoundment of the Colorado River in area lakes seems to have little or no relation to phosphorus concentrations as no significant fluctuations can be noted above and below the lakes. These data also indicate that inflows of waste have caused these fluctuations in water quality but no serious degradation in water quality has occurred.

Dissolved Oxygen and Water Temperature

Dissolved oxygen is necessary to any aquatic ecosystem. Adequate levels of dissolved oxygen are required to insure proper egg and larvae development and normal growth and activity. There is no specific dissolved-oxygen concentration that is favorable for all aquatic species and ecosystems; however, the U.S. Environmental Protection Agency (1977b) found that a minimum concentration of 5.0 mg/L of dissolved oxygen is needed to maintain a good fish population (fig. 13). The principal source of oxygen in the Colorado River is absorption of atmospheric oxygen at the air-water interface. The concentration of dissolved oxygen is controlled primarily by temperature, atmospheric pressure and salinity. The solubility of oxygen in water is inversely related to temperature. As the temperature of the water increases, the amount of oxygen the water is capable of dissolving decreases.

In the upper Colorado River basin, periodic measurements of dissolved oxygen concentrations were taken at one station on the mainstem Colorado River and at one station on a major tributary. The mean water temperature for both stations was approximately 19.0°C, and the mean dissolved oxygen concentration for both stations was approximately 10.5 mg/L.

In the middle Colorado River basin, dissolved oxygen concentrations were measured periodically at two stations on the mainstem Colorado River and at two stations on major tributaries. The mean water temperature for the four stations ranged from 20.0 to 20.5°C. The mean dissolved oxygen concentration ranged from 8.8 to 10.0 mg/L.

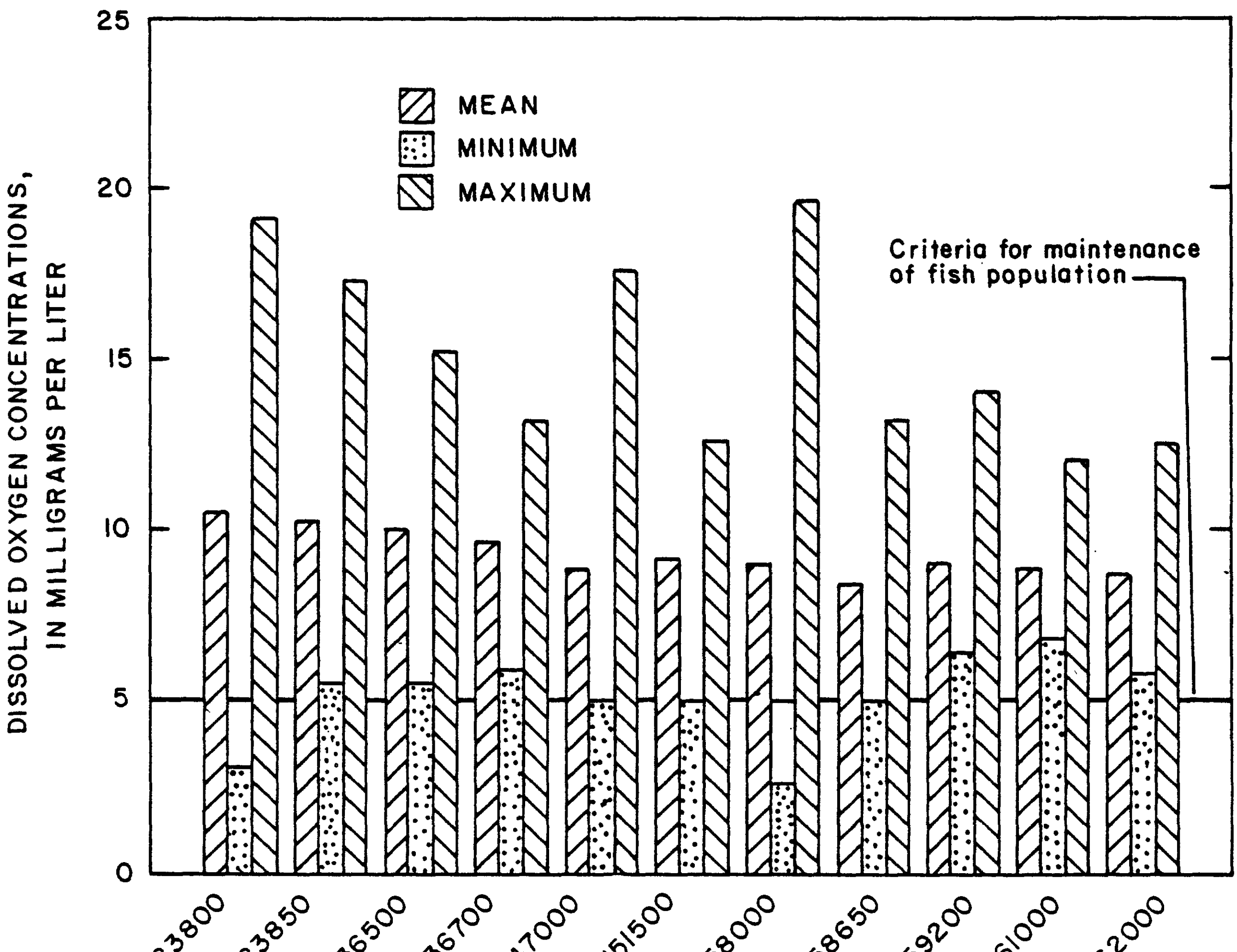

Figure 13.-Variations in dissolved oxygen concentrations in the Colorado River basin during the 1973-82 water years

In the lower Colorado River basin, dissolved oxygen concentrations were measured periodically at all five sampling stations. The mean water temperatures ranged from 20.0 to 21.0°C, and the mean dissolved oxygen concentrations ranged from 8.4 to 9.0 mg/L. Discharge of municipal effluents downstream from Austin has not adversely affected dissolved oxygen concentrations below Austin.

Variations in water temperatures and dissolved oxygen concentrations from the upper to lower basin are insignificant. The mean concentration of dissolved oxygen for each station in the Colorado River basin was above the 5.0 mg/l level recommended as a minimum by the EPA (fig. 13), and, for most stations, the minimum concentration detected during the study period was above 5.0 mg/L.

Biochemical Oxygen Demand

Oxygen-consuming waste in a stream removes oxygen from the stream. The biological uptake of oxygen by organisms for metabolism is measured by the use of the standard 5-day BOD (biochemical oxygen demand) which measures the amount of oxygen consumed biochemically over a 5-day period at 20°C. This measurement typically measures most of the carbonaceous BOD but little of the nitrogeneous BOD. This is an efficient and effective tool to evaluate the amount of organic material being utilized by organisms. A range of 1 to 8 mg/L is common for moderately contaminated streams (Harned, 1980). BOD values for 11 stations in the Colorado River basin are shown in table 13. BOD concentrations ranged from 0.00 to 34 mg/L for the 1973-82 water years. Most mean concentrations were well within the range of 1-8 mg/L. The one exception was the 8.65 mg/L mean concentration found at the Beals Creek near Westbrook station (08123800). BOD concentrations were frequently higher in the upper and middle basin than in the lower part of the basin. According to the Texas Department of Water Resources (1982), this could be attributed to the fact that a majority of the tributaries, streams, and rivers feeding into the Colorado River and many reaches of the mainstem river either are intermittent or have frequent periods of minimal flow. As a result, in some streams domestic wastewater emerges as the major contributor to flow. Beals Creek and Pecan Bayou are two such streams.

Bacteria

Fecal-coliform bacteria and fecal-streptococci bacteria are natural inhabitants of the intestinal tract of man and other warm blooded animals. These bacteria have long been used as indicators of the sanitary quality of water. Water Quality Criteria, 1972 (National Academy of Sciences, National Academy of Engineering, 1973) recommends that raw water contain no more than 2,000 cols./100 mL (colonies per 100 milliliters) of fecal-coliform bacteria if it is a source of public supply and also recommends that bathing waters contain no more than 200 cols./100 mL fecal-coliform bacteria.

Bacteria data have been collected at seven locations in the Colorado River basin since the 1978 water year and are summarized in table 14. Bacterial densities for fecal-coliform bacteria ranged from less than 1 col./100 ml at two locations to 26,000 cols./100 mL at the Colorado River at San Saba station (08147000). Fecal-streptococci bacteria densities ranged from 1 col./100 mL

Table 13.--Statistical summary of biochemical oxygen demand data for selected stations in the Colorado River basin for the 1973-82 water years

[mg/L, milligram per liter]

Station	Mean (mg/L)	Maximum (mg/L)	Minimum (mg/L)
08123800 Beals Creek near Westbrook	8.65	34.00	2.20
08123850 Colorado River above Silver	6.79	14.00	2.10
08136500 Concho River at Paint Rock	3.29	13.00	.50
08136700 Colorado River near Stacy	2.61	5.80	1.10
08147000 Colorado River near San Saba	2.15	12.00	.40
08151500 Llano River at Llano	.82	2.70	.10
08158000 Colorado River at Austin	.67	1.60	.00
08158650 Colorado River below Austin	2.60	12.00	.20
08159200 Colorado River at Bastrop	.80	2.60	.00
08161000 Colorado River at Columbus	1.27	2.80	.20
08162000 Colorado River at Wharton	1.61	33.00	.10

Table 14.--Statistical summary of bacteria data for selected stations in the Colorado River basin for the 1973-82 water years

[col/100 ml, colonies per 100 milliliters; fc/fs, fecal coliform/fecal streptococci; >, more than; <, less than]

Station	Mean fecal coliform density (col/100 ml)	Maximum fecal coliform density (col/100 ml)	Minimum fecal coliform density (col/100 ml)	Mean fecal streptococci density (col/100 ml)	Maximum fecal streptococci density (col/100 ml)	Minimum fecal streptococci density (col/100 ml)	Number of samples with fc/fs ratio >4	Number of samples with fc/fs ratio <4 and >1	Number of samples with fc/fs ratio <1
08123850 Colorado River above Silver, Texas	371	2,100	<1	769	7,800	12	4	19	29
08136700 Colorado River near Stacy, Texas	707	5,500	5	3,300	23,000	37	1	0	11
08147000 Colorado River near San Saba, Texas	694	26,000	5	1,620	50,000	8	2	7	42
08151500 Llano River at Llano, Texas	517	6,000	5	599	12,000	20	2	9	19
08158000 Colorado River at Austin, Texas	653	8,800	6	340	4,000	3	18	28	19
08158650 Colorado River below Austin, Texas	370	3,200	<1	346	9,200	3	13	26	23
08162000 Colorado River at Wharton, Texas	395	6,000	8	661	8,000	1	10	18	37

at the Colorado River at Wharton station (08162000) to 50,000 cols./100 mL at the Colorado River at San Saba for the 1978-82 water years. Maximum fecal-coliform and fecal-streptococci densities detected at Colorado River near San Saba possibly can be attributed to storm runoff. Fecal-coliform densities at the Colorado River at Austin station (08158000) were higher than at the Colorado River below Austin station (08158650). These differences can be explained by progressive die-off downstream. Once these organisms are in the stream, factors such as water temperature, nutrients, metals, pH, and other environmental factors may act to reduce bacterial densities. Fecal-coliform bacteria densities on several occasions exceeded criteria for public supply and bathing water at the Colorado River at Austin and Colorado River below Austin stations.

It is important to know whether fecal-coliform bacteria originated from human or animal sources in locating the source of contamination. An aid to making this determination is the ratio of fecal coliform/fecal streptococci. A ratio greater than 4 indicates human sources. A ratio less than 1 indicates animal sources. A ratio of between 1 and 4 indicates a combination of animal and human sources. These ratios are not valid if time of entry of the bacteria into the stream is greater than 24 hours prior to sampling (Geldriech and Kenner, 1969). These data showed that sources fluctuated between human and animal sources during the period of study. This variation can perhaps be best explained by areal land use which change from rural to urban and back to rural within the basin. A pattern of fecal coliform to fecal streptococci ratios was detected in the basin. In the upper basin at the Colorado River above Silver station, ratios less than 1 were predominant. Ratios were predominantly greater than 1 at the Colorado River at Austin station. Downstream at the Colorado River at Wharton station, ratios returned to less than 1.

Dissolved Trace Elements

Trace elements include those constituents, mostly cations, whose concentrations usually do not exceed 1 mg/L, although in exceptional waters one or more of them may be present in comparatively large amounts and may, for that particular water, be a major component. For this report, dissolved trace elements include arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver and zinc. These samples, when collected, were filtered through a 0.45-micrometer filter. Therefore, this report will consider only the dissolved trace elements.

The occurrence of most of these trace elements in water is a matter of concern to water users and planners alike because of the potentially harmful effects of excessive concentrations on man and aquatic life. Undesirable concentrations of trace elements in water may render it undesirable as a public water supply. Many trace elements may be concentrated at successive steps in the aquatic food chain, making fish and other aquatic life undesirable for human consumption.

The results of analyses for trace elements for seven locations in the Colorado River basin for the 1973-82 water years are summarized in table 15. Data at some stations did not cover the entire period of study. Beginning and ending water years of collection are indicated in the table. The summary table of trace element analyses includes stations in the upper, middle, and lower sections of the basin. No pattern of increasing or decreasing concentrations

Table 15.--Statistical summary of trace element data for selected stations in the Colorado River basin for the 1973-82 water years

[μg/L, microgram per liter]

Trace elements	Mean value (μg/L)	Minimum value (μg/L)	Maximum value (μg/L)	Maximum contaminant level or secondary maximum contaminant level (μg/L)
08123850 Colorado River above Silver, Texas, 1978-82				
Arsenic, dissolved (μg/L as As)	3.72	1.00	7.00	50
Barium, dissolved (μg/L as Ba)	196.11	100.00	400.00	1,000
Cadmium, dissolved (μg/L as Cd)	0.83	0.00	3.00	10
Chromium, dissolved (μg/L as Cr)	7.22	0.00	50.00	50
Copper, dissolved (μg/L as Cu)	2.67	0.00	20.00	1,000
Iron, dissolved (μg/L as Fe)	79.61	3.00	890.00	300
Lead, dissolved (μg/L as Pb)	1.61	0.00	5.00	50
Manganese, dissolved (μg/L as Mn)	70.06	1.00	410.00	50
Mercury, dissolved (μg/L as Hg)	0.12	0.00	0.40	2
Nickel, dissolved (μg/L as Ni)	2.18	0.00	7.00	*
Selenium, dissolved (μg/L as Se)	0.94	0.00	2.00	10
Silver, dissolved (μg/L as Ag)	0.17	0.00	1.00	50
Zinc, dissolved (μg/L as Zn)	25.61	3.00	110.00	5,000
08136500 Concho River at Paint Rock, Texas, 1973-82				
Arsenic, dissolved (μg/L as As)	4.17	1.00	11.00	50
Barium, dissolved (μg/L as Ba)	184.78	100.00	400.00	1,000
Cadmium, dissolved (μg/L as Cd)	0.75	0.00	2.00	10
Chromium, dissolved (μg/L as Cr)	6.36	0.00	60.00	50
Copper, dissolved (μg/L as Cu)	2.25	0.00	20.00	1,000
Iron, dissolved (μg/L as Fe)	20.36	10.00	80.00	300
Lead, dissolved (μg/L as Pb)	4.08	0.00	100.00	50
Manganese, dissolved (μg/L as Mn)	11.31	0.00	30.00	50
Mercury, dissolved (μg/L as Hg)	0.31	0.00	1.60	2
Nickel, dissolved (μg/L as Ni)	1.23	0.00	4.00	*
Selenium, dissolved (μg/L as Se)	3.35	1.00	8.00	10
Silver, dissolved (μg/L as Ag)	0.26	0.00	2.00	50
Zinc, dissolved (μg/L as Zn)	17.72	0.00	70.00	5,000
08147000 Colorado River near San Saba, Texas, 1978-82				
Arsenic, dissolved (μg/L as As)	1.89	1.00	3.00	50
Barium, dissolved (μg/L as Ba)	132.22	90.00	300.00	1,000
Cadmium, dissolved (μg/L as Cd)	1.58	0.00	10.00	10
Chromium, dissolved (μg/L as Cr)	6.32	0.00	20.00	50
Copper, dissolved (μg/L as Cu)	1.21	0.00	3.00	1,000
Iron, dissolved (μg/L as Fe)	14.95	0.00	90.00	300
Lead, dissolved (μg/L as Pb)	0.68	0.00	4.00	50
Manganese, dissolved (μg/L as Mn)	4.26	1.00	10.00	50
Mercury, dissolved (μg/L as Hg)	0.11	0.00	0.20	2
Nickel, dissolved (μg/L as Ni)	2.08	0.00	7.00	*
Selenium, dissolved (μg/L as Se)	0.84	0.00	2.00	10
Silver, dissolved (μg/L as Ag)	0.21	0.00	1.00	50
Zinc, dissolved (μg/L as Zn)	8.05	0.00	20.00	5,000
08151500 Llano River at Llano, Texas, 1972-82				
Arsenic, dissolved (μg/L as As)	1.93	1.00	4.00	50
Barium, dissolved (μg/L as Ba)	54.79	40.00	62.00	1,000
Cadmium, dissolved (μg/L as Cd)	1.29	1.00	3.00	10
Chromium, dissolved (μg/L as Cr)	6.43	0.00	20.00	50
Copper, dissolved (μg/L as Cu)	1.36	0.00	4.00	1,000
Iron, dissolved (μg/L as Fe)	19.50	3.00	120.00	300
Lead, dissolved (μg/L as Pb)	1.07	0.00	4.00	50
Manganese, dissolved (μg/L as Mn)	3.43	1.00	6.00	50
Mercury, dissolved (μg/L as Hg)	0.11	0.00	0.30	2
Nickel, dissolved (μg/L as Ni)	1.17	0.00	3.00	*
Selenium, dissolved (μg/L as Se)	0.43	0.00	1.00	10
Silver, dissolved (μg/L as Ag)	0.29	0.00	1.00	50
Zinc, dissolved (μg/L as Zn)	4.57	3.00	12.00	5,000

Table 15.--Statistical summary of trace element data for selected stations in the Colorado River basin for the 1973-82 water years--Continued

Trace elements	Mean value (µg/L)	Minimum value (µg/L	Maximum value (µg/L)	Maximum contaminant level or secondary maximum contaminant level (µg/L)
08158000 Colorado River at Austin, Texas, 1974-82				
Arsenic, dissolved (µg/L as As)	1.60	1.00	12.00	50
Barium, dissolved (µg/L as Ba)	89.78	60.00	200.00	1000
Cadmium, dissolved (µg/L as Cd)	1.11	0.00	3.00	10
Chromium, dissolved (µg/L as Cr)	4.57	0.00	20.00	50
Copper, dissolved (µg/L as Cu)	2.60	0.00	5.00	1000
Iron, dissolved (µg/L as Fe)	12.94	0.00	30.00	300
Lead, dissolved (µg/L as Pb)	1.29	0.00	7.00	50
Manganese, dissolved (µg/L as Mn)	10.43	2.00	30.00	50
Mercury, dissolved (µg/L as Hg)	0.27	0.00	0.70	2
Nickel, dissolved (µg/L as Ni)	1.87	0.00	7.00	*
Selenium, dissolved (µg/L as Se)	0.80	0.00	2.00	10
Silver, dissolved (µg/L as Ag)	0.25	0.00	2.00	50
Zinc, dissolved (µg/L as Zn)	8.97	0.00	20.00	5000
08158650 Colorado River below Austin, Texas, 1975-82				
Arsenic, dissolved (µg/L as As)	1.74	1.00	4.00	50
Barium, dissolved (µg/L as Ba)	92.46	50.00	300.00	1000
Cadmium, dissolved (µg/L as Cd)	0.81	0.00	3.00	10
Chromium, dissolved (µg/L as Cr)	4.19	0.00	20.00	50
Copper, dissolved (µg/L as Cu)	2.97	0.00	10.00	1000
Iron, dissolved (µg/L as Fe)	12.48	0.00	40.00	300
Lead, dissolved (µg/L as Pb)	2.84	0.00	22.00	50
Manganese, dissolved (µg/L as Mn)	15.65	3.00	90.00	50
Mercury, dissolved (µg/L as Hg)	0.26	0.00	0.70	2
Nickel, dissolved (µg/L as Ni)	1.00	0.00	3.00	*
Selenium, dissolved (µg/L as Se)	0.67	0.00	1.00	10
Silver, dissolved (µg/L as Ag)	0.17	0.00	1.00	50
Zinc, dissolved (µg/L as Zn)	8.65	0.00	20.00	5000
08162000 Colorado River at Wharton, Texas, 1973-82				
Arsenic, dissolved (µg/L as As)	2.24	1.00	4.00	50
Barium, dissolved (µg/L as Ba)	116.87	70.00	300.00	1000
Cadmium, dissolved (µg/L as Cd)	1.32	0.00	9.00	10
Chromium, dissolved (µg/L as Cr)	3.53	0.00	20.00	50
Copper, dissolved (µg/L as Cu)	2.53	0.00	7.00	1000
Iron, dissolved (µg/L as Fe)	16.08	4.00	90.00	300
Lead, dissolved (µg/L as Pb)	4.08	0.00	42.00	50
Manganese, dissolved (µg/L as Mn)	11.50	1.00	60.00	50
Mercury, dissolved (µg/L as Hg)	0.27	0.00	0.50	2
Nickel, dissolved (µg/L as Ni)	1.37	0.00	9.00	*
Selenium, dissolved (µg/L as Se)	0.80	0.00	1.00	10
Silver, dissolved (µg/L as Ag)	0.17	0.00	1.00	50
Zinc, dissolved (µg/L as Zn)	17.76	0.00	110.00	5000

* Limit not included in EPA drinking water standards.

of trace elements was evident, indicating a low level of contamination for the Colorado River basin. Only periodic concentrations of dissolved iron, chromium, and lead at the Concho River at Paint Rock station (08136500) and dissolved manganese at the Colorado River above Silver station (08123850), the Colorado River below Austin station (08158650) and the Colorado River at Wharton station (08162000), exceeded the U.S. Environmental Protection Agency (1977a) secondary drinking-water regulations. Each concentration of dissolved iron and dissolved manganese that exceeded secondary drinking-water regulations was an isolated incident and occurred in less than 4 percent of all samples analyzed. Maximum concentrations of iron and manganese at the Colorado River above Silver station (08123850) and the Colorado River at Wharton station (08162000) were associated with periods of high runoff.

