PRELIMINARY REPORT ON GROUNDWATER RESOURCES
OF
ROWAN COUNTY, NORTH CAROLINA

BY
MICHAEL R. GROVES, HYDROLOGIST
GROUNDWATER SECTION

GROUNDWATER SECTION
Harry M. Peek, Chief

DIVISION OF ENVIRONMENTAL MANAGEMENT
W. E. Knight, Director

NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
George W. Little, Secretary

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ABSTRACT

The two aquifer units in Rowan County are the saprolite or weathered rock material and the crystalline rock. The saprolite acts as the storage reservoir for the groundwater developed in the crystalline rock aquifer. The different crystalline rock units have similar water-bearing properties and can be developed in the same manner.

Precipitation supplies almost all the water that is recharged to the groundwater system. The potentiometric levels in the crystalline rock aquifers are fairly static with the major fluctuations being caused by seasonal precipitation differences.

Natural groundwater quality is generally excellent in the aquifers and all the crystalline rock units. Groundwater pollution is not a problem at the present time, but there are many potential contamination sources that will have to be monitored.

The estimated groundwater use at the present time is 6.3 mgd (million gallons per day). The estimated minimum potential yield of the aquifers in Rowan County is 300,000 gpd (gallons per day) per square mile or 155 mgd for the entire county. Several groundwater users are currently withdrawing several hundred thousand gallons per day with no major effect on the groundwater.

At the present time no groundwater management is necessary, but local management plans may be necessary in the future if withdrawal becomes great in small areas.

INTRODUCTION

Purpose and Scope

The purpose of this preliminary report on the groundwater resources of Rowan County, North Carolina, is to update and revise the existing reports and to present the data on file with the Groundwater Section, Department of Natural and Economic Resources, and to make such interpretations as the data will permit. As may be noted, the data in most instances are not sufficient for adequate evaluation of groundwater conditions, but it is presented to update present knowledge and be a base for continuing research and data collection.

Previous Investigations

Previous investigation of the groundwater resources of Rowan County has consisted of a reconnaissance study (Legrand, 1954) made about 25 years ago, and much new information has become available since that time. The amount of drilling has increased greatly during recent years and particularly the search for higher well yields for industrial water supplies.

Data Availability

A data availability map is included with each section of this report to show the distribution of the type of data considered in that section. Figure 1 shows the known location of wells in Rowan County that have been inventoried through technical assistance, well inspection, and other data collection activities. Figure 1 shows the approximate location of wells and well data determined from diagrams supplied by well contractors as part of

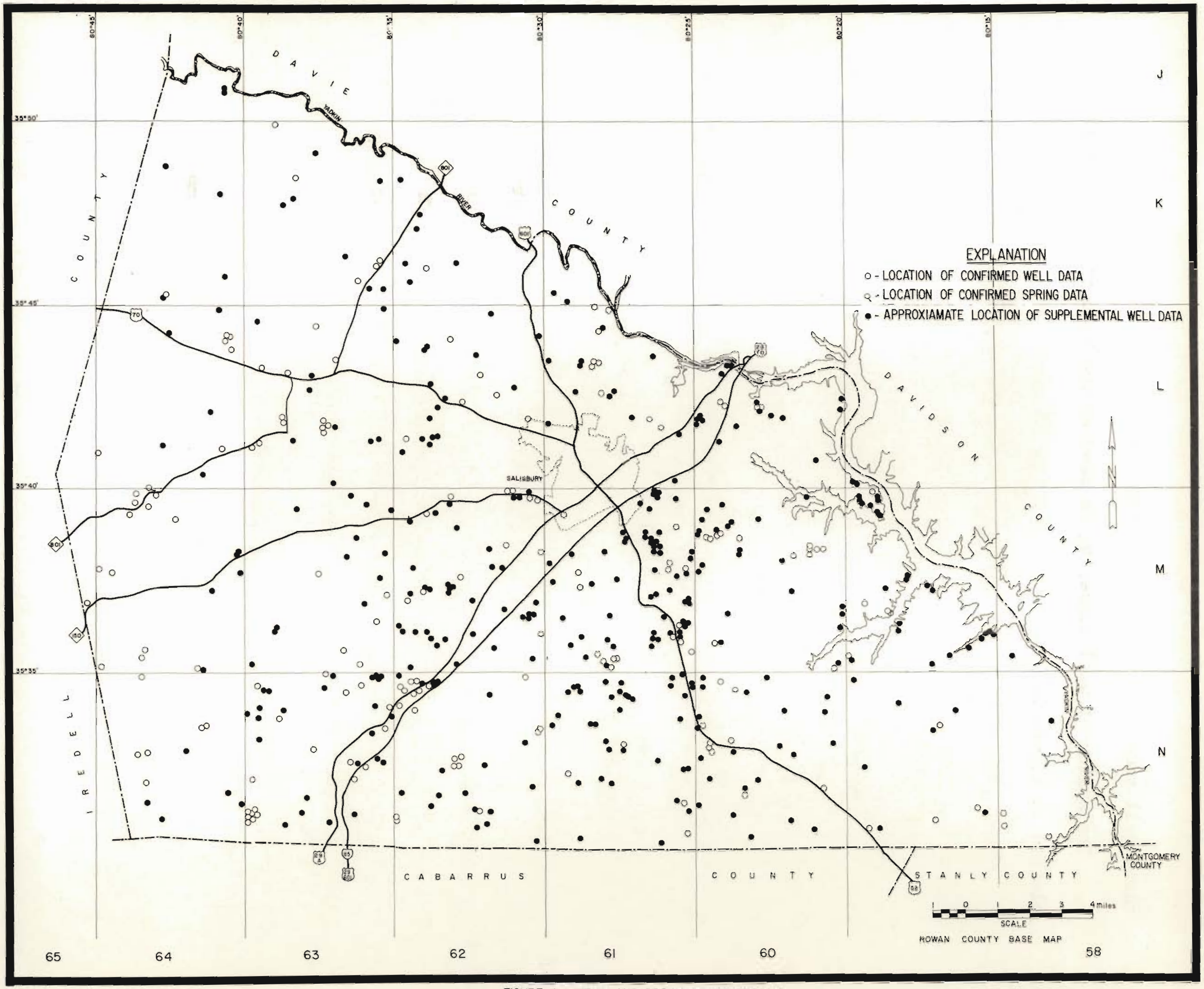


FIGURE 1. - WELL AND SPRING INVENTORY MAP

their well record.

The system of well numbering as used by the Groundwater Section is explained in figure 2.

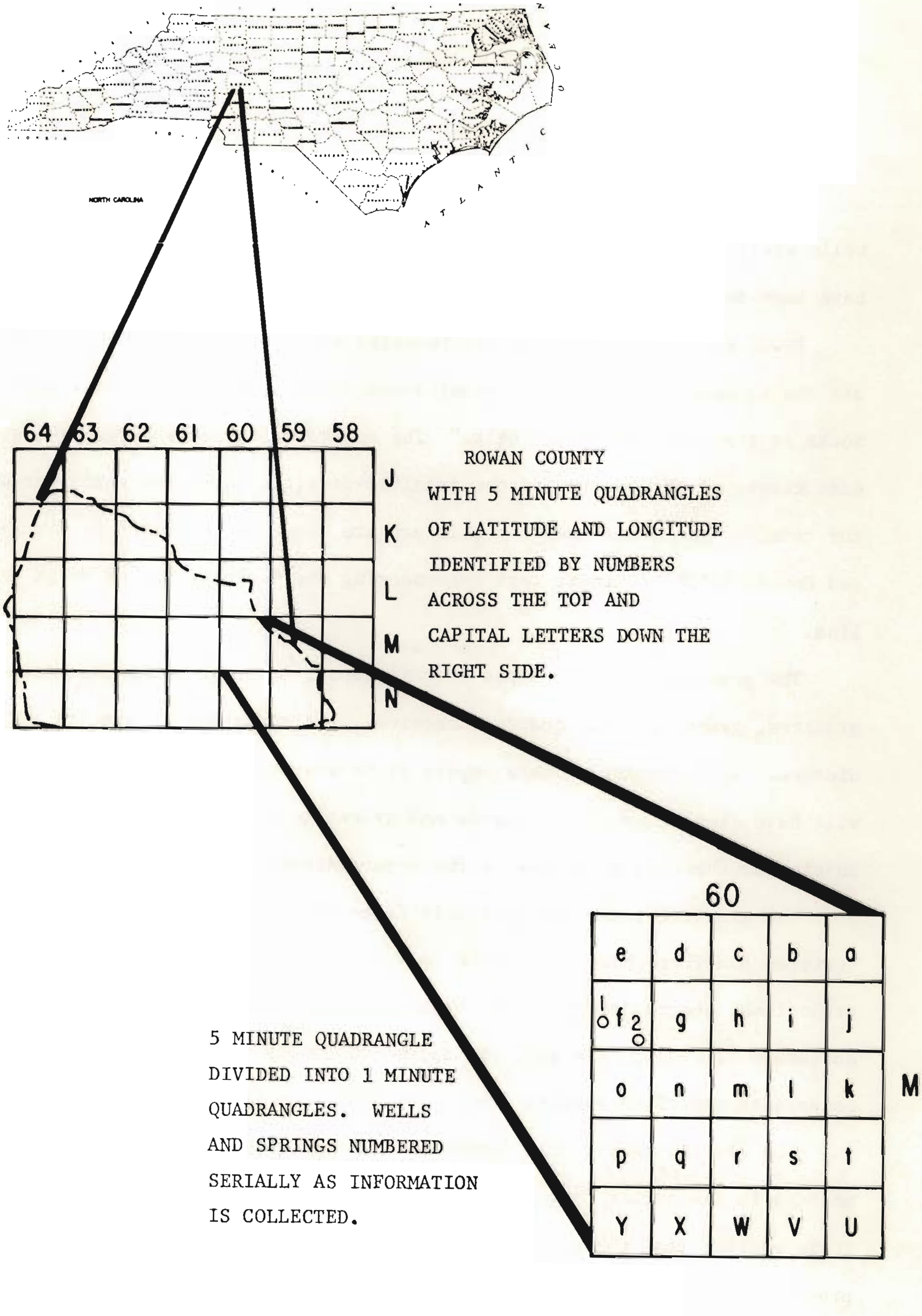


FIGURE 2.- INDEX MAP OF ROWAN COUNTY AND WELL AND SPRING NUMBERING SYSTEM.

HYDROGEOLOGY

Geologic Units

The hydrogeologic data collection map (fig. 3) shows the location of wells where well cuttings have been collected or geophysical logs of wells have been made.

Rowan County geology (fig. 4) is comprised of two major units. These are the igneous rocks, chiefly granite and diorite, and the metavolcanic rocks of the "Carolina Slate Belt." The metavolcanic rocks occupy the southeast corner of the county and the granitic-dioritic rocks the remainder of the county. The units used for this map are those as described by Stuckey and Conrad (1958) in their text accompanying the Geologic Map of North Carolina.

The granitic unit as mapped in this report includes rocks that are granites, granodiorites, quartz monzonites, and a mixture of granite and diorite. For purposes of this report it is assumed that these similar rocks will have similar weathering rates and hydraulic properties and will result in similar chemical qualities of the groundwaters.

The granitic rocks are generally fine- to medium-grained to porphyritic textured and from white to pink to gray colored. The chief minerals are orthoclase, quartz, plagioclase, biotite, muscovite, and several different accessory minerals. The granitic rocks are easily weathered and produce a sandy clay saprolite ranging from a few feet to many feet in thickness.

