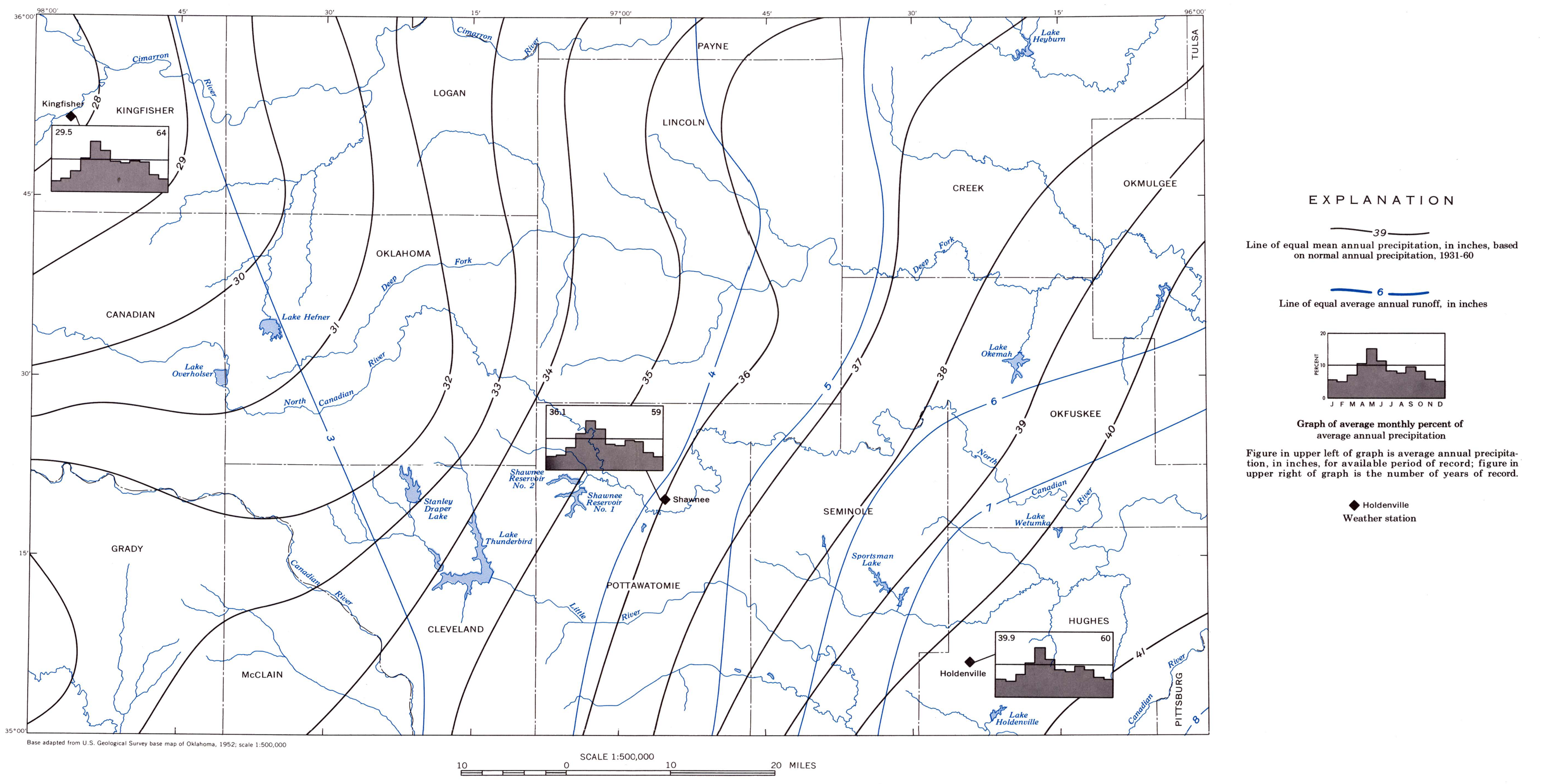

Figure 8. Map showing precipitation and runoff.

