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BOARD OF NATURAL RESOURCES
DEPARTMENT OF GEOLOGY, MINES AND WATER RESOURCES
JOSEPH T. SINGEWALD, JR., *Director*

BULLETIN 8

THE WATER RESOURCES OF CALVERT COUNTY

SURFACE-WATER RESOURCES

by V. R. Bennion
and D. F. Dougherty

GROUND-WATER RESOURCES

by Robert M. Overbeck

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PREFACE

The Calvert County report in the series of county reports was published in 1907, long before a systematic study of the water resources of the State was undertaken. In 1945, investigations of the groundwater resources of Southern Maryland were initiated. The results of the investigations in Charles County were published in 1948 in the Charles County report, and those in Anne Arundel County were published in 1949 in Bulletin 5. This bulletin on the Water Resources of Calvert County supplements the 1907 Calvert County report.

The bulletin is based on investigations conducted jointly by the United States Geological Survey and the Maryland Department of Geology, Mines and Water Resources and is published with the permission of the United States Geological Survey.

The section on Surface-Water Resources was prepared by Mr. V. R. Bennion, former District Engineer, and Mr. D. F. Dougherty, of the United States Geological Survey, in charge of cooperative surface-water measurements in Maryland. The section on Ground-Water Resources was prepared by Dr. Robert M. Overbeck of the cooperative ground-water staff.

The descriptions of the sub-surface formations may be supplemented by the more comprehensive descriptions of these formations in the previously published systematic reports. These are in descending order of the formations, the Pliocene and Pleistocene (1906), the Miocene (1904), the Upper Cretaceous (1916), and the Lower Cretaceous (1911). More recent information on these formations is in a report on Cretaceous and Tertiary Subsurface Geology (Bulletin 2, 1948). Additional information on the Eocene is contained in a report on Eocene Stratigraphy and Aquia Foraminifera (Bulletin 3, 1948).

The areal distribution of the formations is shown on the geologic map of Calvert County published in 1903. Surface elevations are shown on the county topographic map published in 1949.

The report lists and gives the locations of over 200 artesian wells in Calvert County. Data on the sub-surface formations and the water-bearing beds are presented in the drillers' logs of 52 wells and in the descriptions of well cuttings from 18 wells. The quality of the water in the water-bearing sands is shown in 11 water analyses.

The data presented in this report enable a well driller and a prospective well owner to determine the depths at which ground-water may be obtained, the quantity of water obtainable, and the probable quality of the water. However, the Department of Geology, Mines and Water Resources can be called upon at any time for such information.

JOSEPH T. SINGEWALD, JR., *Director.*

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THE SURFACE-WATER RESOURCES OF CALVERT COUNTY

GENERAL DISCUSSION

BY

V. R. BENNION

Water is the natural resource most vital to man's existence. It determines those places on the face of the earth where he can live. If there is insufficient water, as in the desert, he cannot live, or if there is too much water or a continual threat of it, as in the flood plains of the streams, he cannot live except in fear of his life. Without water the average man would live but a few days, and most of the modern industrial processes would cease operation immediately.

Many of the people of this country, and especially those in the eastern section, seem to assume that the water supply is inexhaustible. Actually the water supply is definitely limited and already in many places its scarcity has become an acute problem and it has been necessary to establish laws governing the use and conservation of this valuable resource. The quantity of available water in any region varies from year to year, month to month, and day to day. It cannot be adequately determined by measurements covering a period of only a few months or even of a few years. The immediate source of nearly all water is precipitation from the clouds, and the wide variations in this factor are known to all. The relation between rainfall and the resulting surface-water and ground-water supplies is also variable and complex; therefore, the records of rainfall alone do not serve as a measure of the water supply available for use.

The earth has a fixed amount of water, which circulates in an endless cycle maintained in approximate balance by several processes, the principal of which are precipitation, evaporation, transpiration from vegetation, and runoff in streams. This vast movement of water from the atmosphere to the land, from the land to the ocean, and from land and ocean back to the atmosphere is known as the hydrologic cycle.

The water resources of principal concern to man may be classified as surface water and ground water. Surface water is the water present on the earth's solid surface, such as streams, lakes, and ponds. Ground water is the water that accumulates in the ground in the zone of saturation. Although both surface water and ground water originate from precipitation, there is a distinct difference in their occurrence and behavior. The methods and science involved in their investigation and utilization are also distinctive. Ground-water investigation and utilization are discussed in another section of this report.

Surface water is easily accessible and has a wide variety of uses, including production of power. The force of gravity causes surface water to flow along the path of least resistance, so long as the ground surface is sloping or until it is halted by some barrier to form a lake or pond. Essential to considering the utilization of surface water is a knowledge of the quantity and quality of the water, the topography of the drainage basin, the type of soil, and the land-use practices.

The development of any region is directly dependent upon the availability of an adequate water supply. The history of any country or community shows the importance of water resources, and the future development and expansion will depend to a great extent on the wise use of those resources. Generally, as a community develops in density of population and scope of industry, little thought is given to the prospect that there may not be sufficient water in nearby streams to satisfy the demands. It then becomes necessary to extend the water supply system to more distant streams. Many of the larger cities of the country are faced with an acute water problem today, whch threatens to stall their future development.

Streams may serve a community in several ways. Many streams are used as a municipal water supply, as a source of water for industrial uses, and for sewage disposal. Streams have an important rôle in the conservation of fish and wildlife. Improvement of streams and adjacent areas and the construction of artificial ponds and pools contribute to the program of recreation as well as to the conservation of fish and wildlife. In recent years greater attention has been directed to this improvement, and the efforts of conservationists have produced good results. However, many of our scenic streams are laden with waste and pollution that have resulted in the killing of vegetable and fish life. Under favorable conditions streams purify themselves in a relatively short distance; but when they become overloaded with pollution, the bacteria supplied by nature for purification are killed, the natural oxygen content of the water is depleted, and a so-called dead river results.

The flow of streams is subject to great fluctuation, depending upon the amount and intensity of the precipitation, and during floods a large portion of the water runs off without serving any useful purpose. In addition, the periodic flood damage to cities, highways, and other developments is tremendous. Much of this damage can be averted if there are proper planning and adequate knowledge of stream flow at the time the developments are made. In the early days, nearly all cities and municipalities were located along streams so as to have a readily accessible water supply or means of transportation. As the towns grew into cities, the flood plains of the streams were encroached upon by structures of all kinds. The streams were crowded into narrow channels of insufficient size to carry the flood flows, with resulting large damages in each major flood. In order to reduce or eliminate these damages, it is necessary to build flood-control works, and these cannot be properly designed unless a record of the stream flow is available for a sufficient number of years to determine the flood-flow characteristics of the stream.