These data indicate that conditions in the basin have not resulted in excessive concentrations of dissolved trace elements in water in the basin. However, few data are available on concentrations in bottom sediments and aquatic organisms in the Colorado River basin.

Pesticides

Pesticides are broad classes of toxicants used to control animal and plant pests. Pesticide residues are of concern because of their toxicity and potentially harmful effects to the environment.

Water samples for the determination of selected pesticides were collected from five sites in the Colorado River basin during the 1973-82 water-years. Twenty-six pesticide residues are routinely analyzed for at the selected stations. Among them are chlorinated hydrocarbons, organo phosphorus compounds, and chlorophenoxy herbicides. Analyses were performed on water-sediment mixtures (unfiltered samples) which were collected quarterly at most sites. The analytical results are summarized in table 16.

The use of any persistent chlorinated-hydrocarbon pesticide and other kinds of chemical pesticides in or around fresh water may produce a variety of acute and chronic effects on aquatic life. The safe limits of these pesticides in fresh water depend upon the types of organisms present and thus may vary from stream to stream. EPA recommended or maximum contaminant levels (where applicable) for the protection of aquatic life and drinking water are included in table 16.

All of the 26 compounds analyzed for were detected in trace amounts in at least 1 sample during the 1973-82 water years. The insecticide most widely found was diazinon. It was found at all five stations and ranged in concentration from 0.02 to 0.36 μg/L (microgram per liter). The herbicide most widely found was 2,4-D. It was found at all five stations and ranged in concentration from 0.04 to 0.21 μg/L. None of these concentrations exceeded applicable maximum contaminant levels. However, concentrations of chlordane, DDT, dieldrin, endrin, ethion, heptachlor, and lindane did exceed recommended maximum concentrations for aquatic life protection in at least one sample during the 1973-82 water years. These data indicate that the use of pesticides in the basin has not resulted in serious degradation of the quality of the water.

Table 16.--Statistical summary of pesticide data for selected stations in the Colorado River basin for the 1973-82 water years

[µg/L, microgram per liter; EPA, Enviromental Protection Agency]

Pesticide	Aldrin	Chlor-dane	DDD	DDE	DDT	Diazinon	Dieldrin	Endrin	Endosulfon	Ethion	Hepta-chlor
08123850 Colorado River above Silver, Texas											
Number of analyses	34	34	34	34	35	35	35	34	17	26	34
Number of occurrences /maximum concentration (µg/L)	0/.00	0/.00	0/.00	0/.00	0/.00	22/.25	0/.00	0/.00	0/.00	0/.00	0/.00
08136500 Concho River At Paint Rock, Texas											
Number of analyses	27	27	27	27	27	27	27	27	12	16	27
Number of occurrences /maximum concentration (µg/L)	0/.00	0/.00	0/.00	0/.00	0/.00	5/.02	0/.00	0/.00	0/.00	0/.00	0/.00
08147000 Colorado River near San Saba, Texas											
Number of analyses	30	30	30	30	30	30	30	30	8	21	30
Number of occurrences /maximum concentration (µg/L)	2/.01	3/.26	2/.01	2/.01	2/.01	4/.07	2/.01	2/.01	2/.01	2/.85	2/.01
08158650 Colorado River below Austin, Texas											
Number of analyses	22	22	22	22	22	22	22	21	14	20	22
Number of occurrences /maximum concentration (µg/L)	0/.00	0/.00	2/.01	1/.03	1/.03	16/.36	0/.00	0/.00	0/.00	0/.00	0/.00
08162000 Colorado River at Wharton, Texas											
Number of analyses	44	44	44	44	44	44	44	44	11	32	44
Number of occurrences /maximum concentration (µg/L)	2/.01	2/.10	2/.01	2/.01	2/.01	14/.06	2/.01	2/.01	2/.01	1/.01	2/.01
Maximum contaminant level (µg/L)	-	-	-	-	-	-	.2	.2	-	-	-
Recommended maximum concentration for aquatic life protection (EPA, 1976) (µg/L)	.003	.01			.001		.003	.004		.001	.001

Table 16.--Statistical summary of pesticide data for selected stations in the Colorado River basin for the 1973-82 water years--continued

Pesticide	Heptachlor epoxide	Lindane	Malathion	Methoxychlor	Methyl parathion	Methyl trithion	Mirex	Parathion	Toxophene	Trithion
08123850 Colorado River Above Silver, Texas										
Number of analyses	34	34	34	11	35	26	12	35	31	26
Number of occurrences /maximum concentration (µg/L)	0/.00	1/.01	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00
08136500 Concho River near Paint Rock, Texas										
Number of analyses	27	27	27	7	27	16	9	27	20	16
Number of occurrences /maximum concentration (µg/L)	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00
08147000 Colorado River near San Saba, Texas										
Number of analyses	30	30	30	12	30	21	6	30	25	21
Number of occurrences /maximum concentration (µg/L)	2/.01	2/.01	1/.01	2/.01	1/.01	1/.01	/.01	1/.01	2/1.0	1/.01
08158650 Colorado River below Austin, Texas										
Number of analyses	22	22	22	4	22	20	10	22	22	20
Number of occurrences /maximum concentration (µg/L)	0/.00	1/.02	2/.02	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00	0/.00
08162000 Colorado River at Wharton, Texas										
Number of analyses	44	44	44	22	44	32	8	44	37	32
Number of occurrences /maximum concentration (µg/L)	2/.01	2/.01	1/.01	2/.01	1/.01	1/.01	2/.01	2/.01	2/1.0	1/.01
Maximum contaminant level (µg/L)	-	4	-	100	-	-	-	-	5	-
Recommended maximum concentration for aquatic life protection (EPA, 1976) (µg/L)	-	.01	.1	-	-	-	.001	.04	-	-

Table 16.--Statistical summary of pesticide data for selected stations in the Colorado River basin for the 1973-82 water years--continued

Pesticide	2,4D	2,4,5T	Silvex	PCB	PCN
08123850 Colorado River above Silver, Texas					
Number of analyses	31	31	31	34	17
Number of occurrences /maximum concentration (µg/L)	14/.11	17/.31	0/.00	0/.00	0/.00
08136500 Concho River at Paint Rock, Texas					
Number of analyses	25	25	25	27	12
Number of occurrences /maximum concentration (µg/L)	7/.04	7/.08	0/.00	0/.00	0/.00
08147000 Colorado River near San Saba, Texas					
Number of analyses	21	21	21	30	10
Number of occurrences /maximum concentration (µg/L)	5/.20	2/.01	1/.01	2/.10	2/.10
08158650 Colorado River below Austin, Texas					
Number of analyses	20	20	20	22	16
Number of occurrences /maximum concentration (µg/L)	8/.21	6/.02	0/.00	0/.00	0/.00
08162000 Colorado River at Wharton, Texas					
Number of analyses	34	34	34	34	10
Number of occurrences /maximum concentration (µg/L)	9/.08	3/.01	2/.01	3/.10	2/.10
Maximum contaminant level (µg/L)	100	-	10	-	-
Recommended maximum concentration for aquatic life protection (EPA, 1976) (µg/L)	100	-	10	-	-

Note: PCB and PCN compounds are not pesticides but are commonly associated with pesticide analysis of water.

TRENDS IN WATER-QUALITY CONSTITUENTS

Detection of trends in water-quality constituents is complicated by fluctuations in discharge, seasonal variations, and sampling and analytical variability. Trends of only a few percent annually in constituent concentrations could easily be masked by any or all of these factors. The relationship of dissolved constituents to discharge (either inverse or proportional) causes fluctuations in discharge to be a particularly troublesome factor in trend detection.

Flow adjustment is an attempt to remove the effects of streamflow on water quality, which may be masking those variations attributable to changes in the constituent inputs to the stream or in the processes occurring in the stream. Smith and others (1982) describe the Seasonal Kendall Test, a method for flow adjustment and trend detection. Their approach is to develop a time series of flow adjusted concentrations (FAC) and to test that series for a trend. FAC is defined as the actual concentration (C) minus the predicted concentration (C') from the discharge (Q) constituent relationship. The FAC should be distributed randomly with a mean of zero over the period of record if no change in the processes that affect the water-quality constituent have occurred. The test which serves as the basis for trend detection in their study is Kendall's Tau (Kendall, 1975). The test is nonparametric, indicating that the magnitude of data is ignored in favor of the relative values of the data.

Water-quality constituents commonly exhibit seasonal variations in concentrations. Comparing, for example, a January value with a May value may not contribute any information about the existence of a trend, if a seasonal cycle exists. Thus, to compensate for seasonality, the Seasonal Kendall Test uses the Kendall Tau Test, but restricts the data comparison to those pairs of data which were collected within the same season. Because comparisons are made only between data from the same time period of the year, the problem of seasonality is avoided.

As a companion to the Seasonal Kendall Test, the Seasonal Kendall Slope Estimator (Crawford, Slack, and Hirsch, 1983) was developed to estimate the magnitude of trends detected via the Seasonal Kendall Test. The estimated magnitude is defined as the median of the differences (expressed as slopes) of the ordered pairs of data values, divided by the number of years separating the data points.

The process used to select a regression model and detect any trends for the constituents tested involved the following steps:

1. A regression of the data for each constituent and discharge at each station was performed using the following models:
    - a. $C' = a + b(Q)$ — linear
    - b. $C' = a + b(\log(Q))$ — log-linear
    - c. $C' = a + b(1/(1 + BQ))$ — hyperbolic

      The hyperbolic model involves many models, each a multiple of $10^{-0.5}$ of the previous model beginning with $B = 10^{-2.5}$ B* and ending with $B = 10^{1.5}$ B* (B* = the integer part of log (Q)).
    - d. $C' = a + b(1/Q)$ — inverse
    - e. $C' = a + b_1Q + b_2Q^2$ — quadratic
    - f. $\log(C') = a + b(\log(Q))$ — log-log
    - g. $\log(C') = a + b_1(\log(Q)) + b_2(\log(Q^2))$ — log-quadratic

2. The model that demonstrated the best fit to the relationship between the constituent and discharge was used to calculate the FAC used in the Seasonal Kendall procedure. The 'best fit' was based on the R-square and visual examination of plots of the residuals.
3. If all models indicated a poor fit, then the actual concentrations were used in the Seasonal Kendall procedure.
4. The output from the Seasonal Kendall procedure included a test statistic called the 'P level' which indicated the probability that a trend in actual or flow-adjusted did not exist. Only those trends that were significant at the 95-percent confidence level (P level < 0.05) are reported in this study.
5. The slope value output from the Seasonal Kendall Test was used to calculate the magnitude of the trend by one of the following methods:
    a. Linear models - the slope represents the change in concentration, in milligrams per liter per year, of a constituent due to factors other than discharge. The percent change per year was determined by dividing the slope by the mean concentration for the time period.
    b. Log models - the slope was converted to percent change per year as described by Crawford, Slack, and Hirsch (1983, p. 12-13). This value, multiplied by the mean concentration of a constituent for the time period, is the change in milligrams per liter per year in the constituent concentration due to factors other than discharge.

Table 17 shows the trends detected, in percent per year, in selected dissolved inorganic constituents at stations in the Colorado River basin. Figure 14 shows the same trends graphically, but of the average increase over the 10-year period, in milligrams per liter per year. Significant upward trends in dissolved inorganic constituents were detected at three stations in the upper section of the Colorado River basin. Dissolved solids increased an average of 270.6 mg/L/yr (milligrams per liter per year) or 4.1 percent/yr (percent per year) at the Colorado River at Colorado City station (08121000), 277.8 mg/L/yr (5.4 percent/yr) at the Beals Creek near Westbrook station (08123800), and 166.7 mg/L/yr (4.2 percent/yr) at the Colorado River above Silver station (08123850). Upward trends also were detected for calcium and sulfate at all three stations and for chloride and sodium at stations 08123800 and 08123850. The apparent lack of an upward trend in sodium and chloride at the Colorado River at Colorado City station (08121000) probably is due to the selected confidence level. A trend in the constituents very probably exists (based on the increase detected in dissolved solids), but is not reported because the P-level is not less than 0.05 and is, therefore, not in the 95-percent confidence interval. The reported P-level was 0.084 for chloride and 0.107 for sodium at the Colorado City station.

Several plausible explanations exist for the trends detected in this upper region of the basin. The State law that banned open-pit disposal of oil-field brines in 1969 has prevented additional pollution of the ground water caused by this practice. However, ground water may travel extremely slow and pockets of high-salinity ground water contaminated from open-pit disposal of the brine could continue to affect the surface water for a long time. Lack of a comprehensive ground-water sampling program in the area means that conclusive evidence to support this theory is unavailable. Other possible explanations involve the existence of hundreds of wells in the upper Colorado River basin in all stages of productivity. The following is an excerpt from the 1980 pub-

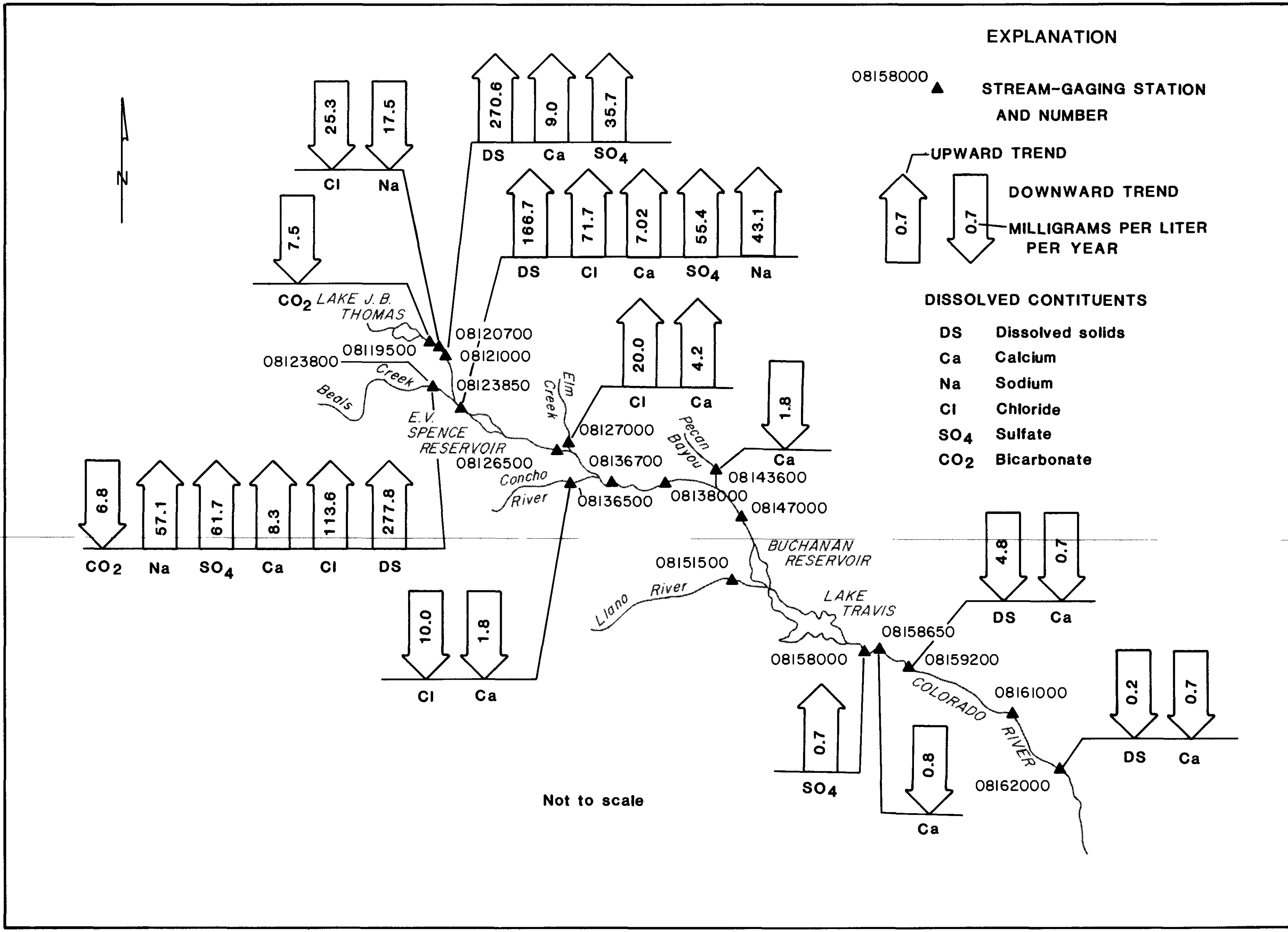

Figure 14.–Trends detected in dissolved constituents in the Colorado River basin

Table 17.--Trends detected in dissolved constituents at stations in the Colorado River basin for the 1973-82 water years

[Trends in percent per year]

Station	Station name	Dissolved solids	Chloride	Calcium	Sulfate	Sodium	Bicarbonate
08119500	Colorado River near Ira	--	--	--	--	--	-4.7
08120700	Colorado River near Cuthbert	--	-2.5	--	--	-2.6	--
08121000	Colorado River at Colorado City	+4.1	--	+3.7	+3.3	--	--
08123800	Beals Creek near Westbrook	+5.4	+5.5	+3.4	+5.0	+4.6	-3.7
08123850	Colorado River above Silver	+4.2	+4.9	+2.7	+5.2	+4.8	--
08126500	Colorado River at Ballinger	--	--	--	--	--	--
08127000	Elm Creek at Ballinger	--	+4.4	+3.6	--	--	--
08136500	Concho River at Paint Rock	--	-2.5	-1.4	--	--	--
08136700	Colorado River near Stacy	--	--	--	--	--	--
08138000	Colorado River at Winchell	--	--	--	--	--	--
08143600	Pecan Bayou near Mullin	--	--	-2.4	--	--	--
08147000	Colorado River near San Saba	--	--	--	--	--	--
08151500	Llano River at Llano	--	--	--	--	--	--
08158000	Colorado River at Austin	--	--	--	+2.1	--	--
08158650	Colorado River below Austin	--	--	-1.5	--	--	--
08159200	Colorado River at Bastrop	-1.5	--	-1.2	--	--	--
08161000	Colorado River at Columbus	--	--	--	--	--	--
08162000	Colorado River at Wharton	-0.7	--	-1.3	--	--	--

lication, "An investigation of sources of salt pollution in the upper Colorado River basin, Texas" by the U.S. Army Corps of Engineers.

