COMMONWEALTH OF VIRGINIA

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT

DIVISION OF MINERAL RESOURCES

GEOLOGY AND GROUND-WATER RESOURCES OF PITTSYLVANIA AND HALIFAX COUNTIES

HARRY E. LEGRAND

BULLETIN 75

VIRGINIA DIVISION OF MINERAL RESOURCES

James L. Calver
Commissioner of Mineral Resources and State Geologist

CHARLOTTESVILLE, VIRGINIA
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1960

Bulletin 75, "Geology and Ground-Water Resources of Pittsylvania and Halifax Counties" by H. E. LeGrand, Division of Mineral Resources, Charlottesville, Virginia.

ERRATA

p. 21 par. 4 ... water in either ... to read ... water table in either ...

p. 24 Table 2... 0.03 parts ... to read ... 0.3 part ...

p. 42 par. 1 ... movement water ... to read ... movement of water ...

p. 49 par. 2 ... action sheet ... to read ... action of sheet ...

p. 53 par. 5 ... Southewest ... to read ... Southwest ...

p. 55 Table 8... $CACO_3$ ... to read ... $CaCO_3$ ...

p. 68 par. 4 ... contains wells from which high yields of water may be obtained ... to read ... is the poorest area insofar as high-yielding wells are concerned ...

p. 70 Table 10.. $CACO_3$ ... to read ... $CaCO_3$ ...

CONTENTS

PAGE

Abstract 1

Introduction 3

Geography
- Area and population 6
- Physical features 6
- Climate 7

Geology
- General statement 8
- General discussion of rock characteristics
  - Sedimentary rocks of Triassic age 10
  - Leatherwood granite 11
  - Mica schist 11
  - Mica schist and granite 12
  - Hornblende gneiss 12
  - Melrose granite 13
  - Mixed gneisses 13
  - Granite gneiss 14
  - Gabbro 16
  - Slates and related volcanic rocks of the Virgilina district 16

Ground water
- Occurrence and movement of ground water 18
- Significance of the water table 21
- Springs 22
- Quality of ground water 23
- Flood-plain deposits 25
- Types of wells 26

Yield of wells
- Introduction 29
- Water levels and the effect of pumping 29
- Relation of yield of wells to depth 32
- Effect of type of rock 34
- Effect of topographic location 35
- Structure in relation to yield of wells 37
- Thickness of weathered materials 38

CONTENTS Continued

PAGE

Conservation and Records

The owner's record and knowledge of his well 39

Contamination of ground-water supplies 40

Potential development of ground water 41

Conservation of ground water 41

Summary 44

County descriptions

Introduction 47

Pittsylvania County

Population and industry 47

Physical geography 49

Geology 50

Ground water 53

Halifax County

Population and industry 65

Physical geography 65

Geology 66

Ground water 68

Glossary 80

References 82

Index 85

ILLUSTRATIONS

PLATE | PAGE

1. Geologic and ground-water map of Pittsylvania and Halifax counties, Virginia . . . . . In Pocket

FIGURE | PAGE

1. Outline map of Virginia showing location of Pittsylvania and Halifax counties and other parts of the Piedmont and Blue Ridge provinces where similar ground-water conditions occur 4
2. Interlayering of light and dark beds of the mixed gneisses along U. S. Highway 501, two miles south of Cluster Springs 15
3. Diagrammatic sketch showing types of topography and typical subsurface cross section in the Piedmont province of Virginia 19
4. Typical subsurface cross section showing the character of materials penetrated by a well on an upland area 20
5. Cross section of a stream valley showing subsurface conditions 27
6. Diagram showing six types of fracture-characteristics that influence the yield of wells 31

TABLES

PAGE

1. Springs in Pittsylvania County 23
2. Standard Water Specifications—Adopted by the American Water Works Association for public water supplies 24
3. Average yield of drilled wells according to depth 33
4. Relationship of depth to yield 33
5. Average yield of drilled wells according to rock type 35
6. Average yield of drilled wells according to topographic location 36
7. Relationship of topography to yield 36
8. Chemical analyses of ground water of Pittsylvania County 55
9. Well records of Pittsylvania County 56
10. Chemical analyses of ground water of Halifax County 70
11. Well records of Halifax County 72

Geology and Ground-Water Resources of Pittsylvania and Halifax Counties Virginia

HARRY E. LEGRAND

ABSTRACT

Ground water in Pittsylvania and Halifax counties is utilized by about two-thirds of the population. It is used in all rural areas, some industrial areas and the town of Halifax. Surface water is used by the municipalities of Chatham, Danville, Gretna, and South Boston.

These counties are located in the south central part of Virginia and are in the Piedmont province. Topography within these counties consists of low, rounded hills with gentle slopes and a few isolated ridges. Three rivers in the counties, the Roanoke River to the north, the Bannister River in the middle, and the Dan River to the south, flow eastward in channels that were cut more than 100 feet below the upland area. These rivers receive drainage from a close network of tributary streams. Parts of all streams flow directly on bedrock and other parts flow over a few feet thickness of channel sand. Flood-plain deposits that contain an upper zone of clay and a lower zone of sand and gravel, occur as bordering parts of all streams. Bedrock is exposed on many steep slopes adjacent to valley floors. A residuum that is composed of surface soil and as much as 60 feet of soft weathered rock covers much of the upland area.

The geology of the counties is described, and the structural and topographic characteristics of the bedrock are shown to be important factors that govern the yield of individual wells. The water table generally occurs in soft weathered rock, a few feet above the hard fresh rock much of which is fractured. Small amounts of water are obtained from dug and bored wells in soft weathered rock. Adequate domestic supplies are obtained in most cases from drilled wells in fractured hard fresh rock. Drilled wells range in yield from less than one gallon per minute to more than 100 gallons per minute; they range in depth from about 60 to 500 feet.

The amount of water available from a particular well is correlated with the surrounding topography. The average yield of wells located in draws is several times that of wells on hills and more than that of wells in other topographic locations. More than 90 percent of the wells are drilled in hilly, upland areas where conditions are unfavorable for large supplies of water.

The withdrawal of water from wells is only a fraction of that available for recharging the underground reservoir. Recharge, derived from about 44 inches of rainfall annually, occurs in the upland areas; discharge occurs mainly in adjacent lowlands. The annual recharge and discharge are in balance, and therefore there is no increase or decrease in the annual trend in the fluctuation of the water table.

Good quality water is obtained from fracture zones within schists and gneisses. Water from only a few wells contains objectionable amounts of the iron impurities. Water from wells in Triassic sediments is hard in many cases.

INTRODUCTION

The results of a recent investigation of the ground-water resources of Pittsylvania and Halifax counties are included in this report. The study was made under the direction of James L. Calver, Commissioner of Mineral Resources and State Geologist, Division of Mineral Resources, Virginia Department of Conservation and Economic Development.

Field work was started in July, 1958, and was carried on intermittently until January, 1959. It consisted of obtaining data on 369 wells, collecting samples of water, and studying the geology and the topography of individual well locations. Information concerning the wells was obtained chiefly from the well owners and well drillers.

There were two main purposes for the study. The first was to appraise the ground-water situation within the two counties, and the second was to try to establish some generalizations that might be helpful to persons developing water supplies in areas underlain by similar rocks in other counties of the Piedmont province in Virginia. It has long been known that wells in igneous and metamorphic rocks have different depths and yields, even though they are closely spaced and are located in similar rocks. These characteristics of the wells prevent a close correlation between ground-water conditions and rock types; and, therefore, have prompted a study of the factors that are related to the occurrence and movement of underground water in these crystalline rocks. In this report diagrammatic sketches and generalizations regarding ground water should have considerable value in estimating ground-water conditions in other counties of the Piedmont province in Virginia (Figure 1).

An attempt was made to simplify and reduce the number of geologic and hydrologic terms to a minimum. However, some terms, which might not be understood by all readers, are listed in a glossary at the end of the report.

The writer is indebted to James L. Calver, Commissioner of Mineral Resources and State Geologist of Virginia for encouragement throughout the investigation and help in guiding the project through to completion. E. O. Gooch and Coyd Yost of the Division of Mineral Resources made numerous helpful suggestions. Ten

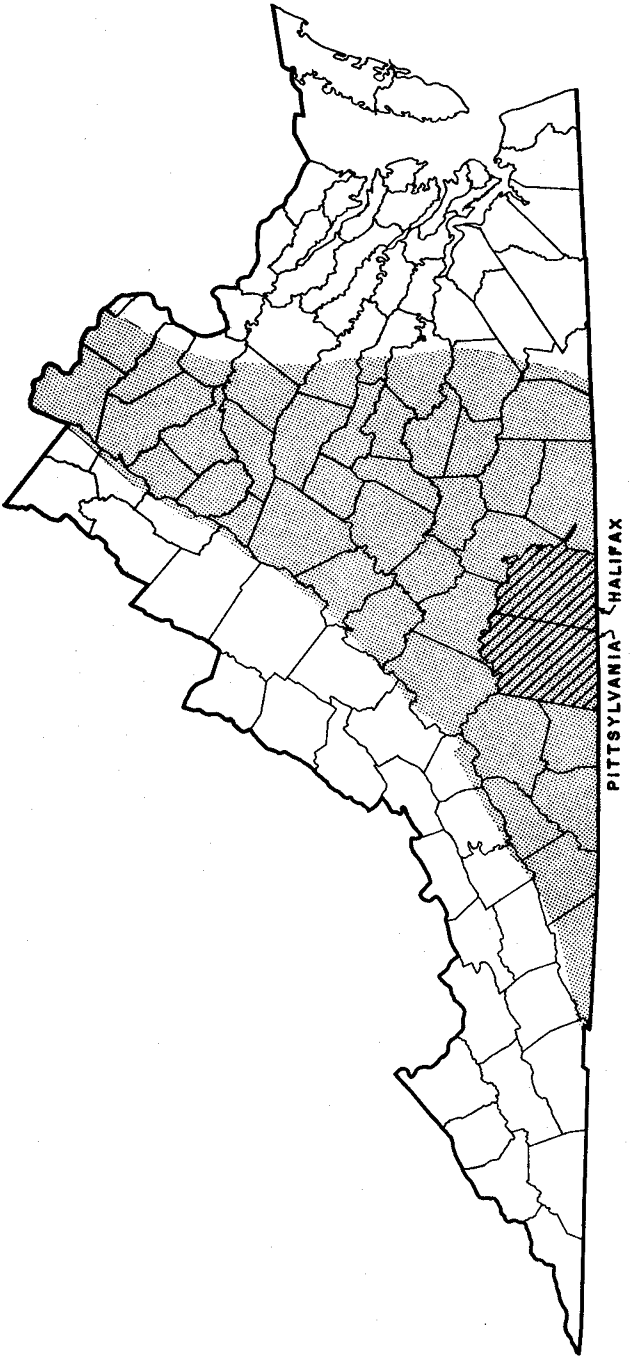

Figure 1.—Outline map of Virginia showing location of Pittsylvania and Halifax counties and other parts of the Piedmont and Blue Ridge provinces where similar ground-water conditions occur.

water samples were analyzed by the State Water Control Board in Richmond. Special help was given by Rich Well Drilling Company of Danville, "Red" Connor Well Company of Volens, W. E. Doss Well Company of Clover, Heater Well Company of Raleigh, N. C., and Dan Hightower of Sinai.

GEOGRAPHY

AREA AND POPULATION

The location of the area investigated is illustrated in Figure 1 of this report. It includes a total area of 1,820 square miles, of which 1,012 square miles are in Pittsylvania County and 808 square miles are in Halifax County. The 1950 census for the area numbered about 143,000 people.

A detailed discussion of population and industry is included with the descriptions for each county.

PHYSICAL FEATURES

Pittsylvania and Halifax counties lie within the Piedmont province (Figure 1). The upland areas, connecting the high points of the interstream areas, are parts of a land surface that has been dissected by numerous streams. Elevations of valley floors which have been lowered as a result of stream erosion are generally more than 100 feet below the upland areas. The hills and ridges are characterized by smooth slopes that are mantled with a deep layer of soil and rotten rock. These slopes are smooth except near streams where they become steep and somewhat broken.

The land surface slopes eastward, from about 900 feet above mean sea level in western Pittsylvania County to about 500 feet above mean sea level in eastern Halifax County. Prominent peaks and ridges, or monadnocks, are as much as 100 feet higher in elevation than the general land surface elevation in Pittsylvania County. The most prominent of these is Whiteoak Mountain, a long ridge extending in a northeastward direction through the county. The monadnocks are composed of rocks more resistant to weathering and erosion processes than the rocks of surrounding areas. Whiteoak Mountain is underlain by dense resistant sandstone, whereas the adjacent land surfaces are underlain by closely interlayered gneisses and schists that are covered with a deep soil cover.

The area is drained by two major rivers each having an eastward course. These are the Staunton River (called Roanoke River both upstream and downstream from the area studied), that forms the north boundary of both counties, and the Dan River that is located near the Virginia State boundary. Bannister River flows in an eastward direction through the central area and previously joined the Dan River a few miles east of South Boston. The Bannister, Staunton, and Dan rivers flow into the Buggs Island Lake.

A close network of tributary streams, courses of which are quite diverse, characterizes the drainage. Parts of many stream courses are determined by the geologic structure of the area.

CLIMATE

The mean annual precipitation in Pittsylvania and Halifax counties is about 44 inches which is distributed fairly evenly throughout the year. The largest amount of rain generally comes in late spring and summer and the smallest amount of rain comes in October and November. The maximum annual precipitation in Danville was 55.95 inches in 1948. The mean annual temperature in the area is about 58°F. The normal monthly and annual precipitation, in inches, at U. S. Weather Bureau Station at Danville is as follows: January, 3.68; February 2.94; March, 3.94; April, 3.40; May, 4.35; June, 3.84; July, 4.60; August, 4.17; September, 3.98; October, 2.74; November, 2.94; December, 3.24; and annual 43.87.

GEOLOGY

GENERAL STATEMENT

Pittsylvania and Halifax counties are underlain by ancient igneous and metamorphic rocks and by sediments of Triassic age. Boundaries of some of the rock groups are arbitrary because outcrops on the upland areas are scarce and because each group contains several kinds of rocks. In a single outcrop several types of rocks may be present, but each is too small to be noted on Plate 1.

The geologic history of the area is not known in detail, but some general comments can be made. Some sedimentary and igneous rocks of Precambrian age were folded and faulted and then altered (metamorphosed) into schists of different types. Some alteration of the Precambrian rocks may have occurred as early as Precambrian, but much of the alteration is thought to have occurred in late Paleozoic time. Volcanic activity occurred during late Precambrian or early Paleozoic time. A wide distribution of rhyolitic and andesitic flows and breccias reflects the extent of the volcanic activity. Slates and siltstones are interbedded with these volcanic rocks that make up a belt of rocks which extend 400 miles from Virginia to Georgia; they are present in the eastern part of Halifax County. More than once during Paleozoic time, igneous masses, especially granite, were intruded into the pre-existing rocks. Many of these pre-existing rocks, shales, limestones, and sandstones, were metamorphosed into schists under the conditions of heat and pressure that accompanied the emplacement of the igneous masses.

Several igneous masses, including the Leatherwood granite in western Pittsylvania County and a few gabbro masses in northern and eastern Halifax County, have been exposed as the overlying schists were removed during erosion. In the northwestern two thirds of Pittsylvania County granite is interlayered with quartz-mica schists; the granite occurs as thin sheets that are roughly conformable with the schist which trends in a northeastward direction. Another group of rocks the "mixed gneisses", underlie the southeastern part of Pittsylvania County and the western three fourths of Halifax County; the gneisses consist chiefly of alternating layers of bodies of light-colored gneisses and dark-colored hornblende gneisses. The presence of strong banding suggests that some of the rocks were originally sediments that were reconstituted during metamorphism. The volcanic rocks and slates of eastern Halifax

County have not been appreciably altered during the intrusion of invading material.

During Triassic time sediments were deposited in inland basins that extended from Nova Scotia to South Carolina. These basins were formed by the development of down-faulted blocks in which clay, silts, and sands accumulated. The Danville Triassic basin, which is several miles wide, extends through the center of Pittsylvania County in a northeastward direction. Two smaller basins, one near Scottsburg and the other northwest of Clover, occur in Halifax County.

With the exception of the time that the down-faulted Triassic basins received sediment, the land surface has remained above sea level for millions of years. Processes of erosion have been continuously active, to the extent that much rock material has been stripped from the present upland surface. The weathering of rocks into soil, the removal of soil during erosion, and the carving of valleys by stream erosion are processes that have been continuous in Pittsylvania and Halifax counties for many millions of years.

A layer of soil and a zone of weathered material, both of which are also referred to as either residuum or mantle rock, underlie the land surface throughout most of Pittsylvania and Halifax counties. This residuum acts as a reservoir from which a ground-water supply for dug and bored wells may be available; some water is stored in fractures of the underlying bedrock. The thickness of the residuum and the position of the water table—whether in the residuum or below it in the bedrock—are important factors that partly govern the accumulation of ground water.

The residuum contains three distinct layers having different characteristics for the percolation of water. The surface soil, which includes the zone commonly plowed is a loose sandy or sandy clay mixture. Beneath the surface soil is a subsoil zone consisting of a compact clay or a mixture of grit and clay. The subsoil grades downward into a zone in which softened rock has been leached of some of its mineral matter. The term, saprolite, is commonly applied to this softened or weathered rock that retains much of its original structure and texture. The saprolite grades downward into hard fresh rock. The thickness of the residuum changes locally from place to place with regard to the relationship between the rate of weathering and the rate of removal of weathered materials. The residuum, the greater part of which is softened rock, is as thick as 60 feet on many of the broad upland areas in the western part of Halifax County.

GENERAL DISCUSSION OF ROCK CHARACTERISTICS

SEDIMENTARY ROCKS OF TRIASSIC AGE

The Triassic rocks are the youngest consolidated sediments in Pittsylvania and Halifax counties. They are composed of shale, sandy shale, siltstone, sandstone, arkosic sandstone, and conglomerate, and in a few places thin beds of coal. These rocks are considered to be a part of the Newark Group (Roberts, 1928) which crop out in northeast-trending formations that occur discontinuously between South Carolina and Novia Scotia.

The Triassic formations that extend from the southwest to the northeast "corners" of Pittsylvania County are a part of a succession of rock which lies between Germanton, North Carolina, and Appomattox, Virginia. During Triassic time, sediments were deposited in down-faulted basins into which rock debris from surrounding areas was carried by streams. The sediment-schist contact on the west side of the Dan River basin is a fault contact, the vertical displacement of which is several thousand feet. Dips of most beds range from 20 to 50 degrees to the northwest (Meyertons, 1959).

Two relatively small areas underlain by Triassic rocks in Halifax County, one in the Scottsburg-Wolf Trap area and the other a few miles northwest of Clover, may have comprised a single basin that has been divided into two units by erosional agents.

The Triassic rocks have been intruded by many dikes that are younger in age than the sediments. The dikes are fine- to medium-grained, dense, black diabase, ranging from a few feet to several hundred feet in width. Most of the dikes cut across these sediments and strike in a northwestward direction.

Some noteworthy features of the Triassic rocks are (1) the red sticky soils and red color of most of the rocks, (2) the high degree of consolidation of the sandstones and conglomerates, (3) the ridge-forming character of the thicker arkosic sandstone beds, (4) the prevailing low relief and gentle slopes on the red shales and the other fine-grained sediments, and (5) the alinement of parts of some streams with the strike of the beds.

LEATHERWOOD GRANITE

Leatherwood granite is named from the village of Leatherwood, near Martinsville, Henry County (Pegau, 1932). The widest outcrop area of the granite is in the vicinity of Axton, Henry County, and the adjacent part of Pittsylvania County.

The granite is a course- to medium-grained rock; in some places it is equigranular and in others, porphyritic. In color it is a light gray to pinkish gray. Unlike many granites in the southeastern United States, it does not weather into large surface and subsurface boulders. In the upland areas fractures within the rock are closely spaced and decay of the rock to saprolite is characteristic. The presence of wide spread light-colored sandy soils indicates that granite is the main rock type in the area mapped as Leatherwood granite, even though many inclusions of schists and other rocks occur within the granite.

MICA SCHIST

Rocks described in this report as mica schist include thinly laminated rocks that contain a large amount of mica and exhibit well developed schistose structures. This schist, and other rocks interlayered with it, lies mainly northwest of the Triassic rocks of Pittsylvania County. These rocks are classified as Wissahickon schist on the Geologic Map of Virginia, 1928. The rocks may be a part of the Virginia Blue Ridge Complex (Brown, 1958, p. 7) that is composed of a complex of schistose, gneissic, and granite rocks.

The main minerals of the schist are quartz and either muscovite or biotite. In places kyanite and garnet occur in noticeable amounts. Interspersed with the schist are layers of other rocks, including hornblende gneiss and granite. The origin of the mica schist is interpreted as a shaley sediment that has been metamorphosed.

In the northwest part of Pittsylvania County the rocks mapped as mica schist are not in all respects similar to those farther east. The area mapped as mica schist contains layers of greenstone, quartzite, and marble; some of the rocks mapped as schists are phyllites. This relationship is illustrated west of line A-A′ on the geologic map, Plate 1. Some of the mica schists are part of the Evington Group (Espenshade, 1954). The Lynchburg formation is reported in the extreme northwest tip of the County (Nelson, 1959, p. 1768). More detailed work is likely to reveal the stratigraphic sequence and structural relations of these rocks. The line A-A′ is an arbitrary boundary.

MICA SCHIST AND GRANITE

The geologic map, Plate 1, contains a unit that represents the gradational zone of mica schist and granite in western Pittsylvania County. Schist and granite are present as separate alternating bands ranging from a fraction of an inch to several hundreds of feet in width. Granitic material was intruded along schistose planes. Consequently, the contacts between the rock types are roughly parallel.

