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Division of Mineral Resources

William M. McGill, State Geologist

Mineral Resources Circular No. 6

RECORDS OF WELLS ON THE NORTHERN NECK PENINSULA, VIRGINIA
(Including Well Logs and Chemical Analyses of Ground Water)

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Figure 1.--Pleistocene sands exposed in cliff on north shore of Rappahannock River southwest of White Stone, Lancaster County.

RECORDS OF WELLS IN THE NORTHERN NECK PENINSULA, VIRGINIA
(Including Well Logs and Chemical Analyses of Ground Water)

By Allen Sinnott

INTRODUCTION

The United States Geological Survey, in cooperation with The Virginia Division of Geology, has been engaged in studies of the geology and ground-water conditions in the Virginia Coastal Plain since 1937. The work was begun under the general direction of Arthur Bevan, former State Geologist, and the late O. E. Meinzer, former Chief, Ground Water Branch, U. S. Geological Survey, and has been continued under the direction of William M. McGill, present State Geologist, and A. N. Sayre, present Chief, Ground Water Branch.

The accompanying tables include most of the factual information thus far collected, on which a comprehensive report, now in preparation, will be based. The information is released at this time in advance of the interpretive report because of its value to prospective users of ground water on the Northern Neck peninsula and, in particular, to well drillers.

Location of the area

The area covered by this report includes all of the counties of Northumberland, Lancaster, Westmoreland, Richmond, and King George, and the eastern part of Stafford County. Together these counties form the peninsula known as the Northern Neck (Figure 2), which is bounded on the north by the Potomac River, and on the south by the Rappahannock River.

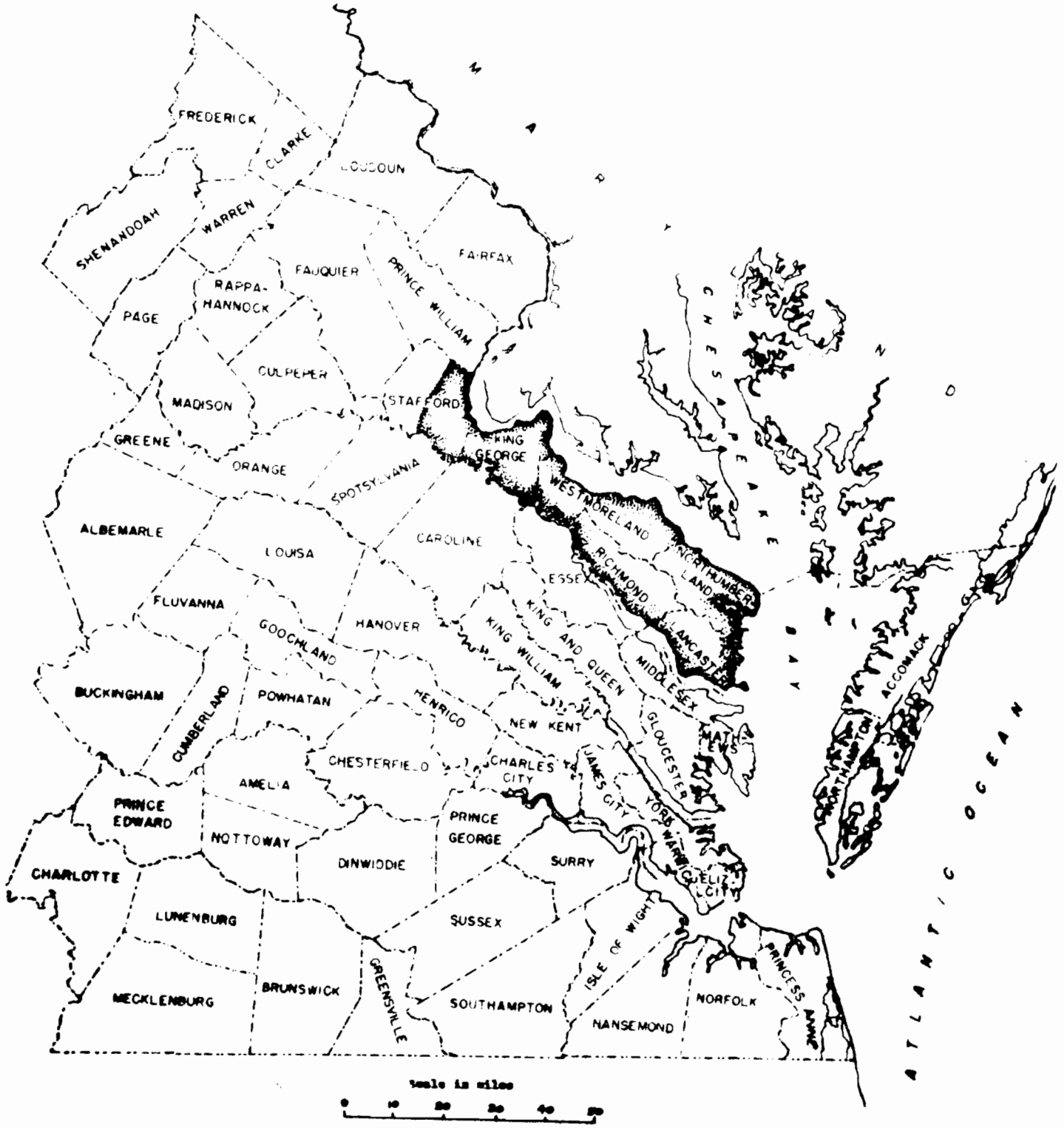

Figure 2.—Index map of eastern Virginia, showing the Northern Neck peninsula.

Acknowledgments

The author is grateful to the well owners on the peninsula for their helpful cooperation in making available much of the basic well information and for granting access to their wells for measurement and sampling. Thanks are also due to the many well drillers and well drilling firms who have furnished logs of wells, especially the following: J. W. Wilson, and A. L. Wilson, Tilghman, Md.; W. S. Reynolds, Leonard Reynolds, and Bruce Norman, of Walkerton, Va.; James P. Prine, of Norfolk, Va.; the late H. Lyons, of Tappahannock, Va.; Sydnor Pump & Well Co., Inc., of Richmond, Va.; Virginia Machinery & Well Co., of Richmond, Va.; Mitchell's Well & Pump Co., of Petersburg, Va.; and Leazer Pump & Well Co., of Fredericksburg, Va.

Mr. W. H. Caldwell, Commissioner of the State Division of Planning and Economic Development, kindly furnished prints of Economic Data maps for each of the counties covered by this report. The Virginia Chamber of Commerce furnished the photograph reproduced as Figure 5.

Field work in the area covered by this report was started in about 1945 by D. J. Cederstrom, who also later assisted with many of the stratigraphic correlations. Carlos E. Milner did much of the field work in Northumberland County. James H. Kempf, G. Chase Tibbitts, Jr., and Seymour Subitzky prepared lithologic descriptions of drill cuttings from several wells. Mrs. Frances H. Dowell assisted in assembling and checking the well records, well logs, and chemical analyses.

SUMMARY OF GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

INTRODUCTION

The Northern Neck peninsula lies in the northeastern part of the Coastal Plain province of Virginia. In this province, relatively soft sedimentary rocks, consisting largely of interbedded sand and clay beds with minor gravel lenses, overlie the eastward extension of the hard crystalline rocks of the Piedmont province. The oldest sediments were deposited directly on the crystalline rocks. Younger rocks were deposited on these beds, so that everywhere the drill penetrates successively older beds with increasing depth. The sedimentary rocks dip gently eastward at a rate of a few feet per mile. In the area covered by this report, they thin westward to a featheredge in a north-south line marking the Fall Zone in the middle of Stafford County.

The several geologic formations comprising the sedimentary rocks of the Northern Neck peninsula are described briefly below. These rocks are grouped in accordance with the major divisions of geologic time, shown in Figure 3.

Era	System or Period	Series or Epoch	Approx. no. of million years ago.[1]	Approx. length in millions of years.[1]
Cenozoic *	Quaternary *	Recent *	0-1	1
		Pleistocene *		
	Tertiary *	Pliocene	1-12	11
		Miocene *	12-28	16
		Oligocene	28-40	12
		Eocene *	40-60	20
		Paleocene *		
Mesozoic *	Cretaceous *	Upper (Late).	60-130	70
		Lower (Early).		
	Jurassic	Upper (Late)	130-155	25
		Middle (Middle)		
		Lower (Early)		
	Triassic	Upper (Late)	155-185	30
		Middle (Middle)		
		Lower (Early)		
Paleozoic	Permian	Provincial series recognized in west Texas and southeastern New Mexico.	185-210	25
	Carboniferous systems: Pennsylvanian	Upper (Late)	210-235	25
		Middle (Middle)		
		Lower (Early)		
	Carboniferous systems: Mississippian	Upper (Late)	235-265	30
		Lower (Early)		
	Devonian	Upper (Late)	265-320	55
		Middle (Middle)		
		Lower (Early)		
	Silurian	Upper (Late)	320-360	40
		Middle (Middle)		
		Lower (Early)		
	Ordovician	Upper (Late)	360-440	80
		Middle (Middle)		
		Lower (Early)		
	Cambrian	Upper (Late)	440-520	80
		Middle (Middle)		
		Lower (Early)		
Proterozoic	Precambrian	Upper Precambrian rocks. (Keweenawan and other provincial series.)	520-2100+	1600+
		Middle Precambrian rocks. (Huronian and other provincial series.)		
		Lower Precambrian rocks. (Provincial series.)		

1 Report of the National Research Council, Committee on the Measurement of Geologic Time, 1949-50.
2 Estimate of J. P. Marble, Chairman of Committee on Measurement of Geologic Time, March 17, 1954.

For the age of the crust of the earth, the data are at present uncertain, but the order of magnitude is about 3,250 million years. The margin of error in the estimate of the age for the Quaternary is ±50,000 years; Tertiary ±1 to 2 million years; Mesozoic ±5 million years; Paleozoic ±10 million years; Proterozoic ±10 to 300 million years.

Terms designating time are in parentheses. Informal time terms early, middle, and late may be used for the eras, and for periods where there is no formal subdivision into Early, Middle, and Late, and for epochs. Informal rock terms lower, middle, and upper may be used where there is no formal subdivision of a system or of a series. There is no formal subdivision of time of the Proterozoic; subdivisions of the Precambrian have only local significance.

Figure 3.--Major divisions of geologic time in use by the U. S. Geological Survey. (After Geologic Names Committee, 1954.) Those divisions marked with an asterisk (*) include rocks that are discussed in this report.

Pre-Cretaceous rocks

So far as known, no important wells in the Coastal Plain portion of the Northern Neck peninsula obtain water from the Pre-Cretaceous crystalline rocks. However, a well at Arkendale in eastern Stafford County penetrated the entire thickness of Coastal Plain sediments and was drilled two feet into the underlying granite, although it taps water from sediments overlying the granite. (See log, Table 17, well 3.)

Cretaceous system

Rocks of Cretaceous age in the Northern Neck peninsula are represented by the Potomac group, and are generally considered to be the Patuxent formation. They consist largely of arkosic sands and clays, with minor gravel lenses. Several wells in eastern Stafford County and in King George County tap sands of the Potomac group. Farther east on the Northern Neck, satisfactory yields are obtained from younger sediments, so that relatively few wells reach the Cretaceous rocks, except insofar as the Mattaponi formation (see below) may be in part of Late Cretaceous age.

Cretaceous-Tertiary system

Upper Cretaceous-Paleocene series

Mattaponi formation

The Mattaponi formation is described by Cederstrom (1956) as sediments of Late Cretaceous-Paleocene age characterized by mottled clays interbedded with important water-bearing sands which are persistent in the northern part of the Virginia Coastal Plain. In the area covered by this report, the water-bearing sands of the Mattaponi formation are by far the most important aquifers, and supply water to many important industrial and municipal wells.

Tertiary system

Eocene Series

Pamunkey group

The sediments of Early and Middle Eocene age, comprising the Pamunkey group, overlie the Mattaponi formation and occur widely in the eastern part of the Northern Neck peninsula. At the base of this group lies the Aquia formation characterized by green to black glauconitic sands and clays of Early Eocene age. Locally, as at Fairview Beach in King George County, fossil beds of indurated marl occur in this horizon. (See Figure 4.) Overlying the Aquia formation is the Nanjemoy formation, of Middle and Early Eocene age, largely composed of glauconitic sands and clays. An extensive thin bed of pink clay, called the Marlboro clay member, lies at the base of the Nanjemoy formation.

The Pamunkey group is relatively thin in the Northern Neck peninsula, and is not significant as a water-bearing horizon. Owing to the more permeable sands overlying and underlying the group, relatively few wells draw water from these beds.

Figure 4.--Indurated marl of the Aquia formation of early Eocene age at Fairview Beach, King George County.

Chickahominy formation

Economically important sands of Late Eocene age have recently been described by Cushman and Cederstrom (1945), and named the Chickahominy formation. In the Northern Neck peninsula, this formation is characteristically sandy, with interbedded clays, and is extensively tapped by many wells.

Miocene Series

Chesapeake group

The Chesapeake group of Miocene age, overlying the Late Eocene sediments, consists largely of gray clays and shell marl, with minor lenses of sand. (See Figure 5.) In this peninsula, the sands are not ordinarily important as aquifers. The Chesapeake group has not been subdivided for the purpose of this report.

Pleistocene Series

These deposits yield small quantities of water to many shallow dug and driven wells supplying homes and small farms. Yields are ample for the purpose for which these wells were constructed, but the water is high in iron in some localities.

The sands and minor gravel lenses of Pleistocene age occur as terrace formations capping nearly the entire Northern Neck peninsula. They are well exposed in many wave-cut cliffs (Figures 1 and 5). The sediments are characteristically yellow or brown in color, as distinguished from the underlying Tertiary formations.

Figure 5.--Exposure of rocks of the Chesapeake group of Miocene age, overlain by Pleistocene sands, in Nomini Cliffs, south bank of Potomac River, Westmoreland County.

(Photograph, courtesy of the Virginia Chamber of Commerce.)

Recent series

Sediments of Recent age are represented chiefly by beach deposits along the Rappahannock and Potomac Rivers, limited deposits of alluvium in smaller stream valleys, marsh and lagoon deposits, bay-mouth bars, spits, and dunes. They are sparsely distributed compared to the geologically older deposits, and are not generally considered to be of particular importance as aquifers. However, there may be a very few shallow dug or driven wells on the peninsula that obtain ground water in small quantities from the Recent deposits.

BASIC WELL RECORDS

During the cooperative investigation preceding this report, information was obtained on about 320 wells in the Northern Neck peninsula. Most of it was obtained by visits to the wells, supplemented by information from well owners, well drillers, and others. A few important wells have been listed from the early report by Sanford (1913) on ground water in the Virginia Coastal Plain.

RECORDS OF MATERIALS PENETRATED

Drillers' Logs

Most of the logs included in this circular are based on drillers' records of materials penetrated. In order to maintain a more uniform terminology, the records have, in many cases, been modified somewhat.

Most of the materials described are of sedimentary origin. For the purpose of this report, it is desirable to divide them loosely into (a) water-bearing and (b) non-water-bearing.

Water-bearing materials

Sand and gravel are granular sediments. The component grains of a sand are large enough to be easily seen by the unaided eye. The grains range in size from very fine to very coarse and grade into fine gravel.

The permeability of a granular water-bearing sand is directly related to the size and degree of uniformity of the componet grains; the coarser the grains, and the more uniform they are in size, the more water the formation will yield to wells--other things being equal.

Most of the wells on the Northern Neck peninsula obtain water from sand or gravel.

Non-water-bearing sediments

Clay and silt are very fine-grained sediments, characteristically non-water-bearing. Silt is described as "mud" by many drillers; its component particles are larger than those of clay, and it may yield very small quantities of water to certain dug wells.

The chief importance of clay and silt relates to the occurrence of ground water under artesian pressure. Under these conditions, the clay and silt beds act as relatively impervious confining layers, and, where the geologic structure is favorable, the ground water contained in the interbedded water-bearing materials, called aquifers, may develop artesian pressure, so that the water in wells tapping these materials rises in the well casing above the top of the water-bearing beds. Where sufficient artesian pressure is developed, the water level may rise above the ground surface, resulting in a flowing artesian well. This occurs most commonly on low ground.

The term "rock" is commonly used by drillers to denote very tough clay, sandstone, or limestone. In eastern Stafford County this term is also used for the crystalline basement rock reached by some wells.

Lithologic Sample Descriptions

Samples were collected by or for the Geological Survey during the drilling of several wells in the Northern Neck. These have been studied in the laboratory and the lithology described in detail. In view of the purpose of this Circular, the specialized terms used in these descriptions are not here defined. However, the generic terms denoting the classes of material penetrated appear at the beginning of the description of each sample, so that those familiar with drillers' logs should have no difficulty in interpreting the essential character of the subsurface material with respect to the probable potential yield of ground water.

CHEMICAL CHARACTER OF GROUND WATER

In this Circular, chemical analyses of ground waters from selected wells are given in tables for each county of the Northern Neck peninsula. These analyses are important in considering the fitness of the water for its intended use. Certain inorganic chemical constituents--commonly called mineral constituents--may not be tolerated above specific maximum concentrations which differ with the use to which the water is put. Methods of treatment are available for removing or reducing the quantity of most of the objectionable dissolved mineral constituents.

The mineral matter contained in ground water is dissolved principally from the rocks and soils with which the water comes in contact. Commonly, ground water contains on the order of one-tenth of 1 percent by weight--1,000 parts per million (ppm)--or less of dissolved mineral matter. The mineral constituents that have a particular bearing on the suitability of ground water for most purposes are silica, iron, calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, fluoride, and nitrate. Many of these

dissolved constituents have characteristic effects when present in the water in sufficient concentrations. In the following paragraphs, these effects are briefly discussed. (Material for this section has been drawn largely from Bulletin 8 of the Virginia Division of Water and Power; see Lamar and Whetstone, 1947.)

Silica (SiO_2).--The silica concentration in water is chiefly of interest to industrial users. Silica in water used in boilers contributes to the formation of a hard scale and is particularly troublesome because the scale prevents rapid transfer of heat. At operating pressures in excess of 250 pounds per square inch, small concentrations of silica--less than about 5 ppm--have adverse effects on the boilers. Silica concentrations determined from Northern Neck ground waters range between 8.7 and 59 ppm.

Iron (Fe).--In concentrations greater than 0.3 ppm, iron in water is objectionable because it causes brownish stains on porcelain fixtures and on clothing and fabrics washed in the water. It also imparts an umpleasant taste to drinking water. Water used in the manufacture of food and carbonated beverages, and in the textile and paper industries, should contain no more than 0.1 ppm of iron. In all of the counties of the Northern Neck, certain wells yield waters greatly in excess of 0.1 ppm of iron; an extreme case occurs in Stafford County, where water from a well (11) near Fredericksburg contains 15 ppm of iron.

Calcium (Ca) and Magnesium (Mg).--Although calcium and magnesium are only slightly soluble in pure water, rain water containing carbon dioxide dissolves calcium and magnesium from rocks and soils. Hardness in water is usually caused by the presence of calcium and magnesium. These constituents also tend to form boiler scale. In the Northern Neck, ground water samples analyzed ranged in calcium content from 0.7 to 40 ppm, and in magnesium from 0.2 to 18 ppm.

Carbonate (CO_3) and Bicarbonate (HCO_3).--Carbonate and bicarbonate in ground water results from the reaction of carbon dioxide in water upon carbonate minerals in the rocks. On the Northern Neck, concentrations of carbonate in the ground water range from 0 to 94 ppm, and of bicarbonate from 8 to 559 ppm, in the waters sampled for analysis. Except for use in boiler feed, even the higher concentrations of these constituents in the Northern Neck ground waters are not seriously objectionable.

Chloride (Cl).--The degree of chloride concentration is usually a good indication of the extent of contamination of ground water with sea water, or of residual sea water left after marine sediments have been deposited. High concentrations of chloride, particularly in waters that are also high in calcium and magnesium, affect the industrial usefulness of water. In the Northern Neck, the ground waters tested range in chloride concentration from 1 to 300 ppm. In concentrations greater than about 250 ppm, chloride imparts a salty taste to drinking water.

Fluoride (F).--Fluoride is largely of interest because of its effect upon human teeth. It results in the dental defect known as mottled enamel if water containing more than about 1.5 ppm is used for drinking by young children during formation of the teeth (Dean, 1936). On the other hand, in concentrations of about 1 ppm, the presence of fluoride has been shown to inhibit tooth decay (Dean and others, 1942). Among the samples of ground water analyzed from the Northern Neck, fluoride ranges in concentration from 0.0 to 3.8 ppm. Waters from the deeper aquifers commonly have the higher concentrations.

Nitrate (NO_3).--More than a few parts per million of nitrate in water is generally regarded as a possible indication of pollution by sewage or other organic waste. Locally, nitrate in water may result from the use of certain fertilizes. Water containing more than about 44 ppm of nitrate, if used in infant feeding formulas, may result in a serious toxic condition (cyanosis) characterized by a blue appearance of infants' skin caused by methemoglobinemia (Faucett and Miller, 1946; Waring, 1949; Maxcy, 1950).

In the Northern Neck, several samples of ground water were found to contain excessive nitrate concentrations. All of these were obtained from shallow wells and springs -- sources which are the most susceptible to pollution. The nitrate concentration in ground waters tested ranges from 0.0 to 123 ppm.

Dissolved solids.--The concentration of dissolved solids is an index of the total mineralization of the water. In general, water with up to about 500 ppm of dissolved solids may be considered acceptable as a domestic or public supply. In the Northern Neck peninsula, several wells in eastern Northumberland and eastern Lancaster counties yield water of the high sodium bicarbonate type, with dissolved solids concentrations in excess of 500 ppm. Inasmuch as the water is used primarily for processing fish or washing oysters, rather than as a public supply, this degree of mineralization has not been regarded as objectionable.

The range in concentration of dissolved solids in the Northern Neck extends from 32 to 872 ppm in the waters sampled for analysis.

Specific conductance.--Specific electrical conductance, expressed as reciprocal ohms x 10^6 (micromhos) at 25°C., generally increases with the dissolved mineral content. For ground waters in the Virginia Coastal Plain, the specific conductance in micromhos, multiplied by 0.7, gives a figure approximating the dissolved-solids concentration in parts per million. For ground waters sampled in the Northern Neck, the range in specific conductance is from 42.6 to 1200 micromhos.

Hardness.--Hardness, expressed as calcium carbonate ($CaCO_3$), is an index of the soap-consuming capacity of water. Hard water--greater than

about 120 ppm of hardness-requires excessive amounts of soap to produce a lather. The same constituents that cause hardness in water also form scale in boilers, water heaters, radiators, and pipes, resulting in loss of heat transfer or loss of flow. Water is usually considered soft when the hardness is 60 ppm or less, moderately hard between 61 and 120 ppm, and hard between 121 and 200 ppm. Very hard water (hardness of greater than 200 ppm) usually requires softening for many ordinary uses. Among the ground waters tested from the Northern Neck, hardness ranges from 3 to 416 ppm.

Range in chemical constituents in Northern Neck
(By County)

Constituents	Richmond High	Richmond Low	Lancaster High	Lancaster Low	Northumberland High	Northumberland Low	Stafford High	Stafford Low	King George High	King George Low	Westmoreland High	Westmoreland Low
SiO_2	59	11	57	12	43	12	--	--	35	19	45	8.7
Fe	1.1	.02	.86	0	4.0	tr. .02	15	.12	5.0	.04	.33	.02
Ca	40	1.2	33	tr. 1.4	20	.7	13	13	26	1.0	14	.8
Mg	14	.3	18	.5	11	.4	5.5	5.5	7.4	.2	5.9	.4
Na	212	45	301	12	256	41	6	5.4	78	12	171	2.4
K	212	45	301	12	256	41	6	5.4	78	12	12	1.1
CO_3	94	0	127	0	149	.0	0	0	0	0	25	0
HCO_3	434	20	547	48	559	20	79	8	246	22	422	5.0
SO_4	58	4	53	.5	45	00	25	1	85	11	19	1
Cl	168	1	122	2	380	1	58	1	15	1.0	28	1
F	2.4	.5	3.8	.0	2.4	.5	.4	.0	.4	.1	2.6	.0
NO_3	123	tr. .1	75	.3	60	tr. .1	46	.0	4.2	.2	9.6	.0
DS	506	217	872	250	851	156	--	--	230	154	444	32
$CaCO_3$	210	5	201	4	416	3	75	15	270	5	105	4
Spec. cond	728	320	1200	416	780	301	304	47.4	370	101	621	42.6
pH	8.6	8.0	8.7	6.3	8.5	7.6	6.8	6.7	8.3	6.3	8.5	5.5

Range in chemical constituents in Northern Neck
(all counties combined)

Constituents	Highest	Location	County	Lowest	Location	County
SiO_2	59	E of Warsaw	Richmond	8.7	E of Westmoreland State Park	Westmoreland
Fe	15	Near Fredericksburg	Stafford	0	W of Bertrand	Lancaster
Ca	40	Warsaw	Richmond	.7	N of Fleeton	Northumberland
Mg	18	Lively	Lancaster	.2	Port Conway	King George
Na	301	Bertrand	Lancaster	5.4	Nr. Fredericksburg	Stafford
K	301	Bertrand	Lancaster	5.4	Nr. Fredericksburg	Stafford
CO_3	149	Fleeton	Northumberland	.0	W of Lewisetta	Northumberland
HCO_3	559	Fleeton	Northumberland	8	WSW of Marlboro Point	Stafford
SO_4	85	Fairview Beach	King George	1	Fredericksburg & Colonial Beach	Stafford & Westmoreland
Cl	380	Reedville	Northumberland	1	(In several places; see other table)	
F	3.8	S of White Stone	Lancaster	.0	(In several places; see other table)	
NO_3	123	NW of Naylors	Richmond	.0	Widewater Leedstown	Stafford & Westmoreland
DS	872	N of Palmer	Lancaster	32	E of Westmoreland State Park	Westmoreland
$CaCO_3$	416	Reedville	Northumberland	3	N of Fleeton	Northumberland
Spec. cond.	1200	N of Palmer	Lancaster	42.6	E of Westmoreland State Park	Westmoreland
pH	8.7	W of White Stone	Lancaster	5.5	E of Westmoreland State Park	Westmoreland

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Table 2.—Logs of wells in Northumberland County, Virginia

Well 2, Callao; Sydnor Pump & Well Co., Inc.

