GROUND-WATER RESOURCES OF CALHOUN COUNTY, SOUTH CAROLINA

by

Teresa Greaney

STATE OF SOUTH CAROLINA

WATER RESOURCES COMMISSION

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State of South Carolina

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ABSTRACT

Calhoun County, S.C., lies in the Atlantic Coastal Plain physiographic province. Sediments of Tertiary and Cretaceous age thicken from 300 ft (feet) in the northwestern part of the county to 1,100 ft in the extreme southeastern part. These sediments, which were deposited on crystalline bedrock, contain an abundance of potable water.

Wells, which commonly are screened in two or more aquifers, produce as much as 500 gpm (gallons per minute) from the Black Mingo Group, 2,000 gpm from the Black Creek and Peedee Formations, and 2,500 gpm from the Middendorf Formation. Most domestic water supplies are obtained from the Black Mingo, except in the northwestern part of the county where the aquifer is thin or eroded.

The ground water is of good quality, with dissolved solids generally not exceeding 100 mg/L (milligrams per liter). The chemical constituents of the water vary in concentration with locality and depth. Ground water in some areas contains excessive iron; it was 3.4 mg/L in one well.

Water levels in Peedee and Black Creek aquifer wells in the St. Matthews area have declined about 10 ft over the past 10 years as a result of withdrawals.

INTRODUCTION

Calhoun County encompasses 392 square miles near the center of South Carolina. Forests cover approximately 133,000 acres, or 53 percent of the total land area of the county. Farm land takes up about 92,000 acres, or 37 percent of the land area (South Carolina Statistical Abstracts, 1992). There are two towns in Calhoun County; St. Matthews, which is the county seat, and Cameron.

In 1990, the population of Calhoun County was approximately 12,500. Population growth has resulted in an increasing number of small communities, mostly in the northeastern part of the county.

Aquifers are the chief source of water supplies in the county. The largest public water supplies are located at St. Matthews and the Sandy Run Community. Approximately 0.8 mgd (million gallons per day) was used for public supply in 1992 (South Carolina Department of Health and Environmental Control, oral communication). Use of ground water for crop irrigation averaged 1.1 mgd, and use by industry was about 0.3 mgd (South Carolina Statistical Abstracts, 1992).

Dependence on this resource is great and will continue to increase with the growing population and the expanding agricultural and industrial activities.

Purpose and Scope

Calhoun County's location near the growing population and industrial centers of central and western South Carolina make it imperative that the available ground-water resources be properly evaluated. The purpose of this report is to present data and findings that have been compiled in the course of a study that began in 1990.

The scope of the study included:

(1) description of the municipal, public, industrial, and irrigation wells,

(2) description of the hydrologic framework of the area, along with the occurrence and availability of ground water (determined from a study of geophysical logs, drill cores, and drill cuttings),

(3) analysis of the hydraulic properties of the major aquifer systems, as indicated by pumping tests,

(4) listing of historical water level measurements,

(5) determination of the relationship between streamflow in Big Beaver Creek and representative precipitation for the area,

(6) inventory of water use, and

(7) determination of the chemical quality of the ground water.

Previous Investigations

Listed below are some of the workers who reported on the geology or ground water of Calhoun County. See "References" for titles of the reports.

Sloan (1908) named the Black Mingo Formation.

Cooke (1936) described the Black Mingo Formation near Fort Motte.

Siple (1946) included technical descriptions of six wells in Calhoun County.

Cooke and MacNeil (1952) worked on classification of the Tertiary formations of South Carolina.

Colquhoun (1965) reported on the terrace-sediment complexes of Central South Carolina.

Poozer (1965) wrote about biostratigraphy of Cenozoic Ostracoda from South Carolina.

Colquhoun and others (1969) reviewed Paleocene-Eocene stratigraphy of South Carolina.

Swift and Heron (1969) studied the stratigraphy of the Carolina Cretaceous sediments.

Van Nieuwenhuise and Colquhoun (1982) worked on sediments in Central South Carolina.

Colquhoun and others (1983) produced maps of the surface and subsurface stratigraphy and structure of the South Carolina Coastal Plain.

Howell (1985) reported on the stratigraphy of the upper Cretaceous, Paleocene, and middle Eocene strata of the updip section of the Coastal Plain.

Aucott and Speiran (1985) described ground-water flow in the Coastal Plain aquifers.

Aucott and Newcome (1986) analyzed the aquifer-test information.

Newcome (1989) provided an overview of ground water in the Coastal Plain.

Colquhoun and others (1990) worked on the Black Mingo Group sediments.

Muthig (1991) and Muthig and Colquhoun (1991) studied Tertiary deposits in Calhoun County.

Speiran and Aucott (1991) studied the effects of depositional environments and ground-water flow and the quality of water in Cretaceous sediments of the Coastal Plain.

Newcome (1993) described pumping test results in the Coastal Plain.

Acknowledgments

The author is grateful to Michael G. Muthig for his input in the construction of geologic sections, structure contour maps, and thickness maps and to Dr. D.J. Colquhoun, Geology Department of the University of South Carolina, and B.C. Spigner, Atlanta Testing and Engineering Company, for helpful technical review and advice. Thanks are due drillers, especially Graves Well Drilling Company, Grosch Irrigation Company, and Charles Burk, for their assistance in obtaining drill samples, geophysical logs, and well construction data.

Well-Numbering System

Identification numbers for wells are based on location. The State is divided into a matrix of grids, each representing 5 minutes of latitude and 5 minutes of longitude. Each of these 5-minute grids has a corresponding number and upper-case letter(s); for example, 28S. The 5-minute grids are further divided into 1-minute latitude-longitude grids, each having a corresponding lower-case letter, 28S-k for example. As wells are located within a 1-minute grid, they are numbered consecutively; for example, to the first well inventoried in grid 28S-k would be assigned number 28S-k1. This grid system is illustrated in Figure 1. All wells noted in this report are referred to by grid number.

In addition to the identification number, each well has a sequentially assigned county number. For example, CAL-82 represents the 82nd well that was inventoried in Calhoun County. County numbers are assigned without regard to location within the county.

Data Availability and Collection

Geologic and ground-water data in the files of the South Carolina Water Resources Commission (SCWRC) and the U.S. Geological Survey (USGS) provided most of the information on which this report is based. Included were 37 geophysical logs of wells, 11 pumping tests, and 17 chemical analyses of well water. Water levels for 54 wells were available; 12 of the wells had two or more measurements.

Detailed descriptions of nearly 90 selected water wells are presented in this report. Their locations, with the aquifer that provides their water, are shown on Plate 1.

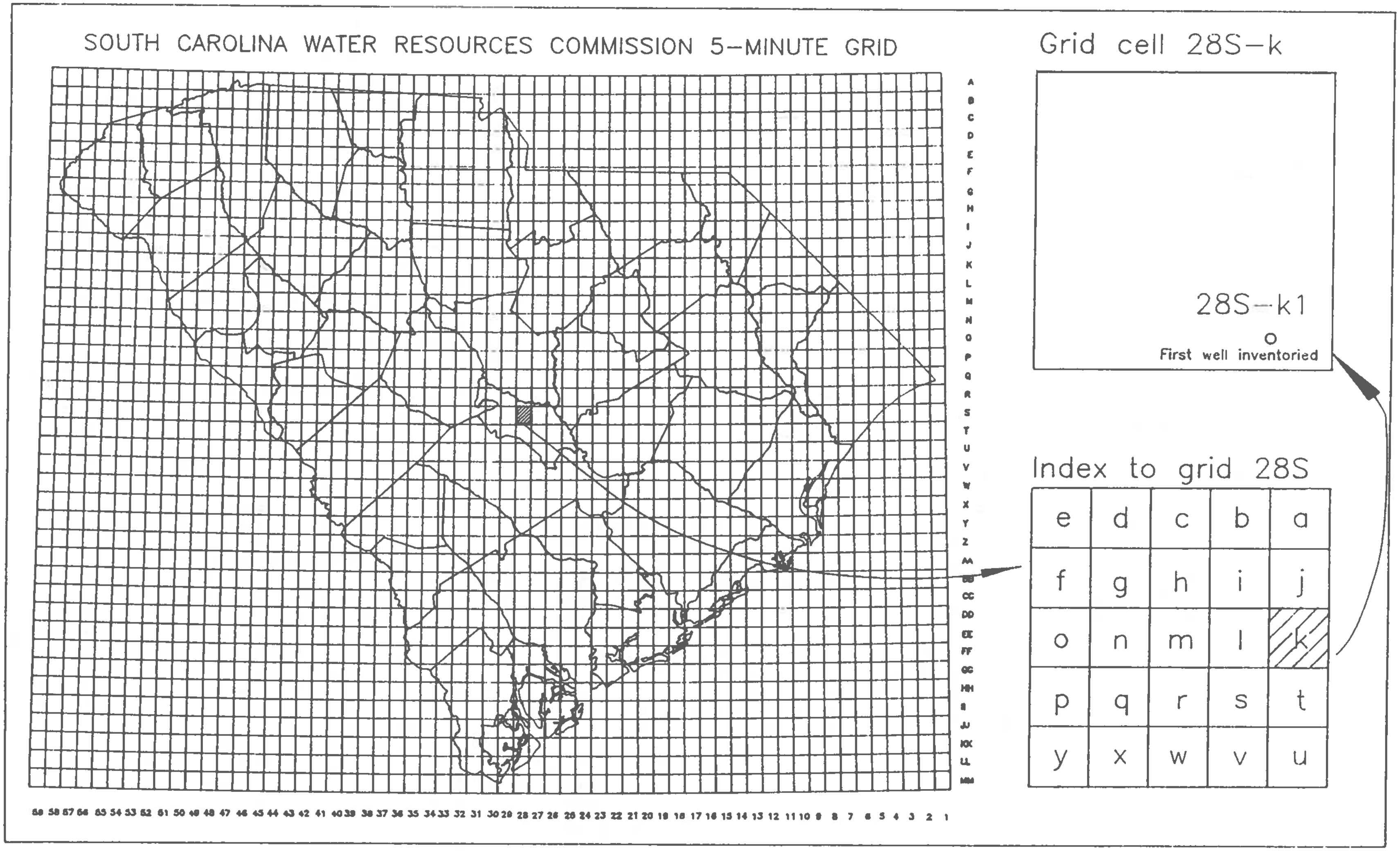


Figure 1. Illustration of the well-numbering system.

DESCRIPTION OF THE STUDY AREA

Physiography

Calhoun County lies mostly within the upper Coastal Plain, with only the southeastern portion of the county being in the middle Coastal Plain. The Citronelle Escarpment separates these two physiographic subregions. The escarpment is the primary geomorphic feature in Calhoun County, where it trends northeasterly before bending to a more northerly direction about 4 miles northeast of the confluence of Halfway Swamp Creek and Lyons Creek.

Land elevations in Calhoun County range from about 400 ft msl in the northwestern part of the county to about 150 ft msl in the southeastern part.

Drainage in Calhoun County occurs by means of three principal systems. The Congaree River drains the northern third of the county; the Santee River drains the southeastern third; and Caw Caw Swamp Creek and Four Hole Swamp Creek, tributaries of the Edisto River, drain the southwestern third of the county (Fig. 2).

The Congaree River drainage basin is characterized by deeply incised streams with maximum relief of several hundred feet in Calhoun County. The general trend is for the depth of stream incision to decrease southeastward from the Fall Line. Big Beaver Creek is a major tributary of the Congaree River.

The Santee River basin is a major watercourse and receives drainage from several small tributaries; the largest of these within the study area is Halfway Swamp Creek. Streams form broad (a few hundred yards wide) incisions with maximum relief of 60 ft.

The tributaries of the Edisto River in the northwestern part of the basin are deeply incised, with maximum relief about 100 ft. Tributaries in the southeastern part of the Edisto basin form broad incisions, similar to those in the Santee River basin, with maximum relief of 40 ft.

Climate

The climate of Calhoun County is temperate to subtropical, influenced by the warm water of the Gulf Stream and by the barrier effect of the Blue Ridge Mountains to the northwest. The 30-year average temperature of the area is 63 degrees F. (South Carolina Statistical Abstracts, 1992).

The temperature during summer months (June - August) frequently reaches 90 degrees F. Nearly one third of the 46 inches of annual precipitation (based on the 30-year period 1961-1990) occurs during the summer.

During a mild fall (September - November) less than 20 percent of the annual precipitation occurs. When there are appreciable amounts of rain, it is usually from hurricanes or tropical storms.

Mild winters (December - February) are typical of the Coastal Plain region. Cold weather occurs but is generally of short duration. Twenty-two percent of the annual precipitation occurs during winter. Snowfall is rare.

Spring (March - May) is marked by cool and windy weather in March that gives way to warm fair weather in May. Nearly 27 percent of the annual precipitation occurs during the spring.

Precipitation and stream discharge for the area in 1988 are illustrated on Figure 3.

Geology

The stratigraphic units defined in this report for the Tertiary and Cretaceous systems, along with stratigraphic sections that have been published for adjacent counties, are shown in Table 1.

Figure 4 shows the locations of wells used to define the tops of the formations in Calhoun County. Elevations of the formation tops in these wells are listed in Table 2.

Plates 2, 3, and 4 contain geologic sections that traverse Calhoun County. The stratigraphy of a test hole about 4 miles east of Calhoun County is presented on Figure 5.

Orangeburg Group-- Sand, silt, and clay of the McBean, Warley Hill, and Congaree Formations are exposed at the surface over much of Calhoun County. The Santee Limestone is penetrated by wells in the eastern part of the county. The maximum remaining thickness of this group is about 120 ft. Southeast of the Citronelle Escarpment and in the Congaree River valley the Orangeburg Group sediments are blanketed by Pleistocene terrace material.

A structure-contour map (Fig. 6) shows the base of the Orangeburg Group dipping generally southeastward from +300 ft msl near Sandy Run Creek to +70 ft msl at Elloree, just over the county line in Orangeburg County. The Orangeburg Group is underlain by the Black Mingo Group.

Black Mingo Group-- Two lithologic assemblages have been recognized in the Black Mingo Group.