> "There are documented cases of salt water pollution of the ground water and streams in the study area due to poor oil well completion and plugging techniques and unlawful brine disposal methods. Undoubtedly, oil well drillers, developers, and producers are still contributing to the salt pollution problem. Overflowing sludge pits and leaking wells and transmission lines were all observed during the field investigations made for this study. Additionally, springs emitting high sodium chloride water with water patterns almost identical to those of deep Triassic waters and Permian brines were noted in areas where water flooding is used. Given an area the size of the Sharon Ridge oilfield with many independent producers operating on a low profit margin, and considering the geologic and hydrologic setting of the area (shallow producing zones with considerable quantities of brine produced with the oil) and the increased production demands on the field, it is logical to assume some pollution will continue unabated."

Trends detected for all other dissolved constituents in the Colorado River basin were generally less than 5 mg/L/yr and included both positive and negative trends.

The trends detected in nutrients in the Colorado River basin are shown in table 18. A general uptrend in total nitrogen and organic nitrogen throughout the basin was detected, but comparison of the trends from each station could be misleading due to the variation in sample collection periods at each station (table 2). The uptrends detected in several nutrient species at Concho River at Paint Rock station (08136500), Colorado River near San Saba station (08147000), and Colorado River below Austin station (08158650) may be attributed to the fact that substantial amounts of municipal wastewater are returned near these stations. These areas would be prime candidates for further study.

NETWORK EVALUATION AND ADDITIONAL STUDIES NEEDED

Continued municipal and industrial growth in the Colorado River basin will increase waste disposal burdens of the stream system and will require continuous effort by water users and planners to keep deterioration of water quality at a minimum. Although many years of data have been collected, there is a need to continually evaluate the effectiveness of the water-quality data-collection program. There is a need to monitor changes in population and land use and to adjust the water-quality data-collection program to monitor these changes. The present water-quality data-collection program is adequate in most respects and the data are good and reliable. This report, however, has already pointed to the need for further investigations in the basin.

Trend analysis of dissolved constituents show that upward trends exist for several constituents in the upper Colorado River basin, but not enough data are available to define the causes. A comprehensive ground-water monitoring program in the upper basin is needed to detect areas of high salinity and locate the sources of saline pollution.

Table 18.--Yearly trends detected in nutrients and biochemical oxygen demand at stations in the Colorado River basin for the 1973-82 water years

[Percent/yr, percent per year; mg/L/yr, milligrams per liter per year]

Station	Ammonia	Organic nitrogen		Total nitrogen		Nitrite + nitrate		Phosphate		Biochemical oxygen demand	
		Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr
08136500 Concho River at Paint Rock	--	+7.0	+0.07	+8.9	+0.58	+10.8	+0.60	--	--	-6.4	-0.21
08147000 Colorado River near San Saba	--	+6.0	+.05	+8.2	+.13	--	--	+20.0	+.02	--	--
08158000 Colorado River at Austin	--	+9.0	+.04	+5.6	+.04	--	--	--	--	--	--
08158650 Colorado River below Austin	--	+6.0	+.05	+6.1	+.14	+3.8	+.03	--	--	--	--
08159200 Colorado River at Bastrop	--	--	--	--	--	--	--	--	--	--	--
08161000 Colorado River at Columbus	--	--	--	--	--	--	--	--	--	--	--
08162000 Colorado River at Wharton	--	+10.3	+.07	+5.7	+.07	--	--	--	--	--	--

A comprehensive water-quality data-collection program in the highland lakes is needed to provide the data necessary for detecting changes in the reservoirs due to increasing growth in this area. Municipal and industrial growth around the highland lakes will continue and will, inevitably, affect the quality of the water.

Nutrient data in the Colorado River basin showed a small, general upward trend in organic and total nitrogen. Continued monitoring of nutrients in the basin is needed to detect continuing trends. Expansion of the nutrient-sampling program in the basin will be necessary to better define areal distribution of nutrient trends.

SUMMARY OF CONCLUSIONS

The Colorado River basin has three physical sections that are separated by reservoirs. Streamflow in the mainstem Colorado River ranged from no flow in the upper basin to 64,000 ft^3/s in the lower basin. Difference in streamflow characteristics from the upper to lower basin and retention and regulation of streamflow by reservoirs on the Colorado River are major influences on the water quality in the basin.

The composition of dissolved constituents in the Colorado River basin changes from predominantly sodium and chloride ions in the upper basin to predominantly calcium and bicarbonate ions in the lower basin. Mean concentrations of total dissolved solids ranged from 113 to 34,800 mg/L in the upper section of the basin. The EPA secondary drinking-water regulations of 500 mg/L for total dissolved solids was exceeded 95 percent of the time at each station on the mainstem Colorado River in the upper basin. The mean concentration of total dissolved solids ranged from 500 to 1,400 mg/L in the middle Colorado River basin. The EPA secondary drinking-water regulation was exceeded approximately 95 percent of the time at all stations except the Colorado River near San Saba station (08147000), where concentrations of dissolved solids exceeded the EPA standard only 50 percent of the time. The mean concentration of dissolved solids was consistently around 300 mg/L throughout the lower basin and showed no evidence of exceeding the EPA level of 500 mg/L.

Significant upward trends in dissolved-solid concentrations were detected at three stations in the upper basin. At two stations, the increases exceeded an average of 270 mg/L/yr. Although the data are not comprehensive enough to determine the source, oil-field activities in the area are the prime suspect.

Nutrient concentrations in the Colorado River basin generally were low. The EPA has a maximum contaminant level of nitrate nitrogen of 10 mg/L. Only one sample exceeded the level set for nitrate nitrogen during the period of study. A general upward trend was detected in organic nitrogen and total nitrogen, but, during the period of study, the concentrations remained low.

Mean water temperatures in the basin ranged from 19.0 to 21.0°C. The mean concentration of dissolved oxygen for each station in the Colorado River basin was above the 5.0 mg/L level recommended as a minimum by the EPA and, for most stations, the minimum concentration detected during the study period was above 5.0 mg/L. No significant differences in the physical characteristics of the water from the three sections of the basin was evident.

BOD concentrations ranged from 0.00 to 34.0 mg/L for the period of study. Only one mean BOD concentration was out of the range of 1 to 8 mg/L common for moderately contaminated streams. The Beals Creek near Westbrook station (08123800) had a mean BOD concentration of 8.6 mg/L.

Densities of bacteria ranged from less than 1 to 26,000 cols./100 mL and averaged about 530 cols./100 mL for fecal coliform and ranged from less than 1 to 50,000 cols./100 mL and averaged 1,090 cols./100 mL for fecal streptococci during the period of study. Fecal-coliform densities exceeded EPA criteria for public supply water at several stations during the study.

Trace elements were detected in the Colorado River basin, but in small concentrations. No pattern of increasing or decreasing concentrations was evident, and maximum contaminant levels rarely were exceeded.

The 26 pesticide compounds analyzed for were detected in trace quantities in the basin. Diazinon was the insecticide found most often, and 2,4-D was the herbicide found most often. However, no concentrations exceeded maximum contaminant levels set by the EPA.

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SUPPLEMENTAL INFORMATION

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas

[DEG C, degree Celsius; UMHOS, micromhos; MG/L, milligram per liter; AC-FT, acre-foot CFS, cubic foot per second; JTU, Jackson turbidity unit; FTU, Formazin turbidity unit]

STATION NUMBER: 08118000 STATION NAME: LAKE J. B. THOMAS NEAR VINCENT, TEXAS

LATITUDE: 323509 LONGITUDE: 1011218 COUNTY: BORDEN DRAINAGE AREA: 3389.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO NOV 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	8	28.00	5.00	14.56	28.00	23.00	13.25	6.25	5.00
SPECIFIC CONDUCTANCE (UMHOS)	10	666.00	385.00	528.40	666.00	641.50	524.00	444.75	385.00
PH (UNITS)	6	8.20	7.30		8.20	8.20	7.95	7.67	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	14.00	1.80	4.77	14.00	7.10	2.95	2.03	1.80
ALKALINITY FIELD (MG/L AS CACO3)	10	197.00	120.00	152.50	197.00	163.00	153.50	137.75	120.00
BICARBONATE FET-FLD (MG/L AS HCO3)	8	240.00	156.00	189.62	240.00	205.25	187.00	172.50	156.00
CARBONATE FET-FLD (MG/L AS CO3)	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	10	160.00	100.00	121.00	160.00	140.00	115.00	107.50	100.00
HARDNESS, NONCARBONATE (MG/L CACO3)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	10	46.00	30.00	35.10	46.00	37.50	34.00	31.00	30.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	10	12.00	5.40	8.19	12.00	9.88	7.95	6.35	5.40
SODIUM, DISSOLVED (MG/L AS NA)	9	93.00	41.00	64.44	93.00	81.00	62.00	46.00	41.00
SODIUM ADSORPTION RATIO	10	3.90	1.90	2.59	3.90	3.30	2.25	2.12	1.90
PERCENT SODIUM	10	62.00	46.00	51.10	62.00	56.50	48.50	46.75	46.00
POTASSIUM, DISSOLVED (MG/L AS K)	9	8.70	4.90	6.00	8.70	6.40	5.60	5.20	4.90
CHLORIDE, DISSOLVED (MG/L AS CL)	10	61.00	22.00	39.80	61.00	51.75	37.00	28.50	22.00
SULFATE DISSOLVED (MG/L AS SO4)	10	89.00	35.00	54.60	89.00	67.25	49.00	41.50	35.00
FLUORIDE, DISSOLVED (MG/L AS F)	10	1.00	0.40	0.71	1.00	0.85	0.70	0.57	0.40
SILICA, DISSOLVED (MG/L AS SIO2)	10	8.10	1.80	5.71	8.10	7.73	6.10	3.80	1.80
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	10	390.00	225.00	304.80	390.00	374.25	298.50	251.75	225.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	10	0.53	0.31	0.42	0.53	0.51	0.41	0.34	0.31

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08118500 STATION NAME: BULL CREEK NEAR IRA, TEXAS

LATITUDE: 323600 LONGITUDE: 1010538 COUNTY: SCURRY DRAINAGE AREA: 26.30 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM FEB 1975 TO MAR 1978

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	24.50	3.50	10.91	24.50	12.50	8.50	5.50	3.50
STREAMFLOW, INSTANTANEOUS (CFS)	13	0.16	0.00	0.05	0.16	0.06	0.04	0.02	0.00
SPECIFIC CONDUCTANCE (UMHOS)	11	8600.00	1970.00	804.55	8600.00	7360.00	6080.00	5220.00	1970.00
PH (UNITS)	11	7.80	7.30		7.80	7.80	7.70	7.60	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	11	11.00	4.40	8.20	11.00	10.00	8.80	5.90	4.40
ALKALINITY FIELD (MG/L AS CACO3)	11	292.00	118.00	208.82	292.00	269.00	213.00	144.00	118.00
BICARBONATE FET-FLD (MG/L AS HCO3)	11	356.00	144.00	254.73	356.00	328.00	260.00	176.00	144.00
CARBONATE FET-FLD (MG/L AS CO3)	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
~~HARDNESS (MG/L AS CACO3)~~	~~11~~	~~1500.00~~	~~370.00~~	~~1185.45~~	~~1500.00~~	~~1400.00~~	~~1400.00~~	~~1200.00~~	~~370.00~~
HARDNESS, NONCARBONATE (MG/L CACO3)	11	1300.00	248.00	965.00	1300.00	1160.00	1140.00	862.00	248.00
CALCIUM DISSOLVED (MG/L AS CA)	11	350.00	100.00	281.82	350.00	350.00	300.00	270.00	100.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	11	150.00	28.00	113.55	150.00	150.00	120.00	110.00	28.00
SODIUM, DISSOLVED (MG/L AS NA)	11	1400.00	250.00	815.45	1400.00	1100.00	850.00	680.00	250.00
SODIUM ADSORPTION RATIO	11	17.00	5.90	10.45	17.00	13.00	10.00	8.70	5.90
PERCENT SODIUM	11	69.00	53.00	59.27	69.00	61.00	58.00	57.00	53.00
POTASSIUM, DISSOLVED (MG/L AS K)	11	10.00	5.80	7.35	10.00	7.50	7.20	6.40	5.80
CHLORIDE, DISSOLVED (MG/L AS CL)	11	2600.00	480.00	1551.82	2600.00	1900.00	1600.00	1300.00	480.00
SULFATE DISSOLVED (MG/L AS SO4)	11	710.00	140.00	530.90	710.00	690.00	590.00	480.00	140.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.60	0.20	0.33	0.60	0.45	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	11	4.40	0.10	1.81	4.40	2.70	1.80	0.90	0.10
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	11	5170.00	1080.00	3427.27	5170.00	4080.00	3720.00	3030.00	1080.00
SOLIDS, DISSOLVED (TONS PER DAY)	11	2.20	0.08	0.60	2.20	0.62	0.42	0.19	0.08
SOLIDS, DISSOLVED (TONS PER AC-FT)	11	7.00	1.50	4.66	7.00	5.60	5.10	4.10	1.50

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08119000 STATION NAME: BLUFF CREEK NEAR IRA, TEXAS

LATITUDE: 323529 LONGITUDE: 1010302 COUNTY: SCURRY DRAINAGE AREA: 42.60 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM FEB 1975 TO MAR 1978

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	22.00	5.00	11.27	22.00	13.50	10.00	7.00	5.00
STREAMFLOW, INSTANTANEOUS (CFS)	13	0.35	0.00	0.15	0.35	0.17	0.15	0.10	0.00
SPECIFIC CONDUCTANCE (UMHOS)	11	3200.00	1590.00	728.18	3200.00	3080.00	2740.00	2640.00	590.00
PH (UNITS)	11	8.10	7.70		8.10	8.00	7.90	7.90	7.70
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	11	6.00	4.00	4.71	6.00	5.00	4.70	4.10	4.00
ALKALINITY FIELD (MG/L AS CACO3)	11	266.00	128.00	203.64	266.00	221.00	207.00	180.00	128.00
BICARBONATE FET-FLD (MG/L AS HCO3)	11	324.00	156.00	248.36	324.00	270.00	252.00	220.00	156.00
CARBONATE FET-FLD (MG/L AS CO3)	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	11	980.00	500.00	865.45	980.00	930.00	920.00	860.00	500.00
HARDNESS, NONCARBONATE (MG/L CACO3)	11	781.00	344.00	662.36	781.00	754.00	704.00	638.00	344.00
CALCIUM DISSOLVED (MG/L AS CA)	11	250.00	130.00	220.91	250.00	230.00	230.00	220.00	130.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	11	98.00	42.00	76.09	98.00	87.00	80.00	74.00	42.00
SODIUM, DISSOLVED (MG/L AS NA)	11	340.00	150.00	285.00	340.00	340.00	280.00	240.00	150.00
SODIUM ADSORPTION RATIO	11	5.10	3.00	4.35	5.10	5.00	4.30	3.90	3.00
PERCENT SODIUM	11	45.00	36.00	41.36	45.00	44.00	41.00	39.00	36.00
POTASSIUM, DISSOLVED (MG/L AS K)	11	5.50	4.30	4.93	5.50	5.40	4.80	4.50	4.30
CHLORIDE, DISSOLVED (MG/L AS CL)	11	570.00	190.00	421.82	570.00	530.00	380.00	370.00	190.00
SULFATE DISSOLVED (MG/L AS SO4)	11	770.00	380.00	659.09	770.00	730.00	680.00	640.00	380.00
FLUORIDE, DISSOLVED (MG/L AS F)	7	0.70	0.40	0.59	0.70	0.70	0.60	0.50	0.40
SILICA, DISSOLVED (MG/L AS SIO2)	11	9.00	1.20	5.35	9.00	8.40	5.80	2.70	1.20
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	11	2100.00	997.00	1795.18	2100.00	2010.00	1880.00	1760.00	997.00
SOLIDS, DISSOLVED (TONS PER DAY)	11	1.70	0.30	0.86	1.70	1.10	0.80	0.67	0.30
SOLIDS, DISSOLVED (TONS PER AC-FT)	11	2.90	1.40	2.45	2.90	2.70	2.60	2.40	1.40

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08119500 STATION NAME: COLORADO RIVER NEAR IRA, TEXAS

LATITUDE: 323218 LONGITUDE: 1010312 COUNTY: SCURRY DRAINAGE AREA: 3483.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM NOV 1974 TO SEPT 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	65	33.00	0.00	16.05	30.00	22.00	16.50	9.50	2.30
STREAMFLOW, INSTANTANEOUS (CFS)	65	7480.00	0.01	176.73	497.10	3.90	0.48	0.21	0.04
SPECIFIC CONDUCTANCE (UMHOS)	63	50900.00	295.00	16399.41	35259.98	22900.00	17300.00	6990.00	784.40
PH (UNITS)	30	8.10	7.20		8.10	7.90	7.80	7.47	7.31
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	30	12.91	1.51	6.03	12.42	7.37	5.38	4.00	1.94
ALKALINITY FIELD (MG/L AS CACO3)	63	350.00	57.00	135.48	198.00	164.00	131.00	98.00	75.80
BICARBONATE FET-FLD (MG/L AS HCO3)	52	244.00	70.00	158.60	230.00	198.75	160.00	115.50	85.75
CARBONATE FET-FLD (MG/L AS CO3)	52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	63	3612.45	101.88	1310.74	2521.41	1823.78	1525.44	634.27	163.72
HARDNESS, NONCARBONATE (MG/L CACO3)	63	3502.45	7.88	1175.26	2380.21	1641.25	1352.64	487.76	68.92
CALCIUM DISSOLVED (MG/L AS CA)	63	820.00	37.00	310.03	572.00	420.00	360.00	160.00	46.80
MAGNESIUM, DISSOLVED (MG/L AS MG)	63	380.00	2.30	130.29	266.00	190.00	150.00	57.00	5.40
SODIUM, DISSOLVED (MG/L AS NA)	63	12000.00	25.00	3468.25	7580.00	5000.00	3600.00	1300.00	90.40
SODIUM ADSORPTION RATIO	63	89.47	1.10	38.72	71.23	54.23	41.16	22.89	3.13
PERCENT SODIUM	63	88.29	30.88	80.39	87.92	85.89	84.09	79.17	52.49
POTASSIUM, DISSOLVED (MG/L AS K)	63	34.00	4.20	13.94	30.20	17.00	13.00	9.00	4.40
CHLORIDE, DISSOLVED (MG/L AS CL)	63	18000.00	35.00	5378.81	12000.00	7700.00	5700.00	2100.00	164.00
SULFATE DISSOLVED (MG/L AS SO4)	63	3500.00	14.00	1149.08	2540.00	1700.00	1300.00	380.00	47.00
FLUORIDE, DISSOLVED (MG/L AS F)	45	1.20	0.20	0.48	0.97	0.60	0.40	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	63	14.00	0.90	5.22	10.00	7.60	4.80	2.50	1.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	63	34800.31	181.35	10537.19	22392.64	15037.43	11346.69	4017.78	430.02
SOLIDS, DISSOLVED (TONS PER DAY)	63	4370.49	0.30	136.50	656.84	33.40	16.15	6.73	1.67
SOLIDS, DISSOLVED (TONS PER AC-FT)	63	47.33	0.25	14.33	30.45	20.45	15.43	5.46	0.58

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08120500 STATION NAME: DEEP CREEK NEAR DUNN, TEXAS

LATITUDE: 323425 LONGITUDE: 1005427 COUNTY: SCURRY DRAINAGE AREA: 198.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM MAY 1973 TO MAR 1978

