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GEOLOGY AND GROUND-WATER RESOURCES IN THE HAYS AREA, WILKES COUNTY, NORTH CAROLINA

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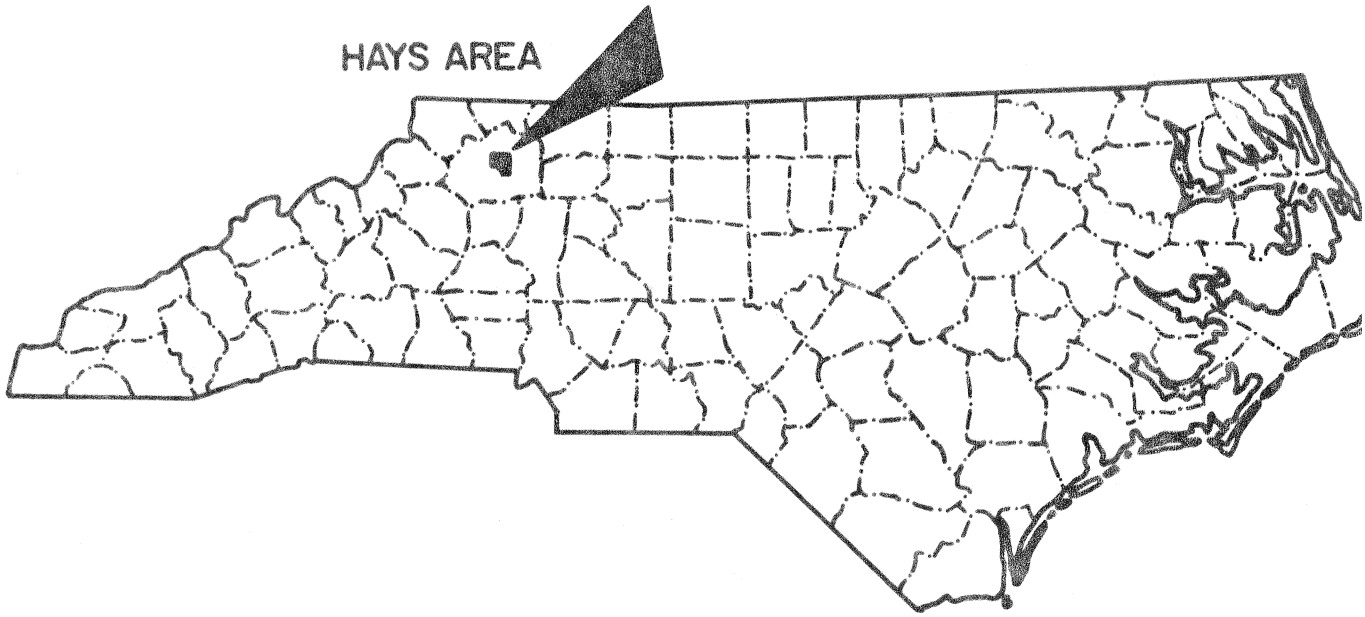

DIVISION OF GROUND WATER
NORTH CAROLINA
DEPARTMENT OF WATER RESOURCES
1965

GEOLOGY AND GROUND-WATER RESOURCES IN THE HAYS AREA, WILKES COUNTY, NORTH CAROLINA

by

Richard R. Peace, Jr.

Ground-Water Circular No. 9

North Carolina
DEPARTMENT OF WATER RESOURCES
Walter E. Fuller, Director

DIVISION OF GROUND WATER
Harry M. Peek, Chief

Raleigh

April 1965

NORTH CAROLINA

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INTRODUCTION

In February 1965, Mr. Joe Brewer, N. C. State Representative from Wilkes County requested information concerning ground-water conditions around the community of Hays in Wilkes County. The information is to be used in the planning of the water supply for the Blue Ridge Water Association, a rural water district. The proposed district plans to supply about 450 customers in the Hays area where, presently, there are more than over 850 potential customers. Mr. Brewer asked that the work be coordinated through Mr. Judson Yale who is president of the Association. The investigation and this report giving the results of the investigation were made under the general supervision of Mr. Harry M. Peek, Chief of the Ground Water Division, N. C. Department of Water Resources.