SURFACE-WATER RESOURCES

BY

D. F. DOUGHERTY

Calvert County is almost completely surrounded by tidal waters. Its only land boundary is the narrow one on the north with Anne Arundel County. The eastern boundary is Chesapeake Bay and the western is the Patuxent River, which is tidal throughout this reach. The Patuxent River flows into Chesapeake Bay at the southern tip of Calvert County, thus forming the southern boundary also. Many of the county streams, therefore, are tidal for a large portion of their length, and a large number of the tributary streams flow directly into tidewater. The entire county is part of the west Chesapeake Bay drainage area. The more important streams and their drainage areas are:

Streams in Calvert County

Stream	Drainage area (sq. mi.)
Patuxent River basin:	
Lyons Creek	19.5
Hall Creek	20.0
Hunting Creek	28.7
Battle Creek	18.9
St. Leonard Creek	22.5
Chesapeake Bay drainage area:	
Fishing Creek	17.9

All the streams are small and relatively short, nearly all having both their source and mouth within the county. The slopes are generally flat and are marked by numerous swampy areas. During periods of medium and high flows the streams overtop the low banks and flow over wide flood plains. This tends to reduce the peak discharges and increase the low-water flow. Because of this characteristic, streams of this type are reliable sources of water supply.

The topography of Calvert County consists of low rolling hills. The divide between Patuxent River drainage and Chesapeake Bay drainage runs roughly north and south through the county, the Patuxent area being generally wider and having flatter slopes.

No gaging stations are maintained in the county at present. However, gaging stations are maintained on Chaptico Creek near Chaptico and on St. Marys River at Great Mills, in St. Marys County, and on Bacon Ridge Branch near Chesterfield, and on North River near Annapolis, in Anne Arundel County. The runoff from these streams should be similar to that from streams in Calvert County. The records for these stations are published in their respective county reports.

THE GROUND-WATER RESOURCES OF CALVERT COUNTY

BY

ROBERT M. OVERBECK

Abstract

Calvert County is in southern Maryland, and hence in the Western Shore portion of the Coastal Plain province. The Chesapeake Bay lies along the eastern side of the county and the Patuxent River along its western side. Rocks that crop out in Calvert County are of Pleistocene, Miocene, and Eocene age. The Pleistocene formations consist of sand and sandy clay, but contain minor amounts of gravel; those of Miocene age consist chiefly of sandy clay, and at places are very fossiliferous and diatomaceous; the outcropping Eocene formation (Nanjemoy) consists chiefly of greensand. The Miocene and Eocene formations have strikes varying between north and east and very low dips to the east and south. The Pleistocene deposits are generally terrace deposits.

The sediments from which ground water is being produced in Calvert County are of Pleistocene, Jackson, Nanjemoy, and Aquia age. Cretaceous rocks underlie the county and are a possible source of water for deep wells. It is estimated that about 2,000,000 gallons of ground water are used per day in the county. This water is for domestic and farm purposes chiefly, as there are no large industries in the county. The Nanjemoy formation is the source of most of the water in the northeastern and eastern parts of the county, and the Nanjemoy formation and rocks of Jackson age in the southern part. The Aquia formation is the source in the northern and western parts of the county and for a few wells in the southern part.

The aquifers yield water that is satisfactory for most uses.

Introduction

LOCATION OF THE AREA

Calvert County is one of the tidewater counties of the Western Shore of the Chesapeake Bay of southern Maryland (fig. 1). It lies between parallels 38°19′ and 38°46′ north latitude, and 76°23′ and 76°42′ west longitude. Its land area is about 217 square miles; and its water area, 153 square miles.[1]

[1] Gazetteer of Maryland: Maryland State Planning Commission and Department of Geology, Mines and Water Resources, p. 239, 1941.

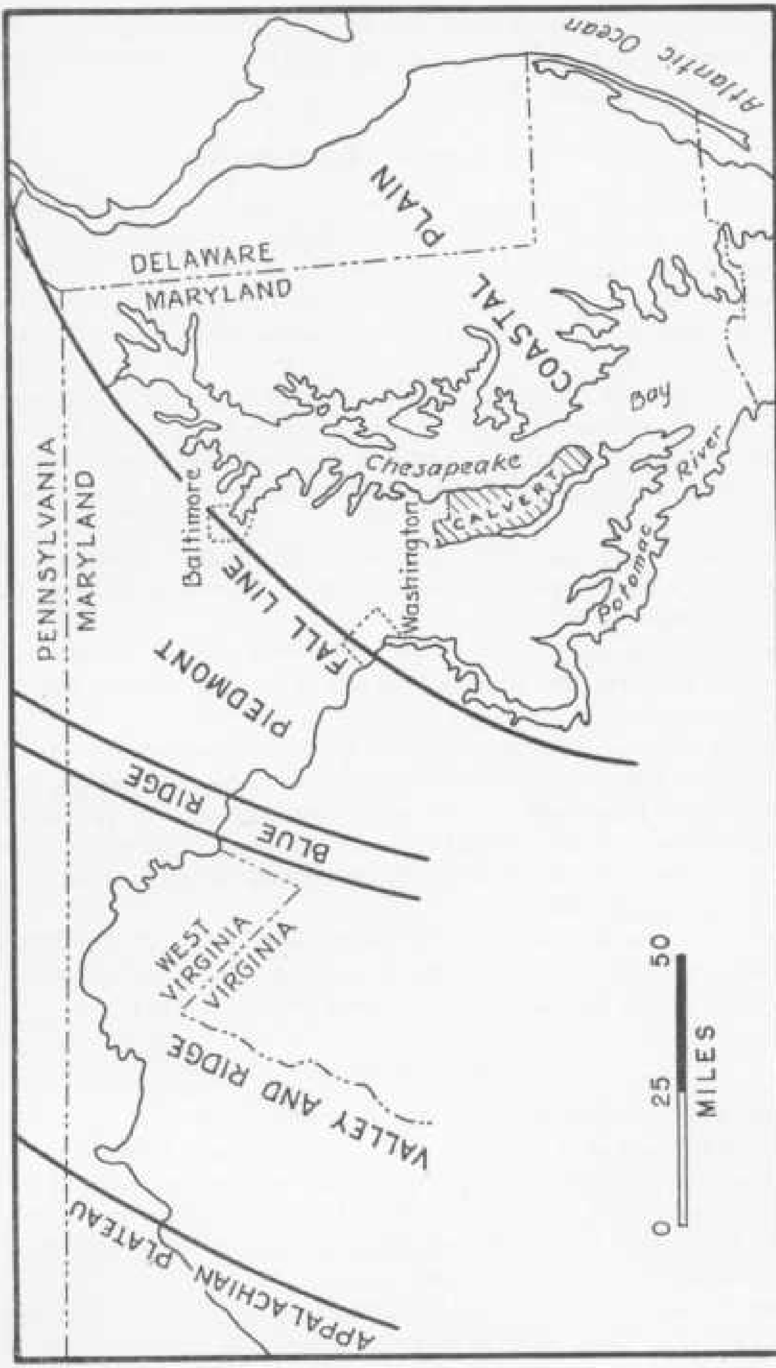

FIGURE 1. Outline map of Maryland, showing the location of Calvert County, the physiographic provinces, and the Fall Line

To the north of Calvert County lies Anne Arundel County, to the west Prince Georges and Charles Counties, and to the southwest and south St. Marys County. Chesapeake Bay lies along the east side.