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	7	16.00	5.50	11.36	16.00	14.50	12.00	6.00	5.50
STREAMFLOW, INSTANTANEOUS (CFS)	7	2.30	0.79	1.73	2.30	2.30	1.70	1.50	0.79
SPECIFIC CONDUCTANCE (UMHOS)	8	1720.00	858.00	1434.75	1720.00	1557.50	1480.00	1402.50	858.00
PH (UNITS)	8	8.00	7.40		8.00	7.90	7.80	7.50	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	8	21.00	3.40	10.88	21.00	15.00	8.75	7.48	3.40
ALKALINITY FIELD (MG/L AS CACO3)	8	344.00	177.00	267.50	344.00	310.00	264.50	240.00	177.00
BICARBONATE FET-FLD (MG/L AS HCO3)	8	420.00	216.00	326.00	420.00	378.00	322.00	292.00	216.00
CARBONATE FET-FLD (MG/L AS CO3)	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	8	420.00	240.00	351.25	420.00	387.50	365.00	322.50	240.00
HARDNESS, NONCARBONATE (MG/L CACO3)	8	142.00	22.00	82.38	142.00	127.00	76.00	45.75	22.00
CALCIUM DISSOLVED (MG/L AS CA)	8	120.00	70.00	99.12	120.00	110.00	100.00	90.25	70.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	8	30.00	15.00	24.75	30.00	27.75	26.00	23.00	15.00
SODIUM, DISSOLVED (MG/L AS NA)	7	210.00	88.00	171.14	210.00	200.00	190.00	150.00	88.00
SODIUM ADSORPTION RATIO	8	5.10	2.60	4.06	5.10	4.58	4.20	3.62	2.60
PERCENT SODIUM	7	57.00	44.00	50.57	57.00	53.00	51.00	48.00	44.00
POTASSIUM, DISSOLVED (MG/L AS K)	7	14.00	7.90	10.69	14.00	13.00	10.00	9.10	7.90
CHLORIDE, DISSOLVED (MG/L AS CL)	8	230.00	99.00	179.87	230.00	190.00	190.00	172.50	99.00
SULFATE DISSOLVED (MG/L AS SO4)	8	250.00	110.00	192.50	250.00	217.50	190.00	182.50	110.00
FLUORIDE, DISSOLVED (MG/L AS F)	5	1.90	0.70	1.20	1.90	1.85	0.80	0.75	0.70
SILICA, DISSOLVED (MG/L AS SIO2)	8	22.00	9.00	14.25	22.00	18.75	13.00	9.50	9.00
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	8	1060.00	506.00	853.25	1060.00	922.00	891.50	803.25	506.00
SOLIDS, DISSOLVED (TONS PER DAY)	7	5.80	1.90	4.00	5.80	5.40	4.10	2.00	1.90
SOLIDS, DISSOLVED (TONS PER AC-FT)	8	1.40	0.69	1.16	1.40	1.28	1.20	1.13	0.69

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08120700 STATION NAME: COLORADO RIVER NEAR CUTHBERT, TEXAS

LATITUDE: 322838 LONGITUDE: 1005658 COUNTY: MITCHELL DRAINAGE AREA: 3912.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS: SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN: 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	94	34.00	0.00	16.89	30.12	24.00	17.00	9.00	4.38
STREAMFLOW, INSTANTANEOUS (CFS)	94	5700.00	0.02	157.69	545.48	13.00	5.07	2.29	0.53
SPECIFIC CONDUCTANCE (UMHOS)	89	11400.00	257.00	4305.48	7359.99	5755.00	4410.00	2905.00	690.50
PH (UNITS)	60	8.50	6.90		8.30	8.10	7.90	7.60	7.21
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	60	25.27	1.74	6.56	21.23	7.45	5.01	3.50	1.94
ALKALINITY FIELD (MG/L AS CACO3)	89	328.00	59.00	198.43	303.00	264.50	207.00	127.00	92.00
BICARBONATE FET-FLD (MG/L AS HCO3)	80	400.00	72.00	238.74	367.70	318.00	250.00	154.50	112.00
CARBONATE FET-FLD (MG/L AS CO3)	80	11.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	10	1.30	0.20	0.73	1.30	1.05	0.70	0.45	0.20
HARDNESS (MG/L AS CACO3)	89	1450.52	107.64	716.10	1217.64	975.57	754.21	452.03	144.76
HARDNESS, NONCARBONATE (MG/L CACO3)	89	1215.59	14.25	517.67	998.08	720.76	529.36	285.66	44.26
CALCIUM DISSOLVED (MG/L AS CA)	89	350.00	37.00	168.83	270.00	220.00	180.00	120.00	45.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	89	140.00	3.00	71.52	140.00	110.00	74.00	37.50	7.50
SODIUM, DISSOLVED (MG/L AS NA)	80	2000.00	13.00	673.40	1200.00	920.00	700.00	427.50	80.15
SODIUM ADSORPTION RATIO	89	23.58	0.56	10.84	18.96	13.14	11.26	8.93	3.13
PERCENT SODIUM	80	77.89	19.18	64.11	75.33	68.09	65.10	62.80	50.05
POTASSIUM, DISSOLVED (MG/L AS K)	80	15.00	2.20	9.32	14.90	11.00	9.50	7.60	5.02
CHLORIDE, DISSOLVED (MG/L AS CL)	89	3200.00	33.00	1011.37	1900.00	1400.00	960.00	680.00	120.00
SULFATE DISSOLVED (MG/L AS SO4)	89	1200.00	16.00	560.85	1000.00	830.00	570.00	335.00	58.00
FLUORIDE, DISSOLVED (MG/L AS F)	56	1.40	0.20	0.67	1.30	0.90	0.60	0.40	0.29
SILICA, DISSOLVED (MG/L AS SIO2)	89	13.00	0.00	5.66	11.00	8.00	5.80	2.70	0.55
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	89	6825.60	179.06	2623.80	4578.44	3532.19	2713.88	1686.41	380.87
SOLIDS, DISSOLVED (TONS PER DAY)	89	3267.93	0.14	182.08	1331.78	90.90	38.36	15.84	4.26
SOLIDS, DISSOLVED (TONS PER AC-FT)	89	9.28	0.24	3.57	6.23	4.80	3.69	2.29	0.52

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08121000 STATION NAME: COLORADO RIVER AT COLORADO CITY, TEXAS

LATITUDE: 322333 LONGITUDE: 1005242 COUNTY: MITCHELL DRAINAGE AREA: 3966.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	101	36.00	1.00	17.93	33.90	24.00	19.00	11.00	4.10
STREAMFLOW, INSTANTANEOUS (CFS)	106	10400.00	0.01	224.73	1276.50	11.25	0.47	0.21	0.06
SPECIFIC CONDUCTANCE (UMHOS)	98	33000.00	195.00	10322.97	25415.00	14050.00	8330.00	4659.99	794.50
PH (UNITS)	59	8.40	7.10		8.20	7.90	7.70	7.50	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	59	24.37	1.47	8.29	17.59	11.36	7.45	3.35	1.97
ALKALINITY FIELD (MG/L AS CACO3)	98	340.00	58.00	175.13	280.00	227.00	180.00	115.00	77.55
BICARBONATE FET-FLD (MG/L AS HCO3)	84	364.00	71.00	203.63	323.00	267.50	210.00	140.00	87.50
CARBONATE FET-FLD (MG/L AS CO3)	84	4.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	8	1.00	0.08	0.41	1.00	0.50	0.35	0.22	0.08
HARDNESS (MG/L AS CACO3)	98	2626.31	64.83	1101.67	2280.52	1559.69	1050.08	512.96	174.23
HARDNESS, NONCARBONATE (MG/L CACO3)	98	2406.31	3.83	926.54	2130.07	1376.92	902.16	388.26	77.70
CALCIUM DISSOLVED (MG/L AS CA)	98	590.00	22.00	243.26	501.00	330.00	230.00	130.00	56.65
MAGNESIUM, DISSOLVED (MG/L AS MG)	98	320.00	2.40	120.02	250.00	180.00	120.00	47.25	7.96
SODIUM, DISSOLVED (MG/L AS NA)	88	7000.00	13.00	2059.60	5500.00	2700.00	1600.00	842.50	88.95
SODIUM ADSORPTION RATIO	95	62.33	0.73	23.86	53.21	30.54	20.97	14.17	2.90
PERCENT SODIUM	88	85.81	29.27	74.55	84.63	82.12	77.26	71.70	46.13
POTASSIUM, DISSOLVED (MG/L AS K)	88	98.00	2.80	12.60	22.55	13.00	11.00	8.28	5.45
CHLORIDE, DISSOLVED (MG/L AS CL)	98	10000.00	15.00	3010.00	8239.99	3725.00	2250.00	1175.00	138.00
SULFATE DISSOLVED (MG/L AS SO4)	98	2800.00	16.00	1083.25	2305.00	1600.00	1100.00	425.00	63.60
FLUORIDE, DISSOLVED (MG/L AS F)	58	1.00	0.20	0.58	0.90	0.73	0.60	0.40	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	98	14.00	0.20	4.61	10.00	6.83	4.20	1.87	0.89
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	98	20831.44	113.59	6600.02	16871.55	8825.75	5258.27	2691.51	435.29
SOLIDS, DISSOLVED (TONS PER DAY)	98	3189.49	0.11	183.54	1532.31	84.79	10.95	4.39	1.23
SOLIDS, DISSOLVED (TONS PER AC-FT)	98	28.33	0.15	8.98	22.95	12.00	7.15	3.66	0.59

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08123000 STATION NAME: LAKE COLORADO CITY NEAR COLORADO CITY, TEXAS

LATITUDE: 321908 LONGITUDE: 1005502 COUNTY: MITCHELL DRAINAGE AREA: 340.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO NOV 1981

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	26.00	5.00	14.23	26.00	19.00	13.00	10.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	11	3120.00	900.00	2006.36	3120.00	2890.00	1970.00	1190.00	900.00
PH (UNITS)	7	8.30	7.40		8.30	8.10	8.00	7.60	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	7	9.10	1.40	4.14	9.10	6.10	2.60	2.00	1.40
ALKALINITY FIELD (MG/L AS CACO3)	11	150.00	92.00	133.82	150.00	148.00	139.00	125.00	92.00
BICARBONATE FET-FLD (MG/L AS HCO3)	9	180.00	144.00	166.56	180.00	180.00	170.00	155.50	144.00
CARBONATE FET-FLD (MG/L AS CO3)	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	11	740.00	230.00	487.27	740.00	700.00	450.00	310.00	230.00
HARDNESS, NONCARBONATE (MG/L CACO3)	11	598.00	134.00	352.36	598.00	552.00	313.00	189.00	134.00
CALCIUM DISSOLVED (MG/L AS CA)	11	140.00	51.00	95.73	140.00	130.00	90.00	71.00	51.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	11	98.00	24.00	59.91	98.00	92.00	54.00	32.00	24.00
SODIUM, DISSOLVED (MG/L AS NA)	11	400.00	96.00	246.00	400.00	390.00	230.00	120.00	96.00
SODIUM ADSORPTION RATIO	11	6.70	2.90	4.81	6.70	6.40	4.90	3.10	2.90
PERCENT SODIUM	11	54.00	45.00	49.91	54.00	53.00	51.00	46.00	45.00
POTASSIUM, DISSOLVED (MG/L AS K)	11	27.00	4.60	17.78	27.00	26.00	18.00	13.00	4.60
CHLORIDE, DISSOLVED (MG/L AS CL)	10	520.00	110.00	295.00	520.00	462.50	235.00	145.00	110.00
SULFATE DISSOLVED (MG/L AS SO4)	10	850.00	190.00	485.00	850.00	730.00	405.00	265.00	190.00
FLUORIDE, DISSOLVED (MG/L AS F)	10	1.10	0.30	0.81	1.10	1.10	0.85	0.55	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	10	8.40	3.40	5.46	8.40	6.83	5.35	3.77	3.40
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	10	2050.00	539.00	1283.10	2050.00	1947.50	1074.00	716.00	539.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	10	2.80	0.73	1.75	2.80	2.63	1.45	0.97	0.73

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08123600 STATION NAME: CHAMPION CREEK RESERVOIR NEAR COLORADO CITY, TEXAS

LATITUDE: 321653 LONGITUDE: 1005130 COUNTY: MITCHELL DRAINAGE AREA: 207.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS: SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN: 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	10	27.00	5.00	14.80	27.00	20.25	13.75	10.25	5.00
SPECIFIC CONDUCTANCE (UMHOS)	10	1420.00	492.00	933.70	1420.00	1107.50	978.00	678.75	492.00
PH (UNITS)	6	8.20	7.80		8.20	8.12	8.05	7.80	7.80
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	4.30	1.70	2.77	4.30	3.93	2.40	1.93	1.70
ALKALINITY FIELD (MG/L AS CACO3)	10	156.00	95.00	131.10	156.00	139.50	134.50	122.25	95.00
BICARBONATE FET-FLD (MG/L AS HCO3)	8	190.00	150.00	167.00	190.00	171.50	168.50	157.75	150.00
CARBONATE FET-FLD (MG/L AS CO3)	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	10	520.00	180.00	342.00	520.00	405.00	365.00	252.50	180.00
HARDNESS, NONCARBONATE (MG/L CACO3)	10	362.00	84.00	208.90	362.00	268.25	222.50	129.50	84.00
CALCIUM DISSOLVED (MG/L AS CA)	10	110.00	47.00	76.80	110.00	86.75	80.00	64.00	47.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	10	59.00	15.00	35.90	59.00	46.00	38.00	22.25	15.00
SODIUM, DISSOLVED (MG/L AS NA)	10	120.00	27.00	64.20	120.00	83.50	62.00	40.50	27.00
SODIUM ADSORPTION RATIO	10	2.40	0.90	1.52	2.40	1.83	1.45	1.23	0.90
PERCENT SODIUM	10	33.00	22.00	27.60	33.00	30.25	28.00	24.75	22.00
POTASSIUM, DISSOLVED (MG/L AS K)	10	12.00	5.70	8.96	12.00	9.80	9.20	7.88	5.70
CHLORIDE, DISSOLVED (MG/L AS CL)	10	120.00	34.00	70.80	120.00	88.75	72.00	49.25	34.00
SULFATE DISSOLVED (MG/L AS SO4)	10	440.00	110.00	246.00	440.00	305.00	265.00	152.50	110.00
FLUORIDE, DISSOLVED (MG/L AS F)	9	0.70	0.30	0.51	0.70	0.65	0.50	0.35	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	10	5.10	0.30	2.65	5.10	4.15	2.35	1.45	0.30
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	10	960.00	296.00	584.50	960.00	702.00	617.50	406.50	296.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	10	1.30	0.40	0.79	1.30	0.95	0.84	0.55	0.40

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08123800 STATION NAME: BEALS CREEK NEAR WESTBROOK, TEXAS

LATITUDE: 321157 LONGITUDE: 1010049 COUNTY: MITCHELL DRAINAGE AREA: 9802.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	101	34.00	1.00	19.05	30.95	25.75	20.00	12.00	4.00
STREAMFLOW, INSTANTANEOUS (CFS)	105	5920.00	0.01	114.82	204.40	8.00	4.60	2.45	0.48
TURBIDITY (JTU)	37	2999.99	3.00	142.68	1109.98	57.50	25.00	10.00	3.90
SPECIFIC CONDUCTANCE (UMHOS)	100	16299.96	293.00	7844.84	14380.00	10850.00	8295.00	4215.00	861.00
OXYGEN, DISSOLVED (MG/L)	33	19.10	3.10	10.49	17.49	13.05	10.30	8.30	4.57
OXYGEN, DISSOLVED (PERCENT SATURATION)	33	200.00	32.00	113.91	184.60	136.00	110.00	89.50	49.50
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	37	34.00	2.20	8.65	23.20	11.50	7.00	4.70	2.29
PH (UNITS)	67	10.00	6.40		9.54	8.70	8.00	7.60	6.90
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	64	32.89	0.01	6.57	29.84	8.18	2.87	0.76	0.11
ALKALINITY FIELD (MG/L AS CACO3)	97	280.00	43.00	157.94	254.20	197.00	153.00	123.00	68.00
BICARBONATE FET-FLD (MG/L AS HCO3)	85	330.00	38.00	181.81	309.40	233.00	176.00	136.00	77.20
CARBONATE FET-FLD (MG/L AS CO3)	85	61.00	0.00	4.71	24.80	4.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	35	7.50	1.13	2.87	7.10	3.37	2.59	1.81	1.19
NITROGEN, ORGANIC TOTAL (MG/L AS N)	35	5.68	0.78	1.90	4.37	2.60	1.49	1.07	0.83
NITROGEN, AMMONIA TOTAL (MG/L AS N)	35	1.50	0.00	0.31	1.42	0.43	0.15	0.07	0.01
NITROGEN, NITRITE TOTAL (MG/L AS N)	37	0.53	0.00	0.12	0.47	0.18	0.08	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	46	4.80	0.00	0.88	3.40	1.35	0.57	0.01	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	36	5.80	0.91	2.19	5.12	2.88	1.75	1.30	0.98
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	35	3.70	0.00	0.76	3.46	1.00	0.50	0.01	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	37	3.70	0.21	0.98	3.43	1.20	0.86	0.45	0.23
CARBON, ORGANIC TOTAL (MG/L AS C)	12	54.00	5.10	17.29	54.00	21.25	14.00	11.25	5.10
HARDNESS (MG/L AS CACO3)	97	3889.75	88.43	1712.76	3178.13	2368.09	1760.97	885.63	198.80
HARDNESS, NONCARBONATE (MG/L CACO3)	97	3636.75	20.43	1554.82	3009.48	2238.09	1606.43	734.02	85.43
CALCIUM DISSOLVED (MG/L AS CA)	97	420.00	27.00	245.44	410.00	335.00	260.00	160.00	56.70
MAGNESIUM, DISSOLVED (MG/L AS MG)	97	690.00	5.10	267.02	541.00	380.00	270.00	115.00	13.00
SODIUM, DISSOLVED (MG/L AS NA)	87	2500.00	24.00	1232.91	2200.00	1700.00	1300.00	600.00	148.00
SODIUM ADSORPTION RATIO	95	19.50	1.16	11.98	17.36	15.22	13.24	8.36	3.19
PERCENT SODIUM	87	64.41	35.87	58.94	63.21	60.94	59.07	57.78	54.04
POTASSIUM, DISSOLVED (MG/L AS K)	87	66.00	3.90	30.64	53.00	42.00	33.00	19.00	7.20
CHLORIDE, DISSOLVED (MG/L AS CL)	97	4599.99	43.00	2065.25	3900.00	3000.00	2100.00	960.00	169.00
SULFATE DISSOLVED (MG/L AS SO4)	97	2800.00	24.00	1234.13	2310.00	1800.00	1300.00	535.00	61.90
FLUORIDE, DISSOLVED (MG/L AS F)	71	1.60	0.10	0.65	1.14	0.80	0.60	0.50	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	97	19.00	0.40	5.90	13.20	8.30	5.60	2.50	0.59
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED	34	10200.00	1030.30	5367.65	9644.99	7372.50	5870.00	2645.00	1142.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	97	11299.97	176.51	5144.46	9523.82	7345.23	5259.97	2517.22	461.72
SOLIDS, DISSOLVED (TONS PER DAY)	97	3430.00	0.12	192.62	959.35	124.12	71.44	29.52	4.61
SOLIDS, DISSOLVED (TONS PER AC-FT)	97	15.40	0.24	7.13	13.13	10.14	7.46	3.53	0.63