(Log by Sydnor Pump & Well Co., Inc.)

Altitude, 101 feet

	Thickness (feet)	Depth (feet)
Top soil	1	1
Columbia group:		
Clay, yellow	17	18
Clay, sandy, yellow	38	56
Chesapeake group:		
Clay, blue	252	308
Clay, blue, with fine sand and shells	12	320
Clay, blue	7	327
Chickahominy formation:		
Clay, blue, with streaks of "rock"	22	349
"Rock" (probably sandstone)	7	356

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 8, 0.9 mile north-northwest of Lodge; C. H. Howell

(Sample descriptions by E. G. Otton, from Md. Dept. Geology, Mines and Water Resources, Bull. 11, p. 187-8; see Ferguson, 1953)

Altitude, 17 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, clean, medium, grayish-orange; mostly subangular and angular, clear white, pale-gray and pale-yellow quartz; some limonite and feldspar fragments	10	10
Sand, and clay, pale yellowish-brown; sand medium to coarse, dull vari-colored, subangular quartz; limonite fragments and a few rounded black glauconite grains	11	21
Sand, medium, grayish-orange; mostly medium, dull, subangular, white, yellow and iron-stained quartz grains	10	31
Sand, medium, grayish-orange; similar to above	11	42
Clay, sandy, pale yellowish-brown to light olive-gray; medium to coarse, angular gray, pale-yellow, violet and clear quartz; vivianite; a few shells and brown plant fragments	10	52
Clay, sandy, olive-gray; quartz as above; several pieces vivianite; coarse pelecypod fragments; black, soft plant fragments and a few pieces of reddish limonite	11	63
Clay, sandy, olive-gray; pale-violet and dull-gray subangular, medium quartz grains; vivianite; a few carbonized plant fragments and a few shell fragments	10	73
Clay, sandy, olive-gray; similar to above	11	84
Clay, slightly sandy, light olive-gray; small amount of medium to coarse quartz, as above; a few pieces of shell and vivianite; grains of dull gray-black flint	11	95
Clay, slightly sandy, light olive-gray; similar to above, except mostly medium to coarse quartz grains and a few coarse shell fragments	10	105
Sand, fine, clean, yellowish-gray; angular clear, pale-yellow and green quartz and fine to very fine irregular glauconite; well-sorted	10	115

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 8, 0.9 mile north-northwest of Lodge; C. H. Howell--Continued

	Thickness (feet)	Depth (feet)
Chesapeake group:		
Clay, silty and sandy, light olive-gray; coarse, subrounded gray-green quartz pieces of chert and jasper; vivianite; pieces of indurated brown silt; coarse pelecypod and shell fragments and a few foraminifera	11	126
Clay, very sandy, light olive-gray foraminifera identified as Miocene Calvert	10	136
Clay, sandy, light olive-gray	22	158
Sand, fine, clayey, light olive-gray; fine to medium, subangular, clear, gray and pale-green quartz grains; abundant phosphate fragments; foraminifera and shell fragments	10	168
Clay, slightly sandy, light olive-gray; similar to above	11	179
Clay, sandy, light olive-gray; fine to coarse, mostly clear and gray, some yellow-green and dull quartz grains; shell fragments; a few sponge spicules and bone fragments	10	189
Clay, slightly sandy, light olive-gray; similar to above	32	221
Sand, medium, light olive-gray; clear and gray subangular quartz grains; shell fragments and phosphate plates	10	231
Sand, medium, mottled light olive-gray; similar to above; shell fragments more common	11	242
Chickahominy formation:		
Sand, calcareous, medium, light-gray; fine to medium, clear, pale-yellow and gray quartz; medium, irregular to botryoidal green and light green glauconite; fragments gray calcareous rock and abundant shell fragments	10	252
Sand, medium, calcareous, light-gray; similar to above; some pyrite	11	263
Sand, medium, light-gray; similar to above, but much more calcareous rock fragments	10	273
Sand, medium, light-gray; similar to above, but contains some brown, medium oblate glauconite	11	284

Table 2.—Logs of wells in Northumberland County, Virginia—Continued

Well 43a, 3 miles E of Burgess; Elliott & Brooks

(Log by W. L. Reynolds; correlations by D. J. Cederstrom)

Altitude, 4 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, sandy	42	42
Chesapeake group:		
Clay, blue	33	75
Sand, and shells	1	76
Clay, blue	114	190
Limestone	10	200
Clay, greenish blue	135	335
Clay, brown, hard	12	347
Limestone, white sand, and shells	1	348
Clay, light brown, grading to greenish brown and light brown	34	382
Limestone	5	387
Chickahominy formation:		
Sand, black	2	389
Clay, brown	41	430
Limestone and black sand	4	434
Clay, compact	66	500
Sand, black	½	500½
Pamunkey group:		
Nanjemoy formation:		
Clay, mottled	59½	560

59½

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 43a, 3 miles E of Burgess; Elliott & Brooks--Continued

	Thickness (Depth)	Depth (Depth)
Pamunkey Group--Continued		
Mattaponi formation:		
Clay, mottled	120	680
Sand, white	60	740

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 56, Readville, Blunden & Hinton

(Log from owner)

Altitude, 1± foot

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand and gravel	42	42
Chesapeake group:		
Clay, blue	12	54
Clay, blue, with white pebbles and peat	3	57
Marl, blue, sandy dark-colored shells in several places	313	370
Chickahominy formation:		
Shells, cemented	1	371
Sand, fish bones, and shells; water-bearing (sulfide odor)	30	401
Clay, yellow, with hard "crusts"	19	420
Pamunkey group (?):		
Clay, sandy, yellow	60	480
Sand, dark	1	481
Mattaponi formation:		
Clay, brown, changing downward through red, yellow, purple, etc.	79	560
Clay, green	10	570
Sandstone, white	1	571
Sand; water-bearing (small flow)	10	581
Clay, black, with fossil wood	5	586
Sand, clean; water-bearing	12	598

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 56, Reedville; Blunden & Hinton--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation--Continued		
Clay, red and brown	20	618
Clay, white	3	621
Clay, red	19	640
Clay, white (and sand?); water-bearing	45	685

Table 2.—Logs of wells in Northumberland County, Virginia—Continued

Well 8d, Fairport; McNeal and Dodson

(Log by Mitchell's Well & Pump Co.; correlations by . J. Cederstrom)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow, and sand	35	35
Chesapeake group:		
Clay, gray	115	150
Clay, blue, sand shells	130	280
Clay, blue	70	350
Chickahominy formation:		
Sand and rock	50	400
Clay, gray	20	420
Sand, black, rock, and shells	20	440
Pamunkey group:		
Sand, black, rock, and shells	40	480
Mattaponi formation (?):		
Sand, black, and blue clay	40	520
Sand, black	20	540
Sand, black, and blue clay	30	570
Clay, blue, very hard	30	600
Sand, black, hard	10	610
Sand, green, and clay	10	620
Clay, black, hard	10	630

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 68, Fairport; McNeal and Dodson--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation (?):		
Sand, yellow	5	635
Sandstone, hard	5	640
Sand, black and white	20	660
Sand, white	65	725
Clay, light gray, hard	5	730
Sand, fine, white	5	735
Clay, red	25	760
Clay, red and blue	80	840
Clay, red	10	850
Potomac group:		
Sand	15	865
Clay	5	870

Table 3.--Logs of wells in Northumberland County, Virginia--Continued

Well 75, Fleeton; T. C. Slaughter

(Log by Reynolds & Norman)

Altitude, 8± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, sandy	35	35
Chesapeake group:		
Clay, blue	340	375
Sand, white	1	376
Rock (sandstone?)	½	377½
Clay, blue	2½	380
Chickahominy formation:		
Sand, white	1	381
Clay, hard, brown	38	419
Pamunkey group:		
Rock (sandstone ?)	21	440
Clay, hard, blue; thin stream of rock	36	476
Mattaponi formation (?):		
Clay, hard	9	485
Sand, black	½	485½
Clay, hard	59½	545
Clay, light blue	51	596
Clay, hard	74	670
Sand, white; water-bearing	41	711

Table 2.—Logs of wells in Northumberland County, Virginia—Continued

Well 84, 1.6 miles north of Ditchley; S. A. Whittaker

(Log by owner)

Altitude, 6± feet

	Thickness (feet)	Depth (feet)
Clay, soil and and loam	5	5
Columbia group:		
Sand	4	9
Clay, bluish black	3	12
Marl, light-colored	5	17
Clay, sandy, blue	10	27
Clay, yellow; some sand at 33-36 feet	29	56
Chesapeake group:		
Marl, light-colored	3	59
Clay, sandy, green	274	333
Clay, hard, yellow	23	356
Shell rock and sandy beds, hard; water-bearing at 372 feet	16	372
Chickahominy formation:		
Sand and clay, black	41	413

Table 2.- Logs of wells in Northumberland County, Virginia--Continued

Well 88, Byroton; Lutner George

(Log by J. P. Prine)

Altitude, 1± foot

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, red	8	8
Sand, iron-stained; water-bearing	4	12
Sand, blue; shells; clay binder	3	15
Clay, blue	30	45
Clay, blue, and shells	40	85
Sand, very fine, blue; mixed with blue clay to 90 ft	25	110
Chesapeake group:		
Clay, blue	170	280
Clay, blue, and shells	62	342
Rock, hard lime	1	343
Sand; water-bearing	27	370

Table 2.—Logs of wells in Northumberland County, Virginia—Continued

Well 90, Byrdton; Col. W. A. Lawson, Estate East Richlands

(Log by Mitchell's Well & Pump Co.)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Soil	2	2
Columbia group:		
Clay, yellow	13	15
Clay, blue	58	73
Marl, blue	29	102
Chesapeake group:		
Clay, blue	90	192
Clay, sandy, blue	28	220
Clay, blue	125	345
Rock	½	345½
Sand, and shells	46½	392
Sandstone	18	410
Sand, black, glauconitic	20	430
Rock	2	432
Chickahominy formation:		
Sand, black, glauconitic, and shells	13	445
Sand, black	4	449
Sand, black; shells	10	459
Sand, gray	7	466
Rock	8	474
Sand, black; glauconitic	6	480
Sand, marly; glauconitic	20	500

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 90, Byrdton; Col. M. A. Dawson, Estate East Highlands--Continued

	Thickness (feet)	Depth (feet)
Pamunkey group:		
Nanjemoy formation:		
Sand, black; glauconitic	30	530
Mattaponi formation:		
Clay, blue	29	559
Sand, black; glauconitic	2	561
Rock	1	562
Clay, green	7	569
Clay, blue; glauconitic	66	635
Clay, blue	16	651
Clay, blue, glauconitic	5	656
Sand, white; trace of glauconite	12	668
Clay, sandy, brown	10	678
Clay, blue; glauconitic	5	683
Sandstone	22	705
Sand, white; coarse at [illegible] feet	74	779
Clay, sandy, black	19	798
Potomac group (?):		
Sandstone	12	810

Table 2.—Logs of wells in Northumberland County, Virginia—Continued

Well 91, 3 miles south-southeast of Burgess; J. L. Sisson

(Log by Reynolds & Norman)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand and clay, yellow	34	34
Chesapeake group:		
Clay, blue	146	180
Sand	½	180½
Clay, green	119½	300
Clay, brown	20	320
Sand, and shells	1½	321½
Clay, brown	63½	385
Chickahominy formation and Pamunkey group, undivided:		
Sand, black	½	385½
Clay, hard, greenish brown	114½	500
Clay, hard	62	562
Sand, black	1	563
Clay, hard	27	590
Sand, black and white	2	592
Mattaponi formation:		
Clay, pink, grading to green and light brown	73	665
Clay, pink, grading to white	15	680
Sand and clay, white, mixed	27	707

Table 2.--Logs of wells in Northumberland County, Virginia--Continued

Well 92, Browns Store; J. D. Hinton

(Log by W. S. Reynolds)

Altitude, 103 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Undescribed	85	85
Clay, hard	47	132
Clay, gray	20	152
Chesapeake group:		
Clay, light gray	128	280
Clay, hard	94	374
Clay, brown	10	384
Clay, hard	23	407
Chickahominy formation and Pamunkey group, undivided:		
Clay, brown	61	468
Clay, blue	57	525
Clay, white	60	585
Mattaponi formation (?):		
Clay, blue	25	610
Clay, red	10	620
Sand, white	30	650
Undescribed	40	690

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia
(Parts per million, except specific conductance and pH)

Well number	2	2	2	10	11	13	13
Location	Callao	Callao	Callao	W of Lewisetta	Lewisetta	Lewisetta	Lewisetta
Depth (feet)	356	356	356	22	325	550	550
Date	March, 1946	June 8, 1948	May 13, 1953	July 5, 1918	July 5, 1918	July 5, 1918	Feb. 27, 1941
Silica (SiO_2)	22	---	36	17	31	24	---
Iron (Fe)	4.0	--	.05	.02	.67	.10	---
Calcium (Ca)	12	---	15	20	5	2.1	---
Magnesium (Mg)	5.4	---	6.3	7.8	6.7	1.7	---
Sodium (Na)	} 41 calc.	---	41	} 53	107	177	---
Potassium (K)		---	12				
Carbonate (CO_3)	0	---	6	.0	60	85	---
Bicarbonate (HCO_3)	163	185	191	90	180	283	378
Sulfate (SO_4)	1.6	1	.8	45	7.6	18	15
Chloride (Cl)	2.8	2	1.5	54	3.5	3.9	3
Fluoride (F)	.5	.5	.5	---	---	---	.9
Nitrate (NO_3)	.4	1.0	1.5	2.9	1.9	.61	---
Dissolved solids	169	---	192	254	311	459	---
Hardness as $CaCO_3$)	52	57	62	82	40	12	9
Specific conductance (micromhos at 25°C)	---	308	301	---	--	---	---
pH	7.6	---	6.2	---	--	---	---

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	17	17	18	24	27	29	29
Location	Walnut Point	Walnut Point	Walnut Point	Walnut Point	SE of Walnut Point	NE of Heathsville	NE of Heathsville
Depth (feet)	340	340	605	260	407	404	404
Date	July 3, 1918	June 8, 1948	July 3, 1918	1906	July 2, 1918	June 8, 1948	May 15, 1953
Silica (SiO_2)	30	---	---	---	32	---	---
Iron (Fe)	.10	---	---	---	.08	---	---
Calcium (Ca)	5.6	---	---	---	4.8	---	3.8
Magnesium (Mg)	6.1	---	---	---	3.3	---	2.5
Sodium (Na)	} 90	---	---	---	} 153	---	---
Potassium (K)		---	---	---		---	---
Carbonate (CO_3)	27	---	125	---	62	---	5
Bicarbonate (HCO_3)	209	243	217	260	308	369	386
Sulfate (SO_4)	8	4	31	0	3.7	1	---
Chloride (Cl)	2.7	1	4	6.7	4.2	2	3.8
Fluoride (F)	---	.7	---	---	---	1.1	1.2
Nitrate (NO_3)	1.2	1.2	.5	---	1.5	1.2	1.4
Dissolved solids	271	---	471	---	124	---	---
Hardness as $CaCO_3$)	39	48	---	10	26	30	20
Specific conductance (micromhos at 25°C)	---	388	---	---	---	567	602
pH	---	---	---	---	---	---	8.4

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	33	36	37a	37a	37b	45c	54b
Location	NE of Heathsville	Heathsville	Avalon	Avalon	Horse Head	ENE of Burgess	Reedville
Depth (feet)	27	50	605	605	30	500	680
Date	July 2, 1918	July 2, 1918	June 8, 1948	May 15, 1953	July 1, 1918	1946	July 1, 1918
Silica (SiO_2)	12	---	14	---	---	---	37
Iron (Fe)	.23	---	.16	---	tr.	---	tr.
Calcium (Ca)	2.6	20	1.4	1.6	4.8	---	2.4
Magnesium (Mg)	7.1	10	.8	1.0	3.6	---	3.0
Sodium (Na) / Potassium (K)	45	60	146 calc.	---	65	---	230
Carbonate (CO_3)	17	---	4.9	11	24	---	115
Bicarbonate (HCO_3)	41	149	356	347	20	542	318
Sulfate (SO_4)	3.5	.5	17	---	5.4	1	37
Chloride (Cl)	28	40	2.8	2.8	41	110	8
Fluoride (F)	---	---	1.0	1.1	---	---	---
Nitrate (NO_3)	21	52	.6	.7	60	.1	.75
Dissolved solids	156	273	366	---	305	---	594
Hardness as $CaCO_3$	36	91	7	8	27	33	18
Specific conductance (micromhos at 25°C)	---	---	608	592	---	---	---
pH	---	---	8.3	8.5	---	7.9	---

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	55a	55b	55c	55c	55c	56	56
Location	Reedville	Reedville	Reedville	Reedville	Reedville	Reedville	Reedville
Depth (feet)	14	18	740	740	740	785	785
Date	July 1, 1918	July 1, 1918	July 1, 1918	Feb. 27, 1941	May 15, 1953	Oct. 22, 1932	Feb. 16. 1938
Silica (SiO_2)	43	34	---	---	---	14.0	---
Iron (Fe)	---	2.9	---	---	---	3.4	---
Calcium (Ca)	18	4.0	---	---	0.8	2.2	8.0
Magnesium (Mg)	11	2.2	---	---	.5	5.3	1.5
Sodium (Na) / Potassium (K)	256	49	---	---	---	164.0	---
Carbonate (CO_3)	.0	.0	120	---	0	14.4	14.4
Bicarbonate (HCO_3)	95	55	278	412	405	402.6	432
Sulfate (SO_4)	31	13	34	20	---	32.2	40.2
Chloride (Cl)	380	42	10	7	8.9	14.0	8
Fluoride (F)	---	---	---	1.8	1.6	---	---
Nitrate (NO_3)	tr.	tr.	.35	---	.8	.2	---
Dissolved solids	775	171	551	---	---	472.4	---
Hardness as $CaCO_3$	90	19	---	6	4	27.2	26.1
Specific conductance (micromhos at 25°C)	---	---	---	---	697	---	---
pH	---	---	---	---	8.3	---	---

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	56	56	58	63	73	73	75
Location	Reedville	Reedville	Reedville	Reedville	N of Fleeton	N of Fleeton	N of Fleeton
Depth (feet:	785	785	680	680	740	740	711
Date	June 8, 1948	May 15, 1953	July 2, 1918	July 1, 1918	July 2, 1918	Feb. 27, 1941	June 8, 1948
Silica (SiO_2)	---	---	25	24	22	---	15
Iron (Fe)	---	---	.40	.09	.04	---	.05
Calcium (Ca)	---	1.0	2	1.9	1.6	---	.7
Magnesium (Mg)	---	.5	1.3	1.2	2.3	---	.4
Sodium (Na)	---	---	} 201	199	202	---	165
Potassium (K)	---	---				---	
Carbonate (CO_3)	---	0	98	75	72	---	3.9
Bicarbonate (HCO_3)	416	411	288	356	348	407	415
Sulfate (SO_4)	32	---	35	35	35	22	32
Chloride (Cl)	11	11	8	8.7	10	8	13
Fluoride (F)	1.6	1.6	---	---	---	2.2	2.4
Nitrate (NO_3)	.6	.9	.6	.59	.56	---	.5
Dissolved solids	---	---	525	526	506	---	455
Hardness as $CaCO_3$	416	4	10	10	13	---	3
Specific conductance (micromhos at 25°C)	714	710	---	---	---	---	742
pH	---	8.3	---	---	---	---	8.3

Table 3.--Chemical analyses of ground waters from wells in Northumberland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	75	77	77	78	83	83	85	85
Location	N of Fleeton	Fleeton	Fleeton	Fleeton	SSW of Burgess	SSW of Burgess	Ditchley	Ditchley
Depth (feet)	711	690	690	400	625	625	580	580
Date	May 15, 1953	July 2, 1918	Feb. 27, 1941	July 2, 1918	June 8, 1948	May 15, 1953	June 19, 1948	May 15, 1953
Silica (SiO_2)	---	26	---	22	---	---	---	---
Iron (Fe)	---	.06	---	---	---	---	---	---
Calcium (Ca)	0.8	1.5	---	---	---	1.8	---	1.0
Magnesium (Mg)	.5	1.7	---	---	---	.6	---	1.0
Sodium (Na)	---	} 194	---	---	---	---	---	---
Potassium (K)	---							
Carbonate (CO_3)	8	86	---	149	12	11	---	0
Bicarbonate (HCO_3)	406	303	429	559	452	448	452	557
Sulfate (SO_4)	---	35	23	6.3	22	---	34	---
Chloride (Cl)	11	9.5	7	20	3	4.6	8	9.2
Fluoride (F)	2.0	---	2.1	---	2.2	2.0	2.2	2.4
Nitrate (NO_3)	.8	.60	---	1.0	.6	1.0	.6	.8
Dissolved solids	---	524	---	851	---	---	---	---
Hardness as $CaCO_3$)	4	11	9	---	15	7	12	6
Specific conductance (micromhos at 25°C)	722	---	---	---	768	761	780	779
pH	8.4	---	---	---	---	8.4	---	8.2

Table 5.—Logs of wells in Lancaster County, Virginia

Well 1, Litwalton; Bass Smith Canning Co.

(Log by O. D. Hale)

Altitude, 2 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Mud, black	15	15
Sand, yellow	12	27
Sand, coarse, brown	10	37
Chesapeake group:		
Sand, greenish	13	50
Clay, blue	50	100
Clay, sandy, green	11	111
Clay, blue	30	141
Clay, gritty, green	20	161
Clay, blue	34	195
Clay, dark-green	11	206
Pamunkey group:		
Sand, dark-gray; water-bearing	18	224
Sand, gray-green, and shells	1	225
"Rock"	½	225½
Sand, gray-green, and shells	5½	231
Sand, and "rock," interbedded; water-bearing	10	241

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 3, Lively; Sydnor Pump & Well Co., Inc.

(Log by Sydnor Pump & Well Co., Inc.)