PURPOSE AND SCOPE OF THE INVESTIGATION

The purpose of this investigation was to determine the factors that govern the availability of ground water in Calvert County. These include the extent, thickness, depth, and water-bearing properties of the geologic formations; the chemical quality of the water; and the development of ground-water supplies. Field work was started in May 1946, and carried on intermittently to the latter part of 1949.

Well cuttings were studied thoroughly to determine geologic markers and the physical characteristics of the aquifers. Samples taken by drillers were obtained from some of the wells. Cuttings from wells which were most important for an understanding of the subsurface geology were collected by a geologist.

Water samples were taken from only a few wells. Many of the drilled wells are producing a mixed water from two aquifers of different geologic age that may be hydrologically connected.

An inventory was made of both dug and drilled wells (table 2). The inventory although not complete gives an overall picture of the distribution of the wells and their utilization.

The wells inventoried are plotted on a Calvert County map (Pl. 1). This map is divided into 5-minute quadrangles which are lettered alphabetically by capital letters from north to south and by small letters from west to east. A well is designated in the text and tables by the abbreviation of the county name (Cal) followed by the letters indicating the quadrangle, followed by the well number; thus, Cal-Bb 1.

Plates 2 and 3 are subsurface contour maps. Plate 3 shows the approximate depth below sea level and configuration of the contact surface at the top of the Aquia formation and Plate 2 at the base of the Calvert formation.

PHYSICAL FEATURES

Calvert County lies on a long narrow peninsula bounded on the east by Chesapeake Bay and on the west and south by the Patuxent River, an estuary of the Bay. The peninsula is about 33 miles long and averages about $6\frac{1}{2}$ miles wide. Its northern portion is about 8 miles wide and its southern portion about 4 miles. The northern two-thirds of the peninsula trends north-south and the southern one-third trends northwest-southeast.

Calvert County lies in the Coastal Plain physiographic province of Maryland (fig. 1). The Fall Line, which separates the Piedmont Province from the

Coastal Plain Province, does not pass through the county, but is about 12 miles to the northwest.

Calvert County is well dissected by streams, most of which are short and are tidal in their lower portions. The land surface is generally rolling and shows a marked contrast to the low-lying and nearly flat Eastern Shore Coastal Plain topography. The maximum altitude in the county, about 190 feet, is in the northern part near Mt. Harmony. The maximum altitude in the southern part of the county is about 135 feet.

A broad terrace, having an altitude of 30 to 50 feet and reaching nearly a mile in width at places, borders the Patuxent River in Calvert County.

The Calvert Cliffs, which at places have a sheer drop of a hundred feet, extend for nearly thirty miles along the Chesapeake Bay side of the county. Erosion has been very rapid locally along the Cliffs.[2]

CLIMATE

The climate of Calvert County has been described in some detail by Von Herrmann.[3] More recent information is included in reports by Weeks[4] and the U. S. Weather Bureau.[5]

The U. S. Weather Bureau maintains two cooperative stations in Calvert County at which temperature and rainfall are measured daily. One station is at Ferry Landing in the northwestern part of the county; the other, which has been in operation for 57 years, is at Solomons in the extreme southern part of the county. The mean monthly precipitation, in inches, at the two stations is:

Mean Monthly Precipitation—Calvert County
(inches)

Stations	Period of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Owings Ferry Landing	1916–1947	3.66	2.74	3.48	3.98	3.63	3.49	4.96	5.11	3.94	3.00	2.77	2.80	43.56
Solomons	1892–1947	3.05	2.89	3.32	3.17	3.05	3.38	4.62	3.98	2.94	2.71	2.17	2.72	38.00

The table shows that Calvert County receives about 41 inches of rain and snow during the year. The precipitation is fairly uniform through the year, but is highest in summer due to frequent heavy afternoon thunder showers.

[2] Singewald, Joseph T., Jr., and Slaughter, Turbit H., Shore erosion in tidewater Maryland: Maryland Dept. of Geology, Mines and Water Resources, Bull. 6, 1949.

[3] Von Hermann, C. F., The climate of Calvert County, in Calvert County: Maryland Geological Survey, pp. 169–206, 1907.

[4] Weeks, J. R., Our climate; Maryland and Delaware: Maryland State Weather Service, 6th ed., June, 1939.

[5] Climatological data, Maryland and Delaware section: U. S. Weather Bureau.

The mean monthly temperatures at the two stations are:

Mean Monthly Temperature—Calvert County
(° F.)

Stations	Period of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Owings Ferry Landing	1916–1947	35.3	36.8	45.5	53.8	64.1	72.8	76.3	74.6	69.0	58.0	47.6	37.7	56.4
Solomons	1892–1947	36.3	36.4	45.0	54.8	65.3	73.7	78.2	77.2	71.8	60.4	49.1	39.0	57.3

The table shows the mean annual temperature to be between 56.4°F. and 57.3°F. July, the hottest month, has a mean temperature of about 77°F. and January, the coldest month, about 36°F.

POPULATION AND INDUSTRIES

The population of Calvert County according to the 1950 census is 12,272. The county has no large towns. The two incorporated towns, Chesapeake Beach and North Beach, had populations in 1940 of 326 and 246, respectively. Prince Frederick, the county seat, has an estimated population (1949) of about 200, and Solomons of about 270. During the summer the population of the county is much larger owing to the influx of vacationers.

The chief industry of Calvert County is agriculture. Tobacco is the most important crop. The vacation trade is also an important source of income. No large industrial plants are located in the county.

PREVIOUS GROUND-WATER INVESTIGATIONS

One of the first published accounts of ground water in Calvert County is included in a report by N. H. Darton.[6] His statement is as follows:

"*Solomons Island, Calvert County.*—There are four flowing wells on this island, and another at Rousby on the mainland just north. They average about 250 feet in depth and furnish good supplies of excellent water. The water horizon is the basal Chesapeake beds, the same as in the St. Mary's County wells, and at Denton and Cambridge on the Eastern Shore."