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08123850 STATION NAME: COLORADO RIVER ABOVE SILVER, TEXAS

LATITUDE: 320307 LONGITUDE: 1004556 COUNTY: COKE DRAINAGE AREA: 14910.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	138	34.00	0.50	19.31	31.50	25.13	21.00	12.50	5.98
STREAMFLOW, INSTANTANEOUS (CFS)	141	2830.00	0.00	154.96	867.20	57.50	13.00	5.80	0.54
TURBIDITY (JTU)	10	70.00	6.00	30.50	70.00	55.00	27.50	9.75	6.00
TURBIDITY (FTU)	42	480.00	0.50	64.39	378.50	60.00	25.00	10.75	1.10
SPECIFIC CONDUCTANCE (UMHOS)	110	13500.00	464.00	6043.61	11625.00	8757.50	5890.00	2945.00	965.80
OXYGEN, DISSOLVED (MG/L)	52	17.30	5.50	10.20	15.31	12.60	9.55	7.82	6.19
OXYGEN, DISSOLVED (PERCENT SATURATION)	52	167.00	65.00	112.21	160.00	130.75	108.50	91.75	76.25
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	51	14.00	2.10	6.79	13.00	9.30	6.20	4.30	2.48
PH (UNITS)	110	9.70	6.60		8.75	8.20	7.80	7.50	7.05
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	110	41.85	0.02	6.02	21.83	7.25	4.20	1.70	0.35
ALKALINITY FIELD (MG/L AS CACO3)	110	246.00	48.00	127.30	207.80	151.00	122.00	100.00	64.55
BICARBONATE FET-FLD (MG/L AS HCO3)	92	300.00	48.00	148.20	225.00	177.25	144.00	120.00	58.00
CARBONATE FET-FLD (MG/L AS CO3)	92	30.00	0.00	2.00	16.70	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	45	4.01	0.70	1.85	3.34	2.11	1.80	1.41	0.83
NITROGEN, ORGANIC TOTAL (MG/L AS N)	46	3.90	0.64	1.55	2.71	1.79	1.40	1.14	0.75
NITROGEN, AMMONIA TOTAL (MG/L AS N)	46	0.35	0.00	0.10	0.26	0.14	0.08	0.04	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	26	0.25	0.00	0.03	0.19	0.04	0.02	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	36	1.24	0.00	0.23	1.12	0.38	0.03	0.00	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	52	4.00	0.46	1.60	2.84	1.80	1.50	1.13	0.76
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	46	1.50	0.00	0.19	1.19	0.22	0.03	0.01	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	52	0.67	0.03	0.23	0.62	0.28	0.18	0.13	0.06
CARBON, ORGANIC TOTAL (MG/L AS C)	30	33.00	6.90	14.27	28.60	16.00	13.50	10.00	7.40
HARDNESS (MG/L AS CACO3)	110	2988.07	154.08	1333.80	2658.07	1946.76	1259.50	618.43	234.02
HARDNESS, NONCARBONATE (MG/L CACO3)	110	2864.07	57.08	1206.50	2542.05	1812.76	1176.82	491.92	109.07
CALCIUM DISSOLVED (MG/L AS CA)	110	570.00	49.00	260.10	450.00	370.00	275.00	140.00	62.65
MAGNESIUM, DISSOLVED (MG/L AS MG)	110	490.00	7.70	166.18	380.00	252.50	150.00	63.25	17.55
SODIUM, DISSOLVED (MG/L AS NA)	101	2000.00	25.00	898.49	1800.00	1300.00	900.00	410.00	99.20
SODIUM ADSORPTION RATIO	108	16.81	0.91	10.18	15.45	13.20	10.89	7.11	2.92
PERCENT SODIUM	101	71.07	25.30	57.42	65.80	60.63	58.13	55.12	45.54
POTASSIUM, DISSOLVED (MG/L AS K)	101	42.00	2.50	17.56	35.00	23.50	17.00	9.95	6.06
CHLORIDE, DISSOLVED (MG/L AS CL)	110	3499.99	40.00	1463.45	3000.00	2100.00	1450.00	610.00	160.00
SULFATE DISSOLVED (MG/L AS SO4)	110	2400.00	59.00	1065.60	2200.00	1600.00	1100.00	417.50	111.00
FLUORIDE, DISSOLVED (MG/L AS F)	78	1.00	0.30	0.56	0.80	0.70	0.50	0.47	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	109	15.00	0.00	4.79	10.50	6.85	5.00	2.20	0.25
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED	52	9650.00	563.00	4663.10	8854.00	6677.50	4830.00	2280.00	674.05
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	109	8809.97	252.22	3970.02	8063.76	5777.43	3749.99	1775.16	546.56
SOLIDS, DISSOLVED (TONS PER DAY)	110	5936.03	0.00	403.72	1981.50	398.84	160.69	75.81	6.39
SOLIDS, DISSOLVED (TONS PER AC-FT)	110	13.12	0.34	5.46	11.53	8.01	5.19	2.33	0.75

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08125500 STATION NAME: OAK CREEK RESERVOIR NEAR BLACKWELL, TEXAS

LATITUDE: 320325 LONGITUDE: 1001737 COUNTY: COKE DRAINAGE AREA: 238.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1973 TO NOV 1981

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	28.00	2.00	14.68	28.00	25.00	15.00	7.00	2.00
SPECIFIC CONDUCTANCE (UMHOS)	11	1500.00	776.00	1041.00	1500.00	1310.00	928.00	824.00	776.00
PH (UNITS)	7	8.20	7.60		8.20	8.00	7.80	7.70	7.60
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	7	5.70	1.80	3.76	5.70	5.70	3.10	1.90	1.80
ALKALINITY FIELD (MG/L AS CACO3)	11	161.00	92.00	131.55	161.00	148.00	135.00	110.00	92.00
BICARBONATE FET-FLD (MG/L AS HCO3)	9	196.00	112.00	159.22	196.00	186.00	165.00	124.00	112.00
CARBONATE FET-FLD (MG/L AS CO3)	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
~~HARDNESS (MG/L AS CACO3)~~	~~11~~	~~530.00~~	~~270.00~~	~~377.27~~	~~530.00~~	~~490.00~~	~~350.00~~	~~290.00~~	~~270.00~~
HARDNESS, NONCARBONATE (MG/L CACO3)	11	400.00	162.00	245.73	400.00	339.00	217.00	180.00	162.00
CALCIUM DISSOLVED (MG/L AS CA)	11	110.00	56.00	83.73	110.00	99.00	86.00	70.00	56.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	11	63.00	26.00	40.73	63.00	57.00	36.00	31.00	26.00
SODIUM, DISSOLVED (MG/L AS NA)	11	110.00	43.00	68.27	110.00	87.00	63.00	52.00	43.00
SODIUM ADSORPTION RATIO	11	2.10	1.10	1.55	2.10	1.70	1.60	1.30	1.10
PERCENT SODIUM	11	31.00	24.00	27.64	31.00	30.00	27.00	26.00	24.00
POTASSIUM, DISSOLVED (MG/L AS K)	11	11.00	5.40	7.56	11.00	9.10	7.10	6.40	5.40
CHLORIDE, DISSOLVED (MG/L AS CL)	11	170.00	65.00	109.73	170.00	150.00	98.00	82.00	65.00
SULFATE DISSOLVED (MG/L AS SO4)	11	390.00	170.00	240.91	390.00	330.00	210.00	180.00	170.00
FLUORIDE, DISSOLVED (MG/L AS F)	10	0.40	0.20	0.33	0.40	0.40	0.35	0.27	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	11	10.00	0.80	5.06	10.00	8.00	6.00	1.40	0.80
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	11	946.00	479.00	635.18	946.00	835.00	550.00	488.00	479.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	11	1.30	0.65	0.86	1.30	1.10	0.75	0.66	0.65

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08126500 STATION NAME: COLORADO RIVER AT BALLINGER, TEXAS

LATITUDE: 314255 LONGITUDE: 1000134 COUNTY: RUNNELS DRAINAGE AREA: 16358.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	113	35.00	0.00	18.80	26.96	23.02	19.04	14.62	10.64
STREAMFLOW, INSTANTANEOUS (CFS)	115	16000.00	0.18	743.95	4127.99	228.00	20.00	4.70	1.26
SPECIFIC CONDUCTANCE (UMHOS)	95	4750.00	214.00	2144.63	3794.00	2870.00	2130.00	1280.00	528.40
PH (UNITS)	63	8.30	7.00		8.20	7.90	7.80	7.50	7.12
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	63	41.63	1.39	7.16	20.42	8.86	5.04	3.72	1.60
ALKALINITY FIELD (MG/L AS CACO3)	95	230.00	67.00	154.65	210.00	180.00	154.00	126.00	81.60
BICARBONATE FET-FLD (MG/L AS HCO3)	83	262.00	82.00	186.53	254.00	220.00	184.00	154.00	102.40
CARBONATE FET-FLD (MG/L AS CO3)	83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	12	7.50	0.60	2.87	7.50	4.42	2.40	0.90	0.60
HARDNESS (MG/L AS CACO3)	95	2220.66	80.55	759.81	1602.79	1011.11	663.09	407.55	171.05
HARDNESS, NONCARBONATE (MG/L CACO3)	95	2040.87	13.55	605.15	1453.79	838.13	505.73	254.11	64.65
CALCIUM DISSOLVED (MG/L AS CA)	95	550.00	25.00	178.74	394.00	240.00	160.00	91.00	45.40
MAGNESIUM, DISSOLVED (MG/L AS MG)	95	230.00	4.40	76.12	152.00	100.00	69.00	43.00	12.60
SODIUM, DISSOLVED (MG/L AS NA)	85	370.00	8.50	189.92	320.00	260.00	200.00	105.00	22.30
SODIUM ADSORPTION RATIO	95	4.80	0.43	3.00	4.10	3.57	3.27	2.51	0.88
PERCENT SODIUM	85	51.11	16.59	34.99	44.78	38.59	35.22	31.66	25.30
POTASSIUM, DISSOLVED (MG/L AS K)	85	9.60	3.80	5.98	8.71	6.80	5.60	5.00	4.16
CHLORIDE, DISSOLVED (MG/L AS CL)	95	640.00	12.00	323.08	612.00	450.00	330.00	180.00	48.00
SULFATE DISSOLVED (MG/L AS SO4)	95	1900.00	14.00	534.64	1300.00	750.00	430.00	240.00	60.80
FLUORIDE, DISSOLVED (MG/L AS F)	83	0.90	0.00	0.47	0.80	0.60	0.50	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	95	22.00	0.30	9.04	16.00	11.00	8.60	6.50	4.00
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	95	3755.47	119.02	1408.65	2874.97	1949.01	1315.66	792.31	290.07
SOLIDS, DISSOLVED (TONS PER DAY)	95	5493.90	0.84	243.18	1192.17	142.41	47.58	23.79	3.81
SOLIDS, DISSOLVED (TONS PER AC-FT)	95	5.11	0.16	1.92	3.91	2.65	1.79	1.08	0.39

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08127000 STATION NAME: ELM CREEK AT BALLINGER, TEXAS

LATITUDE: 314457 LONGITUDE: 0995651 COUNTY: RUNNELS DRAINAGE AREA: 450.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	89	34.00	3.50	18.57	30.75	25.25	18.50	11.50	5.50
STREAMFLOW, INSTANTANEOUS (CFS)	96	6400.00	0.01	122.95	537.70	31.00	8.77	1.32	0.16
SPECIFIC CONDUCTANCE (UMHOS)	92	3980.00	393.00	2199.00	3602.50	3040.00	2420.00	1232.50	570.85
PH (UNITS)	63	8.40	7.00		8.20	8.10	7.90	7.70	7.22
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	63	27.01	0.81	6.03	18.94	6.50	5.04	3.23	1.64
ALKALINITY FIELD (MG/L AS CACO3)	92	271.00	82.00	177.12	260.70	206.75	167.50	144.50	108.95
BICARBONATE FET-FLD (MG/L AS HCO3)	82	330.00	121.00	213.39	318.50	250.00	202.00	176.00	130.90
CARBONATE FET-FLD (MG/L AS CO3)	82	4.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
~~NITROGEN, NITRATE TOTAL (MG/L AS N)~~	~~12~~	~~11.00~~	~~0.30~~	~~5.17~~	~~11.00~~	~~9.40~~	~~4.65~~	~~1.35~~	~~0.30~~
HARDNESS (MG/L AS CACO3)	92	1224.38	153.42	643.40	1094.69	883.02	680.80	362.05	190.24
HARDNESS, NONCARBONATE (MG/L CACO3)	92	1044.38	22.42	466.28	939.17	685.35	479.07	183.27	67.56
CALCIUM DISSOLVED (MG/L AS CA)	92	210.00	39.00	118.30	193.50	160.00	125.00	75.50	48.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	92	170.00	10.00	84.51	160.00	120.00	89.00	38.50	16.30
SODIUM, DISSOLVED (MG/L AS NA)	82	470.00	13.00	224.66	380.00	322.50	260.00	105.50	34.45
SODIUM ADSORPTION RATIO	92	6.28	0.47	3.70	5.18	4.79	4.13	2.60	1.21
PERCENT SODIUM	82	49.16	15.09	40.50	48.39	43.84	42.15	37.86	27.72
POTASSIUM, DISSOLVED (MG/L AS K)	82	11.00	3.00	5.94	8.26	6.63	5.90	5.08	4.12
CHLORIDE, DISSOLVED (MG/L AS CL)	92	970.00	32.00	454.77	807.00	655.00	510.00	212.50	71.85
SULFATE DISSOLVED (MG/L AS SO4)	92	600.00	31.00	291.01	557.00	435.00	305.00	132.50	48.95
FLUORIDE, DISSOLVED (MG/L AS F)	77	1.40	0.10	0.59	1.00	0.80	0.60	0.40	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	92	15.00	0.20	9.15	14.00	11.00	9.20	7.22	2.77
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	92	2430.06	219.62	1294.40	2186.51	1818.18	1377.45	688.26	306.19
SOLIDS, DISSOLVED (TONS PER DAY)	92	3795.05	0.01	144.62	713.15	84.87	29.74	6.05	0.36
SOLIDS, DISSOLVED (TONS PER AC-FT)	92	3.30	0.30	1.76	2.97	2.48	1.87	0.94	0.42

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08131200 STATION NAME: TWIN BUTTES RESERVOIR NEAR SAN ANGELO, TEXAS

LATITUDE: 312255 LONGITUDE: 1003217 COUNTY: TOM GREEN DRAINAGE AREA: 3868.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO OCT 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	22	28.00	4.50	18.68	28.00	24.50	21.75	11.50	4.87
SPECIFIC CONDUCTANCE (UMHOS)	24	803.00	506.00	669.54	795.50	718.00	678.50	627.25	520.25
PH (UNITS)	16	8.40	7.30		8.40	8.25	7.90	7.60	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	16	14.00	1.10	4.84	14.00	7.03	3.60	1.78	1.10
ALKALINITY FIELD (MG/L AS CACO3)	24	167.00	131.00	151.83	166.25	157.50	152.50	147.25	133.00
BICARBONATE FET-FLD (MG/L AS HCO3)	22	204.00	160.00	184.91	203.40	190.50	185.00	179.75	161.50
CARBONATE FET-FLD (MG/L AS CO3)	22	2.00	0.00	0.18	2.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	24	230.00	180.00	203.33	230.00	210.00	200.00	192.50	180.00
HARDNESS, NONCARBONATE (MG/L CACO3)	24	71.00	30.00	51.13	70.50	59.75	50.00	44.00	32.00
CALCIUM DISSOLVED (MG/L AS CA)	24	53.00	40.00	45.96	52.75	51.00	45.50	42.00	40.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	24	29.00	13.00	21.37	28.75	24.75	21.50	18.00	13.50
SODIUM, DISSOLVED (MG/L AS NA)	24	76.00	29.00	54.33	74.50	64.00	54.50	45.25	31.00
SODIUM ADSORPTION RATIO	24	2.30	1.00	1.70	2.25	2.00	1.70	1.43	1.05
PERCENT SODIUM	24	41.00	25.00	35.58	41.00	39.75	35.50	32.25	25.75
POTASSIUM, DISSOLVED (MG/L AS K)	24	7.40	4.60	5.74	7.35	6.00	5.55	5.40	4.63
CHLORIDE, DISSOLVED (MG/L AS CL)	24	120.00	49.00	90.17	120.00	107.50	92.00	76.25	51.50
SULFATE DISSOLVED (MG/L AS SO4)	24	69.00	33.00	48.33	68.00	54.75	49.50	40.00	33.25
FLUORIDE, DISSOLVED (MG/L AS F)	21	0.50	0.20	0.37	0.50	0.40	0.40	0.30	0.21
SILICA, DISSOLVED (MG/L AS SIO2)	24	14.00	3.50	9.96	13.75	13.00	10.95	7.10	4.02
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	24	451.00	285.00	367.42	448.00	401.75	377.00	337.00	290.75
SOLIDS, DISSOLVED (TONS PER AC-FT)	24	0.61	0.39	0.50	0.61	0.55	0.52	0.46	0.40

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08132000 STATION NAME: LAKE NASWORTHY NEAR SAN ANGELO, TEXAS

LATITUDE: 312319 LONGITUDE: 1002841 COUNTY: TOM GREEN DRAINAGE AREA: 3975.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO OCT 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	19	29.00	4.00	19.11	29.00	25.50	21.00	12.00	4.00
SPECIFIC CONDUCTANCE (UMHOS)	19	1750.00	754.00	1061.63	1749.99	1240.00	977.00	850.00	754.00
PH (UNITS)	11	8.30	7.30		8.30	8.00	7.70	7.60	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	11	15.00	1.70	6.29	15.00	7.70	6.20	3.10	1.70
ALKALINITY FIELD (MG/L AS CACO3)	19	200.00	136.00	167.63	200.00	174.00	170.00	158.00	136.00
BICARBONATE FET-FLD (MG/L AS HCO3)	17	244.00	166.00	205.53	244.00	216.00	210.00	194.50	166.00
CARBONATE FET-FLD (MG/L AS CO3)	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	19	390.00	190.00	264.74	390.00	290.00	260.00	230.00	190.00
HARDNESS, NONCARBONATE (MG/L CACO3)	19	210.00	45.00	97.32	210.00	123.00	87.00	65.00	45.00
CALCIUM DISSOLVED (MG/L AS CA)	19	95.00	45.00	59.79	95.00	70.00	54.00	49.00	45.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	19	38.00	17.00	28.00	38.00	32.00	28.00	25.00	17.00
SODIUM, DISSOLVED (MG/L AS NA)	19	210.00	62.00	112.84	210.00	140.00	100.00	81.00	62.00
SODIUM ADSORPTION RATIO	19	4.80	1.90	3.06	4.80	3.90	2.90	2.40	1.90
PERCENT SODIUM	19	54.00	37.00	46.47	54.00	52.00	45.00	44.00	37.00
POTASSIUM, DISSOLVED (MG/L AS K)	19	8.60	5.10	6.00	8.60	6.50	5.60	5.50	5.10
CHLORIDE, DISSOLVED (MG/L AS CL)	19	370.00	100.00	186.84	370.00	240.00	160.00	130.00	100.00
SULFATE DISSOLVED (MG/L AS SO4)	19	140.00	49.00	81.00	140.00	96.00	78.00	64.00	49.00
FLUORIDE, DISSOLVED (MG/L AS F)	18	0.60	0.30	0.48	0.60	0.53	0.50	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	19	19.00	0.50	14.66	19.00	17.00	16.00	13.00	0.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	19	984.00	404.00	590.11	984.00	725.00	543.00	474.00	404.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	19	1.30	0.55	0.80	1.30	0.99	0.74	0.65	0.55

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08134500 STATION NAME: O. C. FISHER LAKE AT SAN ANGELO, TEXAS

LATITUDE: 312904 LONGITUDE: 1002853 COUNTY: TOM GREEN DRAINAGE AREA: 1488.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM DEC 1972 TO JAN 1980

