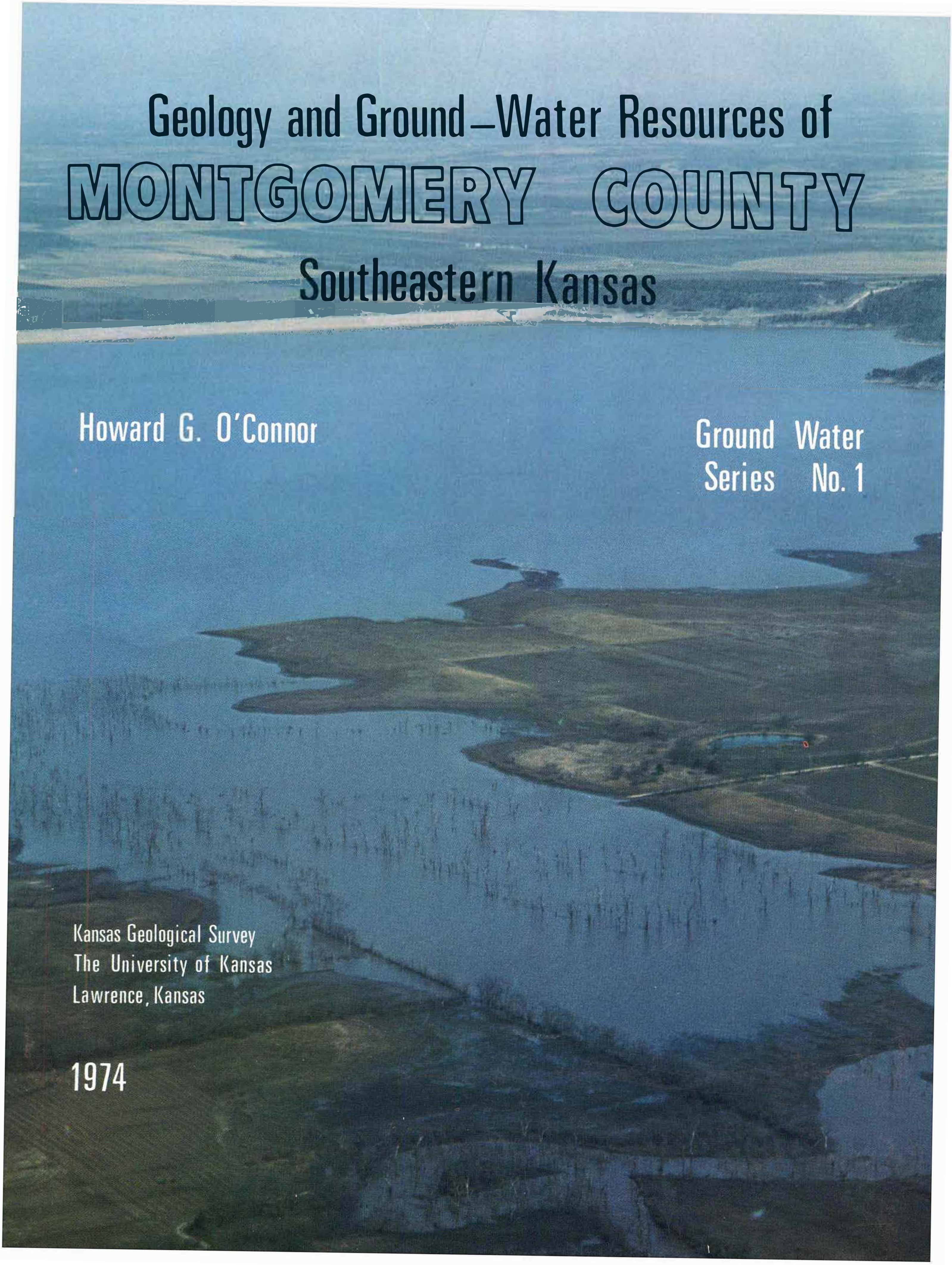
Geology and Ground-Water Resources of MONTGOMERY COUNTY Southeastern Kansas

Howard G. O'Connor

Ground Water Series No. 1



Kansas Geological Survey
The University of Kansas
Lawrence, Kansas

1974

Cover photograph of Elk City Reservoir by Mr. James Elmore, Independence Daily Reporter, Independence, Kansas.

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By

Howard G. O'Connor

Prepared by the Kansas Geological Survey and the U.S. Geological Survey, with support from the Division of Environmental Health of the Kansas State Department of Health and the Division of Water Resources of the Kansas State Board of Agriculture.

Printed by authority of the State of Kansas
Distributed from Lawrence

UNIVERSITY OF KANSAS PUBLICATIONS
September 1974

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HOWARD G. O'CONNOR, *Kansas Geological Survey*

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ABSTRACT

Consolidated rocks of Pennsylvanian age underlie all of Montgomery County and are exposed in most of the upland area. Sandstone beds in the Stranger Formation, Stanton Limestone, and Chanute Shale are the most important consolidated-rock aquifers. Locally, wells in the Stranger may yield as much as 20 gallons per minute, the Stanton yields as much as 15 gallons per minute to wells in the southwestern part of the county, and wells in the Chanute may yield as much as 50 gallons per minute. In parts of the county, suitable water for domestic and stock use is obtained from sandstone at depths of 200 to 400 feet. In other parts of the county, ground water may be moderately saline at depths of 50 feet or less.

Fluvial deposits of Quaternary age underlie flood plains and terraces along the stream valleys, and are an important source of ground water. These deposits yield as much as 100 gallons per minute to wells in the Verdigris River valley and from 5 to 50 gallons per minute in other major stream valleys. The water generally is very hard, but is suitable for domestic and stock use except in local areas where excessive concentrations of sulfate, sodium, and chloride are present.

Aquifers in many local areas have been contaminated by brine associated with oil and gas production and by improperly plugged drill holes. The major use of ground water is for domestic and stock supplies. All of the cities use treated surface water, and water districts obtain surface water to serve much of the rural population.

INTRODUCTION

This report describes the geology and ground-water resources of Montgomery County, an area of 649 squares miles in southeastern Kansas (fig. 1). The investigation on which this report is based was part of a continuing program of ground-water investigations begun in 1937 by the Kansas Geological Survey and the U.S. Geological Survey, with support from the Division of Environmental Health of the Kansas State Department of Health and the Division of Water Resources of the Kansas State Board of Agriculture. The classification and nomenclature of the stratigraphic units used in this report (table 1) are those of the Kansas Geological Survey and differ somewhat from those of the U.S. Geological Survey.