In the areas that are dominantly underlain by mica schist the amount of granitic material seems to increase toward the mass of Leatherwood granite that is located in western Pittsylvania County. It appears that the Leatherwood granite may be a local center of granitization.

HORNBLENDE GNEISS

Different types of dark-colored gneisses and schists, in which hornblende is a prominent mineral, occur in Pittsylvania and Halifax counties. Typical occurrences are present as bodies that are concordant with light-colored schists and gneisses. These small bodies that are only a few inches or a few feet thick could not be illustrated on the geologic map. The mapped areas of hornblende gneiss in most cases represent a mixture of rock types that are composed of more than 70 percent hornblende gneiss.

The gneiss is black to dark green on unweathered or fresh surfaces. Feldspar, quartz, and hornblende are the main minerals, and locally different amounts of biotite and chlorite are present. The saprolite adjacent to the fresh rock is blue, green, or dark gray, and the soil, subsoil, and completely decomposed rock is brown to dark yellow. Hornblende gneiss and related rocks are overlain by soils of the Davidson, Mecklenburg, Iredell, and Helena series. The surface layer of the soil is light gray to grayish brown or brown. The subsoil is a tough heavy plastic clay, commonly known as pipe clay. The characteristics of the soil are important in the distinction between areas underlain by hornblende gneiss and related rocks and those underlain by granite, granite gneiss, and light-colored rocks all of which yield lighter, sandier soils.

MELROSE GRANITE

The Melrose granite facies was named by Jonas (1937, p. 22) for a distinctive porphyritic granite that is exposed at Melrose near the Staunton River in the extreme northwestern part of Halifax County. The granite is a rock mass that is about two miles wide and that trends in a northeast direction near Cody, Virginia. It is bordered on the west by rocks of Triassic age and on the east by mixed gneisses.

The Melrose granite ". . . contains coarse pink phenocrysts of feldspar, green biotite, and blue quartz. Under the microscope the feldspars are seen to be microcline and oligoclase altered to epidote, zoisite, and sericite and dusted by fine iron, to which their pink color is due . . ." (Jonas, 1937, p. 22). The granite grades progressively into an augen gneiss in an eastward direction.

A thick saprolite mantles the granite and gneiss; large feldspar crystals derived therefrom are not thoroughly decomposed in the overlying surface soil. As a result, this soil is more "gravelly" than those soils that cover granites which have finer grain sizes.

MIXED GNEISSES

South and east of the Triassic rocks of Pittsylvania County and west of the slaty rocks of eastern Halifax County are distinctly interlayered rocks that contrast sharply in color and mineralogic composition. These closely interlayered non-uniform rocks are referred to as "mixed gneisses" in this report. There are two main types of gneisses that are interlayered within the mixed gneisses: a dominant granite gneiss and a dark-colored, hornblende gneiss. Geologic mapping done by Jonas (1926) extended across the Staunton River into northwestern Halifax County. In that mapping Jonas recognized several rock units including: granodiorite, Columbia granite injection in hornblende gneiss, Shelton granite gneiss, augen gneiss and granite mylonite, Shelton granite gneiss injection into hornblende gneiss, Melrose granite, and Melrose granite (augen gneiss facies). The occurrence of the mixed gneisses that extend into North Carolina are noted as ". . . Mica gneiss (chiefly mica gneiss, includes mica schist and a wide variety of other gneisses and schists) . . ." on the Geologic Map of North Carolina, 1958; however, the characteristics of the mica gneiss of North Carolina represent a more generalized group that includes rocks from areas of both the Piedmont and Blue Ridge provinces.

The gneisses are well exposed along U. S. Highway 58 between Danville and South Boston, along the stream valleys in northern Halifax County, and along U. S. Highway 501 north and south of Cluster Springs (Figure 2). The light-colored rock in these areas is composed largely of feldspar and quartz with disseminated mica and other accessory minerals. The dark-colored rock is composed mainly of feldspar and hornblende with lesser amounts of biotite, quartz and other minerals. The light and dark components of these gneisses occur in bands that range from a fraction of an inch to several feet in width. Granites and pegmatites occur almost everywhere and are locally the dominant rock types. The granite and pegmatite commonly occur in approximately parallel bands a few inches to a few feet in width. Cross-cutting pegmatites are common. Large pink feldspar crystals are present in many of the pegmatites.

The distinct layering of the gneisses is indicative that they were once sediments that have been metamorphosed. After the sediments were consolidated and partially metamorphosed, they were invaded by magmatic liquids and subsequently reconstituted under the conditions of considerable pressure and temperature.

GRANITE GNEISS

The light-colored component of the "mixed gneisses" that underlie much of the southeastern part of Pittsylvania County and the western two-thirds of Halifax County is a granite gneiss. Northeast of Danville in the area surrounding Kentuck the dark-colored hornblende gneiss component of the "mixed gneisses" is uncommon, and consequently the rocks are mapped as granite gneiss.

The granite gneiss is composed of banded granular layers of feldspar, quartz, muscovite, and biotite. This gneiss weathers into a light sandy soil that is present on the upland areas. Outcrops are principally confined to steep slopes near streams. The unweathered gneiss occurs in the Barnes quarry, about 8 miles north of Danville and just east of U. S. Highway 360.

Some of the granite gneiss may have been originally a granite that became foliated during a period of earth movements; however, much of the gneiss may have been derived from different types of

Figure 2.—Interlayering of light and dark beds of the mixed gneisses along U. S. Highway 501, two miles south of Cluster Springs.

Figure 2.—Interlayering of light and dark beds of the mixed gneisses along U. S. Highway 501, two miles south of Cluster Springs.

sediments. The presence of well developed layers and differences in texture and mineral composition of these layers indicate that the gneiss is a reconstituted sedimentary series.

GABBRO

Gabbro masses are present in both Pittsylvania and Halifax counties; the occurrences in Pittsylvania County are relatively small and scattered and were not mapped separately. A course-grained gabbro occurs in the extreme eastern part of Halifax County. Two other bodies of gabbro occur north and east of Nathalie; these bodies locally contain a considerable amount of epidote. A small gabbro-like body occurs in the Clover area, one mile south of the Staunton River and one mile east of State Road 746. It was not mapped because its area of outcrop is not well defined and because it may be a part of the series of diabase dikes of Triassic age.

The gabbro is generally massive and sparsely jointed. Its area of occurrence is commonly indicated by the presence of boulders or smooth outcrops. The weathered zone is thin, and iron-rich clay nodules, known as "native gravel," occur in the dark yellow or brown sticky soils.

SLATES AND RELATED VOLCANIC ROCKS OF THE VIRGILINA DISTRICT

In eastern Halifax County a series of slates are interbedded with altered volcanic rocks. These rocks form a northeast-trending belt which extends into North Carolina where it is called the Carolina Slate Belt (Stuckey and Conrad, 1958, p. 26). These rocks in eastern Halifax County have been studied by Laney (1917) and his rock groupings and geologic map, with slight modifications, have been used in this report. Discovery of copper ore deposits led to the early detailed study of parts of the Virgilina District. The rocks consist of volcanic-sedimentary formations and include acid and basic flows and tuffs, as well as interbedded slates.

The following brief description of the three formations of the Virgilina District that lie in eastern Halifax County is noted:

"... *The Hyco quartz porphyry* consists largely of quartz-sericite schist, which represents a mashed and otherwise metamorphosed quartz porpyry or rhyolite, and which was tuffaceous in certain areas.

The formation appears to be the oldest of the volcanic rocks, at least its areal distribution indicates that it underlies the other volcanics. It occurs as a narrow belt on each side of the district . . . Its largest and most typical exposures occur along Hyco River, from which it is named.

". . . The name *Aaron slate* has been applied to a slate-like rock formed by mixtures of varying amounts of andesitic volcanic ash and ordinary land waste, which through pressure and other agents of metamorphism have been changed or altered into a kind of hybrid slate—in some places into a schist. It varies from nearly pure greenstone to fairly pure argillaceous sandstone and slate, and in certain places is decidedly conglomeratic. It is realized that the rock is by no means a normal slate, and the term slate was applied to it only after much hesitation and many vain attempts to find a better name. It is the formation immediately overlying the Hyco quartz porphyry, and, like it, is exposed in long narrow bands on each side of the district. It is well exposed in many places along Aaron's Creek, from which the name is taken.

". . . The name *Virgilina greenstone* has been given to the schistose greenstone in which all the developed ore deposits are located and which forms the Virgilina ridge. It is the altered equivalent of andesitic flows and tuffs and, while always more or less schistose, is, in some places, decidedly porphyritic and in others plainly tuffaceous. It occurs as long and narrow bands which make up the backbone, as it were, of the district. The rock occurs in typical development in and near the town of Virgilina, whence the name . . ." (Laney, 1917, p. 19).

GROUND WATER

OCCURRENCE AND MOVEMENT OF GROUND WATER

Water that may be pumped from wells or that may flow from springs is called ground water. This water is stored in the open spaces of clay, sand, and fractures within rocks in what might be termed an underground reservoir. The underground reservoir is to some extent similar to a surface reservoir, but it differs from a surface reservoir in that its boundaries are not definite.

The underground reservoir in Pittsylvania and Halifax counties consists of two contrasting types of materials. These are (1) the clayey and sandy soil, subsoil, and weathered material that underlies the surface to depths generally ranging from several feet to several tens of feet and (2) the underlying bedrock. In the soil, subsoil, and weathered or soft rock, water occurs between individual mineral grains; but in the bedrock below, it occurs only in fractures. These fractures do not have an even distribution but may be an inch to several feet apart. As shown in Figures 3 and 4, many fractures are connected so that water may move through them to a well or to a low place in a valley. In some places the fracture openings are only a fraction of an inch wide. In Pittsylvania and Halifax counties, as in the Piedmont province of North Carolina the "... size and number of fractures appear to decrease with depth. As a result, most ground water occurs at a depth of less than 150 feet—much of it in the upper 30 feet of bedrock. Therefore, the lower limit of the reservoir is a thick, indefinite zone; the top, however, is a definite though fluctuating surface known as the water table . . ." (LeGrand, 1954, p. 10). Because there is a layer of soil and weathered rock throughout the two counties and because the rocks are fractured to some extent the underground reservoir underlies the counties almost everywhere. Factors governing the availability of water from different places will be discussed later.

The source of ground water is the rain and snow that falls on the land surface above. The underground reservoir does not have high priority on the water that falls on the land but must wait until other demands of nature are satisfied. Part of the rain runs off the land immediately and is not available to the underground reservoir. Some of the water that falls is returned to the atmosphere by evaporation and by transpiration of vegetation. The combined effects of evaporation and transpiration are commonly referred to as "evapotranspiration."

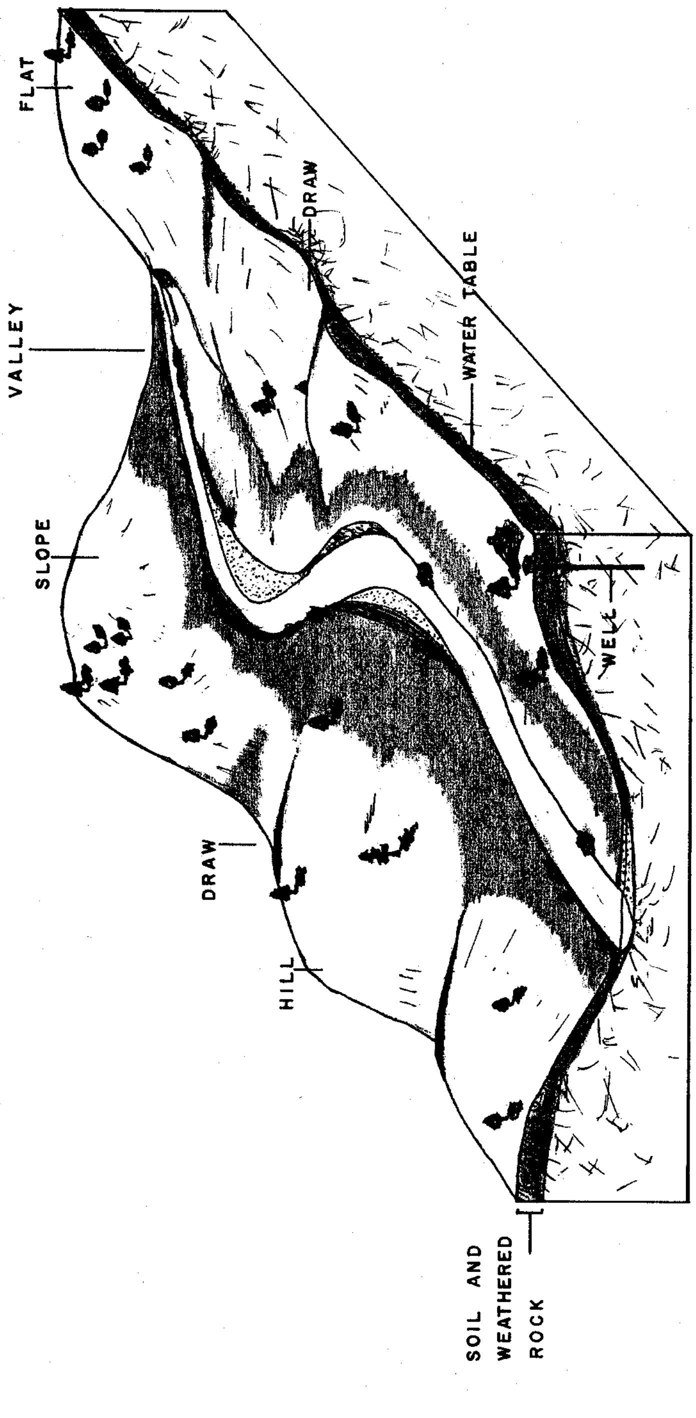

Figure 3.—Diagrammatic sketch showing types of topography and typical subsurface cross section in the Piedmont province of Virginia.

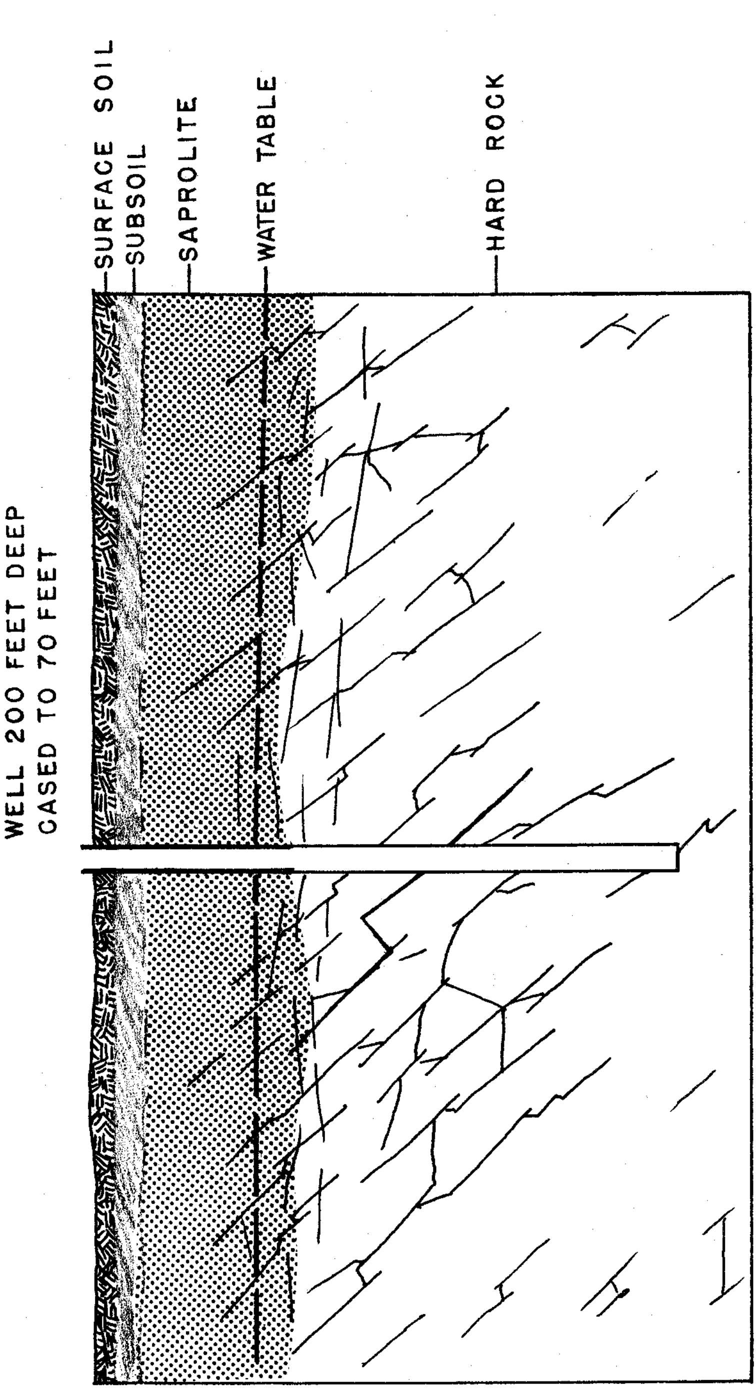

Figure 4.—Typical subsurface cross section showing the character of materials penetrated by a well on an upland area.

Water beneath the ground flows under the influence of gravity, and the rate of flow varies directly with the hydraulic gradient. Water that enters the ground on upland areas tends to move downward but is eventually shunted to a low place in a stream valley where it is discharged as a spring or as evapotranspiration.

SIGNIFICANCE OF THE WATER TABLE

The water table is the upper surface of the water contained in the underground reservoir. Its position at any point below the land surface can be determined by measuring the depth to water in a well that isn't being pumped. In valleys of Pittsylvania and Halifax counties, the water table actually can be seen because it is the level of the surface of creeks and rivers. Its depth is dependent on the topography and on the transmitting characteristics of the residuum and fractures in bedrock. Beneath the hills and upland areas the water table generally lies in the residuum or rotten rock and may be as close as 20 feet or as far as 70 feet below the ground. In all cases the water table beneath a hill is higher above the level of the closest stream (although deeper below the ground) than it is in a low area near the stream.

The slope of the water table toward the stream results in a constant movement of water out of the underground reservoir. Some of the water seeps into the streams to give them a year-round flow. Some of the water, as it comes near the ground in low swampy areas, is lost by evaporation and transpiration of trees and other plants. This constant outflow, or discharge, of ground water causes a gradual lowering of the water table except during and immediately after periods of significant rainfall, when recharge to the underground reservoir is greater than discharge from it; as a result of the periods of rainfall, the water table rises.

No records are available to show the seasonal fluctuations of the water in either Pittsylvania or Halifax counties. However, records of water-level measurements in wells of the Piedmont province of North Carolina and northern Virginia may be used in determining the changes of the water table. Because water is always moving out of the ground, the decline of the water table covers a longer aggregate period during a year and is more gradual than is the rise that follows periods of precipitation. In a year of average rainfall, the replenishment to the underground reservoir is about equal to the discharge from it, so that the water table at the end of the year is at about the same level as at the beginning of the year.

Each season there is a noticeable change in the water table. It begins to fall in April and May when the vegetation starts using more water, and subsequently transpiration and evaporation increases. Although there are slight rises of the water table following heavy summer showers, the water table tends to decline during the summer in spite of abundant rainfall in July and August. By November and December, when much of the vegetation is dormant and evaporation is low, a larger amount of the rainfall accumulates causing the water table to rise until it reaches another high stage about April or May of the next year. Within a few hundred feet of wells that are pumped, the water table changes about 5 feet from its highest to lowest stages in most places, although in places beneath sharp hills the annual fluctuation may be as much as 10 feet.

Although many wells are used in the two counties, the effects of pumping individual wells are felt in most cases no farther away than a few hundred feet. The lowering of the water table around the individual wells does not affect the regional water table.

SPRINGS

In the two counties roads are located mainly on upland surfaces and they cross a minimum number of streams. Consequently a casual observer might get the impression that streams and springs are scarce. This is not the case; in fact, it is difficult to find a spot which is a mile from a spring or stream. Many of the slopes are steep enough to cut into the water table, allowing water to leak from the underground reservoir. The leakage of water may be small and scattered in a swampy place, where evaporation and transpiration use it all, leaving none to run into streams; in other places the leakage is concentrated enough to form small springs. The springs commonly emerge from a cove or re-entrant, near the bottom of the hill. Nearly all of the springs yield less than 10 gallons a minute, and, in fact, most yield one or two gallons a minute. Most of the springs have a nearly steady year-round flow. In addition to the permanent type of spring, some springs of a temporary nature develop during wet seasons when the water table rises to a position at which more water emerges from the slopes.

The size and distribution of the springs are controlled to a great extent by the soil and residuum that cover the bedrock almost everywhere. ". . . If the soil zone is extremely thin or absent at the junction of the water table and surface slope, the flow of water from the fractures or from the upper surface of the bedrock will be concentrated sufficiently for a spring to form. However, a moderately thin layer of soil allows water coming from the fractures to spread through it to be quickly lost by evaporation. Most springs occur in the heads of steep valleys where emerging ground water will have a good chance of being concentrated. Springs would be larger and more abundant if it were not for the fact that the soil tends to creep down the slopes toward the valleys and thus tends to cover the openings through which water might otherwise issue . . ." (LeGrand, 1954, p. 12).

The limited use of springs results from the fact that they are generally located more than a few hundred yards from rural dwellings where the water is needed. The excellent chemical character of almost all water from springs in the area is related to the fact that spring water generally circulates rapidly at shallow depths through the rocks and residuum. Table 1 is a list of two springs that occur in Pittsylvania County.

TABLE 1.—*Springs in Pittsylvania County*

No.	LOCATION	OWNER OR NAME	TYPE OF ROCK	REMARKS
A	Hurt.	Town of Hurt. .	Mica schist and granite.	Analysis—flows from steep cove—flows about 8 gallons a minute.
B	Two miles west of Danville near north bank of Sandy River. . .	Carter Spring. .	Granite and hornblende gneiss.	Analysis—flows from flood plain on Sandy River—flows less than 3 gallons a minute—has been marketed as a medicinal water.