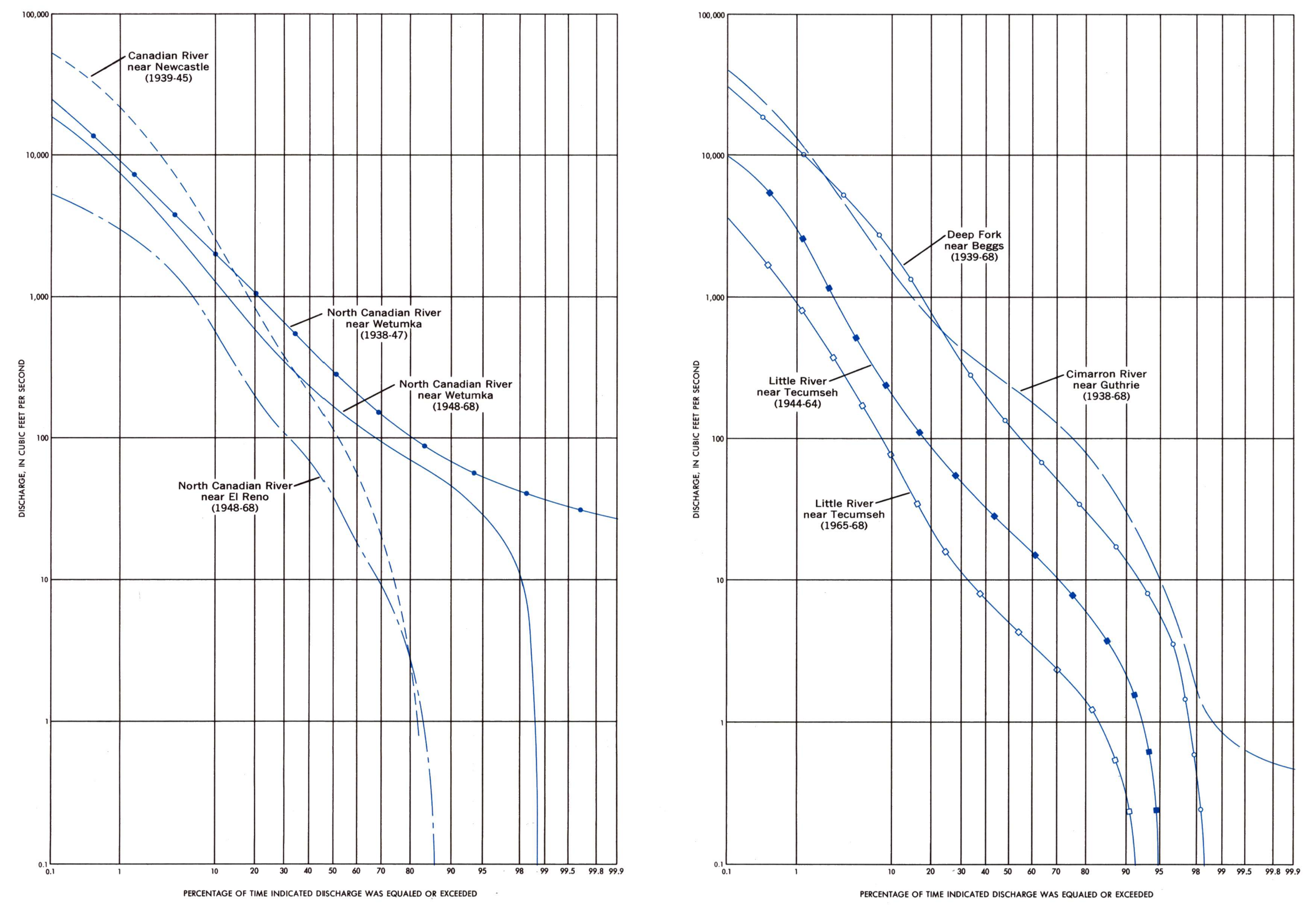

Figure 10. Flow-duration curves of selected streams.

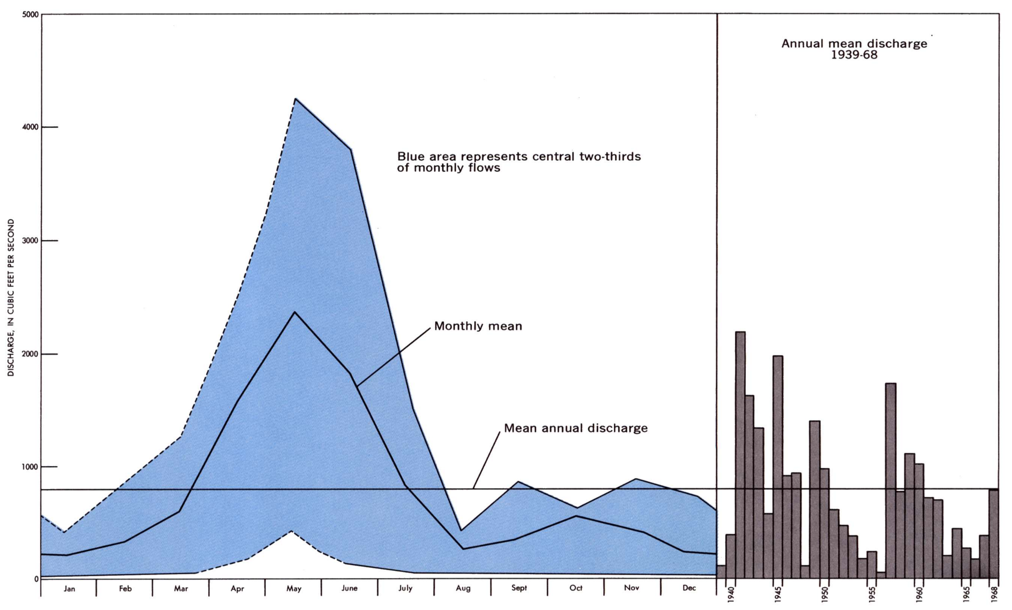

Figure 9. Streamflow distribution of Deep Fork near Beggs.