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	9	26.50	8.00	18.00	26.50	25.50	17.00	11.00	8.00
SPECIFIC CONDUCTANCE (UMHOS)	9	802.00	429.00	554.78	802.00	644.00	497.00	453.50	429.00
PH (UNITS)	7	7.80	7.40		7.80	7.80	7.60	7.50	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	7	10.00	4.50	6.70	10.00	8.50	6.40	4.70	4.50
ALKALINITY FIELD (MG/L AS CACO3)	9	154.00	123.00	141.22	154.00	148.50	144.00	133.00	123.00
BICARBONATE FET-FLD (MG/L AS HCO3)	9	188.00	150.00	172.22	188.00	181.00	176.00	162.50	150.00
CARBONATE FET-FLD (MG/L AS CO3)	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	9	250.00	160.00	185.56	250.00	205.00	170.00	165.00	160.00
HARDNESS, NONCARBONATE (MG/L CACO3)	9	105.00	15.00	46.67	105.00	67.50	35.00	27.00	15.00
CALCIUM DISSOLVED (MG/L AS CA)	9	52.00	40.00	46.89	52.00	50.50	50.00	41.50	40.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	9	31.00	9.50	17.17	31.00	22.00	16.00	11.00	9.50
SODIUM, DISSOLVED (MG/L AS NA)	9	58.00	15.00	32.22	58.00	45.00	26.00	18.00	15.00
SODIUM ADSORPTION RATIO	9	1.60	0.50	1.04	1.60	1.45	0.90	0.65	0.50
PERCENT SODIUM	9	35.00	16.00	24.89	35.00	31.50	25.00	17.00	16.00
POTASSIUM, DISSOLVED (MG/L AS K)	9	20.00	1.60	11.88	20.00	15.50	12.00	9.40	1.60
CHLORIDE, DISSOLVED (MG/L AS CL)	9	130.00	28.00	67.33	130.00	97.50	53.00	37.50	28.00
SULFATE DISSOLVED (MG/L AS SO4)	9	57.00	22.00	33.67	57.00	40.50	30.00	25.50	22.00
FLUORIDE, DISSOLVED (MG/L AS F)	8	0.40	0.20	0.26	0.40	0.30	0.25	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	9	8.40	3.20	5.71	8.40	6.90	6.00	3.80	3.20
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	9	441.00	230.00	299.67	441.00	355.50	268.00	241.50	230.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	9	0.60	0.31	0.41	0.60	0.49	0.37	0.33	0.31

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08136500 STATION NAME: CONCHO RIVER AT PAINT ROCK, TEXAS

LATITUDE: 313057 LONGITUDE: 0995509 COUNTY: CONCHO DRAINAGE AREA: 6574.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	130	33.00	3.50	19.75	30.45	25.62	21.00	13.87	6.28
STREAMFLOW, INSTANTANEOUS (CFS)	133	46400.00	1.20	996.81	5105.98	82.00	49.00	27.00	5.99
TURBIDITY (JTU)	33	80.00	15.00	31.30	59.00	40.00	30.00	20.00	15.00
TURBIDITY (FTU)	25	42.00	1.20	17.44	38.40	23.50	17.00	11.00	1.92
COLOR (PLATINUMCOBALT UNITS)	57	60.00	0.00	9.67	21.00	10.00	10.00	5.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	112	3020.00	232.00	1986.57	2764.00	2400.00	2180.00	1562.50	732.75
OXYGEN, DISSOLVED (MG/L)	58	15.20	5.50	9.96	13.65	11.00	9.50	8.77	6.76
OXYGEN, DISSOLVED (PERCENT SATURATION)	58	208.00	64.00	110.21	156.90	121.25	104.50	98.00	78.45
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	58	13.00	0.50	3.29	9.62	4.20	2.45	1.60	0.69
PH (UNITS)	94	8.60	7.10		8.30	8.10	7.90	7.70	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	94	29.79	0.40	5.33	11.42	6.55	4.47	2.88	1.58
ALKALINITY FIELD (MG/L AS CACO3)	112	230.00	75.00	171.24	220.00	204.75	172.00	150.00	98.00
BICARBONATE FET-FLD (MG/L AS HCO3)	94	280.00	92.00	206.18	267.00	241.00	205.00	180.00	119.50
CARBONATE FET-FLD (MG/L AS CO3)	94	8.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED (MG/L)	58	144.00	0.00	42.03	112.05	56.50	34.00	24.75	5.00
NITROGEN, TOTAL (MG/L AS N)	49	18.40	1.34	6.53	15.35	8.63	6.00	3.15	1.77
NITROGEN, ORGANIC TOTAL (MG/L AS N)	55	2.05	0.00	1.05	1.96	1.38	1.09	0.78	0.05
NITROGEN, AMMONIA TOTAL (MG/L AS N)	58	0.21	0.00	0.06	0.17	0.09	0.05	0.02	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	58	0.33	0.00	0.08	0.21	0.10	0.06	0.04	0.01
NITROGEN, NITRATE TOTAL (MG/L AS N)	65	17.96	0.01	5.80	14.68	8.75	5.33	1.69	0.53
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	49	2.10	0.12	1.20	2.10	1.50	1.20	0.90	0.30
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	50	18.00	0.20	5.58	15.90	7.80	5.00	1.70	0.56
PHOSPHORUS, TOTAL (MG/L AS P)	58	0.25	0.00	0.07	0.15	0.09	0.06	0.04	0.02
CARBON, ORGANIC TOTAL (MG/L AS C)	55	28.00	0.00	7.85	19.00	9.50	6.60	4.80	2.16
HARDNESS (MG/L AS CACO3)	112	973.60	88.51	599.37	891.90	736.17	639.63	441.68	236.58
HARDNESS, NONCARBONATE (MG/L CACO3)	112	847.60	13.51	428.13	694.13	556.48	460.82	295.17	74.08
CALCIUM DISSOLVED (MG/L AS CA)	112	200.00	30.00	129.93	190.00	160.00	140.00	97.50	59.65
MAGNESIUM, DISSOLVED (MG/L AS MG)	112	120.00	3.30	66.66	100.00	82.75	71.00	50.25	19.30
SODIUM, DISSOLVED (MG/L AS NA)	102	270.00	9.10	179.31	248.50	220.00	200.00	140.00	51.65
SODIUM ADSORPTION RATIO	111	4.83	0.44	3.28	4.07	3.73	3.49	3.14	1.69
PERCENT SODIUM	102	49.12	17.38	39.21	44.64	41.63	39.66	37.52	33.92
POTASSIUM, DISSOLVED (MG/L AS K)	102	9.60	3.60	5.32	7.07	5.80	5.15	4.70	4.30
CHLORIDE, DISSOLVED (MG/L AS CL)	112	670.00	20.00	407.07	600.00	510.00	440.00	315.00	106.15
SULFATE DISSOLVED (MG/L AS SO4)	112	440.00	13.00	232.10	373.50	290.00	250.00	162.50	52.90
FLUORIDE, DISSOLVED (MG/L AS F)	99	1.10	0.10	0.52	0.70	0.60	0.50	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	112	35.00	1.50	17.01	24.35	20.75	17.00	14.00	6.76
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	111	1782.89	133.04	1144.56	1649.59	1397.31	1236.91	879.06	405.52
SOLIDS, DISSOLVED (TONS PER DAY)	110	10576.05	4.85	339.88	1031.78	209.35	156.08	82.92	19.45
SOLIDS, DISSOLVED (TONS PER AC-FT)	111	2.42	0.18	1.56	2.24	1.90	1.68	1.20	0.55

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08136700 STATION NAME: COLORADO RIVER NEAR STACY, TEXAS

LATITUDE: 312937 LONGITUDE: 0993425 COUNTY: MCCULLOCH DRAINAGE AREA: 24192.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	97	32.00	2.00	20.49	31.05	27.00	21.00	15.00	6.50
STREAMFLOW, INSTANTANEOUS (CFS)	97	32100.00	0.09	815.38	2214.99	183.50	88.00	50.00	10.82
TURBIDITY (JTU)	37	270.00	8.00	55.22	252.00	60.00	35.00	20.00	9.80
SPECIFIC CONDUCTANCE (UMHOS)	95	3220.00	276.00	1678.39	2650.00	2200.00	1710.00	1170.00	576.80
OXYGEN, DISSOLVED (MG/L)	37	13.20	5.90	9.62	13.02	10.90	9.50	8.25	6.17
OXYGEN, DISSOLVED (PERCENT SATURATION)	37	176.00	76.00	105.62	152.60	109.00	103.00	94.00	78.70
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	37	5.80	1.10	2.61	5.44	3.55	2.30	1.40	1.10
PH (UNITS)	65	8.60	7.10		8.40	8.10	7.90	7.50	7.13
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	62	28.02	0.56	5.47	16.41	7.16	3.44	2.39	0.77
ALKALINITY FIELD (MG/L AS CACO3)	92	207.00	82.00	138.59	203.00	164.00	130.00	110.25	94.65
BICARBONATE FET-FLD (MG/L AS HCO3)	82	252.00	100.00	168.84	248.00	200.00	157.00	135.75	110.90
CARBONATE FET-FLD (MG/L AS CO3)	82	9.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	36	8.17	0.82	3.27	7.60	4.22	2.79	1.87	1.13
NITROGEN, ORGANIC TOTAL (MG/L AS N)	34	2.34	0.12	1.00	2.31	1.25	0.83	0.57	0.27
NITROGEN, AMMONIA TOTAL (MG/L AS N)	34	0.56	0.00	0.07	0.29	0.08	0.05	0.02	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	37	0.06	0.00	0.02	0.05	0.03	0.02	0.01	0.01
NITROGEN, NITRATE TOTAL (MG/L AS N)	48	9.40	0.00	2.37	7.94	3.18	1.69	0.76	0.14
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	36	2.50	0.22	1.07	2.42	1.30	0.94	0.63	0.37
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	36	7.40	0.00	2.20	7.15	3.18	1.65	0.69	0.07
PHOSPHORUS, TOTAL (MG/L AS P)	37	0.43	0.01	0.08	0.20	0.09	0.07	0.03	0.01
CARBON, ORGANIC TOTAL (MG/L AS C)	14	19.00	3.10	7.99	19.00	10.25	7.20	5.45	3.10
HARDNESS (MG/L AS CACO3)	91	968.58	112.14	515.77	841.33	683.41	526.41	355.51	170.58
HARDNESS, NONCARBONATE (MG/L CACO3)	91	858.58	14.14	377.89	705.09	539.36	361.76	213.27	69.50
CALCIUM DISSOLVED (MG/L AS CA)	91	210.00	36.00	116.10	180.00	150.00	110.00	83.00	47.20
MAGNESIUM, DISSOLVED (MG/L AS MG)	91	120.00	5.40	54.80	96.80	75.00	54.00	36.00	12.80
SODIUM, DISSOLVED (MG/L AS NA)	81	340.00	9.30	154.00	250.00	200.00	170.00	104.00	36.70
SODIUM ADSORPTION RATIO	91	4.88	0.40	2.94	3.89	3.50	3.20	2.38	1.39
PERCENT SODIUM	81	45.52	14.68	38.07	43.53	40.81	38.55	36.81	31.13
POTASSIUM, DISSOLVED (MG/L AS K)	81	8.80	3.50	5.50	8.09	6.05	5.30	4.65	3.90
CHLORIDE, DISSOLVED (MG/L AS CL)	91	640.00	15.00	313.98	516.00	420.00	320.00	210.00	78.60
SULFATE DISSOLVED (MG/L AS SO4)	91	680.00	17.00	259.40	494.00	350.00	250.00	150.00	59.40
FLUORIDE, DISSOLVED (MG/L AS F)	81	0.70	0.00	0.43	0.60	0.50	0.40	0.35	0.21
SILICA, DISSOLVED (MG/L AS SIO2)	91	24.00	1.90	11.08	18.40	14.00	11.00	7.00	3.42
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	32	1560.00	405.00	1002.69	1534.00	1247.50	1025.00	713.25	429.70
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	91	2046.39	154.50	998.32	1615.73	1278.71	1024.18	704.00	314.42
SOLIDS, DISSOLVED (TONS PER DAY)	91	13390.86	0.10	825.82	4319.69	466.14	247.81	138.70	31.45
SOLIDS, DISSOLVED (TONS PER AC-FT)	91	2.78	0.21	1.39	2.20	1.76	1.41	0.96	0.43

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08138000 STATION NAME: COLORADO RIVER AT WINCHELL, TEXAS

LATITUDE: 312804 LONGITUDE: 0990943 COUNTY: BROWN DRAINAGE AREA: 25179.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS: SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN: 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	87	32.50	2.50	19.86	31.00	27.00	20.00	14.00	6.80
STREAMFLOW, INSTANTANEOUS (CFS)	88	3920.00	0.03	186.01	555.70	168.50	84.50	44.25	15.30
SPECIFIC CONDUCTANCE (UMHOS)	87	2949.99	434.00	1713.96	2584.00	2220.00	1700.00	1260.00	647.20
PH (UNITS)	48	8.30	7.00		8.25	8.00	7.70	7.52	7.14
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	48	28.02	1.05	5.89	20.54	7.10	4.62	2.80	1.32
ALKALINITY FIELD (MG/L AS CACO3)	87	196.00	76.00	134.52	181.20	156.00	131.00	113.00	95.80
BICARBONATE FET-FLD (MG/L AS HCO3)	69	239.00	93.00	160.54	223.50	184.00	160.00	134.00	114.00
CARBONATE FET-FLD (MG/L AS CO3)	69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	11	6.30	0.40	2.65	6.30	4.00	2.80	0.80	0.40
HARDNESS (MG/L AS CACO3)	87	902.43	142.80	508.65	796.76	646.35	510.75	375.22	184.86
HARDNESS, NONCARBONATE (MG/L CACO3)	87	794.43	44.80	374.13	655.70	528.96	370.35	252.22	87.47
CALCIUM DISSOLVED (MG/L AS CA)	87	180.00	43.00	112.64	170.00	140.00	110.00	86.00	51.40
MAGNESIUM, DISSOLVED (MG/L AS MG)	87	110.00	8.60	55.21	92.40	74.00	56.00	39.00	13.60
SODIUM, DISSOLVED (MG/L AS NA)	74	300.00	23.00	155.72	242.50	192.50	170.00	110.00	46.50
SODIUM ADSORPTION RATIO	87	4.70	0.87	3.10	4.41	3.59	3.32	2.61	1.65
PERCENT SODIUM	74	46.44	25.19	39.11	45.38	41.65	39.42	37.15	33.07
POTASSIUM, DISSOLVED (MG/L AS K)	74	8.30	0.20	5.50	7.43	6.30	5.50	4.60	4.00
CHLORIDE, DISSOLVED (MG/L AS CL)	87	600.00	44.00	322.97	526.00	440.00	330.00	220.00	100.00
SULFATE DISSOLVED (MG/L AS SO4)	87	540.00	41.00	262.07	458.00	350.00	260.00	170.00	68.40
FLUORIDE, DISSOLVED (MG/L AS F)	79	0.60	0.00	0.43	0.60	0.50	0.40	0.40	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	87	22.00	0.00	9.49	17.00	12.00	9.80	6.10	1.66
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	87	1802.70	232.60	1010.79	1592.17	1317.25	1001.96	724.00	346.48
SOLIDS, DISSOLVED (TONS PER DAY)	87	6808.46	0.05	387.46	756.50	347.00	219.93	121.67	48.70
SOLIDS, DISSOLVED (TONS PER AC-FT)	87	2.45	0.32	1.37	2.17	1.79	1.36	0.98	0.47

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08141000 STATION NAME: HORDS CREEK LAKE NEAR VALERA, TEXAS

LATITUDE: 314958 LONGITUDE: 0993338 COUNTY: COLEMAN DRAINAGE AREA: 48.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1973 TO OCT 1979

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	31.50	7.00	19.36	31.50	26.00	19.00	13.00	7.00
SPECIFIC CONDUCTANCE (UMHOS)	11	1520.00	789.00	1110.45	1520.00	1280.00	1170.00	882.00	789.00
PH (UNITS)	8	8.20	7.50		8.20	8.17	7.90	7.52	7.50
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	8	8.20	1.70	4.19	8.20	6.98	3.50	1.83	1.70
ALKALINITY FIELD (MG/L AS CACO3)	11	156.00	107.00	131.55	156.00	146.00	131.00	123.00	107.00
BICARBONATE FET-FLD (MG/L AS HCO3)	11	190.00	131.00	160.45	190.00	178.00	160.00	150.00	131.00
CARBONATE FET-FLD (MG/L AS CO3)	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	11	390.00	210.00	295.45	390.00	330.00	310.00	250.00	210.00
HARDNESS, NONCARBONATE (MG/L CACO3)	11	262.00	99.00	163.09	262.00	200.00	170.00	110.00	99.00
CALCIUM DISSOLVED (MG/L AS CA)	11	83.00	51.00	67.64	83.00	79.00	67.00	64.00	51.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	11	45.00	19.00	30.45	45.00	36.00	30.00	23.00	19.00
SODIUM, DISSOLVED (MG/L AS NA)	11	150.00	65.00	102.55	150.00	130.00	110.00	69.00	65.00
SODIUM ADSORPTION RATIO	11	3.40	1.90	2.65	3.40	3.20	2.80	2.10	1.90
PERCENT SODIUM	11	47.00	35.00	42.09	47.00	45.00	42.00	40.00	35.00
POTASSIUM, DISSOLVED (MG/L AS K)	11	7.80	5.00	6.08	7.80	7.40	5.60	5.30	5.00
CHLORIDE, DISSOLVED (MG/L AS CL)	11	350.00	150.00	237.27	350.00	290.00	260.00	160.00	150.00
SULFATE DISSOLVED (MG/L AS SO4)	11	76.00	33.00	51.00	76.00	56.00	53.00	40.00	33.00
FLUORIDE, DISSOLVED (MG/L AS F)	10	0.50	0.20	0.30	0.50	0.40	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	11	8.00	4.10	6.55	8.00	7.30	6.70	6.10	4.10
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	11	794.00	395.00	580.73	794.00	677.00	613.00	464.00	395.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	11	1.10	0.54	0.79	1.10	0.92	0.83	0.63	0.54

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08143000 STATION NAME: LAKE BROWNWOOD NEAR BROWNWOOD, TEXAS

LATITUDE: 315013 LONGITUDE: 0990013 COUNTY: BROWN DRAINAGE AREA: 1565.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO NOV 1981

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	11	27.00	6.00	18.91	27.00	26.00	21.00	15.00	6.00
SPECIFIC CONDUCTANCE (UMHOS)	12	859.00	490.00	660.75	859.00	753.75	640.00	603.75	490.00
PH (UNITS)	7	8.30	7.50		8.30	8.30	8.10	7.90	7.50
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	7	6.80	1.10	2.69	6.80	3.10	1.80	1.30	1.10
ALKALINITY FIELD (MG/L AS CACO3)	12	133.00	96.00	116.92	133.00	122.25	117.00	112.75	96.00
BICARBONATE FET-FLD (MG/L AS HCO3)	10	162.00	133.00	144.60	162.00	151.25	142.50	139.00	133.00
CARBONATE FET-FLD (MG/L AS CO3)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HARDNESS (MG/L AS CACO3)	12	260.00	150.00	192.50	260.00	217.50	185.00	170.00	150.00
HARDNESS, NONCARBONATE (MG/L CACO3)	12	134.00	49.00	74.25	134.00	92.50	68.00	53.50	49.00
CALCIUM DISSOLVED (MG/L AS CA)	12	68.00	43.00	55.17	68.00	59.75	54.00	50.00	43.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	12	21.00	9.20	12.91	21.00	15.00	12.00	10.25	9.20
SODIUM, DISSOLVED (MG/L AS NA)	12	75.00	36.00	53.17	75.00	60.75	51.50	45.50	36.00
SODIUM ADSORPTION RATIO	12	2.30	1.30	1.73	2.30	1.88	1.70	1.60	1.30
PERCENT SODIUM	12	42.00	32.00	36.50	42.00	38.00	36.50	35.00	32.00
POTASSIUM, DISSOLVED (MG/L AS K)	12	8.00	3.50	6.13	8.00	6.93	6.10	5.35	3.50
CHLORIDE, DISSOLVED (MG/L AS CL)	12	160.00	76.00	106.67	160.00	125.00	100.00	88.25	76.00
SULFATE DISSOLVED (MG/L AS SO4)	12	63.00	32.00	45.58	63.00	52.50	44.00	40.25	32.00
FLUORIDE, DISSOLVED (MG/L AS F)	11	0.40	0.20	0.29	0.40	0.30	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	12	8.40	4.60	6.92	8.40	8.08	7.25	6.05	4.60
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	12	473.00	267.00	356.83	473.00	410.50	342.50	318.25	267.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	12	0.64	0.36	0.49	0.64	0.56	0.47	0.44	0.36