In the period 1896–1912, maps were published in U. S. Geological Survey folios[7] on which the approximate location of water-bearing beds was shown.

[6] Darton, N. H., Artesian well prospects in the Atlantic Coastal Plain region: U. S. Geological Survey Bull. 138, pp. 136, 150–151, 1896.

[7] Darton, N. H., U. S. Geological Survey Geol. Atlas, Nomini folio (No. 23) 1896;
Shattuck, G. B., and Miller, B. L., U. S. Geological Survey Geol. Atlas, St. Marys folio (No. 136), 1906;
Miller, B. L., U. S. Geological Survey Geol. Atlas, Choptank folio (No. 182), 1912.

In 1918, the Maryland Geological Survey issued a report[8] on the water resources of the State, including a discussion of the ground-water resources of Calvert County. Since that time no reports have been published that bear directly on the ground-water resources of Calvert County.

ACKNOWLEDGMENTS

Acknowledgment is made here to the well drillers in Calvert County for their help in collecting well cuttings and for furnishing information on wells drilled before 1945; and to Mr. Glascock for data given on water-level fluctuations, for use of a well as a permanent observation well, and for other material help.

Thanks are also due to Dr. Harold Vokes for helpful discussions of Coastal Plain geology; to Dr. Elaine Shifflett and Miss Doris Malkin for the determination of the microfossils in some of the well cuttings; and to Dr . Julia Gardner for the personal interest she has shown in problems of Coastal Plain geology.

The investigation was made under the general supervision of A. N. Sayre, Geologist in Charge of the Ground Water Branch of the U. S. Geological Survey, and under the immediate supervision of R. R. Bennett, District Geologist of the U. S. Geological Survey in charge of the cooperative ground-water investigations in Maryland.

MAPS

The 1949 Calvert County topographic map of the Department of Geology, Mines and Water Resources (scale 1:62,500) is used as the base from which the maps with this report were drawn. In the field the 7½ minute topographic quadrangle maps of the Corps of Engineers, U. S. Army, and the U. S. Geological Survey, on a scale of 1:31,680 and 1:25,000 were used for those parts of the county where available.

A geologic map of the county, issued in 1903 by the Maryland Geological Survey, was used extensively in the field.

GENERAL PRINCIPLES OF GROUND-WATER OCCURRENCE

The general principles of the occurrence of ground water are discussed in reports on the water resources of Charles and Anne Arundel Counties.[9, 10]

Specific application of the principles in Calvert County will be noted in the section on geologic formations and their hydrologic properties.

[8] Clark, W. B., Mathews, E. B., and Berry, E. W., The surface and underground water resources of Maryland, including Delaware and the District of Columbia: Maryland Geological Survey, vol. 10, pt. 2, 1918.

[9] Overbeck, Robert M., Maryland Department of Geology, Mines and Water Resources, Charles County Report, 1948, pp. 138–143.

[10] Brookhart, J. W., The Water Resources of Anne Arundel County: Maryland Dept. of Geology, Mines and Water Resources, Bull. 5, pp. 32–35, 1949.

GEOLOGIC FORMATIONS AND THEIR HYDROLOGIC PROPERTIES

GENERAL STATEMENT

Meinzer[11] says, "Geology affords the framework on which ground-water hydrology is built." It is essential, therefore, to know in detail the geology of the area under investigation.

A historical account of the geologic work done on the Western Shore Coastal Plain has been given in previous reports.[12, 13]

Rocks that crop out in Calvert County belong in the Tertiary and Quaternary systems. The type locality of the Miocene Calvert formation is the Calvert Cliffs along the Chesapeake Bay. The Pleistocene Sunderland formation is named for the village of Sunderland in Calvert County.

Rocks that lie in the subsurface under the county but do not crop out in the county, as shown by well cuttings and identified as to geologic age, are Aquia greensand and deposits of Jackson age. Some deep wells have undoubtedly penetrated Cretaceous rocks, but samples are lacking to verify this.

Lithologically the rocks of Calvert County are unconsolidated sand, clay, and gravel, and, rarely, indurated lime- or iron-cemented sand.

Table 1 shows the geologic sequence and summarizes the lithology and water-bearing properties of the formations.

Figures 4 and 5 are cross sections of the geologic formations in Calvert County. The location of these sections is shown on Plate 1.

BASEMENT COMPLEX

Crystalline rocks of the Basement Complex do not crop out in Calvert County. They lie at great depth and have no value there as potential sources of water. Geophysical data[14] from two stations in Chesapeake Bay just north of the mouth of the Patuxent River indicate that the surface of these rocks lies approximately 3,050 feet below sea level (fig. 2).

CRETACEOUS SYSTEM

LOWER CRETACEOUS SERIES

Patuxent formation.—Little is known of the physical or hydrologic properties of the Patuxent formation under Calvert County. Its base lies between two and three thousand feet below the surface, and no wells in the county have penetrated it.

The Patuxent formation is considered a potential source of water in Calvert County, though its sediments may contain highly mineralized water.

[11] Meinzer, O. E., and others, Physics of the Earth, IX, Hydrology, p. 386, 1949.

[12] Shattuck, G. B., Calvert County: Maryland Geological Survey, pp. 25–38, 1907.

[13] Dryden, L., The physical features of Charles County, pp. 6–9, 1948.

[14] Ewing, Maurice, Woollard, George P., Vine, A. C., and Worzel, J. L., Recent results in submarine geophysics: Geol. Soc. Amer. Bull., vol. 57, pp. 909–934, 1946.

TABLE 1

Geologic formations in Calvert County

System	Series	Group	Formation	Thickness (feet)	General Character	Water-Bearing Properties
Quaternary	Pleistocene		Talbot Wicomico Sunderland	0–132 38 (?) 40 (?)	Clay, silt, sand, little gravel. Marine Talbot contains sea shells and much wood.	Yields water to dug wells in Calvert County.
Tertiary	Miocene	Chesapeake	St. Marys	50±	Clay, silt, and sand; fossiliferous.	Possibly yields water to dug wells in the southern part of the county. Not an important water-bearer.
			Choptank	100±	Sandy clay; sand; fossiliferous.	Possibly yields water to shallow dug wells. Not an important water-bearer in Calvert County.
			Calvert	150±	Sandy clay; fossiliferous; diatomaceous earth.	Possibly yields water to shallow dug wells. Not an important water-bearer in Calvert County.
	Eocene		Rocks of Jackson age	0–43	Hard lime-cemented beds intercalated with sand beds.	A water-bearing formation. May be hydrologically connected with Nanjemoy formation.
		Pamunkey	Nanjemoy	126–240	Chiefly greensand, some clay. The bottom 20 feet are pink and gray clay.	Chief aquifer in eastern and southern Calvert County. Not widely used as a source of water in the northern and northwestern part of the county.
			Aquia	81+	Chiefly greensand, some clay, interbedded sand and lime rock in upper part of the formation.	An excellent water-bearing formation. Used in only a few wells in county.
	Paleocene		—	70+	Glauconitic sandy clay.	Probably not a water-bearing formation.
Cretaceous	Upper		Monmouth		Dark gray sandy clay with some glauconite.	Not considered a water-bearing formation.
			Matawan		Do.	Do.
			Magothy		Gray sand and brown clay.	Potential source of ground water.
			Raritan		Sand, gravel, and clay.	Do.
			Patapsco		Do.	Do.
			Arundel		Clay.	Not considered a water-bearing formation.
	Lower		Patuxent		Sand, gravel, and clay.	Potential source of ground water. Water may be highly mineralized.
Pre-Cambrian(?)					Hard crystalline rocks such as granite, gneiss, gabbro, etc.	Not considered a potential source of ground water in Calvert County.