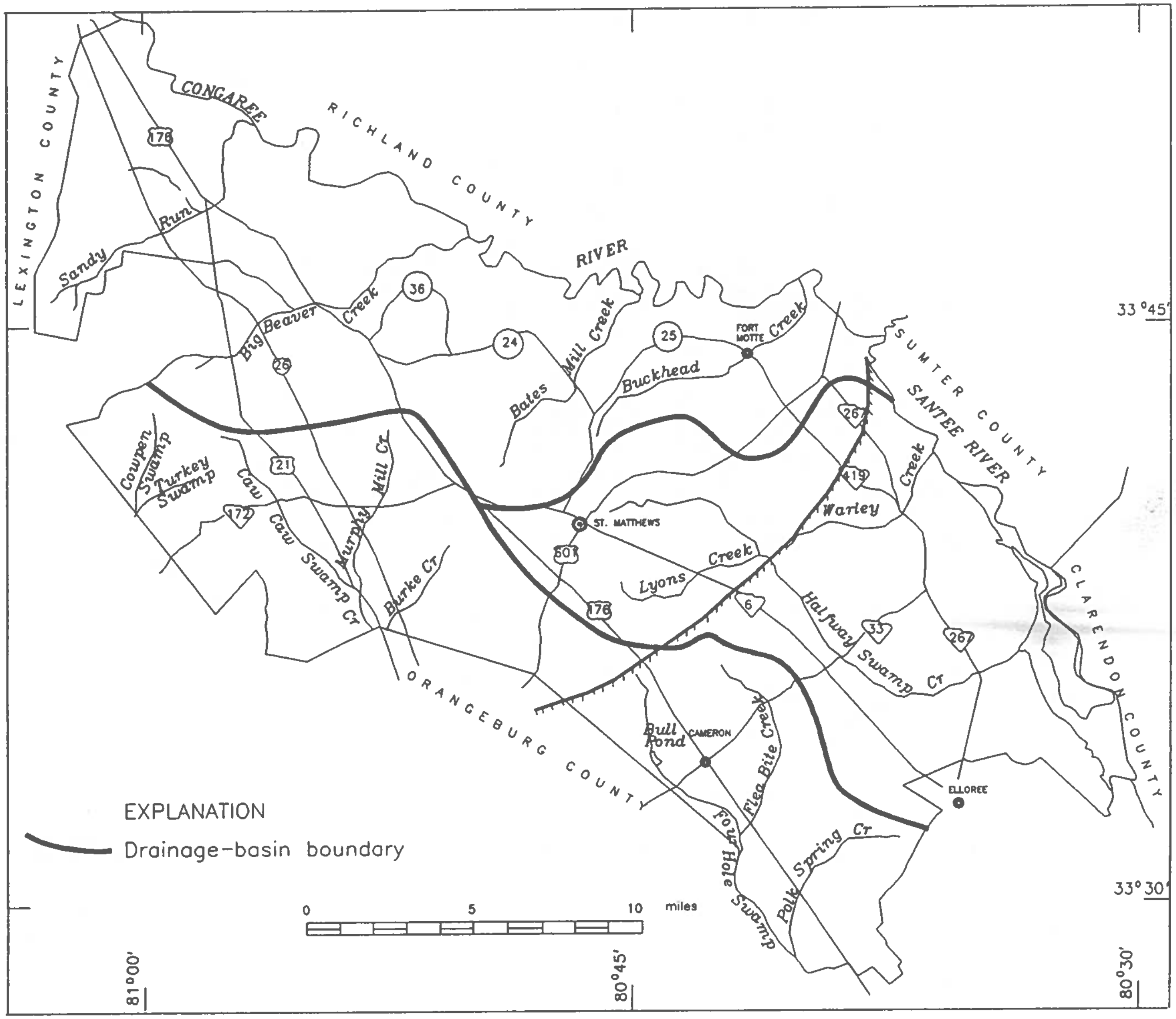


Figure 2. Drainage map for Calhoun County

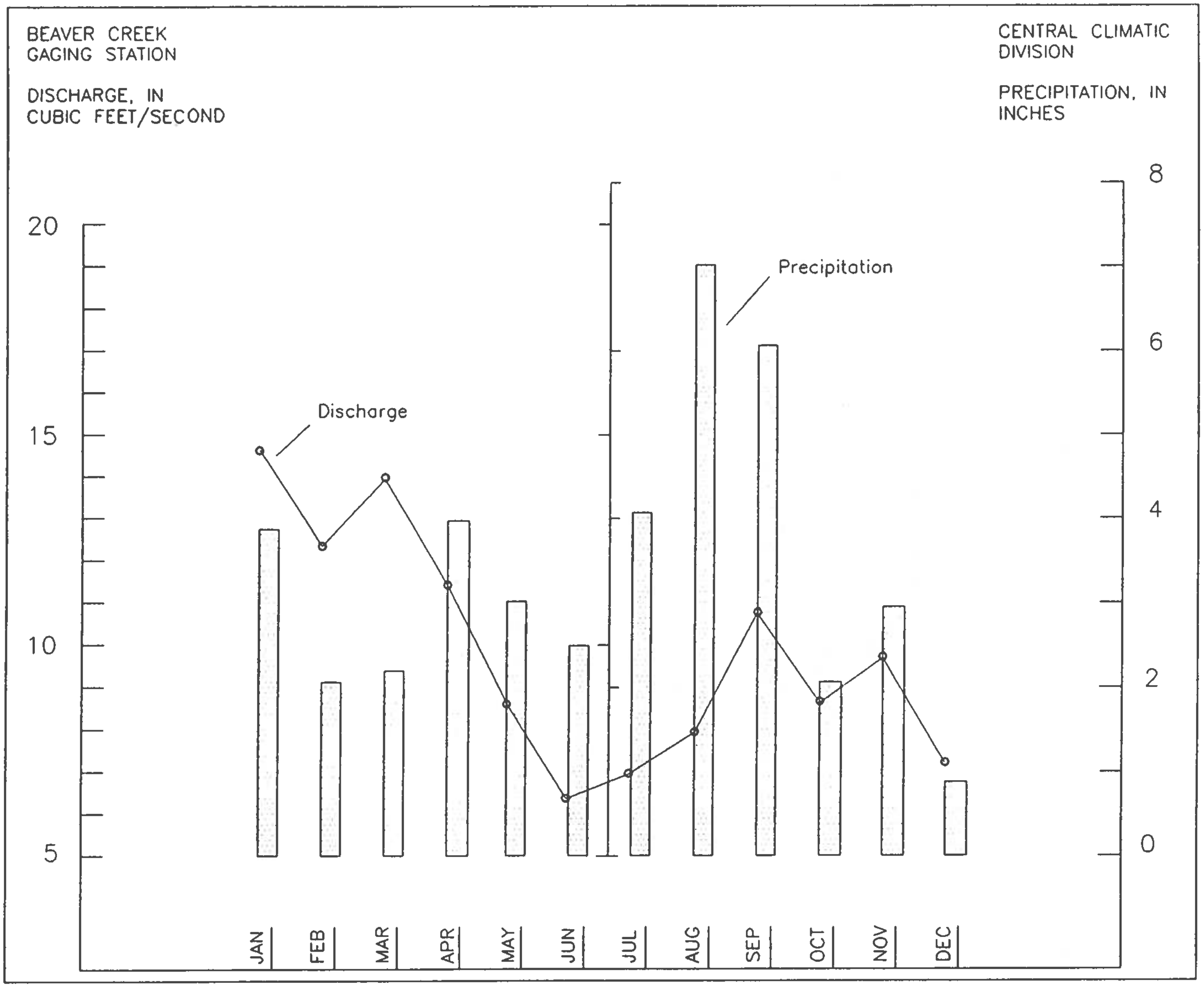
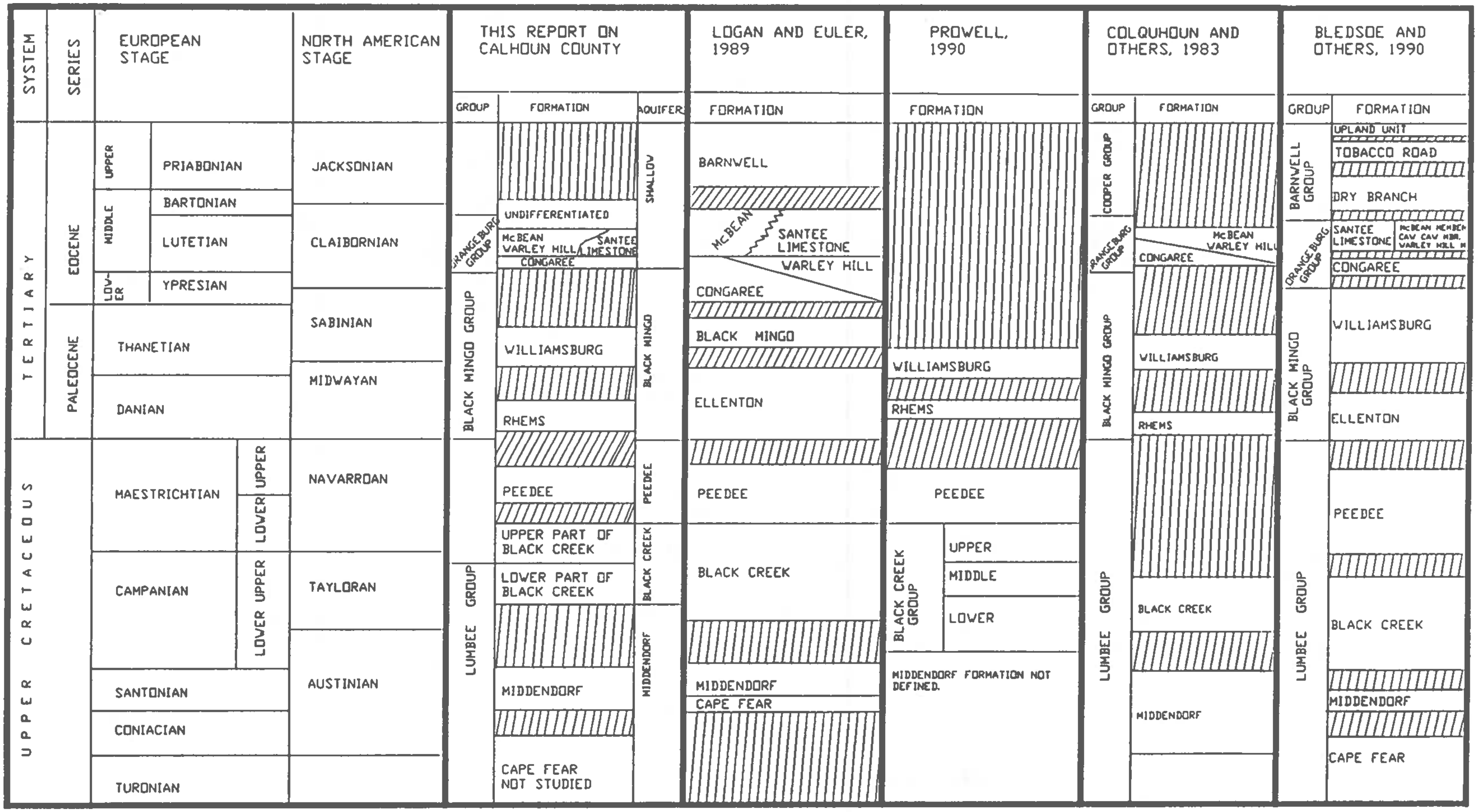


Figure 3. Streamflow in Beaver Creek and representative precipitation for Calhoun County, 1988.

Table 1. Correlation chart for pre-Quaternary stratigraphic units in west-central South Carolina



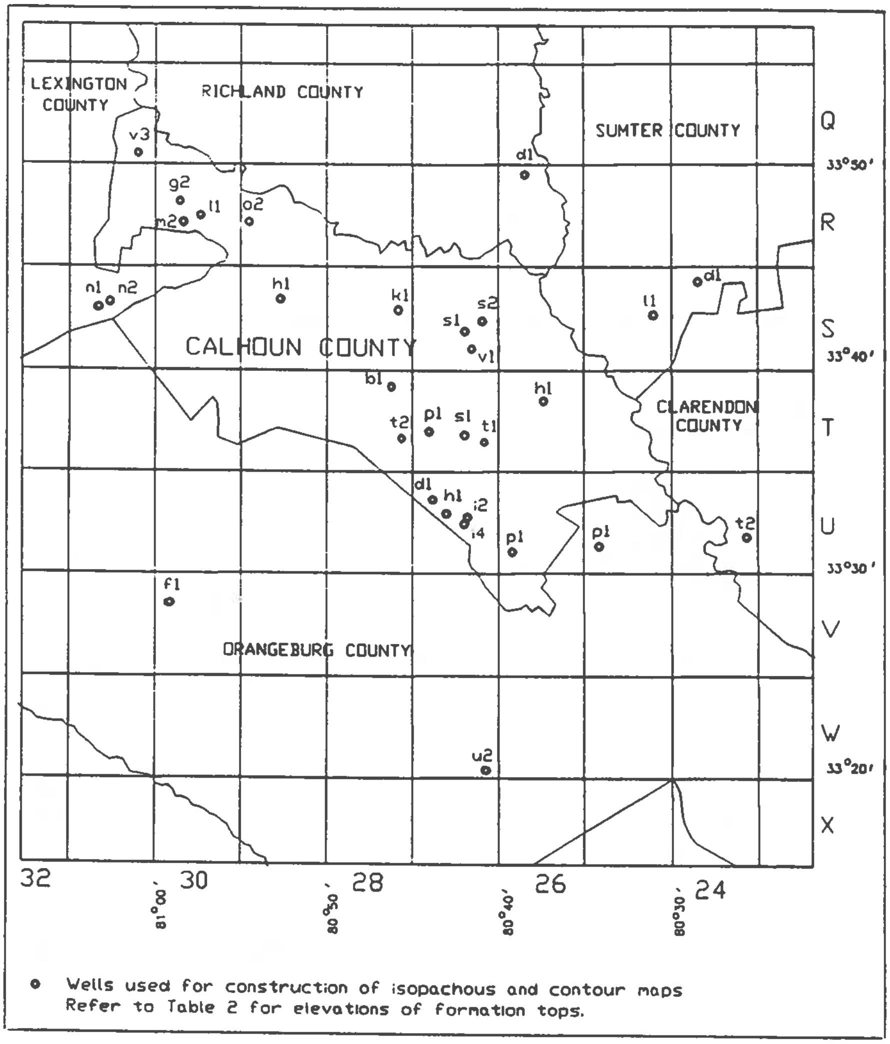


Figure 4. Locations of wells used in drawing structure-contour and thickness maps for Calhoun County.

Table 2. Elevations of formation tops in Calhoun County

SCWRC NUMBER	COUNTY NUMBER	ELEVATION	TOP OF MIDDENDORF	TOP OF BLACK CREEK	TOP OF PEEDEE	TOP OF BLACK MINGO
24S-d1	SUM-151	184		-84	44	eroded
24U-t2	CLA-40	90	-478	-174	-90	eroded
25S-l1	SUM-296	171	-382	-88	36	eroded
25U-p1	ORG-262	165	-500	-173	-89	70
26R-d1	RIC-348	145	-312	-8	eroded	
26T-h1	CAL-39	200		-84	8	150
26U-p1	CAL-101	160		-148	-68	64
27S-s1	CAL-98	265		-51	57	184
27S-s2	CAL-43	265		-35	68	190
27S-v1	CAL-100	240		-60	26	166
27T-p1	CAL-45	220		-95	-10	117
27T-s1	CAL-103	196		-71	3	136
27T-t1	CAL-104	200		-83	-10	131
27U-d1	CAL-105	202		-88	-18	116
27U-h1	CAL-29	180		-132	-60	70
27U-i2	CAL-28	160			-55	81
27U-i4	CAL-99	167		-145	-55	75
27W-u2	ORG-108	142	-700	-344	-234	-58
28S-k1	CAL-41	300	-342	-9	80	215
28T-b1	CAL-30	275		-30	46	150
28T-t2	CAL-49	288		-90	-2	128
29R-o2	CAL-83	280		108	172	surface
29S-h1	CAL-117	348		42	127	256
30R-g2	CAL-115	180	-62	167	surface	
30R-l1	CAL-76	340		110	176	300
30R-m2	CAL-116	150	-112	133	surface	
30V-f1	ORG-253	378		-122	-19	125
31Q-v3	CAL-56	215	20	180	surface	
31S-n1	LEX-191	360		80	161	288
31S-n2	LEX-193	370		85	160	280

Note: Data are in feet relative to sea level.
Refer to Figure 4 for locations of these wells.

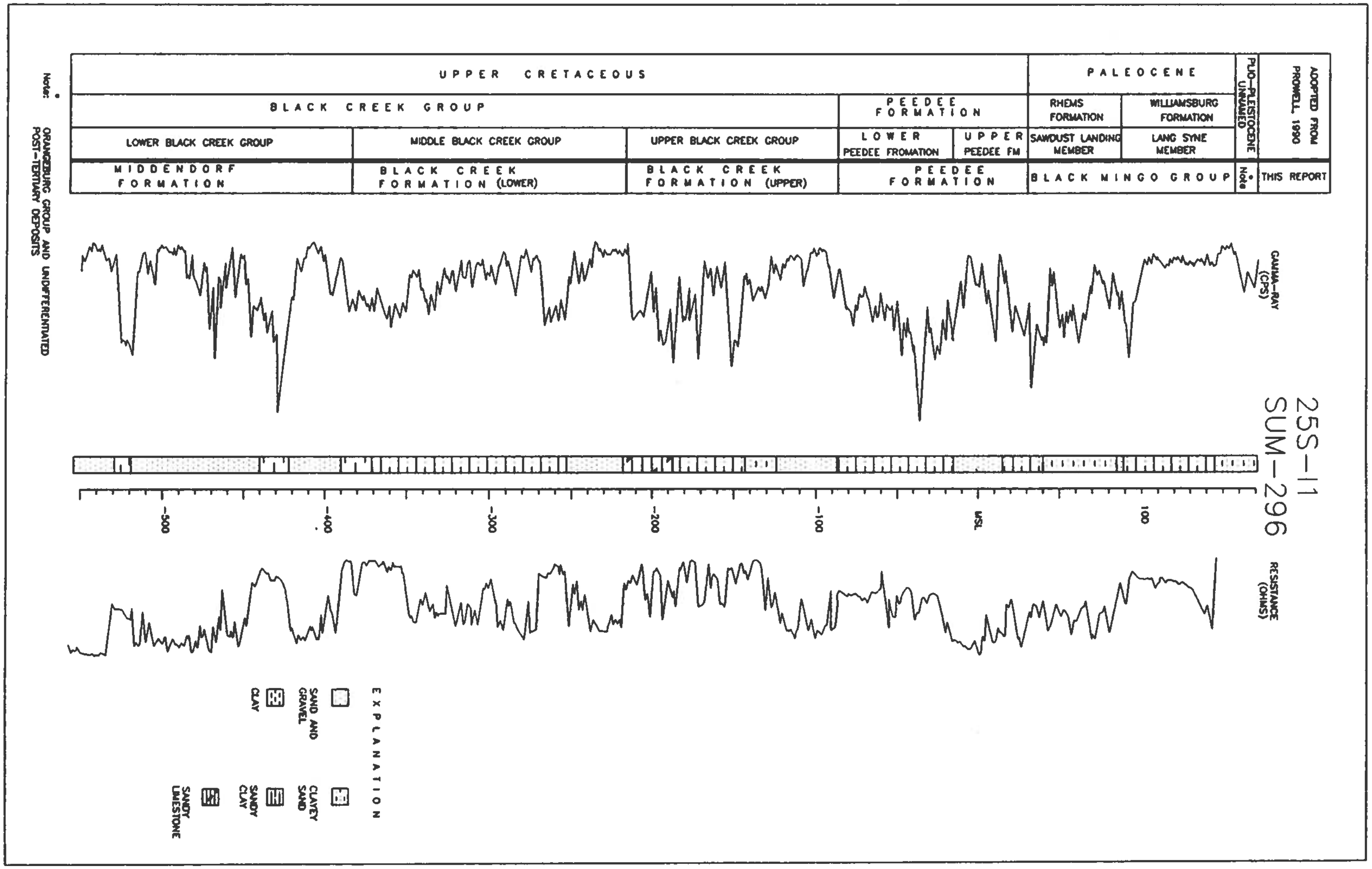


Figure 5. Stratigraphy of test hole 25S-11 in Sumter County.