QUALITY OF GROUND WATER

All natural water contains dissolved mineral matter derived from the soil and rock with which the water has been in contact. Standards of quality of water vary according to the intended use of the supply. Most industries require clear water low in total mineral content and hardness.

Included in Table 2 is a list of specifications that have been adopted by the American Water Works Association and by most municipalities as a standard for public water supplies. These specifications are by no means rigid because greater concentrations of each constituent could be tolerated; however, low concentrations are preferred.

TABLE 2.—*Standard Water Specifications*—Adopted by the American Water Works Association for public water supplies

Iron and Manganese (combined)	less than 0.03 parts per million
Magnesium	less than 125 parts per million
Chloride	less than 250 parts per million
Sulfate	less than 250 parts per million
Fluoride	less than 1.5 parts per million
Total Solids	less than 500 parts per million

The constituents most likely to occur in objectionable concentration in ground water in Pittsylvania and Halifax counties are calcium, magnesium, iron, chloride, nitrate, and dissolved carbon dioxide. Calcium and magnesium are responsible for most of the hardness in water. Iron and manganese cause stains on clothing and fixtures; if their combined concentration exceeds 1 part per million, some clogging of pumps and distribution systems may occur. Where chloride is present in concentrations greater than about 250 parts per million, the water has a slightly salty taste (sea water has a chloride content of slightly more than 19,000 parts per million). Nitrate is an end product of decomposition of organic matter and where present in concentrations greater than 45 parts per million is believed to be associated with the infant's disease, methemoglobinemia, a condition frequently referred to as "blue babies," (Bosch, H. M., and others, 1950). The presence of carbon dioxide causes the water to increase in acidity and to be corrosive. The pH value, which is a number denoting the degree of acidity, or alkalinity, is useful in evaluating the chemical character of water. A pH value of 7.0 represents a neutral condition, which means that the water is neither acid nor alkaline. Values higher than 7.0 denote alkalinity and values lower than 7.0 denote acidity.

Hardness is a matter of considerable importance. Most industries are concerned about the hardness of water because it affects manufacturing processes and finished goods. The scale deposited in hot-water pipes and steam boilers causes much trouble. In the home, hardness is recognized by the difficulties in obtaining a lather without an excessive use of soap and in the sticky curd that results from using soap while washing. Where the hardness is less than 60 parts per million, the water is considered soft and suitable for most uses. Where the hardness is between 60 and 120 parts per million, the water is considered moderately hard and may be satisfactory for some purposes but not in high-pressure steam boilers and in some industrial processes. Water having a hardness ranging between 120 and 200 parts per million is hard, and a water softening procedure should be considered.

Water in granites and in light-colored mica schists and gneisses is generally good chemical quality. The water percolates through highly siliceous rocks, which are not readily soluble. Consequently, the water is normally low in dissolved mineral matter. In the dark-colored igneous and metamorphic rocks, such as hornblende gneiss, gabbro, and greenstone, water is in contact with moderately soluble minerals containing calcium and magnesium; the extraction of calcium, magnesium, and other soluble constituents from these rocks renders the water somewhat harder than from granite and light-colored rocks. The most highly mineralized water in the two counties comes from the sedimentary rocks of Triassic age. Water in the Triassic rocks is almost everywhere acceptable for human use, although it is generally hard. Water from Wells 44 and 45 in Pittsylvania County that penetrated Triassic shale has more than 1,000 parts per million of dissolved solids (Table 9).

FLOOD-PLAIN DEPOSITS

The Dan River and the Staunton River, and to a lesser extent the Bannister River and smaller streams, are bordered on one or both sides by flat lowland areas or flood plains. The flood plains are underlain by loose deposits of clay, sand, and gravel. Although the deposits are not extensive or thick enough to be represented on the geologic map, they are very important to the water resources of the area.

A typical profile of flood-plain deposits in relation to a stream, to bedrock, and to the water table is shown in Figure 4. Preliminary studies by Mundorff (1948) and Schipf and LeGrand (1954) indicate that generally sand and gravel lie near the base of these deposits and that clay comprises the surface layer of the plain. The streams in most places are cutting down into their channels so that they either flow on hard bedrock or on less than five feet of channel sand and gravel; consequently, sediments extending deeper than five feet below the level of the channel bottom are uncommon.

Where flood plains occur, much of the water moving underground from the upland areas must pass through the flood-plain deposits in order to reach the stream. This causes the water table to be so near the ground that evaporation and transpiration intercept some water, preventing it from reaching the stream. Flood-plain deposits are beneficial during floods because a part of the flood water is stored in the granular material above the normal water table thereby reducing the downstream effects of the flood.

Although the flood-plain deposits have not been utilized as a source of well water in the two counties, the possibility of developing a large supply of water for industrial use from shallow wells near a river is good. Where permeable sands and gravels of several feet in thickness occur at the base of the deposits and extend to the river, a line of shallow wells, or galleries, parallel to the river should furnish one million to several million gallons of water a day. The sand and gravel would act as a natural filter for the river water, which would be drawn by pumping into wells or galleries; a lowering of the water table below stream level would result (Figure 5). Careful exploration would be necessary to find places where conditions are favorable for such water supplies. Until a real effort is made to develop water supplies from these deposits, it is safe to say that the ground-water resources of Pittsylvania and Halifax counties have not been fully explored.

TYPES OF WELLS

Ground water is obtained from drilled wells, dug wells, bored wells, and springs.

Drilled wells pass through soft weathered material and extend into bedrock. A pipe, or casing, is driven to the top of bedrock and is used to seal off water in the saprolite and prevent caving of rock and clay. If fractures in the rock are encountered, drilled wells offer the best possibility for obtaining a dependable, and perhaps a large supply of water. The diameter of most drilled domestic wells is 5-5/8 inches and that of some industrial and some municipal wells is either 8 or 10 inches. The cost of a well varies with competition and with the hardness of rock material to be drilled. The prevailing cost in the past 20 years has been about $5.50 per foot for a 5- to 6-inch well and about $8.00 per foot for an 8-inch well. However,

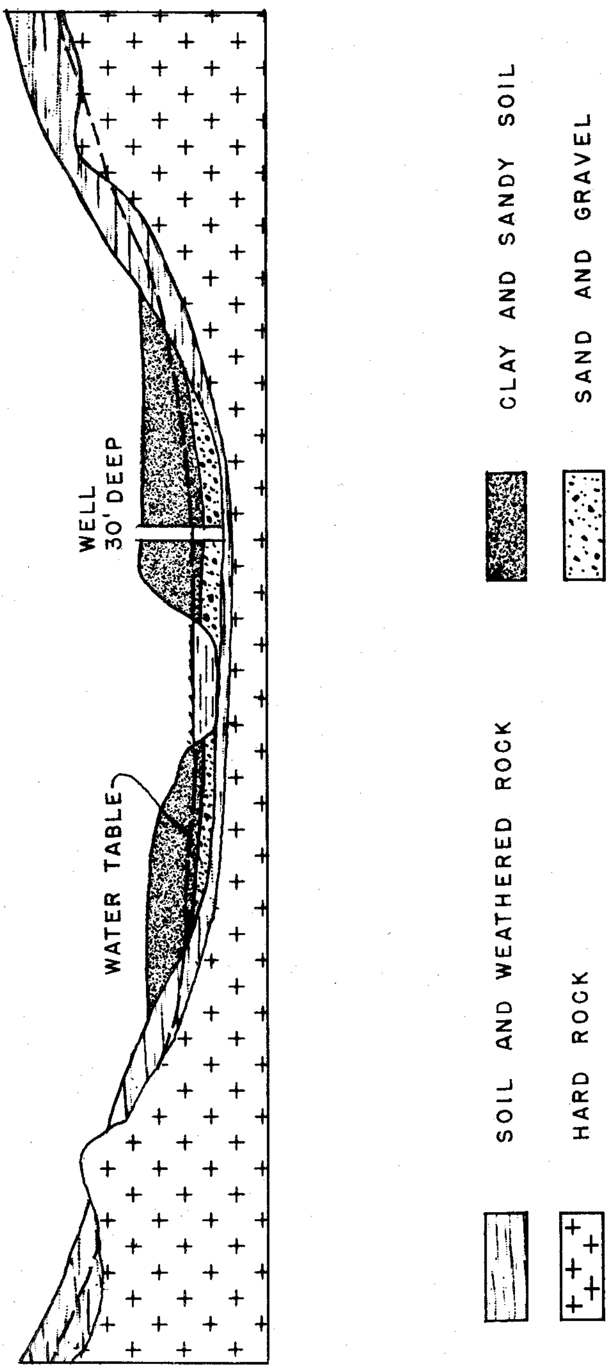

Figure 5.—Cross section of a stream valley showing subsurface conditions.

competition among well drillers has caused a decline in prices within the past few years.

Dug wells are common in rural areas, especially where there is no plumbing in the homes. These wells are usually more than 30 inches in diameter, are dug to a depth slightly below the water table, and do not penetrate hard rock. They yield sufficient water for normal household needs except in dry seasons when the water table may be lowered below the bottom of the well.

Bored wells are similar in construction to dug wells except that a large mechanically-operated auger removes the dirt. Concrete curbing, commonly 18 or 24 inches in diameter, is settled in the ground as "augering" progresses. The well completion is successful if the water table is reached several feet above the bedrock. Because bedrock cannot be penetrated, the well may be incomplete or dry where the water table lies below hard rock; this applies to both dug and bored wells.

There has been a gradual change in the methods of obtaining ground water. In the early days of the Virginia settlers, springs were the chief sources of water, and, as a result, homes and villages were built near springs. Later, dug wells became the most common source of water supply. Today, however, drilled wells and bored wells are increasing greatly in number; many dug wells are being abandoned, and very few springs are now used.

YIELD OF WELLS

INTRODUCTION

Data for 369 drilled wells are tabulated and are placed with county descriptions in this report. These wells represent only a fraction of wells in the area, but they are representative insofar as chemical quality, yield, depth, and other characteristics are concerned.

Because the chemical quality of ground water throughout the two counties is acceptable for most domestic uses, the characteristic of primary importance is the yield of a well. In order to evaluate the yield of a well, it is necessary to record the drawdown of the water level for that particular yield. Because the yield of a well may increase with an increase in drawdown, it would be helpful to know the drawdown at which a certain yield was determined. Unfortunately, most of the records are incomplete because the drawdown for the reported yield is seldom known. Therefore, the yield recorded for a well may represent the maximum or only a fraction of water available.

The yield from one well to the next is different even in the same type of rock and in the same area. One well may be a good producer whereas another a short distance away may yield an insufficient amount of water for rural domestic use. Because a safe dependable yield is the most important consideration, much time was spent in studying the factors controlling the yield of wells.

Although the yield of a well cannot be determined before drilling it, there are criteria that are helpful in selecting a favorable well site. These criteria are related to factors that include the thickness of residuum, structure, topography, and the locations of other wells. Also to be considered are different types of rocks and their history and alterations both beneath and on the land surface.

WATER LEVELS AND THE EFFECT OF PUMPING

When a well is pumped, the water table is lowered in the vicinity of the well to form a depression in the water table, which is known as the cone of depression. The drawdown of the water level in a well increases as the rate of pumping is increased. This is not a simple relation in the area studied.

Because drilled wells are cased to hard, fresh rock, water enters the wells through the rock fractures. The first water that is withdrawn from the well comes from the fractures, and is replaced by water which moves in from more distant fractures toward the well. Also, water in the porous granular saprolite moves downward into the fractures as they are drained.

In some parts of the United States it is possible to evaluate, by quantatitive methods, the behavior of water levels in response to pumping. It is necessary that physical and hydraulic characteristics of an aquifer, or water-bearing formation, be reasonably uniform in all directions in order to evaluate its productive capacity. Storage and transmittal of water within the aquifer can be determined, and the fluctuations in water level can be predicted.

In Pittsylvania and Halifax counties the rocks do not have uniform properties with regard to storage and transmittal of water. Furthermore, the underground reservoir is indefinite in extent and is composed of two parts. These are (1) the soil, subsoil, and upper part of the saprolite, in which water moves through the individual pore spaces, and (2) the lower part of the saprolite and the fresh rock, in which water moves only through interconnecting fractures. The behavior of the water table in response to pumping of water from wells tapping both of these reservoir materials cannot be predicted with any degree of accuracy.

The first requirement for any successful drilled well is the penetration of rock fractures; therefore, the number, size, and position of these fractures are important. Figure 6 contains illustrations of six well types. Well A penetrated no fractures below the casing; therefore, the well yielded no water. Well B penetrated a fracture zone in which two or more fractures occur a few feet below the casing. This is a common type of well. It may yield as much as 10 to 20 gallons a minute for a period of several minutes until the fractures are drained. Its yield will likely decline suddenly to a fraction of this amount, the steady yield depending to a great extent on the permeability of the saprolite. That part of the well below the fracture zone contributes no water and acts only as a storage reservoir into which water drains when the well is not pumped. The yield of this well does not increase with increased drawdown. In fact, the most efficient pumping level is probably no lower than a few feet below the fracture zone. Well C penetrated only one fracture, a large one near the top of the fresh rock. This well is similar to Well B. It may yield considerable water for a few minutes until the stored water in the fracture is drained. The perennial yield,

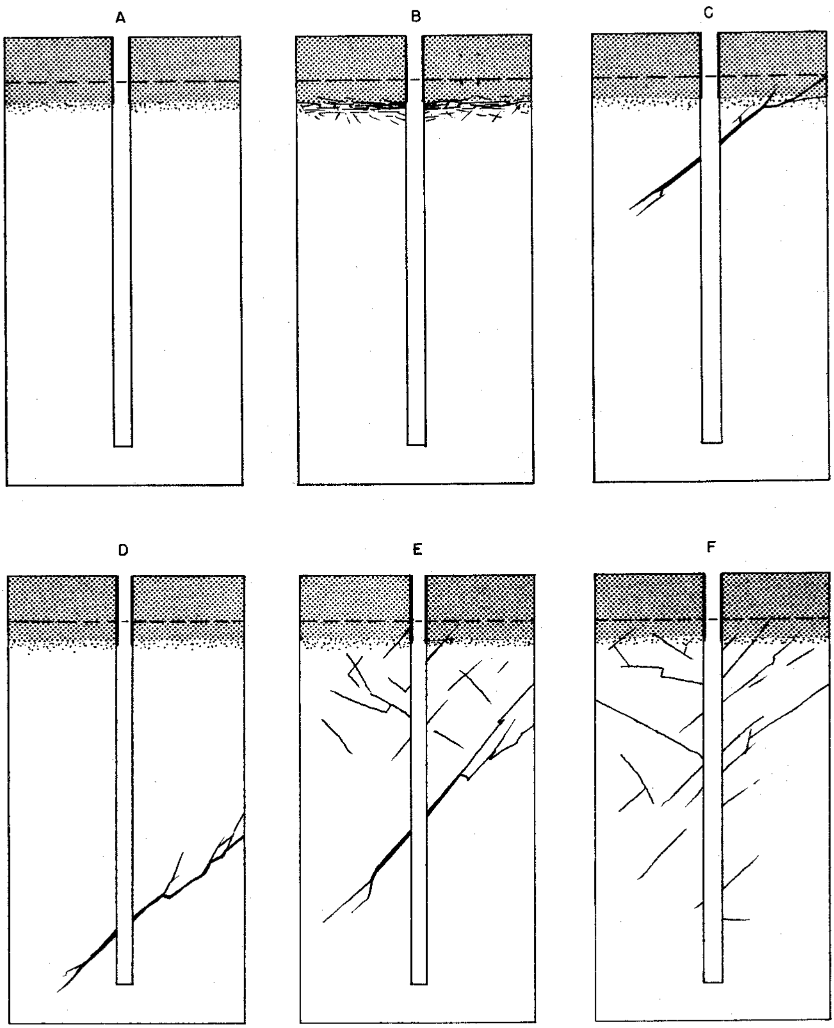

Figure 6.—Diagram showing six types of fracture-characteristics that influence the yield of wells. Stippled pattern represents soil and soft, decomposed rock. Dashed line represents the water table. Each well is 250 feet deep and is cased to about 50 feet.

under continuous pumping, will depend on the permeability of the saprolite and on the amount of water that is released to the fracture. Well D penetrated only one fracture—a large one below a depth of 200 feet. As in Well C, the perennial yield will depend on the permeability of the saprolite and on the transmitting capacity of the fractures. If the water is relayed from the saprolite to the fracture as fast as it is transmitted through the fracture to the well, the yield will increase with increased drawdown until the water level reaches the contributing fracture. There will be no increase in yield below this pumping level. On the other hand, if water is furnished from the saprolite at a slower rate than it is transmitted through the fracture, the most efficient pumping level will be at some intermediate position between the fracture and the base of the saprolite.

Well E penetrated several fractures, contributing small amounts of water, and a large fracture at a depth of about 150 feet. The most efficient pumping level is probably a few feet above the position at which the well penetrated the large fracture. Well F penetrated several small- to medium-sized fractures. These fractures are larger and more closely spaced in the upper part of bedrock. For a steady yield, the proper pump setting is about 25 or 50 feet below the top of the bedrock.

RELATION OF YIELD OF WELLS TO DEPTH

The yield of wells in the igneous and metamorphic rocks is not directly proportional to the depth of the wells because the rocks do not transmit water uniformly. The relation of depth to yield (Tables 3 and 4) shows that deep wells have higher average yields than shallow wells. This apparent relation is somewhat misleading because the greater yield of deep wells is due, in part, to the fact that they are generally for industrial purposes and are pumped at greater rates and have greater drawdown than shallow wells. Most of these shallow wells are drilled for rural domestic supplies and drilling is stopped when it becomes apparent that an adequate supply has been obtained. Wells less than 100 feet deep have a greater yield per foot of well than wells of greater depth (Tables 3 and 4). The relation of yield to depth is true in a general way, but it must be realized that the depth of a well is not necessarily the depth at which water was encountered.

TABLE 3.—*Average Yield of Drilled Wells According to Depth*

Range in Depth (feet)	Number of Wells	Average Depth (feet)	Yield (gallons a minute)	
			Average	Per foot of well
0—100	86	82	10	.12
100—150	118	126	12	.09
Deeper than 150	88	272	23	.08

TABLE 4.—*Relationship of Depth to Yield*

Range in Depth (feet)	Number of Wells	Percentage of Wells Yielding			
		Less than 5 gallons a minute	5 to 10 gallons a minute	More than 10 gallons a minute	20 or more gallons a minute
0—100	86	17	46	37	18
100—150	118	26	37	37	26
Deeper than 150	88	29	22	49	35

Depths at which fractures are reached in wells are illustrated in Figure 6. A careful evaluation of this figure is important to the understanding of water supplies from wells in crystalline rocks. From the writer's own experience, and not from a systematic statistical analysis, the percent of wells in each type appears to be approximately: Well A, 3%; Well B, 20%; Well C, 15%; Well D, 5%; Well E, 32%; and Well F, 25%. These percentages are based on studies in Pittsylvania and Halifax counties and in other areas of the Piedmont province of the Southeastern United States where ground-water conditions are similar. In about 90 percent of the cases most of the water available in a well is reached at a depth of less than 175 feet. In about 80 percent of the cases most of the water is reached at a depth of less than 125 feet.

There are two important reasons why yields of wells generally increase only slightly (or not at all) with increased depth. In the first place, the fractures decrease in size and number with depth. This condition is illustrated in Figure 6, Well F. In the second place, lowering the water level in and around the well during pumping causes the saturated part of the fracture zone to be reduced in thickness. As a result, the upper part of the fracture zone, which has larger and more numerous fractures, will become dry; and the lower part of the fracture zone, that is comprised of only a few small fractures will contain small amounts of water that will be transmitted to the well.

If a satisfactory supply of water is not available at a certain depth, it is difficult to decide how much deeper to drill. The above comments and the conditions illustrated in Figure 6 should be given consideration in coming to a decision. As a matter of hindsight, it appears that some wells abandoned at depths greater than 350 feet because of lack of water should have been abandoned at much shallower depths; on the other hand, some wells abandoned at depths of 125 feet might have yielded good supplies if they had been drilled deeper. The depth at which an inadequate well should be abandoned is largely an economic problem of the well owner. Some well owners believe that water struck at a certain level will be lost by drilling the well deeper. This opinion is incorrect, but the chances of obtaining additional water by increasing the depth may be so poor that drilling deeper will be uneconomical.

EFFECT OF TYPE OF ROCK

In order to understand the relationship between the yield of a well and type of rock the well penetrates, several points concerning the occurrence of water in these rocks should be reviewed. Below the zone of weathering most of the rocks are dense, the only movement of water being dependent upon fractures. Some rocks are more highly fractured than others; this is indicated by the presence of a thicker zone of soil and saprolite and perhaps in concave topographic localities, such as draws and valleys. Rock weathering and topographic conditions are much easier to observe than the type of rock; therefore, these conditions are more suitable for correlation with yields of wells than is the type of rock.

The areas in which different rock units occur are shown on the geologic map. The kind of rock penetrated or thought to have been penetrated by a well is noted with other information in Tables 9 and 11. The relative yields of drilled wells in the more abundant rock types of the two counties are noted in Table 5. The average yield of wells in the Virgilina greenstone and the sericite schist and slate in eastern Halifax County are 8 and 7 gallons a minute, respectively. These low yields are, to some extent, due to the scarcity of large fractures and to the thin soil and saprolite zone. Wells in the Triassic rocks have an average yield of 11 gallons a minute, but only 50 percent of the wells yield more than 6 gallons a minute. Wells in the gneisses and quartz-mica schists have an average yield of 11 gallons a minute.