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08143600 STATION NAME: PECAN BAYOU NEAR MULLIN, TEXAS

LATITUDE: 313102 LONGITUDE: 0984425 COUNTY: MILLS DRAINAGE AREA: 2073.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	94	31.50	3.50	18.75	29.12	25.12	19.50	12.00	6.50
STREAMFLOW, INSTANTANEOUS (CFS)	95	4899.99	0.08	186.36	1256.00	27.00	14.00	8.53	2.46
SPECIFIC CONDUCTANCE (UMHOS)	91	2020.00	217.00	1121.34	1834.00	1530.00	1110.00	714.00	376.80
PH (UNITS)	59	8.60	6.80		8.40	8.10	7.90	7.60	7.20
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	59	25.18	0.77	6.57	18.79	9.30	4.40	2.75	1.04
ALKALINITY FIELD (MG/L AS CACO3)	91	254.00	82.00	171.01	237.40	205.00	180.00	139.00	103.00
BICARBONATE FET-FLD (MG/L AS HCO3)	80	310.00	100.00	210.59	289.20	250.00	222.00	174.00	122.15
CARBONATE FET-FLD (MG/L AS CO3)	80	14.00	0.00	0.56	5.90	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	11	2.70	0.03	1.06	2.70	1.50	0.90	0.40	0.03
HARDNESS (MG/L AS CACO3)	91	410.59	91.31	262.54	387.53	331.08	270.53	182.65	122.65
HARDNESS, NONCARBONATE (MG/L CACO3)	91	188.82	2.30	91.53	171.83	134.34	94.31	51.99	15.13
CALCIUM DISSOLVED (MG/L AS CA)	91	110.00	27.00	75.52	110.00	94.00	76.00	55.00	41.20
MAGNESIUM, DISSOLVED (MG/L AS MG)	91	33.00	4.20	17.96	28.80	24.00	19.00	11.00	6.66
SODIUM, DISSOLVED (MG/L AS NA)	81	290.00	5.10	127.62	257.00	190.00	130.00	59.00	25.10
SODIUM ADSORPTION RATIO	91	7.55	0.21	3.33	5.87	4.72	3.58	1.69	0.80
PERCENT SODIUM	81	68.06	7.88	45.91	62.49	54.53	49.25	37.57	27.26
POTASSIUM, DISSOLVED (MG/L AS K)	81	16.00	4.10	9.03	13.90	11.00	8.90	6.70	5.10
CHLORIDE, DISSOLVED (MG/L AS CL)	91	470.00	7.40	204.84	392.00	290.00	200.00	100.00	35.60
SULFATE DISSOLVED (MG/L AS SO4)	91	150.00	8.20	81.34	130.00	120.00	84.00	51.00	19.40
FLUORIDE, DISSOLVED (MG/L AS F)	78	4.00	0.00	0.39	0.60	0.40	0.30	0.20	0.10
SILICA, DISSOLVED (MG/L AS SIO2)	91	12.00	0.50	6.40	12.00	8.50	7.10	3.40	0.80
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	91	1131.51	132.00	624.03	997.63	861.66	610.51	389.92	219.29
SOLIDS, DISSOLVED (TONS PER DAY)	91	3404.26	0.11	137.09	707.94	51.56	27.34	15.05	3.35
SOLIDS, DISSOLVED (TONS PER AC-FT)	91	1.54	0.18	0.85	1.36	1.17	0.83	0.53	0.30

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08147000 STATION NAME: COLORADO RIVER NEAR SAN SABA, TEXAS

LATITUDE: 311304 LONGITUDE: 0983351 COUNTY: SAN SABA DRAINAGE AREA: 31217.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	123	33.00	4.00	19.78	30.40	26.00	20.00	13.00	8.60
STREAMFLOW, INSTANTANEOUS (CFS)	125	46599.91	16.00	1093.70	2247.99	468.00	228.00	156.00	49.80
TURBIDITY (JTU)	9	50.00	9.00	24.89	50.00	37.50	25.00	10.00	9.00
TURBIDITY (FTU)	37	1500.00	0.40	94.82	464.99	50.50	24.00	11.00	1.48
SPECIFIC CONDUCTANCE (UMHOS)	117	1470.00	248.00	883.95	1274.00	1105.00	903.00	649.00	495.50
OXYGEN, DISSOLVED (MG/L)	82	17.60	4.80	8.82	12.84	10.12	8.35	7.07	5.54
OXYGEN, DISSOLVED (PERCENT SATURATION)	82	160.00	61.00	96.07	131.70	105.25	95.50	83.00	69.60
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	82	12.00	0.40	2.15	3.67	2.50	1.90	1.40	1.00
PH (UNITS)	116	8.80	6.90		8.40	8.20	8.00	7.80	7.20
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	116	38.21	0.39	5.93	18.28	6.26	3.79	2.71	1.44
ALKALINITY FIELD (MG/L AS CACO3)	116	253.00	74.00	186.89	238.00	213.00	192.50	164.50	120.00
BICARBONATE FET-FLD (MG/L AS HCO3)	98	309.00	88.00	229.92	290.30	264.25	240.00	201.50	149.70
CARBONATE FET-FLD (MG/L AS CO3)	98	7.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	69	4.10	0.48	1.56	3.89	2.00	1.29	0.94	0.62
NITROGEN, ORGANIC TOTAL (MG/L AS N)	80	3.32	0.00	0.79	1.52	0.91	0.64	0.55	0.32
NITROGEN, AMMONIA TOTAL (MG/L AS N)	80	0.46	0.00	0.05	0.19	0.07	0.03	0.01	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	54	0.11	0.00	0.01	0.04	0.02	0.01	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	63	2.80	0.00	0.69	2.30	1.00	0.40	0.20	0.03
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	75	3.40	0.30	0.90	1.76	1.10	0.76	0.60	0.40
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	69	2.80	0.00	0.67	2.40	0.86	0.40	0.20	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	83	0.54	0.01	0.10	0.35	0.12	0.07	0.05	0.02
CARBON, ORGANIC TOTAL (MG/L AS C)	30	28.00	2.60	7.01	19.75	9.03	5.30	3.85	2.66
HARDNESS (MG/L AS CACO3)	116	452.17	85.96	302.25	419.30	364.48	308.56	236.65	170.19
HARDNESS, NONCARBONATE (MG/L CACO3)	116	322.17	0.00	115.41	225.59	167.42	109.63	60.07	24.24
CALCIUM DISSOLVED (MG/L AS CA)	116	100.00	27.00	69.30	95.60	83.00	71.50	56.25	42.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	116	54.00	4.50	31.37	47.00	39.75	32.00	24.00	13.70
SODIUM, DISSOLVED (MG/L AS NA)	104	140.00	6.00	63.09	100.00	82.00	63.50	39.00	23.00
SODIUM ADSORPTION RATIO	115	2.94	0.23	1.61	2.39	2.00	1.66	1.17	0.74
PERCENT SODIUM	104	43.34	2.00	29.47	37.96	34.06	30.36	25.96	18.79
POTASSIUM, DISSOLVED (MG/L AS K)	104	6.40	2.80	4.18	5.40	4.68	4.10	3.60	3.10
CHLORIDE, DISSOLVED (MG/L AS CL)	117	280.00	13.00	119.99	211.00	160.00	130.00	70.00	39.80
SULFATE DISSOLVED (MG/L AS SO4)	117	240.00	10.00	85.11	160.00	120.00	82.00	43.00	23.90
FLUORIDE, DISSOLVED (MG/L AS F)	100	0.60	0.00	0.27	0.40	0.30	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	117	73.00	0.00	10.75	16.00	13.00	11.00	7.95	3.68
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	52	898.00	155.00	508.02	764.15	619.75	520.50	369.00	247.55
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	116	892.81	128.05	497.19	743.79	621.96	516.27	356.01	251.94
SOLIDS, DISSOLVED (TONS PER DAY)	116	23531.13	16.46	901.33	2124.32	669.29	371.62	221.34	42.76
SOLIDS, DISSOLVED (TONS PER AC-FT)	116	1.22	0.21	0.69	1.02	0.85	0.71	0.49	0.36

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08151500 STATION NAME: LLANO RIVER AT LLANO, TEXAS

LATITUDE: 304504 LONGITUDE: 0984010 COUNTY: LLANO DRAINAGE AREA: 4197.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM APR 1979 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	30	32.50	8.00	20.63	32.22	26.88	21.00	13.75	8.28
STREAMFLOW, INSTANTANEOUS (CFS)	30	1420.00	23.00	265.63	1013.55	318.50	207.50	104.25	26.85
TURBIDITY (FTU)	28	160.00	0.40	10.32	97.00	5.78	4.20	1.55	0.45
SPECIFIC CONDUCTANCE (UMHOS)	30	498.00	234.00	394.53	490.85	432.00	401.50	357.50	263.70
OXYGEN, DISSOLVED (MG/L)	30	12.60	4.60	9.11	12.38	10.72	8.55	7.97	5.86
OXYGEN, DISSOLVED (PERCENT SATURATION)	30	128.00	66.00	101.60	124.70	106.50	100.50	95.75	79.20
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	30	2.70	0.10	0.82	2.15	1.05	0.70	0.40	0.21
PH (UNITS)	30	8.60	7.10		8.60	8.10	7.90	7.68	7.27
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	30	26.14	0.78	4.98	18.03	5.39	4.17	2.37	0.82
ALKALINITY FIELD (MG/L AS CACO3)	30	190.00	94.00	149.03	190.00	162.50	148.00	138.25	102.80
BICARBONATE FET-FLD (MG/L AS HCO3)	18	190.00	100.00	167.22	190.00	180.00	175.00	157.50	100.00
CARBONATE FET-FLD (MG/L AS CO3)	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	24	3.53	0.17	0.87	3.50	0.94	0.65	0.48	0.18
NITROGEN, ORGANIC TOTAL (MG/L AS N)	24	3.44	0.15	0.66	2.90	0.71	0.48	0.33	0.16
NITROGEN, AMMONIA TOTAL (MG/L AS N)	24	0.11	0.00	0.04	0.11	0.06	0.02	0.01	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	6	0.04	0.00	0.01	0.04	0.03	0.01	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	6	0.18	0.00	0.08	0.18	0.18	0.04	0.01	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	30	3.50	0.15	0.70	2.29	0.81	0.57	0.39	0.17
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	24	2.10	0.00	0.18	1.68	0.18	0.05	0.03	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	30	0.39	0.00	0.04	0.27	0.04	0.03	0.01	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	14	13.00	1.40	4.59	13.00	5.98	4.05	2.68	1.40
HARDNESS (MG/L AS CACO3)	30	217.95	88.86	170.44	216.12	191.03	168.94	153.18	107.57
HARDNESS, NONCARBONATE (MG/L CACO3)	30	69.95	0.00	21.64	51.49	26.57	20.94	15.84	0.00
CALCIUM DISSOLVED (MG/L AS CA)	30	51.00	20.00	36.40	49.35	44.00	37.00	31.50	20.55
MAGNESIUM, DISSOLVED (MG/L AS MG)	30	23.00	7.40	19.31	23.00	21.25	20.00	18.75	8.17
SODIUM, DISSOLVED (MG/L AS NA)	30	21.00	6.50	14.77	20.45	16.25	14.00	14.00	7.71
SODIUM ADSORPTION RATIO	30	0.82	0.27	0.51	0.76	0.56	0.48	0.46	0.35
PERCENT SODIUM	30	25.78	9.93	15.76	22.98	17.31	15.20	13.83	11.15
POTASSIUM, DISSOLVED (MG/L AS K)	30	4.30	1.70	2.36	3.47	2.60	2.30	2.00	1.76
CHLORIDE, DISSOLVED (MG/L AS CL)	30	38.00	12.00	24.73	36.90	28.00	25.00	21.75	12.55
SULFATE DISSOLVED (MG/L AS SO4)	30	25.00	8.40	16.18	23.90	19.00	16.00	13.00	9.28
FLUORIDE, DISSOLVED (MG/L AS F)	30	0.50	0.10	0.25	0.44	0.30	0.20	0.20	0.15
SILICA, DISSOLVED (MG/L AS SIO2)	30	22.00	0.20	12.25	21.45	15.25	11.00	8.50	2.51
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	30	290.00	134.00	224.90	273.50	245.25	221.00	207.50	167.00
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	30	259.30	122.43	215.28	255.69	238.06	211.21	201.91	144.50
SOLIDS, DISSOLVED (TONS PER DAY)	30	743.80	13.79	155.21	538.99	212.64	138.78	68.52	15.16
SOLIDS, DISSOLVED (TONS PER AC-FT)	30	0.39	0.18	0.31	0.37	0.33	0.30	0.28	0.23

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08153500 STATION NAME: PEDERNALES RIVER NEAR JOHNSON CITY, TEXAS

LATITUDE: 301730 LONGITUDE: 0982357 COUNTY: BLANCO DRAINAGE AREA: 901.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	81	32.50	2.00	20.60	30.00	26.75	22.00	15.00	8.05
STREAMFLOW, INSTANTANEOUS (CFS)	84	36800.00	0.72	1057.52	2792.70	157.00	86.15	49.20	11.35
SPECIFIC CONDUCTANCE (UMHOS)	84	830.00	205.00	632.67	791.25	724.75	649.00	588.75	355.25
PH (UNITS)	49	8.50	7.30		8.40	8.20	8.00	7.80	7.35
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	48	23.00	1.30	6.01	19.00	6.33	3.95	2.95	1.62
ALKALINITY FIELD (MG/L AS CACO3)	83	281.00	94.00	215.80	262.80	238.00	220.00	202.00	147.40
BICARBONATE FET-FLD (MG/L AS HCO3)	70	342.00	114.00	265.64	320.45	292.25	270.00	250.00	182.40
CARBONATE FET-FLD (MG/L AS CO3)	71	12.00	0.00	0.51	8.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	11	2.00	0.04	0.69	2.00	1.00	0.60	0.20	0.04
HARDNESS (MG/L AS CACO3)	84	330.00	98.00	250.57	310.00	287.50	260.00	230.00	137.50
HARDNESS, NONCARBONATE (MG/L CACO3)	83	68.00	0.00	36.46	62.00	45.00	36.00	28.00	11.00
CALCIUM DISSOLVED (MG/L AS CA)	84	64.00	18.00	41.31	55.75	47.00	41.50	35.25	29.50
MAGNESIUM, DISSOLVED (MG/L AS MG)	84	51.00	4.90	35.91	47.00	41.75	37.50	33.00	15.75
SODIUM, DISSOLVED (MG/L AS NA)	71	67.00	2.90	35.48	55.20	43.00	36.00	28.00	10.16
SODIUM ADSORPTION RATIO	84	1.80	0.10	0.98	1.55	1.17	1.00	0.80	0.35
~~PERCENT SODIUM~~	~~71~~	~~36.00~~	~~5.00~~	~~22.38~~	~~30.80~~	~~26.00~~	~~24.00~~	~~18.00~~	~~11.40~~
POTASSIUM, DISSOLVED (MG/L AS K)	71	4.50	1.90	2.94	4.18	3.20	2.90	2.60	2.06
CHLORIDE, DISSOLVED (MG/L AS CL)	84	110.00	3.30	57.72	96.50	73.75	58.50	43.00	16.50
SULFATE DISSOLVED (MG/L AS SO4)	84	57.00	4.30	33.37	44.00	40.00	35.50	28.50	12.50
FLUORIDE, DISSOLVED (MG/L AS F)	75	0.90	0.00	0.36	0.50	0.40	0.40	0.30	0.18
SILICA, DISSOLVED (MG/L AS SIO2)	84	28.00	0.80	8.98	20.25	12.00	9.00	4.30	1.52
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	84	475.00	116.00	345.30	422.75	396.25	353.50	318.00	187.75
SOLIDS, DISSOLVED (TONS PER DAY)	84	16700.00	0.69	477.21	1312.23	140.00	76.65	50.03	10.93
SOLIDS, DISSOLVED (TONS PER AC-FT)	84	0.65	0.16	0.47	0.58	0.54	0.48	0.43	0.26

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08158000 STATION NAME: COLORADO RIVER AT AUSTIN, TEXAS

LATITUDE: 301440 LONGITUDE: 0974139 COUNTY: TRAVIS DRAINAGE AREA: 39009.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	115	29.00	9.00	20.07	27.10	23.50	20.50	17.00	12.60
STREAMFLOW, INSTANTANEOUS (CFS)	116	6530.00	9.30	1822.55	5622.98	3372.49	1265.00	99.25	38.55
TURBIDITY (JTU)	55	20.00	0.00	4.40	16.00	5.00	3.00	2.00	1.00
TURBIDITY (FTU)	41	280.00	0.10	9.33	19.00	3.35	1.50	0.95	0.20
COLOR (PLATINUMCOBALT UNITS)	58	5.00	0.00	2.12	5.00	5.00	1.00	0.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	116	613.00	402.00	526.54	600.30	552.75	530.00	499.25	455.20
OXYGEN, DISSOLVED (MG/L)	99	19.60	2.60	8.96	12.80	10.60	9.10	7.30	5.00
OXYGEN, DISSOLVED (PERCENT SATURATION)	99	251.00	30.00	98.61	140.00	109.00	101.00	85.00	57.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	98	1.60	0.00	0.67	1.30	1.00	0.60	0.40	0.10
PH (UNITS)	114	8.50	6.90		8.20	7.80	7.60	7.40	7.10
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	113	36.01	0.90	9.75	23.06	12.04	8.50	4.75	1.78
ALKALINITY FIELD (MG/L AS CACO3)	113	230.00	119.00	165.01	205.00	174.00	162.00	152.00	140.00
BICARBONATE FET-FLD (MG/L AS HCO3)	95	280.00	145.00	203.41	250.80	214.00	200.00	190.00	170.00
CARBONATE FET-FLD (MG/L AS CO3)	95	8.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	59	28.00	0.00	7.14	26.00	10.00	4.00	2.00	0.00
NITROGEN, TOTAL (MG/L AS N)	86	1.76	0.21	0.72	1.30	0.93	0.68	0.45	0.32
NITROGEN, ORGANIC TOTAL (MG/L AS N)	90	1.57	0.04	0.43	1.04	0.52	0.38	0.26	0.07
NITROGEN, AMMONIA TOTAL (MG/L AS N)	91	0.22	0.00	0.04	0.13	0.06	0.03	0.02	0.01
NITROGEN, NITRITE TOTAL (MG/L AS N)	70	0.05	0.00	0.01	0.04	0.01	0.01	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	82	1.10	0.03	0.28	0.69	0.35	0.26	0.13	0.05
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	98	2.60	0.05	0.50	1.10	0.62	0.42	0.30	0.10
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	86	0.74	0.03	0.25	0.58	0.32	0.25	0.13	0.05
PHOSPHORUS, TOTAL (MG/L AS P)	99	0.24	0.00	0.03	0.09	0.04	0.02	0.01	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	70	27.00	0.00	4.66	14.35	4.40	3.30	2.68	1.77
HARDNESS (MG/L AS CACO3)	113	274.51	153.15	206.45	244.58	215.89	204.72	195.54	173.74
HARDNESS, NONCARBONATE (MG/L CACO3)	113	66.30	22.24	41.44	57.56	47.34	40.96	35.47	27.12
CALCIUM DISSOLVED (MG/L AS CA)	113	72.00	30.00	49.55	65.60	52.00	48.00	45.00	40.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	114	25.00	15.00	20.06	23.25	21.00	20.00	19.00	17.00
SODIUM, DISSOLVED (MG/L AS NA)	105	40.00	15.00	26.69	34.00	29.00	27.00	24.00	17.90
SODIUM ADSORPTION RATIO	113	1.23	0.30	0.81	1.05	0.91	0.83	0.73	0.49
PERCENT SODIUM	105	28.70	2.00	21.37	25.77	23.36	21.93	19.92	14.63
POTASSIUM, DISSOLVED (MG/L AS K)	105	4.80	1.70	3.23	3.90	3.50	3.30	3.00	2.09
CHLORIDE, DISSOLVED (MG/L AS CL)	115	68.00	21.00	46.24	62.20	52.00	47.00	41.00	30.00
SULFATE DISSOLVED (MG/L AS SO4)	115	44.00	17.00	33.17	42.20	36.00	33.00	29.00	24.00
FLUORIDE, DISSOLVED (MG/L AS F)	100	1.30	0.00	0.25	0.40	0.30	0.20	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	115	11.00	0.20	8.53	11.00	9.50	8.50	7.90	6.54
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	96	342.00	213.00	295.67	338.00	310.75	295.00	279.00	258.40
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	113	346.61	202.00	286.01	325.75	301.45	286.01	269.67	244.41
SOLIDS, DISSOLVED (TONS PER DAY)	112	5324.56	8.46	1403.65	4100.87	2617.73	1024.95	82.53	35.78
SOLIDS, DISSOLVED (TONS PER AC-FT)	113	0.47	0.27	0.40	0.46	0.42	0.40	0.38	0.34