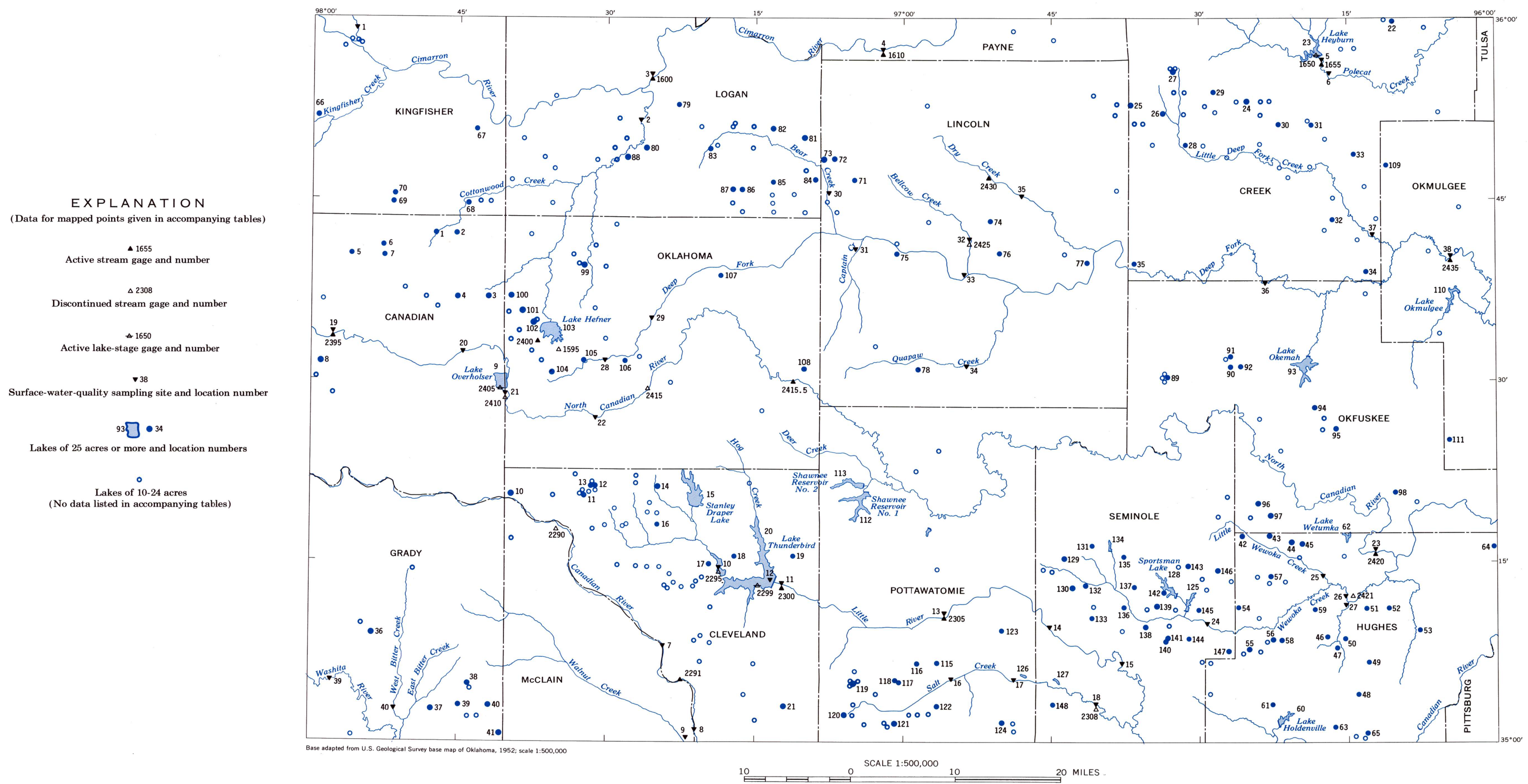

Figure 11. Map showing location of gaging stations, water-quality sampling sites, and lakes.

TABLE 1.—SUMMARY OF STREAMFLOW RECORDS

Stream and gaging station location	Station number[1]	Drainage area (square miles)	Period of record	Discharge (cubic feet per second) Maximum	Minimum	Average	Remarks
Bluff Creek above Lake Hefner	7-1595	1.62	1950–58	1,070	0	0.4	No flow at times in most years.
Cimarron River near Guthrie	1600	16,892	1937–69	158,000	.1	879	
Cimarron River at Perkins	1610	17,852	1939–69	149,000	.8	1,152	
Polecat Creek below Heyburn Reservoir, near Heyburn (prior to 1956 published as "Polecat Creek at Heyburn")	1655	123	1943–69	17,300	0	48.4	No flow at times in most years. Flow regulated since September 1950.
Canadian River near Newcastle	2290	25,763	1938–45	200,000	0	1,140	No flow at times in most years.
Canadian River near Noble (published "at Purcell"; 1959–61)	2291	25,911	1959-61; 1963-69	35,500	0	394	Occasional slight regulation by reservoirs in Texas and New Mexico.
Little River near Norman	2295	120	1951–55	4,470	.1	---	
Little River below Lake Thunderbird, near Norman (prior to Oct. 1964 known as Little River below Hog Creek, near Norman)	2300	257	1952–69	34,600	0	58.9	No flow at times in 1954–56, 1964. Flow completely regulated since March 1965.
Little River near Tecumseh	2305	456	1943–69	32,400	0	149	Average discharge 1964–69; 49.9 cfs. Flow regulated or diverted since 1965 by Lake Thunderbird. No flow at times in 1952–56, 1963–67.
Salt Creek near Dewright	2308	210	1959–63; 1965–67	7,900	0	75.5	No flow at times.
North Canadian River near El Reno	2395	13,042	1902–08; 1937–69	15,000	0	240	No flow at times in most years. Some regulation by Canton Reservoir.
Lake Hefner Canal near Oklahoma City	2400	---	1944–69	[2]1,500	0	---	No flow at times in each year. Canal diverts water from North Canadian River upstream from Lake Overholser and delivers the water to Lake Hefner for municipal supply at Oklahoma City. Average discharge not determined.
North Canadian River below Lake Overholser, near Oklahoma City	2410	13,222	1952–68	8,020	0	104	No flow at times in 1952–57.
North Canadian River near Oklahoma City	2415	13,354	1899; 1938–53; 1959–61	16,700	12	381	Gage heights only from May to December 1899.
North Canadian River near Harrah	2415.5	13,501	1969	4,200	49	--	Some regulation by Canton Reservoir, Lake Overholser, and Lake Hefner.
North Canadian River near Wetumka	2420	14,290	1937–69	66,000	0	679	No flow Aug. 27 to Oct. 11, 1954; Aug. 25 to Oct. 22, 1956. Some regulation by reservoirs upstream.
Wewoka Creek near Wetumka	2421	396	1959–63; 1966–67	11,300	0	180	No flow Oct. 3 to Nov. 18, 1963; Aug. 1-17, 1967.
Bellcow Creek at Chandler	2425	46	1948–55	2,910	0	12.4	No flow at times in most years.
Dry Creek near Kendrick	2430	69	1955–69	5,020	0	18	No flow at times in most years.
Deep Fork near Beggs	2435	2,018	1938–69	66,800	0	796	No flow at times in 1939, 1954, 1956.

[1]From USGS national system of downstream order numbers.
[2]Maximum daily discharge.