TABLE 5—*Average Yield of Drilled Wells According to Rock Type*

Rock Type	Number of wells	Average yield (gallons a minute)	Range in yield (gallons a minute)
Triassic shale and sandstone	20	11	½ to 60
Mixed gneisses	172	17	⅛ to 220
Mica schist	34	11	½ to 30 or more
Mica schist and granite	20	13	2½ to 30 or more
Granite gneiss	26	14	1 to 150
Hornblende gneiss	8	14	4 to 50
Virgilina greenstone	14	8	1 to 25
Sericite schist and slate	15	7	¼ to 20

EFFECT OF TOPOGRAPHIC LOCATION

Topography is one of the most important factors to consider in the location of wells especially if large water supplies are desired. The topographic situation of 282 wells was noted in Pittsylvania and Halifax counties. The average yield with relationship to different types of topography, as well as other statistical information, is included in Table 6. The types of locations used are: hills, flats, slopes, and draws. Too few wells are drilled in valleys to represent them in Table 6 and 7. Examples of these topographic features are shown in Figure 3. Some of the designations are arbitrary and may be a matter of the writer's opinion. A "flat" is a broad upland area without long, steep slopes nearby. If a well is a short distance below the crest of a hill, it still is considered as being on a hill. The designation "draw" is used for any slight to moderate depression leading downward to a stream valley and upward to a saddle in a ridge or a gap between two hills. It is neither an active gulley nor an inactive one that has been healed by a cover of vegetation.

TABLE 6.—*Average Yield of Drilled Wells According to Topographic Location*

Topographic Location	Number of wells	Average depth (feet)	YIELD (GALLONS A MINUTE)	
			Average	Per foot of well
Hill crest	172	160	7	.05
Slope	82	151	20	.11
Flat	7	163	23	.14
Draw	21	140	42	.29
All wells	282	156	14	.09

TABLE 7.—*Relationship of Topography to Yield*

Topographic location	Number of wells	PERCENTAGE OF WELLS YIELDING			
		Less than 5 gallons a minute	5 to 10 gallons a minute	More than 10 gallons a minute	More than 20 gallons a minute
Hill crest	172	39	45	16	9
Slope	82	9	33	58	44
Flat	7	0	14	86	70
Draw	21	0	9	91	81
All wells	282	26	38	36	26

The most striking conclusion drawn from Tables 6 and 7 is the large proportion of low-yielding wells on hills. The average yield is about 7 gallons a minute, or .05 gallons per minute per foot of well. This is only about one-third of the average yield of wells on slopes and flats and one-sixth that of wells in draws. Listed are some reasons why wells on hills generally yield less water than those on other locations:

(1) In many cases, valleys and draws tend to be located in areas where the rocks are fractured; areas beneath the hills tend to be less fractured. The presence of fracture openings facilitate the percolation of ground water, which promotes chemical decay and enlargement of the openings by dissolving some of the rock material. Much of the downhill movement of water beneath the ground is through fractures underlying the trough-like depressions, or draws, that extend from the uplands to the stream valleys. Fractures beneath a draw may be as numerous near the top of the upland area as they are near the stream valley.

(2) In most cases there is a larger perennial source of water available to wells in draws and valleys than to wells on hilltops. There is less seepage into the ground on hills than in low areas because of rapid runoff that results from precipitation. On the other hand, lowlands receive seepage directly from precipitation and also from upland surface runoff. Because the movement of ground water is toward the valleys, or lowland areas, there is a natural movement of water away from wells on hills.

STRUCTURE IN RELATION TO YIELD OF WELLS

Openings that result from the development of faults, folds, contact borders of intrusive rocks, or bedding planes within rocks occur in all the rocks in Pittsylvania and Halifax counties. All such openings are referred to as fractures in this report.

Except for the Triassic sediments, the rocks appear to have been steeply tilted, and a very prominent steeply-dipping banding or layering exists. At a depth of 100 to 200 feet of the land surface some of the layers are separated by openings through which water can pass. These openings that are approximately parallel to the banded planes of the schists, gneisses, and slates are the most common, but other openings also intersect the rocks in many other directions. If the steeply dipping fracture planes in schists control the movement of water, consideration should be given to the positions of the planes that are penetrated by a well. A successful well is one in which a considerable amount of water is contributed from the intake area to the well. ". . . If the strata comprising the intake area for a well crop out on a steep hill where runoff is great and where the influent seepage is therefore relatively slight, the well will, in all probability, be a smaller producer. Hence, it would seem advisable to locate a well in such a manner as to intersect water-laden schistose openings that have adequate access to influent seepage . . ." (Herrick and LeGrand, 1949, pp. 20-21).

A type of fracturing characteristic of massive rocks is called sheeting, or large-scale foliation. The gneisses locally contain prominent, nearly horizontal sheet fractures in the upper 20 feet of the fresh rock. The sheet fractures are either flat or slightly convex beneath the hills, resulting in rapid draining of upland ground water to the adjacent lowlands (LeGrand, 1949, p. 110). Rocks that have noticeable sheet fractures yield very little water to wells on hills. Although sheet fractures are commonly subordinate in number and size to the steeply dipping "bedding plane" fractures, their flatness results in a system of cross fractures that tend to increase the natural circulation of water and to improve the yields of wells.

Schists and gneisses contain numerous veins and dikes that are oriented in different directions; joints commonly occur along the contacts between the veins and dikes that extend through these rocks. Stuckey (1929, p. 10) and Mundorff (1948, p 26) have noted that quartz veins are very brittle and that water-bearing fractures in these veins may contain a supply of water for many wells. The presence of white quartz (flint) boulders in the soil may mark the existence of a quartz vein in the immediate vicinity, or perhaps beneath a slightly higher position on the slope.

THICKNESS OF WEATHERED MATERIALS

The residuum is the result of decomposition or chemical weathering of the rocks. The presence of a thick residuum indicates that water moves with ease downward through it and through some of the fractures in the underlying bedrock. The subsoil zone is probably the least permeable part of the residuum. The compact clay of the subsoil appears to be almost impermeable, even though some water moves slowly through it. In addition water moves downward through the subsoil in openings made by roots and in tension cracks caused by soil creep and slump. In the saprolite, or decomposed rock, fractures and other openings are numerous; some openings, especially those near the subsoil, are filled with clay. Therefore, downward movement of water through the saprolite is similar to the movement of water through the subsoil and through the fractures of the bedrock.

Water will reach the bedrock fractures only as fast as it will flow from the least permeable part of the residuum. Therefore, it is not the average permeability of the residuum but rather the least permeable zone that holds the key to the perennial yield of wells.

The depth to which a well is cased generally indicates the thickness of the residuum because most wells are cased to fresh bedrock. Some fresh rock ledges are penetrated at depths less than that of the casing, but clay-like material between the ledges require that the casing be driven to a level below which all rock is fresh. This fact results in water being sealed off in many cases and tends to offset the general rule that a well penetrating several tens of feet residuum has a better chance of success than one penetrating only a few feet. Therefore, no definite relations could be established between the length of casings and the yield of wells.

CONSERVATION AND RECORDS

THE OWNER'S RECORD AND KNOWLEDGE OF HIS WELL

Many ground-water problems arise because the well owner does not have adequate knowledge of his well and its performance. Some of the problems involve the rate of pumping in relation to fluctuations of water level and other problems involve the chemical character of the water.

The yields of few wells are accurately determined. In many instances, emphasis is placed on the amount of water pumped out of a well in a short pumping or bailing test and little thought is given to the change in water level. For many wells this is the only record of the yield available. It should be emphasized that the first water pumped from a well has been temporarily stored in the fractures around the well and that this water may move toward the well much faster than water from a source of replenishment can move into the fractures near the well. Therefore, a close observation of both the pumping rate and water-level behavior during and after periods of pumping are needed in order to determine the true yield of a well.

In most cases the chemical character of water from individual wells is fairly constant through the years; as a result, a chemical analysis of water from a well at the time of its completion gives the well owner the information that is needed to guard against a type of water that might be unsuitable. If the water is mineralized, the harmful effects may be hardly noticeable at first but may become increasingly worse with time. For example, a well owner may not realize that his water contains iron or is corrosive until red water has stained his bathroom fixtures or corroded his pipes. He may find no real objection to hard, mineralized water until his pipes are nearly closed with a caked deposit of mineral matter from the water. The point to be stressed is that treatment, if necessary, should be started as soon as the well is completed.

In summary, the owner or user should know certain facts about his well if it is to give him satisfactory service. These include depth of well, diameter of the casing and of the well below the casing, depth of casing, static water level, quantity of water yielded, drawdown at the maximum yield, and the chemical character of the water. He should know the type of pump that was installed and amount of suction, or jet, that is rated for his deep-well pump; with this information, the possibility of increasing the yield by changing the pump installation can be determined easily. An opening, at least one-half inch in diameter, which may be plugged or capped, should be made accessible so that static and pumping water levels can be measured from time to time. Information regarding a well should be written and recorded as a document to be used and to be available to each owner or operator of the well. The Virginia Division of Mineral Resources will furnish forms on which the owner can record pertinent well information. It is desirable that the owner request the driller to use these forms and submit the information to the Division. The Division will keep these record forms on file for immediate and future use, thus preventing the loss of valuable information.

CONTAMINATION OF GROUND-WATER SUPPLIES

There have been relatively few occurrences of pollution of ground-water supplies by harmful bacteria in Pittsylvania and Halifax counties. Almost all well owners and drillers take precautions to prevent pollution, and many quite properly request the County Health Officer to look over their grounds and give approval of a well location with regard to sanitation needs. In keeping with requirements of the Virginia Department of Health, it is the practice to locate wells more than 50 feet from any known source of pollution, to drive the casing of drilled wells into hard rock, and to seal the casing so as to prevent an inflow of water from the surface immediately around the well.

A type of contamination that has received very little attention in the past but which will be very important in the years ahead concerns synthetic detergents, commonly known as "syndets." It should be pointed out that harmful bacteria in sewage are removed during filtration through clay and sand, but syndets are added into the ground-water system more or less intact except for dilution. In 1948 syndets represented only about 16 percent of the total annual soap and detergent sales, but by 1957 they represented more than two-thirds of total sales (Flynn, J. M. and others, 1958, p. 1554). As a result, the build-up of syndets under ground may cause water-supply problems in the years ahead, especially where wells and septic tanks are closely spaced. At the present, there is little information concerning the ability of syndets to carry bacteria, viruses, and other pollutants farther than they might normally travel. The extent to which syndets might be toxic in concentrations as low as those found in water supplies has not been determined, but an unpleasant taste and some foaming may occur when the concentration is greater than 1.5 parts per million in the water. The County Health Officer should be notified of all well water with peculiar tastes so that he can make the proper evaluation of the problem.

POTENTIAL DEVELOPMENT OF GROUND WATER

Much of the discussion in this report is centered on the factors related to the yield of individual wells. However, a question that concerns industrial and perhaps future domestic use relates to the maximum amount of water that can be pumped on a sustained basis from a given area—a few acres or even one square mile.

Bearing in mind that the natural movement of ground water is toward the valleys where it is discharged as evapotranspiration or is discharged as seepage and springs that flow into streams, any pumping will divert some water toward the wells. To eliminate or reduce the natural discharge it is necessary to obtain a maximum yield on a sustained basis; to reduce the natural discharge water levels must be lowered. Because the natural discharge areas occur near streams and flood plains, more ground water is available for wells in these areas than wells on upland areas. Moreover, if the cone of depression of one or more pumped wells extends outward to a stream, water from the stream moves toward the center of the pumped area. Several wells spaced strategically within a few acres on both sides of a stream have sufficient recharge to furnish large supplies of water. On the other hand, from the same acreage on an upland area the recharge available is limited, and the sustained yield of several wells in aggregate might be less than 100,000 gallons a day.

CONSERVATION OF GROUND WATER

Although the subject of conservation of ground water in Pittsylvania and Halifax counties is not a critical one, this section is written to summarize for the reader the relation between the quantity of water that may be expected from wells, individually and collectively, to the availability of water in the underground reservoir, in terms of long-continued use.

It has been noted that the storage capacity of the underground reservoir, as compared with a surface reservoir of equal size, is not as large because the movement water is restricted to the fractures in the rock and to the pore space in the clay and sandy material above the rock and below the water table. If there were no recharge or replenishment, a well could withdraw almost all of the water stored in its area of influence within a few months—perhaps in much shorter time. The yield of the well would gradually decline. Although storage is an important factor, it is in certain respects second to recharge as far as conservation of ground water is concerned.

Recharge to the underground reservoir comes from rain falling on the ground surface of the two counties. There is no basis for the common belief that some of the ground water comes through underground channels from the Blue Ridge Mountains. Only a part of the total rainfall is available for recharge because some runs off over the land to streams and some is lost by evapotranspiration. It has been pointed out that the water table is the upper surface of the water contained in the underground reservoir. Recharge causes the water table to rise and as a result more water seeps out of the ground in lowland areas. If an underground reservoir is almost full of water, additional water will be lost as surface runoff except in well areas affected by pumping. Should space in the reservoir be created by increased pumping, some of the runoff could be salvaged. Thus, to a limited extent as pumping increases, recharge increases. This may be considered a form of conservation because water is saved and used before it can be lost to streams and evapotranspiration.

When a well is pumped the water table is depressed around the well in the form of an inverted cone. Some water in the surrounding area moves toward the well, and the direction of water that previously moved away from the well toward a nearby valley is reversed so that it also moves toward the well. Water that would have moved away in streams or that would have evaporated in low swampy areas is therefore utilized from the well. As more wells are pumped, more water is available for use. Full and wise use of ground water is the form of conservation that should be encouraged.

Are the ground-water supplies in danger of depletion by overuse? In considering this question, it must be realized that the withdrawal of water from individual wells is not large. The majority of wells are used domestically, the average need being only a few hundred gallons a day. With this limited pumping, the water table is not lowered significantly at a distance of more than a few hundred feet from each well. Even in the small percentage of wells pumped constantly at 25 gallons a minute, the water table is not lowered significantly at a distance of more than a few hundred yards from each well. Consequently in more than 90 percent of the area within the two counties the water table is not affected by pumping from wells; and, therefore, natural conditions prevail. In some cases, where fractures are penetrated by wells, water flows into the well faster than it can be transmitted from more distant fractures or from the residuum above. In these cases, the withdrawal of water from the wells may exceed the local recharge during the early periods of pumping. Later, the yield may decline until a stage of equilibrium is established in which the amount of water that can be withdrawn is equal to the amount of water that flows through fractures from which the wells are supplied. Thus, it is unlikely that a lowering of the water table over large areas will occur unless the number of wells is multiplied many times. Certainly the ground-water supplies are in no danger of being overdeveloped regionally.

SUMMARY

1. The water underground may be considered as occurring in an underground reservoir, the water being contained in the open spaces of the rock materials. The water table, representing the top of the reservoir, generally lies in clay, or disintegrated rock materials; in the lower part of the reservoir, water occurs in interconnecting bedrock fractures, which diminish in number and size with depth. Water moves by gravity through the residuum and thence through the underlying fractures in the bedrock to the drilled wells. The source of this water is precipitation in the general area of a well and not some remote location such as the Blue Ridge Mountains.

2. The water table has a "hill and valley" relationship that approximately conforms with surface topography, even though the water table is somewhat flatter. For example, a creek or river is the surface expression of the water table in a valley, but beneath a hill, the water table could be 30 to 70 feet below the ground surface. Ground water, like surface water, has the tendency to drain away from the hills to the valleys. This tendency is useful in planning the location of wells in relation to other wells and to sources of possible contamination.

3. The relation of the depth of a well to yield is not simple. In spite of some belief, water already available to a well is never lost by drilling deeper. Therefore, there is always a chance of getting a larger supply by drilling deeper, but this chance becomes poorer as the well deepens because the interconnecting fractures decrease both in size and number with depth; as a result, storage and transmittal of water in rocks also decreases with depth. More than 90 percent of all water occurs in the first 100 feet below the water table. In almost all cases, two wells 200 feet deep each will yield more water than one well 400 feet deep.

4. The important relationship of topography to yield has been emphasized in this report. The great majority of wells are located on hills or smooth upland slopes because of convenience and because these locations appear safe from sources of contamination. Yet, the proportion of low-yielding wells is greater on hills and upland slopes than in lowlands or draws (concave slopes that lead upward from a valley to a saddle or gap in a ridge). Sixty percent of the wells in draws yield more than 30 gallons a minute; many wells

yield more than 50 gallons a minute. On the other hand, sixty percent of the wells on hills yield less than 10 gallons a minute and only twenty percent yield more than 20 gallons a minute.

5. In general, wells are more productive and tend to have a more stable year-round yield where a thick mantle of soil occurs than where rock is exposed at the ground surface. The presence of a thick soil cover and the absence of rock outcrop are indicative of a condition where water may move downward into the rock and is not readily shunted toward the adjacent valley. In fact, the presence of the soil cover indicates that interconnecting rock fractures are available for the storage and transmittal of water to wells. Where there is a thick soil cover the water table generally lies in it; therefore, the storage capacity of the soil is greater than that area where bedrock is exposed and the only water in storage is in the rock fractures, which might be quickly drained.

6. Water-yielding properties of the different types of rock in the Virginia Piedmont may be difficult to predict. There are many varieties of igneous and metamorphic rocks, but for a discussion regarding their ground-water properties, they may be grouped as follows: (1) massive igneous rocks, such as granite, and (2) metamorphic rocks such as schists, gneisses, and slate, which may contain an alinement of minerals, cleavage planes, or openings along which water may move. In some places a type of rock may have distinctive water-bearing characteristics; but, if so, it is also likely to show distinctive topographic and soil-mantle features. Topographic and soil-mantle features may be recognized and consequently used as criteria for predicting the water-yielding potential of a well site; whereas, the inherent water-bearing characteristics of a type of rock, by itself, may be obscure. There are too many complex factors to be correlated to justify generalizations about the yield of wells from individual rock types.

7. Whenever water is pumped from a well, the water level is lowered in and around the well. An increase in yield is not always directly proportional to an increase in drawdown. For example, a well yielding 20 gallons a minute with a drawdown of 50 feet will not yield 40 gallons a minute with a drawdown of 100 feet; instead it will yield less than 40 gallons a minute and perhaps no more than 25 or 30 gallons a minute with a drawdown of 100 feet.

8. The yield of some heavily pumped wells gradually tends to decline. In many instances, the decline in yield may be explained as follows. The size and setting of a pump are often determined during a short testing period just after the well is completed. Such a short testing period may not be indicative of a long-term yield of the well because the first water is withdrawn from storage in the rock materials, and many hours, days, or even months may pass before there is a stable adjustment between the amount of water supplied from fractures and the amount of water available to drain through the overlying residuum into these fractures. Failure to maintain a record of water-level fluctuations, which result from pumping, may lead to the erroneous conclusion that well supplies are not dependable. If a well tends to have an unstable yield, it is probably overpumped. To determine this condition the rate of pumping should be decreased until there is a rise of the water level; this pumping rate is indicative of the perennial safe yield. Constant pumping—if at a moderate rate—does not damage a well.

9. There is a tendency for rocks underlying a light-colored soil to yield water that is soft and low in dissolved mineral matter. Rocks underlying darker soils (dark red, brown, and yellow) tend to yield water that is slightly hard, or hard, and may contain objectionable amounts of iron.

COUNTY DESCRIPTIONS

INTRODUCTION

The geology and ground-water conditions of Pittsylvania and Halifax counties are described separately. With each county description are tables of well data.

Well numbers which correspond to the numbers noted on the well map are listed in the first column of the tables. Approximate location of wells with respect to the nearest town or community is listed in the second column. The water level below land surface, or the static level, which is the level to which the water rises if the well is not being pumped, is listed in the eighth column. The yield in gallons a minute is listed in the ninth column. Most of the figures in this column are based on bailer tests and some of these were of short duration and therefore do not necessarily reflect the true condition of yield. Moreover, the drawdown related to a specific yield is rarely known. Wells in which the water level could not be lowered to the bottom of the well during the bailing test are listed as yielding "30+" gallons a minute. It is assumed that most of the wells, which could not be bailed out, yield more than 30 gallons a minute, because water can be bailed out of a well at nearly 30 gallons a minute where the water level does not fall below 100 feet. As the topographic situation of wells is significant, the wells are listed according to the following topographic locations: hills, flat, slope, draw, and valley. In summary, the well tables should be used only in respect to general information. Because of the complex relationship of factors that govern well characteristics, specific conclusions drawn from these well tables should be avoided.

After the table of well data is a table of analyses of water from wells in the county.

PITTSYLVANIA COUNTY

POPULATION AND INDUSTRY

Pittsylvania County had a population of 102,000 in 1951. The only large city is Danville with a population of 45,000. Chatham, with a population of 1,456 (1950) and Gretna, with a population of 803 (1950), are the only other incorporated towns.

Farming is a major industry; tobacco is the chief income producing crop. Dairying and the raising of corn, hay, and vegetables comprise a large part of the rural produce. Many people in rural areas only farm "home-use" vegetable gardens; these people own small acreages along paved roads and commute to Danville or some other town where they are employed. Danville is the industrial center of the county. Manufactured materials include cotton and rayon fabrics, sheets, knitwear, wearing apparel, lumber products, tobacco products, and fertilizer. Dan River Mills, Inc. represents the largest single-unit textile mill in the world.