LOCATION OF AREA

The Hays area is in the central part of Wilkes County and lies between north latitudes 36°10' and 36°17' and west longitudes 81°03'30" and 81°09'30" (Fig. 1). It comprises about 30 square miles, bounded on the northeast by the Roaring River, on

the south by the Yadkin River and on the west by the communities of Fairplains and Mulberry.

Because of the use of the information in this report--the development of water wells for the rural water system--most of the field work was devoted to an area along the main lines of the proposed system. This area extends northward from N. C. 268 along road number 1966 to Hays, and northward from Hays along road number 1002.

PURPOSE AND SCOPE

The main purpose of the investigation was to map the geology of the area and to relate the geology to potentially good drilling sites for developing large supplies of ground water. Another purpose was to inventory selected wells to determine the quality and quantity of water that might be available in the area. These purposes were fulfilled by mapping the rock units and the structural features of the area (Figs. 1 and 2); by recommending well-drilling sites (see Recommendations section); and by making chemical analyses on selected samples of water (Table 1). The inventoried wells and spring were numbered according to the statewide well-numbering system that is based on 1- and 5-minute quadrangles of latitude and longitude.

ACKNOWLEDGEMENTS

The author expresses his appreciation to W. K. Dickson Co., Inc. for furnishing base maps of the area; to Mr. Arthur Newman

of the Newman Brothers Well Drilling Company for information concerning the hydrologic data in the area; to Mr. Judson Yale for time spent in showing the author over the area; and to the citizens who furnished information concerning their water supplies.

GEOLOGY

The geologic map of Wilkes County in figure 1, based primarily on the Geologic Map of North Carolina, indicates the complexity of the geology in the Piedmont Region. As may be seen, the county is underlain by a series of metamorphic rocks of Precambian (?) age that have been intruded by granites of Paleozoic (?) age. The Hays area of the county is underlain by the three major units of the metamorphic series, but predominantly by the mica schist unit. The mica-gneiss unit occurs in the northwest corner of the area and beneath a small area in the southeastern part. A narrow band of the hornblende gneiss unit occurs with the mica-gneiss unit in the northwestern corner of the area. The strike of the rocks generally paralells the northeast regional strike. Although mapped as single units, the gneiss units contain layers and zones of schist and other rock types of relatively local extent. Likewise, the schist unit is interbedded with gneiss at many places and locally contains other rock types. Most of the rocks of the area have been subjected to intensive weathering and unweathered rocks crop out at few places.

The hornblende gneiss is composed of hornblende, quartz, and feldspar. The color ranges from light to dark gray. In the weathered outcrops, much of the rock shows a dark red color laced with