TABLE 2.—LAKES IN THE OKLAHOMA CITY QUADRANGLE[1]

Map number	Designation	Use	Area (acres)	Capacity (acre-feet)
	CANADIAN COUNTY			
1	Cottonwood Creek (site 16)	F	80	608
2	Cottonwood Creek (site 17)	F	33	254
3	Cottonwood Creek (site 33)	F	25	130
4	Northwood Lake	P	110	550
5	Uncle John Creek (site 7)	F	43	271
6	Uncle John Creek (site 11)	F	25	185
7	Selectman Lake	P	25	125
8	Four Mile Creek (site 1)	F,R	170	709
9	Lake Overholser	M	1,700	17,100
	CLEVELAND COUNTY			
10	Outdoor Life Club	R	25	150
11	Osborne Ski Lake	R	25	210
12	Memorial Lake	R	25	200
13	P. B. Odom Lake	P	28	200
14	Kitchens Lake	R	30	240
15	Stanley Draper Lake	M	2,800	100,000
16	Lazy Day Lake	P	50	560
17	Herman Brown Oil Co.	R	60	450
18	Reynolds Lake	R	40	320
19	Reynolds Rose Rock Lake	R	25	200
20	Lake Thunderbird	F,M,Ir,R		[2]196,200
21	Lake Dalgren	R	30	240
	CREEK COUNTY			
22	Sapulpa Lake	M	96	800
23	Heyburn Reservoir	F,R	–	[2]57,220
24	Bristow Lake	R	35	245
25	Little Deep Fork Watershed (site 5)	F	37	157
26	Little Deep Fork Watershed (site 10)	F	76	360
27	Little Deep Fork Watershed (site 12)	F	45	196
28	Little Deep Fork Watershed (site 19)	F	25	100
29	Little Deep Fork Watershed (site 21)	F	48	230
30	Little Deep Fork Watershed (site 38)	F	55	261
31	Little Deep Fork Watershed (site 43)	F	46	245
32	Little Deep Fork Watershed (site 48)	F	38	157
33	Little Deep Fork Watershed (site 51)	F	30	175
34	Flag Lake	P	25	200
35	Vanderslice Lake	P	25	200
	GRADY COUNTY			
36	Maddox Lake	P	25	200
37	Tabler Lake	P	30	240
38	Winter Creek Watershed (site 1A)	F	30	169
39	Winter Creek Watershed (site 1)	F,R	54	229
40	Winter Creek Watershed (site 6)	F,R	30	202
41	Winter Creek Watershed (site 18)	F	26	145
	HUGHES COUNTY			
42	Little Wewoka Creek Watershed (site 5)	F	42	152
43	Little Wewoka Creek Watershed (site 7)	F	30	133
44	Little Wewoka Creek Watershed (site 8)	F	131	702
45	Little Wewoka Creek Watershed (site 9)	F	35	218
46	Little Wewoka Creek Watershed (site 11)	F,R	122	691
47	Little Wewoka Creek Watershed (site 12)	F	26	153
48	Little Wewoka Creek Watershed (site 13)	F,Ir	40	259
49	Little Wewoka Creek Watershed (site 14)	F	94	522
50	Little Wewoka Creek Watershed (site 15)	F,R	63	396
51	Little Wewoka Creek Watershed (site 16)	F	41	282
52	Little Wewoka Creek Watershed (site 17)	F,R	91	364
53	Little Wewoka Creek Watershed (site 18)	F	78	343
54	Big Wewoka Creek Watershed (site 32)	F	41	314
55	Big Wewoka Creek Watershed (site 36)	F	34	168
56	Big Wewoka Creek Watershed (site 38)	F,Ir	92	475
57	Big Wewoka Creek Watershed (site 39)	F	130	578
58	Big Wewoka Creek Watershed (site 41)	F	55	314
59	Big Wewoka Creek Watershed (site 42)	F	51	278
60	Holdenville Lake	M,R	550	11,000
61	Old Holdenville Lake	R	40	290
62	Wetumka Lake	M	185	2,000
63	State Hatchery	R	40	400
64	Dustin Lake	M	28	165
65	Troupe-Moore Lake No. 6	R	25	200
	KINGFISHER COUNTY			
66	Elmer Lake	R	58	290
67	C. J. White	P	28	140
68	Cottonwood Creek Watershed (site 15)	F	76	625
69	Uncle John Creek Watershed (site 12)	F	34	166
70	Uncle John Creek Watershed (site 13)	F	45	300
	LINCOLN COUNTY			
71	Bear-Fall-Coon Creeks Watershed (site 2R)	F	38	122