Pittsylvania has a wide variety of mineral resources, but the present development is limited. Crushed stone used for road aggregate and for general construction purposes is the most important mineral resource. From two quarry operations granite gneiss in the product of crushed stone is supplied to the Danville area; one operation is located on the Virginia-North Carolina line a short distance east of U. S. Highway 29; and the other operation is located a short distance east of U. S. Highway 360 about 6 miles northeast of Danville. Other stone quarries have been operated from time to time throughout the county as the local demand for stone fluctuated. The Southern Lightweight Aggregate Corporation is processing Triassic shale near the Virginia boundary line about 2 miles south of Cascade; the shale is used in the manufacture of lightweight aggregate. Many years ago, iron was mined northeast of Pittsville; in the area around Toshes there are some prospects for manganese ore and barite. A white to pink coarsely crystalline limestone with tremolite occurs along a stream near the junction of State Roads 626 and 781 north of Museville. Exposures of the limestone are few; therefore, its extent—perhaps northeastward and southwestward from this locality—is unknown. Prospects for sheet mica from pegmatite dikes have been worked in a large area south of Swansonville (Pegau, 1932), and some prospecting has indicated the presence of mica near Pittsville. Relatively large emery deposits occur west of Whittles (Watson, 1923). Coal has been reported in some water wells within the Triassic rocks. Although kyanite has not been prospected, it occurs in much of the mica schist and deserves mentioning. Mineral water, sold for its purported health value, had considerable market in years past, but only Carter Springs near Sandy River, about 3 miles west of Danville, is known to sell mineral water at present. The mineral resources potential of Pittsylvania County is considerable, but future utilization of materials depends greatly on intensive geological investigations and on technological advances that may result in the development of applications for mineral resources not used at present.

PHYSICAL GEOGRAPHY

Pittsylvania County lies entirely within the Piedmont province. The major portion of the county is characterized by a broad and gently rolling plateau; the northwestern quarter of the county is somewhat mountainous. The plateau is apparent only by observing the nearly concordant upland surfaces, because the plateau was carved into a mass of complex slopes by the action of streams and other erosional agents. A close network of streams and valleys separate the upland areas or hills; generally a valley or draw separates two hilltops by a distance of less than 2,000 feet. The slopes are rounded and commonly mantled by a layer of soil and weathered rock material.

Three mountains are prominantly exposed above the plateau level. These are Smith Mountain in the extreme northwest part of the county; Farmers Mountain, a few miles northwest of Gretna; and Whiteoak Mountain, 20 miles or more in length extending northeastward through the center of the county. These mountains are composed of rocks that are more resistant to erosion than rocks underlying adjacent areas. On these mountains and on some other steep slopes, the rate of erosion appears to be greater than the rate at which the rocks disintegrate and decompose; a thin soil zone or exposure of bare rock results. Although the action sheet and gully erosion may occur on moderate to steep surface slopes, the relatively heavy cover of vegetation that is typical of this county tends to retard erosion. As a result, a heavy layer of soil and loosened rock material characterizes almost all slopes.

Surface drainage over the county is generally good, and almost every square mile of land has a perennial stream or small intermittent stream branches. However, in parts of the area underlain by Triassic rocks, the land is almost level and drainage is poor; west of Whiteoak Mountain these parts include the area that extends from Mount Airy to a point about 5 miles northeast of Chatham and south of Cascade in a locality commonly referred to as "The Meadows."

GEOLOGY

Several types of rocks are exposed in Pittsylvania County, and some of these have an irregular distribution. Most of the rocks occur in northeast-trending bands.

The Triassic rocks are the youngest consolidated rocks in the county and are described first because their distribution makes a convenient geographic reference for the description of other rocks. The outcrop belt of Triassic rocks extends diagonally from the southwest corner to the northeast corner of the county. The belt is approximately 2 miles wide near Dry Fork and is somewhat wider to the northeast; it has a maximum width of about 5 miles southeast of Gretna. The belt contains sediments that were deposited on top of a down-faulted block which formed a basin floor during Triassic time. It is known as the Danville Triassic basin and is one of many, narrow, structurally similar basins that contain Triassic rocks which occur discontinuously along the seaboard states between Nova Scotia and South Carolina.

Geologic studies of the Danville Triassic basin have been made by Roberts (1928) and Meyertons (1959). Meyertons mapped several rock formations within the basin. These formations consist of shale, claystone, siltstone, sandstone, and conglomerate. Locally, dark shale and coal are present. Many of the finer-grained rocks are red and many of the coarse-grained rocks, if fresh, have an appearance similar to that of granite. The rocks dip 25 to 40 degrees to the northwest. Characteristic features of the Danville Triassic basin are the high degree of consolidation and toughness of the sandstone and conglomerate beds, the ridge-forming habit of these beds and their prominent elevation even above the adjacent schists and gneisses, the prevailing low relief and gentle slopes on the red shales and other fine-grained sediments, and the coincidence of parts of many streams with the northeast strike of the beds.

Mica schist is the predominant rock northwest of the Triassic rocks of the Danville basin. The schist is especially well developed along U. S. Highway 29 between Chatham and Hurt and eastward to the Danville Triassic basin. In the Chatham and Hurt area, the schist contains many thin beds of granite, hornblende gneiss, and other rocks. The schist is present for several miles west of Chatham and Gretna; the proportionate amount of granite and granite gneiss increases west of U. S. Highway 29, and the rocks may be grouped as a part of the Virginia Blue Ridge Complex. The schistose layers are prominent in the saprolite zone, and schist appears to be the dominant rock type. Kyanite is a common mineral in the schist and is especially common in the vicinity of Farmers Mountain.

Along the western border of the mica schist and extending through Museville, Sandy Level, and Pittsville to a mile or two west of Hurt, is a zone in which coarsely crystalline limestone occurs. The limestone was observed by the writer only in an abandoned quarry near the junction of State Roads 626 and 781. Watson (1907, pp. 313-319) describes several other locations of crystalline limestone that occur as thin beds in the barite and manganese ore prospects near Toshes and Pittsville. Because the limestone weathers readily, but does not leave a surface expression indicative of its occurrence, it is difficult to determine the distribution and thickness of the beds. It is likely that several beds or lenses of limestone occur within the schist, ranging in thickness perhaps from a few inches to a few tens of feet.

Although granite is present locally in the schists and gneisses, its occurrence as large masses is less prominent than in many other counties in the Piedmont province of Virginia. However, the Leatherwood granite, which is typically exposed in eastern Henry County (Pegau, 1932, p. 29), extends into Pittsylvania County near the vicinity of Sandy River and Swansonville. The presence of the saprolite exposures of the granite reflects a medium-textured and even-grained light gray rock with many inclusions of schists and other rocks.

A zone several miles wide that lies between the Leatherwood granite and mica schist is underlain by rocks that are predominantly mica schist and granite. These rocks appear to be an injection complex in which the mica schist is the host rock and the Leatherwood granite is the intrusive rock. The most common relationships of the mica schist and granite are distinct alternating bands that range from a fraction of an inch to many hundreds of feet in width. The gradation zone between the Leatherwood granite and the mica schist contains rock that is not distinctly similar to either of these units; therefore, within the arbitrary boundaries of this zone the rocks are referred to as "mica schist and granite."

In the northwest corner of the county are rocks of the Evington group; in areas to the north this group has been mapped in detail by Brown (1958) and Espenshade (1954). In this report the group is divided into only two types of rocks: (1) greenstone (shown on geologic map as hornblende gneiss) and (2) phyllite and mica schist. The greenstone is a dark green to yellow green, fine-grained rock that is locally schistose. Greenstone saprolite is a yellow or brown, light-weight mass of porous, crumbly material. The greenstone is exposed west of Sandy Level on State Highway 40 and northwestward to the "frying pan," or almost circular loop, in Pigg River west of Hurt. Small belts of greenstone extend northward into Campbell County. The phyllites and schists may represent metamorphosed rocks of a sedimentary series. These rocks do not contain the granite injections that characterize the schist of the Virginia Blue Ridge Complex, and, therefore, the uniform character of the schists is apparent.

Southeast of the Danville Triassic basin is a large area underlain by layered rocks of different mineral and chemical character. For convenience, these rocks are referred to as "mixed gneisses" because the gneissic structure prevails and because light- and dark-colored rocks are closely interlayered. The light-colored layers are quartz-feldspar rocks that are considered to be granite gneiss that ranges considerably in texture and in mineral composition. The dark-colored rocks are largely composed of feldspar and hornblende with different amounts of quartz, biotite, and other minerals. The presence of distinct alinement and banding of layers of different mineral composition indicates that the rocks were originally siliceous and calcareous sediments which have become consolidated and metamorphosed into their present appearance. Granite and pegmatite stringers commonly occur in the mixed gneisses. The mixed gneisses are prominently exposed along U. S. Highway 58 from the Triassic basin eastward through Danville to the Halifax County line. In Danville at the junction of U. S. Highways 29 and 58, the dark-colored hornblende gneiss is predominant; but a light-colored granite gneiss with small stringers and layers of dark-colored hornblende gneiss, all of which typical of the mixed gneisses is also present. The light-colored granite gneiss underlies light sandy soils, whereas the dark-colored hornblende gneiss underlies yellow to brown, sticky, clay soils. Some idea of the proportion of light- to dark-colored gneisses may be estimated by observing the color and textural changes of the soils.

Granite gneiss underlies an area approximately 4 miles wide and 11 miles long located just northeast of Danville. The rock may be similar to the mixed gneisses, but it contains a smaller proportion of dark-colored hornblende gneiss. Fresh exposures of granite gneiss occur in the Barnes quarry that is about 8 miles north of Danville on the east side of U. S. Highway 360, and also where Sandy Creek crosses Pittsylvania-Halifax County line.

GROUND WATER

In Pittsylvania County local topographic, saprolitic, and structural conditions are more important factors that govern the yield of wells in igneous and metamorphic rocks than are the types of rock penetrated. The most important distinction to be made is between that of the area underlain by Triassic rock and that underlain by igneous and metamorphic rocks.

The occurrence and movement of water in the rocks of the Danville Triassic basin, which crosses the county diagonally from southwest to northeast, is largely controlled by the lithology and structure of the rocks. The bedding planes between the rock layers represent the largest openings through which water can move. These planes dip approximately 20 degrees to the northwest. Water from rainfall tends to move downward through the soil and then along the bedding planes. Water already stored in the bedding-plane openings has no natural means of moving toward the surface. Because the occurrence of water is largely controlled by the inclination of the bedding planes, topographic expression appears to have little influence on the yield of individual wells. For example, Well 140, that is located on a hill south of Bachelors Hall, yielded about 60 gallons a minute when tested. The yields of wells in the Danville Triassic basin range from less than 1 gallon a minute to 60 gallons a minute. Topography and the type of rock within the Danville Triassic basin were not noted to be factors relating to yields of wells. There is, however, a contrast in degree of hardness of the rock insofar as drilling is concerned. The sandstone, conglomerate, and diabase dikes are difficult to drill.

In general, the hardest and most mineralized water in the county occurs in the Danville Triassic basin (Table 9, Wells 44 and 45). These conditions result from the poor circulation of ground water and the presence of soluble minerals within the Triassic rocks.

Southewest of the Danville Triassic basin, ground-water conditions in the mixed gneisses are typical of those in the crystalline rocks of the Piedmont province. The rocks are relatively easy to drill and only a few wells yield an insufficient quantity of water for domestic use. Even though almost all wells are located on hills, over 90 percent of them yield more than 2 gallons a minute. In Danville the yield of each of several industrial wells is more than 20 gallons a minute. If only the most favorable topographic locations for wells were drilled, the average yield is likely to be greater than 35 gallons a minute in the vicinity of Danville and elsewhere in the eastern part of the county where the mixed gneisses occur.

Northwest of the Danville Triassic basin, in the area underlain by mica schist, Leatherwood granite, and rocks of the Evington group, ground-water conditions are typical of those elsewhere in the Piedmont. Most of the wells that are located on hills yield an adequate supply for domestic use. Most of the wells are cased through more than 40 feet of saprolite and are completed at depths ranging from 60 to 150 feet, depending on the presence of fractures in the bedrock.

Where there is a need for a large volume of water it is uneconomical to drill on hills. For example, six wells drilled in Gretna are on hills and their combined reported yield is only 34 gallons a minute, or an average of less than 6 gallons a minute per well. These wells are relatively deep and, therefore, it is likely the yield could not have been increased significantly by deeper drilling. Moreover, the wells penetrate a mica schist that contains lenses of other rocks which are noted for having good water bearing characteristics. A careful selection of well sites near the heads of draws could result in an average well with a yield as much as 35 gallons a minute. This condition exists at Gretna, Chatham, Hurt, Callands, and, in fact, everywhere in the county outside of the Triassic basin.

Water from the schists, gneisses, and granites is generally of good quality. To a great extent, the light-colored rocks contain water that is soft and low in mineral matter. The dark-colored rocks—hornblende gneiss and greenstone—contain water that is somewhat harder. Objectionable amounts of iron-bearing water occur in some wells, but too few analyses were made to determine the distribution of iron-bearing water in the county.

Temperatures of water range from 58° to 60°F in individual wells.

TABLE 8.—*Chemical Analyses of Ground Water of Pittsylvania County*
(*Well numbers correspond to numbers in table of well data*)

PARTS PER MILLION

Well or spring No.	Date of Collection	Analyst	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CACO_3$	pH
27	9/2/58	LeGrand (1)		0.4							190					5.2
31	11/24/58	Virginia (2)	30		18	5	10	2	63	26	1	0.2	0.0	187	65	7.0
44	1/8/54	USGS (3)	33		206	168			692	734	120	0.0	1.2	1850	1200	8.1
45	11/24/58	Virginia (2)	50		217	82	28	4	319	40	500	0.0	10.0	1441	882	7.7
62	11/24/58	LeGrand (1)		10.0												6.8
65	11/24/58	Virginia (2)	48		11	18	12	2	46	0	5	0.0	0.0	139	100	6.7
73	10/23/53	USGS (3)	27		6	4			49	3	1	0.1	0.2	62	30	6.9
86	12/22/58	LeGrand (1)									20				200	6.5
120	11/24/58	Virginia (2)	42		32	9	13	3	105	25	3	0.2	0.2	197	116	7.7
139	11/11/58	LeGrand (1)		12.0											200	6.2
140	11/24/58	Virginia (2)	45		14	5	6	1	29	6	10	0.0	3.9	190	55	6.4
163	2/20/51	Virginia (4)		0.6	16	6				2	10	0.1	0.7	168	64	7.4
Spring A	12/22/58	LeGrand (1)		0.1											40	5.5
Spring B	10/8/55	USGS (3)	44		182	8	15		133	395	5	1.4	0.1	717	488	8.2

LeGrand (1)—Field analysis by H. E. LeGrand.
Virginia (2)—Analysis by Virginia Water Control Board.
USGS (3)—Analysis by Quality of Water Branch, U. S. Geological Survey.
Virginia (4)—Analysis by Virginia State Department of Health.

TABLE 9.—*Well Records of Pittsylvania County*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic Situation	Remarks	Well No.
1	Hurt	W. C. Church	...	225	6	50	...	...	mica schist	hill	pump set at 210 ft.	1
2	Hurt	R. B. Mason	Moore	110	3	63	50	6	mica schist	slope	...	2
3	Hurt	B. E. Davis	...	140	5⅝	30	...	...	mica schist	slope	pump set at 130 ft.	3
4	Hurt	Herbert Mattox	...	175	5⅝	30	...	...	mica schist	hill	pump set at 100 ft.	4
5	Hurt	Hurt School	Moore	200	5⅝	50	45	25	mica schist	hill	couldn't bail below 125 ft.	5
6	Hurt	Ernest Maddox	Falwell	154	6	152	81	15	mica schist and granite	hill	...	6
7	Hurt	Paul Lanier	...	137	5⅝	20	...	...	mica schist	hill	pump set at 130 ft.	7
8	Hurt	Methodist Church	...	104	6	40	...	...	mica schist	hill	pump set at 95 ft.	8
9	Hurt	English Construction Co.	Moore	244	5⅝	99	45	30+	mica schist	hill	could not bail below 100 ft.	9
10	Hurt	Pittsylvania Wayside Park	Rich	234	6	50	...	5	hornblende schist	slope	...	10
11	Hurt	Carson Mattox	...	152	6	152	...	...	mica schist	hill	pump set at 138 ft.—water used at motor court	11
12	Hurt, 2 mi. S.	W. T. Moore	Owner	147	5⅝	50	...	3	mica schist	slope	...	12
13	Hurt, 2 mi. S.	W. T. Moore	Owner	137	5⅝	50	...	3	mica schist	slope	...	13
14	Hurt, 3 mi. S.	Coley Irby	Moore	110	5⅝	50	...	10	mica schist	hill	...	14
15	Hurt, 4 mi. S.	Matt Toddy	Moore	100	5⅝	70	...	30+	mica schist	hill	could not bail out	15
16	Hurt, 3 mi. E.	A. E. Arthur	...	110	6	60	...	10	mica schist	hill	...	16
17	Hurt, 3 mi. SE.	Pleasant Grove School	Rich	55	6	42	...	1	mica schist	hill	...	17
18	Hurt, 6 mi. SE.	Level Run School	Rich	80	6	69	...	3	mica schist	hill	school and well abandoned	18

19	Hurt, 10 mi. E.	Cedar Forest School	Rich	97	6	28	....	4	mica schist	hill	....	19
20	Straightstone	Straightstone School	Rich	115	6	99	....	6	Triassic shale	hill	....	20
21	Motley	Calvin Roach	....	103	$5\frac{5}{8}$	55	....	15	mica schist	hill	....	21
22	Motley	James Yeatts	Moore	140	$5\frac{5}{8}$	90	30	30+	mica schist	draw	could not bail out	22
23	Sycamore	Edgar Dalton	....	110	$5\frac{5}{8}$	90	50	30	mica schist	hill	....	23
24	Sycamore, 3 mi. E.	Isaac Walton Lodge	Moore	103	$5\frac{5}{8}$	50	30	10	mica schist	slope	....	24
25	Gretna, 10 mi. NE.	Harvey Mize	....	225	$5\frac{5}{8}$	80	....	10	greenstone	hill	....	25
26	Straightstone	Dr. A. M. Owen	....	115	$5\frac{5}{8}$	41	....	....	Triassic shale and sandstone	slope	....	26
27	Straightstone	J. C. Edmonds	....	45	21	21	14	10	Triassic sandstone	slope	chemical analysis	27
28	Straightstone	Airy Stone Co.	....	59	6	22	....	....	Triassic sandstone	hill	pump set at 50 feet	28
29	Ajax	Ajax School	Rich	96	6	84	....	2	mica schist	hill	....	29
30	Sandy Level	Sandy Level P. O.	Shelton	110	$5\frac{5}{8}$	70	60	20	hornblende gneiss	hill	....	30
31	Gretna	Virginia Hwy. Dept.	Falwell	150	6	35	26	5	mica schist	hill	chemical analysis	31
32	Gretna	Shell Oil Co.	Sigman	106	$5\frac{5}{8}$	35	25	20	mica schist	slope	drilled in old dug well	32
33	Gretna	Town of Gretna	....	235	8	....	....	9	mica schist	hill	well abandoned	33
34	Gretna	Town of Gretna	....	150	6	....	....	3	mica schist	hill	well abandoned	34
35	Gretna	Town of Gretna	....	450	8	....	....	1	mica schist	hill	well abandoned	35
36	Gretna	Town of Gretna	....	135	6	....	35	1	mica schist	hill	well abandoned	36
37	Gretna	Town of Gretna	....	357	8	....	....	12	mica schist	hill	well abandoned	37
38	Gretna	Hunter Burton	Rich	104	6	63	....	30	mica schist	flat	....	38
39	Gretna	Bennett Dairy	Moore	200	$5\frac{5}{8}$	120	....	10	mica schist	hill	....	39
40	Gretna, 2 mi. E.	B. O. Meadows	....	65	$5\frac{5}{8}$	30	....	....	mica schist	slope	pump set at 55 feet	30
41	Gretna, 3 mi. E.	Gibson Sawmill	Moore	240	$5\frac{5}{8}$	60	....	18	mica schist	slope	....	41
42	Gretna, 3 mi. E.	Gretna Broadcasting Co.	....	120	6	....	....	6	mica schist	hill	....	42
43	Gretna, 5 mi. E.	Joe Hodges	....	91	6	60	....	....	mica schist	hill	pump set at 80 feet	43
44	Mt. Airy, 4 mi. E.	W. R. Benner	....	90	55	....	80	10	Triassic sandstone	hill	chemical analysis—dug well	44
45	Mt. Airy, 4 mi. E.	Ollie Robertson	....	35	24	....	....	3	Triassic sandstone and shale	slope	chemical analysis—Temp. 58°F.—dug well	45
46	Riceville	Basil Farson	Connors	303	$5\frac{5}{8}$	75	....	5	hornblende gneiss	hill	....	46

TABLE 9.—*Well Records of Pittsylvania County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic situation	Remarks	Well No.
47	Riceville	Lipford School	Rich	89	6	63	....	6	mixed gneisses	hill	.....	47
48	Riceville	Riceville Baptist Parsonage	Mobley	80	6	60	....	2	mixed gneisses	hill	.....	48
49	Riceville	R. B. Adams	Rich	89	6	61	....	3	mixed gneisses	hill	.....	49
50	Gretna, 8 mi. SE	Mrs. A. W. Womble	Turner	170	6	20	8	10+	Triassic sandstone	slope	water reported to be hard	50
51	Gretna, 8 mi. SE	Mrs. A. W. Womble	Moore	130	5⅝	10	....	½	Triassic sandstone	slope	water reported to be hard	51
52	Chatham, 3 mi. N	James Hayden	.....	84	5⅝	40	....	....	mica schist	hill	pump set at 80 feet	52
53	Chatham, 2 mi. N	Virginia Hwy. Dept.	Falwell	79	8	28	....	30	mica schist	draw	.....	53
54	Chatham, 3 mi. W	Andy Floyd	Moore	104	5⅝	64	....	....	mica schist	hill	pump set at 80 feet	54
55	Chatham, 1 mi. E	A. R. Taylor	.....	105	5⅝	80	....	....	mica schist	hill	pump set at 95 feet	55
56	Chatham, 2 mi. E	G. T. Shelton	.....	85	5⅝	32	....	....	mica schist	slope	pump set at 80 feet	56
57	Riceville, 3 mi. S	Randall Reynolds	Mobley	120	6	100	....	10	mixed gneisses	hill	.....	57
58	Riceville, 4 mi. SE	Ed Oliver	Hightower	117	5⅝	60	30	5	mixed gneisses	hill	.....	58
59	Java, 3 mi. W	Shockoe Baptist Church	Heater	97	6	47	....	4	mixed gneisses	hill	.....	59
60	Java, 3 mi. W	Shockoe School	Rich	95	6	.....	....	8	mixed gneisses	hill	.....	60
61	Java, 2 mi. S	S. S. Gregory	Rich	115	6	89	....	5	mixed gneisses	slope	60-foot pumping level	61
62	Java, 2 mi. S	S. S. Gregory	.....	90	50	85	70	5	mixed gneisses	hill	dug well—chemical analysis	62
63	Java, 2 mi. S	S. S. Gregory	Heater	81	6	63	40	6	granite gneiss	slope	.....	63
64	Java, 3 mi. S	James Gregory	Rich	99	6	68	59	10	mixed gneisses	hill	.....	64
65	Java, 3 mi. S	Lewis Gregory	.....	176	6	60	....	4	mixed gneisses	hill	chemical analysis	65