Altitude, 102 feet

	Thickness (feet)	Depth (feet)
Soil	1	1
Columbia group:		
Clay, yellow; stiff	14	15
Clay, sandy; brown	111	126
Chesapeake group:		
Clay, blue	17	143
Silt, blue	13	156
Clay, blue	188	344
Chickahominy formation (?):		
Sand, gray, medium-fine, and clay	11	355
Clay, brownish-gray	10	365

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 4, Somers; W. F. Pittman & Sons

(Drilled by Reynolds & Norman. Sample descriptions by G. C. Chaterji from 53 to 500 feet; remainder by James H. Kempf.)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Undescribed (no sample)	53	53
Sand, light greenish-gray, quartz, very fine, with subordinate iron ores and mica flakes	11	64
Silt, sandy, light greenish-gray, iron ores, with a few shell fragments	11	75
Clay, yellowish-gray	11	86
Chesapeake group(?):		
Clay, greenish gray, with a little sand	21	107
Silt, sandy, greenish-gray, with quartz and iron ores	20	127
Sand, fine, gray; angular and rounded quartz grains iron ores, zircon, glauconite, shell fragments	10	137
Silt, greenish-gray, with rounded quartz grains and some iron ores; fragments of fossil tests in lower portion	24	161
Silt, yellowish-gray, with fine quartz grains; iron ores and glauconite in upper portion	21	182
Silt, olive gray, with fine quartz, iron ores, and Foraminifera	21	203
Sand, fine, light greenish-gray; quartz and iron ores; shell fragments and Foraminifera	8	211
Silt, sandy, dark olive gray, with quartz grains, iron ores, and shell fragments	15	226
Sand, very fine, light gray, with silt; quartz grains, iron ores and shell fragments richer in silt in lower portion	21	247

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 4, Somers; W. R. Pittman & Sons--Continued

	Thickness (feet)	Depth (feet)
Chesapeake group (?)--Continued:		
Sand, very fine, olive gray, with a little clay; quartz quartz, minor iron ores, and shell fragments	10	257
Chickahominy formation (?):		
Sand, fine, dark olive gray, with a little clay; quartz, glauconite, iron ores, and shell fragments	8	265
Sand, fine, gray; quartz, glauconite, iron ores, and a few shell fragments	13	278
Sand, fine, light olive gray; quartz, glauconite, iron ores, and shell fragments	11	289
Undescribed (no sample)	22	311
Pamunkey group:		
Clay, dark olive gray; glauconitic, with quartz grains and shell fragments	34	345
Mattaponi formation:		
Clay, dark olive gray; somewhat more glauconitic, with quartz grains and shell fragments	57	402
Clay, olive gray, glauconitic	18	420
Silt, light olive gray, with a little glauconite and quartz	10	430
Silt, olive gray, with glauconite and fine quartz sand	40	470
Silt, light olive gray, with minor glauconite, quartz, and mica flakes	20	490
Silt, light olive gray, with minor glauconite, quartz, and fragments of carbonized wood	10	500
Silt, pale yellowish-brown, with abundant medium to coarse grains of glauconite and some quartz	10	510
Silt, pale yellowish-brown, with some flakes of mica	12	522
Silt, light olive gray with flakes of mica	13	535

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 4, Somers; W. R. Pittman & Sons--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation:		
Undescribed (no sample)	82	617
Sand, very fine, light brown, with mica flakes	40	657
Sand, very fine, light brown, with medium to very coarse quartz grains	21	678
Sand, very fine, light brown, with some mica flakes	11	689
Sand, very fine, light brown, with rare mica flakes	4	693
Sand, fine to medium, pale yellowish-brown, with common mica flakes and angular to subangular quartz grains	11	704
Sand, medium to coarse, pale yellowish-brown, subangular to angular quartz grains, well-sorted; very rare glauconite	21	725

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 5, 1.8 miles east-southeast of Morattico; H. Marston Smith

(Log by Reynolds & Norman)

Altitude, 4 feet

	Thickness (feet)	Depth (feet)
Columbia group		
Subsoil	35	35
Clay, sandy, blue	10	45
Chesapeake group:		
Clay, blue; tough clay layer at about 210 feet	165	210
Mud, brown; tough clay layer at about 244 feet	34	244
Clay, tough, and thin layers interbedded with blue clay and sand	13	257
Pamunkey group:		
Sand, black and white; water-bearing	23	280

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 7, Lancaster; A. H. Beane

(Log by Reynolds & Norman; correlations in part by D. J. Cederstrom)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Subsoil	30	30
Clay, blue, and sand	45	75
Chesapeake group:		
Clay, pink and white	25	100
Clay, blue	38	138
Clay, light green and blue	12	150
Sand, fine, white, and shell	2	152
Clay, green	112	264
Clay, tough	1	265
Sand, white, and shells	12	277
Clay, silty, brown	13	290
Chickahominy formation:		
Clay, silty, brown	11	301
Clay, tough	9	310
Clay, gray	9	319
Chickahominy formation (?) and Pamunkey group (?):		
Undescribed	119	438

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 9, Kilmarnock; Town of Kilmarnock

(Log by Sydnor Pump & Well Co.; correlations in part by D. J. Cederstrom)

Altitude, 89 feet

	Thickness (feet)	Depth (feet)
Topsoil	1	1
Columbia group:		
Clay, yellow	11	12
Clay, sandy, yellow	55	67
Clay, blue	71	138
Clay and sand; hard	5	143
Clay and sand, soft; shells	7	150
Chesapeake group:		
Clay, blue	35	185
Clay, sandy	5	190
Clay, blue	33	223
Clay, blue, soft; somewhat sandy	15	238
Clay, blue	11	249
Clay, blue; fine sand and shells	5	254
Clay, blue	142	396
Clay, sandy, blue; shells	5	401
Clay, sandy, hard	13	414
Clay, sandy, blue	5	419
Clay, and hard sand	24	443

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 9, Kilmarnock: Town of Kilmarnock--Continued

	Thickness (feet)	Depth (feet)
Chickahominy formation (?):		
Clay, blue, streaks of gray "rock"	7	450
Clay, blue, streaks of gray "rock"	25	475
Clay, blue, glauconitic	14	489
Clay, light green, sticky, with layers of black and brown sand	6	495
Pamunkey group:		
Clay, blue, and black sand	75	570
Mattaponi formation:		
Clay, blue	48	618
Clay, sandy, black	27	645
Clay, mottled, light brown	28	673
Clay, sandy, gray	25	698
Sand, medium; hard	34	732
Clay, gray	8	740

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 14, 1.8 miles southeast of Kilmarnock; Alexandria Police Boys' Camp

(Lithology by James H. Kempf, based on samples collected at depth indicated; thicknesses are only approximate)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Undescribed (no sample)	65	65
Sand, very fine to fine, light olive gray glauconite, mica flakes, and shell fragments	50	115
Chesapeake group:		
Sand, very fine to fine, light olive gray glauconite, mica flakes, and shell fragments	60	175
Sand, fine to medium, grayish-green; shell fragments and siliceous spicules common, with some glauconite and mica flakes	45	220
Silt, grayish-green; some mica flakes and shell fragments; Miocene Foraminifera	140	360
Chickahominy formation:		
Sand, fine to medium, light olive gray; abundant glauconite, shell fragments common, rare pyrite; Upper Eocene Foraminifera	20	380
Sand, medium to coarse olive gray; very abundant coarse yellow quartz grains; medium clear quartz grains; 30-40% of sample is fresh glauconite; shell fragments; Upper Eocene Foraminifera	60	440
Pamunkey group (?):		
Nanjemoy formation (?):		
Sand, medium to coarse, olive gray; yellow quartz grains and mica rare; about 25% glauconite	20	460

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 14, 1.8 miles southeast of Kilmarnock; Alexandria Police Boys' Camp--Continued

	Thickness (feet)	Depth (feet)
Pamunkey group (?)--Continued:		
Aquia formation:		
Sand, medium, greenish black; quartz and shell fragments common, mica rare; about 80% glauconite; Foraminifera of Aquia aspect	40	500
Mattaponi formation (?):		
Sand, medium, dark greenish gray, glauconite, with about 15% silt; quartz rare	40	540
Sand, medium to coarse, dark greenish gray; about 45% glauconite and 45% quartz; 10% silt; Foraminifera and mica rare	60	600
Sand, coarse to medium, white; subangular clear and milky quartz	35	635

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 15, At Ocran, 2.4 miles northeast of White Stone; Standard Products Co.; formerly, Dymer Fish Co.

(Log from Bull. V, Virginia Geol. Survey)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Columbia and Chesapeake groups, undivided:		
Clay, blue; tough; 3-inch sand bed at 170 feet	237	237
Marl, with shells and gravel	2	239
Gravel, water-bearing; water level rises to within 10 feet of the surface	2	241
Clay, blue	7	248
Sand, coarse, mixed with yellow and green clay; overlain by thin rock layer	2½	250½
Undescribed	2½	253
Clay	132	385
Chickahominy formation		
Sand, medium coarse; dark	3	388
Clay, blue	47	435
Sand, coarse, dark buff; underlain by white sand; water-bearing, flows 7 gpm.	8	443
Pamunkey group:		
"Rock," hard; very tough; porous	21	464
Sand, coarse; mixed with micaceous clay; water-bearing, flows 5 gpm	10½	474½
Undescribed	1½	476
"Rock," hard	3	479
Mattaponi formation (?)		
Clay, blue, and sand	28	507

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 18, Northeast of White Stone; R. T. Herndon

(Log by Sydnor Pump & Well Co., Inc.)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Topsoil	1	1
Columbia group:		
Sand, fine, brown, and mud	39	40
Clay, blue, and mud	6	46
Mud, blue, and "quicksand"	10	56
Columbia group(?):		
"Quicksand" and mud	69	125
Chesapeake group:		
Clay, light gray	43	168
Clay, dark gray, with a few shells and fine sand	27	195
Shells, "quicksand" and mud	32	227
Clay, dark brown	18	245
Clay, dark gray	70	315
Clay and mud	23	338
Sand, fine, and green mud	34	372
Chickahominy formation:		
Clay, dark	22	394
Sand, black, and mud; some black sandstone	23	417
Pamunkey group:		
Clay, hard	25	442
Shell, cemented	5	447

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 18, Northeast of White Stone; R. T. Herndon--Continued

	Thickness (feet)	Depth (feet)
Pamunkey group--Continued:		
Clay, dark	21	468
Mattaponi formation (?)		
Clay, hard	21	489
Clay, dark	13	502
Clay, hard	2	504
Mud and "quicksand"	18	522
Sand, black and mud	14	536
Clay, light gray	4	540
Sand, black, and mud	38	578
Sand, gray, fine, and clay	3	581
Sand, and fine gravel, muddy	6	587
Sand, and gravel	47	634

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 22, Palmer; T. A. Treakle

(Log by Mitchell's Well and Pump Co.)

Altitude, 5± feet)

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand	90	90
Chesapeake group:		
Clay, blue	85	175
"Rock"	5	180
Sand	25	205
Clay, green	75	280
Sand	40	320
Mud, blue	45	365
Sand	34	399
Clay, blue	11	410
Shells	10	420
Chickahominy formation:		
Sand and "rock," interbedded	30	450
Pamunkey group:		
Mud, blue, and sand	30	480
Mud	40	520
Mattaponi formation (?):		
Sand	25	545
Clay	30	575
Sand, black	5	580
"Rock"	45	625

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 22, Palmer; T. A. Treakle--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation (?)--Continued:		
Sand	5	630
"Rock"	10	640
Sand	15	655
"Rock"	10	665
Gravel	1	666

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 23, Palmer; Treakle Fish Factory

(Log by Mitchell's Well and Pump Co.; correlations in part by D. W. Cederstrom)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow, and sand	10	10
Clay, blue, and caving sand	70	80
Chesapeake group:		
Sand, blue	10	90
Clay, blue	40	130
Mud, blue	115	245
Marl, blue	85	330
Chesapeake group and Calvert Formations, undivided:		
Mud, yellow; some sand	126	456
Pamunkey group:		
"Rock"	6	462
Mud, blue, and shell marl	13	475
Sand, black	5	480
Sand, black, and mud	40	520
Mattaponi formation (?):		
"Rock"	3	523
Mud, blue	7	530
Marl, blue	50	580
"Rock"	3	583
Sand, black	14	597
Sand, yellow; very fine	38	635
Sand, yellow; fine	25	660

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 29, White Stone; White Stone School

(Log by Sydnor Pump & Well Co., Inc.; correlations in part by D. J. Cederstrom)

Altitude, 45 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, and clay	6	6
Sand, fine, and gravel	18	24
Marl (?), gray	43	67
Gravel, and sand	8	75
Chesapeake group:		
Marl, dark	5	80
Sand	5	85
Sand, hard, and gravel	5	90
Marl, gray	130	220
Marl, green	150	370
Sand, some gravel	17	387
Chickahominy formation:		
Marl, green	28	415
Clay, gray	10	425
Pamunkey group:		
Nanjemoy formation:		
Clay, green	27	452
Rock," hard	11	463
Aquia formation (?):		
Clay, green	12	475

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 29, White Stone; White Stone School--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation (?):		
Clay, dark	63	538
Mattaponi formation:		
Clay, light	55	593
Sand and clay	2	595
Sand, with some black sand (probably glauconite)	9	604
Sand, black (probably glauconite)	5	609
Sand, dark, with some black sand	5	614
Sand, chiefly white	2	616
Sand, white	17	633
Clay, black	1	634
Sand, white; fine	7	641

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 52, Irvington; Bernard Willing

(Log by Mitchell's Well and Pump Co.)

Altitude, 8 feet

	Thickness (feet)	Depth (feet)
Undescribed	394	394
Mattaponi formation (?):		
"Rock"	8	402
Shells	48	450
Sand and shells	30	480
Clay, blue	55	535
"Rock"	31	566
Sand	9	575
"Rock"	10	585
Shells and clay	65	650
Sand	30	680
"Rock"	30	710
Sand; water-bearing	20	730
"Rock"	10	740
Sand; water-bearing	10	750

Table 5.—Logs of wells in Lancaster County, Virginia—Continued

Well 39, Irvington; Sydnor Pump & Well Co., Inc.

(Log by Sydnor Pump & Well Co., Inc.; correlations in part by D. J. Cederstrom)

Altitude, 6± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, fine	17	17
Sand, white, and gravel; water-bearing	10	27
Chesapeake group:		
Marl, black; shells	63	90
Clay, gray	70	160
Clay, greenish; shells at 200 feet	47	207
Clay, gray	63	270
Clay, green	45	315
Sand, fine	15	330
Clay, green	4	334
Clay, and shells	11	345
Chickahominy formation:		
Marl, dark	15	360
Marl, green; some glauconite; brown clay	20	380
Pamunkey group:		
Marl, green; some glauconite; brown clay	20	400
Shells; indurated beds	8	408
Mattaponi formation:		
Marl, dark gray; glauconitic	72	480
Marl, gray	63	543

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 39, Irvington; Sydnor Pump & Well Co., Inc.--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation--Continued:		
Gravel and black sand	3	546
Clay, gray	7	553
Sand, fine	18	571
Clay, brown	30	601

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 42, Millenbeck; "The Cow Shed," J. H. Sandy

Altitude, 10 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Soil and silt	32	32
Chesapeake group:		
Clay, blue	200	232
Clay, green	28	260
Clay, tough; underlain by nearly 2 feet of white sand	2	262
Clay, brown; hard	38	300
Clay, tough	14	314
Chickahominy formation (?):		
Clay, greenish brown	21	335
Pamunkey group (?):		
Clay, tough	25	360
Clay, yellow; hard	15	375
Clay, greenish-brown; gray sand 1½ feet thick at 375 feet	20	395
Mattaponi formation (?):		
Clay, blue; black sand 1 foot thick at about 435 feet	95	490
Mattaponi formation:		
Clay, dark gray	10	500
Clay, tough	10	510
Clay, brown; tough	20	530

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 42, Millenbeck; "The Cow Shed," J. A. Sawdy--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation--Continued:		
Undescribed; thin layer of white sand at about 535 feet	30	560
(Blue material; hard)	15	575
(Brown material); thin layer of black sand at about 585 feet	15	590
Undescribed	30	620
(Tan material; hard)	10	630
Sand, brown; coarse	5	635
Sand, and white clay, mixed; grading into white water-bearing sand at increasing depth	60	695

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 46, Bertrand; T. D. McGuinness

(Log by Mitchell's Well and Pump Co.)

Altitude, 5 feet

	Thickness (feet)	Depth (feet)
Columbia and Chesapeake groups, undivided:		
Clay, sandy, blue	233	233
Clay, blue, and sand	86	319
Chickahominy formation and Pamunkey group, undivided:		
Clay and sand	65	384
Mattaponi formation:		
"Rock," and sand, interbedded	66	450
Sand	75	525
"Rock," and sand, interbedded	20	545
Sand and clay	65	610
Sand	80	690
Potomac group:		
Sand and clay	75	765

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 52, Ottoman, 2.2 miles south-southeast of Kilmarnock; Faye

(Log by Mitchell's Well and Pump Co.)

Altitude, 10± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, white	50	50
Chesapeake group:		
Sand, blue, and shells	30	80
Sand, blue, and clay	80	160
Clay, blue, and shells	100	260
Chickahominy formation:		
Shell rock (coquina)	3	263
Sand, white; may be water-bearing	34	297
Sand, white, and shells	19	316
Sand, yellow	10	326
Pamunkey group:		
Sand, black	14	340
Sand, gray	1	341
Sand, yellow	1	342
"Rock"	17	359
Sand, black, and "rock"	57	416
Shells, and sand	59	475
Mud, blue, and shells	8	483
Undescribed	37	520
Mattaponi formation:		
Sand, white; water-bearing	10	530

Table 5.--Logs of wells in Lancaster County, Virginia--Continued

Well 54, About 1½ mile west-northwest of Mollusk;
Alexander Leland

(Log by Reynolds & Norman)

Altitude, 2± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Subsoil and sand	30	30
Chesapeake group:		
Clay, blue	40	70
Clay, gray	50	120
Clay, blue	120	240
Sand, white, and shells; thin bed of tough clay at 250 feet	10	250
Clay, brown	20	270
Chickahominy formation:		
Clay, tough, and sand layers	40	310
Clay, tough	5	315
Pamunkey group:		
Sand, black, below 315 feet (no record of thickness); water-bearing		

Table 6.--Chemical analyses of ground waters from wells in Lancaster County, Virginia
(Parts per million, except specific conductance and pH)

Well number	2	2	2	3	3	3
Location	Lively	Lively	Lively	Lively	Lively	Lively
Depth (feet)	60	60	60	365	365	365
Date	Mar., 1946	June 9, 1948	May 15, 1953	May 14, 1946	June 9, 1948	May 15, 1953
Silica (SiO_2)	12	---	12	---	25	---
Iron (Fe)	.25	1.4	.02	---	.83	---
Calcium (Ca)	33	---	24	---	5.2	4.8
Magnesium (Mg)	16	---	18	---	2.4	2.3
Sodium (Na)	} 12	---	21	---	} 148 calc.	---
Potassium (K)		---	4.6	---		---
Carbonate (CO_3)	0	---	0	---	9.8	26
Bicarbonate (HCO_3)	48	115	59	236	374	360
Sulfate (SO_4)	1.5	1	.5	1	11	---
Chloride (Cl)	51	58	53	2	4.0	3.6
Fluoride (F)	.1	.0	.0	1.3	1.8	1.6
Nitrate (NO_3)	75	50	68	.3	.6	1.1
Dissolved solids	311	---	250	---	400	---
Hardness as $CaCO_3$	148	201	137	60	23	22
Specific conductance (micromhos at 25°C)	---	526	416	---	634	634
pH	6.3	---	7.4	7.8	8.4	8.7

Table 6.--Chemical analyses of ground waters from wells in Lancaster County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	11	12	13	13	15	15
Location	ESE of Kilmarnock	ESE of Kilmarnock	ESE of Kilmarnock	ESE of Kilmarnock	NE of White Stone	NE of White Stone
Depth (feet)	620	480	610	610	507	507
Date	July 5, 1918	July 5, 1918	July 5, 1918	Feb. 27, 1941	July 5, 1918	Feb. 27, 1941
Silica (SiO_2)	34	53	34	---	28	---
Iron (Fe)	.06	.08	.07	---	.04	---
Calcium (Ca)	2.7	4.1	3.1	---	2.6	---
Magnesium (Mg)	1.4	1.8	1.9	---	1.5	---
Sodium (Na)	} 205 calc.	230	---	---	---	---
Potassium (K)			---	---	---	---
Carbonate (CO_3)	39	70	42	---	31	---
Bicarbonate (HCO_3)	418	463	399	169	406	469
Sulfate (SO_4)	34	6.9	37	27	39	27
Chloride (Cl)	10	4.5	11	6	14	14
Fluoride (F)	---	---	---	2.7	---	2.9
Nitrate (NO_3)	.6	1.1	.61	---	.61	---
Dissolved solids	534	598	526.0	---	523	---
Hardness as $CaCO_3$)	12	18	16	4	13	9
Specific conductance (micromhos at 25°C)	---	---	---	---	---	---
pH	---	---	---	---	---	---

Table 6.--Chemical analyses of ground waters from wells in Lancaster County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	18	25	25	25	25	27
Location	W of White Stone	N of Palmer	N of Palmer	N of Palmer	N of Palmer	S of White Stone
Depth (feet)	620	580	580	580	580	680
Date	May 15, 1953	July 5, 1918	Feb. 28, 1941	June 9, 1948	May 15, 1953	Feb. 27, 1941
Silica (SiO_2)	13	---	---	13	---	---
Iron (Fe)	.29	---	---	.05	---	---
Calcium (Ca)	1.9	8.0	---	4.5	1.9	---
Magnesium (Mg)	.7	6.8	---	1.7	.8	---
Sosium (Na)	193	} 280 calc.	---	} 271 calc.	---	---
Potassium (K)	4.9		---		---	---
Carbonate (CO_3)	31	108	---	16	8	---
Bicarbonate (HCO_3)	412	364	470	438	452	512
Sulfate (SO_4)	33	53	40	51	---	34
Chloride (Cl)	8.3	86	113	113	122	33
Fluoride (F)	2.8	---	3.7	3.4	3.2	3.8
Nitrate (NO_3)	.6	2.0	---	1.0	.7	---
Dissolved solids	499	872	---	702	---	---
Hardness as $CaCO_3$	8	48	8	18	8	6
Specific conductance (micromhos at 25°C)	817	---	---	1200	1180	---
pH	8.7	---	---	8.3	8.4	---

Table 6.--Chemical analyses of ground waters from wells in Lancaster County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	27	27	28	30	32	32
Location	S of White Stone	S of White Stone	SSW of White Stone	Irvington	Irvington	Irvington
Depth (feet)	680	680	560	450	750	750
Date	June 9, 1948	May 15, 1953	July 5, 1918	July 3, 1918	Feb. 28, 1941	June 9, 1948
Silica (SiO_2)	---	---	27	57	---	12
Iron (Fe)	0.86	---	.07	.05	---	.04
Calcium (Ca)	---	2.9	3.2	3.9	---	1.4
Magnesium (Mg)	---	.5	2.3	2.8	---	.6
Sodium (Na)	---	---	} 265	248	{ ---	} 241 calc.
Potassium (K)	---	---			---	
Carbonate (CO_3)	---	13	84	67	---	15
Bicarbonate (HCO_3)	516	187	425	529	441	547
Sulfate (SO_4)	34	---	46	3.7	40	29
Chloride (Cl)	30	16	10	16	11	12
Fluoride (F)	2.2	3.2	---	---	2.3	3.4
Nitrate (NO_3)	.8	1.0	.7	1.1	---	.6
Dissolved solids	---	---	681	670	---	587
Hardness as $CaCO_3$	15	9	17	21	6	6
Specific conductance (micromhos at 25°C)	939	889	---	---	---	951
pH	---	8.1	---	---	---	8.7

Table 6.--Chemical analyses of ground waters from wells in Lancaster County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	32	49	50	50	50
Location	Irvington	Bertrand	W of Bertrand	W of Bertrand	W of Bertrand
Depth (feet)	750	300	650	650	650
Date	May 15, 1953	July 9, 1918	July 8, 1918	June 9, 1948	May 15, 1953
Silica (SiO_2)	---	50	23	---	14
Iron (Fe)	---	---	0	---	.17
Calcium (Ca)	1.4	tr.	tr.	---	1.6
Magnesium (Mg)	.6	5	2.4	---	1.9
Sodium (Na)	---	} 301	260 calc.	{ ---	212
Potassium (K)	---			---	6.7
Carbonate (CO_3)	19	127	120	9.8	37
Bicarbonate (HCO_3)	442	542	415	537	481
Sulfate (SO_4)	---	tr.	28	25	20
Chloride (Cl)	5.6	12	4	8	5.0
Fluoride (F)	2.4	---	---	2.2	2.4
Nitrate (NO_3)	.8	1.4	.25	.6	.9
Dissolved solids	---	810	656	---	538
Hardness as $CaCO_3$	6	20	10	18	12
Specific conductance (micromhos at 25°C)	783	---	---	885	879
pH	8.6	---	---	---	8.6

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 1b, Colonial Beach; Municipality

(Log by Virginia Machinery & Well Co.)

Altitude, 8± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow	30	30
Clay, gray	42	72
Sand, clayey, yellow	6	78
Columbia group and Chesapeake group, undivided:		
Gravel	6	84
Boulders, fine sand, gravel	11	95
Pamunkey group:		
Nanjemoy formation:		
Clay, black, glauconitic	99	194
Marlboro clay member (?):		
Clay, pink	3	197
Aquia formation:		
Marl, sandy, dark olive green, glauconitic	28	225
Clay, black (10)	10	235
Sand, black	15	250
Mattaponi formation (?):		
Sand, clayey, grayish-green, glauconitic	25	275
Clay, sandy, dark olive green	20	295

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 1b, Colonial Beach, Municipality--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation (?)--Continued:		
Sand, clayey, dark gray	25	320
Mattaponi formation:		
Clay, mottled (yellowish, red to brown, and gray)	54	374
Sand, fine, gray; water-bearing	26	400
Clay, silty, pale green	10	410
Clay, dark gray	7	417
Sand, gray, with lumps of dark gray clay	8	425
Clay, dark gray, and sand	25	450
Clay, gray and brown	110	560
Clay, light gray	4	564
Clay, red	6	570
Clay, light brown	10	580
Clay, dark purplish-brown	10	590
Clay, red	10	600
Clay, light gray	20	620
Clay, dark gray	14	634
Sand, water-bearing, below 634 feet		

Table 8.--Logs of wells in Westmoreland County, Virginia

Well 2a, George Washington Birthplace National Monument; J. H. Muse

(Log by Mitchell's Well and Pump Co.)