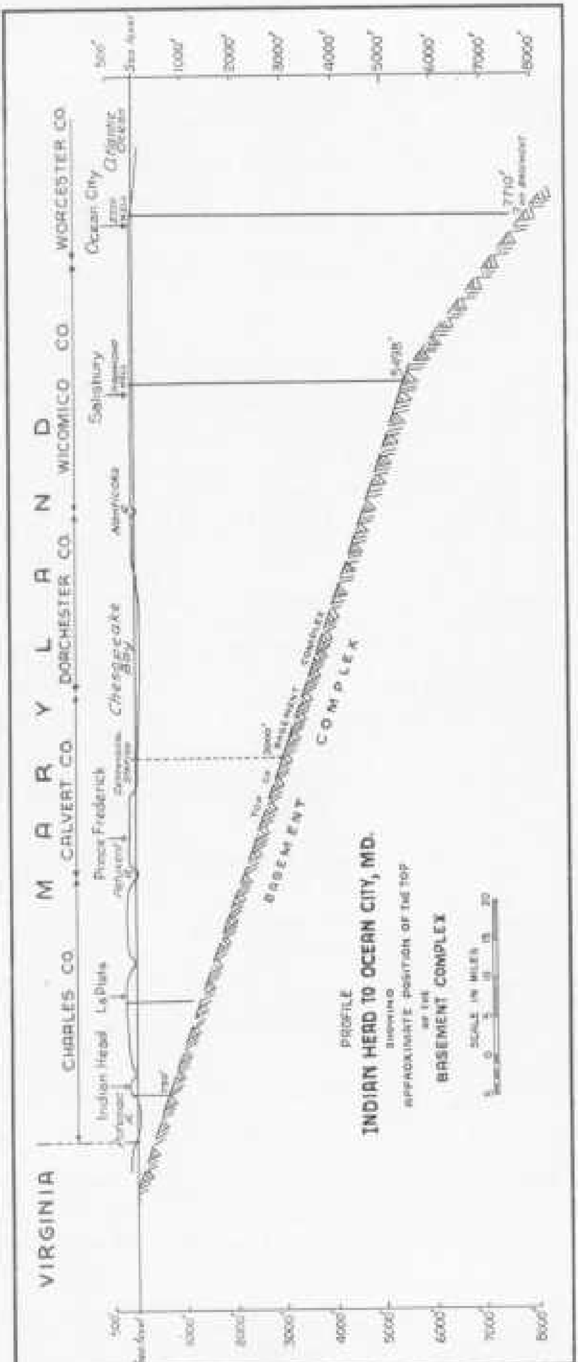

FIGURE 2. Cross section showing probable position of the top of the Basement Complex

UPPER CRETACEOUS SERIES

The Upper Cretaceous series in Maryland comprises the Arundel, Patapsco, Raritan, Magothy, Matawan, and Monmouth formations. None of these formations crops out in Calvert County. Although some deep wells in the county probably have been drilled into the uppermost part of the Upper Cretaceous series, no samples of these sediments are available. The extent, thickness, and hydrologic properties of the Upper Cretaceous rocks underlying Calvert County are therefore not well known.

A rough estimate of the depth of the top of the Cretaceous rocks in Calvert County is 300 feet below sea level in the northwest corner of the county, 450 feet at Prince Frederick , and more than 550 feet at Solomons.

No data are available on the thickness of the Upper Cretaceous rocks in Calvert County. In Anne Arundel County the Magothy formation is 40-60 feet thick and its top is about 100 feet below the base of the Aquia greensand. The Raritan formation which lies under the Magothy formation and in contact with it is about 100 feet thick.[15]

The quality of the water from Upper Cretaceous aquifers under Calvert County is not well known. In Anne Arundel County according to Brookhart[16] water from the Raritan and Patapsco formations is generally low in dissolved solids near the outcrop but increases somewhat in dissolved solids toward the southeast; and the water from the Magothy formation is generally more highly mineralized than water from the Raritan and Patapsco formations, and locally is high in iron.

The Upper Cretaceous rocks are considered potential sources of ground water in Calvert County as the Magothy, Raritan, and Patapsco formations are excellent water-bearing formations to the north in Anne Arundel County.

TERTIARY SYSTEM

EOCENE SERIES

Paleocene rocks.—Paleocene rocks do not crop out in Calvert County, nor were any wells drilled deep enough there to obtain samples of them. Paleocene deposits probably underlie the county, for they are reported by Shifflett[17] to occur in wells in Prince Georges County and in wells on the Eastern Shore of Maryland.

Paleocene rocks in Prince Georges County are argillaceous greensands which are very similar in appearance to the marine Upper Cretaceous rocks of

[15] Little, H. P., Physical features of Anne Arundel County: Maryland Geological Survey, p. 71, 1917.

[16] Brookhart, J. W., The water resources of Anne Arundel County: Maryland Dept. of Geology, Mines and Water Resources, Bull. 5, pp. 43, 46, 1949.

[17] Shifflett, Elaine, op. cit., pp. 23, 26.