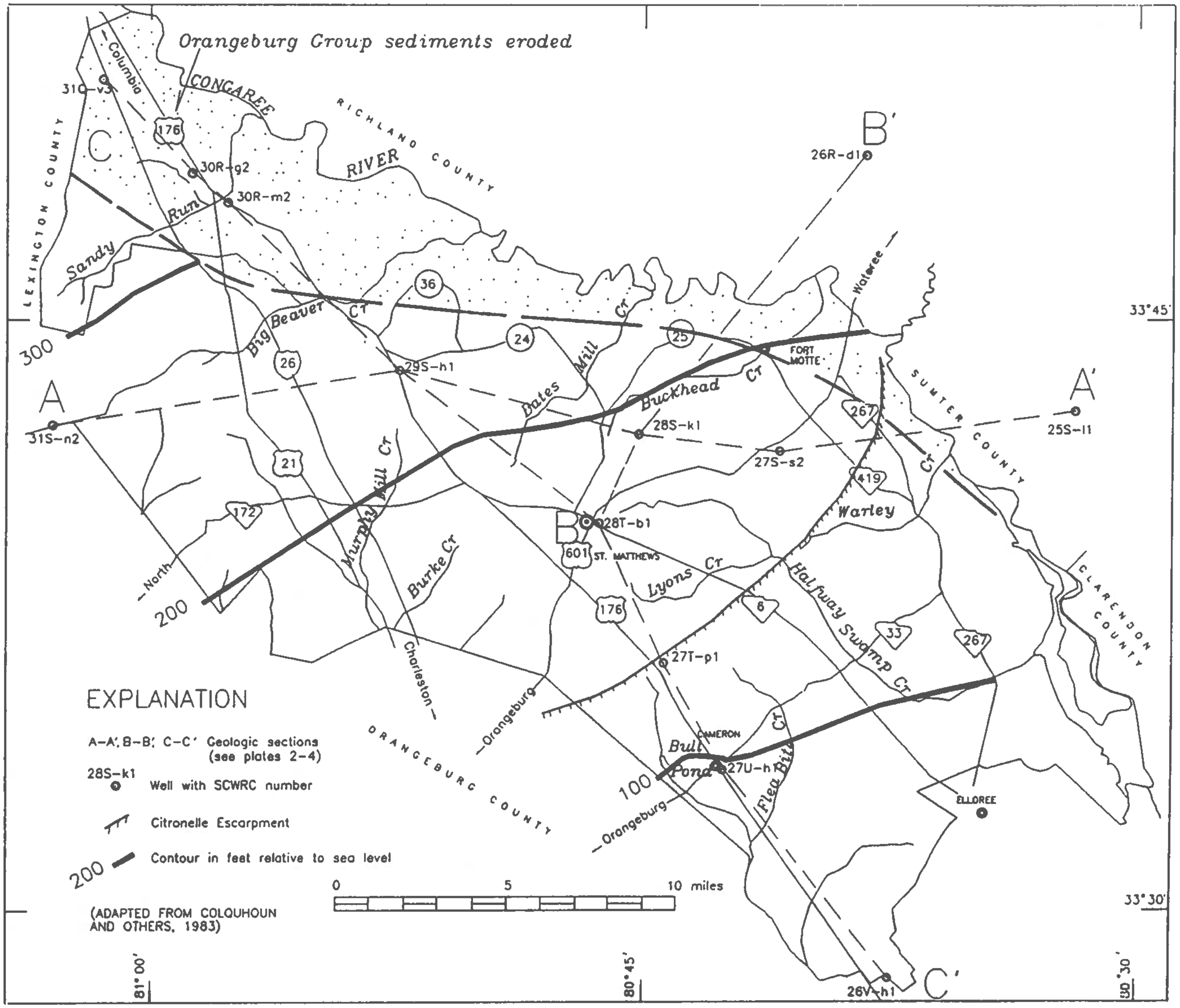


Figure 6. Contours on the base of the Orangeburg Group (top of Black Mingo Group) in Calhoun County.

The carbonaceous yellow sand interbedded with dark clay of the Williamsburg Formation is underlain by dark, compact, laminated, lignitic clay and shale of the Rhems Formation.

Figures 7 and 8 and Plates 2-4 show the thickness and depth of the Black Mingo sediments. Thickness ranges from 110 to 145 ft. The base of the Black Mingo occurs at +150 ft msl in the northwest and at -120 ft msl at the southernmost tip of Calhoun County.

Peedee Formation---The Peedee Formation consists of medium-grained sand, clay, and silt. Its lithology is similar to that of the underlying Black Creek Formation. The unit is 75 to 100 ft thick in much of the area, but it wedges out in the north end of the county (Fig. 9 and Pl. 4).

The base of the Peedee (top of Black Creek) is at +100 ft msl or higher in the northwest and -200 ft msl at the southern tip of Calhoun County (Fig. 10).

Black Creek Formation--The Black Creek Formation consists of fine- to coarse-grained, well sorted sand and carbonaceous, micaceous clay and silt. Lignite is common in the coarse-grained deposits.

The formation ranges in thickness from 175 ft at the north end of the county to about 375 ft at the southern tip (Fig. 11).

The base of the Black Creek Formation (top of Middendorf Formation) ranges from near sea level in the northwest end of Calhoun County to a little below -500 ft msl at the southern tip (Fig. 12). Sediments dip southeasterly at 8 to 12 ft/mile.

Middendorf Formation--The Middendorf Formation consists of medium- to coarse-grained, feldspathic, kaolinitic, and in places gravelly, sand and kaolinitic clay.

In thickness, the Middendorf ranges from a little more than 115 ft at the north end of the county to about 600 ft at the southern tip.

The base of the Middendorf ranges from -100 ft or higher in northwestern Calhoun County to about -1,100 ft msl at the southern tip (Fig. 13). The sediments dip toward the southeast at about 30 ft/mile near the base of the formation and 10-20 ft/mile near the top.

Pre-Cretaceous basement rocks--The crystalline basement, composed of igneous and metamorphic rocks associated with the Carolina Slate belt of Precambrian age, lies beneath the Coastal Plain sedimentary rocks. Only one well in Calhoun County (31Q-v3) penetrated the top of the basement rocks. From wells drilled into the basement in adjacent counties, the probable structure, composition, and hydraulic character can be estimated for the basement rocks underlying Calhoun County.

GROUND-WATER RESOURCES

Water may be obtained from wells screened in a single aquifer or group of aquifers in Calhoun County. The aquifers are saturated, permeable sand beds that have varying capacity to supply water to wells and springs. Water in the aquifers may be unconfined or confined, although most drilled wells are in confined aquifers. The static (standing) water level in a well utilizing an unconfined aquifer is the same as the water table. The direction of flow in unconfined aquifers generally follows the contour of the land surface. In confined aquifers, the water is under pressure and rises in wells that penetrate the aquifer. Water flows from areas of higher to areas of lower potentiometric head.

Several hydraulic properties determine the water flow characteristics of an aquifer. Hydraulic gradient is the change in water level per change in distance in a given direction. Transmissivity is the rate at which water could be transmitted through a unit width of an aquifer under a unit hydraulic gradient. Hydraulic conductivity is a measure of the capacity of an aquifer to transmit water, under a unit gradient, through a unit cross-sectional area of the aquifer. The storage coefficient (dimensionless) reflects the amount of water an aquifer takes in or releases from storage per unit of surface area per unit change in head. Specific capacity is an expression that reflects the productivity of a well. It is measured by dividing the rate of discharge by the drawdown over a given time period (usually 1 day) and is expressed in gallons per minute per foot of drawdown. The drawdown in a well is the distance between the static water level and the pumping water level. During pumping, the potentiometric surface around the pumped well is lowered and forms an inverted cone known as the cone of depression. The depth and extent of this cone depends on the aquifer's transmissivity, storage coefficient, and well discharge and is influenced by the duration of pumping and the existence of hydrologic boundaries. A hydrologic boundary can be either a source of recharge (replenishment) or a barrier to flow. When the spreading cone of depression reaches a recharge boundary (for example, a stream), the drawdown may continue but at a reduced rate. A barrier boundary may be the termination of the aquifer due to thinning or merely reduced capacity where it abuts against a formation of lower permeability. When the cone of depression reaches a barrier boundary, the drawdown will continue at a greater rate.

Water is obtained from five geologic units in Calhoun County. These are (1) shallow undifferentiated deposits of the Orangeburg Group; (2) the Black Mingo Group; (3) the Peedee Formation; (4) the Black Creek Formation; and (5) the Middendorf Formation.

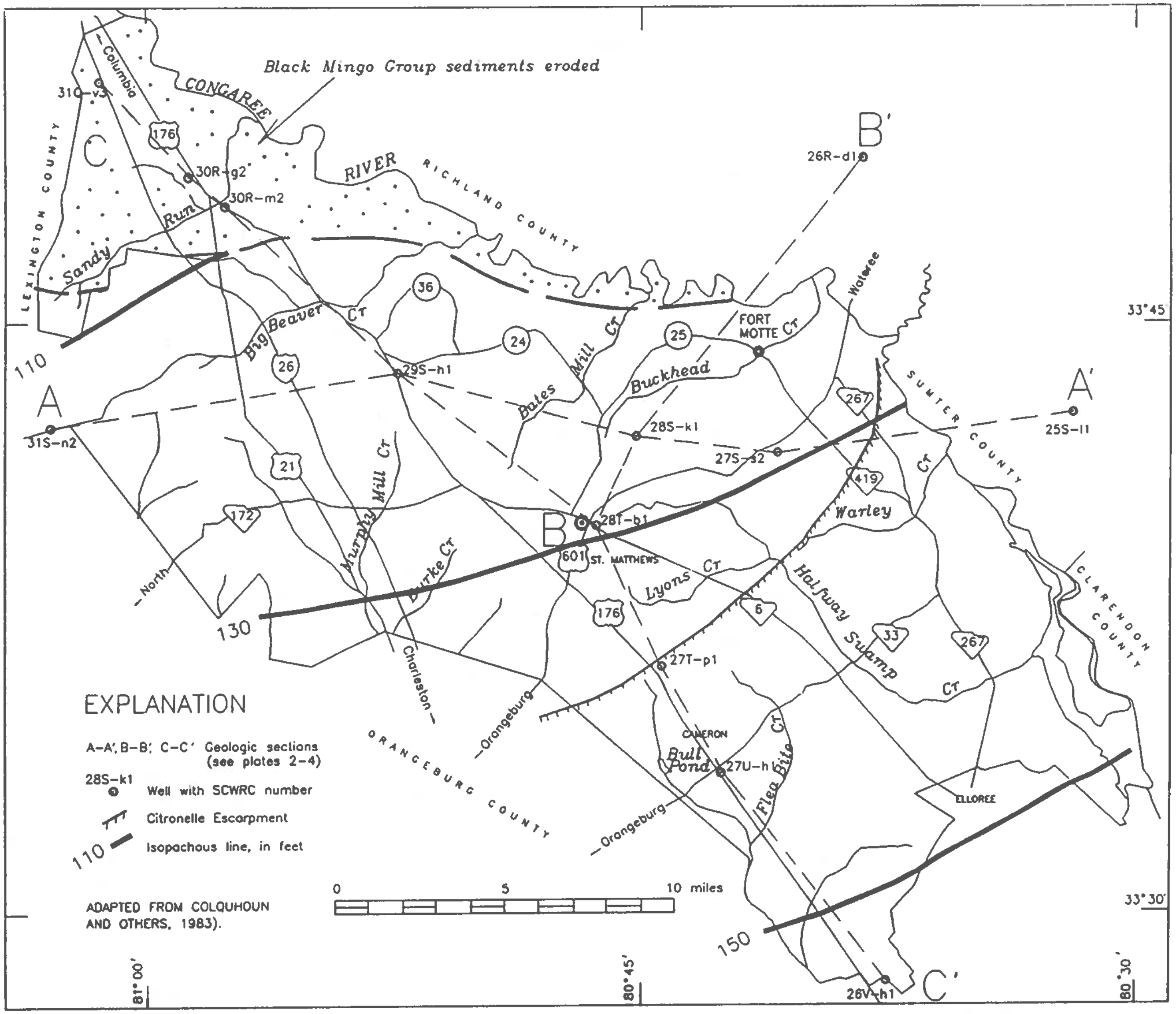


Figure 7. Thickness of the Black Mingo Group in Calhoun County.

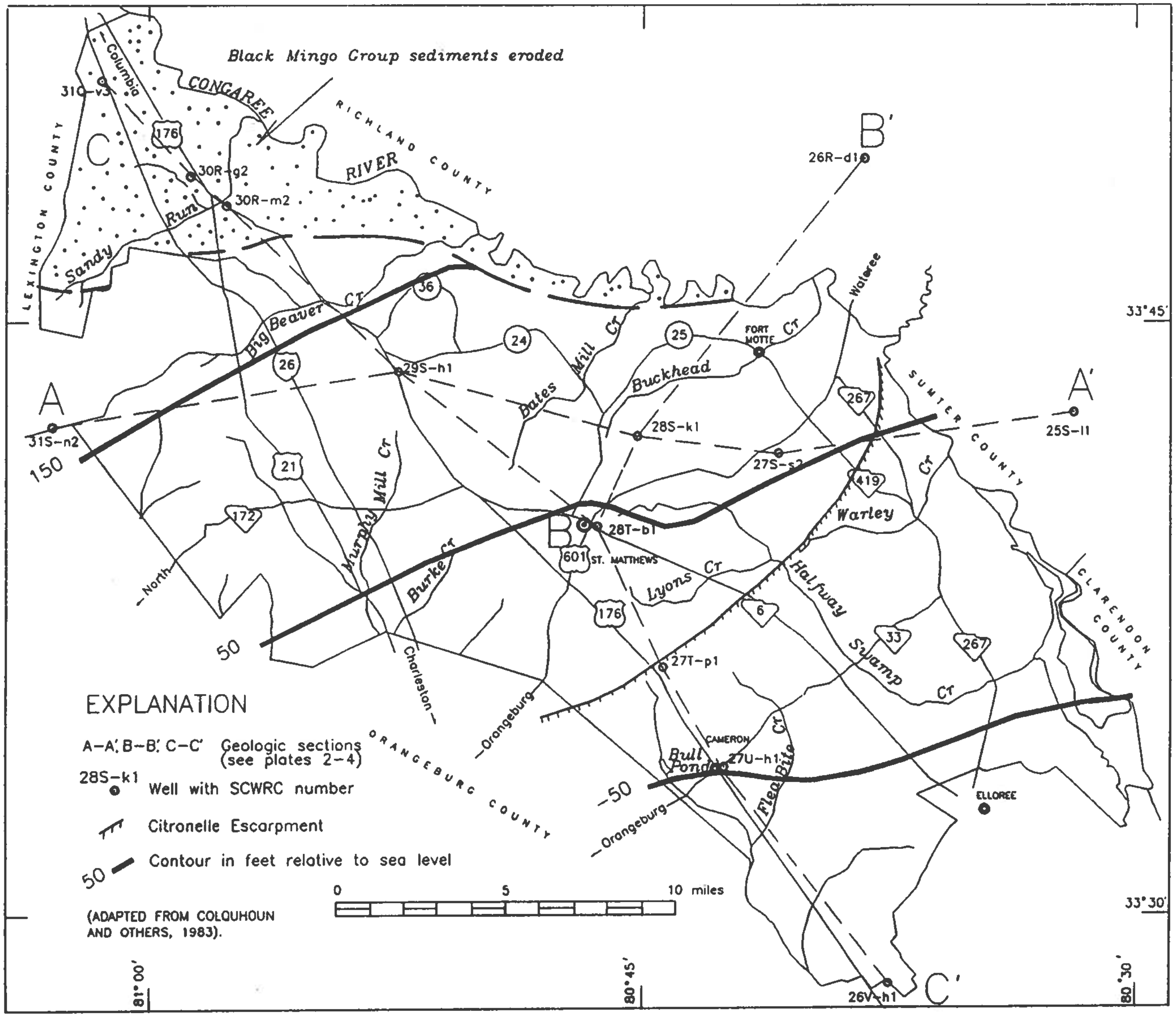


Figure 8. Contours on the base of the Black Mingo Group (top of Peedee Formation) in Calhoun County.

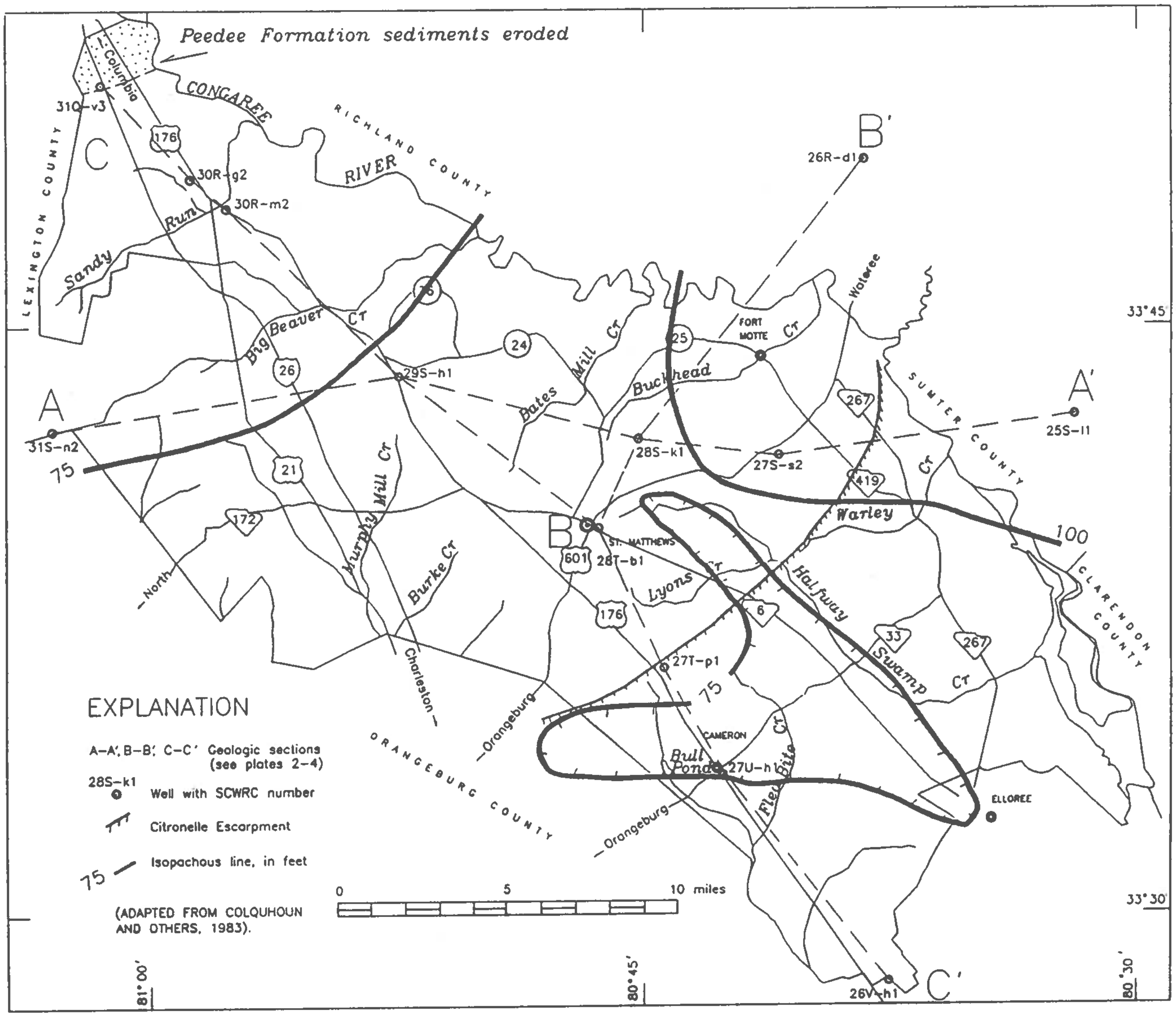


Figure 9. Thickness of the Peedee Formation in Calhoun County.