The diorite-gabbro unit consists of diorite, gabbro, and rocks intermediate in the series from diorite to gabbro. As with the granitic rocks, it is assumed that these similar rock types will have similar hydrogeologic properties. Stuckey and Conrad (1958) described the diorite-gabbro as "a

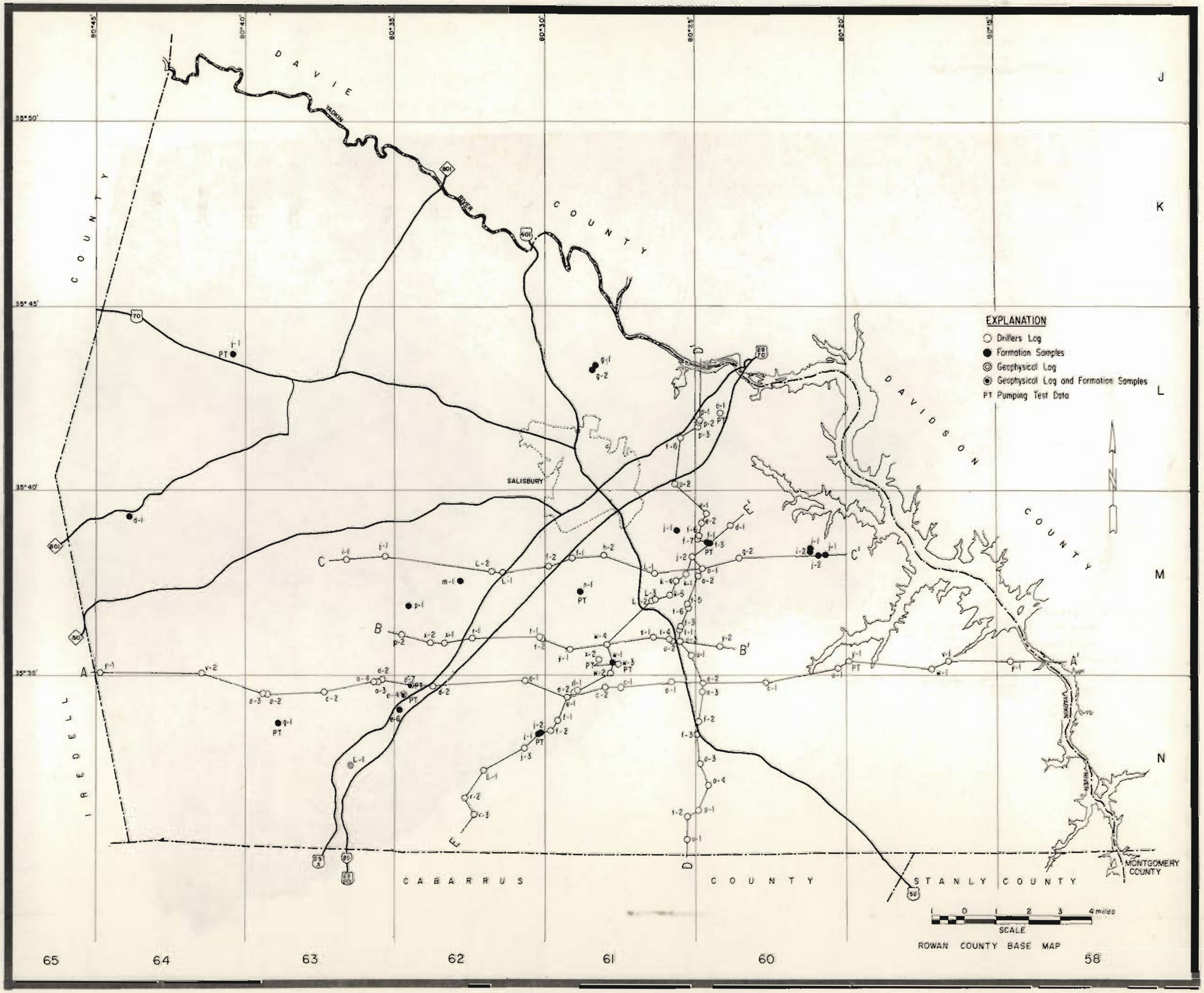
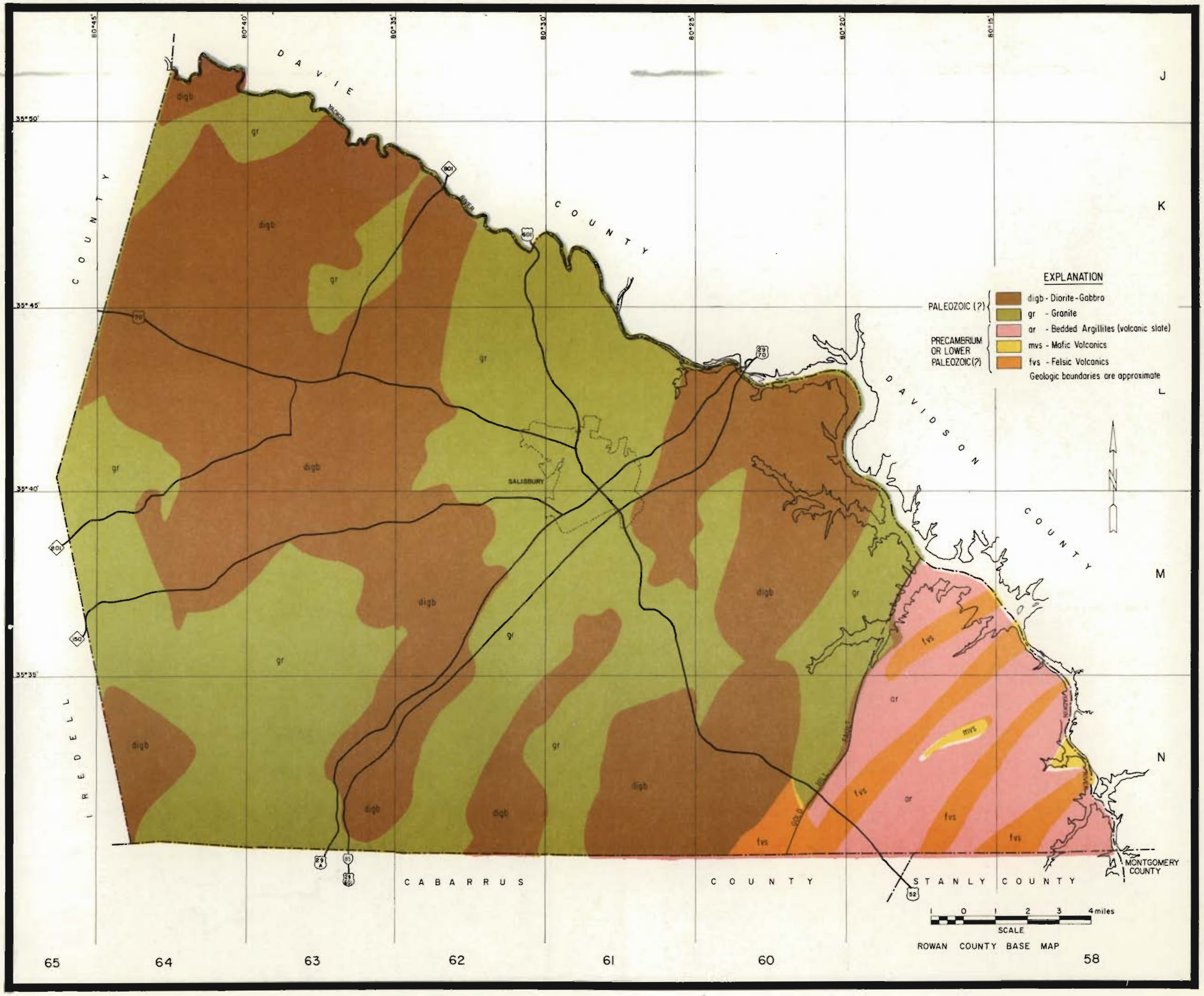


FIGURE 3. - HYDROGEOLOGIC DATA LOCATION MAP

FIGURE 4.- GEOLOGIC MAP OF ROWAN COUNTY, NORTH CAROLINA



coarse textured rock that is distinctly massive and not closely jointed. It is composed of hornblende or pyroxene, plagioclase, and varying amounts of quartz and accessory minerals." The diorite-gabbro unit is also easily weathered and has a clayey saprolite cover ranging from a few feet to many feet thick.

The contacts between the granite and the diorite-gabbro are approximate and in many cases probably gradational. Well cuttings show the contacts can also consist of inter-fingered layers of granite and diorite. The granite does contain some diorite, and the diorite-gabbro unit contains some granitic rocks. For hydrogeologic purposes the two generalized units are satisfactory.

The metavolcanic rocks of the Carolina Slate Belt are represented in Rowan County by three units: the Felsic Volcanics, the Mafic Volcanics, and the Bedded Argillites. These units consist of volcanic-sedimentary formations of shales, breccias, tuffs, and flows. The composition varies from rhyolite to andesite and some basalt. The rocks have been generally metamorphosed to slates and exhibit good slaty cleavage.

Each unit is predominately as mapped. However, there are lenses and small bodies of the other units in each major unit. The following descriptions of the three units are generalized from Stuckey and Conrad (1958).

The Felsic Volcanics comprise about one-third of the Carolina Slate Belt rocks found in Rowan County. The Felsic Volcanic unit consists of rhyolite flows and breccias and coarse- to fine-grained tuffs of rhyolite to dacite composition. Much of the rock has been metamorphosed and has a slaty to schistose cleavage.

The Mafic Volcanic unit is a minor element of the Carolina Slate Belt rocks in Rowan County. These rocks consist of flows varying from andesite to basalt and fragmental materials of generally andesite origin. The Mafic

Volcanics are not as highly metamorphosed as the Felsic Volcanics.

The Bedded Argillite unit occupies the major portion of the Carolina Slate Belt rocks in Rowan County. The unit is composed chiefly of dark-colored or bluish shales or slates which are usually massive and thick bedded. The metamorphism of the unit ranges from extreme to very little. The Bedded Argillite is commonly termed slate, bedded slate, or volcanic slate. Much of the slate is deeply weathered with very few outcrops of fresh rock.

The Felsic and Mafic Volcanics do not exhibit as predominate a slaty cleavage as the Bedded Argillite rocks. However, they do have a cleavage similar to slate. The three units are assumed to have similar hydrologic properties for purposes of this report and comparison with the granitic and diorite-gabbro rocks.

Structure

The major known structural feature is the Gold Hill fault separating the majority of the metavolcanic and igneous units. The direction and extent of movement along the fault zone has not been determined.

Geologic cross-sections were constructed to determine the possibility of any other structural features. Section A-A' (fig. 5) shows several significant features. The general slope of the bedrock surface, except for a ridge in the center of the section, is constant from west to east. This slope is probably the general Piedmont slope from the mountains on the west to the fall line and the beginning of the coastal sediments on the east. The bedrock ridge extends to the north and is reflected in each of the parallel cross-sections. The aeromagnetic profile (Henderson and Gilbert, 1966) exhibits an anomaly that is probably a definition of the ridge.

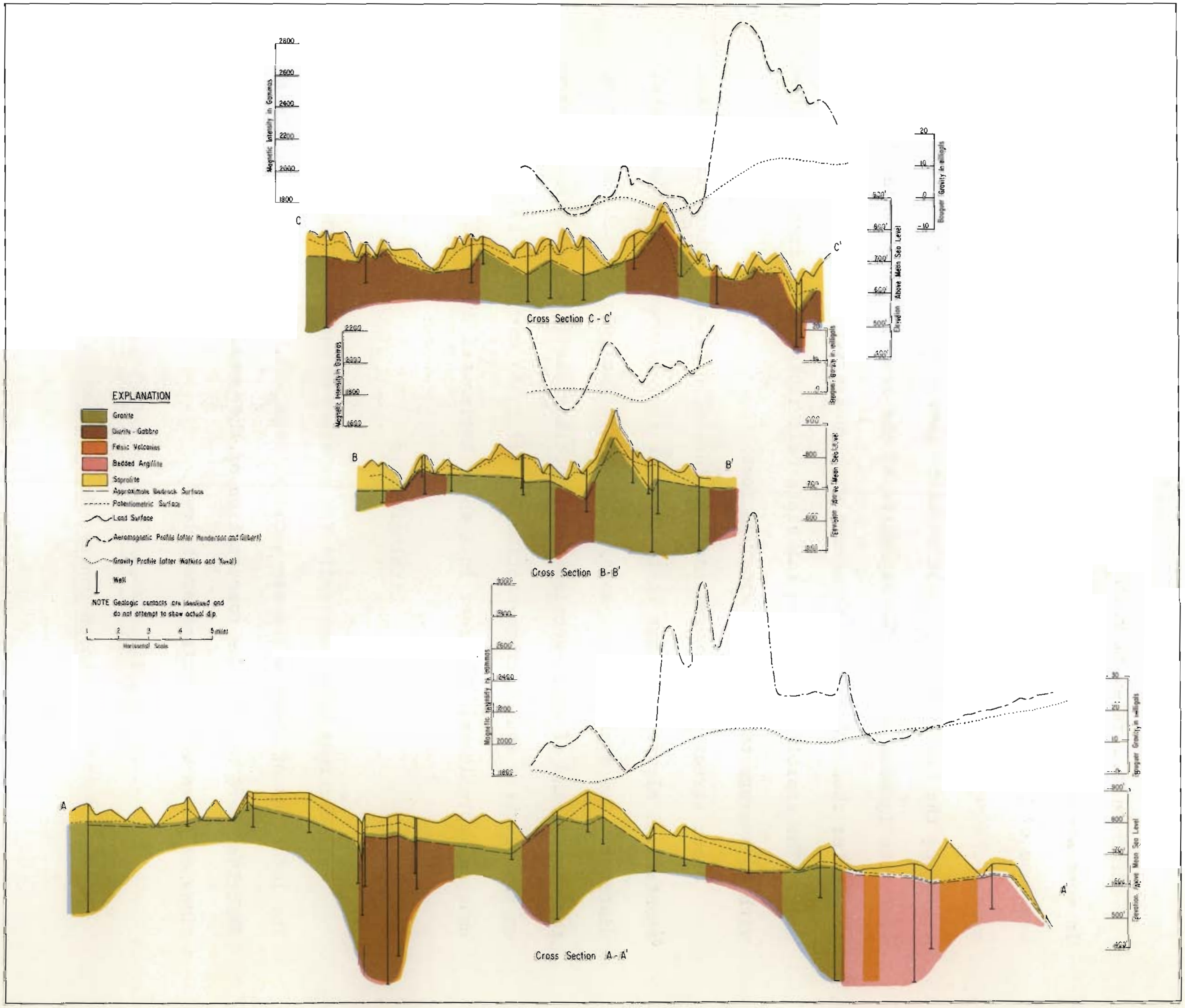


FIGURE 5. - HYDROGEOLOGIC CROSS-SECTION; A-A', B-B', C-C'

Differential rates of weathering are also indicated in the sections. In some areas the saprolite is consistently thicker than in other areas. The west end of Section A-A' may represent an area of thick saprolite and more stream channel erosion than in other areas of the sections. The saprolite overlying the Carolina Slate Belt rocks is generally thinner than that overlying the igneous rocks. The saprolite of the igneous units ranges from 0 to greater than 100 feet in thickness with an average thickness of about 75 feet. The saprolite overlying the slate belt rocks ranges from 0 to 50 feet with an average thickness of about 30 feet.