72	Bear-Fall-Coon Creeks Watershed (site 3R)	F	57	281
73	Bear-Fall-Coon Creeks Watershed (site 5R)	F	42	150
74	Chandler Lake	M	120	360
75	Pool Lake	P	30	90
76	Sowards Lake	P	60	200
77	Brown Lake	P	600	1,200
78	Quapaw Creek Watershed (site 30)	F	25	255
79	Santa Fe Lake	R	71	612
80	Guthrie Lake	M	184	2,246
81	Bear-Fall-Coon Creeks Watershed (site 6)	F	58	235
82	Bear-Fall-Coon Creeks Watershed (site 8)	F	30	114
83	Bear-Fall-Coon Creeks Watershed (site 13)	F	70	435
84	Bear-Fall-Coon Creeks Watershed (site 18)	F	27	122
85	Bear-Fall-Coon Creeks Watershed (site 24R)	F	29	133
86	Bear-Fall-Coon Creeks Watershed (site 28)	F	25	125
87	Bear-Fall-Coon Creeks Watershed (site 29)	F	50	173
88	Liberty Lake	M	201	2,814
	OKFUSKEE COUNTY			
89	Twin Lake	P	40	350
90	Redbird Lake	P	42	126
91	Donnell	P	25	250
92	Donnel Curry	P	55	165
93	Okemah Lake	P	720	10,800
94	Penoskie Lake	P	30	200
95	Knox Payne Lake	P	25	136
96	Cohee Lake	P	80	380
97	Stanley Lake	P	45	270
98	Weleetka Lake	M	60	670
	OKLAHOMA COUNTY			
99	Adams Lake	P	39	488
100	Ed Kloss	P	36	288
101	Mart Brown	P	28	168
102	Ski Island	P	80	560
103	Lake Hefner	M	2,500	75,000
104	Sportsman's Lake	P	35	260
105	Belle Isle Lake	I	73	500
106	Northeast Lake	R	48	480
107	Hiwassee	P	175	1,320
108	Horseshoe Lake	I	191	955
	OKMULGEE COUNTY			
109	Little Deep Fork Creek Watershed (site 54)	F	33	238
110	Okmulgee Lake	M	611	15,300
111	Nichols Park Lake	R	26	312
	POTTAWATOMIE COUNTY			
112	Shawnee Lake	M	1,336	22,600
113	Shawnee Lake No. 2	M	1,100	11,400
114	Tecumseh	M	127	1,118
115	Salt Creek Watershed (site 1)	F	63	243
116	Salt Creek Watershed (site 2)	F	29	106
117	Salt Creek Watershed (site 5)	F	32	136
118	Salt Creek Watershed (site 6)	F	28	105
119	Salt Creek Watershed (site 11)	F	29	101
120	Salt Creek Watershed (site 13)	F	26	131
121	Salt Creek Watershed (site 20)	F	26	125
122	Salt Creek Watershed (site 24)	F	43	254
123	Salt Creek Watershed (site 27)	F	38	148
124	Salt Creek Watershed (site 39)	F	45	213
	SEMINOLE COUNTY			
125	Lake Wewoka	M	200	1,534
126	Thorn Lake	P	200	3,000
127	Thorn Brothers Lake	P	80	800
128	Sportsmans Lake	R	355	4,000
129	Big Wewoka Creek Watershed (site 3)	F	56	318
130	Big Wewoka Creek Watershed (site 4)	F	50	279
131	Big Wewoka Creek Watershed (site 5)	F	24	126
132	Big Wewoka Creek Watershed (site 6)	F	27	121
133	Big Wewoka Creek Watershed (site 8)	F	42	149
134	Big Wewoka Creek Watershed (site 9)	F	57	332
135	Big Wewoka Creek Watershed (site 10)	F	25	136
136	Big Wewoka Creek Watershed (site 11)	F	128	467
137	Big Wewoka Creek Watershed (site 13)	F	26	148
138	Big Wewoka Creek Watershed (site 16)	F	12	47
139	Big Wewoka Creek Watershed (site 17)	F	31	165
140	Big Wewoka Creek Watershed (site 20)	F	44	280
141	Big Wewoka Creek Watershed (site 21)	F	34	183
142	Big Wewoka Creek Watershed (site 22)	F	65	361
143	Big Wewoka Creek Watershed (site 24)	F	93	492
144	Big Wewoka Creek Watershed (site 26)	F	52	308
145	Big Wewoka Creek Watershed (site 27)	F	30	152
145	Big Wewoka Creek Watershed (site 31)	F	25	105
147	Big Wewoka Creek Watershed (site 33)	F	101	614
148	Salt Creek Watershed (site 42)	F	26	92