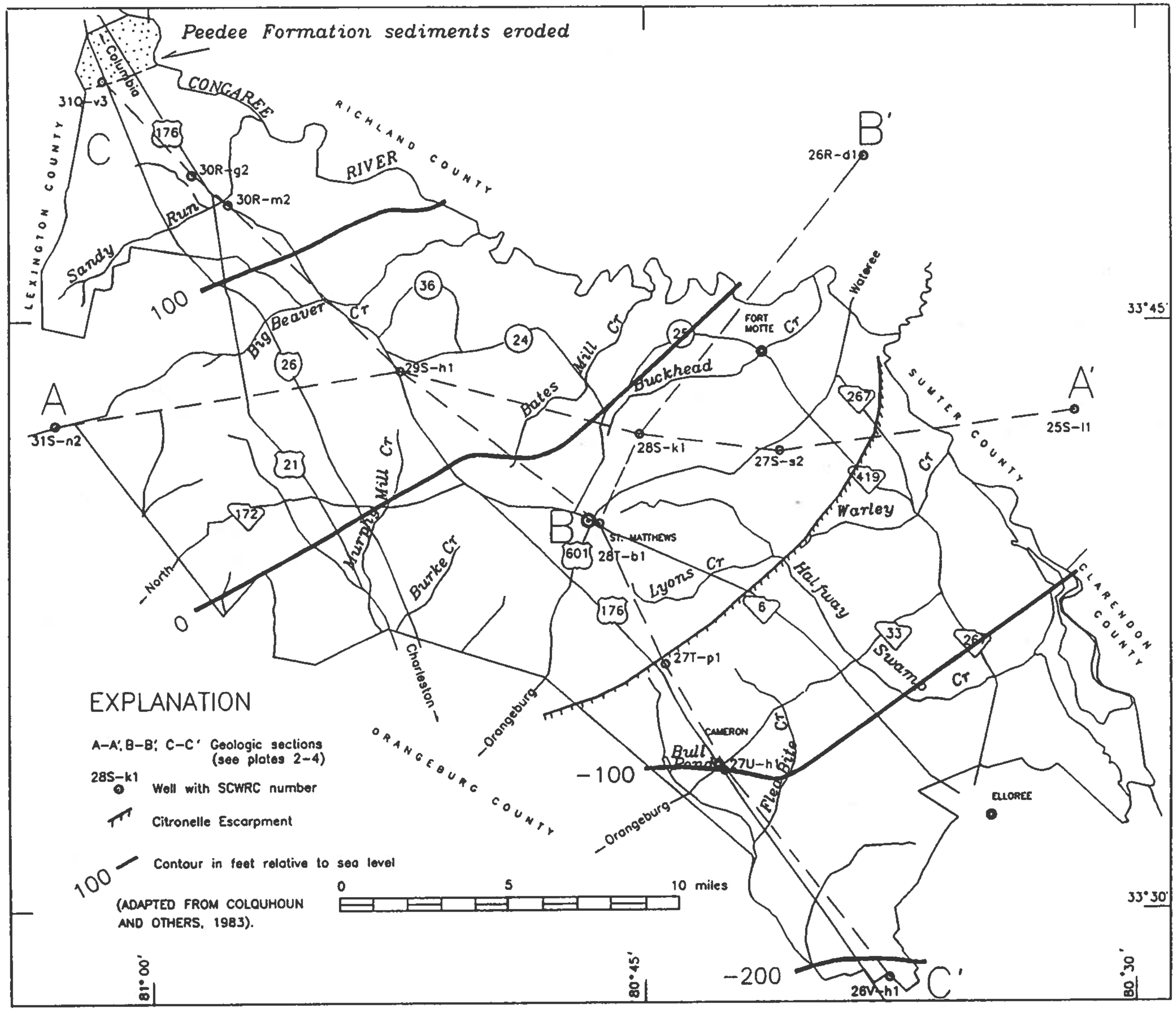


Figure 10. Contours on the base of the Peedee Formation (top of Black Creek Formation) in Calhoun County.

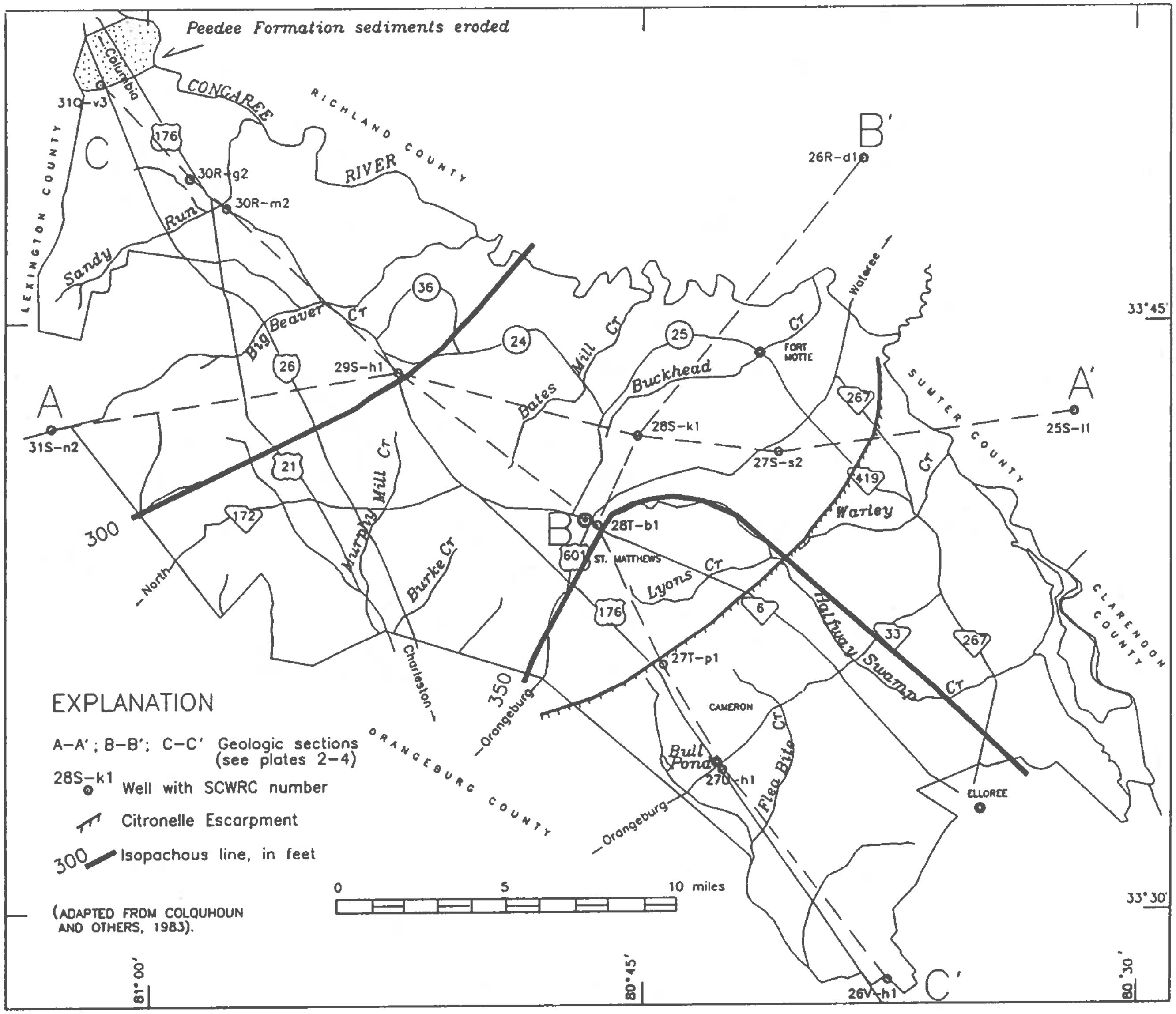


Figure 11. Thickness of the Black Creek Formation in Calhoun County.

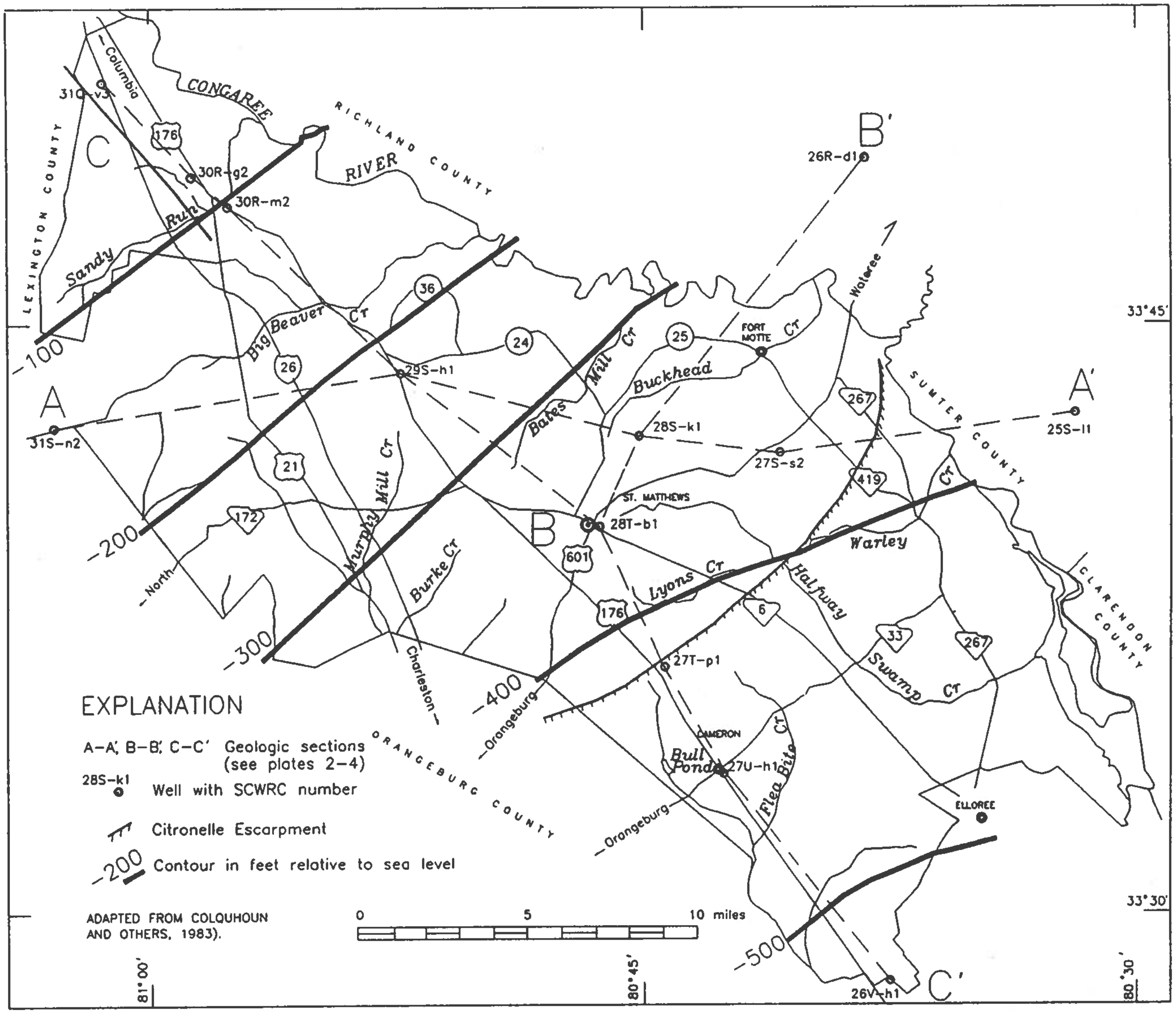


Figure 12. Contours on the base of the Black Creek Formation (top of Middendorf Formation) in Calhoun County.

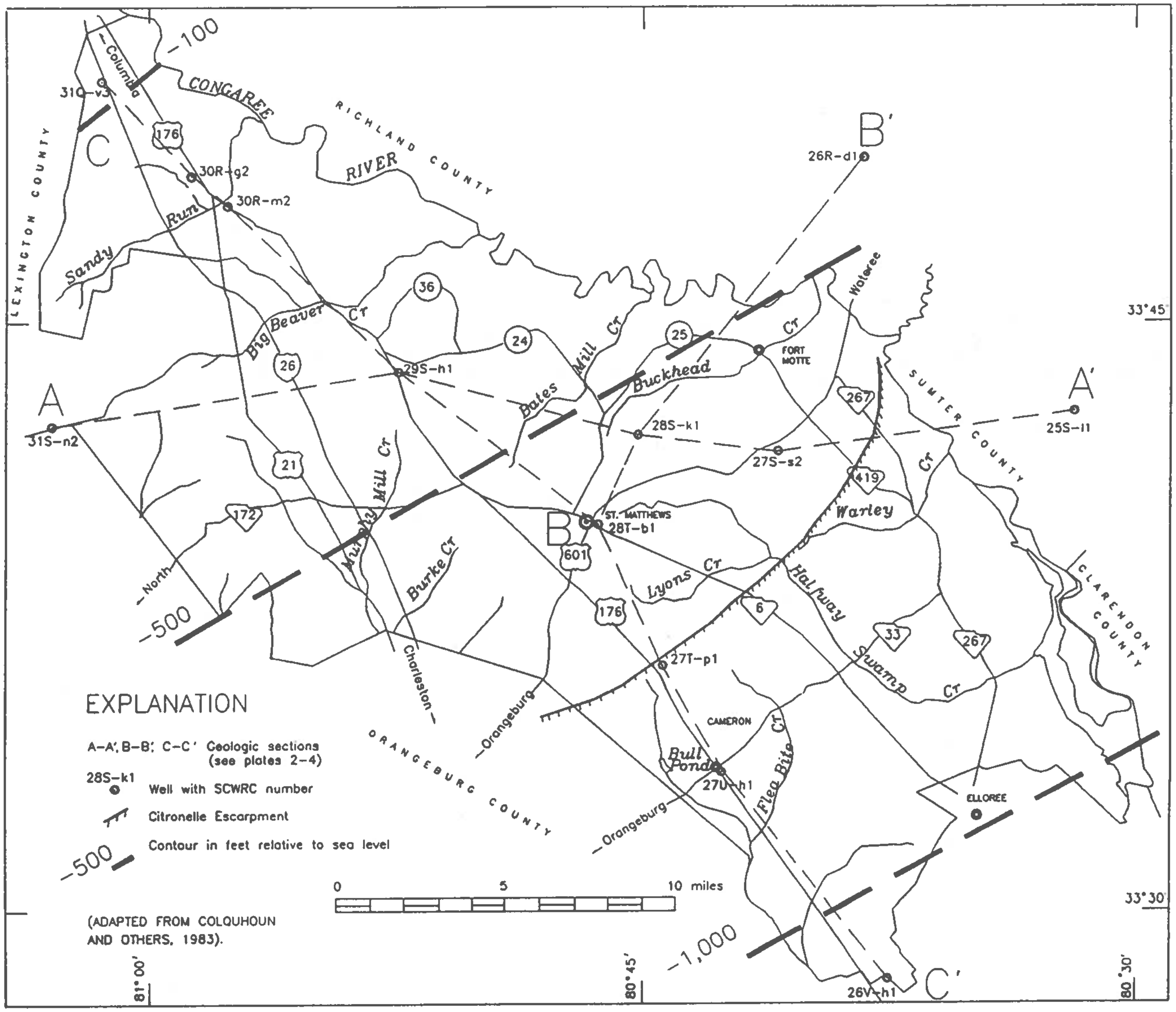


Figure 13. Contours on the base of the Middendorf Formation (top of pre-Cretaceous rocks) in Calhoun County.

A stratigraphic correlation chart of west-central South Carolina (Table 1) and geophysical logs of test hole 25S-11 in Sumter County (Fig. 5), show the aquifer-bearing formations available for water supplies in Calhoun County.

Tertiary Aquifers

Shallow Aquifer

The shallow Tertiary aquifer consists of fine- to medium-grained sand of the Orangeburg Group in the northwestern part of the county and limestone in the southeastern part. This aquifer, interbedded with clay and silt, occurs in most of the county (Fig. 6) and varies in thickness from 0 to 150 ft.

Recharge to the aquifer occurs directly from rainfall, and the water is mostly under water-table (unconfined) conditions. The shallow aquifer discharges water to streams in the eroded valleys where sediments are deeply incised.

Table 3 contains descriptions of several wells producing water from the shallow aquifers. Wells are capable of producing as much as 50 gpm. Well 25T-m1 (80 ft deep) produces 12 gpm with a specific capacity of 3 gpm/ft. Well 25T-m3 (138 ft deep) produces 40 gpm and has a specific capacity of 10 gpm/ft. This well is open to both the shallow and Black Mingo aquifers. No pumping tests have been made at wells in the shallow aquifer in Calhoun County; therefore, transmissivity values are unavailable.

The large exposure of this aquifer to possible contamination from the land surface, coupled with the small available drawdown in most areas make this aquifer less of a dependable water source than the deeper confined aquifers.

Black Mingo Aquifers

Aquifers in the Black Mingo Group consist of poorly sorted fine- to coarse-grained sand and are the most heavily utilized aquifers in the county. The aquifers are interbedded with clay and beds of silicified shell debris. The aquifers extend throughout the county except where eroded in stream valleys. Almost all domestic wells are screened in these aquifers. Most of the Black Mingo wells are between 60 and 265 ft in depth.

The aquifers are recharged directly from rainfall on the outcrops or subcrops, with water then flowing toward nearby streams and southeasterly down the formation dip and becoming confined in the area between Sandy Run and Big Beaver Creeks. Discharge from the aquifers sustains the base flow of the streams. Some water enters the Black Mingo aquifers by leakage from aquifers above and below, depending on local head relationships.

The static water levels measured in some of the Black Mingo wells are listed in Table 4. Water levels were from 45 ft below land surface (+260 ft msl) in well 29S-v1 to 13.8 ft (+118.2 ft msl) in well 28S-i1.

In the southeastern part of the county, where elevations are low, the Black Mingo wells (for example, 26V-f1) are flowing, meaning the static water level is above the land surface.