Altitude, 19 feet

	Thickness (feet)	Depth (feet)
Soil	12	12
Columbia group:		
Mud, blue	48	60
Chesapeake group:		
Sand and mud	20	80
Pamunkey group:		
Nanjemoy formation:		
Mud, hard; black sand	120	200
Marlboro clay member (?):		
Clay, red	20	220
Aquia formation:		
Sand, fine, black	15	235
Sand and mud, black and green	31	266
Mattaponi formation:		
Mud, and sand, green	44	310
Sand, hard, and rock	32	342
"Quicksand," and mud	4	346
Mud, soft	9	355
Clay, red, hard, and yellow mud, mixed	35	390
Sand, green, hard	5	395
Sand, white	25	420

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 4, Westmoreland State Park; State Department of Conservation and Development

(Log by Virginia Machinery & Well Co.; correlations in part by D. J. Cederstrom)

Altitude, 100± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow	2	2
Clay, gray	38	40
Chesapeake group:		
Clay, olive-green	100	140
Pamunkey group:		
Nanjemoy formation:		
Clay, gray; black sand, shell traces	20	160
Clay, gray, and gray sandstone	20	180
Clay, dark gray, little sand	25	205
Clay, tough, dark gray; sand	65	270
Aquia formation (?):		
Clay, tough, dark	30	300
Clay, brown	20	320
Mattaponi formation (?):		
Clay, black; sand	60	380
Clay, light green, traces of black sand	50	430
Clay, dark green; sand	8	438
Clay, tough, brown	32	470
Clay, tough, gray	10	480

Table 6.--Logs of wells in Westmoreland County, Virginia--Continued

Well 4, Westmoreland State Park; State Department of Conservation and Development--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation (?)--Continued:		
Clay, dark brown	50	530
Clay, gray and brown	20	550
Clay, dark red	10	560
Clay, dark brown	20	580
Clay, light brown	25	605
Clay, gray	12	617
Sand; water-bearing	12	629
Clay, tough	3	632

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 6, Montross; Coca Cola Bottling Company

(Log by Mitchell's Well and Pump Co.)

Altitude, 145 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand and gravel	46	46
Chesapeake group:		
Clay, blue	214	260
Unclassified:		
Undescribed	224	484
Mattaponi formation:		
Rock	3	487
Clay, blue	43	530
Clay	6	536
Clay, and sand; shell marl at 571 feet	37	573
Clay, yellow	16	589
Clay, blue	14	603
Sand	42	645
Gravel	3	648

Table 8.—Logs of wells in Westmoreland County, Virginia—Continued

Well 7, Montross; ~~J. C. Parker~~ Town of Montross

Altitude, 145 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, yellow	40	40
Chesapeake and Pamunkey groups, undivided:		
Clay, blue	330	370
Mattaponi formation:		
Clay, yellow	50	420
Sand, black, and mud, mixed	40	460
Sand, green, and mud	80	540
Clay, white	5	545
Sand, white	15	560

Table 8.—Logs of wells in Westmoreland County, Virginia—Continued

Well 8, 3.6 miles east-northeast of Montross; Stratford Packing Co.

(Log by R. Williams)

Altitude, ~~150+~~ 142 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow	35	35
Chesapeake group:		
Marl, blue	235	270
Pamunkey		
Clay, black	25	295
Pamunkey group and Mattaponi formation, undivided:		
Clay, blue	130	425
Clay, pink	15	440
Sand, very fine, black	10	450
Sand, fine, and clay, mixed	5	455

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 37a, Coles Point; W. P. Campbell

(Sample descriptions by E. G. Otton, from Md. Dept. Geology, Mines and Water Resources, Bull. 11, p. 186-87; see Ferguson, 1953)

Altitude, 23 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, fine, angular, grayish-orange, quartz fine, clear angular, pale-yellow; feldspar, dull, fine, pink, and white; glauconite, green, very fine and rare	10	10
Sand, angular, fine to medium, light olive-gray; quartz, clear and gray, fine to medium, angular to subangular; glauconite, green, oblate, rare; feldspar, white, fragments; a few coarse chlorite and biotite fragments; grains of gray flint	11	21
Sand, medium, angular, yellowish gray, as above, but coarser, with coarse, angular, violet and pink quartz and fragments of brown limestone	10	31
Chesapeake group:		
Sand, fine, light olive-gray; mostly fine and medium, clear, angular quartz grains; glauconite rare, fine, oblate, green; feldspar, fine, rare; gray dull flint	11	42
Sand, very clayey, greenish-gray; fine to medium, clear, angular quartz; fine mica; black phosphate fragments; a few ostracods and pelecypods	11	53
Sample questionable	10	63
Clay, silty, soft, pale-olive; some clear, subangular, fine and medium quartz, black and brown phosphatic fragments and a few grains, green, glauconite; a few small Foraminifera	10	73
Clay, silty, pale-olive, a few small foraminifera; fish teeth and sponge spicules	11	84
Clay, silty, pale-olive; fine, clear and gray angular quartz and a few small Foraminifera	11	95

Table 8.—Logs of wells in Westmoreland County, Virginia—Continued

Well 37a, Coles Point; W. P. Campbell—Continued

	Thickness (feet)	Depth (feet)
Chesapeake group—Continued:		
Clay, silty, pale-olive; small amount of coarse to fine, clear and white angular quartz; a few Foraminifera and fish teeth	10	105
Clay, silty, pale-olive; some quartz as above and a few small Foraminifera; phosphatic material common	10	115
Clay, silty, pale-olive; similar to above	21	136
Clay, silty, grayish-olive	11	147
Clay, silty, yellowish-gray to grayish-olive	11	158
Clay, silty, mostly yellowish-gray, similar to above; sponge spicules very abundant; small Foraminifera frequent	10	168
Clay, sandy, grayish-olive to pale-olive; mostly clear, angular, fine quartz; some fine black phosphatic material; sponge spicules and shell fragments common	10	178
Clay, very sandy, grayish-olive; similar to above; some coarse subrounded clear quartz grains; light-green fine glauconite more common; several small black phosphatic pebbles	11	189
Chickahominy formation (?)		
Sand, slightly clayey, mottled greenish-gray; quartz, fine to medium, clear, angular, glauconite, common, light-green to green, fine, oblate to irregular; pyrite, microgranular, rare	10	199
Sand, medium, mottled greenish-gray; similar to above	11	210
Sand, light-gray, clean; mostly clear, subangular, medium to coarse quartz; fine black glauconite; shell fragments and Foraminifera common	10	220
Sand, clean, light-gray; similar to above, with a slight increase in amount of glauconite	11	231

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 44, 2 miles south of Coles Point

(Log by G. Pfeiffer)

Altitude, 10± feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, shells	12	12
Clay	10	22
Chesapeake group:		
Marl	38	60
Sand, dark	10	70
Sand, and gravel	12	82
Sand, mud, and marl	48	130
Clay, brown	60	190
Shells, cemented	1	191
Sand, dark	6	197
Shells, cemented	1	198
Chickahominy formation:		
Sand, dark green	62	260
Sand, dark; slightly water-bearing	10	270
Pamunkey group:		
Clay, dark brown	48	318
Sand, light; slightly water-bearing	8	326
Mattaponi formation:		
Clay, mixed	74	400
Clay, dark yellow	13	413
Undescribed (probably penetrates one or more water-bearing sands)	314	727

Table 8.--Logs of wells in Westmoreland County, Virginia--Continued

Well 65, Kinsale; Sydnor Pump & Well Co., Inc.

(Log by Sydnor Pump & Well Co., Inc.)

Altitude, 60 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, brown, and clay	20	20
Sand, dark blue	12	32
Chesapeake group:		
Clay, blue	186	218
Clay, olive drab	39	257
Clay, olive drab, with fine sand and shells	5	262
Chickahominy formation:		
Clay, olive drab, with thin streak of rock at base	2	264
Clay, gray	5	269
Shells, indurated; water-bearing	11	280

Table 8.—Logs of wells in Westmoreland County, Virginia--Continued

Well 73, 1.8 mile south-southwest of Oak Grove; E. T. Hynson

(Log by Mitchell's Well & Pump Co.)

~~Approximate~~ altitude, 180 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Mud, red	20	20
Mud and sand	55	75
Mud, yellow	10	85
Chesapeake group:		
Mud, blue	105	190
Pamunkey group:		
Manjemoy formation:		
Mud, blue, gravel, sand	50	240
Clay	40	280
Clay, and black sand	60	340
Marlboro clay member(?):		
Clay, red	10	350
Aquia formation:		
Sand, black and white	20	370
Mattaponi formation:		
Sand, black and white	25	395
Sand, fine, black	17	412
Sand, fine, black, and mud	48	460
Sand, and mud, hard	15	475

Table 8.—Logs of wells in Westmoreland County, Virginia—Continued

Well 73, 1.8 mile south-southwest of Oak Grove; L. T. Hynson—Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation—Continued:		
Clay, red and gray	10	485
Clay, hard, gray; sand	30	515
Sand, gray and white	10	525
Mud, yellow	5	530

Table 8.—Logs of wells in Westmoreland County, Virginia—Continued

Well 74, 2.5 miles south-southwest of Oak Grove; Wirtland Estate

(Log by Mitchell's Well & Pump Co.)

Altitude, 172 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, red	8	8
Clay, yellow	71	79
Chesapeake group:		
Clay, gray	91	170
Pamunkey group:		
Clay, gray	92	262
Clay, gray, with a trace of glauconite	93	355
Sand, glauconitic	32	387
Mattaponi formation:		
Sand, glauconitic	97	484
Clay, yellow; glauconitic	84	568
Clay, yellow-brown	92	660
Sand, white	48	708

Geo. Washington Birthplace Nat'l Monument

Table 9.--Chemical analyses of ground waters from wells in Westmoreland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	1a	2b	2c	3a	3a	3a
Location	Colonial Beach	Geo. Washington Birthplace Nat'l Monument	Geo. Washington Birthplace Nat'l Monument	Westmoreland State Park	Westmoreland State Park	Westmoreland State Park
Depth (feet)	585	(spring)	380	(spring)	(spring)	(spring)
Date	Dec., 1943	Sept., 1944	Oct. 12, 1933	Aug. 27, 1935	June 7, 1948	May 20, 1953
Silica (SiO_2)	---	---	12	8.7	8.7	---
Iron (Fe)	---	---	.08	.02	.10	---
Calcium (Ca)	---	---	3.4	1.8	2.2	1.7
Magnesium (Mg)	---	---	2.3	1.5	1.9	1.1
Sodium (Na)	---	---	143	2.4	} 3.0 calc.	{ ---
Potassium (K)	---	---	8.7	1.1		{ ---
Carbonate (CO_3)	2.0	---	---	0	0	0
Bicarbonate (HCO_3)	241	110	400	5.0	6	6
Sulfate (SO_4)	14	15	8.0	2.6	1.6	---
Chloride (Cl)	1	4	2.5	3.9	3.8	4.3
Fluoride (F)	1.5	.2	1.3	---	.1	.0
Nitrate (NO_3)	.2	8.4	.10	5.0	9.6	6.2
Dissolved solids	---	---	381	32	14	---
Hardness as $CaCO_3$	6	105	18	11	13	9
Specific conductance (micromhos at 25°C)	---	---	---	---	74.5	12.6
pH	8.2	6.4	---	---	5.5	5.8

Table 9.--Chemical analyses of ground waters from wells in Westmoreland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	6	6	6	16	16	16
Location	Montross	Montross	Montross	W of Mount Holly	W of Mount Holly	W of Mount Holly
Depth (feet)	648	648	648	130	130	130
Date	Jan. 1, 1944	June 9, 1948	May 20, 1953	Aug. 16, 1946	June 7, 1948	May 20, 1953
Silica (SiO_2)	18	17	19	---	---	---
Iron (Fe)	.06	.09	.04	.04	---	---
Calcium (Ca)	.8	.8	1.6	---	---	10
Magnesium (Mg)	.8	.5	.4	---	---	3.7
Sodium (Na)	} 130 calc.	130 calc.	{ 130	---	---	---
Potassium (K)			3.9	---	---	---
Carbonate (CO_3)	2.0	0	14	5.9	---	0
Bicarbonate (HCO_3)	320	326	299	153	157	161
Sulfate (SO_4)	10	8.3	7.5	11	10	---
Chloride (Cl)	2.8	3.5	2.6	1	1	1.3
Fluoride (F)	2.6	2.2	2.4	---	.4	.5
Nitrate (NO_3)	.4	.3	2.3	.5	.5	.9
Dissolved solids	326	330	328	---	---	---
Hardness as $CaCO_3$	5.5	4	6	45	45	40
Specific conductance (micromhos at 25°C)	---	534	529	---	290	276
pH	8.1	8.0	8.5	---	---	8.2

Table 9.--Chemical analyses of ground waters from wells in Westmoreland County, Virginia
(Parts per million, except specific conductance and pH)

Well number	33	42	45	62	62	65	65
Location	W of Coles Point	SSW of Coles Point	S of Coles Point	Sandy Point	Sandy Point	Kinsale	Kinsale
Depth (feet)	362	220	240	594	594	280	280
Date	June 7, 1948	Aug. 15, 1946	June 8, 1948	May, 1946	June 8, 1948	May, 1946	June 8, 1948
Silica (SiO_2)	---	---	---	12	---	45	---
Iron (Fe)	---	0.29	---	.09	---	.05	---
Calcium (Ca)	---	---	---	2.0	---	14	---
Magnesium (Mg)	---	---	---	1.7	---	5.8	---
Sodium (Na)	---	---	---	} 158	---	49	---
Potassium	---	---	---				
Carbonate (CO_3)	---	9.8	---	23	11	0	---
Bicarbonate (HCO_3)	327	294	309	347	364	182	187
Sulfate (SO_4)	7	7	1	17	19	11	7
Chloride (Cl)	4	1	4	10	3	1.8	1
Fluoride (F)	1.1	---	.7	.6	.7	.5	.4
Nitrate (NO_3)	.4	.1	.6	.1	.5	.1	.4
Dissolved solids	---	---	---	396	---	212	---
Hardness as $CaCO_3$	24	33	36	12	15	59	63
Specific conductance (micromhos at 25°C)	522	---	484	---	621	---	320
pH	---	---	---	8.5	---	7.8	---

Table 9.--Chemical analyses of ground waters from wells in Westmoreland County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	65	66	67	68	71	72	73
Location	Kinsale	SSE of Hague	ENE of Hague	S of Machodoc	Leedstown	Leedstown	SSW of Oak Grove
Depth (feet)	280	456	273	366	160	500	520
Date	May 20, 1953	June 7, 1948	Sept. 14, 1951	Aug. 15, 1946	Oct. 14, 1944	Oct. 14, 1944	Oct. 12, 1944
Silica (SiO_2)	---	---	---	---	11	11	---
Iron (Fe)	---	---	---	.12	.33	.03	---
Calcium (Ca)	13	---	---	---	5.4	2.2	---
Magnesium (Mg)	5.9	---	---	---	4.0	1.8	---
Sodium (Na)	---	---	---	---	154	171	---
Potassium (K)	---	---	---	---	12	9.0	---
Carbonate (CO_3)	0	---	---	13	15	25	5.9
Bicarbonate (HCO_3)	191	223	256	403	417	422	268
Sulfate (SO_4)	---	1	19	4	11	11	7
Chloride (Cl)	1.0	1	28	1	3.5	2.0	1
Fluoride (F)	.5	.7	.8	---	1.7	1.7	1.6
Nitrate (NO_3)	1.0	.5	.1	.6	.0	.0	.2
Dissolved solids	---	---	---	---	421	444	---
Hardness as $CaCO_3$	57	51	50	24	30	13	6
Specific conductance (micromhos at 25°C)	315	359	494	---	---	---	---
pH	8.2	---	7.9	---	8.1	8.4	8.0

Table 11.--Logs of wells in Richmond County, Virginia

Well 1, 2.7 miles east of Warsaw; E. W. Garland

(Log from Bull. V, Virginia Geol. Survey)

Altitude, 11 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand	8	8
Columbia and Chesapeake groups, undivided:		
Marl, blue	157	165
Rock (sandstone?)	2	167
Marl, blue	17	184
Chickahominy formation (?):		
Rock (sandstone?)	3	187
Sand, quartz; glauconitic; water-bearing	1	188

Table 11.—Logs of wells in Richmond County, Virginia—Continued

Well 4, Emmerton; Hammock Cannery

(Log by Mitchell's Well & Pump Co.)

Altitude, 100 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Undescribed	36	36
Sand and mud	44	80
Chesapeake group:		
Mud, blue	100	180
Mud, yellow	10	190
Clay, light-colored	65	255
Mud, green	45	300
Chickahominy formation(?):		
Mud, black, and sand	20	320
Mud, green	10	330
Pamunkey group(?):		
Sand, black	40	370
Mud and sand, hard	23	393
Mattaponi formation(?):		
Sand, black, and mud	17	410
Mud, gray	10	420
Mud and black sand	10	430
Sand, black, soft, and mud	6	436
Sand, black, and mud	4	440

Table 11--Logs of wells in Richmond County, Virginia--Continued

Well 4, Emmerton, Hammock Cannery--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation(?):		
Clay, hard, and black sand	10	450
Mud and sand, dark	10	460
Mud, pink	8	468
Mud, light-colored, and sand	22	490
Sand, black and white, mixed	10	500
Undescribed	10	510
Sand, black	5	515
Mud and black sand	20	535
Mud and sand	15	550
Sand, white and black, mixed	3	553

Table 11.--Logs of wells in Richmond County, Virginia--Continued

Well 6, Downings; J. W. Welch

(Log by Mitchell's Well & Pump Co.; residue descriptions by D. J. Cederstrom)

Altitude, 75 feet

	Thickness (feet)	Depth (feet)
Columbia and Chesapeake groups:		
Undescribed	195	195
Chesapeake group:		
Mud, blue	105	300
Chickahominy formation and Pamunkey group, undivided:		
Sand, brown	50	350
Mud, sandy, blue	50	400
Sand, glauconitic, and shells	8	408
Mattaponi formation (?):		
Mud, clay; glauconitic	52	460
Clay, yellow, glauconitic	28	488
Undescribed	134	622

Table 11.—Logs of wells in Richmond County, Virginia—Continued

Well 16, About 1 mile southwest of Simpson; Dr. Wingfield

(Log by Reynolds & Norman)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Subsoil	16	16
Columbia and Chesapeake groups, undivided		
Clay, blue	174	190
Chesapeake group:		
Shells and sand	2	192
Sand, black	3	195
Clay, tough	21	216
Clay, tough; water-bearing sand	24	240

Table 11.--Logs of wells in Richmond County, Virginia--Continued

Well 17, about a mile southwest of Simonson; U. L. Johnson

(Log by Reynolds & Norman)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Subsoil	22	22
Columbia and Chesapeake groups, undivided:		
Clay, blue	168	190
Chesapeake group:		
Sand, and shells	3	193
Clay, tough; water-bearing sand below 214 feet	55	248

Table 11.—Logs of wells in Richmond County, Virginia—Continued

Well 18, about a mile southwest of Simonson; J. R. Self

(Log by Reynolds & Norman)

Altitude, 5± feet

	Thickness (feet)	Depth (feet)
Subsoil	18	18
Columbia and Chesapeake groups, undivided:		
Clay, blue	174	192
Chesapeake group:		
Sand and shells	2	194
Sand, black	6	200
Clay, tough; water-bearing sand below 209 feet	40	240

Table 11.--Logs of wells in Richmond County, Virginia--Continued

Well 40, Cat Point Creek; Frazier

(Log by Reynolds & Norman)

Altitude, 10 ? feet

	Thickness (feet)	Depth (feet)
Soil	18	18
Columbia and Chesapeake groups, undivided:		
"Fuller's earth," blue	94	112
Sand, white	1	113
"Fuller's earth," blue	17	130
Chickahominy formation (?):		
Sand, black	1	131
Clay, medium hard	14	145
Sand, black and white	3	148

Table 12.--Chemical analyses of ground waters from wells in Richmond County, Virginia
(Parts per million, except specific conductance and pH)

Well number	1	3	3	3	5	6	6
Location	E of Warsaw	SE of Warsaw	SE of Warsaw	SE of Warsaw	Farnham	Downings	Downings
Depth (feet	188	180	180	180	44	622	622
Date	July 9, 1918	Aug. 29, 1946	June 9, 1948	May 15, 1953	July 9, 1918	June 9, 1948	May 15, 1953
Silica (SiO_2)	59	---	---	---	---	16	---
Iron (Fe)	.60	.03	---	---	---	.38	---
Calcium (Ca)	4.0	---	---	9.1	1.2	7.6	9.0
Magnesium (Mg)	3.8	---	---	3.8	1.0	.9	.6
Sodium (Na)	} 131	---	---	---	} 110	114 calc.	---
Potassium (K)		---	---	---			---
Carbonate (CO_3)	86	---	---	0	17	14	13
Bicarbonate (HCO_3)	156	220	222	225	83	281	231
Sulfate (SO_4)	13	7	4	---	7.1	8.6	---
Chloride (Cl)	18	1	2	1.0	100	2.8	3.0
Fluoride (F)	---	---	.6	.7	---	1.8	1.2
Nitrate (NO_3)	tr.	.6	.5	.9	2.0	.2	.5
Dissolved solids	400	---	---	---	315	309	---
Hardness as $CaCO_3$	116	54	42	38	7	23	25
Specific conductance (micromhos at 25°C)	---	---	355	353	---	501	417
pH	---	---	---	8.3	---	8.5	8.6

Table 12.--Chemical analyses of ground waters from wells in Richmond County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	28	30	33	36	37	37	41	41
Location	NW of Sharps	Tidewater	S of Warsaw	Warsaw	Warsaw	Warsaw	Naylors	Naylors
Depth (feet	29	285	180	40	385	385	385	385
Date	Nov., 1946	Sept. 3, 1946	July 8, 1918	July 12, 1918	June 9, 1948	May 15, 1953	July 10, 1918	Feb. 27, 1941
Silica (SiO_2)	---	---	49	11	46	17	21	---
Iron (Fe)	.06	.75	tr.	1.1	.59	.02	.06	---
Calcium (Ca)	---	---	2.2	40	16	1.6	2.0	---
Magnesium (Mg)	---	---	3.9	14	5.1	.3	2.0	---
Sodium (Na)	---	---	} 106	113	15 calc.	{ 118	} 212	{ ---
Potassium (K)	---	---				3.5		---
Carbonate (CO_3)	5.9	---	60	0	0	10	94	---
Bicarbonate (HCO_3)	265	206	173	212	176	285	335	430
Sulfate (SO_4)	9	5	6.8	32	12	6.7	12	5
Chloride (Cl)	3	3	2.0	81	1.0	3.0	3.7	2
Fluoride (F)	---	---	---	---	.5	2.2	---	2.2
Nitrate (NO_3)	.6	.5	tr.	108	.3	.7	.33	---
Dissolved solids	---	---	314	490	217	297	506	---
Hardness as $CaCO_3$	20	78	21	157	61	5	13	12
Specific conductance (micromhos at 25°C)	---	---	---	---	320	482	---	---
pH	---	---	---	---	8.0	8.4	---	---

Table 12.--Chemical analyses of ground waters from wells in Richmond County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	41	41	42	43	43
Location	Naylors	Naylors	NW of Naylors	SW of Newland	SW of Newland
Depth (feet)	385	385	22	350	350
Date	June 7, 1948	May 15, 1953	Aug. 29, 1946	June 7, 1948	May 15, 1953
Silica (SiO_2)	---	---	---	---	---
Iron (Fe)	---	---	.05	---	---
Calcium (Ca)	---	2.2	---	---	3.2
Magnesium (Mg)	---	1.7	---	---	1.5
Sodium (Na)	---	---	---	---	---
Potassium (K)	---	---	---	---	---
Carbonate (CO_3)	17	17	---	---	14
Bicarbonate (HCO_3)	411	434	20	420	389
Sulfate (SO_4)	12	---	58	11	---
Chloride (Cl)	2	3.8	168	2	2.5
Fluoride (F)	2.4	2.0	---	2.4	2.0
Nitrate (NO_3)	.6	.9	123	.1	.2
Dissolved solids	---	---	---	---	---
Hardness as $CaCO_3$	33	12	210	21	14
Specific conductance (micromhos at 25°C)	709	728	---	671	654
pH	---	8.5	---	---	8.4

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 7a, Fairview Beach; Sydnor Pump & Well Co., Inc.