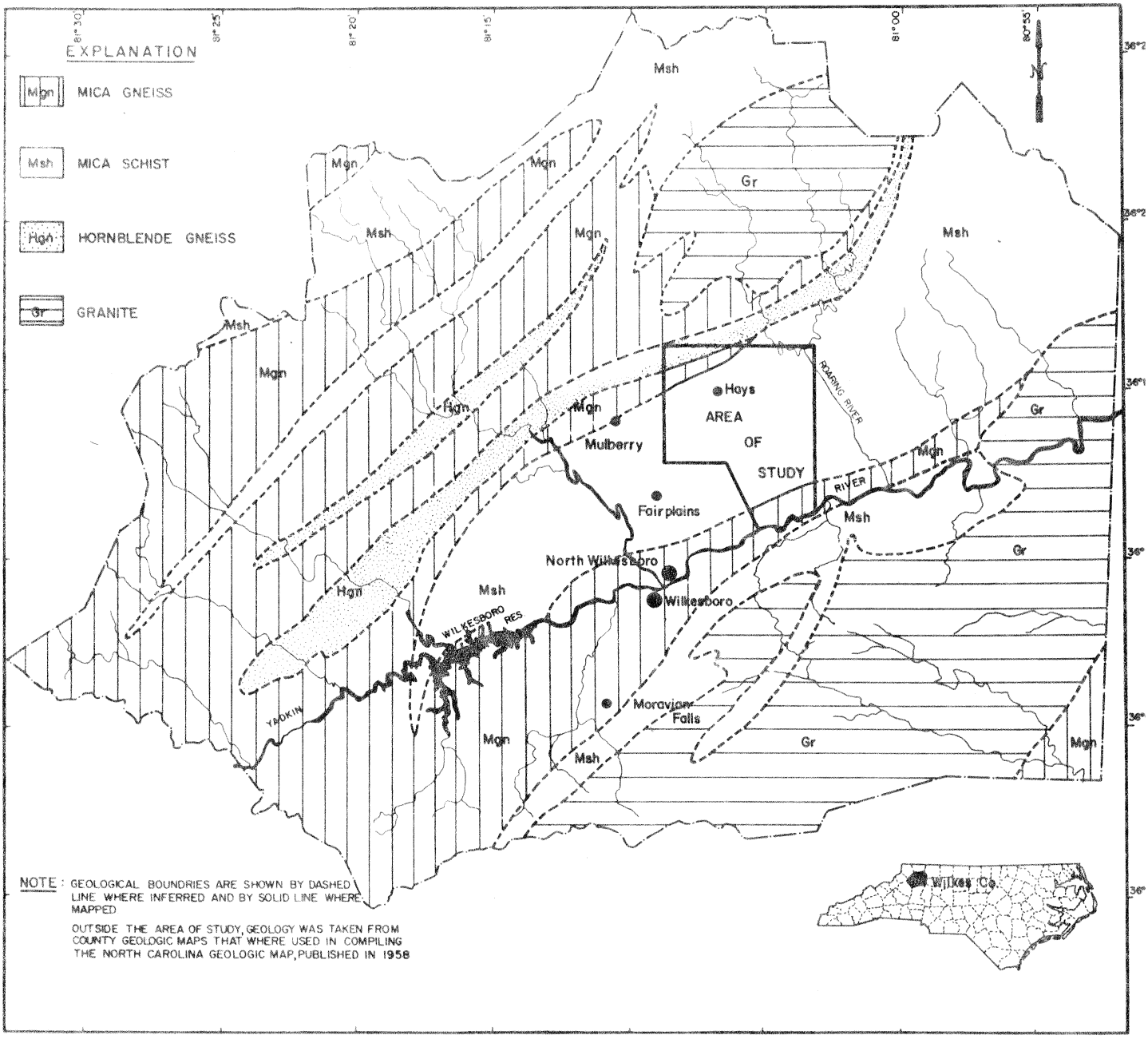

Figure 1 - GEOLOGIC MAP OF WILKES COUNTY, NORTH CAROLINA, SHOWING AREA OF STUDY

black fragments of weathered hornblende. The mica gneiss consists chiefly of quartz, feldspar, and biotite. The color is generally dark gray. Much of the weathered area of the mica gneiss is void of any rock fragments and the color of the residual is red. This residual of the mica gneiss rock resembles the residual of a composite gneiss the author has mapped in Iredell County. The mica schist is composed principally of feldspar, quartz, hornblende and muscovite and the color ranges from gray to dark gray. Strong planes of schistosity are present in the rock and are well preserved in the weathered outcrops. Most exposures are weathered to a considerable degree and are dark red to brown in color.

Quartz veins were mapped at numerous places in the Hays area and these locations are shown in figure 2. On County Road 1713, one quartz vein was located on which strike and dip could be measured with accuracy. The strike of this quartz body was N15°E and the dip was 70°SE.

GROUND WATER

Ground water is water below the land surface that flows from or is pumped from springs and wells. In the Hays area ground water is derived from local precipitation, chiefly in the form of rain and occasionally in the form of snow. A part of the precipitation flows into streams and lakes as direct runoff, a part returns to the atmosphere through evaporation and transpiration, and a part seeps downward through the soil and rocks to become ground water.

Ground water occupies interstices or open spaces in the soil and rocks of the earth's crust. According to their origin these

interstices can be divided into original and secondary. Original interstices are created as a result of the process by which the rock was formed, and secondary interstices are created by processes that affect the rock after it is formed. The size, shape, and arrangement of these voids affect the storage and movement of ground water.

The data collected during this investigation indicate that in some areas the rocks are highly fractured as indicated by the main veins of secondary quartz that cut the formations of schist and gneiss. In these areas, ground-water supplies of 80,000 gpd (gallons per day) or more can be developed from individual wells. These areas are shown in figure 2 and are discussed in the section under Recommendations.

QUALITY OF WATER

The quality of ground water depends upon the amount and kind of dissolved matter in the water and varies from place to place. The amount and type of dissolved mineral matter in a specific sample of ground water depends primarily upon the type of soil through which the water has moved, the type of rock through which the water has passed, the time the water has been in contact with the soil and rock, and the temperature of the water.