Pumping tests of two wells producing only from the Black Mingo showed specific capacities of 7.1 and 10 gpm/ft and transmissivities of 22,000 and 30,000 gpd/ft (Table 5). The highest yielding Black Mingo wells in Calhoun County produce about 500 gpm. A limiting factor in the yield of these wells is their relatively shallow depth and the consequent lack of great available drawdown.

Cretaceous Aquifers

Peedee Aquifers

Beds of medium-grained sand in the Peedee Formation constitute the Peedee aquifers. Recharge to the Peedee occurs as a result of precipitation and leakage from the Black Mingo and Black Creek aquifers. The Peedee Formation is generally less than 100 ft thick in Calhoun County, and the aquifers generally occupy only a small percentage of the formation. Most are in the 5-10 foot range in thickness, but rarely a much thicker one is encountered.

In the study area, 35 wells screened in Peedee aquifers were recorded, but only five were screened solely in the Peedee. A pumping test of well 27U-h1 (Table 5) indicated a specific capacity of 11 gpm/ft and a transmissivity of 32,000 gpd/ft. This is a very good aquifer for the Peedee. The pumping rates for wells 27U-g1 and 27U-g4 were 100 and 147 gpm, respectively (Table 3). The greatest yield from the Peedee is 250 gpm, at Cameron.

Black Creek Aquifers

Black Creek aquifers consist of permeable beds of fine- to coarse-grained sand within the Black Creek Formation. Wells in these aquifers range generally between 150 and 500 ft in depth (Table 3), and some are screened also in the overlying Peedee Formation or underlying Middendorf Formation.

Table 3. Description of selected wells in Calhoun County and vicinity

SCWRC NUMBER	COUNTY NUMBER	LAT	LONG	ELEV feet	OWNER AND WELL DESCRIPTION	AQUIFER(S) UTILIZED	WELL USE	TOTAL DEPTH	SCREEN TOP	SCREEN BOTTOM	CASING DIA.	PUMP RATE	YEAR DRILLED
25S-l1	SUM-296	334238	803156	171	USGS CORE HOLE, MANCHESTER 1A	BC,M	TH	728	285	675	-	-	1988
25T-m1	CAL-65	333723	803235	100	SANDIFER	SH	DO	80	75	80	4	12	1979
25T-m2	CAL-64	333731	803235	100	RAY DERRICK	SH	DO	103	80	100	2	10	1980
25T-m3	CAL-63	333738	803237	100	PITTARD	SH	DO	138	123	138	4	20	1980
25U-j1	CAL-111	333319	803053	98	CAMP DANIELS, WELL 1	SH	PS	190	27	190	4	40	1989
25U-j2	CAL-112	333318	803052	98	CAMP DANIELS, WELL 2	SH	PS	190	27	190	4	40	1989
25U-k1	CAL-66	333237	803020	100	POPLAR CREEK LANDING	SH	PS	104	50	104	4	-	1983
26R-d1	RIC-348	334908	803818	145	GODSPEED FARMS	M	IR	680	470	608	14	2,500	1978
26S-o1	CAL-42	334234	803920	226	J.D. WILES, WELL 1, FORT MOTTE	PD,BC	IR	300	220	300	10	525	1980
26S-o2	CAL-106	334215	803950	262	J.D. WILES, WELL 2, FORT MOTTE	BC	IR	380	300	380	10	-	-
26T-h1	CAL-39	333830	803710	200	JEFF GATES	PD,BC	TH	298	-	298	-	-	1980
26U-e1	CAL-102	333405	803945	177	SIMS MOORER	PD,BC	IR	284	204	284	6	-	1988
26U-g1	CAL-94	333310	803812	173	KENNETH BICKLEY	PD,BC	IR	350	220	340	26	2,056	1987
26U-h1	CAL-14	333335	803740	170	JOE RAST, CRESTON	BC	IR	480	-	-	-	-	1960
26U-h2	CAL-95	333338	803753	173	HAIGLER FARMS, CAMERON, WELL 6	PD,BC	IR	350	250	350	10	800	1989
26U-p1	CAL-101	333132	803955	160	MR. BATES, CAMERON	PD,BC	IR	376	-	376	-	-	1988
26U-p2	CAL-81	333115	803950	167	HAIGLER FARMS, WELL 3	PD,BC	IR	350	200	350	-	850	1984
26V-d1	CAL-96	332955	803752	160	GASQUE FARMS	BM,PD	IR	345	222	343	12	984	1987
26V-e1	CAL-74	332933	803932	156	E. V. HAIGLER, WELL 1	BM,PD	IR	340	240	340	-	500	1981
26V-f1	CAL-40	332841	803940	132	E. V. HAIGLER, WELL 2	BM	IR	132	102	132	-	450	1981
26V-g1	CAL-97	332825	803805	150	HUGO L. FELKEL	PD,BC	IR	329	208	328	8	-	1987
26V-h1	ORG-260	332816	803738	138	HUGO FELKEL, ELLOREE	PD,BC	IR	360	260	360	-	400	1984
27S-s1	CAL-98	334126	804136	265	JOHN W.HANE, ST. MATTHEWS	PD,BC	IR	353	-	353	-	-	1988
27S-s2	CAL-43	334133	804106	265	JOHN HANE, ST. MATTHEWS	PD,BC	IR	340	260	340	10	500	1980
27S-s3	CAL-127	334122	804102	270	FORT MOTTE FIRE TOWER	BM	DO	200	200	200	4	-	1980
27S-u1	CAL-44	334010	804010	230	TATUM GRESSETTE, (GRIF WELL)	PD,BC	IR	340	240	340	-	800	1981
27S-v1	CAL-100	334038	804130	240	KITT HANE, ST. MATTHEWS	PD,BC	IR	358	-	358	-	-	-
27T-d1	CAL-50	333944	804346	270	L.B. WANNAMAKER, ST. MATTHEWS	BC	IR	425	260	380	10	900	1980
27T-p1	CAL-45	333617	804430	220	BILL SMITH, ST. MATTHEWS	PD,BC	IR	340	280	340	8	575	1981
27T-s1	CAL-103	333611	804124	194	JAMES MOSS, NEAR CAMERON	PD,BC	IR	355	185	355	16	1,200	1989
27T-t1	CAL-104	333644	804004	194	MOSS PERROW, NEAR CAMERON	BM,PD,BC	IR	340	181	340	16	1,250	1989
27T-u1	CAL-47	333538	804042	187	J.D. RAST, JR., (HOME WELL)	BM,PD,BC	IR	350	200	300	10	1,000	1981
27U-d1	CAL-105	333433	804348	202	MONTY RAST, NEAR CAMERON	BM,PD,BC	IR	340	198	340	16	1,200	1989
27U-g1	CAL-1	333326	804300	170	CAMERON, TOWN OF	PD	AB	90	-	90	10	100	1935
27U-g2	CAL-2	333327	804300	170	CAMERON, TOWN OF	PD,BC	AB	285	267	285	10	85	1935
27U-g3	CAL-24	333323	804301	172	CAMERON, TOWN OF	BM	AB	112	76	101	8	42	1962
27U-g4	CAL-25	333324	804303	172	CAMERON, TOWN OF	PD	AB	274	248	272	8	147	1968
27U-h1	CAL-29	333334	804238	180	CAMERON, TOWN OF	PD	AB	285	250	280	8	250	1978
27U-i1	CAL-46	333330	804139	160	J.D. RAST FARMS	PD	AB	302	-	302	2	-	1977
27U-i2	CAL-28	333332	804139	170	RAST BROS. FARMS, (HOUCK WELL)	BC,M	IR	810	300	810	12	1,200	1982
27U-i4	CAL-99	333310	804155	167	JOE HAIGLER, WELL 4	PD,BC	IR	350	250	350	10	600	1988
27U-j1	CAL-123	333355	804015	164	W. ELLISON, NEAR CAMERON	BM	DO	120	-	120	-	-	-
27U-m1	CAL-108	333202	804243	160	C.F. EVANS, CAMERON	BM	DO	130	116	130	4	75	1986
27U-u1	CAL-107	333005	804056	148	HAIGLER'S FARMS, WELL 5	PD,BC	IR	350	230	350	-	550	1988
28S-h1	CAL-122	334317	804701	157	R. ARANT, RT. 4, ST. MATTHEWS	PD	DO	105	95	105	4	30	1987
28S-i1	CAL-9	334318	804644	132	MT. CARMEL CHURCH, ST. MATTHEWS	BM	PS	70	-	70	2	-	1934
28S-k1	CAL-41	334205	804514	300	TOM HARMON, PECAN HILL FARM	BC,M	IR	823	510	770	12	1,120	1978

Note: See end of the table for explanation of abbreviations.

Table 3. **Description of selected wells in Calhoun County and vicinity - continued**

SCWRC NUMBER	COUNTY NUMBER	LAT	LONG	ELEV	OWNER AND WELL DESCRIPTION	AQUIFER(S) UTILIZED	WELL USE	TOTAL DEPTH	SCREEN TOP	SCREEN BOTTOM	CASING DIA._	PUMP RATE	YEAR DRILLED
28S-s1	CAL-59	334138	804620	300	MRS. TAYLOR	BM	DO	120	115	120	4	10	1980
28S-u1	CAL-60	334057	804516	240	TOM HARMON, PECAN HILL FARM	BM	DO	90	80	90	4	13	1979
28S-v4	CAL-4	334013	804629	230	ST.MATTHEWS, TOWN OF	BM	AB	93	84	93	8	300	1946
28S-v5	CAL-10	334010	804630	230	ST. MATTHEWS, TOWN OF	PD,BC	AB	310	258	290	8	70	1906
28S-v7	CAL-78	334014	804638	236	ST. MATTHEWS, CHURCH ST. WELL	BM	PS	155	108	142	10	506	1986
28S-x1	CAL-13	334135	804835	292	ALEX HICKLIN, ST. MATTHEWS	BM	DO	175	-	175	4	30	-
28S-x2	CAL-119	334032	804816	312	R. HICKLIN, SR., RT.2	BM	DO	265	-	265	4	-	-
28S-x3	CAL-120	334053	804842	292	R. HICKLIN, JR., RT.2	BM	DO	152	-	152	4	-	1986
28S-y1	CAL-62	334000	804959	295	A. BURKE	BM	DO	120	115	120	4	50	1980
28T-b1	CAL-30	333952	804629	260	ST. MATTHEWS, TANK WELL	BM,PD,BC	AB	420	170	410	10	500	1980
28T-b2	CAL-48	333952	804623	275	ST. MATTHEWS, HWY 69 AND 63	BM	PS	220	100	200	12	450	1981
28T-m1	CAL-32	333753	804748	325	P. W. FAIREY	BM	DO	183	-	183	4	-	-
28T-m3	CAL-11	333750	804735	320	JOE FAIREY, ST. MATTHEWS	BM	DO	217	150	217	4	30	1957
28T-o1	CAL-121	333705	804908	285	R. THORNTON, ST. MATTHEWS	BM	DO	148	-	148	4	-	1977
28T-t2	CAL-49	333654	804512	288	J.D. RAST, CAMERON, CULLER WELL	PD,BC	IR	428	346	426	10	-	1981
29R-o2	CAL-83	334742	805425	280	JACKIE MICHELLE, NEAR SANDY RUN	BC	DO	240	210	220	4	10	1985
29S-h1	CAL-117	334343	805233	348	WATER DISTRICT, (BELLEVILLE 1)	PD,BC	PS	381	288	366	8	250	1990
29S-h2	CAL-126	334337	805254	364	ST. MATTHEWS FIRE TOWER	SH	DO	120	-	120	4	50	1988
29S-m1	CAL-53	334248	805220	370	BOZARD, MOBILE HOME PARK	SH	PS	150	130	150	4	32	1981
29S-o1	CAL-79	344215	805455	344	TATUM GRESSETTE, (TWG)	PD,BM	IR	260	210	260	-	375	-
29S-u1	CAL-12	334035	80500	315	POLLY BANKS, ST. MATTHEWS	BM	DO	217	-	217	4	45	-
29S-v1	CAL-57	334022	805158	305	MURDAUGH, RT. 6, ST. MATTHEWS	SH	DO	100	80	100	2	-	1980
29S-x1	CAL-67	334018	805345	300	BREAKFIELD'S EXXON & RESTAURANT	SH,BM	PS	139	99	139	4	37	1983
29S-y1	CAL-68	334025	805402	308	BETLEHEM SCHOOL	BM,PD	PS	275	174	275	-	-	1982
30R-g1	CAL-75	334828	805815	155	HUBERT L. STABLER, RT.2 GASTON	SH	DO	60	-	60	4	10	1977
30R-g2	CAL-115	334844	805855	180	WATER DISTRICT, SUNDY RUN 1	BC,M	PS	351	228	336	10	403	1990
30R-j1	CAL-26	334838	805506	150	TEE PAK CORPORATION, 1	M	PS	405	306	400	12	402	1976
30R-j2	CAL-27	334839	805504	155	TEE PAK CORPORATION, 2	M	IN	410	305	405	12	524	1976
30R-j4	CAL-55	334800	805500	159	DANIEL CONSTRUCTION, TEST WELL	BC	TH	270	-	270	4	-	1975
30R-k5	CAL-88	334753	805517	375	ROBERT OTRAN, SWANSEA	BC	DO	260	-	260	4	-	1985
30R-l1	CAL-76	334713	805631	340	JOHN LYNN	BC	DO	312	297	307	4	30	1984
30R-m1	CAL-110	334703	805718	310	NORMAN STURKIE	BC	DO	275	255	275	4	-	1987
30R-m2	CAL-116	334759	805747	150	WATER DISTRICT, SANDY RUN 2	BC,M	PS	287	195	282	10	431	1990
30R-t2	CAL-109	334655	805548	330	GENE CRIM	PD	DO	220	200	220	4	-	1986
31Q-k1	CAL-31	335205	810037	140	CAROLINA EASTMAN	M	AB	169	160	169	6	55	1965
31Q-v1	CAL-16	335018	810127	275	HWY I-26, EASTBOUND REST AREA	BC	AB	183	166	176	6	35	1967
31Q-v2	CAL-17	335019	810120	260	HWY I-26, WESTBOUND REST AREA	BC	AB	165	146	156	6	28	1967
31Q-v3	CAL-56	335037	810136	215	NATIONAL WELDERS	M	IN	280	174	275	8	250	1982
31Q-v4	CAL-124	335020	810120	260	HWY I-26, WESTBOUND REST AREA	M	PS	342	317	337	6	85	1988
31Q-v5	CAL-125	335020	810128	280	Hwy I-26, EASTBOUND REST AREA	M	PS	365	340	360	6	68	1989
31S-n1	LEX-191	334215	810333	360	CHAMPION INTERNATIONAL, WELL 1	BC	IR	425	286	425	12	1000	1977
31S-n2	LEX-193	334218	810310	370	CHAMPION INTERNATIONAL, WELL 2	BC	IR	365	300	350	14	500	1977

Explanation of abbreviations:
LAT - latitude, LONG - longitude. ELEV - elevation (feet mean sea level). WELL USE: PS - public supply, DO - domestic, IR - irrigation, IN - industrial, TH - test hole, AB - abandoned. DEPTH OF WELL AND SCREEN - in feet. CASING DIAMETER - in inches.
PUMP RATE - in gallons per minute.
Aquifer(s) utilized: SH - shallow, BM - Black Mingo, PD - Peedee, BC - Black Creek, M - Middendorf.

Table 4. Water levels in Calhoun County well

SCWRC WELL NUMBER	COUNTY WELL NUMBER	AQUIFER	SCREEN ZONE	ELEVATION	WATER LEVEL	DATE
25T-m1	CAL-65	BM	75-80	100	+1.0	12/79
25T-m2	CAL-64	BM	80-100	100	9.0	04/80
25T-m3		BM	123-138	100	+6.0	04/80
25U-k1	CAL-66	BM	50-104	100	5.1	09/83
26S-o1	CAL-42	PD,BC	220-300	226	146.3	12/81
26S-o2	CAL-106	BC	300-380	262	146.0	02/81
26U-e1	CAL-102	PD,BC	204-284	177	50.0	11/88
26U-g1	CAL-94	PD,BC	220-340	173	51.0	03/87
26V-f1	CAL-40	BM	102-132	125	flowing	10/81
26V-g1	CAL-97	PD,BC	208-328	150	35.0	07/87
27S-s1	CAL-98	PD,BC	260-340	265	160.5	12/90
27S-s2	CAL-43	PD,BC	? -353	265	151.4 152.0 151.5 160.5	12/80 10/82 11/89 12/90
27S-u1	CAL-44	PD,BC	240-340	230	142.8	08/81
27S-v1	CAL-100	PD,BC	? -358	250	168.0 143.7	03/88 12/90
27T-p1	CAL-45	PD,BC	280-340	220	82.0	10/81
27T-s1	CAL-103	PD,BC	185-355	196	85.0	05/89
27T-t1	CAL-104	BM,PD,BC	181-340	194	70.0	05/89
27T-u1	CAL-47	BM,PD,BC	200-300	187	53.3 69.3	10/82 12/90
27U-g1	CAL-1	PD	80-90	170	7.3 8.2 7.2	08/80 11/82 11/89
27U-g2	CAL-2	PD,BC	267-285	170	28.4 30.6 30.1 38.0	01/81 11/82 11/89 11/90
27U-g3	CAL-24	BM	76-101	172	18.0	10/62
27U-g4	CAL-25	PD	248-272	172	40.0	01/68
27U-h1	CAL-29	PD	250-280	180	41.6	06/78
27U-i1	CAL-46	PD	? -302	160	27.0	10/82
27U-i2	CAL-28	BC,M	300-810	170	27.8 23.4	10/82 12/90
27U-m1	CAL-108	BM	116-130	160	20.0	08/86
28S-i1	CAL-9	BM	? -70	132	13.8	11/82
28S-k1	CAL-41	BC,M	510-770	300	159.0	07/78
28S-s1	CAL-59	BM	115-120	300	65.0	03/80
28S-u1	CAL-60	BM	80-90	240	15.0	10/87
28S-v4	CAL-4	BM	84-93	230	15.2	03/46
28S-v5	CAL-10	PD,BC	258-290	230	30.1	11/89
28S-v7	CAL-78	BM	108-142	236	30.0	10/86
28S-x3	CAL-120	BM	? -152	292	60.0	08/86
28S-y1	CAL-62	BM	115-120	295	48.0	01/80
28T-b1	CAL-30	BM,PD,BC	170-410	260	144.0 143.6	03/80 04/80
28T-b2	CAL-48	BM	100-200	275	67.0	09/81
28T-m1	CAL-32	BM	? -183	325	71.5 75.6	08/80 10/82
28T-t2	CAL-49	PD,BC	346-426	288	149.5 169.4	10/82 12/90
29R-o2	CAL-83	BC	210-220	280	184.5	04/85
29S-h1	CAL-117	PD,BC	288-366	348	225.0	03/90
29S-h2	CAL-126	SH	? -120	364	95.4	05/91
29S-m1	CAL-53	BM	130-150	370	67.0	03/80
29S-v1	CAL-57	SH	80-100	305	45.0	01/80
29S-x1	CAL-67	SH,BM	99-139	300	53.2	02/84
30R-g2	CAL-115	BC,M	228-336	180	21.5	03/90
30R-j1	CAL-26	M	306-400	150	44.0 44.5	05/76 12/80
30R-j2	CAL-27	M	305-405	155	42.0 43.8	12/76 12/80
30R-k5	CAL-88	BC	? -260	375	47.0	08/85
30R-l1	CAL-76	BC	297-307	340	13.8	11/82
30R-m2	CAL-116	BC,M	195-282	150	2.7	02/90
31Q-k1	CAL-31	M	160-169	140	8.3 9.4 8.9	09/80 11/82 11/90
31Q-v1	CAL-16	BC	166-176	275	85.2 89.7	01/67 11/82
31Q-v2	CAL-17	BC	146-156	260	77.1	01/67

Note: Elevation is in feet above sea level.
Screen zone and water level are in feet below land surface.
Aquifer: SH, shallow; BM, Black Mingo; PD, Peedee; BC, Black Creek; M, Middendorf.