Well and test-hole numbers used in this report give locations according to the U.S. Bureau of Land Management system of land subdivision. The number is composed of township, range, and section numbers, followed by letters that indicate the subdivision of the section in which the well is located. The first letter denotes the quarter section, or 160-acre tract; the sec-

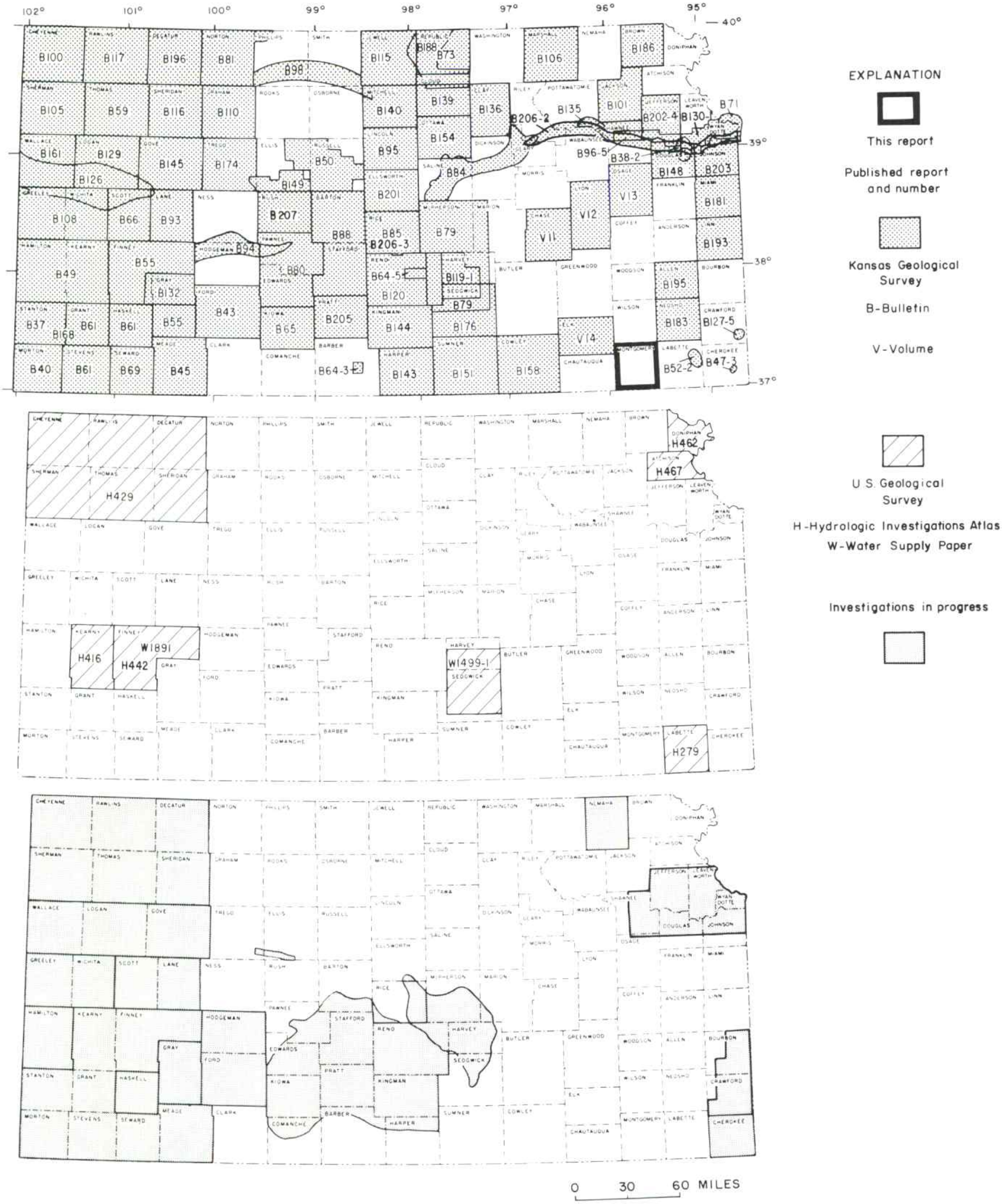


FIGURE 1.—Index maps showing area discussed in this report, and other areas for which ground-water reports have been published or are in preparation.

ond letter denotes the quarter-quarter section, or 40-acre tract; and the third letter, when used, indicates the quarter-quarter-quarter section, or 10-acre tract. The 160-acre, 40-acre, and 10-acre tracts are designated *a*, *b*, *c*, and *d* in a counter-clockwise direction, beginning in the northeast quarter (fig. 2).

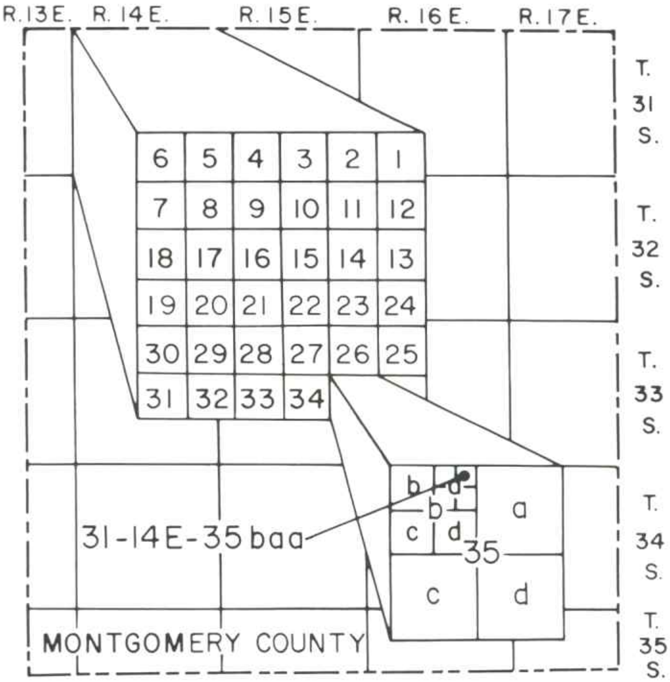


FIGURE 2.—Well-numbering system used in this report.

GROUND WATER IN CONSOLIDATED ROCKS

Ground-water supplies in the consolidated rocks in parts of Montgomery County are inadequate or are of poor chemical quality for domestic and livestock use; however, in other parts of the county, sandstone aquifers yield as much as 50 gpm (gallons per minute) of good quality water to wells.

Sandstone beds in the Stranger Formation, Stanton Limestone, and Chanute Shale are the most important consolidated-rock aquifers (table 1). Locally, the Stranger Formation contains more than 100 feet of sandstone and siltstone, and well yields of as much as 20 gpm of hard but otherwise good quality water for domestic and stock use can be obtained (table 2). In the southwestern part of Montgomery County, as much as 40 feet of sandstone in the upper and middle parts of the Stanton yields ½ to 15 gpm of good to poor quality water to wells.

The Chanute Shale ranges in thickness from about 80 feet in the northern part of Montgomery County to about 200 feet in the southern part. It contains two extensive sandstone members—the Cottage Grove in the upper part and the Noxie in the lower part. Well yields range from less than 1 gpm to as much as 50 gpm. The chemical quality of water supplies obtained from these sandstones ranges from good to poor for stock and domestic use. Some wells in the Cottage Grove Member and the Noxie Member obtain very hard water of the calcium and magnesium sulfate type, whereas other wells obtain much softer water having sodium chloride and sodium bicarbonate as the principal constituents (fig. 3). About one-fourth of the water samples collected from wells and springs obtaining water from the Chanute have dissolved-solids concentrations of less than 300 mg/l (milligrams per liter); this water generally is of good quality for stock and domestic use.