Other structural features could be indicated in areas where there is a substantial elevation change in the bedrock surface over a short horizontal distance. One such feature, associated with a geologic contact is shown on the western end of cross-section A-A'. Another possible fault zone is shown on the northern end of cross-section D-D' (fig. 6) where the bedrock elevation changes approximately 200 feet in a short horizontal distance.

Lithlogic Logs

Well cuttings have been collected at several locations in Rowan County. The locations of these wells are shown in figure 3, and their rock units as described were used in the construction of the geologic map (fig. 4). Descriptions of these well cuttings are below:

Descriptions of rock cuttings from wells in Rowan County, North Carolina

	Thickness (feet)	Depth (feet)
Well M60 f-3		
Saprolite, very pale-orange to moderate orange-pink, sandy clay texture, contains weathered grains of quartz and mica, feldspars weathered to clay....................	20	20

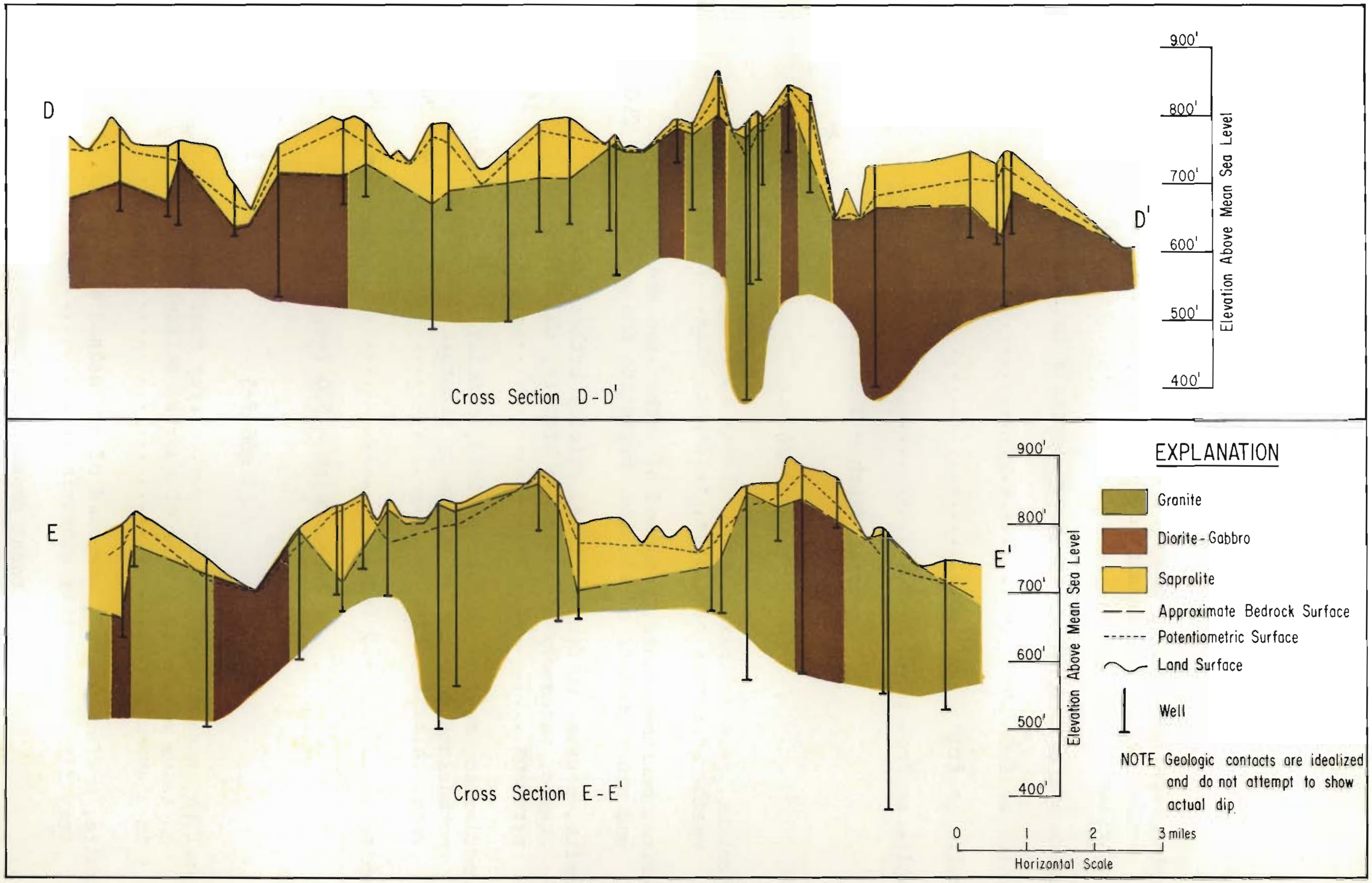


FIGURE 6. - HYDROGEOLGIC CROSS-SECTION; D-D', E-E'

	Thickness (feet)	Depth (feet)
Well M60 f-3 - continued		
Granite, medium-grained, composed chiefly of quartz and orthoclase, minor amounts of biotite, pyroxene, magnetite	50	70
Granite similar to above, accessory minerals increased	10	80
Granite as from 20-70 feet	40	120
Granite as from 70-80 feet	20	140
Granite as from 20-70 feet	210	350
total depth - 350 feet		
Well M60 f-4		
Saprolite, pale yellowish-brown, clayey sand, contains weathered grains of quartz, feldspar, mica	20	20
Granite, medium-grained, composed of orthoclase and quartz and minor amounts of biotite, magnetite and muscovite	390	410
Granite, medium- to fine-grained, chiefly orthoclase, quartz, accessory minerals are biotite, chlorite, pyroxene	10	420
Granodiorite, medium- to fine-grained, chiefly plagioclase, orthoclase and quartz, accessory minerals are pyroxene, chlorite, biotite	30	450
Granite as from 20-410 feet	80	530
total depth - 530 feet		
Well M60 f-5		
Saprolite, moderate yellowish-brown, clayey sand texture, contains weathered grains of quartz, feldspar, mica in clay matrix	5	5
Granite, medium-grained, composed of orthoclase and quartz, very little accessory minerals	225	230
total depth - 230 feet		

Well M60 j-1

	Thickness (feet)	Depth (feet)
Saprolite, no sample	105	105
Gabbro-diorite, fine-grained, chiefly plagioclase, pyroxene, quartz, some biotite, pyrite	21	126
Granodiorite to diorite, medium-grained, chiefly feldspar, quartz, biotite, pyroxene, chlorite	59	185

total depth - 185 feet

Well M60 j-2

	Thickness (feet)	Depth (feet)
Saprolite, no sample	72	72
Gabbro, fine-grained, medium dark-gray, composed of plagioclase, pyroxene, biotite	123	195
Gabbro as above, some pegmatite vein material in interval, chiefly orthoclase and actinolite	10	205

total depth - 205 feet

Well M61 x-2

	Thickness (feet)	Depth (feet)
Saprolite, no sample	100	100
Granodiorite, fine- to medium-grained, composed of orthoclase, plagioclase, quartz, biotite, muscovite	50	150
Granite, fine- to medium-grained, chiefly orthoclase, quartz, some biotite, pyroxene, and sphene	55	205

total depth - 205 feet

Well M62 p-1

	Thickness (feet)	Depth (feet)
Saprolite, no sample	121	121
Diorite, medium-grained, chiefly feldspars, pyroxene, quartz, some biotite, chlorite, magnetite	59	180
Granodiorite, medium-grained, chiefly feldspars, pyroxene, quartz, biotite, chlorite, some pyrite	70	250
Granite, medium-grained, chiefly pink orthoclase, quartz, plagioclase, pyroxene, biotite, muscovite, some pyrite	15	265

Well M62 p-1 - continued	Thickness (feet)	Depth (feet)
Diabase, aphanitic, dark-gray to black....................	5	270
Granite as from 250-265 feet..............................	10	280
Diorite, medium- to fine-grained, chiefly plagioclase, orthoclase, pyroxene, quartz, some chlorite, pyrite...	10	290
Granite, medium- to fine-grained, pink tinted, chiefly orthoclase, plagioclase, pyroxene, quartz, some chlorite, pyrite....................................	10	300
Diorite as from 280-290 feet..............................	10	310
Granite as from 290-300 feet..............................	10	320
Diorite as from 280-290 feet, some diabase in interval between 320 and 340 feet............................	40	360
Diorite, medium-grained, chiefly plagioclase, biotite, pyroxene, orthoclase, quartz.........................	45	405

total depth - 405 feet

Well N62 a-1

	Thickness (feet)	Depth (feet)
Saprolite, moderate yellowish-brown to grayish-orange, sandy clay texture, contains weathered grains of quartz, mica, feldspar..............................	20	20
Weathered bedrock, relic grains still visible, feldspars weathered to clays, contains grains of quartz, mica...	90	110
Gabbro, fine-grained, iron-stained, chiefly plagioclase, pyroxene, biotite, some quartz.......................	10	120

total depth - 120 feet

Well N62 e-7

	Thickness (feet)	Depth (feet)
Saprolite, very pale-orange, clay to silt texture, very few sand-size grains................................	20	20
Saprolite, moderate-orange to grayish-orange, silty texture and some sand, sand is chiefly weathered quartz grains	40	60
Diorite, medium-grained, composed of quartz, hornblende, plagioclase..	180	240

	Thickness (feet)	Depth (feet)
Well N62 e-7 - continued		
Diorite, medium- to fine-grained, chiefly plagioclase, hornblende, olivine, biotite, some orthoclase, quartz, pyrite	70	310
Diabase, aphanitic, grayish-black to black, some feldspar phenocrysts, some pyrite	20	330
Gabbro, fine-grained phaneritic rock, general color is dark-gray, composed of plagioclase, hornblende, or pyroxene, some olivine, pyrite	90	420
Diorite, medium-grained, chiefly feldspars, pyroxene, some quartz, pyrite	20	440

total depth - 445 feet

Geophysical Logs

Geophysical logs of natural gamma radiation and electrical resistivity have been made in several wells in Rowan County. Figure 7 shows selected geophysical logs correlated with geologic data where available. The electrical resistivity logs show possible fractured zones by decreasing resistivity measurements. The fractured areas are assumed to be water entrance zones. Changes in natural gamma radiation indicate changes in lithology as shown in figure 7.