Table 5. Results of pumping tests in Calhoun County

SCWRC WELL NUMBER	WELL DEPTH (feet)	AQUIFER / THICKNESS (feet)	DATE OF TEST	DURATION TEST/RECOV. (hours)	STATIC WATER LEVEL (feet)	PUMPING RATE (gpm)	TRANSMISSIVITY (gpd/feet)	SPECIFIC CAPACITY (gpm/ft)	WELL EFFICIENCY (percent)	HYDROLOGIC BOUNDARY
26S-o1	300	PD,BC/120	2/17/81	14	146	540	98,000	27	55	
27S-s2	340	PD,BC/170	12/5/80	10 / 1	151	535	94,000	22	50	DISCHARGE
27U-h1	285	PD / 60	5/24/68	24 / 2	42	250	32,000	11	70	RECHARGE
28S-k1	770	BC,M /300	7/26/78	5 / 2	159	1,120	42,000	14	65	
28S-v7	155	BM / 90	10/20/86	24 / 2	30	506	30,000	10	65	RECHARGE
28T-b1	416	BM,PD,BC/200	4/10/80	26 / 3	144	500	37,000	26	?	
28T-b2	220	BM / 50	9/2/81	24 / 1	67	450	22,000	7.1	65	
29S-h1	381	PD,BC /100	3/20/90	24 / 24	225	250	28,000	6.6	45	
30R-g2	341	BC,M / 70	3/13/90	24 / 16	22	403	16,000	3.2	40	
30R-j2	410	M / 100	12/13/76	24 / 5	40	402	28,000	9	85	DISCHARGE
30R-m2	287	BC,M / 90	2/28/90	24 / 18	3	481	23,000	5	45	

From Newcome (1993)

A potentiometric map (Fig. 14) shows water level elevations in Black Creek aquifers to be +200 ft msl in the southwestern part of the county and +125 ft msl in the northeast. The direction of ground-water flow is northeasterly (Aucott and Speiran, 1985) toward the large part of the Coastal Plain in which the Upper Cretaceous aquifers have lower pressure.

The Black Creek aquifers in Calhoun County are recharged by precipitation in the outcrop area and by leakage from overlying and underlying aquifers. Yields up to 1,000 gpm have been obtained from a single well, for example well 31S-n1.

Pumping tests of wells screened in the Black Creek and Peedee aquifers (26S-o1, 27S-s2, and 29S-h1) indicate a transmissivity range from 28,000 to 98,000 gpd/ft and specific capacities between 6 and 27 gpm/ft. The Black Creek and Middendorf aquifers where tested together (28S-k1, 30R-g2, and 30R-m2) showed transmissivity values from 16,000 gpd/ft (30R-g2) to 42,000 gpd/ft (28S-k1). Their pumping rates are 400 to 1,120 gpm, and their specific capacities range from 3 to 14 gpm/ft. Well 28T-b1 is screened in three aquifers (Black Creek, Peedee, and Black Mingo). It produces 500 gpm, has a specific capacity of 26 gpm/ft, and the aquifer transmissivity is indicated to be 37,000 gpd/ft at this site. The largest production from a Black Creek well is 2,056 gpm, but the well is screened also in the Peedee, which supplies an unknown portion of this yield.

Middendorf Aquifers

Middendorf aquifers consist of permeable fine- to coarse-grained sand beds in the Middendorf Formation. Wells in these aquifers are usually between 250 and 850 ft in depth, the deepest being in the northeastern part of the county.

Recharge to the Middendorf aquifers occurs by precipitation and by leakage from overlying aquifers. A potentiometric-contour map (Fig. 15) shows water level elevations in the Middendorf aquifers to be +200 ft msl in the southwestern part of the county to +125 ft msl in the northeastern part. As with the Black Creek aquifers, water movement is northeasterly.

Seven of the recorded wells in this county utilize solely the Middendorf aquifers for public supply, industrial, or irrigation use. Some Middendorf wells in Calhoun County yield more than 1,000 gpm. The static water level is 109 to 266 ft above the top of the formation. This suggests a substantial amount of available drawdown for wells. Table 4 contains water levels measured at various times in three Middendorf wells.

Wells screened in the Middendorf are commonly screened also in a Black Creek aquifer. The wells are 6 to 12 inches in diameter, screened, and gravel packed. Industrial well 30R-j2, located in the Sandy Run Community, was constructed with 65 ft of 12-inch screen set between the depths of 305 and 405 ft (-150 and -250 ft msl). This well produces 524 gpm and has a specific capacity of 9 gpm/ft. In the central part of the county, well 28S-k1 at Pecan Hills Farm was constructed with 100 ft of 8-inch screen set between 510 and 770 ft (-210 and -470 ft msl). It produces 1,120 gpm and has a specific capacity of 14 gpm/ft.

The one pumping test available for a well producing only from the Middendorf aquifers (30R-j2), indicates a transmissivity of 28,000 gpd/ft. This is not a large transmissivity value, but a highly efficient well with 100 ft of available drawdown could yield well over 1,000 gpm. Well 26R-d1, an irrigation well at Godspeed Farm, in the southeast corner of Richland County, yields 2,500 gpm.

Pre-Cretaceous Basement Rocks

The pre-Cretaceous basement rocks are buried under 500 to 1,200 ft of younger materials in the study area. In the hard basement rocks the water flows primarily through fractures. Wells in these rocks in the Piedmont region of South Carolina generally have low yields, and they probably are no more prolific in the Coastal Plain region. Wells drilled into the basement rocks at the Savannah River Site, approximately 40 miles southwest of Calhoun County, indicate that the ground water is of limited quantity and poor quality.

Ground-Water Quality

Several variables influence the chemical quality of ground water. The longer period of time that ground water has been in contact with the rocks the greater is the amount of minerals dissolved from or deposited in the sediments, thereby determining the concentration of dissolved solids in the water. Another factor influencing the chemical quality of ground water is the type of water that enters the recharge areas. A more acidic rainwater, for example, will dissolve sediments more readily than a more alkaline water that enters the aquifer by way of stream recharge.

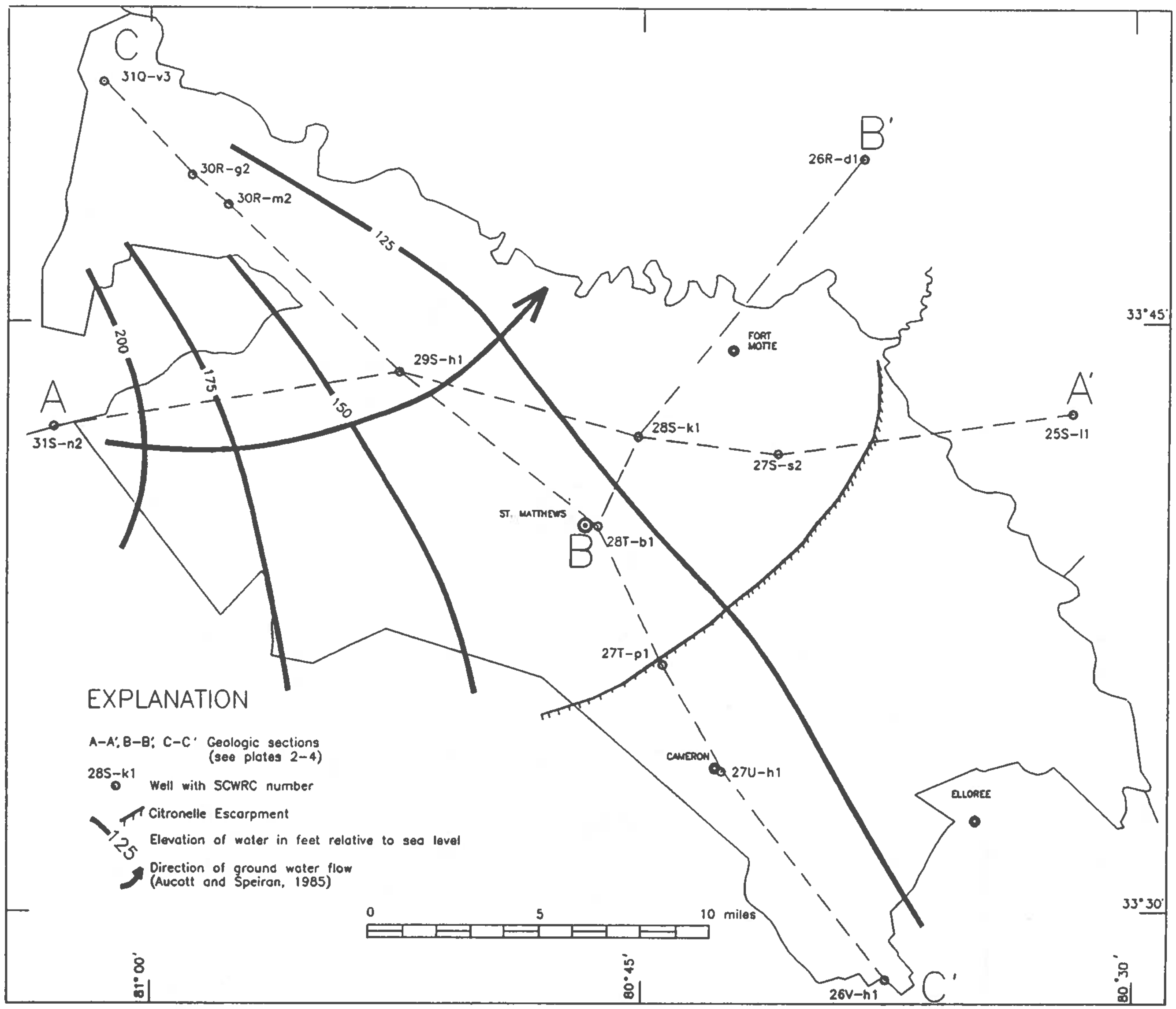


Figure 14. Potentiometric contours for the Black Creek aquifers in Calhoun County.

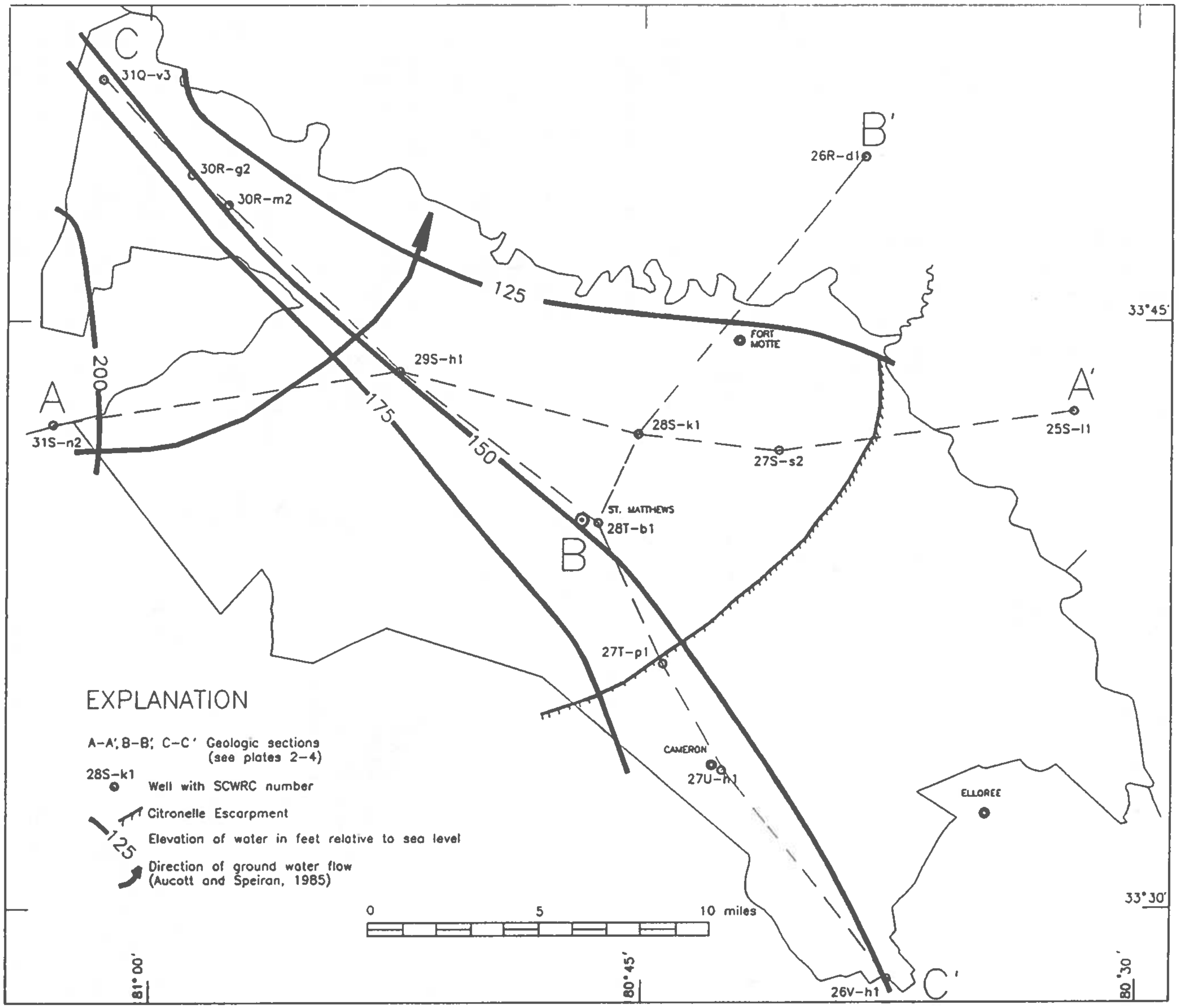


Figure 15. Potentiometric contours for the Middendorf aquifers in Calhoun County.

Water from aquifers in Calhoun County is soft (hardness less than 60 mg/L) and low in dissolved solids (usually less than 95 mg/L), making it acceptable for drinking and many other uses. Most of the chemical constituents of ground water in Calhoun County do not exceed the South Carolina recommended concentrations for drinking water. Iron concentrations sometimes exceed the recommended drinking water limit of 0.3 mg/L. The water may be acidic (pH less than 7.0), making it corrosive to metals, which would tend to create iron problems even where the iron is not naturally excessive in the water.

Table 6 lists the major constituents and properties for several ground water samples. Graphical representations (Figs. 16 and 17) are used to display and compare analyses, using the reacting concentrations, expressed in milliequivalents per liter. For each well, the left bar represents cations and the middle bar represents anions. The patterns show concentrations of the major ions. The bar on the right of each graph represents the hardness in milligrams per liter. The number above each bar indicates the total dissolved solids in milligrams per liter.

Water from several aquifers has been tested for uranium content (Sargent and others, 1982). Water analyses for 79 wells (depths ranging from 25 to 360 ft) in Calhoun County show the uranium concentration to range from 0 to 1.5 ppb (parts per billion), which is below the maximum acceptable level of 20 ppb for drinking water. In six wells screened between 25 and 135 ft, uranium was 0.1 to 1.5 ppb. In the remaining 73 wells, uranium was below 0.1 ppb.

Shallow aquifer-- Water from only one well (29S-h2) was chemically analyzed, and it showed the water to be low in dissolved solids (35 mg/L), soft, and acidic (pH of 4.4). It may also be noted that the measured nitrate level of 2.6 mg/L is higher than the 0.9 mg/L average from wells of others aquifers. Nitrate in ground water often has its source in surface contamination, especially by fertilizer and feed effluent.

Black Mingo aquifers-- Water derived from the Black Mingo is generally of good quality. The dissolved solids are less than 100 mg/L, and the water is soft and usually near neutral in pH. The water is a calcium bicarbonate type due to dissolution of the calcareous sand that composes the aquifer. The high iron content at wells 27U-j1, 28S-x2, and 28S-x3 (0.60 to 3.41 mg/L) may be due to contamination by iron-forming bacteria, but analyses for iron bacteria were not available. The water from well 28S-v4 contained a 3.6-mg/L nitrate concentration, which was higher than the 0.9 mg/L (average) for water from the other wells but below the maximum acceptable concentration level of 10 mg/L for drinking water.