The most common mineral constituents in ground water are the cations--calcium, magnesium, sodium, potassium, and iron; and the anions--bicarbonate, carbonate, sulfate, chloride, fluoride, and nitrate. Silica, also, is present in most natural waters. Standards for drinking water established by the U. S. Public Health

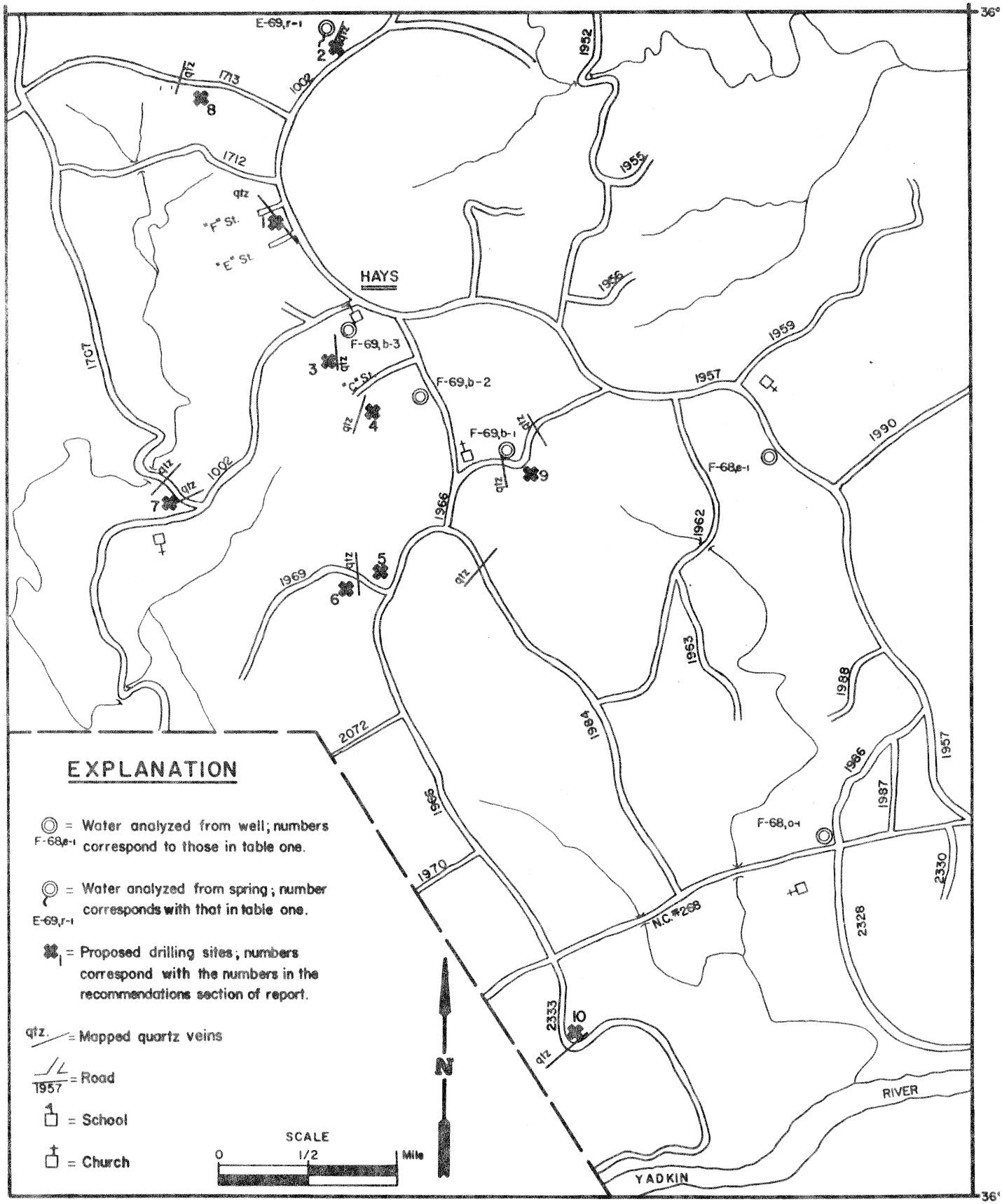

Figure 2 - LOCATIONS OF PROPOSED DRILLING SITES AND SELECTED WELLS IN THE HAYS AREA, WILKES COUNTY, NORTH CAROLINA

Service (1962) to control the quality of water supplied by common carriers generally are quoted as desirable for drinking water. According to these standards, supplies should not contain more than 0.3 ppm (parts per million) of iron, 250 ppm of sulfate, 250 ppm of chloride, 45 ppm of nitrate, and 500 ppm of total dissolved solids.