Groundwater in the Saprolite

Saprolite is chemically weathered rock material that has undergone all changes in place and has not undergone any erosional transport. Weathering rates vary from rock type to rock type depending on the mineral composition and their respective weathering properties. Weathering also varies from area to area dependent upon the degree of fracturing. The weathering rates in Rowan County are not variable from place to place because of climatic

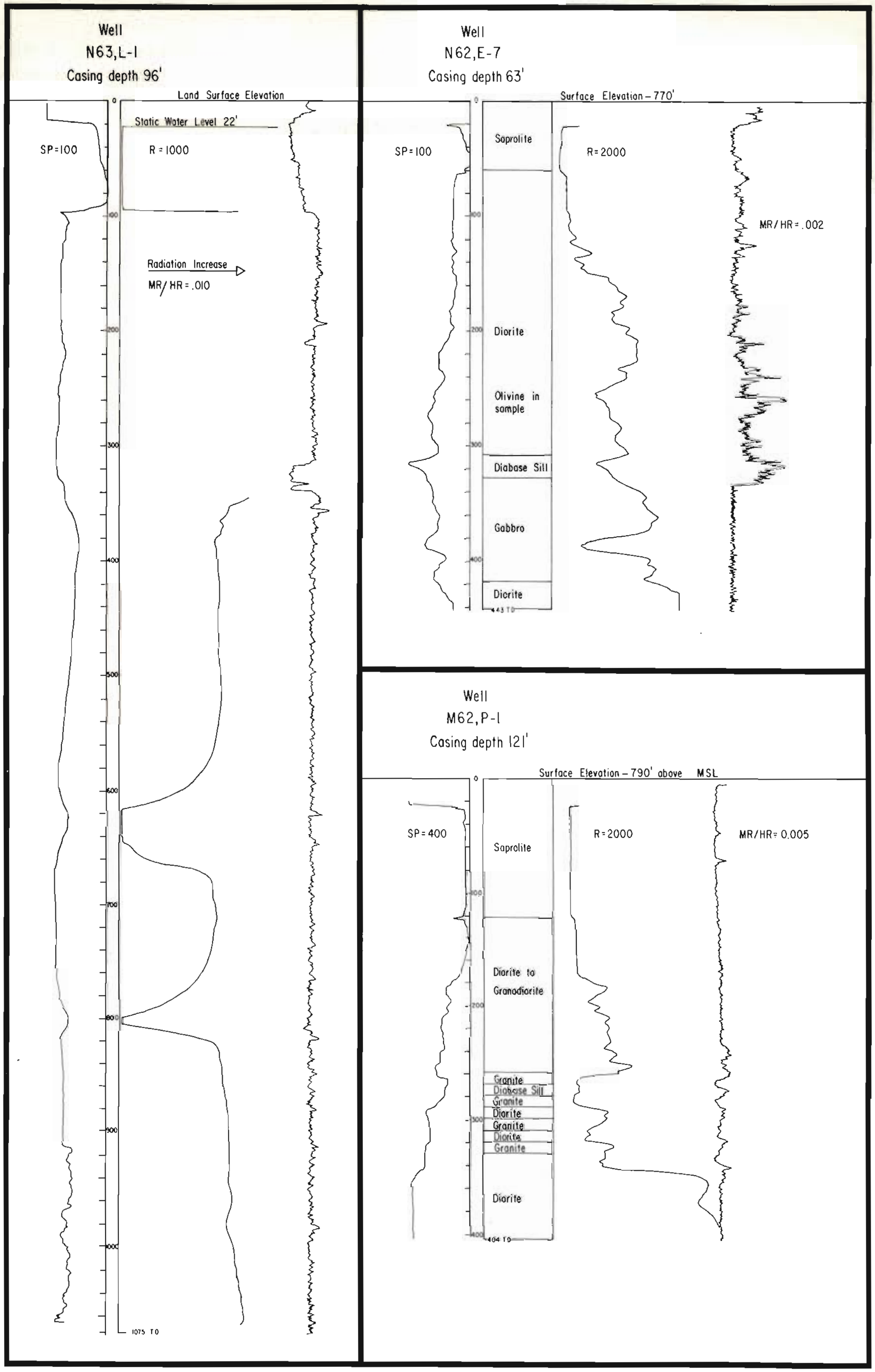


FIGURE 7. - GEOLOGIC AND GEOPHYSICAL LOGS

differences. The county area is relatively small, and the entire county receives the same average precipitation.

The approximate saprolite thickness is shown in figure 8. This figure shows several areas of thin saprolite, probably associated with topographic and bedrock highs. The factors which would produce this situation are resistance to weathering by the bedrock or degradation by erosion. The figure also shows several areas of thick saprolite which may indicate holes or depressions in the bedrock surface.

The Carolina Slate Belt unit exhibits a fairly constant rate of weathering throughout, with most saprolite thickness in the range from 30 to 50 feet. The igneous rocks underlying the remainder of the county have a wide range of saprolite thicknesses that vary from rock type to rock type and within the same rock unit.

Groundwater in the saprolite occurs under water table conditions. The water occupies the interstices between the grains of the saprolite and is in hydrostatic balance with the atmosphere. The groundwater occurring under these conditions in the saprolite is the majority of the groundwater in storage in Rowan County.

The saprolite has a relatively low permeability as would be associated with a clay or a sandy clay mixture. The saprolite developed from the metavolcanic rocks contains more clay than that from the intrusive rocks. Horizontal and vertical permeabilities differ because the individual minerals have weathered in place and any lineation of mineral grains in the rock will be represented by varying permeability in the saprolite.

Groundwater in the Crystalline Rock Aquifer

In crystalline rocks groundwater occurs in the fractures, joints, faults,

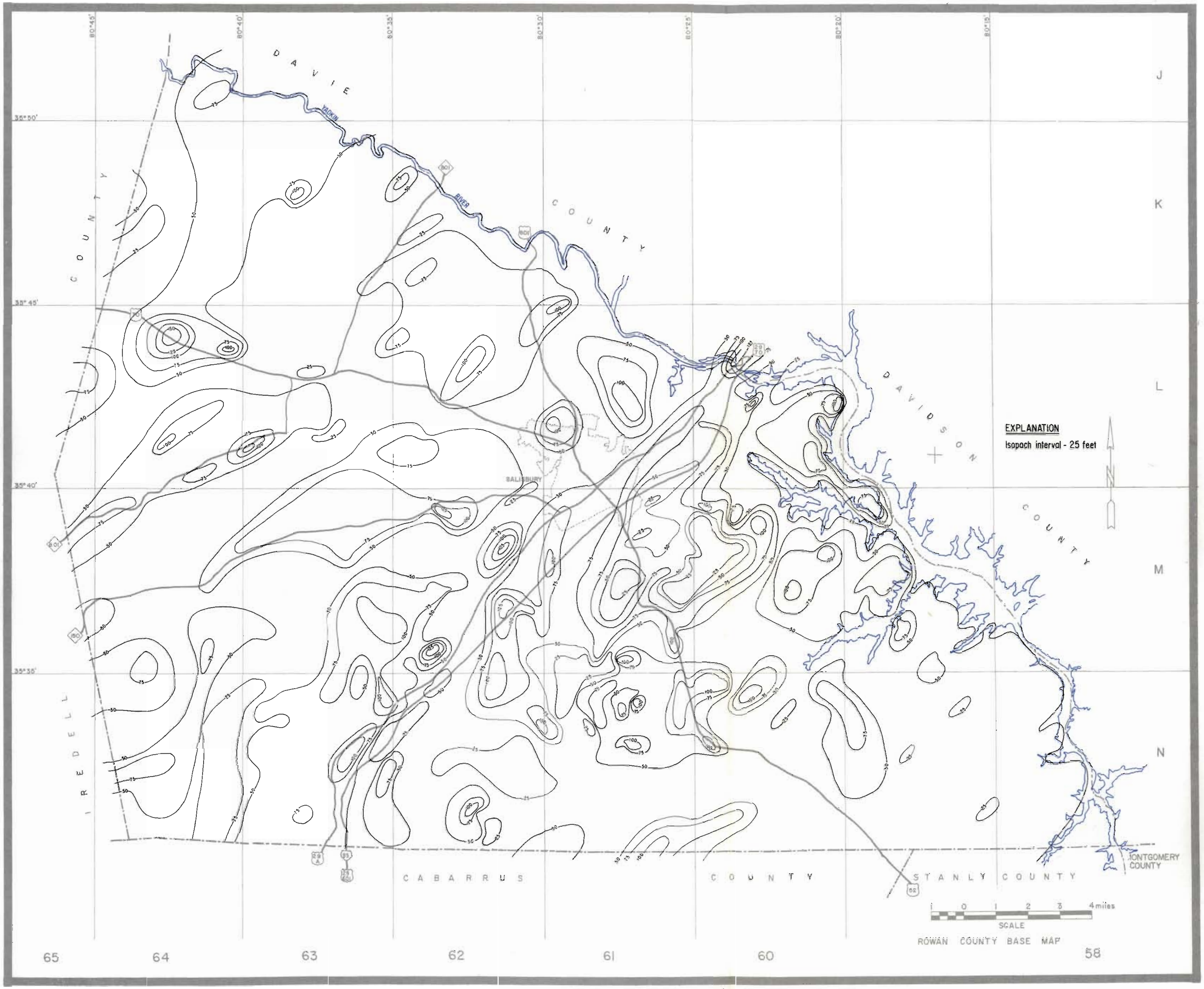


FIGURE 8.- APPROXIMATE SAPROLITE THICKNESS

and other openings in the rock. These openings intersect the top of the bedrock and are supplied groundwater by the water in storage in the overlying saprolite. When a well is constructed and intersects a fracture, water moves through the fractures, joints, and faults from the saprolite to the well.

In the granite and diorite-gabbro units the openings in the rocks are commonly either fractures, joints, or faults. The metavolcanic unit is different because, although it contains fractures, joints, and faults, it also contains the openings associated with slaty cleavage.

The joints occurring in the granitic bodies are vertical or near vertical with strikes in two main directions. Councill (1954) measured the strikes in various quarries in Rowan County and determined that there is one set striking in the direction of N. 10° E. to N. 70° E. and a second set striking from N. 10° W. to N. 70° W. Horizontal sheeting planes are also common near the surface of the bedrock. These joints and sheeting planes give three sets of openings which may be intercepted by a well.

The size of the openings supplying water to a well vary considerably in width. The width of a single fracture or joint is probably a tenth of an inch or less. Well contractors report fractures or openings of sufficient size to cause a noticeable drop by the drill bit. Geophysical logs made on wells (fig. 7) show that water entrances may be from fractured zones which may be as much as ten feet in width. These fractured zones when encountered at a depth below the bedrock surface are probably faults or faulted zones.

The groundwater in the crystalline rock aquifer is under artesian conditions. However, since most water-bearing fractures intersect the bedrock surface in the vicinity of the well, the artesian water level or potentiometric head is closely associated with the water table. Figure 9 shows the approximate depth to water from land surface based on reported water-level

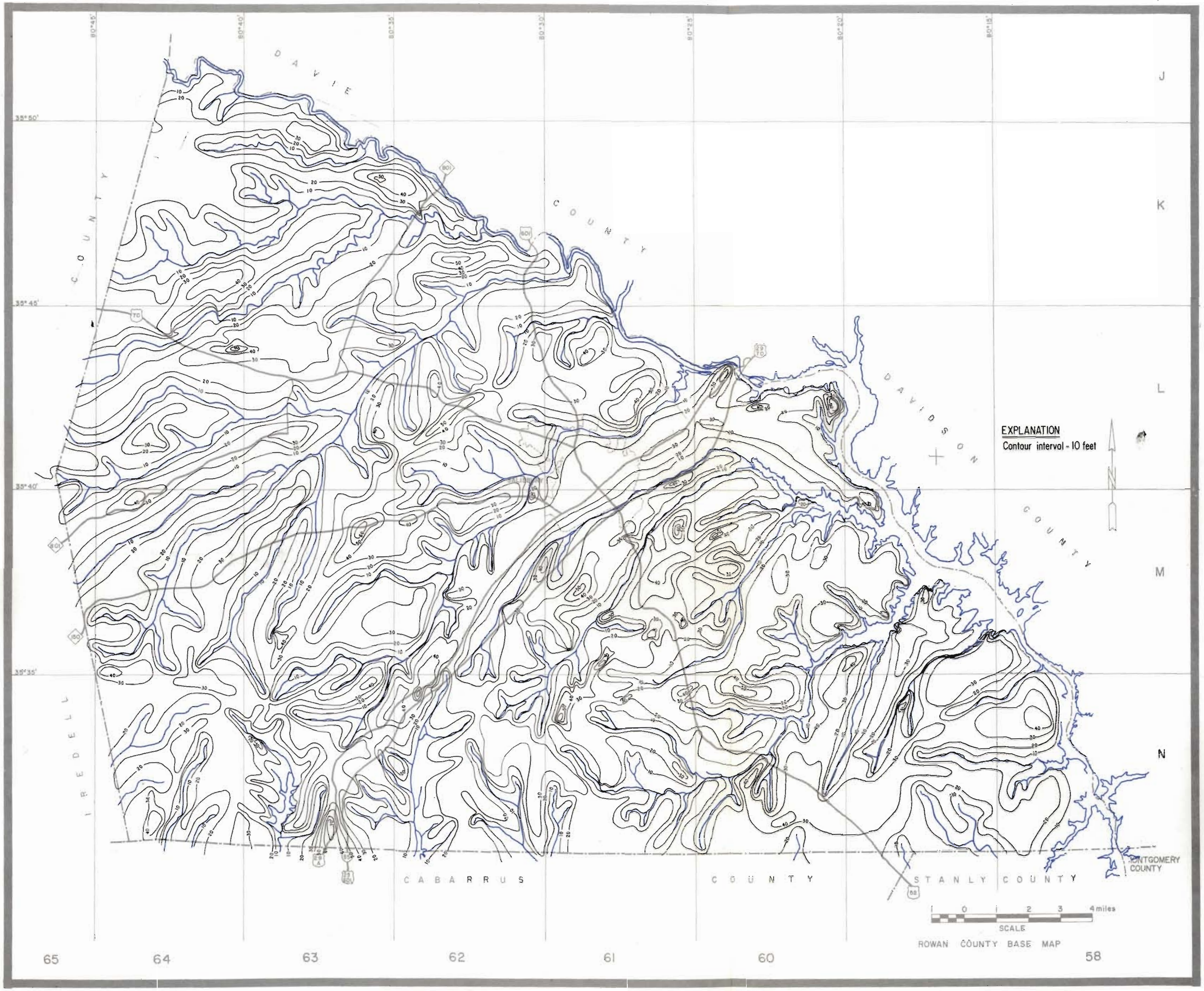


FIGURE 9.- APPROXIMATE DEPTH OF WATER TABLE BELOW LAND SURFACE, ROWAN COUNTY, N. C.

measurements and topographic interpretation. The depth to water from land surface is generally from 30 to 40 feet along ridges and topographic highs to 0 or near 0 along stream channels.