The difference in quality between Tertiary (Black Mingo) and Cretaceous water in this area can be seen by comparing the bar graphs (Figs. 16 and 17). The average total dissolved solids measured in water from the Black Mingo aquifers (20 to 90 mg/L) is approximately three times that measured in water from the Cretaceous aquifers. The average hardness of water from the Black Mingo was 37 mg/L in the nine samples analyzed. Cretaceous aquifers in Calhoun County have an average hardness less than 5 mg/L. The average bicarbonate concentration in the Black Mingo is 44 mg/L, while that in the Cretaceous averages about 1.0 mg/L.

Peedee aquifers-- Ground water from the Peedee appears to be soft and less acidic than water from the Middendorf and Black Creek. Water from well 28S-h1 had a pH of 5.6, a hardness of 14 mg/L, and a dissolved-solids concentration of 38 mg/L (Table 6).

Iron concentrations in water from the Peedee may be high, as indicated by the analysis of water from well 28S-h1 (0.35 mg/L). The town of Cameron abandoned its wells because of the high iron concentration (1.3 mg/L). Cameron now purchases water from the Orangeburg Department of Public Utilities.

Black Creek aquifers-- The quality of water from the Black Creek aquifers is similar to that from the underlying Middendorf aquifers in the study area. Typically, water from this formation is low in dissolved solids, soft, and acidic. Water from well 30R-11 was acidic (pH of 4), and the iron concentration (0.6 mg/L) exceeds the drinking water standard.

Middendorf aquifers-- Water from the Middendorf aquifers is very low in dissolved solids, extremely soft, and acidic, making it corrosive to most metals. The analysis of water from well 31Q-v5 shows low amounts of dissolved solids (10 mg/L) and the pH value to be 5.1. These characteristics suggest that the water is corrosive. The iron concentration in water from this well was 0.3 mg/L.

SUMMARY

A largely undeveloped ground water resource exists in Calhoun County. Water may be obtained from the Black Mingo, Peedee, Black Creek, and Middendorf Formations. The Black Mingo and Black Creek sediments are the principal sources of water supplies; however, in the northwestern part of the county the Black Mingo and Black Creek are eroded, and the Middendorf aquifers are utilized.

The Black Mingo Group, which extends throughout the county except where it is eroded in stream valleys, supplies good water to domestic wells.

Table 6. Water quality analyses

WELL NUMBER		27S-s3	27U-j1	28S-h1	28S-v4	28S-v7
AQUIFER		BM	BM	PD	BM	BM
DATE / ANALYST		06-17-91 / S	03-08-91 / S	03-08-91 / S	01-19-55 / D	10-29-86 / P
SILICA	mg/L	5.0	10	13	13	
IRON	mg/L	.03	3.4	.35	.12	<.05
MANGANESE	mg/L	.01	.02	.01		.03
CALCIUM	mg/L	.7	6.3	3.2	19	20
MAGNESIUM	mg/L	.7	.9	1.5	.5	.6
SODIUM	mg/L	2.4	1.4	1.6	1.5	2.3
POTASSIUM	mg/L	2.6	1.7	1.3	.8	.8
BICARBONATE	mg/L	6	30	6	56	40
SULFATE	mg/L	0	7.2	7.6	1.0	<1
CHLORIDE	mg/L	5.8	1.1	1.7	3.5	5.6
FLUORIDE	mg/L	0	0	0	0	<.2
NITRATE	mg/L	.78	0	.29	3.6	2
DIS. SOLIDS	mg/L	30	40	38	74	62
HARDNESS	mg/L	3	19	14	49	50
pH	units	5.5	6.6	5.6	7.1	6.4

WELL NUMBER		28S-x2	28S-x3	28T-o1	29S-h1	29S-h2
AQUIFER		BM	BM	BM	PD, BC	SH
DATE / ANALYST		08-01-91 / S	08-01-91 / S	03-08-91 / S	03-21-90 / P	06-17-91 / S
SILICA	mg/L	11	11	9.1	5	5
IRON	mg/L	1.1	.60	.07	.25	.09
MANGANESE	mg/L	<.01	<.01	<.01	.01	<.01
CALCIUM	mg/L	21	4.6	18	1.7	0.5
MAGNESIUM	mg/L	.6	.3	.6	.2	1.0
SODIUM	mg/L	1.7	1.9	1.3	2.1	3.7
POTASSIUM	mg/L	.9	.7	.8	.9	2.1
BICARBONATE	mg/L	78	15	70	<1	1
SULFATE	mg/L	1.1	.7	.8	7.0	0
CHLORIDE	mg/L	2.6	4.8	2.3	1.9	5.8
FLUORIDE	mg/L	0	.5	0	<.1	0
NITRATE	mg/L	.35	.44	.45	.17	2.6
DIS. SOLIDS	mg/L	80	35	73	15	35
HARDNESS	mg/L	55	13	47	5	4
pH	units	6.8	6.1	7.0	4.9	4.4

Analyst: S, SCWRC; D, SCDHEC; P, Private.

Table 6. Water quality analyses - continued

WELL NUMBER		29S-m1	29S-x1	30R-g1	30R-g2	30R-l1
AQUIFER		BM	SH, BM	BM	BC, M	BC
DATE / ANALYST		03-08-91 / S	03-08-91 / S	05-01-84 / S	03-15-90 / P	04-29-84 / S
SILICA	mg/L	30	6	2.9		11
IRON	mg/L	.11	.09	0	.3	.6
MANGANESE	mg/L	<.01	<.01	.08	<.01	.01
CALCIUM	mg/L	18	.6	14	.3	1.2
MAGNESIUM	mg/L	.8	1.0	4.0	.2	.3
SODIUM	mg/L	1.1	1.1	3.8	.2	.8
POTASSIUM	mg/L	.9	.6	6.7	.6	.4
BICARBONATE	mg/L	52	6	50	<1	0
SULFATE	mg/L	14	.6	6.0	4.6	8.3
CHLORIDE	mg/L	2.4	3.4	16	1.7	2.0
FLUORIDE	mg/L	.4	0	.1	<.1	0
NITRATE	mg/L	.27	2.0		.06	0
DIS. SOLIDS	mg/L	95	20	75	29	25
HARDNESS	mg/L	49	6	50	1.5	5
pH	units	6.8	5.0		5.4	4.0

WELL NUMBER		30R-m2	31Q-v5			
AQUIFER		BC, M	M			
DATE / ANALYST		03-01-90 / P	06-17-91 / S			
SILICA	mg/L		3.8			
IRON	mg/L	<.1	.3			
MANGANESE	mg/L	<.01	.01			
CALCIUM	g/L	.4	.1			
MAGNESIUM	mg/L	.2	<.1			
SODIUM	mg/L	1.3	1.4			
POTASSIUM	mg/L	.6	.7			
BICARBONATE	mg/L	<1	2			
SULFATE	mg/L	2.5	1.6			
CHLORIDE	mg/L	1.4	.9			
FLUORIDE	mg/L	<.1	0			
NITRATE	mg/L	.07	.22			
DIS. SOLIDS	mg/L	17	10			
HARDNESS	mg/L	1.8	<1			
pH	units	6.7	5.1			

Analyst: S, SCWRC; D, SCDHEC; P, Private.

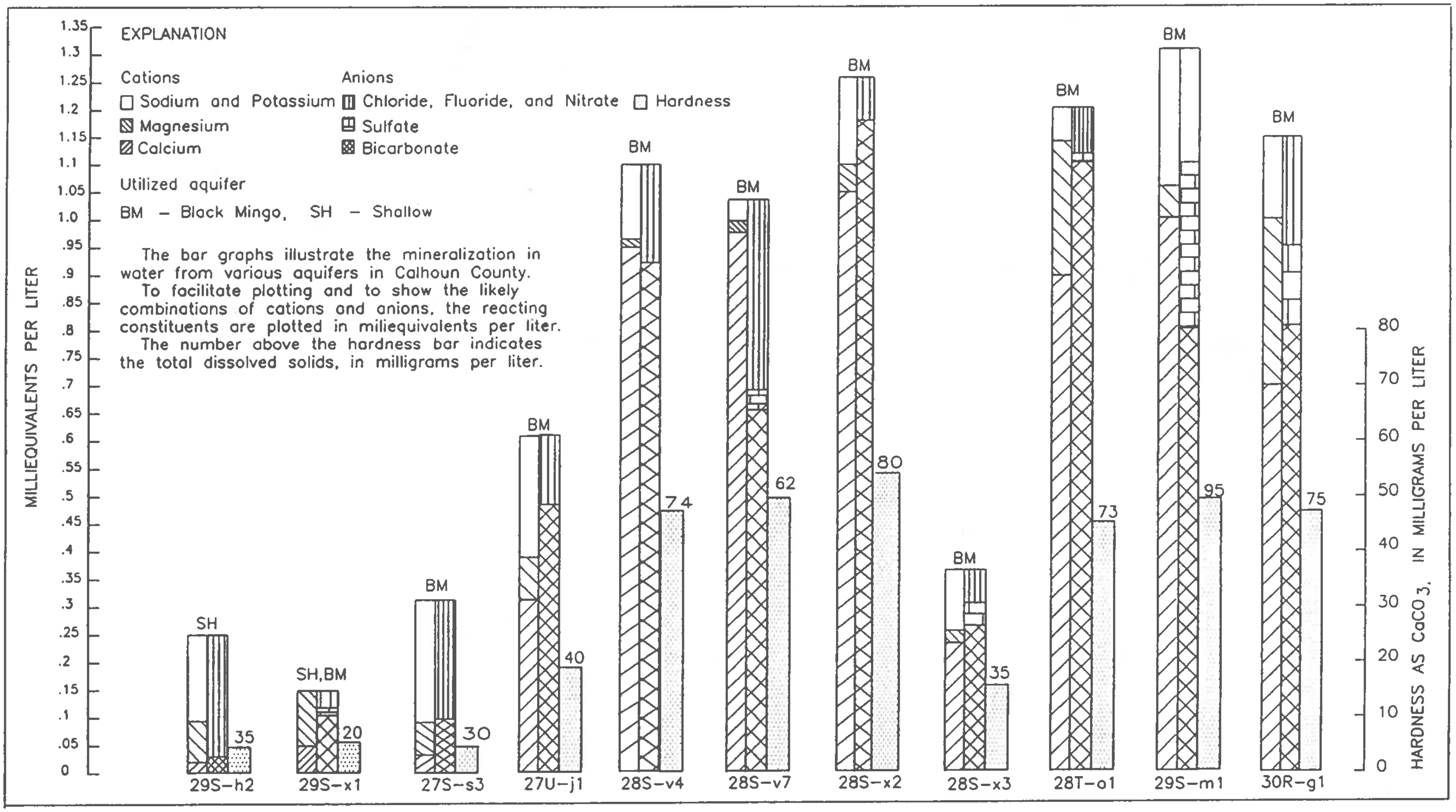


Figure 16. Graphical illustration of ground-water quality in the Tertiary aquifers of Calhoun County.

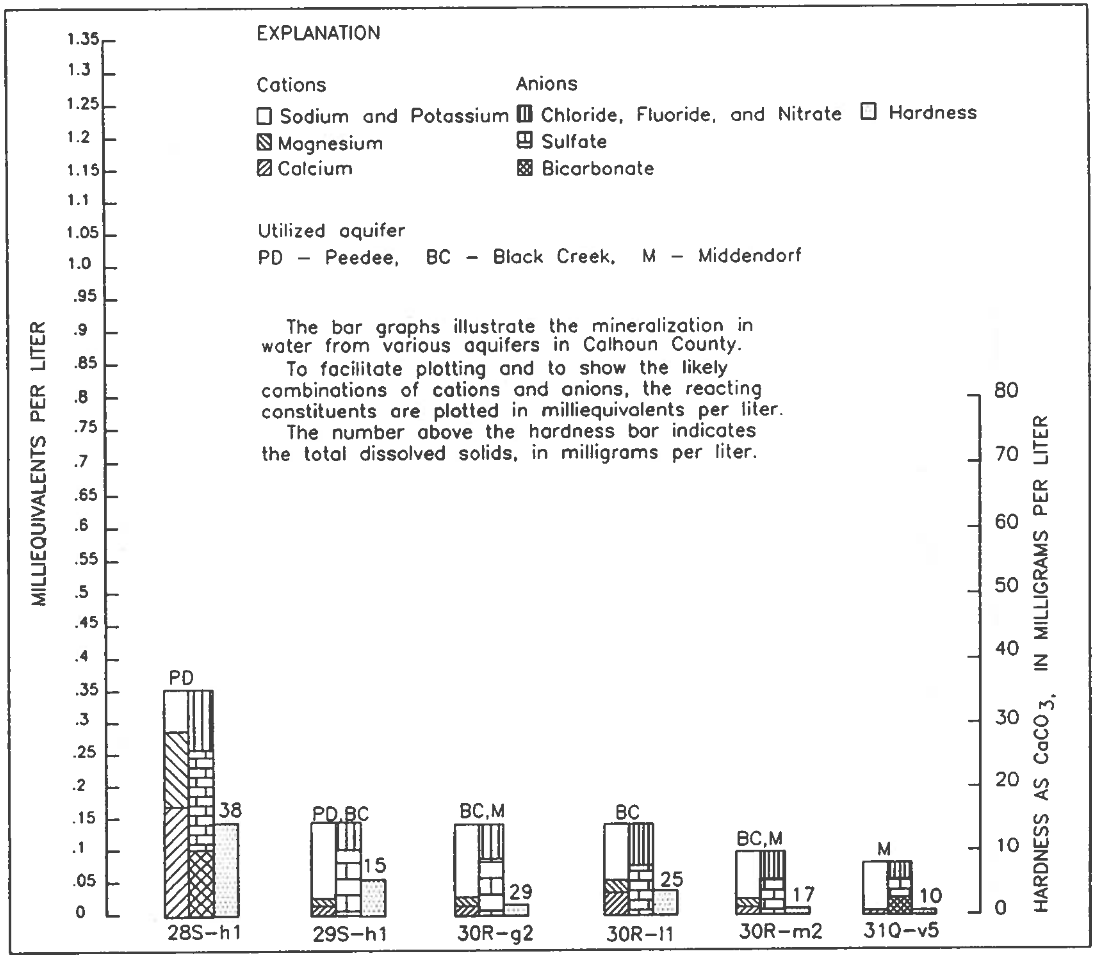


Figure 17. Graphical illustration of ground-water quality in the Cretaceous aquifers of Calhoun County.

The water-yielding capacity of the Cretaceous aquifers in the study area increases in the downdip direction, owing to the thickening of sediments in that direction.

Pumping-test data suggest that Peedee aquifers may have transmissivity values in the neighborhood of 30,000 gpd/ft and could support pumping rates of several hundred gallons per minute. Aquifers in the Peedee may be irregular in their development, so exploration should be undertaken to discover the favorable areas. Water from this formation is soft and less acidic than Black Creek and Middendorf water. The iron concentration may exceed the maximum recommended amount of 0.3 mg/L.

Wells completed in the Black Creek aquifers are usually screened also in the Peedee or Middendorf aquifers. Wells screened in the Peedee and Black Creek have indicated aquifer transmissivities of 28,000 to 98,000 gpd/ft. Water from wells using Peedee and Black Creek aquifers is low in dissolved solids, soft, and acidic. Tests of wells screened both in Black Creek and Middendorf aquifers have demonstrated transmissivity values ranging from 16,000 to 42,000 gpd/ft. The wells have pumping rates between 400 and 1,120 gpm.

The Middendorf Formation has the potential for being the most productive source of water supplies. A single well may produce more than 1,000 gpm. The transmissivity calculated from one pumping test is 28,000 gpd/ft. The water is very low in dissolved solids, soft, and acidic.

REFERENCES

Aucott, W.R., and Newcome, Roy, Jr., 1986, Selected aquifer-test information for the Coastal Plain aquifers of South Carolina: U. S. Geological Survey Water-Resources Investigations Report 86-4159, 30p.

Aucott, W.R., and Speiran, G.K., 1985, Ground-water flow in the Coastal Plain aquifers of South Carolina: Journal of Groundwater, v. 23, no. 6, p. 736-745.

Bledsoe, H.W., Aadland, R.K., and Sargent, K.A., 1991, SRS baseline hydrogeologic investigation-summary report (U): USDOE Report WSRC-RP-90-1010, Savannah River Site, Aiken, S.C.

Colquhoun, D.J., 1965, Terrace sediment complexes in central South Carolina: University of South Carolina, 62 p.

Colquhoun, D.J., Heron, S.D., Johnson, Jr., H.S., Pooser, W.K., and Siple, G.E., 1969, Updip Paleocene-Eocene stratigraphy of South Carolina, reviewed: Geologic Notes, v. 13, p. 1-25,

Colquhoun, D.J., and Muthig, M.G., 1991, Stratigraphy and structure of the Paleocene and lower Eocene Black Mingo Group, South Carolina, in Geology of the Carolinas: Carolina Geological Society 50th Aniversary Volume, p. 196-202.

Colquhoun, D.J., Muthig, M.G., and Muthanna, A., 1990, Timing of structural events recorded in the Black Mingo Group of the central South Carolina Coastal Plain: Proceedings of the Second Hilton Head Island Conference on Coastal Plain Geology,p. 36-38.

Colquhoun, D.J., Woollen, I.D., Van Nieuwenhuise, D.S., Padgett, G.G., Oldham, R.W., Boylan, D.C., Bishop, J.W., and Howell, P.D.,1983, Surface and subsurface stratigraphy, structure, and aquifers of the South Carolina Coastal Plain, in Report for the South Carolina Department of Health and Environmental Control: State of South Carolina, Columbia, S.C., 78 p.

Cooke, C.W., 1936, Geology of the Coastal Plain of South Carolina: U.S.Geological Survey Bulletin 867, 196 p.

Cooke, C.W., and MacNeil, E.S., 1952, Tertiary stratigraphy of South Carolina: U.S. Geological Survey Prof. Paper 243-B, p. 19-29.

Environmental Protection Agency, 1991, National primary drinking water regulation, radionucleides proposed rule: Federal Register, v. 56, no. 138, 77 p.

Howell, P.D., 1985, Surface and subsurface stratigraphy and depositional history of the upper Cretaceous, Paleocene, and middle Eocene strata of the Coastal Plain of updip central South Carolina: M.S. Thesis, University of South Carolina, Columbia,S.C., 118 p.