A few wells obtain water from sandstone beds in the Coffeyville and Seminole Formations in eastern Montgomery County. Locally, water from the Coffeyville, even at shallow depths, may be of poor quality and unsuitable for domestic or stock use because of large concentrations of sulfate (table 2). No wells were inventoried that obtained water supplies from sandstones in the Nowata or Bandera Shales, although

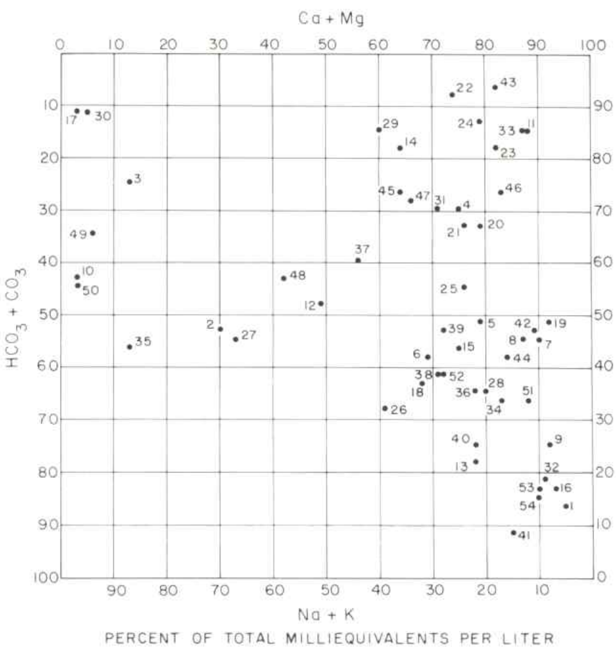


FIGURE 3.—Modified Piper diagram showing grouping of analyses of water from wells. Numbers by symbols are sample-identification numbers from table 2.

TABLE 1.—Generalized columnar section and water-bearing characteristics.

System	Series	Stage	Group	Formation or rock unit	Thickness, in feet	Lithology	Water supply[1]
Quaternary	Pleistocene			Alluvium	0-60	Unconsolidated clay, silt, sand, and gravel. Basal part contains 0 to 14 feet of sand and gravel.	Yields moderate supplies of water to wells in parts of the Verdigris River valley and in major tributary valleys.
				Terrace deposits	0-38		Yields moderate supplies of water to wells in low terrace deposits. Intermediate and high terrace deposits yield lesser amounts to wells or may be above water table.
Pennsylvanian	Upper Pennsylvanian	Virgilian	Douglas	Lawrence Formation	140	Chiefly olive-gray shale. As much as 30 feet of sandstone in upper part. Thin bed of Haskell Limestone Member at base.	Yields very small supplies of water to shallow wells in weathered zones. Sandstone beds generally above water table.
				Stranger Formation	100-175	Gray shale and siltstone, and gray fine-grained sandstone. Thin bed of Westphalia Limestone Member in upper part.	Generally yields small to moderate supplies of water to wells in areas underlain by sandstone. Where sandstone beds are absent, yields very small to small supplies to shallow wells in weathered zone.
		Missourian	Lansing	Stanton Limestone	70-130	Consists of three limestone and two shale members. Limestones include fine-grained dense limestone, oolitic and sandy limestone, and fine-grained to coarsely crystalline limestone. Lower shale member locally includes a black fissile shale. Upper shale contains sandstone beds in outcrops in southern part of county.	Generally yields very small supplies of water to wells. Yields very small to small supplies of water to wells in areas underlain by thick limestone beds or shale. In southwestern part of county, yields very small to moderate supplies of water to wells in sandstone.
				Vilas Shale	50-120	Chiefly medium-gray shale.	Generally yields little or no water to wells except in the shallow zone of weathering.
				Plattsburg Limestone	0-70	Thick gray fine-grained to crystalline limestone in northern part of county. Thin or absent south of Elk River.	
			Kansas City	Bonner Springs Shale and Lane Shale	85-150	Gray silty to argillaceous shale.	
				Iola Limestone	2-10	Consists of two limestones separated by a black fissile shale containing phosphatic concretions. Lower limestone locally sandy or may be absent.	Generally yields little or no water to wells except in the shallow zone of weathering. Yields small supplies to wells locally from black shale.
				Chanute Shale	80-200	Chiefly gray shale and fine-grained sandstone. The Noxie Sandstone Member occurs extensively in the lower part and the Cottage Grove Sandstone Member in the upper part. The middle part contains the Thayer coal bed, one to three thin limestones, and gray shale.	Widespread aquifer. Generally yields small to moderate supplies of water to wells from sandstone beds at depths of as much as 400 feet.
				Drum Limestone	0-60	Light-gray fine-grained limestone and light-gray crossbedded very fossiliferous oolitic limestone.	Generally yields little or no water to wells except in the shallow zone of weathering.
				Cherryvale Shale	0-90	Chiefly bluish-gray shale with flagstones at top in outcrops in northern part of county. Flags increase in abundance southward.	
				Dennis Limestone	10-70	Light-gray to bluish-gray limestone, locally sandy or oolitic in upper part. Gray shale and black fissile shale in lower part. Locally contains a 1- to 4-foot thick limestone at base.	In northeast area, yields very small to small supplies of water to wells at depths of as much as 200 feet. Elsewhere, generally yields little or no water except in the shallow zone of weathering.

		Pleasanton	Coffeyville Formation	200	Chiefly medium-gray shale and siltstone. Upper part locally contains much fine-grained sandstone and several thin coals. Lower beds contain medium- to dark-gray and black shale. The Swope Limestone, 1 to 6 feet of gray limestone, occurs near the middle.	Generally yields little or no water to wells from the gray shales, siltstones, and thin limestones. Beds of sandstone and black shales locally yield small supplies of water to wells.
		Pleasanton	Checkerboard Limestone	1-14	Consists of two thin limestones separated by gray shale where thickest. Lower limestone is brown-weathering crossbedded coquina.	
		Pleasanton	Seminole Formation	5-10	Chiefly medium- to dark-gray shale. Locally contains a thin fine-grained sandstone at base.	
Middle Pennsylvanian	Desmoinesian	Marmaton	Holdenville Shale	5-25	Gray and bluish-green fossiliferous shale.	Generally yields little or no water to wells.
		Marmaton	Lenapah Limestone	7-18	Upper massive limestone and lower nodular bedded limestone separated by a thin gray shale.	Yields very small to small supplies of water to wells generally less than 50 feet deep.
		Marmaton	Nowata Shale	3-30	Medium- to light-gray shale, locally contains some fine-grained sandstone.	
		Marmaton	Altamont Limestone	15-20	Upper and lower light-gray limestone members separated by gray and black fissile shale.	
		Marmaton	Bandera Shale	60-150	Gray shale and sandstone.	