Water Level Fluctuations

The approximate depth to the water table in Rowan County has been shown previously in figure 9. These water levels are subject to several different conditions which cause fluctuations. Water levels have been measured in several wells in Rowan County for varying periods of time. The locations of available groundwater level, precipitation, and streamflow data for Rowan County are shown in figure 10. The figure also shows the relationship between these data collection points and the stream drainage systems. The construction data and period of record for each of the water-level monitor wells are contained in table 1.

The groundwater level hydrographs in figures 11, 12, and 13 represent the monthly and seasonal fluctuation in water level for the period of record available for the monitor wells. The seasonal fluctuation is normally from a high water level during the months of April or May to a low occurring in November or December. These high and low water levels coincide with the periods of maximum and minimum precipitation as shown in figure 14. The monthly precipitation totals (fig. 14) for Rowan Research Station and the Salisbury Station show that the period January through April commonly has a greater total precipitation than the period from September through December.

Figures 15 and 16 compare the daily precipitation at both Rowan County precipitation stations with the daily water-level fluctuations in well N63 1-1, located in China Grove. Although the precipitation stations are some distance away from the monitor well, the records indicate on which days precipitation occurred but do not accurately measure the amount of precipitation in the China Grove area. The hydrograph of well N63 1-1 shows a minor fluctuation of 0.2 to 0.3 inch following precipitation events. Apparently the great depth below land surface of the zones of water entrance into the well, 630 and 810

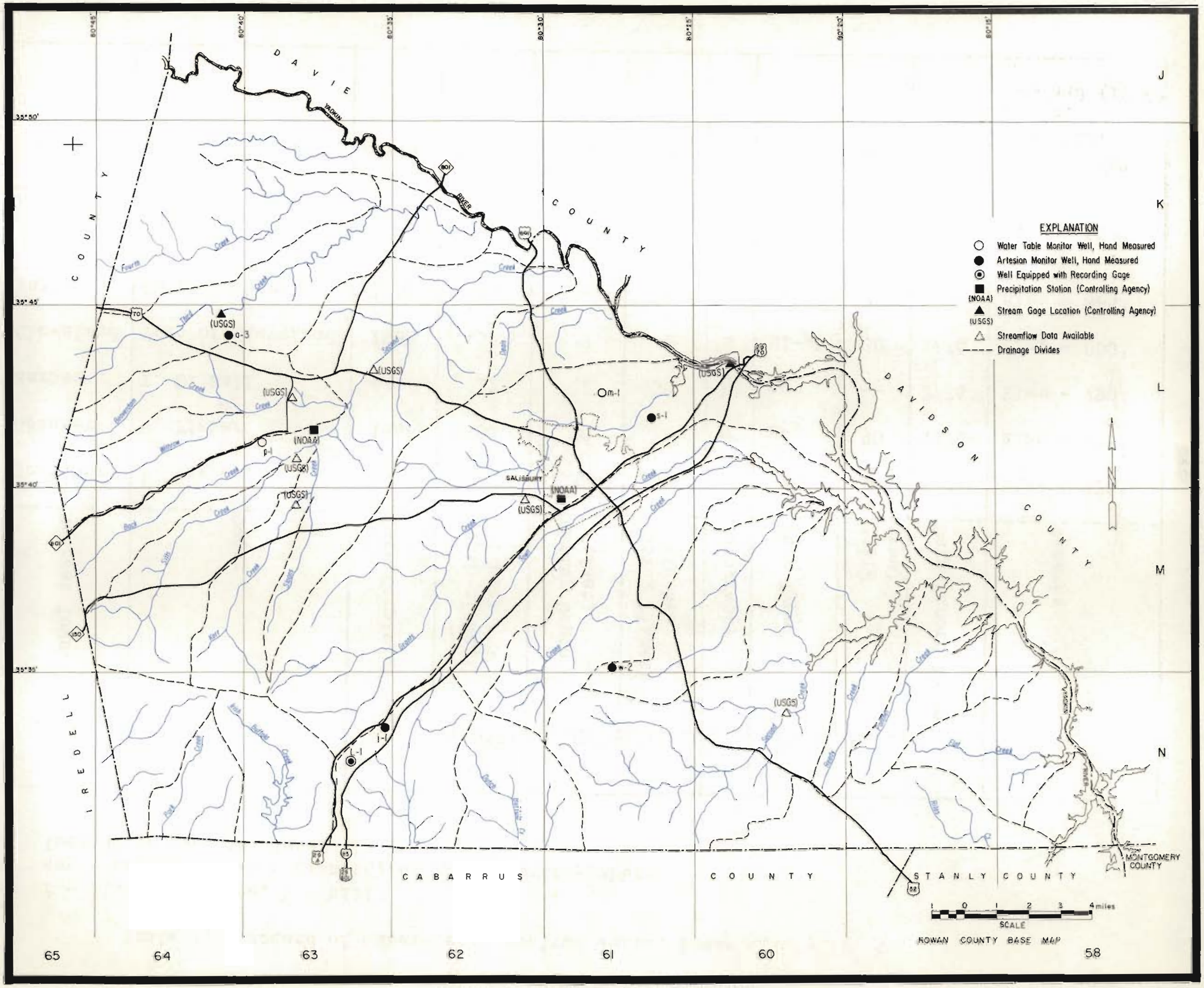


FIGURE 10 - LOCATION OF HYDROLOGIC MONITORING STATIONS

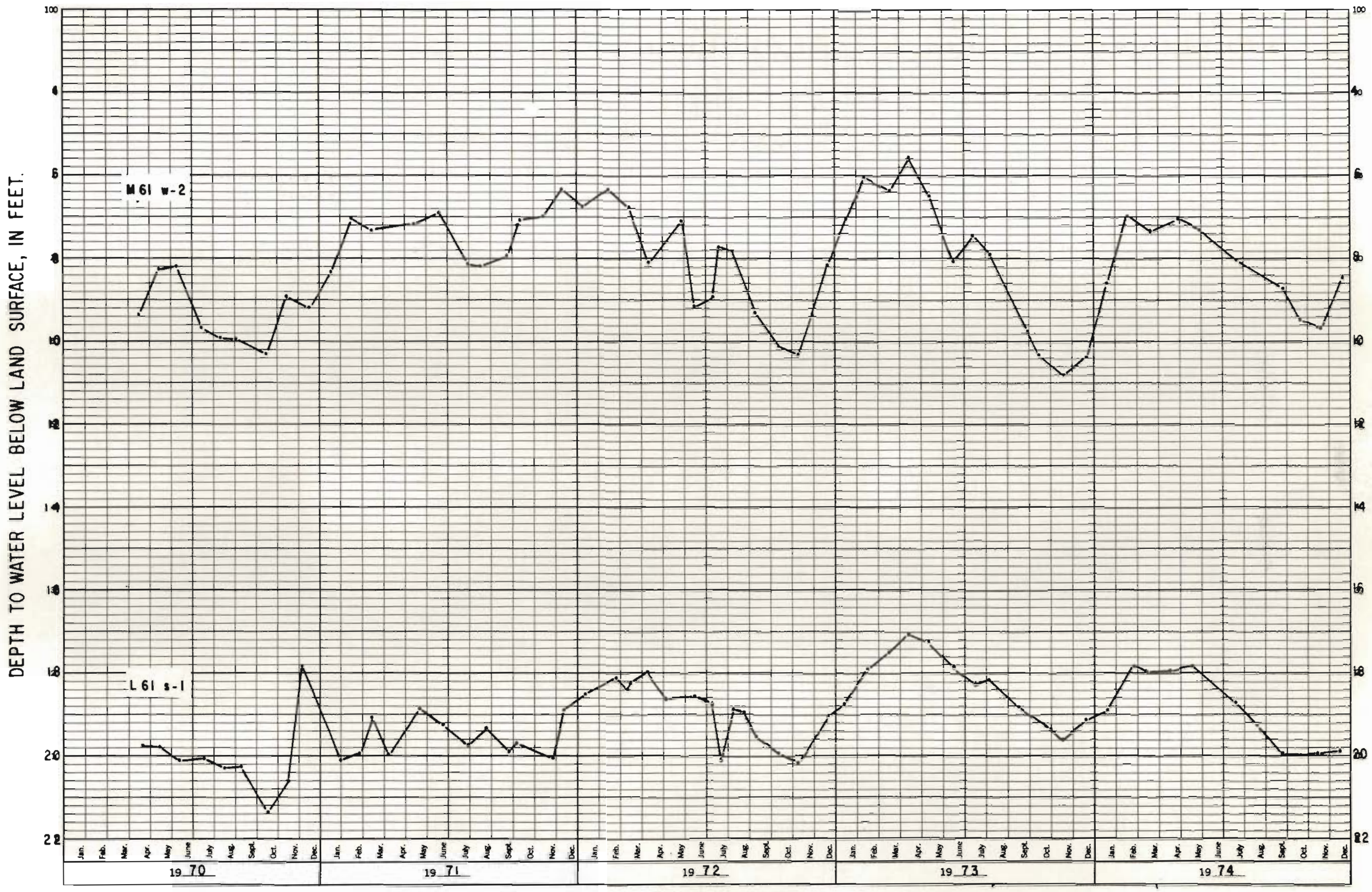


FIGURE 11. - HYDROGRAPHS OF MONITOR WELLS M61 w-2, L61 s-1.