M, municipal; P, private; R, recreation; I, industrial; F, flood control (may be used to some extent for recreation); Ir, irrigation.
[1]Data provided by Oklahoma Water Resources Board and U.S. Department of Agriculture Soil Conservation Service.
[2]Capacity at spillway elevation.

TABLE 4.—SUMMARY OF CHEMICAL ANALYSES OF SURFACE WATER

(Results in milligrams per liter except as indicated)

Location number	Station	Period of record	Years of record	Sampling frequency[1]	Sulfate Maximum	Sulfate Minimum	Chloride Maximum	Chloride Minimum	Dissolved solids (residue at 180°C) Maximum	Dissolved solids Minimum	Hardness[2] Maximum	Hardness[2] Minimum	Sodium adsorption ratio Maximum	Sodium adsorption ratio Minimum	Specific conductance[3] Maximum	Specific conductance[3] Minimum
1	Turkey Creek near Dover	1952–62	4	P	98	30	440	34	1,315C	270	480	84	6.2	1.5	2,190	334
2	Cottonwood Creek near Guthrie	1951–61	11	P	280	122	170	10	750	641	1,240	105	3.7	.6	1,590	284
3	Cimarron River near Guthrie	1949–63	12	P	1,020	70	16,500	136	29,800C	611	1,940	86	106	4.5	42,600	701
4	Cimarron River near Perkins	1950–67	15	D,P	765	19	11,500	80	20,500	277	1,880	76	98	1.5	32,400	438
5	Polecat Creek at Heyburn Reservoir	1956–61	4	P	17	9.0	71	21	207	122	98	26	2.0	.9	379	110
6	Polecat Creek near Heyburn	1952–58	4	P	---	---	110	40	---	---	136	46	---	---	499	209
7	Canadian River near Noble	1965–67	3	P	530	4.6	330	5.5	1,410	102	600	56	11	.2	2,090	176
8	Canadian River at Purcell	1952–63	8	P	570	49	278	24	1,780	297	890	96	8.4	.5	2,370	378
9	Walnut Creek at Purcell	1950–62	11	P	45	18	110	7.0	433	265	465	136	1.3	.4	947	311
10	Little River near Norman	1951–61	9	D,P	20	.0	50	3.0	446	97	410	70	2.8	.0	926	154
11	Little River below Hog Creek near Norman	1953–65	5	D,P	372	.0	880	3.0	2,140	80	562	73	13	.0	3,640	100
12	Lake Thunderbird near Norman	1965–67	3	P	15	7.2	32	20	263	204	216	162	.7	.4	486	364
13	Little River near Tecumseh	1952–63	12	P	129	9.5	630	13	1,550C	163	450	86	11	.5	2,820	266
14	Little River near Maud	1959–61	2	P	51	---	360	---	900	---	320	---	4.3	---	1,540	---
15	Little River near Dewright	1953–61	2	P	59	---	2,880	---	5,280	---	1,180	---	18	---	9,090	---
16	Salt Creek near Pearson	1956–61	6	P	84	8.6	1,700	15	3,400	144	790	76	12	.5	5,420	219
17	Salt Creek near St. Louis	1959–61	3	P	73	---	6,340	---	12,200	---	2,630	---	25	---	18,800	---
18	Salt Creek near Dewright	1952–63	12	P	217	9.1	113,000	171	150,000C	441	37,100	148	52	2.4	162,000	575
19	North Canadian River near El Reno	1950–57	6	D,P	353	13	248	5.5	1,162	55	520	32	3.8	.4	1,980	108
20	North Canadian River near Yukon	1952–54	3	D,P	280	15	248	7.8	1,060	98	518	53	5.0	.5	1,780	144
21	North Canadian River below Lake Overholser	1960–61	2	P	214	---	160	---	783	---	410	---	2.8	---	1,260	---
22	North Canadian River near Oklahoma City	1952–63	5	P	225	51	8,640	79	15,800	333	3,030	152	11	1.9	23,400	564
23	North Canadian River near Wetumka	1952–67	15	D,P	351	7.0	14,300	31	25,800	157	4,640	76	47	1.0	37,100	262
24	Wewoka Creek near Wewoka	1962–63	2	P	91	17	2,400	490	4,570	1,020	1,090	248	16	6.7	7,270	1,770
25	Little Wewoka Creek near Wetumka	1962–63	2	P	70	6.2	5,370	124	10,600	326	2,250	66	23	1.7	15,000	488
26	Wewoka Creek near Wetumka	1952–64	11	D,P	72	5.0	48,100	40	---	108	15,600	34	26	2.0	87,900	183
27	Grief Creek near Wetumka	1962–63	2	P	56	8.0	525	19	1,080	122	330	44	5.9	1.1	1,810	177
28	Deep Fork at Oklahoma City	1960–62	3	P	280	59	140	32	909	266	535	160	2.9	1.1	1,330	458
29	Deep Fork at Witcher	1960–62	3	P	149	100	360	138	1,100	650	364	260	7.2	2.6	1,800	992
30	Bear Creek near Ellis	1954–55	2	P	---	---	24	13	---	---	414	218	1.4	.6	896	483
31	Captain Creek near Wellston	1954–57	4	P	---	---	52	21	---	---	300	194	1.2	.5	659	442
32	Bellcow Creek near Chandler	1949–54	6	D,P	30	8.1	382	5.0	644	77	392	50	4.7	.4	1,710	130
33	Deep Fork near Chandler	1960–62	3	P	100	19	300	74	982	303	480	178	4.5	1.5	1,580	546
34	Quapaw Creek near Meeker	1954–55	2	P	---	---	292	38	---	---	338	160	4.1	1.2	1,270	469
35	Dry Creek near Kendrick	1955–67	6	P	19	7.0	158	.6	440	81	240	34	2.2	.0	792	79
36	Deep Fork near Welty	1954–57	4	P	---	---	505	32	---	---	400	100	5.9	.9	2,020	296
37	Little Deep Fork Creek near Edna	1952–62	9	P	33	4.1	4,880	130	10,800C	317	1,990	84	16	2.8	14,400	554
38	Deep Fork near Beggs	1951–67	17	D	313	1.6	3,000	24	5,340	87	1,310	16	18	.4	10,500	113
39	Washita River near Chickasha	1952–61	7	P	810	237	128	14	1,510	588	940	270	1.9	.2	1,810	548
40	West Bitter Creek near Tabler	1952–67	9	D,P	605	8.6	46	.2	1,200	89	730	68	1.9	.1	1,630	135

[1]D, daily; P, periodic.
[2]As $CaCO_3$.
[3]Micromhos per centimeter at 25°C.
C, dissolved solids calculated.