(Log by Sydnor Pump & Well Co., Inc.; correlations by D. J. Cederstrom)

Altitude, 36 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, yellow, and clay	10	10
Pamunkey group:		
Mud, blue	17	27
Marl, indurated; fossiliferous	8	35
Sand; shells	10	45
Mud, blue	10	55
Sand; shells	15	70
Mud, blue; sand; shells	45	115
Mattaponi formation:		
Mud, blue	5	120
Clay, yellow	8	128
Sand, white and blue	12	140
Sand, white; some glauconite	10	150
Clay, yellow and white	30	180
Clay, reddish brown	8	188

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 11, Dogue; W. M. Grigsby

(Log by Leonard Reynolds; correlations in part by D. J. Cederstrom)

Altitude, 92 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, yellow, and clay	24	24
Chesapeake group:		
Clay, blue	15	39
Pamunkey group:		
Nanjemoy formation:		
Sand, black	5½	39½
Marl, blue; glauconitic	70½	110
Aquia formation:		
Marl, blue; glauconitic	30	140
Clay, sandy, blue	35	175
Limestone	1	176
Marl, blue; glauconitic	24	200
Mattaponi formation:		
Clay, brown and light brown	20	220
Clay, light brown to light blue; hard	97	317
Clay, brown	23	340
Undescribed	7	347
Sand, white, fine	1	348

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 11, Dogue; W. M. Grigsby--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation--Continued		
Undescribed	11	359
Limestone	10	369
Limestone (?)	17	386
Sand, and limestone (?)	23	409

Table 14.--Logs of Wells in King George County, Virginia--Continued

Well 14, King George; E. R. Morris, Sr.

(Drilled by Leazer Well & Pump Co.; log by Seymour Subitzky and J. P. Prine)

Altitude, 205 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, yellow	14	14
Sand, silty, red, very fine	7	21
Clay, white; fine sand with some gravel	14	35
Chesapeake group:		
Sand, fine to medium-coarse; limonitic, with some clay; water-bearing	36	71
Clay, yellow	3	74
Clay, green	54	128
Pamunkey group(?):		
Clay, green; trace of black minerals	2	130
Clay, silty, green	10	140
Clay, silty, green, and shells	13	153
Clay, green, sticky; black sand and shells	7	160
Clay, green, sticky; black sand, with streaks of indurated shell beds and shells	10	170
Clay, silty, green, sticky; very fine black sand; shells	30	200
Clay, silty, green, sticky; indurated shell beds; fine black sand and shells	10	210
Clay, silty, green, sticky; fine black sand; shells	42	252
Rock	4	256
Clay, blue, with shells; fine black silty sand	34	290

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 14, King George; E. R. Morris, Sr.--Continued

		Thickness (feet)	Depth (feet)
	Mattaponi formation:		
	Rock, soft; fine sand; shells	10	300
	Limestone, soft, mixed with blue clay	20	320
	Clay, gray, red, and blue; sticky	30	350
C	Clay, gray	22	372
	Clay, red and gray, sticky	92	464
	Marl and gray clay, interbedded	16	480
	Rock and sand, interbedded	20	500
	Marl and gray clay, interbedded; water-bearing	10	510
	Clay	67	577
	Rock and sand, interbedded; water-bearing	20	597
	Rock and clay, interbedded	19	616

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 22, 2 miles southeast of King George; Pickle Factory

(Log by Sydnor Pump & Well Co., Inc.; correlations in part by D. J. Cederstrom)

Altitude, 180 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, silty, yellow; soil on top	25	25
Chesapeake group:		
Sand; gravel	17	42
Sand, clayey; gravel	23	65
Clay, blue	57	122
Sand	10	132
Clay, blue; sticky	36	168
Pamunkey group:		
Nanjemoy formation:		
Sand	19	187
Mud, blue	3	190
Silt, blue	6	196
Mud, blue; shells	5	201
Mud, blue	65	266
Sandstone	5	271
Marlboro clay member:		
Mud, pink	24	295
Aquia formation:		
Mud, blue	7	302
Sand, gray	18	320
Mud, blue; sticky	9	329

Table 14.—Logs of wells in King George County, Virginia--Continued

Well 22, 2 mi. SE of King George; Pickle Factory--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation:		
Mud, blue, and sand	3	332
Sandstone	8	340
Mud, blue, sticky	6	346
Mud, blue; underlain by black sand	6	352
Clay, silty, blue; some black sand	16	368
Clay, brown; hard	9	377
Clay, blue, and brown; tough	103	480
Clay, blue; sticky	40	520
Clay, brown, sticky	23	543
Clay, blue, sticky	4	547
Clay, blue, sandy	10	557
Sand, gray; clayey at top	5	562

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 28, Dahlgren; Naval Proving Ground

(Log by Washington Pump and Well Co.)

Altitude, 15 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand; clay	11	11
Sand, yellow, medium coarse	7	18
Gravel, yellow	10	28
Columbia and Pamunkey groups, undifferentiated:		
Marl, sandy, black	104	132
Pamunkey group:		
Nanjemoy formation:		
Marl, light gray	17	149
Marlboro clay member:		
Clay, brown	18	167
Aquia formation:		
Marl, sandy, black	23	190
Marl, black; shells	11½	201½
Rock, gray	11½	213
Mattaponi formation:		
Marl, glauconitic, green	79	292
Clay, reddish brown	22	314
Clay, yellow	74	388
Sand, blue-gray; clay	11	399
Clay, blue; tough	3	402
Clay, red; tough	6	408

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 28, Dahlgren; Naval Proving Ground--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation:		
Clay, yellow	91	499
Clay, sandy, brown	10	509
Sand, glauconite-quartz; water-bearing	12	~~521~~ 521

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 30, Dahlgren; Naval Proving Ground

(Drilled by Virginia Machinery and Well Co.; sample descriptions by G. C. Tibbitts, Jr.

Altitude, 19 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Clay, sandy, very light gray	1	1
Clay, sandy, white, mottled with yellow	13	14
Clay, sandy, light olive gray; very hard; with a few shell fragments	66	80
Gravel and boulders, with quartz sand	4	84
Pamunkey group:		
Nanjemoy formation:		
Clay, sandy, light tan, with some glauconite; streaks of lighter clay	11	95
Sand and clay, olive gray, with glauconite; streaks of lighter clay	52	147
Marlboro clay member:		
Clay, sandy, grayish pink, with some glauconite and muscovite	15	162
Aquia formation:		
Clay, sandy, dark gray, with glauconite	23	185
Clay, dark gray, with glauconite and shells	15	200
Clay, sandy, bluish-green, with abundant glauconite; some shell fragments	25	225
Sand, olive gray, glauconitic, with abundant quartz; clay and some shell fragments	25	250
Sand, fine, olive gray, glauconitic, with abundant quartz and some clay	20	270

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 30, Dahlgren; Naval Proving Ground--Continued

	Thickness (feet)	Depth (feet)
Mattaponi formation:		
Sand, fine, clayey, light yellow; abundant quartz	15	285
Clay, brown, with very fine quartz grains and trace of hematite from 292-300 feet	15	300
Clay, dark brown; abundant fine yellow quartz grains and traces of jasper, rose quartz, and glauconite	20	320
Clay, light brown and some light yellow; with coarse to fine clear, rose and milky quartz; some glauconite	3	323
Clay, brown, with abundant coarse sand; some glauconite	12	335
Clay, brown, with very fine quartz grains; trace of glauconite	30	365
Sand, gray, medium- to coarse-grained, with dark gray silt	15	380
Clay, light brown, with some fine sand	20	400
Clay, dark brown	35	435
Clay, light brown, with very fine sand	10	445
Clay, light brown, with fine sand	20	465
Clay, light brown, with a few sponge spicules	20	485
Clay, dark brown, with fine quartz sand and some muscovite; more sandy in the lower 35 feet	71	556
Silt, clayey, light brown, with very fine quartz and glauconite	30	586
Clay, light brown, sandy, with clear and yellow quartz	19	605
Sand, light gray, with some glauconite	23	628

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 30, Dahlgren; Naval Proving Ground--Continued

	Thickness (feet)	Depth (feet)
Potomac group(?):		
Silt, clayey, brown, with fine quartz sand	27	655
Sand, light gray, very fine	28	683
Silt, clayey, light brown, with some fine sand	11	694
Sand, light gray, very fine	21	715
Clay, sandy, grayish brown	15	730
Sand, nearly white, coarse; with small pebbles	3	733
Silt, sandy, light brown	7	740
Clay, dark brown, with grains of quartz and muscovite	10	765
Sand, silty, dark brown	15	780

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 31, 1.8 mi. WSW of Dahlgren; W. H. Washington

(Drilled by Leazer Well & Pump Co.; log by James P. Prine)

Altitude, 80 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Hard yellow clay	11	11
Iron stain; water-bearing sand	6	17
Yellow clay	15	32
Clay with large gravel	8	40
Chesapeake group(?):		
Blue clay	10	50
Green clay	15	65
Organic matter mixed with green clay	20	85
Unclassified:		
Soft silty clay with sea shells	5	90
Fine silty sand with sea shells	10	100
Soft limestone	7	107
Blue clay	43	150
Pamunkey group:		
Nanjemoy formation:		
Soft sticky blue clay and black fine sand	41	191
Lime rock	1	192
Soft sticky blue clay	20	212
Hard shell rock	2	214
Blue clay with sea shells	5	219

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 31, 1.8 mi. WSW of Dahlgren; W. H. Washington--Continued

	Thickness (feet)	Depth (feet)
Pamunkey group:--Continued		
Nanjemoy formation:--Continued		
Blue and red clay mixed	10	229
Marlboro clay member:		
Light red clay	16	245

Table 14.--Logs of wells in King George County, Virginia--Continued

Well 32, Dahlgren; Union Bethel Church (Six mi. S of Potomac River Bridge on Route 301)

Altitude, 160± feet

	Thickness (feet)	Depth (feet)
Columbia and Chesapeake groups, undifferentiated:		
Clay, blue	130	130
Pamunkey group:		
Nanjemoy formation:		
Sand, blue	20	150
Clay, blue	103	253
Clay, tough; (Nanjemoy fossils at this depth)	2	255
Marlboro clay member:		
Clay, red	2	257
Aquia formation:		
Clay, blue	68	325
Sand, blue	25	350
Mattaponi formation:		
clay, tough	2	352
Clay, brown	18	~~300~~ 370
Clay, white	20	390
Clay, tough	6	396
Clay, yellow, and sand	304	700
Clay, red	50	750
Clay, white	100	850
Sand, white	44	894

Table 15.--Chemical analyses of ground waters from wells in King George County, Virginia
(Parts per million except specific conductance and pH)

Well number	4	7b	13	19	24	24
Location	Nr. Sealston	Fairview Beach	King George	SSW of Edge Hill	Port Conway	Port Conway
Depth (feet)	201	105	400	35	401	401
Date	June 16, 1949	April 2, 1944	May 14, 1953	May 14, 1953	June, 1949	May 14, 1953
Silica (SiO_2)	30	--	19	--	35	--
Iron (Fe)	5.0	--	.04	--	.32	--
Calcium (Ca)	26	--	3.8	5.0	1.0	1.8
Magnesium (Mg)	7.4	--	2.5	1.2	1.4	.2
Sodium (Na)	12	--	78	--	54	--
Potassium (K)		--	8.4	--		--
Carbonate (CO_3)	0	--	0	0	0	0
Bicarbonate (HCO_3)	129	246	210	22	124	121
Sulfate (SO_4)	11	85	18	--	19	--
Chloride (Cl)	2.8	6	1.0	15	2.8	6.2
Fluoride (F)	.3	.2	.4	.1	.1	.2
Nitrate (NO_3)	.2	1.0	.9	4.2	.2	.4
Dissolved solids	154	--	230	--	170	--
Hardness as $CaCO_3$	95	270	20	17	8	5
Specific conductance (micromhos at 25°C)	238	--	370	101	245	234
pH	6.8	7.6	8.3	6.3	7.5	7.8

Table 17.--Logs of wells in eastern Stafford County, Virginia

Well 3, Arkendale; Arkendale Farm

(Log by W. S. Reynolds)

Altitude, 25 feet

	Thickness (feet)	Depth (feet)
Potomac group:		
Clay, red and yellow	30	30
Marl, gray	27	57
Clay, brown	11	68
Sand, white, hard	2	70
Marl, gray	42	112
Sand, white, hard	10	122
Marl, gray	21	143
Marl, dark red	20	163
Marl, brown	19	182
Marl, gray	7	189
Marl, hard red	10	199
Marl, gray	91	290
Sand; water-bearing	6	296
Marl, red; fossil wood	12	308
Marl, gray	67	375
Sand, gray	12	387
Marl, red	69	456
Sand; water-bearing	32	488
Pre-Cretaceous:		
Granite	2	490

Table 17.--Logs of wells in eastern Stafford County, Virginia--Continued

Well 9, 3 miles northeast of Fredericksburg; Frank A. Stevens

(Log by G. C. Tibbitts, Jr.)

Altitude, 210 feet

	Thickness (feet)	Depth (feet)
Columbia group:		
Sand, fine, red	15	15
Sand fine, dark red; water-bearing	5	20
Clay, brown and gray, interbedded	2	22

Well 17, 3 miles southeast of Fredericksburg; L. P. ~~Gravel~~ Graves

(Generalized log)

Altitude, 40 feet

Columbia group:		
Clay	10	10
Sand, brown	30	40

Table 17.--Logs of wells in eastern Stafford County, Virginia--Continued

Well 18, Sherwood Forest Farm, 4 miles southeast of Fredericksburg; J. L. Pratt

(Log by L. L. Martin)

Altitude, 90 feet

	Thickness (feet)	Depth (feet)
Columbia group(?):		
Clay, red	25	25
Unclassified (Potomac group ?)		
Clay, yellow	60	85
Marl, blue	20	105
Potomac group:		
Sand, gray	15	120
Clay, white	20	140
Sand, and blue marl	26	166
Sand, gray; water-bearing	3	169
Sand, and blue marl	11	180
Sand, and gravel, gray; water-bearing	15	195

Well 21, 6.5 miles east-southeast of Fredericksburg; Jesse Olive

(Log by owner)

Altitude, 50 feet

Columbia group:		
Clay	~~20~~ 20	20
Sand, white	1	21

Table 18.--Chemical analyses of ground waters from wells in eastern Stafford County, Virginia
(Parts per million, except specific conductance and pH)

Well number	1	2	4	5	6	7
Location	Widewater	Widewater	Brooke	NW of Marlboro Point	SSW of Brooke	NW of Marlboro Point
Depth (feet)	210	290	55	37	41	16
Date	April 26, 1940	April 26, 1940	June 14, 1949	June 15, 1949	June 15, 1949	June 15, 1949
Silica (SiO_2)	--	--	--	--	--	--
Iron (Fe)	2.3	2.6	.12	--	.24	--
Calcium (Ca)	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--
Bicarbonate (HCO_3)	54	56	14	76	10	24
Sulfate (SO_4)	18	25	1	15	4	1
Chloride (Cl)	1	2	17	8	6	4
Fluoride (F)	.0	.0	.0	.0	.0	.2
Nitrate (NO_3)	.0	.0	46	--	22	--
Dissolved solids	--	--	--	--	--	--
Hardness as $CaCO_3$	63	72	33	63	21	21
Specific conductance (micromhos at 25°C)	--	--	177	190	47.4	51.6
pH	--	--	--	--	--	--

(Na)-

Table 18.--Chemical analyses of ground waters from wells in eastern Stafford County, Virginia--Continued
(Parts per million, except specific conductance and pH)

Well number	8	9	10	11	12	14
Location	Marlboro Point	Fredericksburg	WSW of Marlboro Point	Near Fredericksburg	Fredericksburg	Near Fredericksburg
Depth (feet)	20	22	27	1102	27	25
Date	June 15, 1949	June 16, 1949	June 17, 1949	Sept. 23, 1953	June 16, 1949	July 17, 1949
Silica (SiO_2)	--	--	--	--	--	--
Iron (Fe)	--	--	--	15	.12	.28
Calcium (Ca)	--	--	--	13	--	--
Magnesium (Mg)	--	--	--	5.5	--	--
Sodium (Na)	--	--	--	} 5.4	{ --	--
Potassium (K)	--	--	--		--	--
Carbonate (CO_3)	--	--	--	0	--	--
Bicarbonate (HCO_3)	40	34	8	64	10	10
Sulfate (SO_4)	4	5	6	11	1	3
Chloride (Cl)	6	4	58	1.8	58	16
Fluoride (F)	.0	.1	.4	.1	.0	.0
Nitrate (NO_3)	--	--	--	.2	34	17
Dissolved solids	--	--	--	--	--	--
Hardness as $CaCO_3$	66	18	39	55	24	21
Specific conductance (micromhos at 25°C)	132	88.5	260	132	304	113
pH	--	--	--	6.8	--	--

Table 18.--Chemical analyses of ground waters from wells in eastern Stafford County, Virginia--Continued
) (Parts per million, except specific conductance and pH)

Well number	15	17	18	19	20	21
Location	ESE of Fredericksburg	Fredericksburg	SE of Fredericksburg	N of Butzner Corner	Fredericksburg	Fredericksburg
Depth (feet)	22	40	195	65	16	21
Date	June 17, 1949	June 14, 1949	Dec., 1943	June 17, 1949	June 14, 1949	June 14, 1949
Silica (SiO_2)	--	--	--	--	--	--
Iron (Fe)	.29	.28	13	--	--	--
Calcium (Ca)	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--
Sodium (Na)	--	--	6	--	--	--
Potassium	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--
Bicarbonate (HCO_3)	20	80	79	30	8	30
Sulfate (SO_4)	2	14	17	1	3	6
Chloride (Cl)	12	10	3	6	8	16
Fluoride (F)	.0	.0	.3	.0	.0	.0
Nitrate (NO_3)	.8	26	.0	--	--	--
Dissolved solids	--	--	--	--	--	--
Hardness as $CaCO_3$	33	75	74	24	15	48
Specific conductance (micromhos at 25°C)	99.4	238	--	97.6	51.0	112
pH	--	--	6.7	--	--	--

Table 7.—Records of wells in Westmoreland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
41	2 mi. SW of Coles Point	Mrs. Ficklen			1	J	300	1½	Late Eocene (?)	Chickahominy fm (?)	(+)		D, S	Flows 5-10 gpm. Another similar well nearby.	41
42	2.5 mi. SSW of Coles Point	Harden Daiger			20	J	220	1¼	Miocene	Chesapeake group	(−)		D, S	See analysis, Table 9.	42
43	2 mi. SE of Coles Point	Smith	John W. Wilson		10	J	239	1½	Miocene (?)	Chesapeake group (?)	(−)		D	Pumps 18 gpm.	43
44	2 mi. S of Coles Point		G. Pfeiffer, Jr.	1918	10	D	727	8-6	Paleocene-Late Cretaceous	Mattaponi fm	(+)			See log, Table 8. Flowed 100 gpm in 1918.	44
45	Do.	William Barnes	John W. Wilson	1945	10	J	240	1¼	Miocene(?)	Chesapeake group (?)	(−)		D	See analysis, Table 9. Temp., 58° F.	45
49	2.4 mi. SSW of Coles Point	Carl Hubbard			2	J	220	1½	Miocene	Chesapeake group	(−)		D, S		49
51	2.6 mi. SSW of Coles Point	B. Tilman			3	J	220	1½	do	do	(+)		D, S	Flows 10 gpm. No decline in water level during dry years.	51
54	1.3 mi. NNE of Hague	G. M. Thompson			13	J	240	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flowing for 35 years. Some iron stain.	54
55	1 mi. NE of Hague	Strongs	C. Jones		16	J	350	2	Eocene	Pamunkey group	−6		D, I	Stopped flowing in 1945.	55
56	1.4 mi. NE of Hague	H. L. Barnes	John W. Wilson		14	J	270	2	Late Eocene	Chickahominy fm	−2		D, S	No iron stain.	56
57	1.4 mi. ENE of Hague	E. L. Mozingo	do		15	J	400	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	Flows ¼ gpm. No iron stain.	57
58	1.6 mi. ENE of Hague	I. T. Short	do	1924	18	J	260+	2	Late Eocene	Chickahominy	(−)		D, S	Pumps some sand. Water causes slight brown stain.	58
62	Sandy Point	T. Brooks	Mitchell's Well and Pump Co.	1946	11	D	594	6-4¼	Paleocene-Late Cretaceous	Mattaponi fm	(+)	60		See analyses, Table 9. Flows about 30 gpm. When pumped, yields, 60 gpm with 2-ft drawdown.	62
63	Do.	do	John W. Wilson		3		497		do	do	(−)			Stopped flowing in about 1945.	63
64	1.4 mi. S of Sandy Point	S. P. Collier	do		3		470		do	do	(+)			Flows 1 gpm.	64
65	Kinsale	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1946	70	D	280	8	Late Eocene	Chickahominy	−53		PS	See log, Table 8; analyses, Table 9. Temp., 62° F. Pumps 66 gpm with 25-ft drawdown. Has yielded 130 gpm on test.	65
66	0.7 mi. SSE of Hague	C. C. Cole	Arthur Cole		35	J	456		Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	See analysis, Table 9. Temp., 62° F. Supplies cannery. Black sand at 250 ft.	66

Table 1.—Records of wells in Northumberland County, Virginia

Type of well: D, drilled; J, jetted; B, bored; Dv, driven
Use of water: PS, public supply; D, domestic; I, industrial; S, stock

gpm, gallons per minute; fm, formation; ppm, parts per million
Temp., temperature (degrees Fahrenheit)

o.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	Luttrellville	J. E. Winstead			144	Dug	22		Pleistocene	Columbia group					1
2	Callao	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1945	101	D	356		Late Eocene	Chickahominy fm	-87	22	PS	See log, Table 2; analysis, Table 3. Temp., 63½°. Drawdown, 4 ft when bailing 22 gpm.	2
3	1.7 mi. WNW of Lodge	L. B. Northern		Prior to 1918	5	J	252	2	do	do				Water level reported ½ ft above surface in 19 1918.	3
4	1.9 mi. NNW of Lodge	Lovis Courtney	John W. Wilson		3	J	432		Paleocene-Late Cretaceous (?)	Mattaponi fm (?)			D, I	Used for washing oysters.	4
5	Do.	Warren Courtney	do	1939	3	J	310		Late Eocene	Chickahominy fm					5
6	Lodge	M. T. Dawson			5	J	590	2	Paleocene-Late Cretaceous	Mattaponi fm	(−)			Weak flow in 1918.	6
7	Do.	Dawson and Callahan		1908	5	J	325	2	Late Eocene	Chickahominy fm	(+)			In 1918, flow reported 6 gpm, and water level 3 ft above surface.	7
8	0.9 mi. NNW of Lodge	C. H. Howell	A. L. Wilson	1950	17	J	284	1½	do	do	-12	16	D	See log, Table 2. Drawdown 7 ft after 4 hrs. pumping at 11 gpm.	8
9	1.2 mi. ESE of Lodge	Garner Bros.			21	Dug	22		Pleistocene	Columbia group	-7				9
10	1 mi. W of Lewisetta				11	Dug	22		do	do	(−)			See analysis, Table 3.	10
11	Lewisetta	Lewisetta Packing Co.			5		325	1½	Miocene	Chesapeake group	(+)			See analysis, Table 3. Several other wells in this vicinity are of same depth. Flow reported 3 gpm in 1918.	11
13	Do.	do		Prior to 1918	5	J	550	2	Paleocene-Late Cretaceous	Mattaponi fm				See analysis, Table 3. In 1918, flow reported 25 gpm, and water level 12 ft above surface.	13
14	Do.	C. R. Lewis and Co.			3	J	317	2	Miocene (?)	Chesapeake group (?)	(+)			In 1918(?), reported flow 16 gpm.	14
15	Do.	Garner Bros		Prior to 1912	2		700		Paleocene-Late Cretaceous	Mattaponi fm	(+)			In 1910, reported flow 17 gpm.	15
16a	0.6 mi. WSW of Lewisetta	S. Cowart		Prior to 1918	10	J	310	1½	Late Eocene (?)	Chickahominy fm (?)				In 1918, flow reported 3½ gpm, and water level 8 ft above surface.	16a
16b	Do.	J. L. Dobins		Prior to 1918	8	J	288	2	Miocene (?)	Chesapeake group (?)				In 1918, flow reported 2 gpm, and water level 6 ft above surface.	16b