FIGURE 13.- HYDROGRAPHS OF MONITOR WELLS L 6l m-l, L 63 p-l, L 64 a-3, 1974

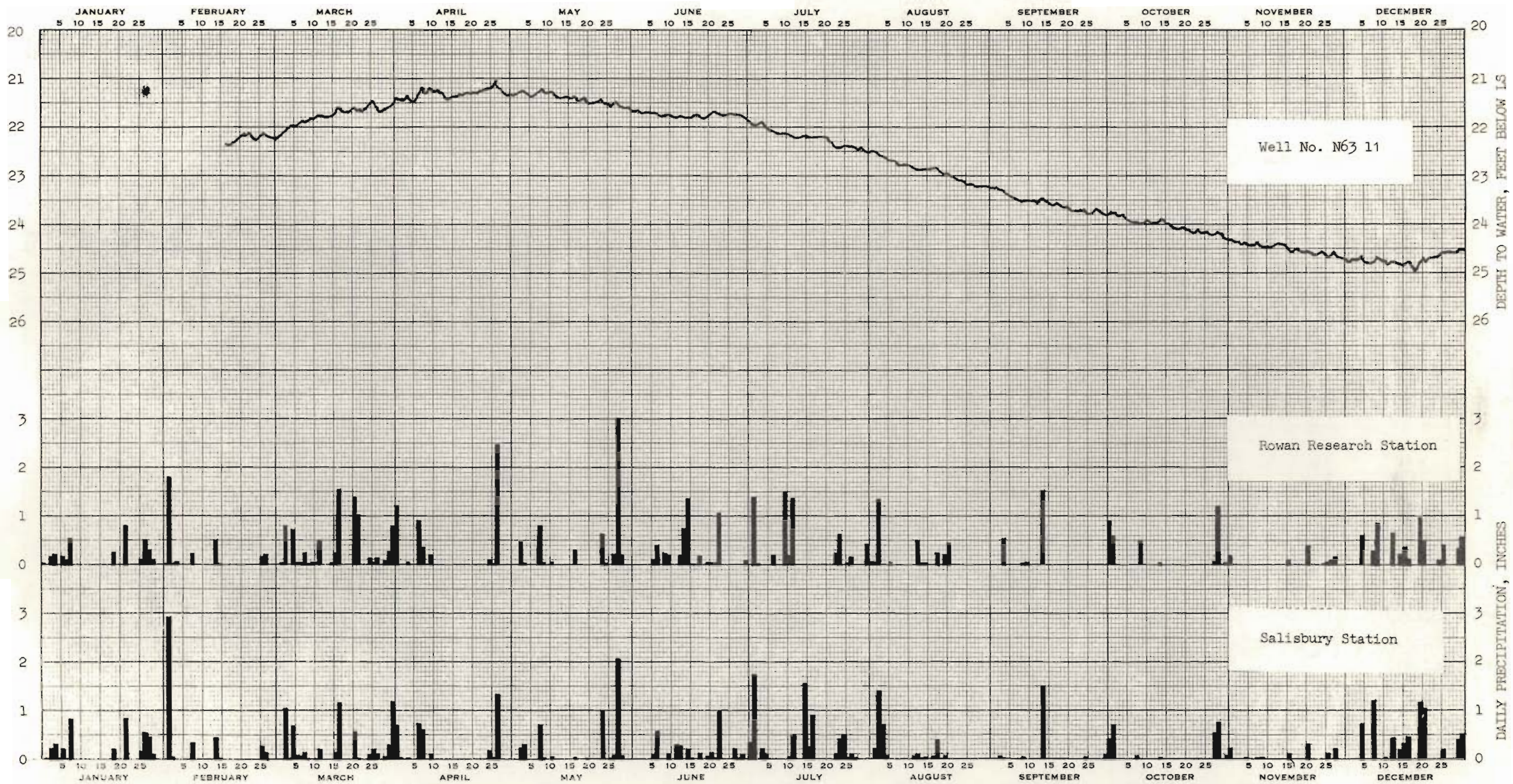


FIGURE 15. - HYDROGRAPH OF MONITOR WELL N63 L-1 COMPARED TO PRECIPITATION; 1973

HYDRAULICS

Hydraulic Characteristics of Aquifers

Rowan County has two distinct aquifers, the crystalline rocks and the saprolite. The two aquifer units are directly connected hydraulically, but different well construction techniques are used in each unit. In the Piedmont region and specifically in Rowan County, the saprolite is developed for small well yields only, and the crystalline rock is considered the source of water for developing large well yields. No information is available on the hydraulic characteristics of the saprolite, but it is assumed to have a low permeability.

The crystalline rock aquifer supplies water to wells through the fractures in the unit. These fractures are either directly, or indirectly through other fractures, connected to the top of the bedrock. Groundwater is supplied to these fractures by the overlying saprolite. Storage of groundwater is mainly in the saprolite, but some storage occurs in the fractures and openings in the crystalline rock. It is impossible to determine the number and configuration of fractures supplying groundwater to a well. Commonly, the fractures, joints, and faults intersecting a well will in turn intersect the surface of the bedrock in the vicinity of the well. Under these conditions, withdrawal of groundwater will create a cone of depression centered around the well. The areal extent of this influence can be determined by a network of water-table monitor wells. However, it is possible that a fracture zone or fault supplying water to a well might intersect the surface of the bedrock some distance from the well. In this case the area of influence from pumping will be centered some distance away from the well.

The permeability of crystalline rock is secondary permeability as a

Table 2. - Aquifer test data.

Aquifer: di-gb - diorite-gabbro, gr - granite
T pumped well: T - coefficient of transmissivity; a - test data supplied by well contractor insufficient to compute a value for "T"
Total drawdown: measured in pumping well

WELL NO.	LENGTH OF TEST (hours)	AQUIFER	THICKNESS OF SAPROLITE	AVERAGE DISCHARGE (gpm)	TOTAL DRAWDOWN (feet)	SPECIFIC CAPACITY (24 hr dd)	T PUMPED WELL (gpd/ft)
L60 o-1	24	di-gb	63	45.3	196	0.23	469
L64 j-1	24	di-gb	125	35	252	0.14	84.5
M59 y-1	24	gr	40	10.8	239	0.045	a
M60 f-1	24	gr	12	35.5	178	0.20	a
M61 n-1	24	gr	148	55	67.5	0.815	2074
M61 x-2	24	gr	--	22.5	100.1	0.22	213
M61 w-1	24	gr	40	27.5	99	0.28	a
M61 w-3	14.5	gr	46	21.4	100	0.21	a
N62 e-4	24	di-gb	--	60	158.5	0.38	a
N62 e-7	24	di-gb	60	120	56	2.14	a
N62 j-1	24	di-gb	109	23	49	0.47	a

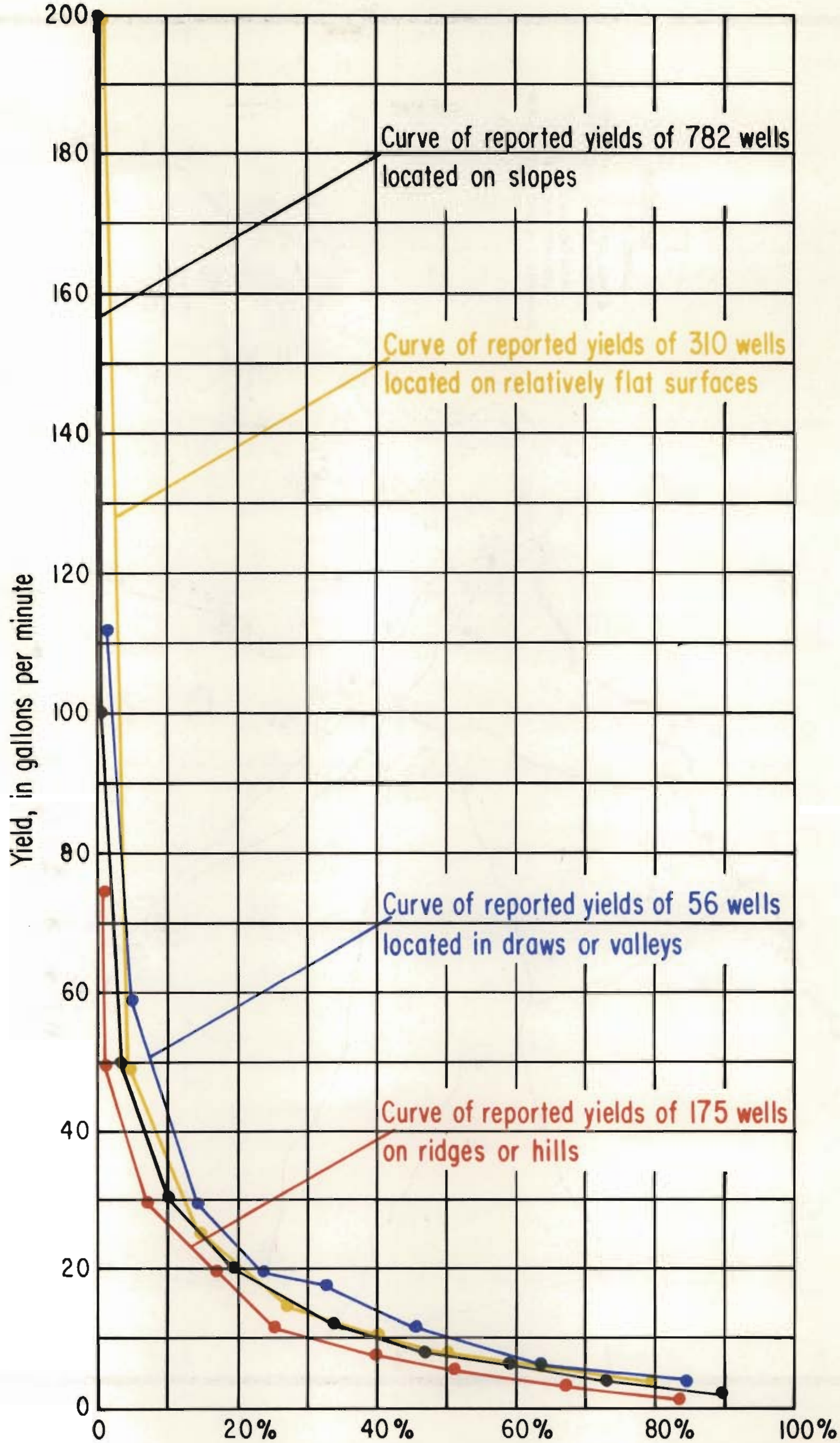


FIGURE 17.- RELATIONSHIP OF WELL YIELDS TO TOPOGRAPHY

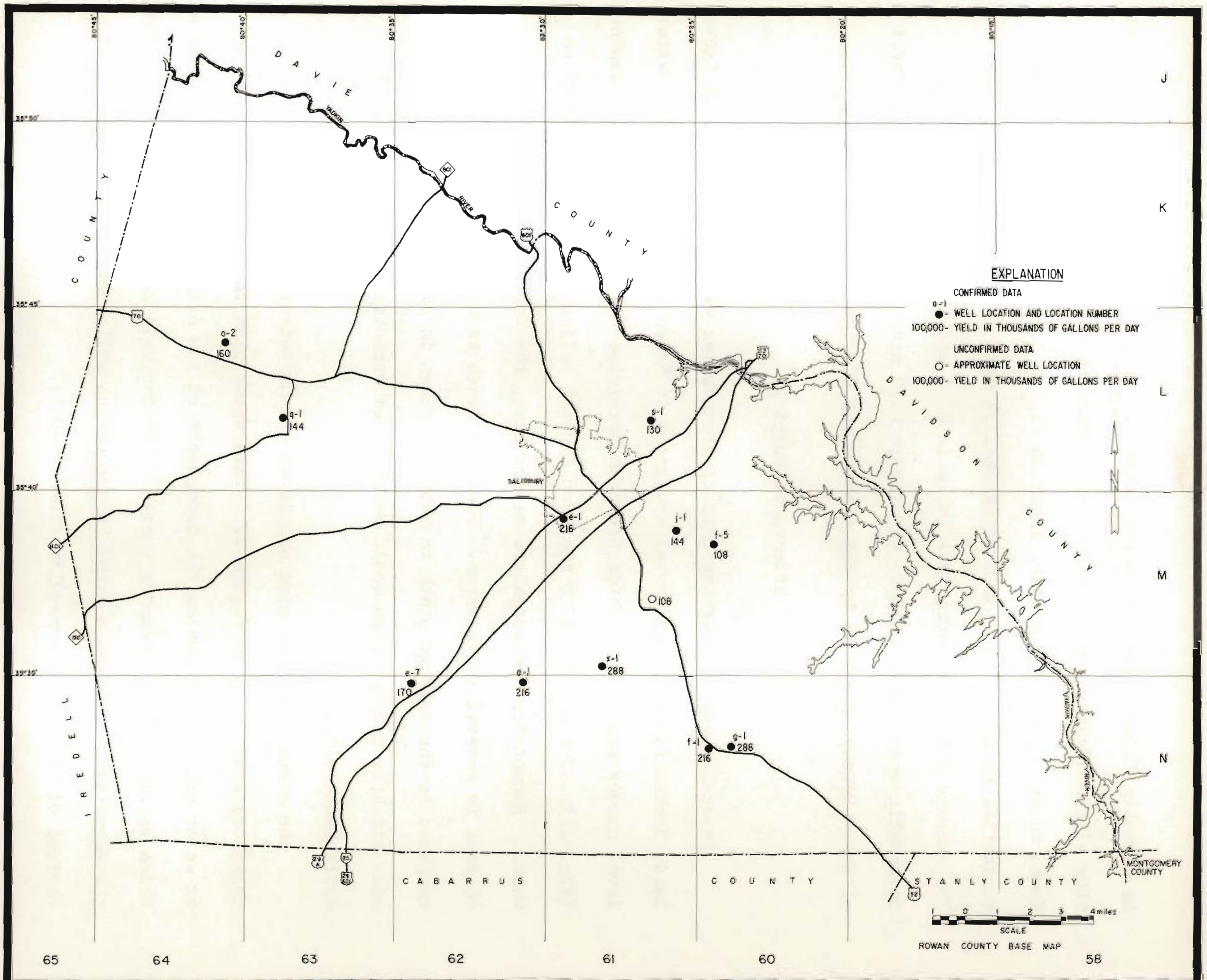


FIGURE 19. - LOCATION OF WELLS YIELDING MORE THAN 100,000 GALLONS PER DAY.