[1] In this report, very small supplies refers to yields generally less than 1 gpm, small supplies to 1 to 5 gpm, and moderate supplies to 5 to 100 gpm.

small water supplies might be obtainable from these units east of the Verdigris River and south of Claymore Creek in southeastern Montgomery County.

Most limestone units at shallow depths in Montgomery County will yield small supplies of ground water to large-diameter wells in the zone of weathering during periods of normal or above normal precipitation. The thick limestone reefs or banks of the Stanton and Plattsburg Limestones in northwestern Montgomery County and the Drum Limestone in the Independence area are unreliable sources of water for wells. A few wells obtain domestic and stock water supplies at depths of 200 feet or less from the Dennis Limestone in the northern part of T.31 S., R.17 E. Limestone aquifers generally yield hard to very hard water of the calcium bicarbonate type. Locally, the concentration of sulfate may be excessive for domestic use.

The shale units in Montgomery County generally yield little water to wells. Shallow large-diameter wells constructed in weathered shale may yield 100 to 1,000 gallons per day, but may be dry part of the time. Black or dark-gray shales commonly contain plant and other carbonaceous material and associated iron sulfides. Water from shallow wells in these shales may be very hard and contain so much sulfate that it is not suitable for either domestic or stock use.

The deepest known fresh (less than 1,000 mg/l dissolved solids) to slightly saline (1,000 to 3,000 mg/l dissolved solids) water supplies in the county are from sandstone in the Chanute Shale in the southwestern part of the county at depths of 200 to 400 feet below land surface, and from the Dennis Limestone and Coffeyville Formation in the northeastern part at depths of 100 to about 250 feet. Locally, in southeastern Montgomery County, ground water at depths of less than 50 feet is moderately saline (3,000 to 10,000 mg/l dissolved solids). Oil has been reported at depths of less than 50 feet in the vicinity of Coffeyville, and the water associated with the oil is not suitable for domestic use. Throughout the county, rocks older than the Bandera Shale yield saline water having dissolved-solids concentrations greater than 3,000 mg/l. These rocks commonly contain water having 10,000 to 200,000 mg/l dissolved solids. Although shallow consolidated-rock aquifers may contain large concentrations of sulfate locally, the chloride concentration is normally low.

Aquifers in many local areas have been contaminated by brine associated with oil and gas production and by improperly plugged abandoned drill holes. In these areas, the contamination of fresh ground water is indicated by the increased amounts of sodium chloride in relation to other constituents. Most of the more than 11,000 holes drilled for oil and gas in Montgomery County were drilled prior to the enactment of legislation in 1934 regulating the drilling, casing, and plugging of wells and the disposal of produced brine to protect the fresh and usable water resources. Improperly plugged wells in local areas are a continuing source of contamination.

Water levels in the consolidated-rock aquifers fluctuate in response to natural discharge and recharge of water and to pumping by wells. Hydrographs for three wells tapping consolidated-rock aquifers are shown on figure 4. Fluctuations of water levels in wells tapping consolidated-rock aquifers in highly dissected topography, such as along a bluff of a stream valley, or in wells tapping aquifers of poor water-yielding characteristics, such as some of the shale units, generally are relatively large. Fluctuations of water levels in wells tapping the better aquifers, or aquifers that are not highly dissected, generally are small.

GROUND WATER IN UNCONSOLIDATED DEPOSITS

Fluvial deposits of clay, silt, sand, and gravel, which form and underlie the flood plains and low terraces of stream valleys, are important sources of ground water. Information obtained from wells and test holes (geohydrologic map) indicates that the thickness of alluvium commonly ranges from about 10 to 60 feet. Four geologic sections (fig. 5) illustrate the range in thickness of the alluvium and the low-terrace deposits, show the position of the water table and the thickness of saturated deposits, and indicate that the water table slopes toward the streams and that ground water is discharged to the streams. During high stages of the streams, when surface water is above the level of the adjacent water table, water in streams infiltrates and recharges the aquifer. Yields of wells in the alluvium and low-terrace deposits may be as much as 100 gpm in the Verdigris River valley, and may range from 5 to 50 gpm in other major stream valleys.

The chemical quality of water from the alluvium and low-terrace deposits ranges from good to poor for domestic and stock use. These aquifers generally yield very hard water of the calcium bicarbonate type that is low in concentrations of chloride, but locally may contain appreciable concentrations of sulfate. In some areas, however, high concentrations of sodium and chloride result from contamination associated with past oil and gas exploration and production.