Table 1.—Records of wells in Northumberland County, Virginia--Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
17	Walnut Point	J. A. Lewis, store		Prior to 1918	1		340		Miocene (?)	Chesapeake group (?)	(−)		D	See analysis, Table 3. Temp., 63° F. Shark teeth at 340 ft.	17
18	Do.	J. A. Lewis, residence		Prior to 1918	1		605		Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	See analysis, Table 3. Chief aquifer, black sand from 400-408 ft.	18
19	1 mi. SSW of Walnut Point	Headly	John W. Wilson		4	J	360		Late Eocene	Chickahominy fm	(+)	10	D, I	Used for washing oysters.	19
20	Do.	J. H. Darling	Reynolds & Norman	1941	15	J	572	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)			Flowed 27 gpm in 1941. Black sand and marl at about 300 feet; taps white sand at 572 feet.	20
21	Do.	Mrs. J. W. Cowart			1	J	360	1½	Late Eocene	Chickahominy fm	(+)		D, S	Reported flow, 1/3 gpm. Reported iron-free.	21
22	2.1 mi. E of Lottsburg	T. H. Fallin			3	J	318	1½	do	do	(+)			Reported flow, 3/4 gpm in about 1918 (?).	22
23	Do.	do			1	J	310	1½	do	do	(+)			Reported flow, 7½ gpm in about 1918 (?).	23
24	1.3 mi. SSE of Walnut Point	do		Prior to 1906 ?	5	J	260	1½	Miocene	Chesapeake group	(+)			See analysis, Table 3. In 1918, flow reported 3/4 gpm, and water level 12 feet above surface.	24
25	Do.	do			2	J	270	1½	do	do			D	In 1918, flow reported 1½ gpm, and water level 10 feet above surface. Temp., 67° in 1948.	25
26	1.4 mi. SSE of Walnut Point	do			3	J	290	1½	do	do	(+)		D	In 1918, flow reported 3/4 gpm.	26
27	1.7 mi. SE of Walnut Point	A. H. Clark		1910	12	J	407	1½	Late Eocene	Chickahominy fm	(−)		D	See analysis, Table 3. Adequate during dry years.	27
28	2.4 mi. SE of Walnut Point	C. F. Howard			12	D	400+		do	do	(−)		D	Reported iron-free, and soft.	28
29	4.2 mi. NE of Heathsville	E. W. Bray	A. G. Hainey	1926	2	D	404	2	do	do	(+)		D, S	See analysis, Table 3. Temp., 63° F. in 1948. In about 1926, flow reported 1/3 gpm.	29
30	Do.	G. B. Bray	do	1926	2	B	400	2	do	do	(+)		D, S	Reported iron-free. In about 1926, flow reported ½ to 1/3 gpm.	30
32	2.3 mi. NE of Heathsville	B. Fletcher			115	Dug	42		Pleistocene	Columbia group	(−)		D, S	Water level declines in dry years; reported to contain some iron.	32
33	2 mi. NE of Heathsville	J. H. Sisson			114	Dug	27		do	do	−27		D	See analysis, Table 3.	33
34	1.2 mi. NNE of Heathsville	W. C. Snow			6	J	265	2	Miocene	Chesapeake group	(+)			In 1918, flow reported 4 gpm.	34
35	Heathsville	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1946	100	D	448	8	Late Eocene	Chickahominy fm	−87	50	PS	See log, Table 2. Screen set at 414 to 440 ft. Drawdown, 70 ft after pumping 50 gpm for 24 hours.	35

Table 1.—Records of wells in Northumberland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
36	Heathsville	Public Supply Well			102	Dug	50		Pleistocene	Columbia group	−40			See analysis, Table 3.	36
37a	Avalon	J. A. Lewis			105	D	605	1½	Paleocene-Late Cretaceous	Mattaponi fm	(−)			See analysis, Table 3.	37a
37b	1 mi. S of Avalon	W. N. Bentley		Prior to 1918	115	Dug	30		Pleistocene	Columbia group	−26		D	See analysis, Table 3. In 1918, water level reported 26 ft below surface.	37b
37c	Avalon	At Post Office			105	Dug	43		do	do	(−)		D, S	Adequate during dry years; reported to contain a little iron.	37c
38	1.6 mi. NNE of Avalon	O. H. Crowther			90	Dug	53		do	do	(−)			Water level declines in dry years. Reported to contain some iron.	38
39	3.5 mi. NNE of Avalon	Jedson Hall			1	Dv	300+		Miocene	Chesapeake group	(+)		D, S	Flows up to ½ gpm. No lack of water in dry years.	39
40	3.8 mi. NNE of Avalon	T. H. Gile			15	Dug	15		Pleistocene	Columbia group	(−)		D, S		40
41	4.8 mi. NE of Avalon	Redford			10	Dv	22		do	do	(−)		D	Some decline in water level in dry years. Reported soft and iron-free.	41
42	Do.	C. F. Bowles			2		595		Paleocene-Late Cretaceous	Mattaponi fm	(+)			Taps black sand at about 595 feet; also, black and gray sand with "rock" at about 360 ft.	42
43a	3 mi. E of Burgess	Elliott & Brooks	W. S. Reynolds	1946	4	J	740		do	do	(+)	75	I	See log, Table 2.	43a
43b	1.8 mi. NNW of Burgess	R. W. Edwards			82	Dug	34		Pleistocene	Columbia group	(−)		D, S	Water level declines during dry years. Reported hard, contains iron.	43b
44	3.6 mi. NNE of Burgess	T. H. Swann			15	Dug	16		do	do	(−)		D, S	Water level declines during dry years.	44
45a	4 mi. NE of Burgess	A. W. Noble	Mitchell's Well and Pump Co.		15		385		Miocene	Chesapeake group	(−)		D	Sulfide odor reported.	45a
45b	Do.	F. W. Herndle	do		15		425		Late Eocene	Chickahominy fm	(−)		D		45b
45c	4.6 mi. ENE of Burgess	E. J. Spilling	John W. Wilson	1940-41	11		500	3	Late Eocene (?)	Chickahominy fm(?)	(+)		D	See analysis, Table 3. Flowed ½ gpm in 1946.	45c
46	5.2 mi. ENE of Burgess	Moses Cockrell			10	Dug	16		Pleistocene	Columbia group	(−)		D	Water level declines during dry years.	46
47	3.2 mi. NNE of Reedville	E. S. Gough			1	Dv	14	1½	do	do	(−)		D, I	Reported iron-free. Used for washing oysters. Many other dug wells in vicinity.	47

Table 1.—Records of wells in Northumberland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
48	3.2 mi. NNE of Reedville	Mrs. A. A. Page			9	Dug	20		Pleistocene	Columbia group	(−)		D	Reported to contain iron.	48
49	3.0 mi. N of Reedville	C. O. Hancock			2	Dv	12+	2	do	do	(−)		D		49
50	2.8 mi. N of Reedville	H. G. Williams			11	Dug	15		do	do	(−)		D, S	Used for 1,000 chickens. Water level declines during dry years. Reported high in iron.	50
51	3 mi. NNE of Reedville	Robert Jett			11	Dv	18		do	do	(−)		D		51
52	2.1 mi. NNE of Reedville	J. H. Youngquist			12	Dug	15		do	do	(−)		D, S	Water level declines during dry years. Reported to contain iron.	52
53	1.7 mi. NNE of Reedville	P. Lee			11	Dug	10		do	do	−5		D, S	Reported to contain iron.	53
54a	Reedville	Albert Morris			8	J	724	2	Paleocene-Late Cretaceous	Mattaponi fm			D	In 1918, flow reported 40 gpm, and water level 38 ft above surface.	54a
54b	Do.	William Blunden		Prior to 1908	8	J	680	2	do	do			D	See analysis, Table 3. In 1918, flow reported 25 gpm, and water level 8 ft above surface.	54b
55a	Do.	V. McFarland			10	Dug	14		Pleistocene	Columbia group	−12		D	See analysis, Table 3.	55a
55b	Do.	S. O. Butler			10	Dug	18		do	do				See analysis, Table 3.	55b
55c	Do.	Mrs. R. B. Moore			5	J	740	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	See analysis, Table 3. In 1918, flow reported 75 gpm.	55c
56	Do.	Blunden & Hinton		1918	1	J	685	3	do	do	(+)		PS, I	See log, Table 2; analysis, Table 3. In 1918, flow reported 50 gpm; in 1948, flowed 17½ gpm.	56
57	Do.	McNeal & Edwards			5	J	682	2	do	do	(+)		I	In 1918, flow reported 30 gpm, and water level 25 ft above surface.	57
58	Do.	McGill & McNeal Co.	R. H. Milligan	1902	3	J	680	3	do	do	(+)		I	See analysis, Table 3. In 1910, flow reported 50 gpm, and water level 38 ft above surface.	58
59	Do.	G. N. Reed			1	J	680	2½	do	do	(+)			In 1918, flow reported 35 gpm.	59
60	Do.	Jas. C. Fisher		1904	5	J	698	2	do	do	(+)			In 1918, flow reported 45 gpm.	60
61	Do.	Edwards, Reed, & Co.	R. H. Milligan	1902	5	J	685	2	do	do	(+)		I	In 1918, flow reported 32 gpm; in 1910, water level reported 25 feet above surface.	61
62	Do.	Paine & Snow Co.			3	J	683	2	do	do	(+)		I	In 1910, flow reported 45 gpm; in 1918(?), flow reported 40 gpm.	62

WELL
VIRGINIA PRIMA
COUNTY BOUND
CORPORATE LI
COUNTY SEAT
TOWN
LANCASTER COUNTY
VIRGINIA
SCALE OF MILES
1956
RICHMOND COUNTY
NORTHUMBERLAND COUNTY
NICOLESEX COUNTY
WESTMORELAND COUNTY
Chinns Pond
Creek
Bells Branch
McMahon Swamp
Lancaster
Morattico
Mulberry Cr
Lively
Little Branch
Lively Airport
Grassy Creek
Mollusk
West Branch
Corotoman River
Lancaster
Broad Creek
Kilmarnock
Corotoman River
Morgan Creek
Paynes Creek
Bulls Cr
Millenbeck
Corotoman River
Taylors Creek
Carter Cove
Irvington
Weems
Carters Cr
Eastern Branch
White Stone
Tabbs Creek
Antipoison Cr
Foxwells
Oyster Cr
Little Bay
Palmer
Windmill Pt. Creek
Mosquito Cr
Mosquito Pt.
Windmill Point
FERRY
TOLL
River
Bay

Table 4.—Records of wells in Lancaster County, Virginia

Type of well: D, drilled; J, jetted; Dv, driven
Use of water: D, domestic; PS, public supply; I, industrial; S, stock

gpm, gallons per minute; fm, formation
Temp., temperature (degrees Fahrenheit)

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	3 mi. NE of Morattico	Bass Smith Canning Co.	O. D. Hale	1918	2		241		Late Eocene	Chickahominy fm	(+)			See log, Table 5.	1
2	Lively	Hale's Garage			103	Dug	60		Pleistocene		−50		D	See analyses, Table 6. Excessive nitrate; unfit for drinking.	2
3	Do.	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1946	103	D	365	8	Late Eocene	Chickahominy fm	−91		PS	See log, Table 5; analyses, Table 6.	3
4	2.7 mi. ESE of Morattico	W. T. Pittman & Sons	Reynolds & Norman	1949	5	J	725		Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	See log, Table 5. Flowed 25 gpm in 1949. Used only for washing down oyster plant.	4
5	2 mi. ESE of Morattico	H. Marston Smith	Reynolds & Norman	1949	4	J	280		Late Eocene	Chickahominy fm	(+)		D	See log, Table 5. Flows 3 gpm.	5
7	Lancaster	A. R. Beane	do	1951	5	J	438		Late Eocene(?)	Chickahominy fm(?)	(+)			See log, Table 5.	7
8	Do.	I. V. Farlee	W. S. Reynolds	1947	5	J	740	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	Flows 15 gpm.	8
9	Kilmarnock	Town	Sydnor Pump & Well Co., Inc.	1946	89		740	10-8	do	do	−75		PS	See log, Table 5. Drawdown 44 feet after pumping 24 hrs. at 110 gpm.	9
10	1 mi. ESE of Kilmarnock	do		1903	8		637	2	do	do	(+)		PS	Flow reported 140 gpm in 1903.	10
11	Do.	do	Milligan	1914	5		620	3	do	do	(+)		PS	See analysis, Table 6. Flow reported 105 gpm in 1918.	11
12	1.8 mi. ESE of Kilmarnock	Menhaden Products Co.; formerly Eubank Tankard Co.			2		480		Late Eocene	Chickahominy fm			I	See analysis, Table 6.	12
13	Do.	do	Milligan	Prior to 1918	2		610	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	See analyses, Table 6. Flow reported 100 gpm, water level 14 ft above surface in 1918.	13
14	1.8 mi. SE of Kilmarnock	Alexandria Police Boys' Camp	Reynolds & Norman	1950	8	J	635	4-3-2	do	do	(+)		D	See log, Table 5. Pumps 10 gpm.	14
15	2.4 mi. NE of White Stone	Standard Products Co.; formerly Dymer Fish Co.		Prior to 1918	5		507	4½	do	do	(+)		I	See log, Table 5 (from Bull. 5, Va. Geol. Survey); analyses, Table 6. Flow reported 120 gpm in 1913.	15
17	2.7 mi. ENE of White Stone	Bellows & Squire	Milligan	1907	6		660	3	do	do	(+)			Flow reported about 90 gpm in 1918.	17
18	2.2 mi. NNE of White Stone	R. T. Herndon	Sydnor Pump & Well Co., Inc.	1951	25	Dr	634	3	do	do	(−)			See log, Table 5; analysis, Table 6. Water level very near surface in 1951.	18
20	1.5 mi. SSE of Foxwells	B. L. Farinholt		1896	2		443		Late Eocene	Chickahominy fm	(−)			Did not flow.	20
22	0.3 mi. N of Palmer	T. A. Treakle	Mitchell's Well and Pump Co.	1941	5	Dr	666	4-3	Paleocene-Late Cretaceous	Mattaponi fm	(+)			See log, Table 5.	22

Table 4.—Records of wells in Lancaster County, Virginia--Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
23	0.3 mi. N of Palmer	Treakle Fish Factory	Mitchell's Well and Pump Co.	1945	5	D	660	6	Paleocene-Late Cretaceous	Mattaponi fm	+12		I	See log, Table 5.	23
24	Do.	T. A. Treakle	do	1946	5	D	824	6-4	do	do	(+)	22		Flows 10 gpm. Drawdown 10 ft when pumping 22 gpm. Gravel-packed well.	24
25	0.5 mi. N of Palmer	Little Bay Ice Co.	R. H. Milligan	1913	3		580	4½	do	do	+12			See analyses, Table 6. Flowed more than 60 gpm in 1941. Flow reported 125 gpm in 1913.	25
27	1.3 mi. S of White Stone	W. H. Culver		1918	5		680	2	do	do	(+)			See analyses, Table 6. Flow reported 50 gpm in 1918.	27
28	1.5 mi. SSW of White Stone	Taft Fish Co.			5		560	3	do	do	(+)			See analysis, Table 6.	28
29	White Stone	White Stone School	Sydnor Pump & Well Co., Inc.	1945	40	D	641		do	do	−35	93		See log, Table 5. Drawdown 93 ft after 8 hours pumping at 93 gpm.	29
30	Irvington	Messick & Gumby	H. A. Crittendon	1903	4		450	1½	Eocene (?)	Pamunkey group(?)	(+)		I	See analysis, Table 6. Flow reported 2 gpm, water level 6 ft above surface, in 1903. Oyster packing house.	30
31	Do.	Sydnor Pump & Well Co., Inc.		Prior to 1912	10		580	4	Paleocene-Late Cretaceous	Mattaponi fm	(+)		PS	Flow reported 50 gpm in 1912.	31
32	Do.	Bernard Willing		1938	8		750	8-2	do	do	(+)		PS	See log, Table 5; analyses, Table 6. Pumps 30 gpm.	32
33	Do.	W. McDonald Lee			25		690	3	do	do	(−)			Water level at surface in 1918.	33
34	0.5 mi. ESE of Weems	I. H. Francis			6		330?	2	Late Eocene	Chickahominy fm	(+)			Flow reported 1½ gpm in 1905.	34
35	Do.	do			5		537	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)			In 1905, flow reported 50 gpm, water level 18 ft above surface.	35
36	Weems	Doggett & Chance			3½		330	1½	Late Eocene	Chickahominy fm	(+)			In 1896, flow reported 2½ gpm, water level 6 ft above surface.	36
37	0.8 mi. W of Irvington	Joseph Childs		ca. 1600	5	Dug	21	48	Pleistocene	Columbia group	−12			Reported iron taste; soft. Formerly King Carter Plantation.	37
38	Do.	Carters Creek Fish & Guano Co.			6	D	580	3-2	Paleocene-Late Cretaceous	Mattaponi fm	(+)			In 1899, flow reported 50 gpm, water level 35 ft above surface.	38
39	1.5 mi. NW of Irvington	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1945	6	D	742	8	do	do	−4		PS	See log, Table 5. Pumps 60 gpm with 72-ft drawdown.	39

Table 4.—Records of wells in Lancaster County, Virginia -- Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (—) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
62	0.5 mi. E of Morattico	Whealton Packing Co.		1903?	4		265	1½	Late Eocene	Chickahominy fm			I	Flow reported 20 gpm in 1903; water level 15 ft above surface in 1908.	62
63	Do.	J. W. Whealton		1894	6		262	1½	do	do					63
64	Do.	Lewis Lankford Lull			8		256	1½	do	do	(+)			Flow reported 16 gpm in 1902.	64
66	0.9 mi. NE of Morattico	J. R. Crabbe			12	Dv	12	2	Pleistocene	Columbia group			D	Water leaves iron stain.	66
67	0.7 mi. N of Morattico	B. Koons	S. Conrad		1	J	278	1½	Late Eocene	Chickahominy fm	(+)		D	Flow reported 10 gpm in 1946.	67
68	1 mi. N of Morattico	J. R. Crabbe			12	J		2			-1½		D,S	Water stored in 500-gallon tank on windmill.	68
70	1.2 mi. NE of Morattico	F. E. Bornis			3	J	278	1½	Late Eocene	Chickahominy fm	(+)		D,S	Flows 10 gpm.	70
71	1.4 mi. NE of Morattico	W. Clarke			7	J	275	1½	do	do	(-)		D,S	Another similar well nearby; flowed until about 1946.	71

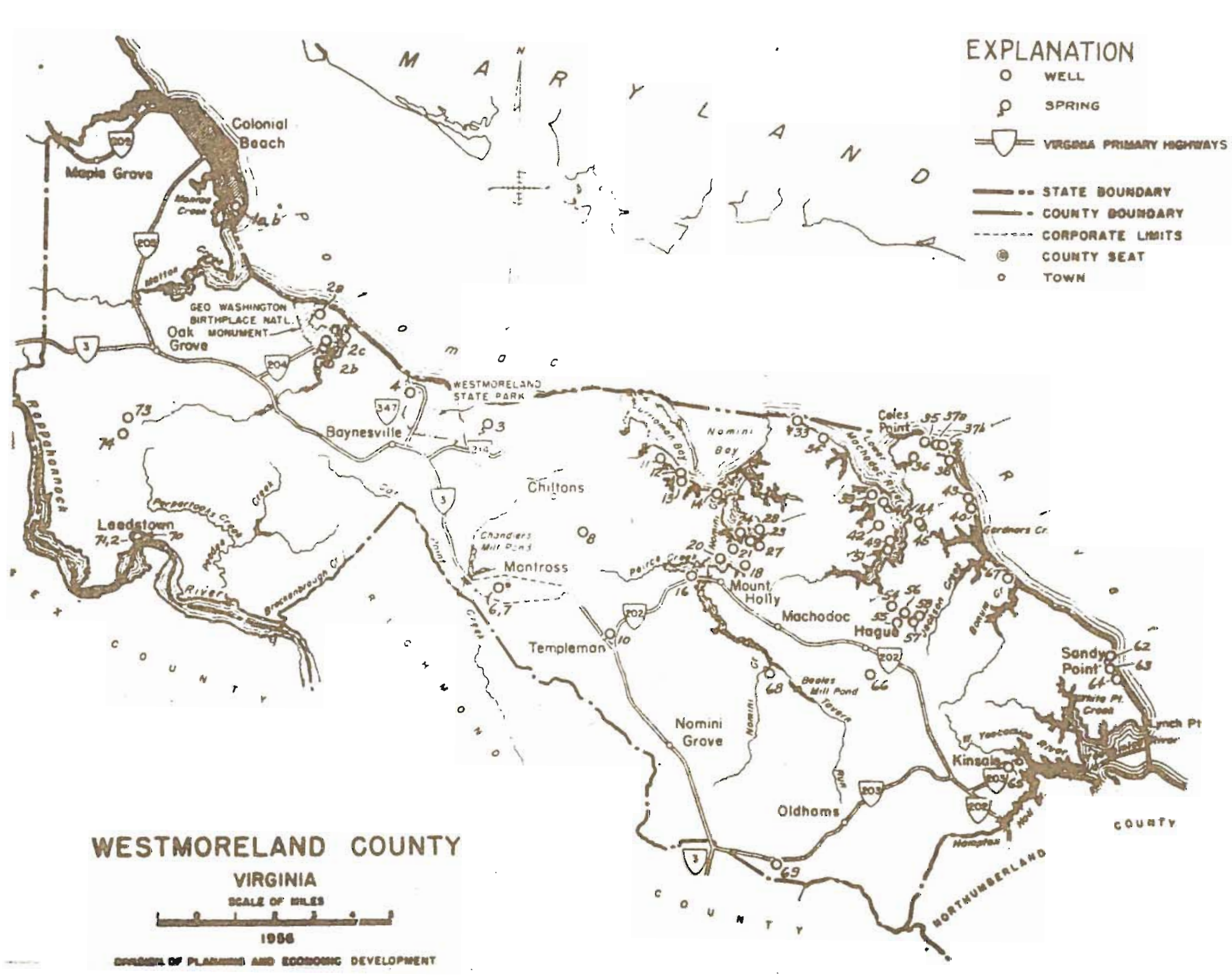
EXPLANATION
WELL
SPRING
VIRGINIA PRIMARY HIGHWAYS
STATE BOUNDARY
COUNTY BOUNDARY
CORPORATE LIMITS
COUNTY SEAT
TOWN
MARYLAND
Colonial Beach
Maple Grove
Monroe Creek
Mattox Creek
GEO WASHINGTON BIRTHPLACE NATL. MONUMENT
Oak Grove
WESTMORELAND STATE PARK
Baynesville
Chiltons
Chandlers Mill Pond
Montross
Leadstown
Rappahannock River
Popes Creek
Bridge Creek
Bracebridge Cr
Mount Holly
Machodoc
Hague
Templeman
Nomini Grove
Nomini Bay
Coles Point
Lower Machodoc Creek
Gardners Cr
Sandy Point
White Pt. Creek
Lynch Pt
Kinsale
Oldhams
Hampton Hd
Beales Mill Pond
Tavern Run
Nomini Cr
Jackson Creek
Bonum Cr
Peirce Creek
Cat Point Creek
COUNTY
NORTHUMBERLAND
WESTMORELAND COUNTY
VIRGINIA
SCALE OF MILES
1956
DIVISION OF PLANNING AND ECONOMIC DEVELOPMENT

Table 7.—Records of wells in Westmoreland County, Virginia

Type of well: D, drilled; J, jetted
Use of water: PS, public supply; D, domestic; I, industrial; S, stock

gpm, gallons per minute; fm, formation
Temp., temperature (degrees Fahrenheit)

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1a	Colonial Beach	Town of Colonial Beach	Miller		8		585	6	Paleocene-Late Cretaceous	Mattaponi fm	(+)	225	PS	See analysis, Table 9. Flows 100 gpm.	1a
1b	Do.	do	Virginia Machinery and Well Co.		8		634±	8	do	do	(+)	400	PS	Water from sand below 634 feet. Flows 50 gpm.	1b
2a	Near George Washington Birthplace National Monument	J. H. Muse	Mitchell's Well and Pump Co.	1945	19	D	420		do	do	−4½	15	D		2a
2b	George Washington Birthplace National Monument	U. S. Dept. of Interior			20		Spring		Pleistocene	Columbia group				See analysis, Table 9.	2b
2c	Do.	do			20	D	380		Paleocene-Late Cretaceous	Mattaponi fm	(−)	20		See analysis, Table 9.	2c
3	0.5 mi. E of Westmoreland State Park	R. E. Lee Memorial Foundation, Inc.			25		Spring		Pleistocene	Columbia group			D	See analyses, Table 9. Flows 3 gpm.	3
4	Westmoreland State Park	State Department of Conservation and Development	Virginia Machinery and Well Co.	1945	100	D	631		Paleocene-Late Cretaceous	Mattaponi fm	−58	72	D	See log, Table 8. Drawdown 104 ft after 45 hrs pumping at 72 gpm.	4
6	Montross	Coca Cola Bottling Co.	Mitchell's Well and Pump Co.	1936	145	D	648	6	do	do	(−)	75	I	See log, Table 8; analyses, Table 9. Drawdown 60 ft after 38 hrs pumping at 75 gpm. Casing to 628 ft.	6
7	Do.	Town of Montross		1936	145	D	560	6	do	do	−130	50±	PS	See log, Table 8.	7
8	2.5 mi. ENE of Montross	Stratford Packing Co.	R. Williams	1943	142	D	455	6	do	do	−146	46	I	See log, Table 8. Drawdown 104 ft after 18 hrs pumping at 46 gpm.	8
10	Templeman	J. F. Johnson			125	Dug	30		Pleistocene	Columbia group	−5	5	I	Water level declines during dry years.	10
11	3.5 mi. NW of Mt. Holly	E. Hastings			3	J	360	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	In 1946, flowed 1/3 gpm.	11
12	3 mi. NW of Mt. Holly	Littlefield			1	J	360	1½	do	do	(+)			Not in use in 1946. Flowed 1/3 gpm.	12
13	2.7 mi. NW of Mt. Holly	C. Hennage	C. Lyons		2	J	199	1½	Late Eocene (?)	Chickahominy fm (?)	(+)		I	In 1946, flowed 2 gpm at low tide. Oyster packing plant.	13
14	2.2 mi. N of Mt. Holly	A. Reed			2	J	340	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	In 1946, flowed 5 gpm. Another similar well nearby.	14