66	Callands	Reynolds School	Rich	149	6	39		5	granite	hill		66
67	Callands	L. C. Barber	Rich	180	6	60		4	granite and mica schist	hill		67
68	Callands, 1 mi. S.	E. G. Williams	Mobley	350	6	40		$2\frac{1}{2}$	mica schist and granite	hill		68
69	Callands, 2 mi. S.	H. J. Herndon		86	6	34			granite and mica schist	hill	pump set at 75 feet	69
70	Callands, 3 mi. S.	Charles Ellers		104	6	40			granite	hill	pump set at 80 feet	70
71	Chatham, 6 mi. W.	Felix Clements		138	6	90			mica schist and granite	hill	pump set at 115 feet	71
72	Chatham, 3 mi. SW	Virginia Hwy. Dept.		86	6	48			mica schist and granite	hill	pump set at 78 feet	72
73	Chatham, 3 mi. S.	B. J. Davenport		150	6	60	40	$3\frac{1}{2}$	mica schist and grantie	hill	chemical analysis	73
74	Chatham, Rt. 29, 2 mi. S.	Geyer Florists		102	6	40		22	mica schist and granite	slope		74
75	Chatham, Rt. 29, 2 mi. S.	Victor Adkins		115	6	62			mica schist	hill	pump set at 110 feet	75
76	Chatham, Rt. 29, 2 mi. S.	Meadow View Tourist Ct.	Mobley	187	6	60		6	mica schist	hill		76
77	Chatham, 3 mi. SE.	Norman Neill	Mobley	190	$5\frac{5}{8}$	60		30+	mica schist and granite	slope		77
78	Chatham, 3 mi. SE.	E. W. Owens		147	$5\frac{5}{8}$	98			mica schist and granite	slope	pump set at 130 feet	78
79	Chatham, 4 mi. S.	Shonaberger Homes, Inc.		80	$5\frac{5}{8}$		35	2	mica schist	hill		79
80	Chatham, 5 mi. S.	J. L. LaPlade		112	6	80		18	mica schist and granite	hill		80
81	Dry Fork	V. P. I. Exp. Station	Rich	205	6			3	mica schist and granite	hill		81
82	Dry Fork	V. P. I. Exp. Station	Rich	100	6	80		13	mica schist and granite	draw		82
83	Dry Fork	Dry Fork School	Rich	145	6	60		5	mica schist and granite	hill	well yields 1 quart a minute at a depth of 106 feet.	83
84	Dry Fork	L. H. Jones	Rich	172	6			$1\frac{1}{2}$	Triassic shale	hill		84
85	Dry Fork, 2 mi. E.	Frank Chattin		123	6	30		3	Triassic conglomerate	slope		85

TABLE 9.—*Well Records of Pittsylvania County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic Situation	Remarks	Well No.
86	Dry Fork, 2 mi. E.	Frank Chattin	....	69	....	3	....	2	Triassic conglomerate	hill	chemical analysis	86
87	Dry Fork, 2 mi. E.	Frank Chattin	....	40	....	....	0	1	Triassic conglomerate	slope	well is near base of hill—slight overflow in wet weather	87
88	Dry Fork, 4 mi. SE.	Faith Home	Rich	119	6	20	....	8	granite gneiss	hill	....	88
89	Dry Fork, 4 mi. SE.	Faith Home	Rich	79	6	20	....	3	granite gneiss	hill	will yield 15 gpm for 20 min., then by resting 15 min. will pump 15 gpm	89
90	Callands, 8 mi. S.	James Fuller	....	105	6	100	....	....	granite	hill	pump set at 100 feet	90
91	Swansonville	J. F. Watkins Store	....	116	5⅝	63	....	30+	granite and mica schist	flat	could not bail water out	91
92	Swansonville	H. O. Reynolds	....	80	5⅝	32	....	....	granite and mica schist	slope	pump set at 78 feet	92
93	Swansonville	Sam Adams	Rich	157	5⅝	....	....	10	granite	....	75-foot pumping level	93
94	Sandy Ridge	L. I. Compton	....	140	5⅝	90	....	30+	mica schist and granite	hill	could not bail water out	94
95	Sandy Ridge	Neal Earley	Doyle Moore	133	5⅝	60	....	3½	mica schist and granite	hill	....	95
96	Swansonville, 4 mi. S.	Hinesville School	Rich	100	5⅝	43	....	5	mica schist and granite	hill	....	96
97	Swansonville, 4 mi. S.	Dennis Dodd	....	138	6	95	60	8	mica schist and granite	hill	....	97
98	Whitmell	Nettie Stowe	Mobley	665	6	....	30	½	mica schist	hill	....	98

99	Whitmell	Claude Pritchett	Mobley	104	5⅝	47	...	5	mica schist and granite	hill	...	99
100	Whitmell	Whitmell School	Rich	286	6	...	...	20	mica schist and granite	hill	...	100
101	Whitmell	Whitmell Methodist Parsonage	Mobley	76	5⅝	55	...	30+	mica schist and granite	flat	could not bail water out	101
102	Whitmell	Donald Phillips	Mobley	75	5⅝	40	...	7	mica schist and granite	hill	...	102
103	Whitmell, 4 mi. S.	F. S. Gibson	Rich	37½	6	12	...	10	Triassic shale	valley	...	103
104	Danville, 10 mi. NW.	Gordon Lewis	...	115	5⅝	55	...	20	mixed gneisses	hill	...	104
105	Blairs	Roland Brown	Mobley	100	5⅝	95	...	...	mixed gneisses	hill	well reported to have a good yield	105
106	Blairs	Bryant Bros. & Johnson Store	...	107	6	100	45	...	granite gneiss	hill	good well—furnishes 5 houses and store	106
107	Blairs	Bryant Bros. & Johnson Store	...	150	6	100	50	...	granite gneiss	hill	good well—furnishes 5 houses	107
108	Blairs	J. D. Meadows	Buck Scarce	130	5⅝	80	30	...	mixed gneisses	draw	level drops 12 ft. in 15 min. when pumped at 12 gpm then drops no more	108
109	Blairs	G. F. Slayton	Raymond Scarce	109	5⅝	30	50	2	mixed gneisses	hill	...	109
110	Blairs	L. W. Shelton	...	112	5⅝	...	55	4	mixed gneisses	hill	...	110
111	Danville, 6 mi. NW.	G. B. Parker	...	62	5⅝	38	...	...	mixed gneisses	slope	pump set at 58 feet	111
112	Danville, 6 mi. NW.	J. F. Dodd	...	54	5⅝	30	20	9	mixed gneisses	slope	...	112
113	Danville, 6 mi. NW.	Mt. Herman School	Rich	134	6	...	...	30	mixed gneisses	hill	...	113
114	Danville, 4 mi. NW.	Hughes Memorial Home	...	400	10	30	...	20	mixed gneisses	hill	another well, same depth and yield is located 20 feet away	114
115	Danville, Rt. 29, 3 mi. N.	Harry Greenburg	Rich	75	6	20	...	50	mixed gneisses	slope	...	115
116	Danville, Rt. 29, 3 mi. N.	D. V. Murphey	...	60	5⅝	40	...	...	mixed gneisses	draw	good yield	116
117	Danville, 2 mi. N.	Turnpike Bakery	...	176	5⅝	50	...	...	mixed gneisses	slope	pump set at 100 feet	117
118	Danville, 2 mi. N.	Charles Lovelace	Scarce	140	5⅝	80	...	30+	mixed gneisses	slope	could not bail water out	118
199	Kentuck, 2 mi. N.	Mrs. Elizabeth Collie	...	76	5⅝	42	...	...	mixed gneisses	hill	pump set at 75 feet	119
120	Kentuck	Dan River High School	Rich	376	6	80	...	15	granite gneiss	hill	pumping level 350 feet	120
121	Kentuck	J. H. Slaughter	...	114	5⅝	63	...	...	granite gneiss	hill	pump set at 90 feet	121

TABLE 9.—*Well Records of Pittsylvania County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic situation	Remarks	Well No.
122	Kentuck	Kentuck Baptist Parsonage	Rich	350	6			1½	mixed gneiss	hill		122
123	Swansonville, 7 mi. S.	Clarence Carter		95	6	75			mica schist	hill	pump set at 90 feet	123
124	Brosville, 5 mi. W	Girl Scout Camp	Rich	70	6	29	30	5	mica schist and granite	slope		124
125	Brosville, 5 mi. W	Stuart James Grant	Rich	383	6	60		2	mica schist	hill		125
126	Brosville, 5 mi. W	Stuart James Grant	Rich	359	6	40		½	mica schist	hill		126
127	Brosville, 1 mi. W	McDaniel Texaco Service		150	6		50		mica schist	hill	yield reported to be good	127
128	Brosville	Miss Maggie Montgomery		115	5⅝	75			mica schist	hill	pump set at 100 feet	128
129	Brosville	Jack Gray	Rich	124	5⅝	63		5	mica schist	hill		129
130	Brosville	Vincent Briedlove		130	5⅝	120			mica schist	hill	pump set at 125 feet	130
131	Brosville	Virginia Hwy. Dept.	Moore	143	5⅝	70			mica schist	hill	pump set at 135 feet	131
132	Brosville, 4 mi. SE.	Morris Hyler		135	5⅝	96			mica schist	hill	pump set at 120 feet	132
133	Cascade	Ernest Stophel		93	5⅝	21			mica schist	slope	pump set at 87 feet	133
134	Cascade	J. H. Lillard		77	5⅝	12			hornblende gneiss	draw	good yield	134
135	Cascade	Lewis Nursery		102	5⅝				mica schist & granite	flat	well furnishes 3 houses & nursery	135
136	Cascade	Cascade School	Rich	146	6	20		½	Triassic shale	hill		136
137	Bachelors Hall	Mrs. Grace Arnett	Rich	94	6	84		20	mica schist	slope		137
138	Bachelors Hall	Rich Gulf Service		175	6	18			Triassic shale	slope	pump set at 90 feet	138
139	Bachelors Hall	Willie Robertson	Rich	60	8	10			Triassic shale & diabase dike	flat	chemical analysis—3 other wells 45, 46, 39 ft. hit diabase boulders	139
140	Bachelors Hall 2 mi. S.	Hal Rich	Rich	151	6			60	Triassic shale	hill	chemical analysis	140

141	Danvlle, 10 mi. W...	Harvey School..........	Rich	61	6	....	....	2	Triassic shale	hill	....	141
142	Danville, 8 mi. W...	H. C. Beckham.........	....	78	5⅝	50	....	....	mixed gneisses	hill	pump se tat 70 feet....	142
143	Danville, 7 mi. W...	Westover Plumbing & Heating Co............	Rich	79	5⅝	77	58	25	mixed gneisses	draw	....	143
144	Danville, 7 mi. W...	Branches Danville Gardens..............	Rich	88	6	75	50	30	mixed gneisses	draw	....	144
145	Danville, 5 mi. W...	J. G. Boatwright........	Rich	252	6	60	....	85	mixed gneisses	draw	200-foot pumping level.	145
146	Danville, 4 mi. W...	Dan Hills Development..	Rich	252	10	82	....	85	mixed gneisses	slope	....	146
147	Danville, 3 mi. W...	John Parker............	Rich	45	6	24	....	10	mixed gneisses	draw	20-foot pumping level..	147
148	Danville, 2 mi. W...	Triangle Cleaners........	Rich	121	6	63	....	9	mixed gneisses	slope	....	148
149	Danville............	Wickers Ice Plant.......	....	600	....	....	....	100	mixed gneisses	slope	....	149
150	Danville............	Dan River Cotton Mills..	Rich	400	8	210	....	30	mixed gnelsses	valley	mud seams encountered at depth of 195 feet/ well cased to 210 ft...	150
151	Danville............	Jones Sausage Co........	Rich	130	6	80	....	18	mixed gneisses	slope	....	151
152	Danville............	Norwood Homes........	....	182	10	78	....	....	mixed gneisses	slope	furnishes 15 homes.....	152
153	Danville............	Smith-Douglas Co.......	Rich	175	6	40	....	15	mixed gneisses	slope	chemical analysis— water contaminated...	153
154	Danville............	Smith-Douglas Co.......	Rich	100	6	50	25	3½	mixed gneisses	slope	water contaminated....	154
155	Danville............	E. W. Boggs...........	....	165	6	80	....	....	mixed gneisses	hill	pump set at 80 feet....	155
156	Danville, 1 mi. E....	Harry Greenburg........	Rich	209	5⅝	50	....	1	mixed gneisses	hill	....	156
157	Ringgold...........	Lawrence Collie.........	....	152	5⅝	78	....	....	granite gneiss	slope	pump set at 130 feet	157
158	Ringgold...........	G. Wesley Moshenck.....	....	146	5⅝	90	....	....	mixed gneisses	slope	pump set at 130 feet...	158
159	Ringgold...........	William Smith..........	....	97	5⅝	60	....	....	mixed gneisses	slope	pump set at 93 feet....	159
160	Ringgold, 2 mi. SE..	Taylorsville School......	Rich	110	6	67	....	6	granite gneiss	hill	....	160
161	Danville, 5 mi. E....	Robert Richardson......	....	66	5⅝	46	....	4	mixed gneisses	flat	....	161
162	Danville, 4 mi. E....	Gilbert & Myers Real Estate Co............	Rich	173	6	112	....	4	mixed gneisses	hill	....	162
163	Danville, 4 mi. E....	Municipal Airport.......	Rich	143	8	90	....	18	mixed gneisses	hill	....	163
164	Danville, 6 mi. E....	H. A. Bass.............	Rich	80	6	50	....	17	mixed gneisses	slope	....	164
165	Danville, 6 mi. E....	Norman Richardson.....	....	122	5⅝	25	....	....	mica schist	hill	pump set at 105 feet...	165
166	Danville, 6 mi. SE...	Mt. Hill White Rock School................	Rich	76	6	67	....	4	mixed gneisses	hill	....	166
167	Danville, 7 mi. E....	E. F. Arrington.........	Rich	146	5⅝	....	60	½	mixed gneisses	hill	....	167
168	Danville, 7 mi. E....	C. E. Hall.............	Mobley	50	6	....	2	....	mixed gneisses	slope	good yield reported....	168
169	Danville, 8 mi. E....	McCormick Service St...	Mobley	98	6	45	25	12	granite gneiss	hill	....	169
170	Danville, 8 mi. E....	E. F. Arrington.........	Rich	134	6	40	....	20	mixed gneisses	slope	....	170

TABLE 9.—*Well Records of Pittsylvania County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic Situation	Remarks	Well No.
171	Danville	Forest Lawn Baptist Church	Rich	138	6	42	40	18	mixed gneisses	slope	well tested at 18 gpm for 1 wk. with 40-foot drawdown	171
172	Danville	J. O. Bryant	Rich	115	6	53	....	10	mixed gneisses	slope	....	172
173	Danville	Howard Johnson	Rich	118	6	60	....	25	mixed gneisses	slope	another well a few feet away dry at a depth of 350 feet	173
174	Danville	Virginia Veneer Co.	Rich	133	6	105	....	11	mixed gneisses	slope	....	174
175	Danville, 2 mi. SW	T. C. Baker	Moore	116	$5\frac{5}{8}$	100	28	30+	granite gneiss	draw	could not bail water out	175
176	Danville, 2 mi. SW	Virdan Motor Ct.	Rich	84	6	76	....	16	mixed gneisses	slope	used as stand-by well	176
177	Danville, 2 mi. SW	Virdan Motor Ct.	Rich	125	6	90	....	31	mixed gneisses	slope	....	177
178	Danville, 2 mi. SW	Virdan Motor Ct.	Rich	109	6	85	....	22	mixed gneisses	slope	....	178
179	Danville, 2 mi. SW	Good Gulf Service St.	Rich	131	6	89	....	35	mixed gneisses	slope	original test of 50 hours at 35 gpm	179
180	Danville, 3 mi. S	Greystone Quarries	Rich	146	6	10	....	1	granite gneiss	hill	....	180
181	Danville, 2 mi. S	Proteat & Wells-Albright Transfer Co.	....	170	$5\frac{5}{8}$	33	....	....	mixed gneisses	slope	pump set at 80 feet	181
182	Danville, 3 mi. S	Harvey Brinchfield	Rich	52	$5\frac{5}{8}$	41	....	10	mixed gneisses	slope	pumping level 32 feet	182

HALIFAX COUNTY

POPULATION AND INDUSTRY

Halifax County had a population of 41,442 in 1950. Population of the municipalities in 1950 were: South Boston, 6,057; Halifax, 791; Virgilina, 323; Clover, 274; and Scottsburg, 222.

Agriculture is the most important income-producing activity and crops include tobacco, corn, grain, hay, vegetables, watermelons and, in the southern half of the county, cotton. Dairying is another income-producing farm activity. Large textile plants are located at both South Boston and Halifax; tobacco is marketed at South Boston.

There are no active mines in the county. The gneisses near South Boston and Halifax are quarried intermittently for road materials. Copper ore was mined in the Virgilina area (Laney, 1917); during the early 1900's the area was one of the more important copper ore districts in the eastern United States.

PHYSICAL GEOGRAPHY

Halifax County is located in the Piedmont province. The county consists of gently rolling interstream areas that are hilly near the larger streams. No hills are higher than the general level of the upland surface, or plateau, that slopes eastward from an elevation of 655 feet near Cody to about 450 feet in the eastern part of the county. The plateau area is cut by several streams, and the channels of the Staunton and the Dan rivers have been lowered to an elevation of 300 feet near their confluence at Staunton River State Park.

The Staunton River flows eastward and southward, marking the north and northeast boundary of the county. The Dan River enters the county near the southwest corner and flows northeast to the vicinity of South Boston and thence eastward. The Bannister River receives the chief drainage from the center of the county, flows southeastward through Halifax, and then flows into the Dan River about 6 miles east of South Boston. The major divides are north of mid-positions between the 3 rivers, resulting in short north-flowing tributaries into the Staunton and Bannister rivers and long south-flowing tributaries into the Bannister and Dan rivers. The Hyco River flows northeastward into the Dan River and drains much of the southern part of the county. The valleys are relatively narrow because stream action has lowered them below the general upland surface approximately 100 to 150 feet. Flood plains, or "first bottoms," adjoin one or both sides of the larger streams and range in width from a few feet to more than a quarter of a mile.

GEOLOGY

The relative ages of the rock in Halifax County and the sequence of events which is reflected in their complex occurrence are not distinct in all cases, however, some generalizations may be made. Sedimentary rocks were folded, faulted, and metamorphosed into a complex group of gneisses and schists that are in the western two-thirds of the county. A part or all of the sediments may have been deposited during Precambrian time, but the metamorphism of the sedimentary rocks and the emplacement of the igneous rocks may have occurred during the Paleozoic time. Volcanic activity before late Paleozoic time is evident in the occurrence of interspersed volcanic and sedimentary rocks in the eastern part of the county. The volcanic rocks have been called "Virgilina volcanic group" (Jonas, 1932, p. 6). Several down-faulted blocks, or troughs, which received sediments from the adjacent areas were developed during Triassic time from tensional stresses, that occurred throughout the Piedmont province. Parts of three of these basins occur in Halifax County. Much of the weathered rock material of the basins has been stripped from above the existing beveled surface.

About two-thirds of the county is underlain by non-uniform layered rocks that dip steeply. They are called mixed gneisses because there is a prevailing gneissic structure and because there are two chief lithologic rock types—light-colored granite gneiss and dark-colored hornblende gneiss. Intrusive bodies that range in mineral composition from granite to gabbro are common and are located generally parallel to the northeast trending structure of the gneisses. The major part of the county is underlain by light-colored rock of granitic composition, and about 20 to 30 percent is underlain by dark-colored hornblende gneiss and related rocks. Typical exposures of the mixed gneisses occur along U. S. Highway 501 from the Virginia boundary through South Boston, Halifax, and Clover to the Halifax-Charlotte county boundary. In the northwestern part of the county, between Halifax and Volens, rock outcrops are scarce, but the light-colored soils suggest that granite gneiss is present. All of the upland areas underlain by the mixed gneisses are covered almost entirely by a mantle of soft and weathered rock. The scarcity of hard bedrock exposures is characteristic of the area. In some places along the lower slopes of upland areas and above the valley bottoms hard bedrock is more common.