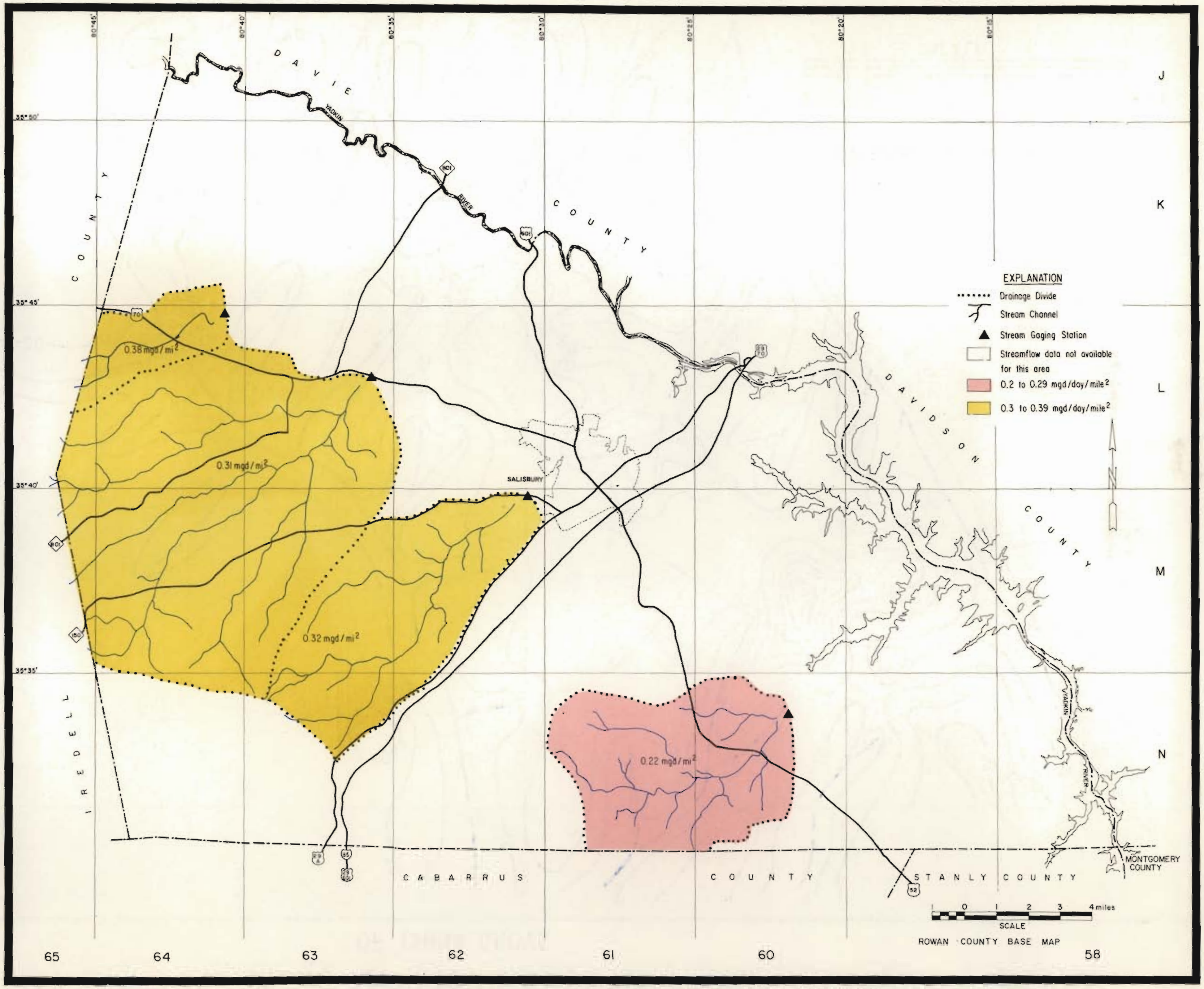


FIGURE 20.- GROUNDWATER AVAILABILITY AS DETERMINED FROM STREAMFLOW DATA

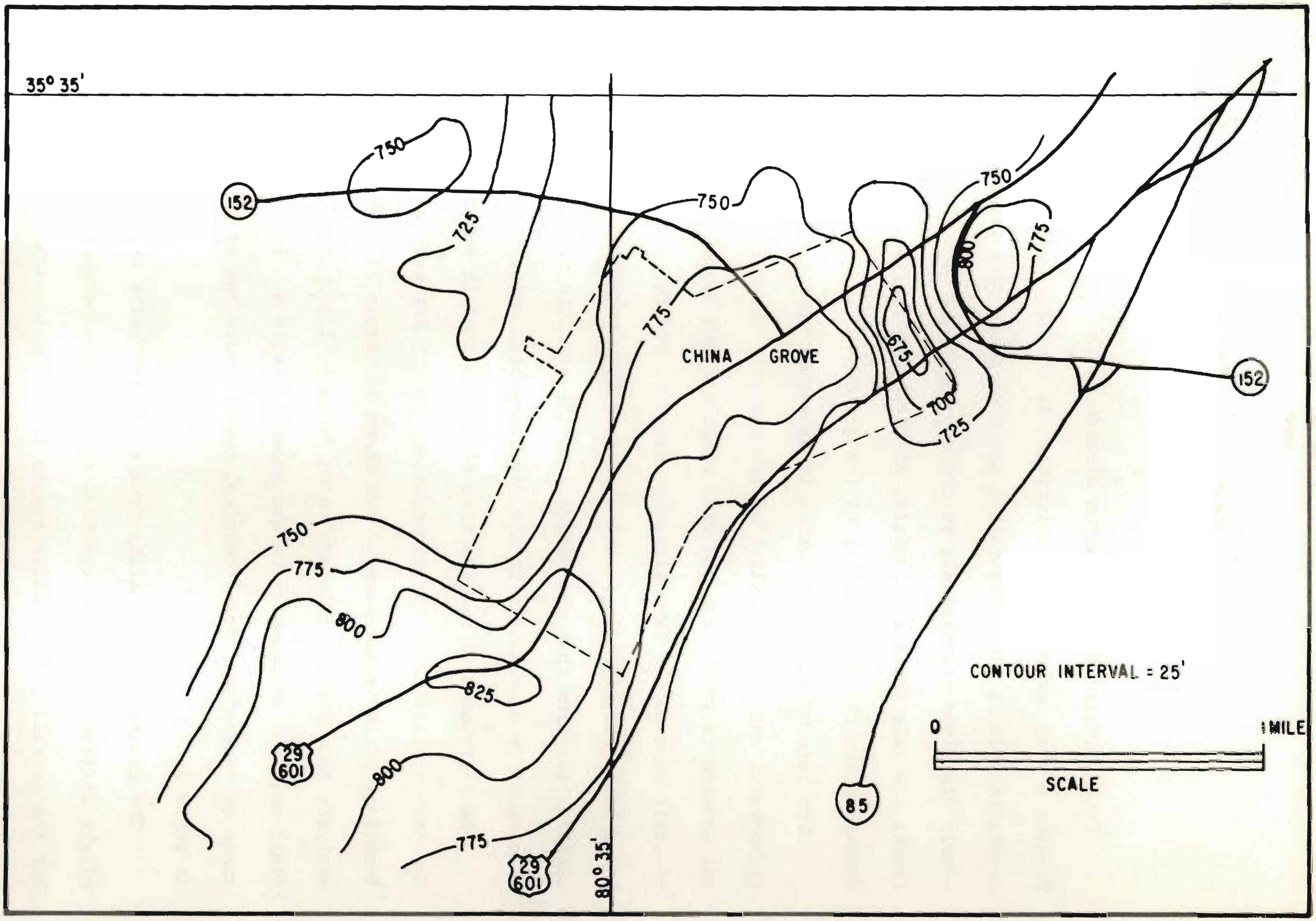


FIGURE 22.- ELEVATION OF POTENTIOMETRIC SURFACE IN VICINITY OF CHINA GROVE

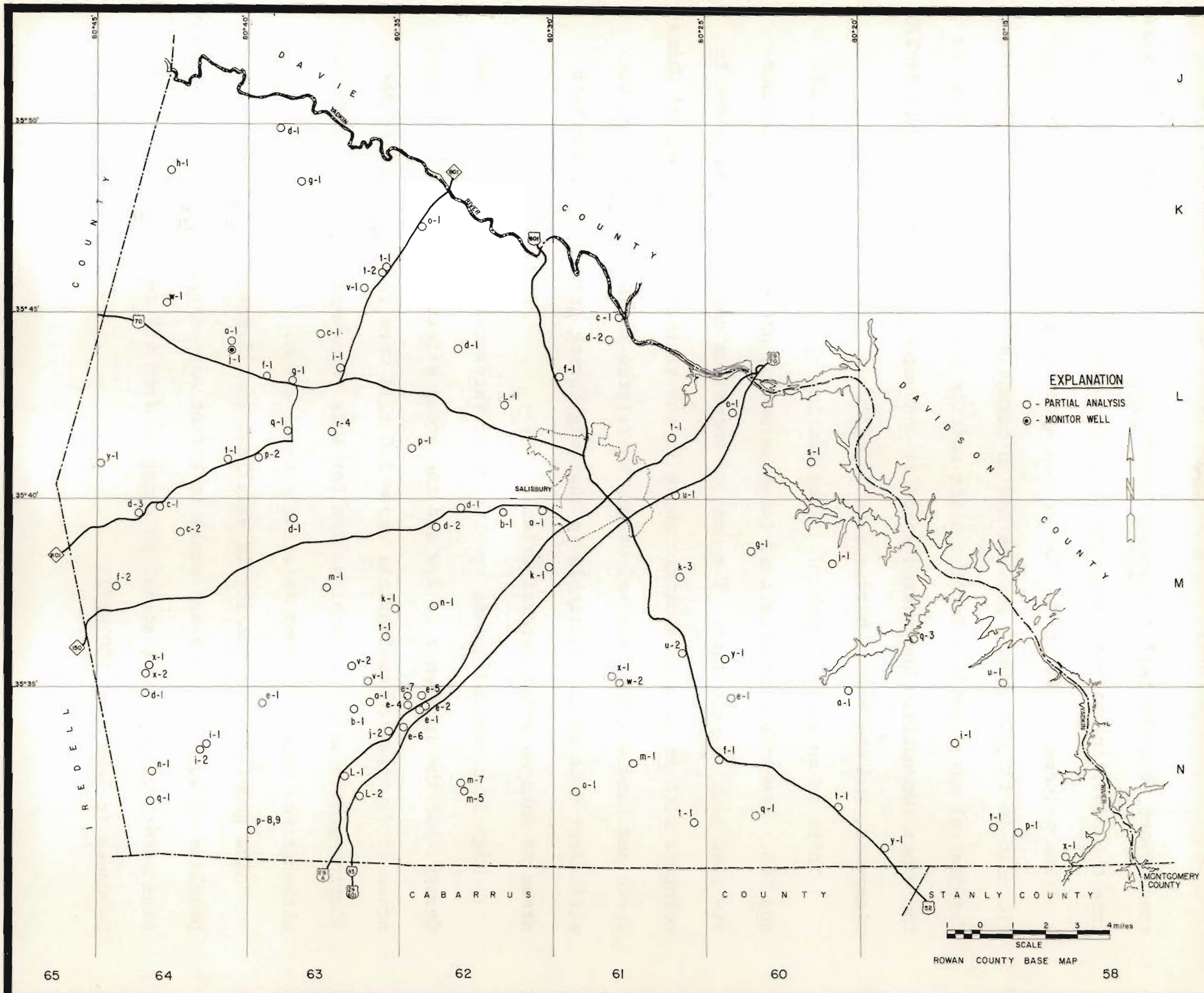


FIGURE 23.- LOCATION OF WELLS SAMPLED FOR CHEMICAL ANALYSES

Table 3. - Chemical and physical analyses of water from selected wells in Rowan County, North Carolina.

Aquifer: gr - granite, gr-di - granite-diorite, di-gb - diorite-gabbro.