Table 7.—Records of wells in Westmoreland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
16	0.7 mi. W of Mt. Holly	W. B. Davis			2	J	130	2	Miocene	Chesapeake group	(+)		D	See analyses, Table 9. Temp., 62½°F. In 1948, flowed 4 gpm.	16
18	0.7 mi. ENE of Mt. Holly	T. S. Hall	John W. Wilson		3	J	375	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	Equipped with hydraulic ram. Tide affects flow. Another similar well nearby.	18
20	0.5 mi. N of Mt. Holly	Mrs. J. B. Hall			3	J	340	2	do	do	(+)		D	Formerly used by fish factory. Ram delivers water to house on terrace.	20
21	0.9 mi. NNE of Mt. Holly	J. F. Farwell	John W. Wilson		4	J	200	1½	Late Eocene (?)	Chickahominy fm (?)	(−)		D		21
23	1.3 mi. NE of Mt. Holly	J. B. Dall			1	J	200	1½	do	do	(+)		D, S	Flows ½ gpm.	23
24	1.3 mi. NNE of Mt. Holly	M. R. Dean	John W. Wilson		3	J	230	2½	Late Eocene	Chickahominy fm	(+)		D, I	Flows 2 gpm. Used by oyster packing plant. Another similar well nearby.	24
27	1.4 mi. NE of Mt. Holly	do	do		2	J	330		Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	Flows 1 gpm.	27
28	1.6 mi. NE of Mt. Holly	Bushfield Farm	Parks	1946	1	J	255	1½	Late Eocene	Chickahominy fm	(+)		D	Flows 5 gpm.	28
33	3.5 mi. W of Coles Point	Mrs. May B. Woods	John W. Wilson		2	J	362	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	See analysis, Table 9. Temp., 66° F. Flows 1 gpm.	33
34	2.6 mi. W of Coles Point	R. D. McFaden			2	J	168	1½	Miocene	Chesapeake group	(−)		D, S		34
35	Coles Point	Fred Torrence	John W. Wilson	1946	2	J	231	1½	Late Eocene	Chickahominy fm	(−)		D	Pumps 6 gpm.	35
36	Do.	Edward Godman	Do.	1945	5	J	240	1½	do	do	(−)		D	Pumps 4 gpm.	36
37a	Do.	W. P. Campbell	A. L. Wilson	1950	23	J	231	1½	do	do	−12		D	See log, Table 8.	37a
37b	Do.	R. Campbell	John W. Wilson	1932	2	J	380	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)	32	D	Flows 10 gpm. Another similar well nearby.	37b
38	Near Coles Point	G. H. McDaniel			1	J	200	1½	Miocene	Chesapeake group	(+)		D, S	Flows ½ gpm.	38
39	2 mi. SSW of Coles Point	L. H. Linton	John W. Wilson		1	J	375	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	Flows 2 gpm. Four similar wells nearby.	39
40	2 mi. SE of Coles Point	Britton	do	1946	10	J	242	1½	Miocene(?)	Chesapeake group (?)	(−)	5	D	Three similar wells nearby.	40

Table 7.—Records of wells in Westmoreland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
41	2 mi. SW of Coles Point	Mrs. Ficklen			1	J	300	1½	Late Eocene (?)	Chickahominy fm (?)	(+)		D, S	Flows 5-10 gpm. Another similar well nearby.	41
42	2.5 mi. SSW of Coles Point	Harden Daiger			20	J	220	1¼	Miocene	Chesapeake group	(−)		D, S	See analysis, Table 9.	42
43	2 mi. SE of Coles Point	Smith	John W. Wilson		10	J	239	1½	Miocene (?)	Chesapeake group (?)	(−)		D	Pumps 18 gpm.	43
44	2 mi. S of Coles Point		G. Pfeiffer, Jr.	1918	10	D	727	8-6	Paleocene-Late Cretaceous	Mattaponi fm	(+)			See log, Table 8. Flowed 100 gpm in 1918.	44
45	Do.	William Barnes	John W. Wilson	1945	10	J	240	1¼	Miocene(?)	Chesapeake group (?)	(−)		D	See analysis, Table 9. Temp., 58° F.	45
49	2.4 mi. SSW of Coles Point	Carl Hubbard			2	J	220	1½	Miocene	Chesapeake group	(−)		D, S		49
51	2.6 mi. SSW of Coles Point	B. Tilman			3	J	220	1½	do	do	(+)		D, S	Flows 10 gpm. No decline in water level during dry years.	51
54	1.3 mi. NNE of Hague	G. M. Thompson			13	J	240	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flowing for 35 years. Some iron stain.	54
55	1 mi. NE of Hague	Strongs	C. Jones		16	J	350	2	Eocene	Pamunkey group	−6		D, I	Stopped flowing in 1945.	55
56	1.4 mi. NE of Hague	H. L. Barnes	John W. Wilson		14	J	270	2	Late Eocene	Chickahominy fm	−2		D, S	No iron stain.	56
57	1.4 mi. ENE of Hague	E. L. Mozingo	do		15	J	400	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S	Flows ¼ gpm. No iron stain.	57
58	1.6 mi. ENE of Hague	I. T. Short	do	1924	18	J	260+	2	Late Eocene	Chickahominy	(−)		D, S	Pumps some sand. Water causes slight brown stain.	58
62	Sandy Point	T. Brooks	Mitchell's Well and Pump Co.	1946	11	D	594	6-4¼	Paleocene-Late Cretaceous	Mattaponi fm	(+)	60		See analyses, Table 9. Flows about 30 gpm. When pumped, yields, 60 gpm with 2-ft drawdown.	62
63	Do.	do	John W. Wilson		3		497		do	do	(−)			Stopped flowing in about 1945.	63
64	1.4 mi. S of Sandy Point	S. P. Collier	do		3		470		do	do	(+)			Flows 1 gpm.	64
65	Kinsale	Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.	1946	70	D	280	8	Late Eocene	Chickahominy	−53		PS	See log, Table 8; analyses, Table 9. Temp., 62° F. Pumps 66 gpm with 25-ft drawdown. Has yielded 130 gpm on test.	65
66	0.7 mi. SSE of Hague	C. C. Cole	Arthur Cole		35	J	456		Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	See analysis, Table 9. Temp., 62° F. Supplies cannery. Black sand at 250 ft.	66

Table 7.—Records of wells in Westmoreland County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
67	4.1 mi. ENE of Hague	Maurice A. Thorne		1951	20	J	273		Late Eocene	Chickahominy fm	(−)		D	See analysis, Table 9.	67
68	1.2 mi. S of Machodoc	T. M. Arnest, Jr.		1914	15	D	366	1¼	Eocene	Pamunkey group	(+)		D, S	See analysis, Table 9. Flows about 3 gpm.	68
69	2.1 mi. WSW of Oldhams	Belmont Canning Co.			130	Dug	45		Pleistocene	Columbia group	−125	13	I	Canning factory. Two similar wells in vicinity.	69
70	Leedstown	G. W. Grigsby	H. Lyons		10	J	214		Eocene	Pamunkey group				Black sand at 214 ft.	70
71	Do.	S. S. Hall			10		160		do	do				See analysis, Table 9. Black sand at 160 ft beneath streak of red clay.	71
72	Do.	Leedstown			10		500	3	Paleocene–Late Cretaceous	Mattaponi fm	(+)			See analysis, Table 9. Flows 3 gpm.	72
73	1.8 mi. SSW of Oak Grove	E. T. Hynson	Mitchell's Well and Pump Co.	1943	180	D	530	4¼	do	do	−168	9		See log, Table 8; analysis, Table 9. Drawdown 61 ft when pumping 9 gpm.	73
74	2.3 mi. SSW of Oak Grove	Slocum	do	1940	170	D	708		do	do	(−)			See log, Table 8.	74

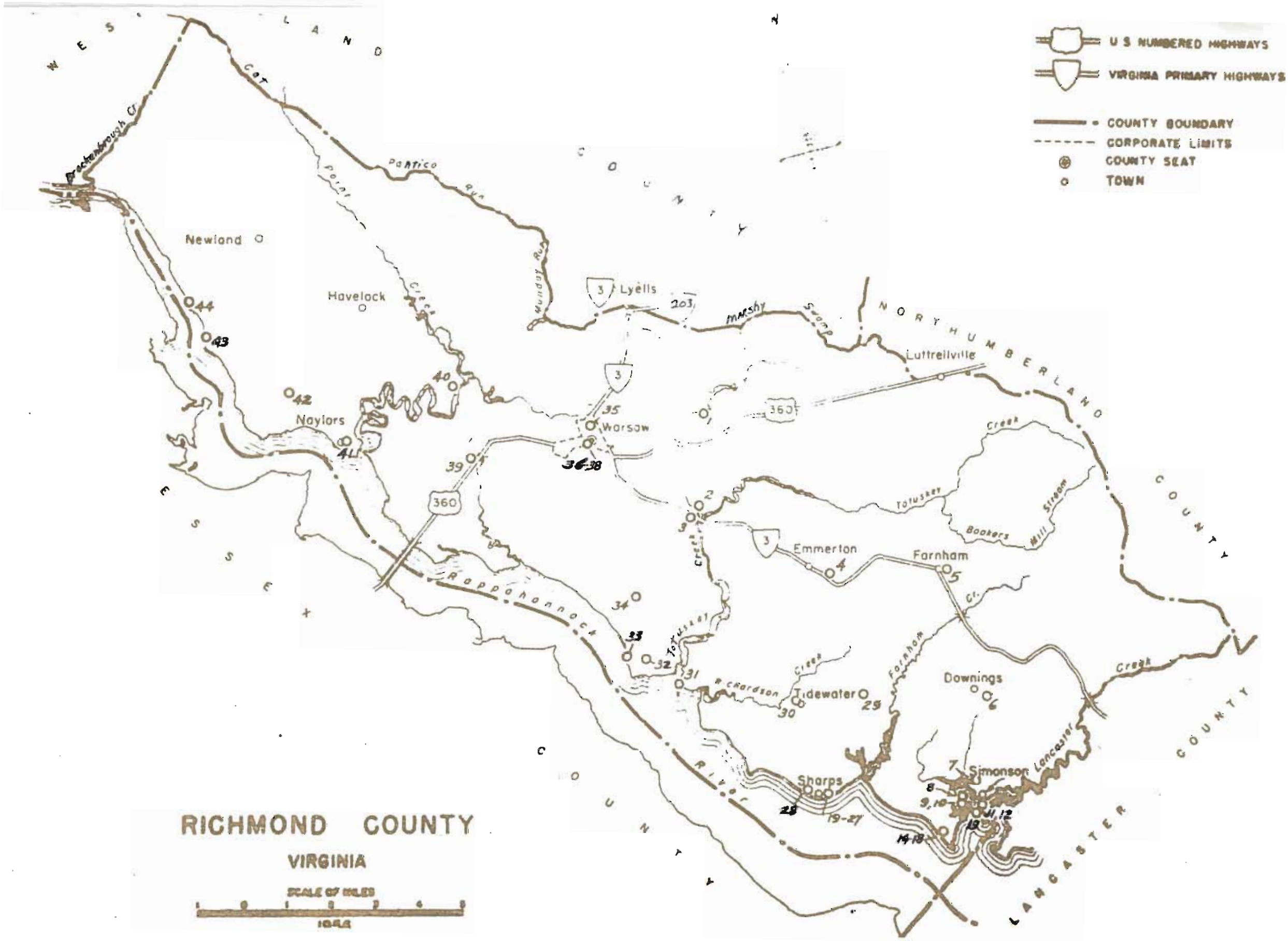
U S NUMBERED HIGHWAYS
VIRGINIA PRIMARY HIGHWAYS
COUNTY BOUNDARY
CORPORATE LIMITS
COUNTY SEAT
TOWN
RICHMOND COUNTY
VIRGINIA
SCALE OF MILES
Newland
Havelock
Naylors
Lyells
Warsaw
Emmerton
Farnham
Tidewater
Downings
Sharps
Simonson
Luttrellville
Rappahannock River
Totuskey Creek
Farnham Creek
Lancaster Creek
Marshy Swamp
Mundy Run
Portico Run
Cat Point Creek
Brockenbrough Cr
Richardson Creek
Bookers Hill Stream
Cr.
ESSEX COUNTY
NORTHUMBERLAND COUNTY
LANCASTER COUNTY
360
3
203

Table 10.—Records of wells in Richmond County, Virginia

Type of well: J, jetted; D, drilled; Dv, driven
Use of water: D, domestic; I, industrial; S, stock; PS, public supply

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit
fm, formation

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (—) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	2.7 mi. E of Warsaw	E. W. Garland			11	J	188	2	Late Eocene	Chickahominy fm			D	See log, Table 11; analysis, Table 12. In 1899, flow reported 20 gpm, and water level 36 ft above surface.	1
2	3 mi. SE of Warsaw	M. D. Kalbach			8	J	181	1½	Miocene	Chesapeake group			D	In 1906, flow reported 2 gpm, and water level 20 ft above surface.	2
3	Do.	G. M. Snyder			3	J	180	1½	do	do			D	See analyses, Table 12. Temp. 61° F. In 1906, flow reported 15 gpm, and water level 20 ft above surface. Flowed 4 gpm in 1948.	3
4	0.5 mi. SE of Emmerton	Hammock Cannery	Mitchell's Well and Pump Co.	1945	102	D	553	4½	Paleocene-Late Cretaceous	Mattaponi fm	-70		I	See log, Table 11; analysis, Table 12.	4
5	Farnham	L. M. Simonson		Prior to 1918	114	Dug	44		Pleistocene	Columbia group	(-)		D	See analysis, Table 12.	5
6	Downings	J. W. Welch	Mitchell's Well and Pump Co.	1942	75	J	622	6-4	Paleocene-Late Cretaceous (?)	Mattaponi fm (?)	-70	15	I	See log, Table 11; analyses, Table 12. Drawdown 13 ft after 6¼ hrs pumping at 14 gpm. Canning factory.	6
7	0.5 mi. N of Simonson	F. C. Packet			5	J	310+	1½	Upper Eocene	Chickahominy fm	(+)			See log, Table 11. Flows 10 gpm. Sulphide odor reported.	7
8	0.5 mi. W of Simonson	John Oakley	J. W. Wilson	1925	10	J	609	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		S	Flows 18 gpm.	8
9	Do.	do	do	1940	10	J	615	1½	do	do	(+)		D, S	Flows 11 gpm.	9
10	Do.	do	I. Rude	1900	10	J	275	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flows 11 gpm.	10
11	Simonson	H. G. Oakley			5	J	516	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S		11
12	Do.	W. M. Simonson	E. Lewis		3	J	245	1½	Miocene (?)	Chesapeake group (?)	(+)		D, S	Sulphide odor reported. Iron-free.	12
13	0.5 mi. SW of Simonson	J. W. Welch	Hale		1	J	180	1½	Miocene	Chesapeake group	(+)			Flowed 5 gpm. Now abandoned.	13
14	1.3 mi. SW of Simonson	W. P. Handley			7	J	240	1½	do	do			D	Sulphide odor reported.	14

Table 10.—Records of wells in Richmond County, Virginia

Type of well: J, jetted; D, drilled; Dv, driven
Use of water: D, domestic; I, industrial; S, stock; PS, public supply

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit
fm, formation

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (—) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	2.7 mi. E of Warsaw	E. W. Garland			11	J	188	2	Late Eocene	Chickahominy fm			D	See log, Table 11; analysis, Table 12. In 1899, flow reported 20 gpm, and water level 36 ft above surface.	1
2	3 mi. SE of Warsaw	M. D. Kalbach			8	J	181	1½	Miocene	Chesapeake group			D	In 1906, flow reported 2 gpm, and water level 20 ft above surface.	2
3	Do.	G. M. Snyder			3	J	180	1½	do	do			D	See analyses, Table 12. Temp. 61° F. In 1906, flow reported 15 gpm, and water level 20 ft above surface. Flowed 4 gpm in 1948.	3
4	0.5 mi. SE of Emmerton	Hammock Cannery	Mitchell's Well and Pump Co.	1945	102	D	553	4½	Paleocene-Late Cretaceous	Mattaponi fm	-70		I	See log, Table 11; analysis, Table 12.	4
5	Farnham	L. M. Simonson		Prior to 1918	114	Dug	44		Pleistocene	Columbia group	(-)		D	See analysis, Table 12.	5
6	Downings	J. W. Welch	Mitchell's Well and Pump Co.	1942	75	J	622	6-4	Paleocene-Late Cretaceous (?)	Mattaponi fm (?)	-70	15	I	See log, Table 11; analyses, Table 12. Drawdown 13 ft after 6¼ hrs pumping at 14 gpm. Canning factory.	6
7	0.5 mi. N of Simonson	F. C. Packet			5	J	310+	1½	Upper Eocene	Chickahominy fm	(+)			See log, Table 11. Flows 10 gpm. Sulphide odor reported.	7
8	0.5 mi. W of Simonson	John Oakley	J. W. Wilson	1925	10	J	609	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		S	Flows 18 gpm.	8
9	Do.	do	do	1940	10	J	615	1½	do	do	(+)		D, S	Flows 11 gpm.	9
10	Do.	do	I. Rude	1900	10	J	275	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flows 11 gpm.	10
11	Simonson	H. G. Oakley			5	J	516	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S		11
12	Do.	W. M. Simonson	E. Lewis		3	J	245	1½	Miocene (?)	Chesapeake group (?)	(+)		D, S	Sulphide odor reported. Iron-free.	12
13	0.5 mi. SW of Simonson	J. W. Welch	Hale		1	J	180	1½	Miocene	Chesapeake group	(+)			Flowed 5 gpm. Now abandoned.	13
14	1.3 mi. SW of Simonson	W. P. Handley			7	J	240	1½	do	do			D	Sulphide odor reported.	14

Table 10.—Records of wells in Richmond County, Virginia

Type of well: J, jetted; D, drilled; Dv, driven
Use of water: D, domestic; I, industrial; S, stock; PS, public supply

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit
fm, formation

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (—) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	2.7 mi. E of Warsaw	E. W. Garland			11	J	188	2	Late Eocene	Chickahominy fm			D	See log, Table 11; analysis, Table 12. In 1899, flow reported 20 gpm, and water level 36 ft above surface.	1
2	3 mi. SE of Warsaw	M. D. Kalbach			8	J	181	1½	Miocene	Chesapeake group			D	In 1906, flow reported 2 gpm, and water level 20 ft above surface.	2
3	Do.	G. M. Snyder			3	J	180	1½	do	do			D	See analyses, Table 12. Temp. 61° F. In 1906, flow reported 15 gpm, and water level 20 ft above surface. Flowed 4 gpm in 1948.	3
4	0.5 mi. SE of Emmerton	Hammock Cannery	Mitchell's Well and Pump Co.	1945	102	D	553	4½	Paleocene-Late Cretaceous	Mattaponi fm	-70		I	See log, Table 11; analysis, Table 12.	4
5	Farnham	L. M. Simonson		Prior to 1918	114	Dug	44		Pleistocene	Columbia group	(-)		D	See analysis, Table 12.	5
6	Downings	J. W. Welch	Mitchell's Well and Pump Co.	1942	75	J	622	6-4	Paleocene-Late Cretaceous (?)	Mattaponi fm (?)	-70	15	I	See log, Table 11; analyses, Table 12. Drawdown 13 ft after 6¼ hrs pumping at 14 gpm. Canning factory.	6
7	0.5 mi. N of Simonson	F. C. Packet			5	J	310+	1½	Upper Eocene	Chickahominy fm	(+)			See log, Table 11. Flows 10 gpm. Sulphide odor reported.	7
8	0.5 mi. W of Simonson	John Oakley	J. W. Wilson	1925	10	J	609	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		S	Flows 18 gpm.	8
9	Do.	do	do	1940	10	J	615	1½	do	do	(+)		D, S	Flows 11 gpm.	9
10	Do.	do	I. Rude	1900	10	J	275	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flows 11 gpm.	10
11	Simonson	H. G. Oakley			5	J	516	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S		11
12	Do.	W. M. Simonson	E. Lewis		3	J	245	1½	Miocene (?)	Chesapeake group (?)	(+)		D, S	Sulphide odor reported. Iron-free.	12
13	0.5 mi. SW of Simonson	J. W. Welch	Hale		1	J	180	1½	Miocene	Chesapeake group	(+)			Flowed 5 gpm. Now abandoned.	13
14	1.3 mi. SW of Simonson	W. P. Handley			7	J	240	1½	do	do			D	Sulphide odor reported.	14

Table 10.—Records of wells in Richmond County, Virginia

Type of well: J, jetted; D, drilled; Dv, driven
Use of water: D, domestic; I, industrial; S, stock; PS, public supply

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit
fm, formation

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (—) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	2.7 mi. E of Warsaw	E. W. Garland			11	J	188	2	Late Eocene	Chickahominy fm			D	See log, Table 11; analysis, Table 12. In 1899, flow reported 20 gpm, and water level 36 ft above surface.	1
2	3 mi. SE of Warsaw	M. D. Kalbach			8	J	181	1½	Miocene	Chesapeake group			D	In 1906, flow reported 2 gpm, and water level 20 ft above surface.	2
3	Do.	G. M. Snyder			3	J	180	1½	do	do			D	See analyses, Table 12. Temp. 61° F. In 1906, flow reported 15 gpm, and water level 20 ft above surface. Flowed 4 gpm in 1948.	3
4	0.5 mi. SE of Emmerton	Hammock Cannery	Mitchell's Well and Pump Co.	1945	102	D	553	4½	Paleocene-Late Cretaceous	Mattaponi fm	-70		I	See log, Table 11; analysis, Table 12.	4
5	Farnham	L. M. Simonson		Prior to 1918	114	Dug	44		Pleistocene	Columbia group	(-)		D	See analysis, Table 12.	5
6	Downings	J. W. Welch	Mitchell's Well and Pump Co.	1942	75	J	622	6-4	Paleocene-Late Cretaceous (?)	Mattaponi fm (?)	-70	15	I	See log, Table 11; analyses, Table 12. Drawdown 13 ft after 6¼ hrs pumping at 14 gpm. Canning factory.	6
7	0.5 mi. N of Simonson	F. C. Packet			5	J	310+	1½	Upper Eocene	Chickahominy fm	(+)			See log, Table 11. Flows 10 gpm. Sulphide odor reported.	7
8	0.5 mi. W of Simonson	John Oakley	J. W. Wilson	1925	10	J	609	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		S	Flows 18 gpm.	8
9	Do.	do	do	1940	10	J	615	1½	do	do	(+)		D, S	Flows 11 gpm.	9
10	Do.	do	I. Rude	1900	10	J	275	1½	Late Eocene	Chickahominy fm	(+)		D, S	Flows 11 gpm.	10
11	Simonson	H. G. Oakley			5	J	516	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D, S		11
12	Do.	W. M. Simonson	E. Lewis		3	J	245	1½	Miocene (?)	Chesapeake group (?)	(+)		D, S	Sulphide odor reported. Iron-free.	12
13	0.5 mi. SW of Simonson	J. W. Welch	Hale		1	J	180	1½	Miocene	Chesapeake group	(+)			Flowed 5 gpm. Now abandoned.	13
14	1.3 mi. SW of Simonson	W. P. Handley			7	J	240	1½	do	do			D	Sulphide odor reported.	14