Within the large area underlain by mixed gneisses are smaller areas underlain by hornblende gneiss, diorite, or gabbro. The contacts between them and the mixed gneisses are arbitrary and represent approximate boundaries between areas underlain chiefly by granite gneiss with those underlain by dark-colored basic rocks. The largest area of hornblende gneisses occurs between Paces and Turbeville and north and west of News Ferry. Gabbro, which is not related to the mixed gneisses, occurs in the eastern part of Halifax County at Staunton River State Park. This gabbro is a coarse-grained, greenish black rock that weathers into a brown, sticky soil. Two other areas of gabbro that locally contain considerable amounts of epidote occur north and east of Nathalie. These gabbro bodies weather to a yellow-green rock material sufficiently resistant to erosion to be exposed as hard ledges on the relatively flat upland area. The epidote-rich rock is prominently exposed at the junction of State Roads 644 and 627.

The Virgilina volcanic group is present in the eastern part of the county and lies east of a line connecting Mayo, Scottsburg, and Clover. The geology illustrated on the present map has been adapted largely from the map by Laney (1917). The slate and quartz sericite schist group is similar to the Aaron slate and the Hyco quartz porphyry of Laney. They are combined here because their soils are difficult to distinguish from each other and because their ground-water conditions are similar. They are light-colored, layered rocks that are steeply inclined and that trend northeastward. Interspersed with the slate and schist is the Virgilina greenstone, which is the altered equivalent of andesitic flows and tuffs. The greenstone does not appear to have visible fractures that extend downward in the fresh rock. As a result, the small amount of loose residual material is removed nearly as soon as it is formed; consequently the soil zone is thin and the greenstone underlies low ridges.

There are three separate areas underlain by Triassic rocks. The eastern side of the Danville Triassic basin is in the extreme northwestern tip of the county that crosses Pittsylvania County and extends northeastward into Campbell County. The Scottsburg-Wolf Trap Triassic basin and the basin northwest of Clover may have comprised one basin that was divided into two units by erosional agents. The likelihood that sediments in the Clover Triassic basin are relatively thin is indicated by the presence of an irregular outcrop pattern of the sediments and by the exposure of pre-Triassic rocks beneath the sediments along Walnut Run. Red shale is the main type of sediment in each of the three basins. Each basin is characterized by a relatively low and flat topography that is developed on shale.

GROUND WATER

Ground-water conditions are different from place to place in Halifax County; these differences are not clearly related to rock type. In areas underlain by igneous and metamorphic rocks local topographic conditions control the yield of wells to a greater extent than do regional conditions.

In the three areas underlain by Triassic rocks, topography is not an important consideration with regard to the yield of wells. Water occurs chiefly in openings that are parallel to the bedding planes. Because these bedding-planes are inclined, water cannot easily move out of the openings. Therefore, below a depth of approximately 100 feet no significant circulation exists, and it is thought that almost all subsurface movement of water in these rocks is within 50 feet of the land surface. The relatively flat topography in the Scottsburg-Wolf Trap area is paralleled by a shallow water table that is in most places no deeper than 15 feet below the ground surface.

That part of the county lying east of a line connecting Clover, Scottsburg, and Mayo contains wells from which high yields of water may be obtained. Development of more than a few gallons of water per minute from drilled wells in the vicinity of Virgilina, Omega, and Dryburg has been difficult. This scarcity of water occurs in areas underlain by light-colored schists and slates and by dark-colored greenstone. Part of the difficulty arises from the presence of a thin soil and saprolite, from the nearly vertical schistose planes along which openings become closed to the movement of water a few feet below the top of hard rock, and from the fact that flat-lying joint planes are scarce. Dug and bored wells are not common in this part of the county because the well owner runs the risk of paying for a dry hole that must be abandoned if hard rock is encountered above the water table. Also he runs the risk that during dry seasons the water table may be lowered below the bottom of the well, in which case the water supply fails.

In the western four-fifths of the county, which is underlain by gneisses, ground-water conditions are typical of those elsewhere in the Piedmont province. Almost all wells yield an adequate supply of water for domestic use, even though almost all are on hills and ridges where chances are poorest for large-yielding wells. A study of the well records indicates that the most productive wells are in draws or lowland areas.

Flood plains, which border parts of all the streams, represent the largest local source of ground water in the county. The flood plains typically contain permeable sand that occurs beneath a surface layer of clay. Where a part of the sand horizon is below the level of the stream, water may infiltrate the sand and be available from wells. Shallow "river-infiltration" wells have not been developed in the county, but they may be of considerable importance to industrial development because they represent the cheapest large source of water available for industry. It should be emphasized that exploratory drilling should precede any definite plans for this type of water supply because in many places sand is absent, and in some places the stream lies below the level of the sand and hence the water from the stream could not move toward the sand. The Dan, Staunton, and Bannister rivers are bordered by flood plains that might be surveyed if maximum utilization of ground water in the county is to be attained.

Considerable difference exists in the chemical character of water within the county. Perhaps the hardest and most mineralized water occurs in the Triassic sediments of the Scottsburg-Wolf Trap Triassic basin. Water in the Virgilina greenstone, as well as that in gabbro and hornblende gneiss, is also hard. In the major part of the county, especially that underlain by schists and gneisses that weather to light-colored soils, the water from wells and springs contains only a small amount of mineral matter. The temperature of well water ranges from about 58° to 60° Fahrenheit.

TABLE 10.—*Chemical Analyses of Ground Water of Halifax County*
(Well numbers correspond to numbers in table of well data)

PARTS PER MILLION

Well No.	Date of Collection	Analyst	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CACO_3$	pH
58	11/25/58	Virginia (1)	43		19	5	8	2	50	25	3	0.3	3.0	231	70	7.2
126	11/25/58	Virginia (1)	41		92	19	25	4	186	74	68	0.2	8.7	544	310	7.4
131	11/25/58	Virginia (1)	28		13	5	4	1	21	43	2	0.2	1.6	131	56	6.5
154	11/25/58	Virginia (1)	44		20	4	8	2	39	20	3	0.1	0.4	158	65	6.6
157	12/4/58	LeGrand (2)									250				400	7.0
158	1957	Calgon		0.8					61		6				65	6.3
171	11/24/58	Virginia (1)	41		90	31	24	1	260	14	103	0.1	1.1	547	351	7.4
184	8/20/58	LeGrand (2)		0.3							200				740	6.8
185	8/20/58	LeGrand (2)		0.3											190	6.0

Virginia (1)—Analysis by Virginia Water Control Board.
LeGrand (2)—Field analysis by H. E. LeGrand.

TABLE 11.—*Well Records of Halifax County*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic situation	Remarks	Well No.
1	Clarkton, 3 mi. N	Thornton Francis	Connor	176	5⅝	52	....	4½	mixed gneisses	steep hill	no water until 175 feet	1
2	Clarkton, 3 mi. N	Walker Ferguson	Connor	154	5⅝	63	....	25+	mixed gneisses	slope	hit water at 125 feet	2
3	Clarkton	Sammie Parker	Connor	125	5⅝	52	....	3	mixed gneisses	hill	....	3
4	Clarkton	Frank White	Connor	111	5⅝	85	....	5	mixed gneisses	hill	....	4
5	Nathalie, 6 mi. N	West Store	....	70	5⅝	20	....	2	mixed gneisses	hill	....	5
6	Cody, 4 mi. NE	Dr. Frank LaPrade	Holland	100	5⅝	30	....	5	mixed gneisses	hill	....	6
7	Childry	Childry Baptist Ch.	Connor	135	5⅝	45	....	5	mixed gneisses	hill	....	7
8	Childry	Dick Adams	Connor	100	5⅝	57	....	20	mixed gneisses	flat	....	8
9	Clarkton	Lee Hines	Connor	250	5⅝	40	....	6	mixed gneisses	flat	....	9
10	Rabat	Sam Holland	Connor	165	5⅝	45	....	5	mixed gneisses	hill	....	10
11	Rabat	Sanford Woosley	Connor	86	5⅝	47	....	8	mixed gneisses	hill	yield improved with depth	11
12	Rabat	Shilo School	Connor	112	5⅝	87	40	5	mixed gneisses	hill	....	12
13	Childry	Carlton Yates	Connor	110	5⅝	51	....	6½	mixed gneisses	hill	....	13
14	Volens	Guy Francis	Connor	150	5⅝	68	....	4	mixed gneisses	hill	....	14
15	Volens	F. C. Guthrie	Connor	114	5⅝	56	....	30+	mixed gneisses	hill	only 1½ gpm at depth of 75 ft.	15
16	Cody	Jackson Tucker	Holland	95	5⅝	45	....	5	Melrose granite gneiss	hill	....	16
17	Cody	DeRoy Jennings	Connor	149	5⅝	37	....	5	mixed gneisses	hill	....	17
18	Cody	James Beddington	Holland	90	5⅝	40	....	5	mixed gneisses	hill	....	18
19	Cody	Ross Jennings	Connor	105	5⅝	28	....	8	mixed gneisses	hill	....	19
20	Cody	M. G. Hardy	Heater	120	6	100	30	5	mixed gneisses	slope	....	20

21	Cody	Nimrod Ferguson	Connor	103	5⅝	49	....	5	mixed gneisses	hill	.....	21
22	Republican Grove	Irvin Hunt	Connor	136	5⅝	122	....	5	mixed gneisses	hill	.....	22
23	Republican Grove	Mrs. Ruth Fourquera	Connor	85	5⅝	80	....	10	mixed gneisses	hill	.....	23
24	Republican Grove	Mrs. Lena Conner	Connor	93	5⅝	72	....	10	mixed gneisses	hill	.....	24
25	Cody, 4 mi. S.	Aubrey Hubbard	Connor	252	5⅝	82	....	1	mixed gneisses	hill	.....	25
26	Republican Grove	J. T. Holland	Holland	75	5⅝	30	30	30+	mixed gneisses	draw	could not bail water out of well	26
27	Republican Grove	Republican Grove Church	Holland	150	5⅝	30	26	4	mixed gneisses	hill	.....	27
28	Republican Grove	Robert Cunningham	Connor	86	5⅝	74	....	7	mixed gneisses	slope	.....	28
29	Volens	James de Jarnette	Connor	80	5⅝	40	....	6	mixed gneisses	hill	.....	29
30	Volens	Guthrie Store	Connor	114	5⅝	56	....	30+	mixed gneisses	draw	could not bail water out of well	30
31	Volens, 4 mi. NE.	Frank Roark	Connor	150	5⅝	53	....	4½	mixed gneisses	hill	.....	31
32	Volens, 4 mi. NE.	Burke Stevens	Connor	90	5⅝	61	....	7	mixed gneisses	hill	.....	32
33	Volens	Mrs. H. P. Trent	Connor	149	5⅝	48	....	4	mixed gneisses	hill	.....	33
34	Volens	Roy Martin	Connor	85	5⅝	50	....	25	mixed gneisses	slope	.....	34
35	Volens	W. R. Roark	Holland	324	5⅝	30	25	30+	mixed gneisses	flat	could not bail below 30 feet	35
36	Volens	Barkley Perkins	Connor	200	5⅝	62	....	3	mixed gneisses	hill	.....	36
37	Volens	Martins Service Center	Connor	345	5⅝	52	....	7½	mixed gneisses	slope	.....	37
38	Volens	Dr. L. P. Bailey	Connor	100	5⅝	69	....	4	mixed gneisses	hill	.....	38
39	Volens	Lacy Ragsdale	Connor	425	5⅝	52	....	22	mixed gneisses	hill	at 400 ft. yield was less than 1 gpm	39
40	Nathalie	Arney Gosney	Connor	150	5⅝	50	....	5	mixed gneisses	hill	.....	40
41	Nathalie	Philip Ingram	Connor	123	5⅝	105	....	5	mixed gneisses	hill	.....	41
42	Nathalie, 4 mi. E.	S. B. Guill	Doss	131	5⅝	99	25	4	hornblende gneiss	slope	.....	42
43	Nathalie, 4 mi. E.	C. M. Irby	Doss	70	5⅝	50	22	10	hornblende gneiss	slope	.....	43
44	Nathalie, 5 mi. E.	W. R. Carr	Heater	50	6	10	....	3	mixed gneisses	hill	.....	44
45	Lenning, 6 mi. NE.	T. N. Snow	Moore	122	6	60	....	3	mixed gneisses	hill	.....	45
46	Lenning, 4 mi. E.	Norman Bray	Doss	154	5⅝	80	....	30+	mixed gneisses	draw	.....	46
47	Clover, 6 mi. NW.	W. E. Doss	Doss	115	5⅝	87	....	5½	granite gneiss	hill	.....	47
48	Clover, 8 mi. N.	Sam Holmes	Doss	109	5⅝	60	....	7	mixed gneisses	hill	.....	48
49	Clover, 8 mi. N.	Sam Holmes	Doss	150	5⅝	75	....	20	mixed gneisses	hill	.....	49
50	Clover, 4 mi. N.	Jane Ruffin Sims	Doss	150	5⅝	60	....	20	granite gneiss	slope	.....	50
51	Clover, 4 mi. N.	Jane Ruffin Sims	Heater	86	6	85	....	10	mixed gneisses	slope	.....	51
52	Clover, 3 mi. N.	Jane Ruffin Sims	Doss	150	5⅝	58	42	20	mixed gneisses	hill	.....	52

TABLE 11.—*Well Records of Halifax County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic Situation	Remarks	Well No.
53	Clover, 3 mi. N	Jane Ruffin Sims	Doss	120	5⅝	70	....	20	mixed gneisses	slope	....	53
54	Clover	Dr. Warren Hagood	Doss	180	5⅝	80	....	18	mixed gneisses	flat	....	54
55	Clover	W. E. Crews	Doss	190	5⅝	120	....	30+	mixed gneisses	slope	could not bail water out	55
56	Clover, 5 mi. W	Ed Hardy	Doss	115	5⅝	80	....	15	mixed gneisses	hill	....	56
57	Clover, 3 mi. W	S. C. Boman	Doss	100	5⅝	.....	50	25	mixed gneisses	hill	....	57
58	Clover	Clover High School	Doss	160	5⅝	63	....	30+	mixed gneisses	draw	could not bail water out	58
59	Clover	Hunt Texaco Service St.	Doss	150	5⅝	90	....	30+	mixed gneisses	slope	could not bail water out	59
60	Cody, 8 mi. S	Allie Reynolds	Mobley	200	6	80	....	5	mixed gneisses	hill	....	60
61	Volens, 2 mi. S	Neil Guthrie	Connor	252	5⅝	54	....	1	mixed gneisses	hill	....	61
62	Volens, 4 mi. S	Semmie Martin	Connor	185	5⅝	42	....	1½	mixed gneisses	hill	....	62
63	Nathalie, 5 mi. S	Miss Bertha Harper	Connor	93	5⅝	65	....	6	mixed gneisses	slope	....	63
64	Nathalie, 7 mi. S	E. W. Ewell	Hightower	125	5⅝	118	....	4	granite gniess	hill	....	64
65	Crystal Hill	Mary Pennick	Connor	81	5⅝	54	....	4½	granite gneiss	hill	....	65
66	Crystal Hill	George Covington	Doss	300	5⅝	60	....	20	granite gneiss	slope	could not bail out—struck most water at depth of 296 feet	66
67	Crystal Hill	Mrs. M. L. Owens	Heater	137	6	130	40	4	granite gneiss	hill	....	67
68	Crystal Hill	Ernest Chaffin	Doss	351	5⅝	80	....	3½	granite gneiss	hill	....	68
69	Vernon Hill, 6 mi. N.	C. C. McDowell	Heater	120	6	57	50	1¼	granite gneiss	hill	....	69
70	Youngers Store, 5 mi. W	Amos Jennings	Connor	90	5⅝	40	....	5	granite gneiss	hill	....	70
71	Crystal Hill 5 mi. SW	Mrs. B. W. Carter	Connor	253	5⅝	60	....	4	granite gneiss	hill	....	71

72	Halifax, 4 mi. N.	W. J. Hilton	Holland	466	5⅝	40	....	....	granite gneiss	hill	furnishes 4 houses—couldn't bail water below 200 feet	72
73	Halifax, 5 mi. N.	C. A. Cliborne	Doss	350	5⅝	60	....	2½	mixed gneiss	hill	....	73
74	Halifax, 6 mi. NE.	W. J. Dalton	Doss	120	5⅝	60	....	10	mixed gneisses	hill	....	74
75	Clover, 4 mi. SW.	Bennie Ricketts	Doss	150	5⅝	80	....	30+	mixed gneisses	draw	could not bail water out	75
76	Clover, 4 mi. SW.	F. E. Edmondson	Heater	95	6	65	28	10	mixed gneisses	slope	....	76
77	Clover, 4 mi. SE.	James Coleman	Doss	101	5⅝	34	....	10	sericite schist	hill	....	77
78	Clover, 5 mi. SE.	Jees Store	Doss	98	5⅝	28	....	4	sericite schist	hill	....	78
79	Clover, 4 mi. S.	Joe Guill	Doss	140	5⅝	70	....	2½	sericite schist	hill	....	79
80	Clover, 4 mi. S.	C. H. Guill	Doss	84	5⅝	74	....	20	sericite schist	slope	....	80
81	Halifax Rt. 360, 4 mi. E.	Mrs. Stella Francis	Doss	104	5⅝	71	....	30+	mixed gneisses	draw	could not bail water below bottom of casing.	81
82	Scottsburg, 4 mi. W.	J. T. Burton	Heater	104	6	72	....	8	mixed gneisses	hill	....	82
83	Scottsburg, 5 mi. W.	Harold Connor	Doss	232	5⅝	65	....	3	mixed gneisses	hill	....	83
84	Scottsburg, 3 mi. W.	Morrell Elliot	Heater	111	6	95	....	10	mixed gneisses	hill	....	84
85	Scottsburg, 3 mi. W.	Mrs. G. H. Ligon	Heater	93	6	77	38	7	mixed gneisses	hill	....	85
86	Scottsburg	Dorothy Bailey	Heater	93	6	36	....	4	Triassic shale	flat	....	86
87	Scottsburg, 4 mi. W.	Dr. Allen	Heater	96	6	35	....	3¾	mixed gneisses	hill	....	87
88	Scottsburg	F. S. Throckmorton	Heater	61	6	45	....	16	Triassic shale	slope	....	88
89	Scottsburg	J. H. Owen	Doss	120	5⅝	50	15	30+	Triassic shale	flat	could not bail water out	89
90	Dryburg	Floyd Fisher	Doss	218	5⅝	40	....	½	sericite schist	hill	....	90
91	Halifax, 10 mi. W.	Nellie Weatherford	Heater	77	6	51	....	2	granite gneiss	hill	....	91
92	Halifax, 1 mi. N.	Jack Forline	Connor	167	5⅝	42	....	3	mixed gneisses	hill	....	92
93	Halifax	Halifax Worsted Mills	Sydnor	551	8	42	30	9	mixed gneisses	hill	....	93
94	Halifax	Halifax Worsted Mills	Sydnor	603	8	.....	15	1	mixed gnesses	hill	well abandoned	94
95	Halifax	Town of Halifax	Hubbard	303	8	50	20	20	mixed gneisses	draw	....	95
96	Halifax	Town of Halifax	Sydnor	283	8	52	....	15	granite gneiss	hill	....	96
97	Halifax	Town of Halifax	Sydnor	526	8	.....	....	65	mixed gneisses	slope	....	97
98	Halifax	Town of Halifax	Rich	316	8	.....	39	55	mixed gneisses	slope	....	98
99	Halifax	Paul Edmonds	Hightower	143	5⅝	69	45	5	granite gneiss	hill	drilled in dug well 69 feet deep	99
100	Halifax, 2 mi. E.	Herbert Hall	Heater	385	6	55	38	5	mixed gneisses	hill	....	100
101	Halifax, 3 mi. E.	Easley Owens	Hightower	70	5⅝	60	35	4	mixed gneisses	hill	....	101
102	Halifax, 2 mi. W.	Lacy Garber	Connor	135	5⅝	54	....	30+	mixed gneisses	slope	could not bail water out	102
103	Halifax, 1 mi. S.	Mrs. Robert Greenwood	....	90	5⅝	....	25	25	mixed gneisses	slope	....	103
104	Halifax, 1 mi. S.	Halifax Golf Course	Doss	170	5⅝	45	15	10	mixed gneisses	draw	....	104

TABLE 11.—*Well Records of Halifax County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic situation	Remarks	Well No.
104 (a)	Halifax	D & T Chevrolet Co.	Doss	200	5⅝	20	....	20	mixed gneisses	slope	....	104 (a)
105	Halifax, 1 mi. S	H. J. Hudson, Jr.	Doss	386	5⅝	40	....	7	mixed gneisses	hill	....	105
106	Halifax, 1 mi. S	J. W. Moore	Heater	369	6	40	40	16	mixed gneisses	hill	....	106
107	Halifax, 1 mi. S	J. W. Moore	Heater	250	6	57	....	10	mixed gneisses	hill	....	107
108	Halifax, 1 mi. S	Short & de Jarnette	Heater	107	6	45	30	10	mixed gneisses	slope	....	108
109	Halifax, 1 mi. S	C. E. Payne	Heater	225	6	46	32	3	mixed gneisses	hill	....	109
110	Halifax, 2 mi. S	Elizabeth Oliver	Connor	123	5⅝	38	....	6	mixed gneisses	hill	....	110
111	Halifax, 2 mi. S	Neil Guthrie	Connor	100	5⅝	22	....	10	mixed gneisses	hill	....	111
112	Halifax, 2 mi. S	Irving Anderson	....	133	5⅝	60	30	30+	mixed gneisses	draw	furnishes 6 houses—pumping level at 60 feet	112
113	Halifax, 2 mi. S	Duffer Pure Oil St.	....	97	5⅝	75	32	7	mixed gneisses	hill	yields 5 gpm with a drawdown of 20 feet	113
114	Halifax, 2 mi. S	H. C. Landrum	Heater	133	6	66	....	12	mixed gneisses	hill	....	114
115	Halifax, 2 mi. S	Centerville Esso St.	Doss	135	5⅝	100	....	20	mixed gneisses	slope	....	115
116	Halifax, 3 mi. S	R. E. Clark	Heater	108	6	51	40	20	mixed gneisses	slope	temperature 60°	116
117	Halifax, 3 mi. S	Harold Ford	....	102	5⅝	46	....	5	mixed gneisses	slope	....	117
118	South Boston, 3 mi. N	Aylor Talbott	Heater	75	6	42	....	8	mixed gneisses	hill	....	118
119	Halifax, 3 mi. SE	Oak Hill Farms	Heater	110	6	35	4	20	mixed gneisses	valley	....	119
120	Halifax, 3 mi. SE	Oak Hill Farms	....	265	6	45	25	2	mixed gneisses	hill	....	120
121	South Boston, 2 mi. N	Dr. J. S. Sopher	Doss	254	5⅝	76	....	5	mixed gneisses	slope	....	121
122	South Boston, 2 mi. N	Merriot Hills Subdivision	Sydnor	287	6	66	....	20	mixed gneisses	slope	....	122
123	South Boston, 2 mi. N	J. E. Burton	Heater	92	6	72	45	12	mixed gneisses	slope	....	123
124	South Boston	Felton Bros.	Heater	221	6	14	20	10	mixed gneisses	slope	....	124