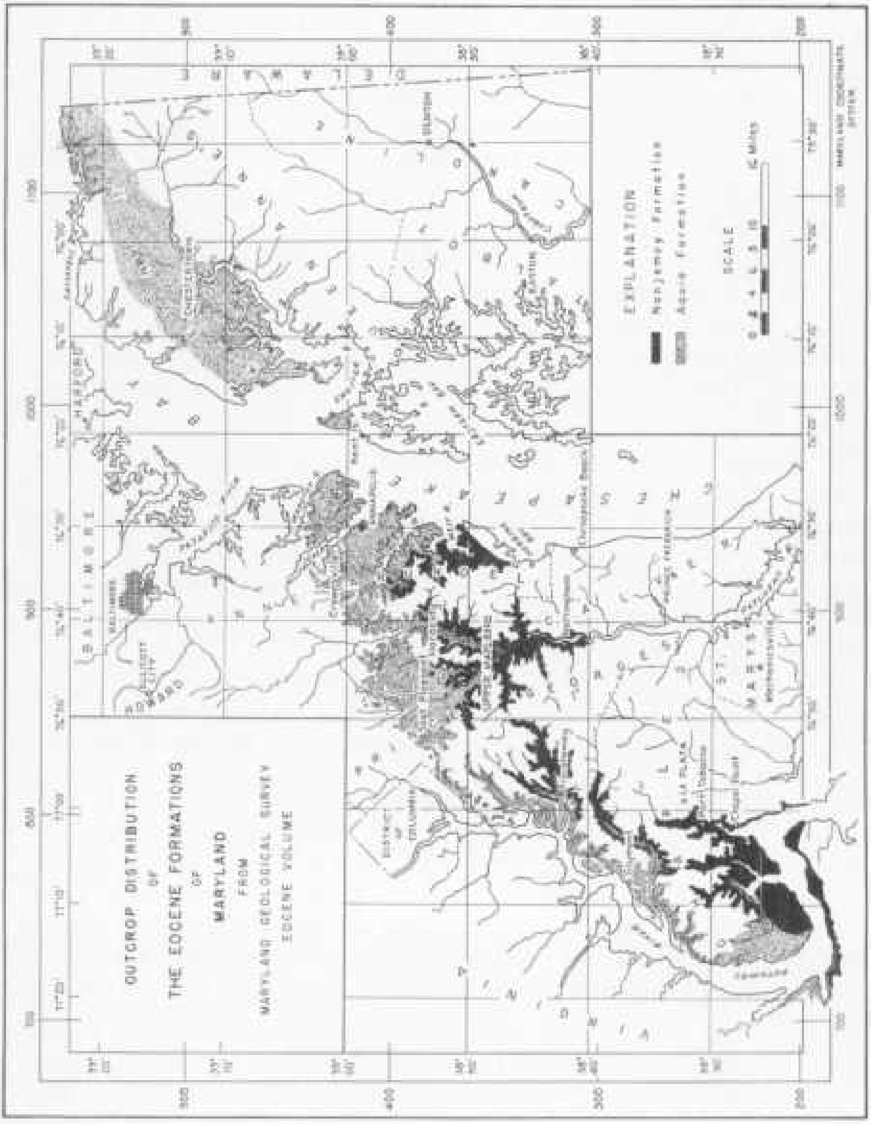

FIGURE 3. Outcrop distribution of the Eocene formations of Maryland

the Monmouth formation, although the faunas of the two formations are distinct.

The thickness of the Paleocene deposits in Calvert County is not well known. In a well in Prince Georges County they have a thickness of about 70 feet and in a well[18] on the Eastern Shore they have a thickness of 170 feet.

The Paleocene deposits in Prince Georges County and Eastern Shore wells contain much clay and do not appear to be water-bearing.

Aquia greensand.—The Aquia greensand takes its name from the type locality at Aquia Creek, Stafford County, Virginia. It does not crop out in Calvert County, and well cuttings are available from only a few wells drilled into the formation. A discussion of the Eocene rocks of Maryland and those of Calvert County are given in publications of the Maryland Geological Survey.[19, 20] Their areal distribution in Maryland is shown in Figure 3. Foraminifera from Calvert County wells are described by Shifflett.[21]

Detailed descriptions of well samples from the Aquia greensand are given in Table 4. (See wells Bb 9, Ca 2, Db 3, and Dc 17.)

The Aquia greensand is a glauconitic sand containing some beds of sandy clay. Hard beds composed of lime-cemented quartz and glauconite grains are rather common near the top of the formation. Green-black glauconite of various degrees of coarseness, and subrounded quartz grains, many of them yellow-stained, make up the sandy fractions of the well cuttings.

The Aquia greensand lies under the Marlboro clay member of the Nanjemoy formation. A sharp lithologic change is shown by the well samples. The presence of pieces of indurated greensand and of much yellow-stained quartz further characterizes the Aquia greensand cuttings.

The thickness of the Aquia greensand under Calvert County is not known, as no sampled drilled wells have gone completely through it. The maximum thickness penetrated is 168 feet in well Cal-Ca 2. In Charles County to the west the thickness ranges between 86 and 170 feet; and in Anne Arundel County to the north, between 75 and 150 feet. Sediments of the Aquia formation are not known to have been encountered in drilled wells on the southern Eastern Shore; a thinning of the formation south-eastward across Calvert County is, therefore, suggested.

The subsurface contour map (Pl. 3) represents the approximate depth below sea level and the shape of the surface at the top of the Aquia formation. The strike of this surface varies between east-west and north-south. Its dip in the

[18] Shifflett, Elaine, op. cit., p. 26.

[19] Clark, W. B., and Martin, G. C., Eocene: Maryland Geological Survey, 1901.

[20] Shattuck, G. B., Calvert County: Maryland Geological Survey, 1907.

[21] Shifflett, Elaine, Eocene stratigraphy and foraminifera of the Aquia formation: Maryland Dept. of Geology, Mines and Water Resources, Bull. 3, 1948.