The water in the Hays area is of excellent quality as it contains only small amounts of dissolved matter. Chemical analyses were made on six selected samples of ground water from the Hays area (Table 1). All constituents were within the limits of the U. S. Public Health Service's recommendations, except the iron content in well number F68-e1. The reader's attention is called to the note in table 1 concerning the condition under which the sample from well F68-e1 was collected. Discussion with residents of the area indicated that there is no problem of high iron content in the water supply. The pH, a measure of the acidic or basic property of the water, ranges from 5.4 to 7.5. The color and turbidity is very low. The hardness of ground water from soft to moderately hard. This classification is according to Lamar's (1942, p. 25-26) and is as follows:

Hardness

Parts per million	Description
1 - 60	Soft
61 - 120	Moderately Hard
121 - 200	Hard
201 - and more	Very Hard

CONCLUSIONS

The results of the investigation of the geology and groundwater resources of the Hays area, Wilkes County, North Carolina are as follows:

1. The principal rock underlying the area is gray to dark-gray mica schist. Light to dark-gray hornblende gneiss is exposed in the extreme northwest part of the area and dark gray mica gneiss is exposed in a narrow band in the northwest part of the area and in the extreme southeast part of the area.
2. The rocks in the area have been subjected to intense weathering.
3. The rocks have been highly fractured at many places as indicated by quartz veins that occur at numerous places in the Hays area.
4. Where veins of quartz cut the schist and gneisses, yields of 80,000 gpd or more can probably be developed.
5. The water in the Hays area is of excellent quality, containing only small amounts of dissolved matter.

RECOMMENDATIONS

The selection of favorable well-drilling sites was the principal objective of this investigation. The most favorable locations for wells in an area of consolidated rocks, such as underlies the Hays area, are:

1. At sites where quartz veins, indicating major fracture zones, occur in draws.
2. At sites where quartz veins or other indications or major facture zones occur, regardless of topography.
3. In the head of draws where topography generally indicates zones of fracturing.

The selected drilling sites are shown in figure 2 and are described below as to location, topography, and geology in the order of priority favored by the author. However, after each well is drilled, another evaluation should be made on the overall drilling plan as the order might be changed because of new information. The area contains many other favorable sites.

Primary Sites

1. In the area on E Street or F Street, about 100 to 300 feet west of road 1002. Slope. Large quartz intrusions.
2. On road 1002, 2,700 feet northeast of road 1713. Valley on north side of creek and west side of road. Numerous pieces of quartz. Large quartz vein 100 feet to the north of site.
3. On wildlife property south of fire station. About 200 feet northeast of wildlife club building on east edge of trail road. Slope. Numerous pieces of quartz float.
4. About 2000 feet south of C Street, about 200 feet before C Street dead ends. On slope of large draw southwest of house. Large quartz vein in road.

5. North side of road 1969 and west side of road 1966, long northwest trending draw. Quartz float in road cut.

6. South side of road 1969 two-tenth mile west of road 1966. South trending draw. Quartz float in road cut.

7. On road 1707 three hundred feet off road 1002 either directly behind the old house in steep-sided draw or about 200 feet behind old house in bottom. Large quartz vein in road cut. In front of old house and small quartz vein about 200 feet north on road.

8. On road 1713, four-tenth mile west of road 1002. In draw. Quartz observed in road cut 200 feet west of draw.

9. 300 feet east of road 1966 on unnumbered road between roads 1966 and 1957. In valley small quartz veins observed on both sides of road cuts coming into narrow valley.

10. East side of road 2337 south of N. C. 268 at 90° left-hand turn in road. Steep draw, trending to the east. Largest (about 3 feet wide) quartz vein observed in Hays area.

Table 1. -- Partial chemical analyses of water from selected wells and a spring in the Hays area, Wilkes County, North Carolina.

(Results are in parts per million except as indicated)

Spring Number: E69-r1
Owner: F. Pendry
Yield: 50 gpm (est.)