Well Number	L61 t-1	L64 a-1	L64 j-1	M61 x-1	N60 f-1	N62 e-1	N62 e-2	N62 e-4	N62 e-5	N62 e-6	N62 e-7	N63 j-2	N63 1-2
Silica (SiO_2)	-	-	30	53	-	39	40	52	60	25	22	34	-
Iron (Fe)	0.05	0.05	0.0	1.2	0.07	0.0	0.18	0.5	0.2	0.143	.22	0.0	0.15
Manganese (Mn)	0	0	0.02	1.7	0	0	0	0	0	0.125	.05	0	-
Calcium (Ca)	120	50	34	20	15	65	55	15	30	127	37	40	-
Magnesium (Mg)	-	-	8.4	8	-	-	-	-	-	53	8	-	-
Sodium (Na)	-	-	10	-	-	-	-	-	-	-	11	-	-
Potassium (K)	-	-	3.2	-	0.4	-	-	-	-	3.3	1.4	-	-
Bicarbonate (HCO_3)	-	-	143	-	73	104	105	76	104	99	116	94	-
Sulfate (SO_4)	-	-	10	4	-	80	65	4	7	336	27	39	-
Chloride (CL)	4.0	4.0	7.5	14	3.2	2.8	-	3.0	2.4	5.0	5.0	2.8	7.0
Fluoride (F)	0.5	1.2	0.3	-	1.15	0.2	0.1	0.0	0.0	0.4	0.1	0.1	3.0
Nitrate (NO_3)	-	-	0.84	-	2.0	-	-	-	-	0.0	0.09	-	0.0
Hardness as $CaCO_3$	-	-	118	50	-	160	133	43	75	395	120	95	-
total	170	190	120	58	100	210	175	55	95	709	140	125	51.3
Dissolved solids	205	221	189	127	104	221	260	120	143	616	226	-	-
Color (apparent)	0	0	2	-	0	0	0	0	0	5	-	0	-
Turbidity (Jackson unit)	-	-	-	-	-	0	0	5	0	0	-	5	-
pH	7.1	7.3	7.1	6.5	7.2	7.0	7.2	6.5	6.7	7.6	7.2	7.2	6.3
Specific conductance in micromhos at 25°C	315	340	260	195	160	415	400	185	220	772	292	310	160
Odor	none	none	none	none	none	none	none	none	none	none	none	none	none
Temperature (°C)	17	16.5	-	-	18	18	18	15.5	16.5	15.5	17	-	16
Date and appearance when collected	11-63 clear	11-63 clear	12-74 clear	4-67 clear	11-63 -	3-68 clear	3-68 -	3-68 clear	3-68 clear	11-72 clear	12-74 clear	3-68 clear	6-74 clear
Aquifer	gr-di	di-gb	di-gb	gr	gr-di	di-gb	di-gb	di-gb	di-gb	gr-di	di-gb	di-gb	di-gb

Table 4. - Partial field analyses of water from selected wells in Rowan County, North Carolina (continued).

Well Number	M63 m-1	M63 t-1	M63 v-1	M63 v-2	M64 c-1	M64 c-2	M64 d-3	M64 f-2	M64 x-1
Iron (Fe)	.05	.1	trace	.1	.6	.1	.3	.05	.1
Chloride (Cl)	20.0	1.5	2.0	4.0	5.0	2.5	26.5	2.0	27.5
Fluoride (F)	.3	.4	.4	.35	.6	.3	.4	.6	.3
Nitrate (NO_3)	-	-	-	-	-	-	-	-	-
Hardness - total	34.2	51.3	51.3	51.3	51.3	34.2	119.7	34.2	102.6
pH	6.5	6.7	6.8	6.9	6.7	7.0	6.3	6.8	6.5
Specific conductance in micromhos at 25°C	90	130	130	120	120	80	300	90	240
Date analyzed	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75

Well Number	M64 x-2	N58 p-1	N58 x-1	N59 i-1	N59 t-1	N59 y-1	N60 a-1	N60 e-1	N60 f-1
Iron (Fe)	.05	.9	1.6	.1	.9	1.1	.1	.05	.04
Chloride (Cl)	4.5	1.3	3.0	48.0	4.0	103	2.5	2.0	3.2
Fluoride (F)	.3	.6	.5	.4	.35	.35	.35	.4	1.15
Nitrate (NO_3)	-	-	-	-	-	6.0	-	-	-
Hardness - total	51.3	34.2	51.3	205.2	68.4	342.0	34.2	85.5	100.0
pH	6.9	7.0	6.6	6.4	6.5	6.3	7.2	6.9	7.2
Specific conductance in micromhos at 25°C	120	210	120	520	170	800	80	160	160
Date analyzed	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	11/8/63

Well Number	N60 q-1	N60 t-1	N61 m-1	N61 o-1	N61 t-1	N62 e-1	N62 e-2	N62 e-4	N62 e-5
Iron (Fe)	.05	.1	.05	.15	.05	.0	.0	.5	.2
Chloride (Cl)	2.5	1.5	6.0	13.0	4.5	-	-	-	-
Fluoride (F)	.35	.3	.3	.3	.55	.2	.1	.0	.0
Nitrate (NO_3)	-	-	-	1.0	1.0	-	-	-	-
Hardness - total	34.2	34.2	68.4	34.2	102.6	210.0	175.0	55.0	95.0
pH	7.3	7.2	6.6	6.9	6.8	7.2	7.5	6.2	7.0
Specific conductance in micromhos at 25°C	50	70	160	150	220	415	400	185	220
Date analyzed	8/6/75	8/6/75	8/6/75	8/6/75	8/6/75	3/8/68	3/8/68	4/7/68	3/8/75

Well Number	N62 m-5	N62 m-7	N63 a-1	N63 b-1	N63 e-1	N63 j-2	N63 l-1	N63 l-2	N63 p-8
Iron (Fe)	.25	.1	.1	.05	.25	.00	.49	.15	.1
Chloride (Cl)	-	3.5	2.0	2.5	3.5	-	2.0	7.0	4.0
Fluoride (F)	-	.4	.4	.4	.4	.1	1.8	3.0	.2
Nitrate (NO_3)	.01	-	-	-	-	-	.2	-	1.0
Hardness - total	17.1	136.8	34.2	17.1	34.2	125.0	449.0	51.3	34.2
pH	6.5	6.8	6.8	6.8	7.1	7.2	7.3	6.3	6.3
Specific conductance in micromhos at 25°C	80	280	95	70	70	310	696	160	110
Date analyzed	3/14/75	8/6/75	8/6/75	8/6/75	8/6/75	3/8/68	6/49	6/14/74	6/7/74

Well Number	N63 p-9	N64 d-1	N64 i-1	N64 i-2	N64 n-1	N64 q-1			
Iron (Fe)	.02	.05	.15	.1	.05	.05			
Chloride (Cl)	4.5	2.0	3.0	2.5	2.0	3.0			
Fluoride (F)	.25	.3	.35	-	.3	.4			
Nitrate (NO_3)	-	-	-	-	-	-			
Hardness - total	34.2	34.2	51.3	34.2	34.2	68.4			
pH	6.3	6.8	6.7	6.7	6.8	7.0			
Specific conductance in micromhos at 25°C	70	60	80	80	90	190			
Date analyzed	6/7/74	8/6/75	8/6/75	4/4/75	8/6/75	8/6/75			

GROUNDWATER POLLUTION

Groundwater contamination and pollution is a potential problem in small areas of Rowan County. There are no actual measured and monitored areas of contamination, but several potential pollution sources have been inventoried and located (fig. 24). The Groundwater Section is continuing to inventory pollution sources as they are located and is sampling the groundwater in their vicinity to determine the extent of any possible contamination associated with the source.

Permanent water quality monitor wells are being established and sampled at regular intervals. Baseline monitor wells are established to determine any natural changes in water quality which might occur. These wells are located so as to be free from any man-caused contamination. Pollution monitor wells are those which monitor the extent of contamination from a known pollution source. Quality of water analyses from these wells are compared with the analyses from the baseline wells to determine if any change measured is a result of groundwater contamination or from a natural source. The locations of water quality monitor wells now being sampled are shown on figure 23. As of this time, no groundwater pollution has been definitely established in Rowan County.

There have been some individual cases of bacterial contamination of wells, but in most cases the cause has been attributed to poor well construction allowing entrance of water into the well from land surface. When these wells were properly repaired, contamination was eliminated.

GROUNDWATER MANAGEMENT

Current Groundwater Use

Domestic groundwater supplies account for the major portion of inventoried groundwater use in Rowan County. The total groundwater use by industrial, commercial, agricultural, and public water supplies is not known. The location of inventoried non-domestic wells is shown in figure 25 and tabulated in table 6. The total amount of groundwater utilized for non-domestic use that has been reported is approximately 4.4 million gallons per day. Estimated groundwater use based on current population and considering industrial use is 6.3 million gallons per day.

Potential Yield

Information on file indicates that it is possible to develop groundwater supplies of several hundred thousand gallons per day throughout most of the county. Estimates of the productivity of the aquifer system, based on streamflow data, are shown for much of the county in figure 20. The potential yield of groundwater in Rowan County is estimated to be in excess of 155,000,000 gallons per day.

Groundwater Management

There is no current management plan for the use of groundwater in Rowan County. At the present rate of use, no management is necessary. However, if use in small areas exceeds 300,000 gpd, local management and use plans might be necessary.

Present control over groundwater use is only by the issuance of Well Construction Permits by the Department of Natural and Economic Resources.

Table 6. - Groundwater use other than domestic.

Well Location Number	Owner	Type of Use	Maximum Daily Yield in Gallons per Day
L60 o-1	Finetex, Inc.	Industrial	64,800
L60 o-2	Finetex, Inc.	Industrial	57,600
L61 c-1	City of Salisbury	Industrial (cooling)	11,520
L61 d-1	David L. Frye	Public	21,600
L61 g-1	Yarborough & Burge	Public	
L61 g-2	Yarborough & Burge	Public	
L63 n-1	Rowan County Board of Education	School	14,400
L63 p-2	T. Hall	Agricultural	7,200
L63 q-1	Rowan County Board of Education	School	144,000
L64 a-2	Town of Cleveland	Municipal	161,280
L64 j-1	Town of Cleveland	Municipal	50,400
M59 y-1	D. C. Shepherd	Public	14,400
M60 f-1	Hannah Construction Co.	Public	50,400
M60 f-2	Hannah Construction Co.	Public	21,600
M60 f-5	Hannah Construction Co.	Public	108,000
M60 i-1	Rowan County Parks & Rec. Dept.	Public	11,520
M60 i-2	Rowan County Parks & Rec. Dept.	Public	36,000
M60 i-4	Rowan County Parks & Rec. Dept.	Public	57,600
M60 j-1	Hornets Nest Scout Council, Inc.	Public	36,000
M60 j-2	Rowan County Parks & Rec. Dept.	Public	17,280
M61 e-1	C. Parrish	Industrial	216,000
M61 h-1	Mrs. B. Martin	Commercial	43,200
M61 j-1	R. A. Everhardt	Public	144,000
M61 k-2	McCanless Golf Course	Public	57,600
M61 n-1	Rowan County	Public	79,200
M61 u-1	Rowan County Board of Education	School	86,400
M61 u-3	Indian River Fruit Company	Commercial	34,560
M61 w-1	Town of Faith	Municipal	57,600
M61 w-3	Town of Faith	Municipal	28,800

Table 6. - Groundwater use other than domestic - continued.

Well Location Number	Owner	Type of Use	Maximum Daily Yield in Gallons per Day
L61	Rowan County Parks & Rec. Dept.	Public	25,920
L61	W. Wamsley	Public	43,200
L61	H. Rhodes	Irrigation	7,200
L61 h	M. Burrage	Public	17,280
L61 t	Town of Spencer	Municipal	37,000
L61 t	Town of Spencer	Municipal	24,000
L61 t	Town of Spencer	Municipal	24,000
L61 t	Town of Spencer	Municipal	27,000
L62	J. Foil	Stock	21,600
L63	Pilch-DeKalb	Industrial	28,800
L64 f	Knox Brothers Farm	Agricultural	64,800
L64 v	E. Little	Industrial	43,200
M59	H. Hall	Commercial	8,640
M60 y	Salisbury Christian School	Institutional	21,600
M61	Trailer City Park	Public	72,000
M62	V. McKinney	Stock	8,640
M62 j	Roadway Truck Terminal	Commercial	36,000
M64 k	Caldwell Dairy Farm	Stock	14,400
N60	Rockwell Mobile Home Park	Public	14,400
N63 j	China Grove Cotton Mills	Industrial	64,800
N63 j	China Grove Cotton Mills	Industrial	36,000
N63 j	China Grove Cotton Mills	Industrial	43,200

SUMMARY AND RECOMMENDATIONS

Groundwater is a natural resource available for use by everyone in Rowan County. Presently groundwater supplies thousands of single family residences and many industrial, public, and municipal systems.

The minimum yield for the crystalline rock-saprolite aquifer system has been estimated at 300,000 gpd. Several of the largest groundwater users withdraw approximately 200,000 gpd with only minimal lowering of the water table. If proper hydrogeologic considerations are used in selecting well locations, it is possible to develop groundwater supplies of several hundred thousand gallons per day.

The natural quality of groundwater in Rowan County is excellent. There are no documented instances of groundwater pollution, but the potential for contamination is present. Continued monitoring of water quality is necessary to maintain the quality at the present level. All waste disposal systems should be designed to prevent or minimize any hazard to the groundwater resources of Rowan County.

Present groundwater use in Rowan County is small. No groundwater management is necessary at the present time, but local management plans may be necessary in the future if withdrawal exceeds a safe amount in small areas.

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