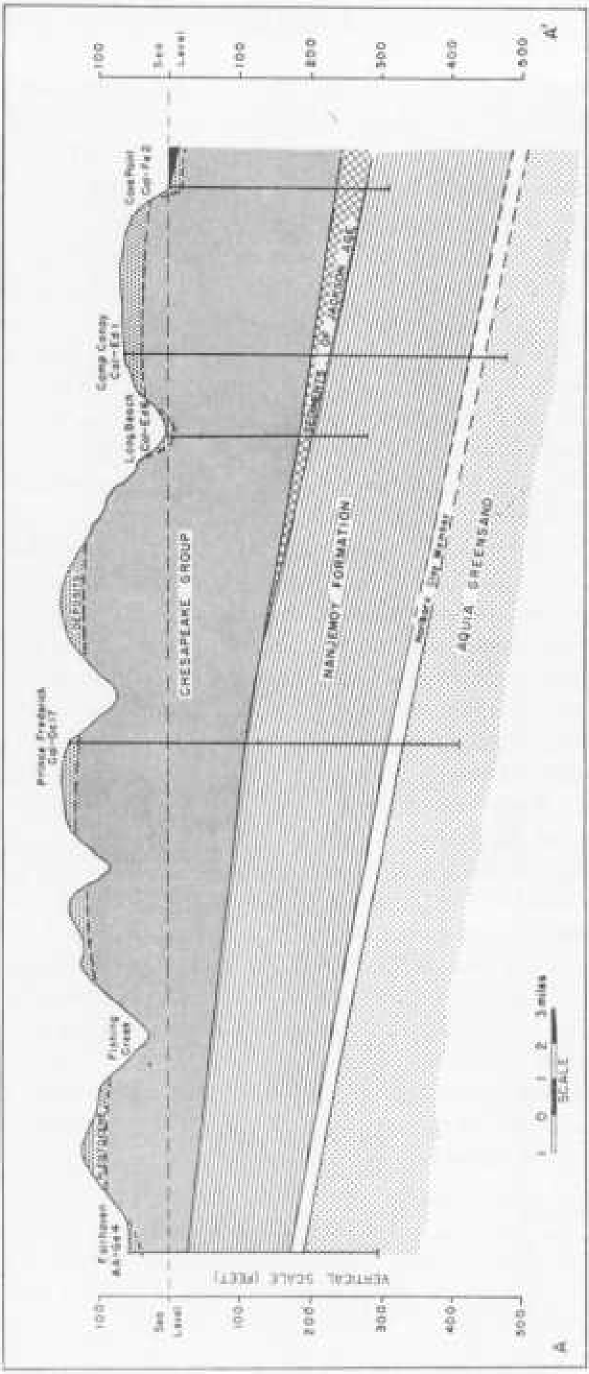

FIGURE 4. Section A-A' through Calvert County, showing approximate positions of geologic formations

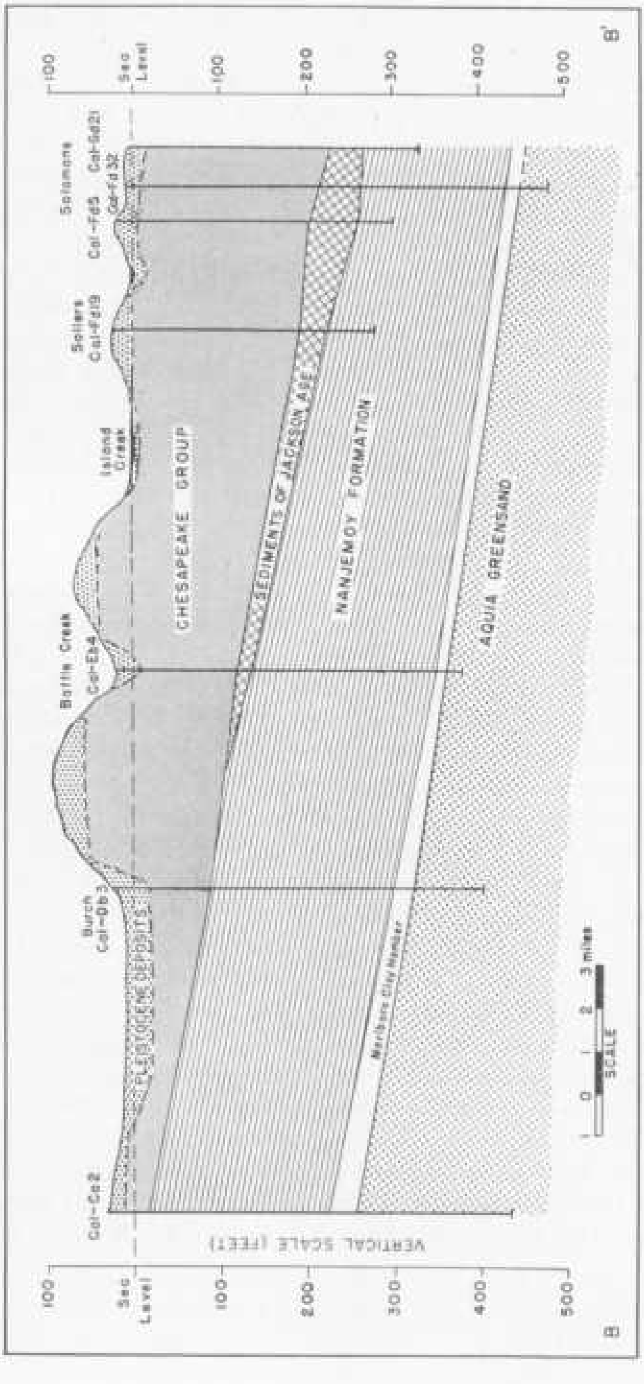

FIGURE 5. Section B-B' through Calvert County, showing approximate position of geologic formations

northern part of the county is about 21 feet to the mile and in the southern part of the county about 10 feet to the mile.

The Aquia greensand is a good water-bearing formation. The following wells are known to produce water from this sand: Bb 9, Ca 2, Db 3, Db 5, Db 11, Db 12, Dc 17; and wells Fd 1 and Gd 36 probably produce from the Aquia greensand. Wells Db 3, Ca 2, Db 11, Db 12 were flowing in 1949. Well Ca 2 was flowing at an altitude of 36 feet, and well Db 12 was flowing 22 gallons a minute at an altitude of 12 feet.

The water yielded by the Aquia greensand does not come from any one sand, but chiefly from a series of sands interbedded with hard lime-cemented layers. The water-bearing material penetrated by well Db 12 is in the uppermost part of the Aquia greensand and is in contact with the overlying Marlboro clay member. Well Dc 17 is screened from 67 to 79 feet below the top of the formation, and well Db 3 from 79 to 88 feet below the top of the formation.

Some wells ending in the Aquia greensand are of large diameter and they have large yields. For example, well Fd 1 is reported to yield 125 gallons a minute; well Gd 6, 150; and Gd 7, 350. The specific capacities are respectively 0.8, 2.0, and 3.5 gallons per minute per foot of drawdown.

R. R. Bennett, in 1944, conducted a pumping test at the Naval establishments in the Solomons-Patuxent River area.[22] He says the following about the tests in the Aquia aquifer in the Solomons area:

> "Three pumping tests were run on wells drilled to the Aquia but one was unsuccessful. A pumping test was run on the Amphibious Training Base well 3 (Gd 6), and by using the Theis recovery method the coefficient of transmissibility was determined to be 5,650."
>
> "A recovery test was run on Amphibious Training Base well 4 (Gd 7) and the coefficient of transmissibility was determined to be 5,500."

Quality of water.—Samples of water from three wells (Cal-Db 3 and 5 and Gd 6) that are believed to be producing from the Aquia formation were analyzed chemically. The results of the analyses are shown in Table 5.

The table shows a very close similarity in the analyses of the waters from wells Db 3 and Db 5. These wells are about 4 miles apart and both yield water from a sand or sands 80 to 90 feet below the top of the Aquia greensand. The waters are both bicarbonate waters and have total hardnesses of 108.0 parts per million (Cal-Db 3) and 104.0 parts per million (Cal-Db 5). They are medium hard. The principal difference lies in the greater amount of magnesium in Db 5.