125	South Boston	Halifax Cotton Mills	Heater	400	8	27	10	150	granite gneiss	valley	pumped 150 gpm at 200-foot pumping level for 24-hour test	125
126	South Boston	Blue Ribbon Dairy	Heater	240	8	60	....	40	mixed gneisses	slope	analysis	126
127	South Boston	South Boston Bottled Gas Co.	Doss	137	6	45	6	30+	mixed gneisses	valley	could not lower water level below 70 feet with bailer test	127
128	Vernon Hill	H. B. Moorefield	Heater	224	6	42	....	1	granite gneiss	hill	....	128
129	Vernon Hill	Sandy Hardy Store	Doss	110	5⅝	40	35	6	granite gneiss	hill	....	129
130	Vernon Hill	Edgar Owen	Heater	100	6	42	....	⅛	mixed gneisses	hill	....	130
131	Vernon Hill	Oak Level School	Heater	206	6	44	....	12	mixed gneisses	draw	....	131
132	Halifax, 5 mi. W.	Midgetts Store	Russell	96	5⅝	36	....	6	mixed gneisses	hill	....	132
133	Halifax, 5 mi. W.	Theodore Perkins	Heater	168	6	.....	....	35	mixed gneisses	draw	....	133
134	Halifax, 7 mi. SW.	Robert Jennings	Connor	124	5⅝	94	....	30+	mixed gneisses	slope	could not bail water out	134
135	Vernon Hill, 6 mi. E.	J. R. Williams	Heater	227	6	38	20	50+	mixed gneisses	slope	yielded 48 gpm with drawdown of 20 feet	135
136	News Ferry	Dr. Janet Meade	....	83	6	30	....	18	hornblende gneiss	slope	....	136
137	Paces	W. L. Owen	....	67	4	30	37	7	granite gneiss	slope	....	137
138	Turbeville, 10 mi. W.	C. M. Powell	Rich	100	6	60	35	50	hornblende gneiss	draw	....	138
139	Turbeville, 10 mi. W.	C. M. Powell	....	60	6	40	50	4	hornblende gneiss	hill	....	139
140	Alton	W. A. Blaine	....	110	6	65	35	3	granite gneiss	hill	....	140
141	Alton	W. A. Blaine	Pressley	100	5⅝	40	25	30+	granite gneiss	draw	could not lower water level below 40 feet with bailer test	141
142	South Boston, 3 mi. NW	W. L. Talbott	Heater	90	6	63	....	5	mixed gneisses	hill	....	142
143	South Boston	S. R. Maxey	Connor	110	5⅝	66	....	10	mixed gneisses	hill	....	143
144	South Boston	Vons Motor Ct.	....	216	6	60	....	20	mixed gneisses	slope	....	144
145	South Boston	Vons Motor Ct.	....	160	6	60	40	15	mixed gneisses	slope	....	145
146	South Boston	White House Dairy	Hickory Well Co.	300	10	.....	9	80	mixed gneisses	slope	sustained yield is about 45 gpm	146
147	South Boston	White House Dairy	Hickory Well Co.	299	10	.....	10	80	mixed gneisses	slope	well abandoned after declining yield since 1945	147

TABLE 11.—*Well Records of Halifax County—Continued*

Well No.	Location	Owner	Driller	Depth of Well (ft)	Diameter of well (Ins)	Depth of Casing (ft)	Water level ft below surface	Yield (GPM)	Type of Rock	Topographic Situation	Remarks	Well No.
148	South Boston	White House Dairy	Heater	362	8	44	20	120	mixed gneisscs	draw	yield has declined to about 80 gpm	148
149	Soutl. Boston	Victory Warehouse	Doss	150	5⅝	70	15	30+	mixed gneisses	valley	sand and gravel to 50 feet	149
150	South Boston	Venerable Thaxton	Connor	200	5⅝	25	....	2½	mixed gneisses	hill	....	150
151	South Boston	Wyatt & Cruse Co.	Doss	80	5⅝	30	....	7	mixed gneisses	slope	....	151
152	South Boston	E. J. Puryear	....	75	5⅝	48	....	12	mixed gneisses	slope	....	152
153	South Boston, 4 mi. NE	Paul Edmunds	Heater	98	6	22	....	10	mixed gneisses	slope	....	153
154	South Boston, 4 mi. NE	V. A. Weaver	Heater	142	6	47	25	1¼	mixed gneisses	hill	analysis	154
155	South Boston, 4 mi. NE	E. J. Wyatt	Heater	180	6	141	65	6	Triassic shale	hill	....	155
156	Wolftrap	Airport	Doss	100	5⅝	40	....	15	mixed genisses	hill	....	156
157	Wolftrap	N. D. Snead	....	82	6	35	20	30+	Triassic shale	flat	analysis—could not bail water out of well	157
158	Wolftrap	Lonnie Hatcher	Hightower	36	18	36	22	1	Triassic shale	hill	analysis	158
159	Scottsburg, 4 mi. S.	Roy Hatcher	Heater	125	6	10	....	½	quartz-sericite schist	hill	....	159
160	Scottsbrug, 4 mi. S.	R. A. McKinney	Heater	115	6	22	....	¼	quartz-sericite schist	slope	....	160
161	Dryburg	Henry Wilmer	Doss	191	5⅝	20	....	1½	quartz-sericite schist	slope	....	161
162	Dryburg, 3 mi. SE	Paul Edmunds	Doss	70	5⅝	25	....	7	gabbro	slope	....	162
163	Omega, 3 mi. NE	R. H. Arrington	Heater	66	6	45	....	5	greenstone	hill	....	163
164	Omega	Chester Stevens	Doss	120	5⅝	65	....	15	sericite schist	hill	....	164

165	Omega	G. W. Nunn	Doss	126	5⅝	60	....	16	sericite schist	slope	....	165
166	Omega	Omega School	Doss	195	5⅝	45	....	10	greenstone	hill	....	166
167	Omega	S. R. Hailey	Heater	145	6	51	....	1½	sericite schist	hill	....	167
168	Omega	A. J. Brennan	Heater	97	6	50	60	10	greenstone	hill	....	168
169	Omega	Paul Edmunds	Heater	99	6	37	50	25	greenstone	hill	....	169
170	Midway	Presley Thompson	Heater	69	6	28	15	5	greenstone	hill	....	170
171	Midway	Aaron's Creek Baptist Parsonage	Pressley	114	5⅝	10	....	10	slate	hill	analysis	171
172	Cluster Springs	Virginia Hwy. Dept.	Falwell	78	6¼	47	38	10	mixed gneisses	slope	....	172
173	Cluster Springs	Cluster Springs School	Doss	160	5⅝	30	....	5	mixed gneisses	hill	....	173
174	Cluster Springs	Royster Super Market	....	92	5⅝	....	....	20	mixed gneisses	flat	....	174
175	Mayo	Hanlon Lumber Co.	Doss	104	6	20	16	20	sericite schist	draw	well abandoned	175
176	Mayo, 3 mi. S.	Mrs. G. W. Joyner	Heater	143	6	35	....	5	mixed gneisses	hill	....	176
177	Christie	A. J. Wilson	Moore	112	5⅝	12	18	16	greenstone	hill	....	177
178	Virgilina, 8 mi. NW.	W. M. Cole	....	51	5⅝	5	....	5	greenstone	hill	water reported to be hard	178
179	Virgilina, 8 mi. N.	S. W. White	....	130	5⅝	....	20	3	slate	slope	....	179
180	Virgilina, 8 mi. N.	Heights Store	Doss	120	5⅝	20	....	2	slate	hill	....	180
181	Redbank	A. E. Morris	Doss	65	5⅝	30	....	3	greenstone	hill	....	181
182	Redbank	Clifton Loftis	Doss	110	5⅝	20	25	10	greenstone	slope	water hard containing iron oxide	182
183	Virgilina	Glascock Service St.	Davis	82	6	15	....	5	greenstone	hill	....	183
184	Virgilina	C. F. Morris	Davis	83	6	7	20	6	greenstone	hill	....	184
185	Virgilina	Richard Caudle	....	32	24	....	12	....	greenstone	slope	dug well—analysis	185
186	Virgilina	Charles Newman	Williamson	150	6	30	....	1	greenstone	slope	....	86
187	Virgilina	J. W. Pleasants	Pressley	113	5⅝	10	....	3	greenstone	hill	....	187

GLOSSARY

(The definitions of the terms listed below are for the benefit of the layman and driller and are not necessarily as precise as those found in scientific textbooks.)

Acid rock—an igneous rock composed chiefly of light-colored minerals.

Basic rock—an igneous rock composed chiefly of dark-colored minerals.

Cone of depression—depression produced in the water level around a pumped well.

Decomposition—the breaking down of minerals, usually through chemical processes; a softening or rotting of rock into clay and sand.

Diorite—a medium- to dark-colored granite like rock composed chiefly of hornblende and feldspar; generally a dark-red soil; called black granite by some drillers.

Disintegration—the loosening of mineral grains in the zone above fresh rock.

Draw—a sag or trough-like part of the land surface leading up from a stream valley to a gap between two hills.

Drawdown—difference, in feet, between the static water level and the pumping water level of a well.

Flat—a relatively flat upland area.

Flood plain—a flat area, underlain by alluvium, bordering parts of some streams.

Gabbro—a dark-colored crystalline rock composed chiefly of feldspar and pyroxene; generally produces a dark-red soil; called black granite by some drillers.

Gneiss (pronounced "nice")—a banded rock showing alinement of some minerals. If the composition is that of granite, it is a granite gneiss.

Granite—a light-colored crystalline rock composed chiefly of quartz and feldspar; generally produces a light-colored soil; called by some drillers "white granite" and by others "sand rock."

Greenstone—a green rock of the diorite class.

Hornblende—a common black mineral containing silica, iron, lime, and magnesia.

Influent seepage—seepage of water into the ground.

Pegmatite—a granite, commonly occurring as a dike, that contains large crystals of feldspar, mica, and other minerals.

Recharge—water that enters the ground and reaches the water table.

Reservoir—openings in the ground in which water is stored.

Residuum—weathered material, including the soil, down to fresh, unweathered rock.

Saprolite—soft, decomposed (chemically weathered) rock; rotten rock.

Schist—a rock which occurs in thin layers—called slate by some drillers.

Static level—the position of the water table when not influenced by pumping.

Topography—the surface features of an area.

Tuff—a hardened volcanic rock composed largely of volcanic ash.

Water table—upper surface of the zone of saturation.

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INDEX

PAGE

Aaron slate....................17, 67
Aarons Creek....................17
Andesitic flows....................8

Bachelors Hall....................53
Bannister River..........6, 7, 25, 65, 69
Barnes quarry....................14, 53
Blue Ridge Mountains..........42, 44
Blue Ridge province..........14
Buggs Island Lake....................7

Callands....................54
Carolina Slate belt....................16
Carter Springs....................23, 48
Cascade....................48, 49
Chatham..........47, 49, 50, 54
Clover..........9, 16, 65, 66, 67, 68
Clover Triassic basin..........10, 68
Cluster Springs....................14
Cody....................13, 65
Cone of depression..........29, 41
Conservation of ground water..........41
Contamination of ground water
supplies....................40

Dan River..........1, 6, 7, 25, 65, 69
Danville..........14, 47, 48, 52, 54
Danville Triassic
basin..........9, 10, 50, 52, 53, 65
Davidson soil....................12
Draw....................35, 36
Drawdown....................29
Dryburg....................68
Dry Fork....................50

Evapotranspiration..........19, 21
Evington group..........11, 51, 54

Farmers Mountain..........49, 51
Flat....................35
Flood-plain deposits..........1, 25
Fractures, bedding plane..........37
sheet....................37

Gabbro....................16
Granite gneiss..........14, 52, 53
Gretna..........47, 49, 50, 54
Ground water....................18
Halifax....................65, 66

PAGE

Helena soil....................12
Hornblende gneiss....................12
Hurt..........23, 51, 52, 54
Hyco quartz porphyry..........16, 67
Hyco River....................17

Iredell soil....................12

Kentuck....................14

Leatherwood granite.....8, 11, 12, 51, 54
Lynchburg formation....................11

Mayo....................67, 68
Mecklenburg soil....................12
Melrose granite....................13
Methemoglobinemia....................24
Mica schist....................11, 50
Mica schist and granite..........12, 51
Mixed gneisses..........8, 13, 52, 53
Monadnocks....................6
Mount Airy....................49
Museville....................48, 51

Nathalie....................16, 67
Native gravel....................16
Newark group....................10
News Ferry....................67

Omega....................68

Paces....................67
Pegmatite....................14
Piedmont province.1, 3, 6, 14, 18, 33, 49,
54, 65, 66, 69
Pigg River....................52
Pipe clay....................12
Pittsville....................48, 51
Pollution....................40

Recharge....................2, 41, 42
Reservoir..........9, 18, 21, 22, 42
Residuum..........9, 21, 38, 44
Rhyolotic flows....................8
Roanoke River....................1

PAGE

Sandy Creek....53
Sandy Level....51, 52
Sandy River....48, 51
Saprolite....9, 11, 12
26, 30, 38, 51
Scottsburg....10, 65, 68
Scottsburg-Wolf Trap Triassic
basin....10, 67, 69
Slate....16
Smith Mountain....49
South Boston....14, 65, 66
Springs....16, 22
Staunton River....6, 7, 13, 25, 65, 69
Staunton River State Park....65, 67
Swansonville....48, 51
Syndets....40

The Meadows....49
Toshes....48, 51

PAGE

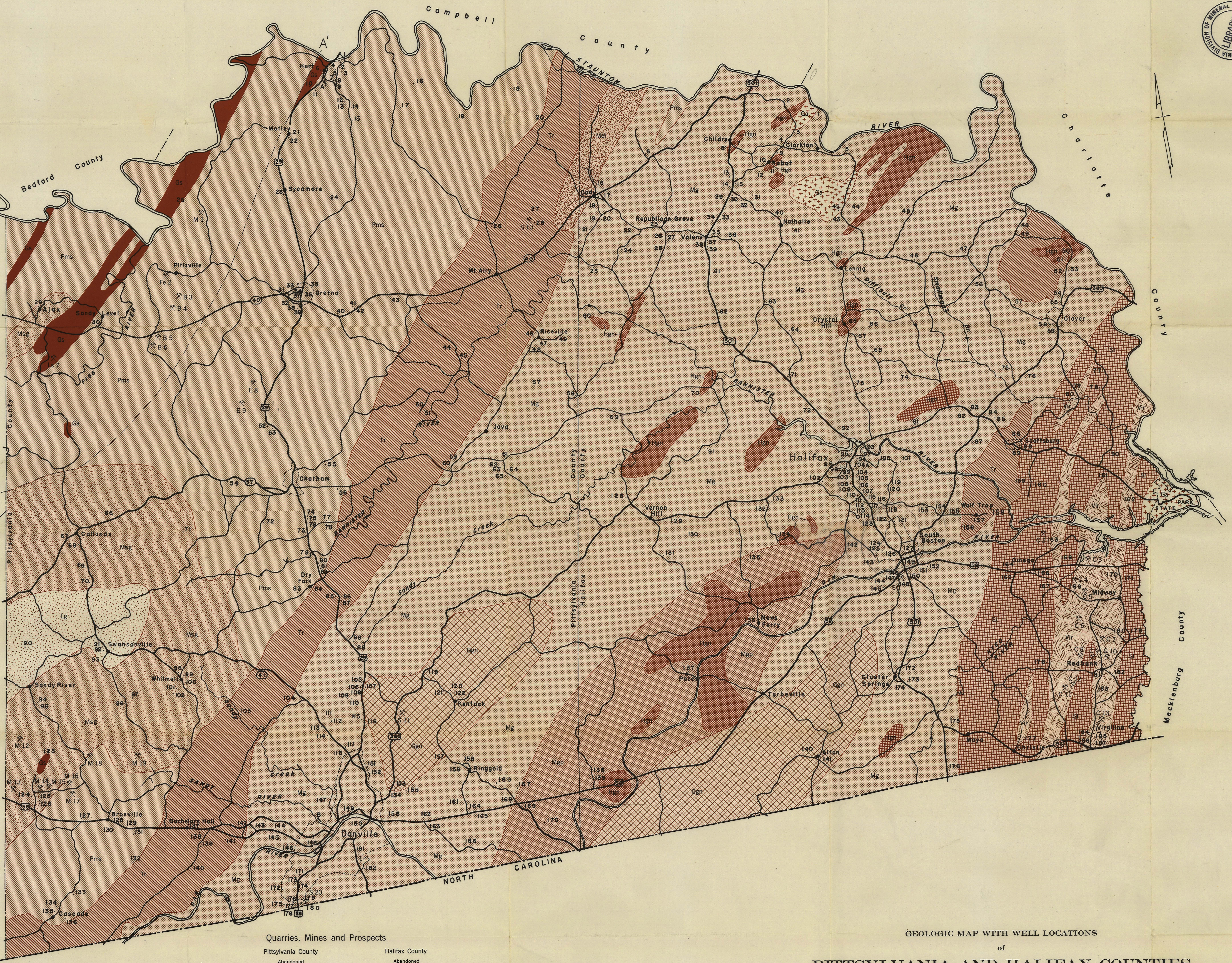
Turbeville....67

Virgilina....17, 65, 68
Virgilina greenstone....17, 34, 69
Virginia Blue Ridge Complex.11, 51, 52
Volens....66

Walnut Run....68
Water table....1, 9, 18, 22, 30, 42, 44
Wells, bored....26, 28
dug....26
drilled....1, 26, 30
hardness of....24
yield....29, 30, 31, 32
Whiteoak Mountain....6, 49
Whittles....48
Wissahickon schist....11
Wolf Trap....10, 68

VIRGINIA DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES

James L. Calver, Commissioner of Mineral Resources
and State Geologist



EXPLANATION

Tr — Sedimentary rocks of Triassic age
Includes shales, sandstones, and conglomerates of continental origin.

Gs — Greenstone
Fine-grained amphibole schist and gneiss. May be equivalent to the Catoctin greenstone.

Pms — Mica schist
Undifferentiated fine- to coarse-grained schistose rocks. In places contains interspersed granite, pegmatite and layers of hornblende gneiss. Contains rocks in northwestern Pittsylvania County that may be related to the Lynchburg formation and the Evington group of other workers. The Lynchburg formation and rocks of the Evington group lie west of line A-A', the approximate boundary.

Lg — Leatherwood granite
Light gray, coarse- to medium-grained granite. Weathers deeply and fresh-rock outcrops rare.

Msg — Mica schist and granite
Mica schist in which interspersed granite composes more than 10 percent of the total rock.

Ggn — Granite gneiss

Hgn — Hornblende gneiss
Variable in composition. Generally concordant with other gneisses and schists. Contacts with other rocks are gradational.

Mg / Mgp — Granite gneiss and hornblende gneiss
(Referred to as "mixed gneisses" in text of Bulletin 75)
Closely interlayered light and dark gneisses, the proportion of light (granitic) beds to dark (hornblendic) beds varying greatly from place to place: Mg.
Interlayered light and dark gneisses with phenocrysts of feldspar common: Mgp.

Mel — Melrose granite and augen gneiss

Ga — Gabbro and related rocks

Vir — Virgilina greenstone
Altered andesitic flows and tuffs, steeply dipping and schistose, in places porphyritic.

Sl — Slate and quartz sericite schist
Represents, together with the Virginia Greenstone, a volcano-sedimentary series.

Arrangement of units, one above the other, does not indicate a chronologic sequence. All units, with the exception of the sedimentary rocks of Triassic age, are of Paleozoic or Precambrian age.

SYMBOLS

- • well
- spring
- ⚒ quarries, mines and prospects

Quarries, Mines and Prospects

Pittsylvania County

Abandoned

M 1	Mica	M 12	Mica
Fe 2	Iron	M 13	Mica
B 3	Barite	M 14	Mica
B 4	Barite	M 15	Mica
B 5	Barite	M 16	Mica
B 6	Barite	M 17	Mica
Ls 7	Limestone	M 18	Mica
E 8	Emery	M 19	Mica
E 9	Emery	S 20	Stone
S 10	Stone		

Active

S 11 Stone — Barnes Stone Company

Halifax County

Abandoned

S 1	Stone
C 2	Copper
C 3	Copper
C 4	Copper
C 5	Copper
C 6	Copper
C 7	Copper
C 8	Copper
C 9	Copper
G 10	Gold
C 11	Copper
C 12	Copper
C 13	Copper

GEOLOGIC MAP WITH WELL LOCATIONS
of
PITTSYLVANIA AND HALIFAX COUNTIES VIRGINIA

Compiled by
Harry E. LeGrand

Scale of Miles
0 1 2 3 4 5

Williams & Heintz Map Corporation, Washington 27, D.C.