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08158650 STATION NAME: COLORADO RIVER BELOW AUSTIN, TEXAS

LATITUDE: 301228 LONGITUDE: 0973815 COUNTY: TRAVIS

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	96	30.00	10.00	20.04	28.00	24.00	20.75	15.13	11.50
STREAMFLOW, INSTANTANEOUS (CFS)	73	7999.98	39.00	1846.44	6083.99	3140.00	940.00	197.50	87.50
TURBIDITY (JTU)	45	30.00	1.00	7.58	28.50	9.50	5.00	3.00	2.00
TURBIDITY (FTU)	37	260.00	0.50	12.57	75.50	6.30	3.30	1.75	0.50
COLOR (PLATINUMCOBALT UNITS)	82	12.00	0.00	4.30	10.00	5.00	5.00	0.75	0.00
SPECIFIC CONDUCTANCE (UMHOS)	97	704.00	454.00	560.74	675.40	605.50	556.00	517.00	470.90
OXYGEN, DISSOLVED (MG/L)	97	13.20	4.50	8.36	11.29	9.40	8.40	7.30	5.69
OXYGEN, DISSOLVED (PERCENT SATURATION)	97	148.00	44.00	91.88	117.10	102.00	94.00	81.50	63.50
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	94	12.00	0.20	2.60	9.17	3.20	1.40	1.00	0.50
PH (UNITS)	97	8.30	6.90		8.10	7.70	7.50	7.30	7.10
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	74	42.01	1.67	12.06	28.07	15.93	10.30	6.30	2.54
ALKALINITY FIELD (MG/L AS CACO3)	74	203.00	131.00	163.59	195.50	171.25	160.00	150.00	142.25
BICARBONATE FET-FLD (MG/L AS HCO3)	60	247.00	160.00	201.70	237.80	214.00	200.00	190.00	178.10
CARBONATE FET-FLD (MG/L AS CO3)	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED (MG/L)	83	486.00	0.00	19.84	60.00	15.00	10.00	6.00	0.00
NITROGEN, TOTAL (MG/L AS N)	85	11.79	0.39	2.28	6.44	3.11	1.45	0.93	0.62
NITROGEN, ORGANIC TOTAL (MG/L AS N)	94	9.30	0.00	0.84	2.46	0.89	0.59	0.38	0.11
NITROGEN, AMMONIA TOTAL (MG/L AS N)	95	3.70	0.00	0.62	2.62	0.72	0.26	0.14	0.06
NITROGEN, NITRITE TOTAL (MG/L AS N)	95	0.66	0.00	0.10	0.41	0.13	0.05	0.03	0.01
NITROGEN, NITRATE TOTAL (MG/L AS N)	95	3.90	0.08	0.67	2.44	0.75	0.43	0.29	0.12
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	86	11.00	0.19	1.52	4.10	1.93	0.93	0.57	0.30
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	86	4.50	0.09	0.78	2.86	0.82	0.48	0.33	0.16
PHOSPHORUS, TOTAL (MG/L AS P)	95	4.90	0.05	0.71	2.70	0.86	0.28	0.16	0.07
CARBON, ORGANIC TOTAL (MG/L AS C)	81	20.00	0.80	5.67	14.90	7.00	4.40	3.50	2.61
HARDNESS (MG/L AS CACO3)	66	246.30	168.27	203.95	237.54	213.34	203.87	190.43	181.52
HARDNESS, NONCARBONATE (MG/L CACO3)	66	57.70	24.23	40.44	54.90	45.96	40.40	34.79	26.18
CALCIUM DISSOLVED (MG/L AS CA)	66	65.00	41.00	50.06	61.65	54.25	49.00	45.00	42.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	66	24.00	11.00	19.15	23.00	20.00	19.00	18.00	16.00
SODIUM, DISSOLVED (MG/L AS NA)	60	59.00	17.00	31.50	49.90	36.00	30.00	25.25	22.05
SODIUM ADSORPTION RATIO	66	1.82	0.56	0.98	1.53	1.10	0.94	0.82	0.73
PERCENT SODIUM	60	36.74	15.35	24.50	33.62	26.62	23.63	21.88	19.51
POTASSIUM, DISSOLVED (MG/L AS K)	60	7.00	2.20	4.02	6.50	4.00	3.75	3.50	3.11
CHLORIDE, DISSOLVED (MG/L AS CL)	66	87.00	26.00	51.62	68.65	57.25	50.00	45.75	33.80
SULFATE DISSOLVED (MG/L AS SO4)	66	56.00	27.00	38.18	54.65	41.25	37.00	33.00	29.00
FLUORIDE, DISSOLVED (MG/L AS F)	60	1.10	0.20	0.40	1.00	0.40	0.30	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	66	12.00	6.00	9.02	11.00	9.70	9.05	8.20	7.23
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	66	384.45	247.26	301.93	361.96	325.25	298.36	274.32	256.16
SOLIDS, DISSOLVED (TONS PER DAY)	50	5635.59	32.50	1502.82	5204.64	2545.95	870.57	164.94	66.98
SOLIDS, DISSOLVED (TONS PER AC-FT)	66	0.52	0.34	0.41	0.49	0.44	0.41	0.37	0.35

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08159200 STATION NAME: COLORADO RIVER AT BASTROP, TEXAS

LATITUDE: 300620 LONGITUDE: 0971908 COUNTY: BASTROP DRAINAGE AREA: 39979.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	56	29.00	6.00	20.32	28.57	26.00	21.50	15.13	9.55
STREAMFLOW, INSTANTANEOUS (CFS)	50	4060.00	123.00	1718.50	3741.50	2950.00	1480.00	461.50	168.45
SPECIFIC CONDUCTANCE (UMHOS)	56	720.00	452.00	575.18	700.00	608.75	566.50	528.00	477.30
OXYGEN, DISSOLVED (MG/L)	48	14.00	6.40	8.99	13.35	10.30	8.60	7.40	6.69
OXYGEN, DISSOLVED (PERCENT SATURATION)	48	147.00	76.00	98.65	129.05	104.00	95.50	89.00	80.80
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	47	2.60	0.00	0.80	2.24	1.10	0.70	0.40	0.14
PH (UNITS)	56	8.60	7.20		8.40	8.00	7.80	7.53	7.28
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	56	21.05	0.88	6.88	17.40	9.97	5.54	3.11	1.52
ALKALINITY FIELD (MG/L AS CACO3)	56	226.00	139.00	172.48	217.60	188.25	166.50	156.75	146.80
BICARBONATE FET-FLD (MG/L AS HCO3)	44	276.00	170.00	214.52	267.75	230.00	209.00	200.00	180.00
CARBONATE FET-FLD (MG/L AS CO3)	44	6.00	0.00	0.32	4.50	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	42	4.36	0.52	1.59	3.98	1.99	1.26	1.01	0.65
NITROGEN, ORGANIC TOTAL (MG/L AS N)	48	2.16	0.11	0.59	1.18	0.69	0.51	0.42	0.17
NITROGEN, AMMONIA TOTAL (MG/L AS N)	48	0.70	0.00	0.10	0.32	0.13	0.06	0.03	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	48	0.35	0.00	0.04	0.14	0.04	0.02	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	55	7.40	0.10	0.97	2.89	1.19	0.55	0.40	0.26
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	42	2.20	0.20	0.71	1.30	0.83	0.66	0.50	0.22
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	42	3.50	0.24	0.87	3.02	1.13	0.56	0.45	0.29
PHOSPHORUS, TOTAL (MG/L AS P)	48	1.70	0.01	0.39	1.35	0.48	0.24	0.15	0.08
HARDNESS (MG/L AS CACO3)	55	280.39	181.50	218.00	263.90	238.81	210.46	198.10	186.17
HARDNESS, NONCARBONATE (MG/L CACO3)	55	85.07	27.63	44.91	66.95	48.21	42.33	38.11	30.76
CALCIUM DISSOLVED (MG/L AS CA)	55	76.00	43.00	55.04	75.00	63.00	52.00	47.00	43.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	55	25.00	14.00	19.56	23.00	21.00	20.00	18.00	15.00
SODIUM, DISSOLVED (MG/L AS NA)	41	53.00	20.00	32.68	49.40	37.50	31.00	27.00	21.30
SODIUM ADSORPTION RATIO	55	1.52	0.60	1.01	1.32	1.13	0.97	0.86	0.75
PERCENT SODIUM	41	31.07	16.09	23.92	29.55	26.48	23.86	22.04	16.98
POTASSIUM, DISSOLVED (MG/L AS K)	42	6.20	2.50	3.81	5.61	4.00	3.70	3.40	2.93
CHLORIDE, DISSOLVED (MG/L AS CL)	56	73.00	37.00	52.00	67.30	57.00	52.00	45.00	37.00
SULFATE DISSOLVED (MG/L AS SO4)	56	71.00	29.00	41.50	66.60	44.00	40.00	36.00	30.85
FLUORIDE, DISSOLVED (MG/L AS F)	55	0.90	0.20	0.34	0.62	0.40	0.30	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	56	11.00	0.20	7.75	10.15	9.10	8.40	6.92	2.78
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	56	406.14	101.00	314.31	387.35	339.82	308.19	290.31	256.30
SOLIDS, DISSOLVED (TONS PER DAY)	50	3237.47	128.60	1360.49	2927.57	2196.49	1195.00	368.20	169.28
SOLIDS, DISSOLVED (TONS PER AC-FT)	56	0.55	0.14	0.43	0.53	0.46	0.42	0.39	0.35

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08161000 STATION NAME: COLORADO RIVER AT COLUMBUS, TEXAS

LATITUDE: 294222 LONGITUDE: 0963212 COUNTY: COLORADO DRAINAGE AREA: 41640.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	64	32.50	5.00	21.20	30.75	26.75	23.00	16.00	9.50
STREAMFLOW, INSTANTANEOUS (CFS)	58	9200.00	295.00	2274.67	7443.97	2802.50	1790.00	703.50	316.85
SPECIFIC CONDUCTANCE (UMHOS)	58	757.00	327.00	557.34	680.20	595.25	560.00	520.00	423.30
OXYGEN, DISSOLVED (MG/L)	53	12.00	6.80	8.82	11.86	9.70	8.80	7.80	6.97
OXYGEN, DISSOLVED (PERCENT SATURATION)	53	130.00	84.00	98.15	115.20	105.00	96.00	91.00	84.70
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	52	2.80	0.20	1.27	2.73	1.70	1.05	0.80	0.40
PH (UNITS)	58	8.60	6.40		8.51	8.10	7.75	7.20	6.70
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	58	111.34	0.72	14.28	58.07	19.10	6.00	2.54	1.05
ALKALINITY FIELD (MG/L AS CACO3)	59	230.00	87.00	168.15	220.00	180.00	167.00	156.00	110.00
BICARBONATE FET-FLD (MG/L AS HCO3)	52	280.00	106.00	205.79	270.00	221.50	207.50	188.50	134.40
CARBONATE FET-FLD (MG/L AS CO3)	52	3.00	0.00	0.10	0.70	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	40	2.98	0.27	1.24	2.67	1.40	1.15	0.86	0.59
NITROGEN, ORGANIC TOTAL (MG/L AS N)	51	2.03	0.00	0.55	1.23	0.72	0.50	0.30	0.05
NITROGEN, AMMONIA TOTAL (MG/L AS N)	53	0.41	0.00	0.05	0.32	0.05	0.02	0.00	0.00
~~NITROGEN, NITRITE TOTAL (MG/L AS N)~~	~~53~~	~~0.25~~	~~0.00~~	~~0.02~~	~~0.07~~	~~0.02~~	~~0.01~~	~~0.01~~	~~0.00~~
NITROGEN, NITRATE TOTAL (MG/L AS N)	57	1.42	0.02	0.57	1.11	0.80	0.56	0.35	0.12
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	41	2.10	0.12	0.69	1.29	0.86	0.58	0.47	0.16
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	40	1.50	0.12	0.57	1.19	0.76	0.55	0.34	0.16
PHOSPHORUS, TOTAL (MG/L AS P)	53	0.79	0.05	0.23	0.63	0.27	0.19	0.13	0.08
HARDNESS (MG/L AS CACO3)	58	276.40	115.05	209.40	265.33	230.91	208.03	193.21	154.46
HARDNESS, NONCARBONATE (MG/L CACO3)	59	87.40	0.00	40.92	55.70	47.23	41.73	34.11	23.24
CALCIUM DISSOLVED (MG/L AS CA)	58	81.00	30.00	55.47	78.05	63.25	53.00	48.00	41.75
MAGNESIUM, DISSOLVED (MG/L AS MG)	58	22.00	5.50	17.22	21.05	19.25	18.00	15.75	10.95
SODIUM, DISSOLVED (MG/L AS NA)	44	50.00	21.00	30.45	46.75	33.00	29.00	25.25	22.25
SODIUM ADSORPTION RATIO	58	1.39	0.60	0.93	1.31	1.00	0.92	0.82	0.60
PERCENT SODIUM	44	30.02	18.14	23.40	29.62	24.78	23.49	21.83	18.38
POTASSIUM, DISSOLVED (MG/L AS K)	44	6.00	3.20	3.87	4.48	4.18	3.85	3.50	3.30
CHLORIDE, DISSOLVED (MG/L AS CL)	58	68.00	26.00	47.38	62.25	53.00	47.50	41.75	27.90
SULFATE DISSOLVED (MG/L AS SO4)	58	83.00	27.00	40.60	67.30	44.00	39.00	36.00	28.95
FLUORIDE, DISSOLVED (MG/L AS F)	54	0.60	0.00	0.28	0.50	0.30	0.30	0.20	0.00
SILICA, DISSOLVED (MG/L AS SIO2)	58	14.00	1.30	8.60	13.05	10.00	9.00	7.12	3.14
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	58	423.39	178.00	304.41	380.51	326.06	299.60	281.94	241.89
SOLIDS, DISSOLVED (TONS PER DAY)	58	6501.92	242.92	1757.24	5991.52	2162.30	1573.64	602.88	289.31
SOLIDS, DISSOLVED (TONS PER AC-FT)	58	0.58	0.24	0.41	0.52	0.44	0.41	0.38	0.33

Table 5.--Statistical summary of selected water-quality data for the Colorado River basin, Texas--Continued

STATION NUMBER: 08162000 STATION NAME: COLORADO RIVER AT WHARTON, TEXAS

LATITUDE: 291832 LONGITUDE: 0960613 COUNTY: WHARTON DRAINAGE AREA: 42003.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS: SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN: 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	119	33.50	5.00	20.93	31.00	27.00	21.50	16.00	7.50
STREAMFLOW, INSTANTANEOUS (CFS)	125	58499.89	134.00	3652.25	14919.95	3294.99	1580.00	952.00	435.90
TURBIDITY (JTU)	58	350.00	5.00	63.36	254.00	76.25	42.50	23.75	9.75
TURBIDITY (FTU)	43	1000.00	0.30	75.44	290.00	58.00	40.00	10.00	0.78
COLOR (PLATINUMCOBALT UNITS)	91	250.00	0.00	23.46	79.00	30.00	10.00	10.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	118	711.00	188.00	542.14	686.10	609.00	561.50	500.00	304.10
OXYGEN, DISSOLVED (MG/L)	100	12.50	5.80	8.69	11.69	9.60	8.70	7.40	6.30
OXYGEN, DISSOLVED (PERCENT SATURATION)	100	139.00	69.00	95.80	118.80	100.75	94.00	89.00	81.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	101	33.00	0.10	1.61	3.16	1.70	1.20	0.75	0.41
PH (UNITS)	118	8.70	6.00		8.50	8.20	7.90	7.50	6.80
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	118	333.69	0.83	13.11	50.71	10.07	3.57	1.98	1.19
ALKALINITY FIELD (MG/L AS CACO3)	118	246.00	62.00	170.42	231.05	190.00	170.00	153.00	96.95
BICARBONATE FET-FLD (MG/L AS HCO3)	100	300.00	75.00	207.78	282.95	231.50	207.00	190.00	118.10
CARBONATE FET-FLD (MG/L AS CO3)	100	8.00	0.00	0.31	3.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED (MG/L)	94	1980.00	1.00	161.43	759.00	157.25	95.50	39.00	7.25
NITROGEN, TOTAL (MG/L AS N)	85	3.94	0.38	1.23	2.39	1.48	1.14	0.83	0.49
NITROGEN, ORGANIC TOTAL (MG/L AS N)	94	3.29	0.00	0.68	1.66	0.84	0.61	0.43	0.13
NITROGEN, AMMONIA TOTAL (MG/L AS N)	97	0.57	0.00	0.04	0.12	0.06	0.03	0.01	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	72	0.06	0.00	0.01	0.04	0.01	0.01	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	78	1.40	0.00	0.43	1.00	0.60	0.38	0.16	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	89	3.30	0.00	0.77	1.70	0.90	0.67	0.49	0.31
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	89	1.60	0.00	0.45	1.10	0.64	0.36	0.17	0.04
PHOSPHORUS, TOTAL (MG/L AS P)	101	0.68	0.05	0.22	0.47	0.27	0.20	0.13	0.08
CARBON, ORGANIC TOTAL (MG/L AS C)	80	45.00	1.80	6.95	18.70	7.95	5.00	3.63	2.01
HARDNESS (MG/L AS CACO3)	118	282.14	74.79	205.90	265.49	228.75	208.09	191.25	119.06
HARDNESS, NONCARBONATE (MG/L CACO3)	118	66.90	0.00	35.70	51.02	42.18	36.67	28.46	14.92
CALCIUM DISSOLVED (MG/L AS CA)	118	80.00	25.00	55.25	74.05	63.25	53.00	48.00	36.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	118	26.00	3.00	16.47	22.00	19.00	18.00	15.00	6.29
SODIUM, DISSOLVED (MG/L AS NA)	102	48.00	7.50	29.25	39.85	34.25	29.00	25.00	15.30
SODIUM ADSORPTION RATIO	117	1.36	0.30	0.90	1.15	1.01	0.90	0.79	0.49
PERCENT SODIUM	102	32.15	12.17	22.92	27.08	24.68	22.89	21.43	17.89
POTASSIUM, DISSOLVED (MG/L AS K)	102	5.00	3.10	3.83	4.70	4.00	3.80	3.50	3.30
CHLORIDE, DISSOLVED (MG/L AS CL)	118	70.00	11.00	45.14	61.00	53.00	48.00	40.75	17.95
SULFATE DISSOLVED (MG/L AS SO4)	118	55.00	12.00	36.21	49.10	42.00	37.00	33.00	18.95
FLUORIDE, DISSOLVED (MG/L AS F)	104	0.60	0.00	0.29	0.50	0.30	0.30	0.20	0.12
SILICA, DISSOLVED (MG/L AS SIO2)	118	16.00	0.30	8.70	13.00	11.00	9.05	7.27	1.39
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	87	404.00	119.00	307.16	381.60	344.00	306.00	283.00	197.60
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	118	392.37	108.48	297.14	376.01	334.42	301.84	277.05	180.89
SOLIDS, DISSOLVED (TONS PER DAY)	118	17855.64	139.65	1961.60	5742.17	2009.14	1255.28	732.14	392.70
SOLIDS, DISSOLVED (TONS PER AC-FT)	118	0.55	0.16	0.41	0.52	0.47	0.42	0.38	0.25