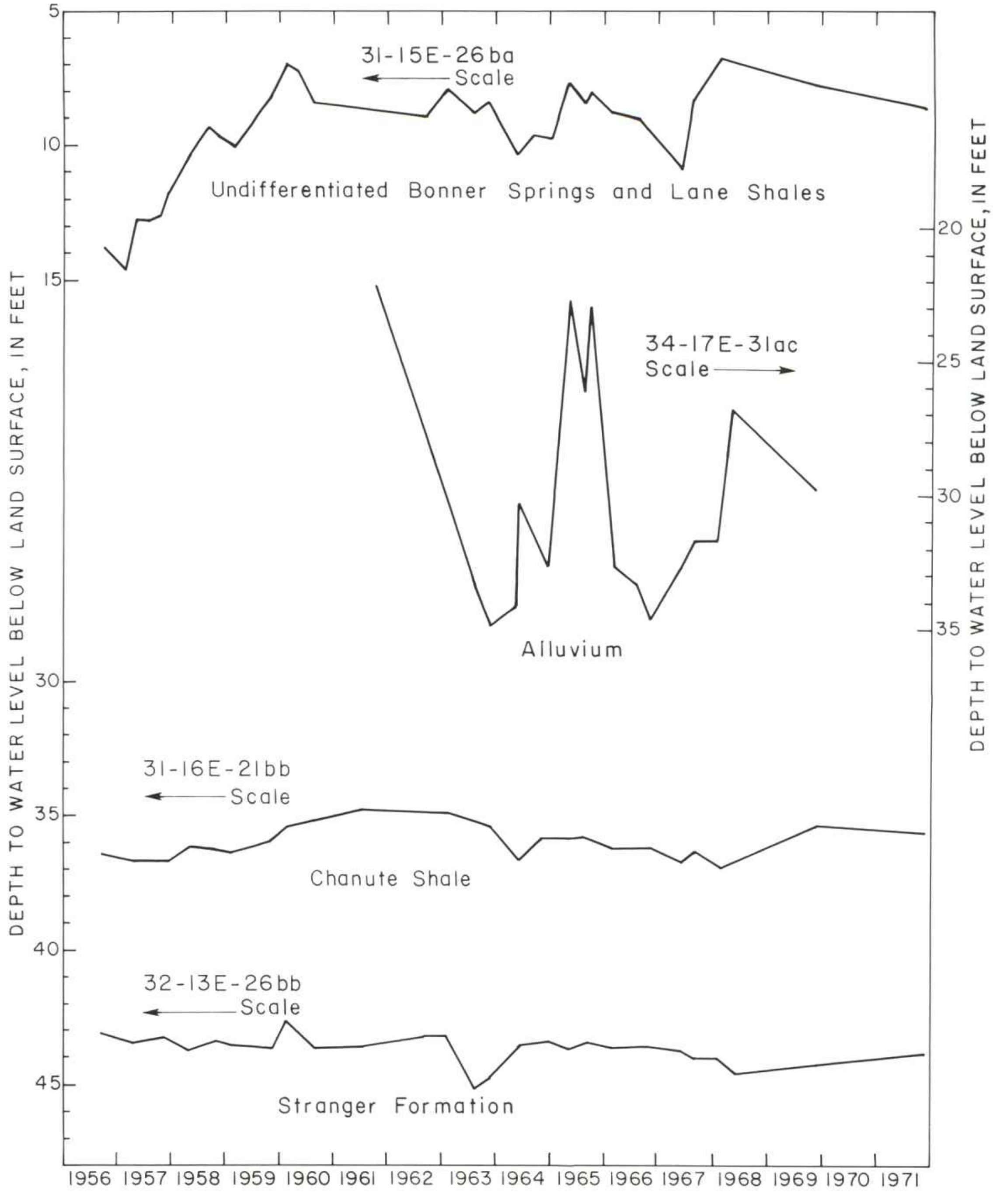


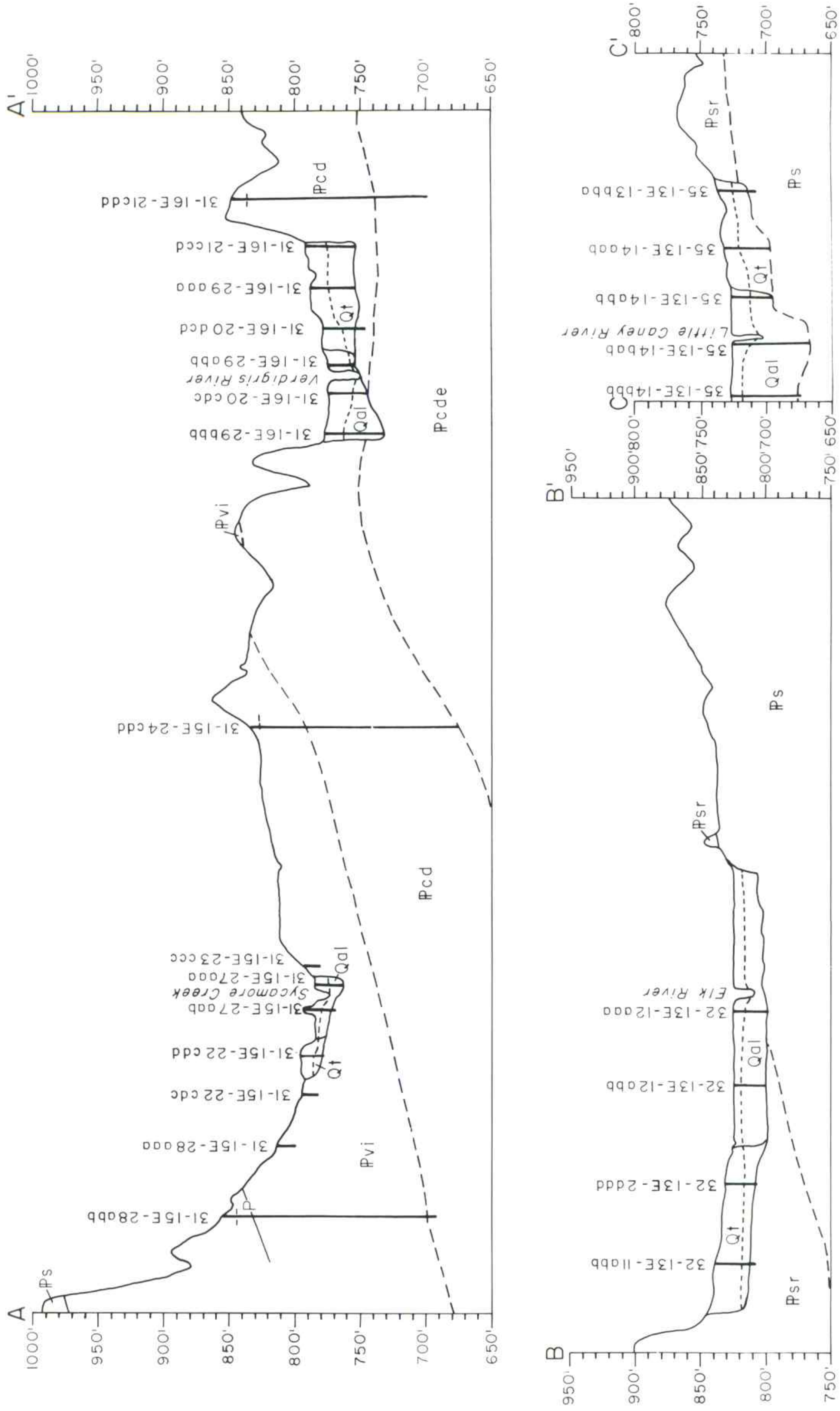
FIGURE 4.—Hydrographs for four selected wells.

TABLE 2.—Chemical analyses of water from selected wells, test holes, and springs.
[Dissolved constituents and hardness given in milligrams per liter. Analyses by Kansas State Department of Health.]