Table 10.—Records of wells in Richmond County, Virginia--Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
15	1.3 mi. SW of Simonson	R. T. Coutts		1938	1	J	167	1½	Miocene	Chesapeake group	(+)			Flows 8 gpm; supplies 4 cottages. Sulphide odor reported.	15
16	About a mile SW of Simonson	Dr. Wingfield	Reynolds & Norman	1947	5	J	240	2	do	do	(−)		D	See log, Table 11. Cased to 216 ft.	16
17	Do.	U. L. Johnson	do	1947	5	J	235		do	do	(−)		D	See log, Table 11. Cased to 214 ft. Flows a little during high tide.	17
18	Do.	J. R. Self	do	1947	5	J	240		do	do	(−)		D	See log, Table 11. Cased to 209 ft. Does not flow.	18
19	Sharps	P. Y. Barber			15	J	240	1½	Miocene (?)	Chesapeake group (?)	(+)			In 1899, water level reported 12 ft above surface.	19
20	Do.	A. T. Davis			10		325		Late Eocene	Chickahominy fm	(+)			Water level reported 20 ft above surface in earlier years.	20
21	Do.	F. Downing			10		325		do	do	(+)			Water level reported 20 ft above surface in earlier years.	21
22	Do.	J. M. McCarty			10	J	240	2	Miocene (?)	Chesapeake group (?)	(+)	52		In 1894, flow reported 52 gpm, and water level 26 ft above surface.	22
23	Do.	D. W. Sharp			4	J	212	1½	Miocene	Chesapeake group	(+)			In 1890, water level reported 16 ft above surface.	23
24	Do.	E. Sharp			3	J	230	1½	do	do	(+)			Cased to 188 ft. Water level reported 9 ft above surface in earlier years.	24
25	Do.	G. L. Smith & Bro.			3	J	245	2	Late Eocene (?)	Chickahominy fm (?)	(+)			In 1903, flow reported 4 gpm.	25
26	Do.	J. B. Smith			15	J	255	1½	do	do	(+)			In 1886, water level reported 14 ft above surface.	26
27	Do.	Hotel		1907?	10	J	440	1½	Paleocene-Late Cretaceous	Mattaponi fm					27
28	0.3 mi. WNW of Sharps	F. Norfolk			1	J	29	2	Pleistocene	Columbia group	(+)		I	See analysis, Table 12. Flows 5 gpm.	28
29	1.5 mi. E of Tidewater	W. S. Hale			32	J	400+	1½	Paleocene-Late Cretaceous	Mattaponi fm	(−)		D, S		29
30	Tidewater	J. L. Saunders	H. Lyons		25	J	285	1½	Late Eocene	Chickahominy fm	-16		D, S	See analysis, Table 12. Water turbid; causes iron stain.	30

Table 10.—Records of wells in Richmond County, Virginia -- Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
31	2.8 mi. WNW of Tidewater	L. Dean			1	J	180	1½	Miocene	Chesapeake	(+)		D, S	Supplies two houses.	31
32	5.2 mi. S of Warsaw	G. Delano			1	J	180	1½	do	do	(+)		S	Flows 5 gpm.	32
33	5 mi. S of Warsaw	A. W. Delano			1	J	180	1½	do	do			D	See analysis, Table 12. Two similar wells in vicinity.	33
34	3.7 mi. S of Warsaw	R. O. Delano			30	J	82	1½	Pleistocene	Columbia group	-16		D, S		34
35	Warsaw	Warsaw Cleaners			145	Dug	36		do	do	-7			Pumps about 15 gpm. Water level declines during dry years.	35
36	Do.	Rice			143	Dug	40		do	do	(-)			See analysis, Table 12.	36
37	Do.	Town	Mitchell's Well and Pump Co.	1936	143	J	385	4	Eocene	Pamunkey group	(-)		D, PS	See analysis, Table 12. Temp., 64° F. Not used since about 1948; probably insufficient yield.	37
38	Do.	Town of Warsaw	do	1949	143	D	653	8	Paleocene-Late Cretaceous	Mattaponi fm	(-)	211	PS	See log, Table 11; analysis, Table 12. Drawdown 99 ft after 7 hrs pumping at 211 gpm.	38
39	2.8 mi. W of Warsaw	A. Stephens	Reynolds & Norman	1945	20	J	177	3	Miocene	Chesapeake group	-17	3		See log, Table 11. Cased to 147 ft. Drawdown about 3 ft after pumping 3 hrs at 3 gpm.	39
40	3.5 mi. NW of Warsaw	Vernon	do	1945	10	J	148	2	do	do	(+)		D	See log, Table 11. Flows 2 gpm.	40
41	Naylors	L. Jenkins; formerly Wadington & Holme		Prior to 1918	6		385	1½	Paleocene-Late Cretaceous	Mattaponi fm	(+)			See analyses, Table 12. Temp. 64½°F. In 1918 water level reported 32 ft above surface. Flowed ¼ gpm, in 1953. Abandoned tomato factory; well no longer used.	41
42	1.6 mi. NW of Naylors	G. Bowen		1943	20	Dv	22	1½	Pleistocene	Columbia group	(-)			See analysis, Table 12. Reported iron taste; stains utensils.	42 4
43	2.5 mi. SW of Newland	G. W. Oliff	H. Lyons		1	J	350	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)			See analyses, Table 12. Temp., 62°F. Flows about 1 gpm. Abandoned cannery; now public landing.	43
44	2.2 mi. SW of Newland	W. A. Tory	do		3	J	350	1½	do	do	(+)		D, S	Flows 1 gpm.	44

Table 1.—Records of wells in Northumberland County, Virginia -- Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
63	Reedville	Taylor & Roed Co.			3	J	680	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	See analysis, Table 3. In 1918, flow reported 45 gpm, and water level 33 ft above surface.	63
64	Do.	Edwards Fish Hatchery			3	J	659	3	do	do	(+)		I	In 1918(?), flow reported 110 gpm.	64
65	Fairport	Morris Fisher Co.			5	J	393	1½	Late Eocene	Chickahominy fm	(+)		I	Flows 2 gpm.	65
66	Do.	do		1912	5	J	405	1½	do	do	(+)		I	Flows ½ gpm. Chloride reported 20 ppm.	66
67	Do.	do			5	J	680	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	In 1918, flow reported 20 gpm. Chloride reported 8 ppm.	67
68	Do.	McNeal & Dodson	Mitchell's Well and Pump Co.	1940	5	D	870	3	Cretaceous	Potomac group	(+)		I	See log, Table 2. Flows 15 gpm.	68
69	Do.	do			3		680	3	Paleocene-Late Cretaceous	Mattaponi fm	(+)		I	Chloride reported 6 ppm.	69
70	Do.	McGill & McNeal Co.		1903	3	J	690	2	do	do	(+)		I	In 1918, flow reported 50 gpm, and water level 35 ft above surface.	70
71	Do.				1		662		do	do	(+)			In 1918, flow reported 75 gpm, and water level 30 ft above surface.	71
72	0.5 mi. S of Fairport	C. E. Davis and P. King Co.			1		634	3	do	do	(+)			In 1918, flow reported 60 gpm.	72
73	0.5 mi. N of Fleeton	Douglas Co. (Fish Factory)			1		740	3	do	do	(+)			See analysis, Table 3. In 1918, flow reported 75 gpm.	73
74	0.4 mi. NNW of Fleeton	Mrs. Otis Douglas			8		660	2	do	do	(+)		D	In 1918, flow reported 35 gpm; in 1946, flow reported 10 gpm. Furnishes water to several homes.	74
75	0.4 mi. NE of Fleeton	T. C. Slaughter	Reynolds & Norman	1946	8	J	711	3-2	do	do	(+)		D, S	See log, Table 2; analysis, Table 3. Temp., 72°F. In 1946, flow reported 12 gpm; in 1948, flow reported 4½ gpm.	75
76	Fleeton	Fleeton Development Co.	R. H. Milligan	1904	3	J	746	2	do	do	(+)			In 1918, flow reported 40 gpm, and water level 35 ft above surface.	76
77	Do.	Town well			5	J	690	2	do	do	(+)			See analysis, Table 3. In 1918, flow reported 10 gpm.	77
78	3.5 mi. SE of Burgess	J. H. Smith			1		680		do	do					78

KING GEORGE COUNT

VIRGINIA

SCALE OF MILES

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Table 13.—Records of wells in King George County, Virginia

Type of well: Spr., spring; J, jetted; D, drilled; Dv, driven
Use of water: D, domestic; S, stock; PS, public supply; I, industrial

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit)
fm, formation

Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
W. Henderson		1910	160	Dug	36	36	Pleistocene	Columbia group	−33		D, S	Temp., 56° F. Water reported soft.	1
Virginia Construction Camp No. 2			150	Spr.	—	—	do	do			D	Temp., 52° F. Spring, developed and covered; Water is pumped to camp.	2
H. M. Chinn	W. B. Jenkins	1936	80	Dug	30	42	do	do	−26		D	Temp., 52° F. Nearly dry in summer.	3
L. P. Graves; W. J. Howard, tenant	Lyons	1914	55	J	201	3	Paleocene-Late Cretaceous	Mattaponi fm	−8		S	Temp., 62° F. See analysis, Table 15. Sulfide odor reported in water.	4
W. D. Taylor		1937	55	J	?	6	———	———	+9		D, S	Temp., 60° F. Probably more than 200 ft deep.	5
Steamboat Co.			3	J	245		Paleocene-Late Cretaceous	Mattaponi fm	(+)				6
Sydnor Pump & Well Co., Inc.	Sydnor Pump & Well Co., Inc.		36	D	188		do	do	−27	86	PS	See log, Table 14; analysis, Table 15. Drawdown 59 feet after pumping at 86 gpm.	7a
			36	D	105		Eocene	Pamunkey group			PS	See analysis, Table 15.	7b
Mrs. Taylor		1934	160	D	235	6	do	do	−85		D		8
Mrs. E. W. Clark		1938	160	Dug	28	36	Pleistocene	Columbia group	−24		D	Temp., 56° F. Water reported soft.	9
C. E. Daniels			150	Dug	65	36	do	do	−50		D	Temp., 57° F. Supplies two houses. Water reported hard; contains iron.	10
W. M. Grigsby			92		409		Paleocene-Late Cretaceous	Mattaponi fm	(−)	7	D	See log, Table 14.	11
do			92		24		Pleistocene	Columbia group	(−)		D	Water reported to contain a little iron.	12
King George County School		1939	185	J	400	8–4	Paleocene-Late Cretaceous	Mattaponi fm	(−)	11	D	See analysis, Table 15. Water reported soft. Supplies 550 pupils.	13
E. R. Morris, Sr.	Leazer Well & Pump Co.	1955	205	D	616	6	do	do				See log, Table 14. Screens set at 500–510 and 587–597 ft.	14
T. S. Cheadle		1947	150	Dug	22	36	Pleistocene	Columbia group	−18.5		D, S	Temp., 55° F. Water reported soft; supply barely adequate.	17
L. W. Fitzgerald, Sr.			200	Spr.	—	—	do	do			D, S	Temp., 51° F. Water reported soft.	18
Hanzel Brooks			160	Dug	35	36	do	do	−30		D	See analysis, Table 15. Water reported soft.	19

Table 13.—Records of wells in King George County, Virginia—Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
21	3 mi. SW of Shiloh	R. E. Owens		Prior to 1850	55	Dug	40	30	Pleistocene	Columbia group	−36.5		D	Water reported hard.	21
22	2 mi. SE of King George	Pickle factory	Sydnor Pump & Well Co., Inc.	1946	180	D	552	8	Paleocene-Late Cretaceous	Mattaponi fm	−184		I	See log, Table 14.	22
23	Port Conway	Belgrove Farm			10	J	320	1½	do	do	(+)			Chief aquifer is glauconite sand at 300-320 ft. Flows 10 gpm.	23
24	Do.	J. P. Hooker		1908, 1908, & 1934	5	J	401?	3	Cretaceous	Potomac group	(+)		PS	See analyses, Table 15. Three flowing wells; combined flow, 7.5 gpm. Water level more than 3 ft above land surface.	24
25	Shiloh	J. D. Owens			160	Dug	50	48	Pleistocene	Columbia group	−43		D, S	Temp., 56° F. Water reported hard.	25
26	3.5 mi. NE of Edge Hill	A. C. Rollins		1946	160	Dug	32	30	do	do	−28		D	Temp., 57° F. Water from white sand; reported soft.	26
27	1.2 mi. WNW of Dahlgren	B. Johnson		1940	15	Dv	16	1½	do	do	−12		D	Temp., 53° F. Water reported soft.	27
28	1.4 mi. E of Dahlgren	Dept. of The Navy	Washington Pump & Well Co.	Prior to 1938	15	D	521		Paleocene-Late Cretaceous	Mattaponi fm			D	See log, Table 14. Next deeper aquifer reported to be at 732-750 ft.	28
29	1.3 mi. ESE of Dahlgren	A. P. Berry Farm	W. S. Reynolds	1936 ?	10	J	749		Cretaceous	Potomac group			D, S	Aquifer is medium sand, 742-749 ft.	29
30	0.7 mi. E of Dahlgren	Dept. of The Navy	Virginia Machinery and Well Co.	1952 ?	19	D	780		do	do			D	See log, Table 14	30
31	1.8 mi. WSW of Dahlgren	W. H. Washington	Leazer Well & Pump Co.		80	D	720		do	do		14	D	See log, Table 14.	31
32	2 mi. NE of Edge Hill	Union Bethel Church	Reynolds & Norman	1952	160	J	894		do	do			D	Cased to 850 ft. Aquifer is white sand, 850-894 ft. See log, Table 14.	32
33	2.5 mi. E of Edge Hill	S. B. Tallis			155	J	265	1½	Eocene	Nanjemoy fm				Temp., 54° F. Water reported poor; not used.	33
34	4.2 mi. E of Edge Hill	R. Rolling		1938	100	Dug	48	36	Pleistocene	Columbia group	−44		D	Temp., 54° F. Water reported soft.	34
35	Rollins Fork	F. Ashby		1900	100	Dug	52	36	do	do			D, S	Equipped with windmill. Temp., 56° F. Water reported soft; iron taste.	35

Table 1.—Records of wells in Northumberland County, Virginia--Continued

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
79	2.8 mi. ESE of Burgess	Cobbs Dairy			21	Dug	20		Pleistocene	Columbia group	-15		D, S	Water level declines during dry years.	79
80	2.1 mi. SE of Burgess	Lilian Lumber Co.	Virginia Machinery and Well Co.	1945	15	D	590		Paleocene-Late Cretaceous	Mattaponi fm	(+)	39	I	Flows 2 gpm. Drawdown 50 ft when pumping 39 gpm. Water foams in boiler.	80
81	2.5 mi. SSW of Burgess	Mason Booth			3		375		Miocene	Chesapeake group	(+)		D, I, S	Flows 1½ gpm. Water-bearing sand at 318 ft.	81
82	Do.	Earl Cockrell			3	J	320	1½	do	do	(+)		D	Flows 1½ gpm. No decline of water level during dry years. Reported to contain iron.	82
83	Do.	Mrs. W. H. Booth	J. M. Buxess		4		625	2	Paleocene-Late Cretaceous	Mattaponi fm	(+)		PS	See analysis, Table 3.	83
84	1.6 mi. N of Ditchley	S. A. Whittaker			6		372	1	Miocene	Chesapeake group	(+)			See log, Table 2. Flow reported 1 gpm in 1918. Chloride reported 5.5 ppm.	84
85	Ditchley	Mrs. E. I. DuPont			2		580	4½	Paleocene-Late Cretaceous	Mattaponi fm	+16		D	See analysis, Table 3. Temp., 70° F. In 1912, flow reported 150 gpm, and water level 16 ft above surface.	85
86	0.3 mi. S of Ditchley	Virginia Fish Co.			2		580	4½	do	do	+16			In 1911, flow reported 150 gpm, and water level 16 ft above surface.	86
87	3 mi. ESE of Kilmarnook	Western Chemical Co.			1		637	8	do	do			I	In 1918, flow reported 100 gpm. Chloride reported 10 ppm.	87
88	Do.	Luther George	J. P. Prins	1953	1	D	370	2	Miocene	Chesapeake group	(+)	40±		Flows 3/4 gpm. Sulfide odor.	88
89	2 mi. ESE of Kilmarnook	Mark Dawson			5	Dug	14		Pleistocene	Columbia group	-8		D		89
90	Do.	do	Mitchell's Well and Pump Co.	1943	5	D	810	8	Paleocene-Late Cretaceous	Mattaponi fm	(+)		D	In 1943, flow reported 15 gpm. Water-bearing white sand from 705 to 779 ft.	90
91	3 mi. SSE of Burgess	J. L. Sisson	Reynolds & Norman	1942	5	J	707	3	do	do			D	See log, Table 2.	91
92	Browns Store	J. D. Hinton	W. S. Reynolds	1950	103	J	690	4-3	do	do			D	See log, Table 2.	92

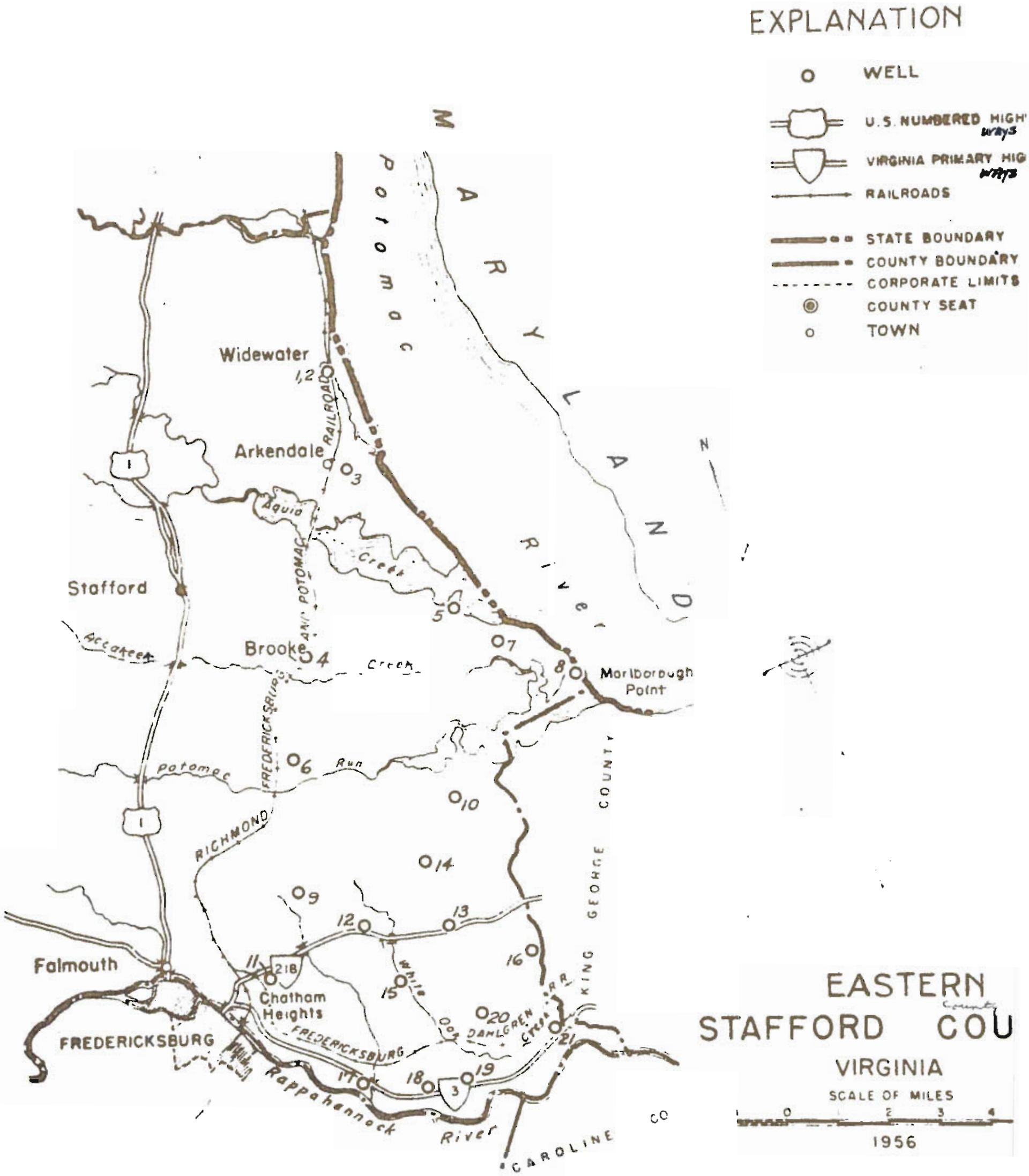
EXPLANATION
WELL
U.S. NUMBERED HIGHWAYS
VIRGINIA PRIMARY HIGHWAYS
RAILROADS
STATE BOUNDARY
COUNTY BOUNDARY
CORPORATE LIMITS
COUNTY SEAT
TOWN
EASTERN STAFFORD COUNTY
VIRGINIA
SCALE OF MILES
0 1 2 3 4
1956
MARYLAND
Potomac River
Widewater
Arkendale
Aquia Creek
Stafford
Brooke
Accotink Creek
Potomac Run
Marlborough Point
Falmouth
Chatham Heights
FREDERICKSBURG
Rappahannock River
RICHMOND
FREDERICKSBURG
ANN POTOMAC
RAILROAD
DAHLGREN
KING GEORGE COUNTY
CAROLINE CO
N

Table 16.—Records of wells in Eastern Stafford County, Virginia

Type of well: D, drilled; J, jetted; B, bored
Use of Water: D, domestic; S, stock; I, industrial

gpm, gallons per minute
Temp., temperature (degrees Fahrenheit)

No.	Location	Owner or tenant	Driller	Year completed	Approximate altitude above sea level (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Principal water-bearing zone: Geologic age	Principal water-bearing zone: Stratigraphic unit or named aquifer	Approximate water level above (+) or below (−) land surface (feet)	Approximate yield (gpm)	Use of water	Remarks	No.
1	Widewater	Murray Decatur		ca. 1937	15	D	210	6	Cretaceous	Potomac group	(+)			See analysis, Table 18.	1
2	Do.	do		ca. 1940	15	D	290	6	do	do	(+)			See analysis, Table 18.	2
3	Arkendale	Arkendale Farm	W. S. Reynolds		25	J	490		do	do			D,S	See log, Table 17.	3
4	Brooke	Fanny Milton			100	Dug	55	48	Pleistocene	Columbia group	−51		D	See analysis, Table 18. Temp., 56° F.	4
5	3 mi. NW of Marlboro Point	J. Hoyt Reed		1909	15	Dug	37	36	do	do	−32		D	See analysis, Table 18. Temp., 55° F.	5
6	2 mi. SSW of Brooke	Meta Jett			100	Dug	41	36	do	do	(−)		D	See analysis, Table 18. Temp., 58° F.	6
7	1.7 mi. NW of Marlboro Point	R. J. McCloskey		1919	30	Dug	16	24	do	do	(−)		D,S	See analysis, Table 18. Temp., 65° F.	7
8	Marlboro Point	James Ashby, Sr.		1913	20	Dug	20	36	do	do	−17		D	See analysis, Table 18. Temp., 63° F.	8
9	3 mi. NE of Fredericksburg	Frank A. Stevens	Frank A. Stevens	1949	210	Dug	22	34	do	do	−18½		D	See log, Table 17; analysis, Table 18. Temp., 61° F.	9
10	3.6 mi. WSW of Marlboro Point	Roy Newton			80	Dug	27½	48	do	do	−21		D	See analysis, Table 18. Temp., 56° F.	10
11	1.4 mi. NE of Fredericksburg	W. W. Lupton	Leazer Well & Pump Co.	1949	160	D	1102½	6	Cretaceous	Potomac group			D,S	See analysis, Table 18. Water from black sand, 170–180 ft.	11
12	3.3 mi. ENE of Fredericksburg	R. E. Wright			175	Dug	27	36	Pleistocene	Columbia group			D	See analysis, Table 18. Reported soft. Iron taste. Temp., 58° F.	12
13	4.5 mi. E of Fredericksburg	T. J. Fines		prior to 1861	220	Dug	33	36	do	do	−25			Reported soft. Temp., 56° F.	13
14	5 mi. ENE of Fredericksburg	Erwin Allen		1930	200	Dug	25	36	do	do	−20		D	See analysis, Table 18. Temp., 62° F.	14
15	3.5 mi. E of Fredericksburg	M. Robertson		1941	170	Dug	22	36	do	do	−19		D	See analysis, Table 18. Temp., 56° F. Water level measured in 1941.	15
16	6 mi. E of Fredericksburg	John S. Hudson		1934	190	Dug	30	24	do	do	−26		D	Reported soft. Temp., 59° F.	16
17	3 mi. SE of Fredericksburg	L. P. Graves		1800	40	Dug	40	60	do	do	−33		D,S	See log, Table 17; analysis, Table 18. Temp., 70° F. Another similar well nearby.	17
18	Sherwood Forest Farm, 4 mi. SE of Fredericksburg	J. L. Pratt	L. L. Martin	1930	90	D	195	8	Cretaceous	Potomac group	−55	20	S	See log, Table 17; analysis, Table 18.	18
19	5 mi. SE of Fredericksburg	John F. Barrett			70	Dug	65	24	Pleistocene	Columbia group	−53		D	See analysis, Table 18. Temp., 61° F.	19
20	5 mi. ESE of Fredericksburg	Wm. White, Sr.			140	Dug	16	36	do	do	−13		D, S	See analysis, Table 18. Temp., 58° F.	20
21	6.5 mi. ESE of Fredericksburg	Jesse Olive	Jesse Olive	1946	50	B	21		do	do			I	See log, Table 17; analysis, Table 18. Temp., 65° F.	21