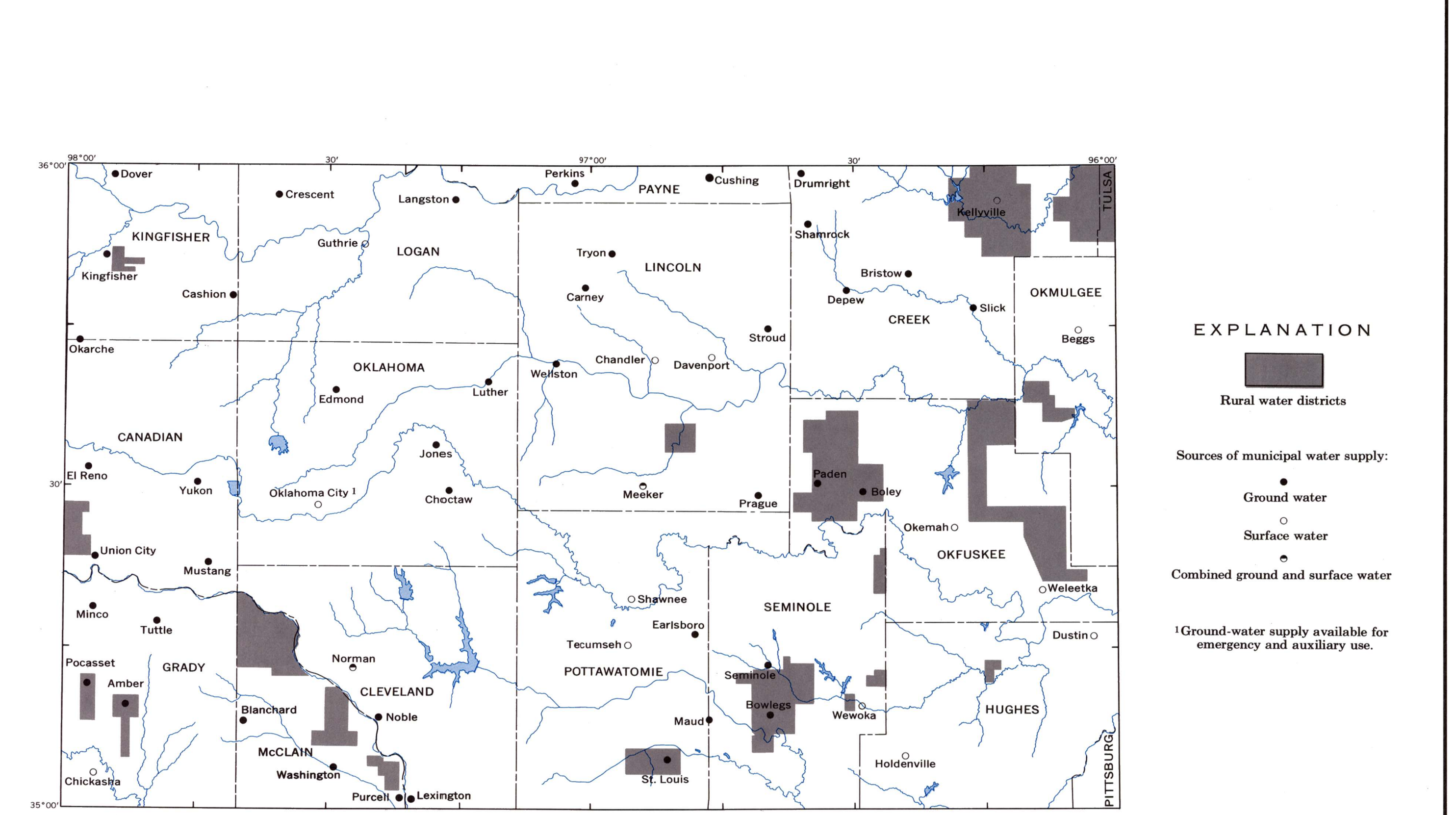

Figure 12. Map showing rural water districts and sources of municipal water supplies.

TABLE 3.—SUMMARY OF DATA AT GAGED RESERVOIRS

Reservoir	Date of closure	Station number	Capacity of conservation pool (acre-feet)	Total capacity[1] (acre-feet)	Range of recorded contents since reservoir closure: Maximum contents (acre-feet)	Date	Minimum contents (acre-feet)	Date
Heyburn Reservoir near Heyburn	1950	7-1650	8,150	57,220	26,670	6-25-58	6,580	4- 9-67
Lake Thunderbird near Norman	1965	2299	119,600	196,200	84,690	6- 9-69	15,370	11-30-65
Lake Overholser	1917	2405	17,100	17,100	[2]20,900	6-14-44	1,870	5-14-55

[1]At spillway crest.
[2]Gage height 0.40 foot above top of spillway gates.

WATER USE, 1970

(Figures shown in table are in billions of gallons)

Use	Source of supply: Ground water	Surface water	Totals: Ground and surface water
Municipal	7.7	23.9	31.6
Rural domestic	2.9	0	2.9
Industrial	1.6	6.3	7.9
Irrigation	5.2	3.1	8.3
Totals	17.4	33.3	50.7

AVAILABILITY OF SURFACE WATER

The greatest potential sources of surface water in the Oklahoma City quadrangle include the Cimarron, North Canadian, Canadian, Deep Fork, and Little Rivers and man-made ponds and lakes. The rivers and their tributaries provide drainage in most of the quadrangle. Some of the major streams are perennial, but flow normally stops for some period each year in all the tributaries. The principal factors that affect streamflow are climate, topography, geology, and man's activities.

The average annual precipitation ranges from about 28 inches in the northwestern part of the quadrangle to about 41 inches in the southeastern part (fig. 8). The precipitation graphs show that spring is the wettest season, receiving about 35 percent of the total precipitation, and winter the driest season, receiving about 15 percent of the total. Precipitation returned to the atmosphere through evaporation and transpiration is generally lowest in the winter and early spring, when temperatures are low and vegetation is dormant. During the summer and early fall, however, much of the rainfall is evaporated or transpired by active plant growth, high temperatures, and dry winds. Because of those variations in precipitation and temperatures, streamflow is highest in the spring and lowest in the fall (fig. 9). Precipitation varies considerably from year to year, resulting in large variations in annual streamflow, as illustrated by the bar graph in figure 9.

Average annual runoff ranges from about 2.5 inches, or less than 10 percent of the annual precipitation in the western part of the quadrangle, to about 8 inches, or about 20 percent of the annual precipitation in the southeastern part (fig. 8). Runoff, as depicted in figure 8, represents natural conditions and does not show the effects of streamflow regulations. The increase in the percentage of runoff from west to east across the quadrangle is probably caused by differences in topography, soils, and the effects of development of large amounts of ground water from the alluvium and terrace deposits in the western half. Also, the wetter climate of the eastern part maintains a greater soil-moisture content, and consequently more water runs off.

The western half is a gently rolling surface with flat upland areas, gentle slopes, and shallow valleys. Erosion has formed relatively deep valleys and steep hillsides in the eastern half; thus the rate of runoff is greater, allowing less time for water to seep into the ground.

During the spring wet period, most rocks underlying the stream basin receive water in their recharge area in excess of the amount that can move through them; thus water levels in the rocks reach their annual high. After the wet season, the excess water in the rocks drains slowly into the adjacent stream and provides base flow during part of the summer. Such drainage, in combination with evaporation and transpiration, and pumpage from wells cause the water level to decline to a point at which water stops flowing from the rocks and into the stream. Thus, small streams in the quadrangle have no flow for some period during most years.

VARIATION OF STREAMFLOW

Flow-duration curves can be used to illustrate streamflow variability at selected gaging stations. Such curves show the percentage of time that a given flow can be expected to be equaled or exceeded. For example, the flow of the North Canadian River near El Reno equaled or exceeded 37 cfs (cubic feet per second) 50 percent of the time during 1948–68, and equaled or exceeded about 10 cfs 70 percent of the time during the same period. However, the curve also shows that flow is less than 0.1 cfs about 15 percent of the time (fig. 10).

Differences in streamflow characteristics shown by the two curves for the North Canadian River near Wetumka are attributed largely to climatic variations. The upper curve represents a period (1938–47) when precipitation was above normal and base flow of the stream was sustained. In contrast, the lower curve represents a period (1948–68) which includes several years of below-normal precipitation. The lack of sustained base flow shown by the lower curve reflects periods of no flow during several months in the dry years of 1954 and 1956; however, a sustained base flow normally occurs during most years. Comparison of the lower curve with the curve for the North Canadian River near El Reno shows that approximately two-thirds of the average flow near Wetumka is derived from within the quadrangle.