Well number	Sample identification number	Depth of well below land surface (feet)	Geologic source[1]	Date of collection	Temperature (°C)	Dissolved solids (residue at 180° C)	Dissolved silica (SiO_2)	Total iron (Fe)	Total manganese (Mn)	Dissolved calcium (Ca)	Dissolved magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Dissolved sulfate (SO_4)	Dissolved chloride (Cl)	Dissolved fluoride (F)	Dissolved nitrate (NO_3)	Hardness[3] as $CaCO_3$: Calcium, magnesium	Hardness[3] as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25° C)	pH
31-15E- 9bd	1	Spring	Stanton Ls	5- 2-60	...	306	6.5	0.06	0.09	100	5.7	6.7	307	16	15	0.1	3.5	280	26	520	...
26ba	2	61	Lane and Bonner Springs Sh	6- 2-59	...	908	12	.74	.00	64	19	260	516	140	150	1.0	16	240	0	1,580	...
32dd	3	120	Chanute Sh	5- 2-60	...	1,730	10	.52	.07	55	15	610	448	20	800	2.0	2.4	200	0	3,250	...
31-16E- 5bbb	4	22	Alluvium	5- 2-60	...	1,250	12	.22	.12	210	54	110	359	450	65	.2	170	740	450	1,890	...
20dad	5	25	Terrace dep	5- 2-60	...	530	14	.09	.00	110	20	42	276	170	10	.3	26	350	130	825	...
30ab	6	105	Chanute Sh	5- 5-60	...	183	17	.07	.12	31	7.9	22	112	6.2	38	.1	5.8	110	18	315	...
32-13E-26bb	7	56	Stranger Fm	6- 2-59	...	287	14	.14	.00	66	13	11	163	86	8.0	.1	8.0	220	84	455	...
26bb	8	56	do	5-14-68	...	267	12	.06	.00	62	10	13	149	81	9.0	.2	7.1	200	74	390	7.2
32-14E-14cb	9	28	Alluvium	5- 5-60	...	400	19	.23	.78	120	6.9	12	314	36	6.0	.1	49	320	60	660	...
23bab	10		Chanute(?) Sh	5-14-63	...	1,290	5.4	1.7	.14	8.0	3.9	500	544[2]	53	420	.6	1.5	36	0	2,140	8.9
32-15E-33abb	11	80	Chanute Sh	4-24-63	...	2,220	15	.09	.81	500	64	93	327	1,200	61	.5	140	1,500	1,200	2,580	...
32-16E- 7ab	12	90	do	5- 5-60	...	311	25	9.1	.27	31	11	57	143	48	40	.2	28	120	5	515	...
26dc	13	168	Coffeyville Fm	4-25-63	...	464	10	.13	.10	86	32	44	410	74	8.0	.4	8.4	350	10	800	...
29dd	14	23	Chanute Sh	6- 3-59	...	1,170	12	.38	.35	150	52	150	207	630	62	.3	11	600	420	1,700	...
32-17E- 9bb	15	79	Cherryvale(?) Sh	4-24-63	...	574	10	3.8	.10	110	25	57	346	160	37	.1	.4	390	100	940	...
31dbb	16	71	do	4-24-63	15.0	342	7.0	2.3	.12	100	12	10	327	36	11	.1	.4	310	41	600	...
33-13E-36ba	17	140	Stanton Ls	6- 3-59	...	3,890	10	.19	.00	27	12	1,500	510	20	2,100	...	...	120	0	7,390	...
36ca	18	25	Stranger Fm	6- 3-59	...	737	11	.14	.00	120	43	99	524	110	87	.1	9.3	460	34	1,280	...
33-14E-14ab	19	33	Stanton Ls	6- 3-59	14.5	246	6.0	.08	.00	59	11	7.4	129	77	6.0	.2	16	190	86	425	...
14bb	20	40	do	6- 3-59	...	932	13	.03	.00	180	37	72	316	400	51	.3	23	610	350	1,400	...
34ad	21	80	do	6- 3-59	...	1,750	14	.66	.20	240	120	160	603	810	63	.3	35	1,100	620	2,450	...
33-15E- 8dc	22	15	Vilas and Lane Sh	6- 3-59	...	2,920	7.0	.16	.00	500	140	280	256	1,100	730	.4	53	1,800	1,600	4,500	...
27cc	23	74	Chanute Sh	4-25-63	15.5	2,170	9.5	1.9	.31	290	170	150	378	1,300	16	.6	1.1	1,400	1,100	2,550	...
33-16E- 7bc	24	125	do	6- 3-59	...	3,690	24	.30	.00	520	240	280	464	2,200	91	.5	71	2,300	1,900	4,240	...
7dc	25	44	do	5- 2-60	14.0	474	11	3.9	.92	68	33	44	217	200	11	.3	4.4	300	130	750	...
20bb	26	90	do	6- 3-59	...	838	17	3.9	.46	100	56	140	664	66	130	.1	1.3	490	0	1,490	...
30bc	27	175	do	6- 3-59	15.5	680	14	3.8	.00	41	21	170	376	230	12	.4	1.8	190	0	1,100	...
32bd	28	59	do	5- 3-60	...	175	25	.14	.00	31	7.4	12	107	12	9.0	.1	26	110	20	255	...
33-17E-15cd	29	20	Coffeyville Fm	4-25-63	...	2,880	9.0	.13	.11	230	180	410	412	1,600	77	.7	190	1,300	990	3,550	...
34-13E-13ba	30	140	Stanton Ls	6- 3-59	...	3,590	7.0	.22	.00	40	17	1,400	466	28	1,900	1.9	2.0	170	0	6,880	...
34-14E-11ddd	31	85	do	5- 4-60	...	1,300	10	.07	.00	230	45	140	386	550	91	.5	53	760	440	1,920	...
12dd	32	Spring	do	6- 3-59	15.0	221	6.0	.03	.00	64	6.9	8.3	207	14	9.0	.1	11	190	18	410	...
16ab	33	65	do	4-24-63	...	3,740	12	23	.48	500	340	180	527	2,400	49	.7	1.1	2,600	2,200	4,010	...
25da	34	74	do	4-25-63	...	529	12	.05	.10	100	38	38	390	120	25	.2	1.9	410	90	860	...
36dd	35	175	Chanute Sh	5- 4-60	...	786	11	.08	.00	24	7.3	270	473	120	120	1.6	3.4	90	0	1,320	...
34-15E-15cb	36	65	do	6- 3-59	...	204	22	.66	.00	39	6.5	16	124	4.1	13	.1	42	120	22	335	...
25da	37	30	do	5- 3-60	15.0	1,690	16	.80	3.2	250	49	300	702	420	310	.3	4.1	820	240	2,620	...
26da	38	40	do	5- 3-60	...	302	25	.26	.11	53	11	32	184	42	21	.1	27	180	25	505	...

34-16E-16aa	39	65	do	5- 3-60	......	224	19	.08	.08	36	9.3	22	116	56	6.0	.1	19	130	34	360	....
16dc	40	Spring	do	5- 3-60	13.0	139	18	.04	.00	27	5.0	11	101	14	4.0	.1	10	88	5	220	....
17ab	41	50	do	5- 3-60	15.0	261	16	.21	.00	48	23	17	278	9.1	7.0	.6	3.6	210	0	445	....
30bc	42	29	do	5- 3-60	......	486	7.5	.07	.00	110	23	20	273	91	43	.1	53	380	160	860	....
34-17E-15cc	43	31	Coffey-ville(?) Fm	4-25-63	14.5	7,160	9.5	.11	.10	520	850	480	504	4,400	510	1.1	170	4,800	4,400	7,350	....
19cd	44	Spring	Terrace dep	5- 4-60	15.0	499	13	.06	.00	120	15	31	311	86	53	.2	24	370	120	880	....
28bb	45	32	Checker-board Ls and Semi-nole(?) Fm	5- 4-60	......	1,210	17	1.0	.00	180	52	170	334	400	230	.4	2.1	650	380	1,920	....
34aa	46	23	Altamont Ls	4-25-63	13.5	1,110	9.0	.05	.00	210	53	69	284	310	140	.1	180	750	520	1,690	....
35-14E- 1ab	47	190	Chanute Sh	5- 4-60	......	644	8.0	.39	.12	110	20	82	190	160	120	.1	43	360	200	1,120	....
6dcc	48	59	Stanton Ls	5- 4-60	14.5	1,210	13	.12	.12	87	53	270	539	440	81	1.7	5.8	440	0	1,850	....
9dd	49	265	Chanute Sh	5- 4-60	18.0	1,550	12	6.3	.38	20	9.3	580	573	35	600	2.2	8.0	88	0	2,750	....
16dba	50	255	do	5- 4-60	......	1,780	8.5	.09	.00	5.8	7.2	710	832	.0	630	4.6	2.8	44	0	3,250	....
35-15E- 1add	51	35	do	6- 3-59	14.5	361	12	.17	.00	94	12	17	261	54	27	.1	16	280	70	650	....
2ba	52	151	do	6- 3-59	16.0	533	20	.78	.10	81	34	59	354	140	24	.2	2.1	340	52	900	....
35-16E- 6ba	53	35	do	5- 3-60	......	269	8.5	.07	.10	76	9.4	11	256	29	7.0	.1	2.5	230	19	465	....
35-17E-10ba	54	Spring	Lenapah Ls	4-25-63	......	305	7.5	.06	.06	93	7.8	13	296	21	12	.4	5.3	260	22	530	....
Kansas State Board of Health (1973) recommended maximum concentration for drinking water						500		.3	.05					250	250	1.5	45				