Appearance when collected: Clear
Use: Domestic
Date of collection: 3-18-65

Iron (Fe)		Trace
Calcium (Ca)		5
Carbonate (CO_3)		0
Bicarbonate (HCO_3)		7
Sulfate (SO_4)		0
Chloride (Cl)		8
Silica (SiO_2)		12
Nitrogen (NO_2 and/or NO_3)		0.5
Total Hardness (as $CaCO_3$)		10
Specific conductance in micromhos at 25° C	less than	50
pH		5.4
Color (Apparent)		3 units
Turbidity		0

Well Number: F68-e1
Owner: W. V. Byrd
Use: Grocery Store

Date of collection: 3-18-65
Appearance when collected: Slightly dingy

Note: Well had not been in regular use for sometime because of a broken water line; therefore, the iron content may reflect absorbation from the iron water lines. Because of the broken line the water system was not throughly flushed before sample was taken.

Iron (Fe)		1.55
Calcium (Ca)		50
Carbonate (CO_3)		0
Bicarbonate (HCO_3)		70
Sulfate (SO_4)		8
Chloride (Cl)		4
Silica (SiO_2)		23
Nitrogen (NO_2 and/or NO_3)		3.0
Total Hardness (as $CaCO_3$)		95
Specific conductance in micromhos at 25° C		115
pH		6.8
Color (Apparent)		48 units
Turbidity		18 Jackson units

Table 1. -- Continued

Well Number: F68-o1
Owner: J. L. Elmore
Depth: 157 feet
Diameter: 6 inches
Cased to: 80 feet
Date of collection: 3-18-65

Water Level, below land surface: 27 feet
Yield: 7½ gpm
Appearance when collected: Clear
Use: Domestic (3 houses and grocery store)

Iron (Fe)	.05
Calcium (Ca)	10
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	42
Sulfate (SO_4)	0
Chloride (Cl)	6
Silica (SiO_2)	25
Nitrogen (NO_2 and/or NO_3)	8.5
Total Hardness (as $CaCO_3$)	10
Specific conductance in micromhos at 25° C	58
pH	5.9
Color (Apparent)	0
Turbidity	0

Well Number: F69-b1
Owner: J. C. Haynes
Water Level, below land surface: 13 feet
Yield: 10 gpm

Date of collection: 3-18-65
Appearance when collected: Clear
Use: Domestic and poultry houses

Iron (Fe)	0.3
Calcium (Ca)	45
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	71
Sulfate (SO_4)	2
Chloride (Cl)	10
Silica (SiO_2)	13
Nitrogen (NO_2 and/or NO_3)	0.5
Total Hardness (as $CaCO_3$)	55
Specific conductance in micromhos at 25° C	105
pH	7.3
Color (Apparent)	0
Turbidity	0

Table 1. -- Continued

Well Number: F69-b2
Owner: Holly Farms
Depth: 312 feet
Diameter: 6 inches
Water Level, below land surface:
47 feet

Date of collection: 3-18-65
Appearance when collected: Clear
Use: Domestic and poultry
(4500 chickens)

Iron (Fe)	.15
Calcium (Ca)	25
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	62
Sulfate (SO_4)	3
Chloride (Cl)	10
Silica (SiO_2)	28
Nitrogen (NO_2 and/or NO_3)	0
Total Hardness (as $CaCO_3$)	40
Specific conductance in micromhos at 25° C	100
pH	7.1
Color (Apparent)	0
Turbidity	0

Well Number: F69-b3
Owner: Wilkes County Board of Education
(Mountain View School)
Depth: 310 feet
Diameter: 6 inches
Yield: 56 gpm (pumped 6 hours on test)

Date of collection: 3-18-65
Appearance when collected: Clear
Use: Public supply, (803 students, and used to fill 2000 gallon tank on fire truck)

Iron (Fe)	.5
Calcium (Ca)	50
Carbonate (CO_3)	0
Bicarbonate (HCO_3)	64
Sulfate (SO_4)	6
Chloride (Cl)	6
Silica (SiO_2)	37
Nitrogen (NO_2 and/or NO_3)	0.5
Total Hardness (as $CaCO_3$)	55
Specific conductance in micromhos at 25° C	110
pH	6.8
Color (Apparent)	5 units
Turbidity	0

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