Johnson, P.W., 1978, Reconnaissance of the ground water resources of Clarendon and Williamsburg Counties: U.S. Geological Survey and S.C. Water Resources Commission Report, Columbia S.C., 44 p.

Logan, W.R., and Euler,G.M., 1989, Geology and ground-water resources of Allendale, Bamberg, and Barnwell Counties, and part of Aiken County, South Carolina: South Carolina Water Resources Commission Report 155, 113 p.

Muthanna, A., 1988, An integrated geological and geophysical study of the central South Carolina Coastal Plain: M.S. Thesis, University of South Carolina, Columbia, S.C., 107 p.

Muthig, M.G., 1991, Sequence stratigraphy of the Black Mingo Group (Lower Tertiary) in South Carolina: Ph.D. dissertation, University of South Carolina, Columbia, S.C., 121 p.

Newcome, Roy, Jr., 1989, Ground-water resources of South Carolina's Coastal Plain -- 1988, an overview: Water Resources Commission, Report 167, 127p.

Newcome, Roy, Jr., 1993, Pumping Tests of the Coastal Plain aquifers in South Carolina -- with a discussion of aquifer and well characteristics: South Carolina Water Resources Commission Report 174, 52p.

Owens, J.P., 1988, Geology of the Cape Fear Arch area (Florence and one-half Georgetown 2-degree sheets): U.S. Geological Survey Map Series MI-1948a.

Prowell, D.C., 1990, Geology near a hazardous waste landfill at the headwaters of Lake Marion, Sumter County, South Carolina: U.S. Geological Survey Open File Report 90-236, 20 p.

Sargent, K.A., Cook, J.R., and Fay, W.M., 1982, Data report, North and South Carolina, National uranium resource evaluation program, hydrogeochemical and stream sediment reconnaissance: E.I. du Pont de Nemours & Co., Aiken, South Carolina, 45 p.

Siple, G.E., 1946, Progress report on ground-water investigations in South Carolina: Research, Planning, and Development Board Bulletin no. 15, 116 p.

Siple, G.E., 1975, Ground-water resources of Orangeburg County South Carolina: South Carolina State Development Board Bulletin No. 36, 59 p.

Sloan Earl, 1908, Cataloque of the mineral resources of South Carolina: South Carolina Geological Survey, Series IV, Bulletin 2, 505 p.

South Carolina State Budget and Control Board, 1992, SouthCarolina statistical abstracts, 1992, 392 p.

South Carolina Water Resources Commission, 1990, South Carolina water use, 1990: South Carolina Water Resources Commission, 11 p.

Speiran, G.K. and Aucott, W.R., 1991, Effects of sediments, depositional environment and ground-water flow on the quality and geochemistry of water in aquifers in sediments of Cretaceous age in the Coastal Plain of South Carolina: U.S. Geological Survey Open-File Report 91-202, 79 p.

Swift, D.J.P., and Heron S.D., Jr., 1969, Stratigraphy of the Carolina Cretaceous: Southeastern Geology, v. 10, no. 4.

Van Nieuwenhuise, D.S., and Colquhoun, D.J., 1982, The Paleocene-lower Eocene Black Mingo Group of the east central coastal Plain of South Carolina: South Carolina Geology, v. 26, no. 2, p. 47-67.

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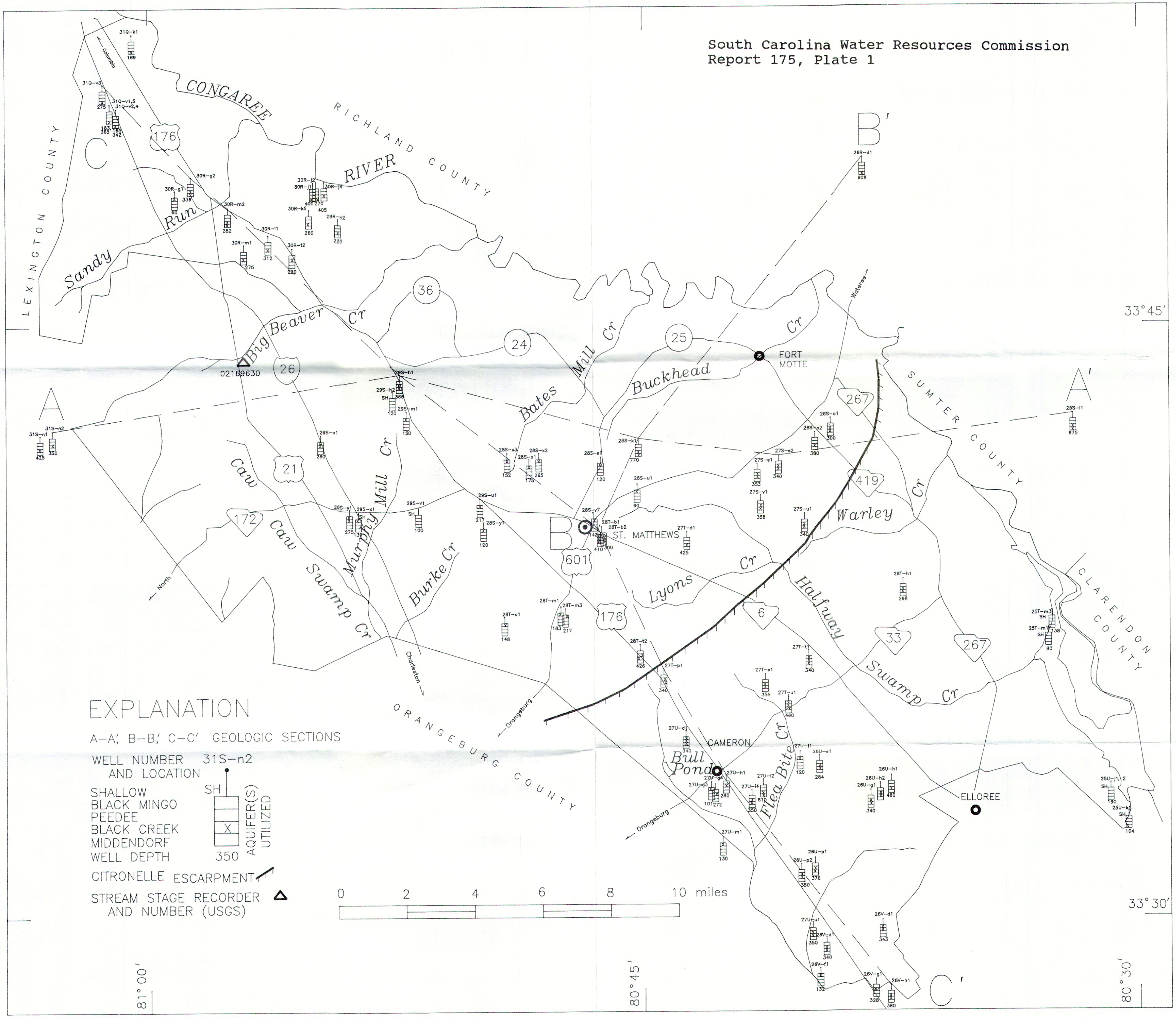
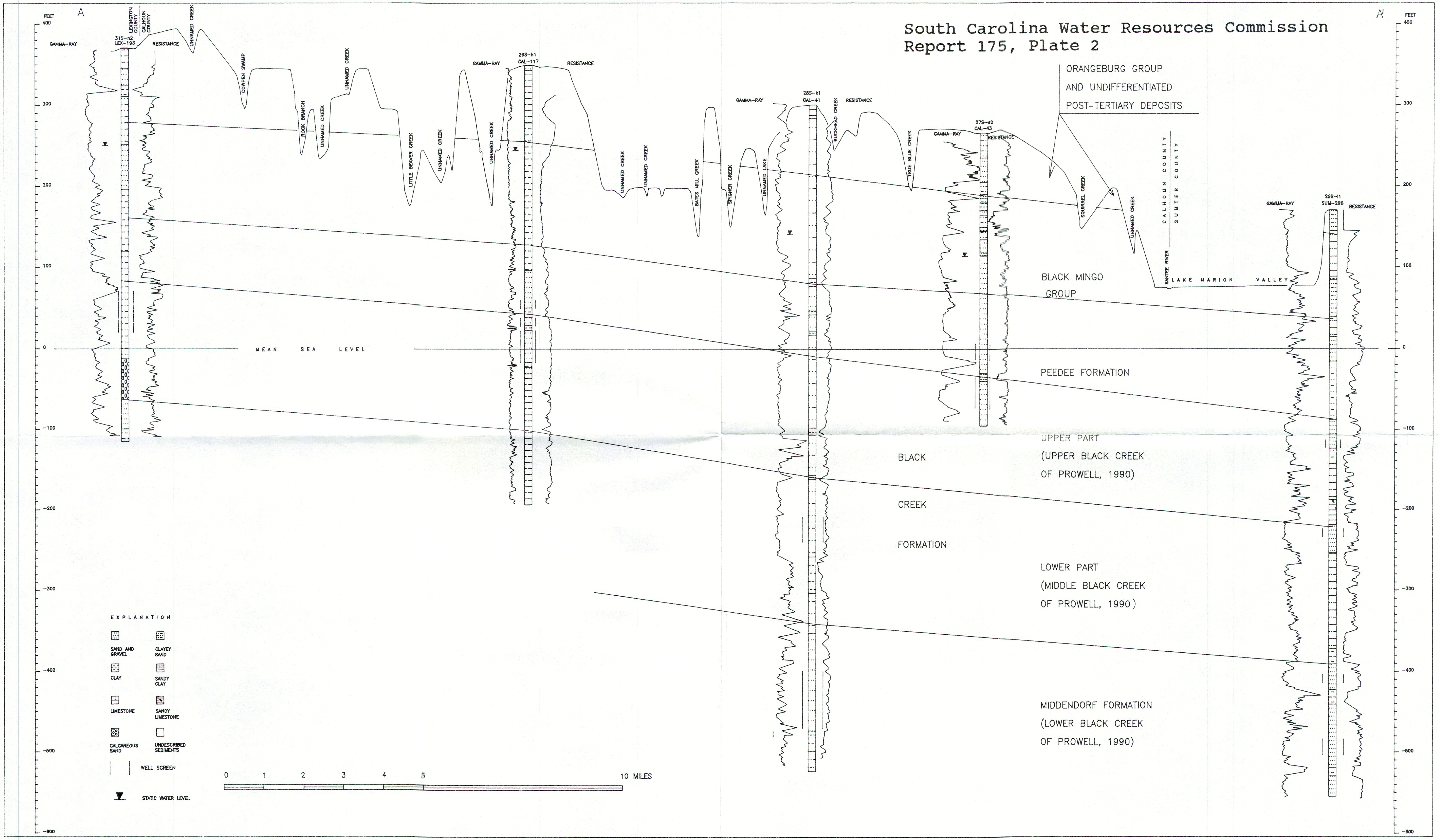
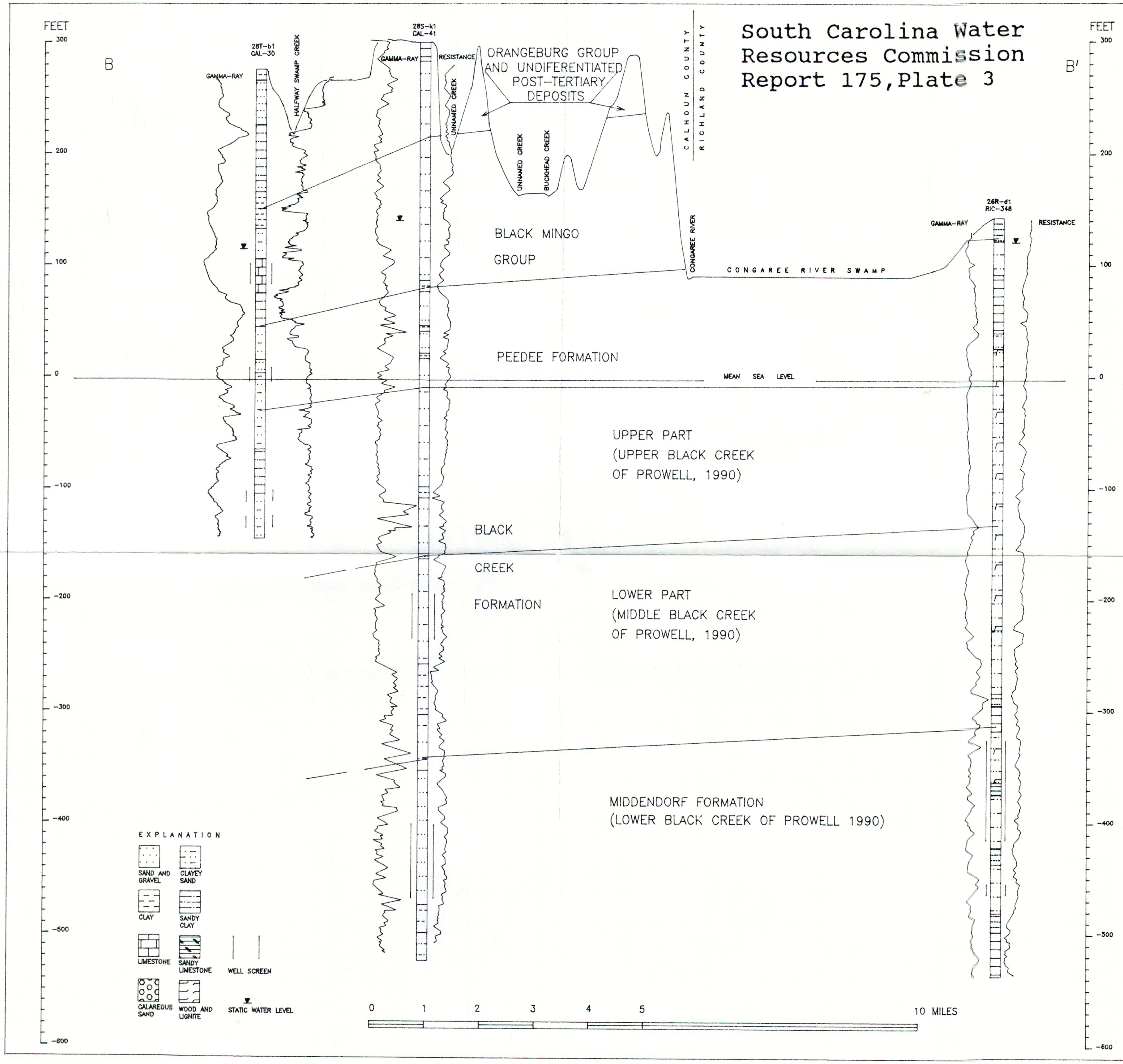


SOURCES OF GROUND WATER SUPPLIES IN CALHOUN COUNTY

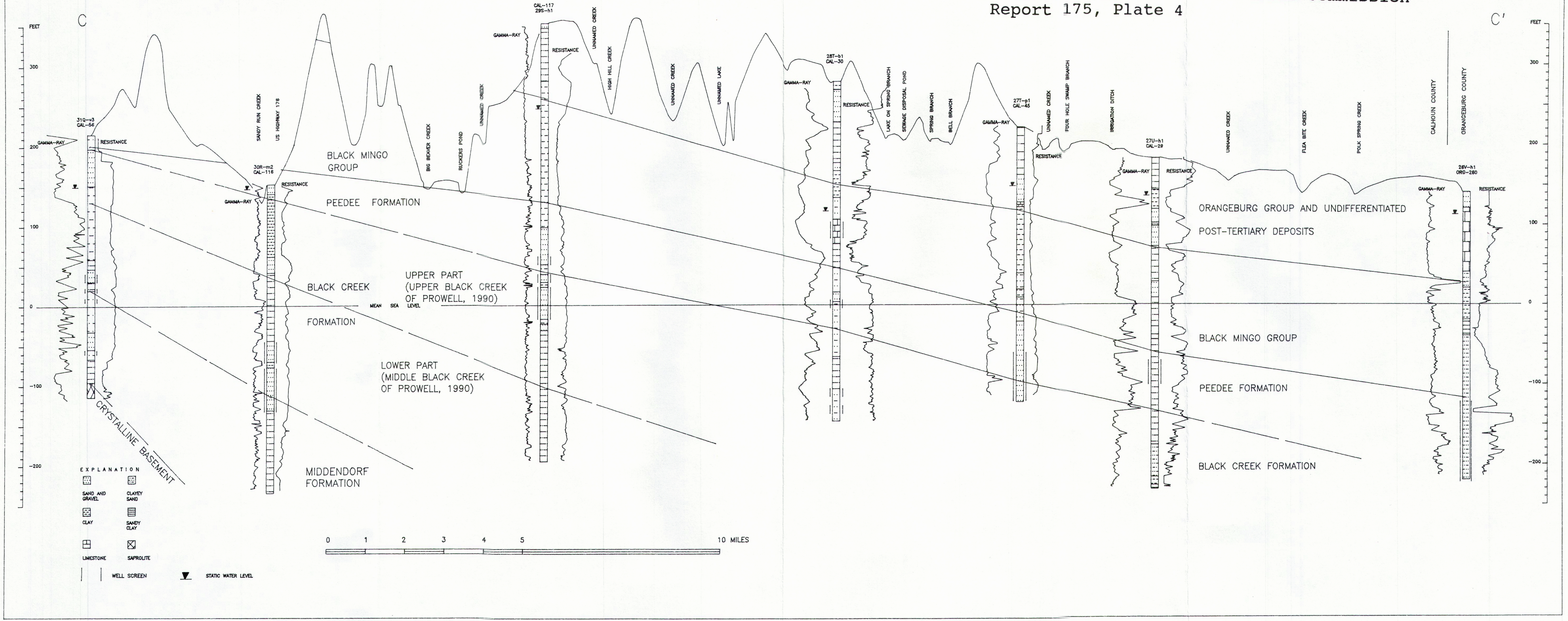


GEOLOGIC SECTION FROM WEST TO EAST ACROSS CALHOUN COUNTY



GEOLOGIC SECTION FROM ST. MATTHEWS TO LOWER RICHLAND COUNTY

South Carolina Water Resources Commission
Report 175, Plate 4



GEOLOGIC SECTION FROM NORTHWEST TO SOUTHEAST ACROSS CALHOUN COUNTY