[1] dep, deposits; Fm, Formation; Ls, Limestone; Sh, Shale.
[2] Includes 46 mg/l carbonate.
[3] The classification for hardness used in this report is as follows: 0-60, soft; 61-120, moderately hard; 121-180, hard; more than 180, very hard.


A
A'
B
B'
C
C'
1000'
950'
900'
850'
800'
750'
700'
650'
31-15E-28abb
31-15E-28aaa
31-15E-22cdc
31-15E-22cdd
31-15E-27aab
Sycamore Creek
31-15E-27aaa
31-15E-23ccc
31-15E-24cdd
31-16E-29bbb
31-16E-20cdc
Verdigris River
31-16E-29abb
31-16E-20dcd
31-16E-29aaa
31-16E-21ccd
31-16E-21cdd
Ps
Pvi
Pcd
Pcde
Qal
Qt
32-13E-11abb
32-13E-2ddd
32-13E-12abb
32-13E-12aaa
Elk River
Psr
Qal
Qt
35-13E-14bbb
35-13E-14bab
Little Caney River
35-13E-14abb
35-13E-14aab
35-13E-13bbb

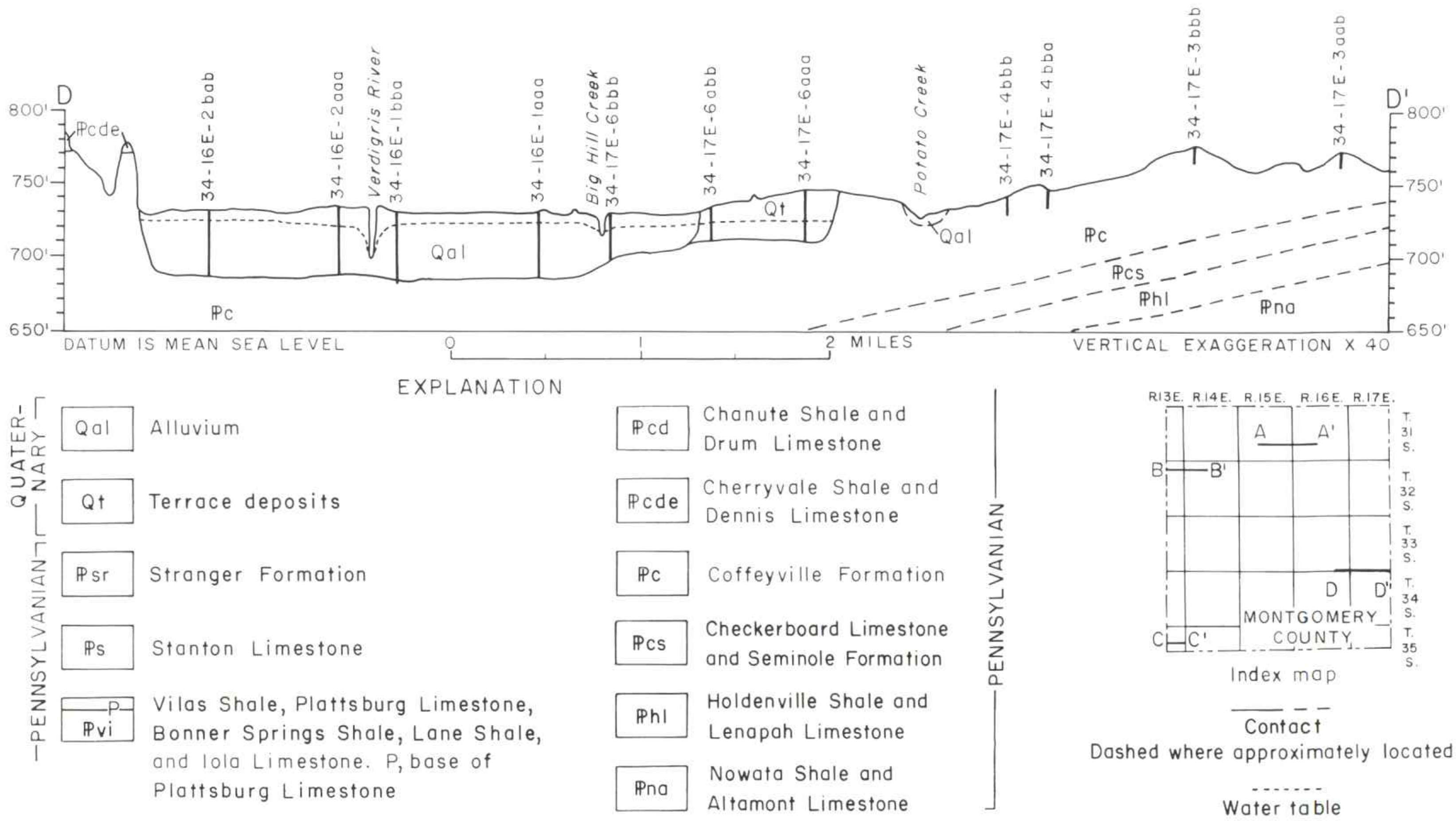


FIGURE 5.—Geologic sections. Traces of the sections are also shown on the geohydrologic map.

Water levels in test holes in the alluvium ranged from about 3 to 22 feet below land surface in 1961. A water-level fluctuation of 13 feet during 1961-69 is shown by the hydrograph for observation well 34-17E-31ac in the alluvium near Coffeyville (fig. 4). Water-level changes of 20 feet or more in areas not affected by pumping probably should be expected in the alluvium of the Verdigris River valley during a cycle of wet and dry years.

The older fluvial deposits that occur as dissected and discontinuous terraces 20 to 100 feet above the flood plain may contain a thin saturated section or may be above the water table.