The flow-duration curve for Little River near Tecumseh is divided into two parts to illustrate the effects of closure of Lake Thunderbird in 1965. Differences in streamflow characteristics between the two periods reflect storage requirements for Lake Thunderbird and climatic variations since 1965. The lower curve is based on a relatively short period of record (1965–68) and probably will change with the inclusion of additional streamflow data. These two curves illustrate, to some extent at least, the effect that man's activity can have on the natural flow of a stream.

Flow-duration data indicate that all major streams flow more than 80 percent of the time. The Cimarron River near Guthrie has sustained base flow all the time, whereas Deep Fork near Beggs has sustained base flow only about 98 percent of the time. Generally, base flows are derived from ground water; however, in Deep Fork, Cimarron, and North Canadian Rivers, base flows are probably sustained or prolonged by discharge of sewage and industrial wastes.

AVAILABILITY OF STREAMFLOW RECORDS

Streamflow data are available at 23 sites in the quadrangle and are published in reports of the U.S. Geological Survey. The locations of the gaging stations are shown in figure 11, and selected data from the records are given in table 1.

Prior to 1961 the records of streamflow and reservoir contents were published in an annual series of U.S. Geological Survey Water-Supply Papers entitled *Surface-Water Supply of the United States*. The records for Oklahoma are contained in part 7 of that series. The records for the 5-year period 1961–65 are contained in a 2-volume publication of the same series.

Beginning with the 1961 water year, streamflow records also have been issued by the U.S. Geological Survey in annual reports on a State basis. These basic-data reports are released by the District Offices primarily for local needs.

The summary of surface-water records gives the station location; station number; drainage area; period of published record available through 1969; the maximum, minimum, and average discharge for the complete years of record; and remarks on no-flow occurrences and on flow regulation. The average discharge is not given for stations having less than 5 complete years of record.

LAKES

Development of surface storage is necessary to provide dependable water supplies in the Oklahoma City quadrangle because of the limited availability of ground water, the high variability of streamflow, and the lack of sustained low flow in the small streams. Man-made ponds and small lakes provide water for stock and other farm uses. Most of the lakes of 25 acres or more are listed in table 2, and most of those with 10 acres or more are shown in figure 9.

Surface reservoirs constitute a major part of the water resources in the area, and the large ones are a prime source of water for municipal and industrial use. Although the prime purpose of the large reservoirs is flood control or water supply, recreation is an important secondary benefit.

Average annual lake evaporation ranges from 54 inches in the eastern part of the quadrangle to 62 inches in the western part; about 70 percent of the evaporation occurs during the period from May to October.

Reservoir data are available at three sites in the area and are published annually by the U.S. Geological Survey. The locations of the reservoir gaging stations are shown in figure 11, and pertinent data from available records are summarized in table 3.

QUALITY OF SURFACE WATER

The usability of surface water for municipal, industrial, and irrigation purposes depends chiefly upon its quality. Available information on the chemical quality of surface water in the Oklahoma City quadrangle is summarized in table 4, and the sampling stations are shown in figure 11. The U.S. Geological Survey has published an annual series of Water-Supply Papers, *Quality of Surface Waters of the United States,* from 1941 through 1965. Records for streams in the Oklahoma City quadrangle are in part 7 of this series. Beginning with the 1964 water year, water-quality data were published in a series of annual releases on a statewide basis. Chemical-quality data given in these reports include concentrations of certain dissolved constituents, such as sodium, calcium, sulfate, and chloride, and other characteristics, such as hardness, sodium adsorption ratio, specific conductance, and pH. Data on fluvial sediment and water temperature are also included in these reports. Fluvial-sediment information is given for suspended-sediment discharges and concentrations and for particle-size distribution of suspended sediment and bed material. Water-temperature data are given only for daily observations.

Data collected by the U.S. Geological Survey provide a general description of the chemical quality of surface waters in the Oklahoma City quadrangle. The data indicate that, generally, Deep Fork tributaries, Walnut Creek, and the upper part of Little River basin contain low to moderate amounts of dissolved solids. The water in these streams is usually of the calcium bicarbonate type and may be very hard during periods of low flow.

In contrast to water in these small streams, the water of the Cimarron River, Canadian River, North Canadian River, Deep Fork, and the lower reaches of Little River are at times more mineralized. The high mineral content of these larger streams is partly of natural origin, but discharge of sewage and industrial waste may be sources of some mineralization.

WATER USE

Surface water is the major source of water used in the Oklahoma City quadrangle (fig. 12). The total amount of water used in 1970 is estimated at 50.7 billion gallons. Approximately 66 percent of this amount, or about 33.3 billion gallons, was taken from the lakes and rivers of the area; the remaining 17.4 billion gallons was provided from ground-water sources. The major use of water was for municipal purposes, which accounted for approximately 31.6 billion gallons; of this, 76 percent was from surface-water sources. Oklahoma City is the largest user of surface water. Approximately 20.6 billion gallons was used by the city in 1970, accounting for 78 percent of the total water used in Oklahoma County and 41 percent of the total water used in the quadrangle. The area of most intensive ground-water development is Oklahoma County, where approximately 5.7 billion gallons was pumped in 1970.

Rural water districts have been developed in some areas where sufficient amounts of good-quality water are difficult to obtain. In 1971, 19 rural water districts had been established in the quadrangle area (fig. 12). These districts supplied an estimated 0.2 billion gallons to approximately 12,000 persons; of this, 86 percent was provided by ground-water development. Many of the districts will be expanded and new ones established to meet the increasing rural demand for good-quality water.

RECONNAISSANCE OF THE WATER RESOURCES OF THE OKLAHOMA CITY QUADRANGLE, CENTRAL OKLAHOMA

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