GROUND-WATER DEVELOPMENT

The largest development of ground water in the county is for livestock and domestic use. In some areas, aquifers have only very small supplies of ground water or have hard water of poor quality. In other areas, aquifers have been contaminated by brine as a result of improper drilling, casing, and plugging of oil and gas wells and the improper handling of brines in the early years of oil and gas exploration. Since 1960, therefore, an effort has been made to expand rural water-distribution systems using water purchased from larger cities; all cities in Montgomery County utilize treated surface water for their water supplies. The trend toward public-water supplies to serve rural areas probably will continue even though some areas served by rural water districts have ground-water supplies of good quality.

No irrigation developments utilize ground water and only a few industries have developed small ground-water supplies. Some ground water from shallow wells is used in oil-field secondary recovery projects.

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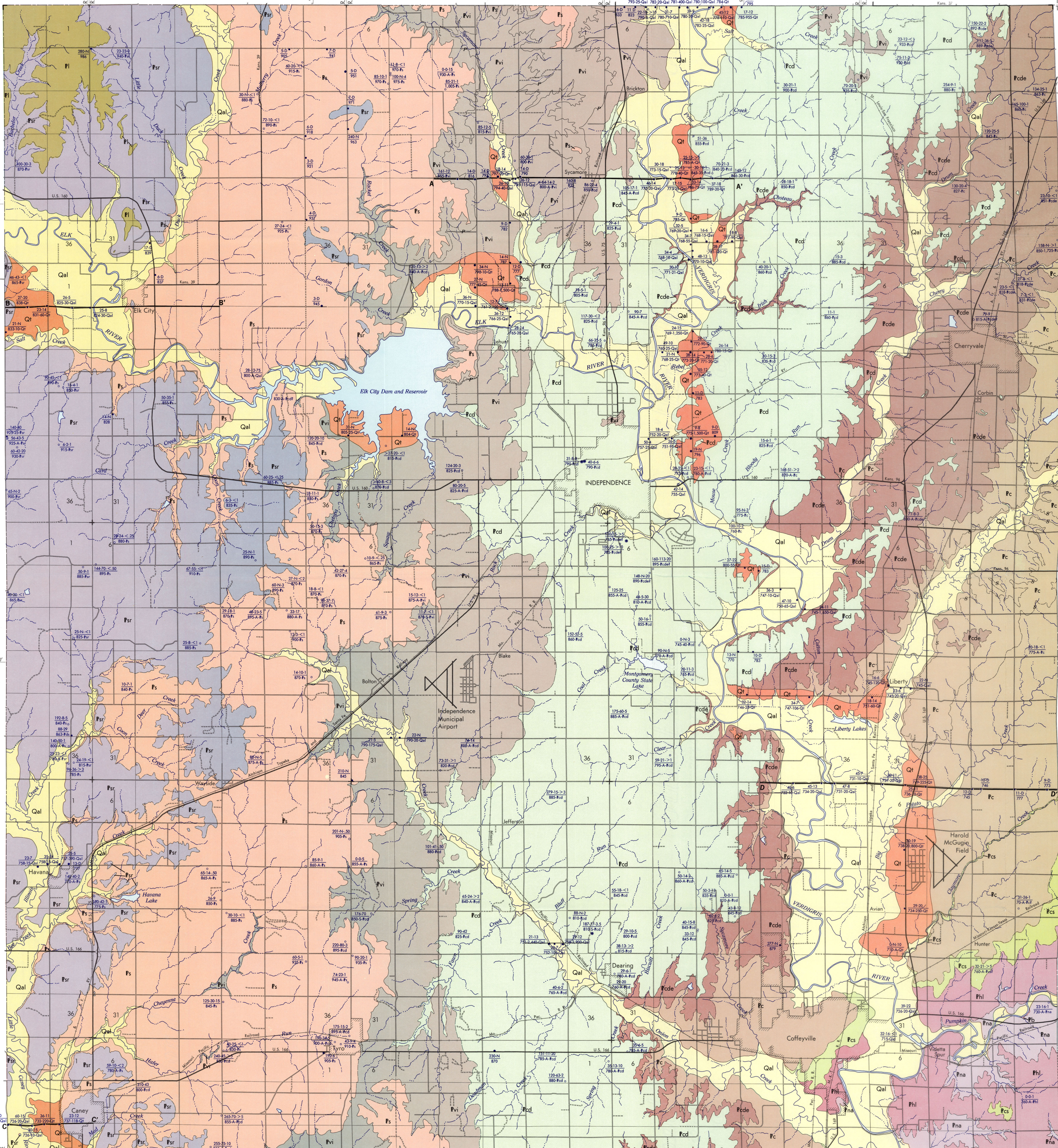
GEOHYDROLOGIC MAP OF MONTGOMERY COUNTY, SOUTHEASTERN KANSAS



Base from U.S. Geological Survey, 1:24,000 Bolton, Coffeyville West, Independence, Neodesha, Sycamore, Tyro, 1959; Caney, Table Mound, 1961; Caney NW, Cherryvale, Coffeyville East, Elk City, Liberty, 1962; Lafontaine, Morehead, 1963; Buxton, 1964

Illustration prepared by Lanna J. Combs

Prepared by the Kansas Geological Survey and the U.S. Geological Survey in cooperation with the Division of Environmental Health of the Kansas State Department of Health and the Division of Water Resources of the Kansas State Board of Agriculture

Geology mapped by H. G. O'Connor, 1970-71

EXPLANATION

QUATERNARY — Pleistocene

- Qal — Alluvium
- Qt — Terrace deposits

PENNSYLVANIAN

Virgilian — DOUGLAS GROUP

- Pl — Lawrence Formation
- Psr — Stranger Formation

Missourian — LANSING GROUP

- Ps — Stanton Limestone
- Pvi — Vilas Shale, Plattsburg Limestone, Bonner Springs Shale, Lane Shale, and Iola Limestone (*P, base of Plattsburg Limestone*)

Missourian — KANSAS CITY GROUP

- Pcd — Chanute Shale and Drum Limestone
- Pcde — Cherryvale Shale and Dennis Limestone
- Pc — Coffeyville Formation (*S, base of Swope Limestone*)

Missourian — PLEASANTON GROUP

- Pcs — Checkerboard Limestone and Seminole Formation

Desmoinesian — MARMATON GROUP

- Phl — Holdenville Shale and Lenapah Limestone
- Pna — Nowata Shale and Altamont Limestone
- Pb — Bandera Shale

Contact
Dashed where approximate or inferred

A———A′
Trace of geologic section
Sections shown on figure 5

Domestic or stock well

Industrial well

Observation well

Test hole

Spring

70-21-3 / 840-20-Pcd

Upper left number is depth of well or test hole below land surface, in feet; second number is depth to water below land surface (1956-61), in feet; third number (when shown) is well yield, in gallons per minute. Lower left number is altitude of land surface, in feet above mean sea level; second number (when shown) is concentration of dissolved chloride, in milligrams per liter; letter symbol is principal aquifer (queried where uncertain). A = complete chemical analysis of water given in table 2; D = dry; N = water level not measured; S = water reportedly has a salty taste.

8½°
True North
Magnetic North

APPROXIMATE MEAN DECLINATION, 1972

Scale 1:63 360

1 0 ½ 1 2 MILES