The analysis of the water from well Gd 6 shows some differences from those of Db 3 and Db 5. It is lower in calcium and magnesium, much higher in sodium, and has a hardness of only 9 parts per million. The dissolved solids con-

[22] Bennett, Robert R., Ground-water resources at the Naval establishments in the Solomons-Patuxent River area, Maryland. Report on file at Maryland Dept. of Geology, Mines and Water Resources, 1944.

tent of Gd 6, however, is almost the same as that of Db 3. Well Gd 6 is about 17 miles southeast of well Db 3. The change in character of the water from a hard water to a very soft water is probably due to the presence of abundant glauconite, which is one of the most important base exchange minerals in the Aquia greensand. The difference between the two waters was probably brought about as the water moved down dip, by the exchange of calcium in the water nearer the outcrop for sodium in the glauconite.

The water from the Aquia greensand is satisfactory for general use, although it contains a small amount of iron.

Nanjemoy formation.—The Nanjemoy formation is named for Nanjemoy Creek in Charles County where the rocks were first studied by Clark and Martin.[23] Outcrops of the rocks in Charles County are described by Dryden.[24]

In Calvert County the Nanjemoy formation crops out only in the northwest corner of the county. Exposures occur along the Patuxent River for a short distance south of the mouth of Lyons Creek; and also at places eastward along Lyons Creek.

Figure 3 shows the areas of outcrops of the Aquia and Nanjemoy formations in Maryland.

Most of the drilled wells in the county penetrate Nanjemoy rocks. Detailed descriptions of well cuttings from the Nanjemoy formation are given in Table 4.

The Nanjemoy formation consists chiefly of greensand and glauconitic sandy clay. The lowest 20–25 feet of the formation is a distinctive pale-brown clay bed—the Marlboro clay member. This member does not crop out in Calvert County. Exposures of the clay in Prince Georges and Anne Arundel County show that it is homogeneous, without sand, and of rather uniform thickness. Although the color is generally pale-brown, gray beds occur at places in the upper part of the member.

In the northern two-thirds of the county the Nanjemoy formation is overlain by the Fairhaven diatomaceous earth member of the Calvert formation. In the southern third of the county it is overlain by deposits of Jackson age.

The contact between the Calvert and the Nanjemoy formation is well exposed at the Kaylor diatomite property on Patuxent River. The section there is:

Geologic section of formations on Patuxent River, Md.

Location: Kaylor diatomite deposit, 2 miles southwest of Dunkirk, on Route 525.
Altitude: Sea level to 60 feet above sea level.

	Altitude (feet) Top-Bottom	Thickness (feet)
Pleistocene series:		
Sand and clay; thin gravel bed at base	60.0–32.5	27.5

[23] Clark, W. B., and Martin, G. C., Eocene: Maryland Geological Survey, 1901.

[24] Dryden, L., and others, The physical features of Charles County: Dept. of Geology, Mines and Water Resources, 1948.

	Altitude (feet) Top-Bottom	Thickness (feet)
Miocene series:		
Calvert formation:		
Fairhaven member		
Diatomaceous earth; olive-brown, where damp; yellowish-gray, where dry; yellow-orange, where iron-stained	32.5–22.5	10
Sand, admixed clay; yellowish-orange color due chiefly to iron-staining; upper portion more clayey and gradational to diatomaceous earth. Washed material shows coarse quartz, clear, subangular to rounded; medium-grained quartz, clear, angular to subangular; also a little medium-grained glauconite (green-black and pale-olive)	22.5–19.5	3
Clay, sandy; yellowish-orange; a little green-black glauconite, botryoidal, and flattened; a little clear quartz in subangular to subrounded grains. Sand grains are medium fine-grained	19.5–18.5	1
Eocene series:		
Nanjemoy formation:		
Greensand, pale-olive, somewhat clayey; a few hard rod-like concretions up to 6 inches long, bleached on outside, pale-brown in center; concretions are lime-cemented quartz grains and glauconite. In a washed sample the sand residue is large; medium-sized grains predominate; a fair amount of it coarse- and fine-grained and a little very coarse- and very fine-grained. The coarse fraction consists of about 40% glauconite, most of it green-black, somewhat shiny, botryoidal and flattish. A few of the glauconite grains are olive-brown. The quartz generally has dark inclusions. The medium-grained fraction contains about 90 per cent green-black glauconite, botryoidal, rounded, much of it shiny. A few of the quartz grains are stained yellow.	18.5–16.0	2.5
Greensand, pale-olive; streaks of iron stain, and at 15 feet a continuous 2-inch band of iron-cemented sand. The washed residue from this sample is large, and consists chiefly of medium-grained glauconite and quartz. The medium-grained fraction contains about 90 per cent glauconite. The glauconite is green-black, shiny, botryoidal to flattish.	16 –11	5
Concealed	11 –0	11

Note: No megafossils were found in the outcrop. The contact between the Nanjemoy and Calvert formations is placed at an altitude of 18.5 feet, at the top of the heavy greensand bed and at the base of the yellowish-orange sandy clay unit.

The thickness of the Nanjemoy formation shows a considerable range as indicated by the samples obtained from wells which were drilled completely through it. In well Bb 9, in the extreme northern part of the county it is 126 feet thick; in well Ca 2 in the northwest part, it is 240 feet thick; in well Db 3 in the west-central part, it is 233 feet thick; and in well Dc 17, in the central part, it is 225 feet thick. No samples were obtained in the southern part of the county from drilled wells which went completely through the Nanjemoy formation. The driller's log of well Fd 32, near Solomons, indicates a thickness of about 140 feet

Well AA-Ge 4, which lies in Anne Arundel County a short distance north of the Calvert County line, shows a thickness of 162 feet. A well at Hughesville in Charles County shows a thickness of 234 feet. Nanjemoy rocks are not known to be present in the subsurface in the southern part of the Eastern Shore.

The above figures on thickness suggest a thinning of the Nanjemoy formation toward the northeastern, eastern, and southern parts of the county from a maximum thickness of 240 feet in the northwestern part.

Plate 2 is a subsurface map showing the elevation of the base of the Calvert formation. In the northern two-thirds of the county this represents also the top of the Nanjemoy formation. In the southern third of the county, it represents the contact between the Calvert formation and underlying deposits of of Jackson age. The Nanjemoy formation has a generally northeast strike and a dip of about 12 feet to the mile to the southeast.

The Nanjemoy formation is a good aquifer throughout the northeastern, eastern, and southern parts of the county. Few wells have been drilled in the northern part of the county or along the Patuxent River north of Hallowing Point. Those that have been drilled from which data are available are producing from Aquia sands. Well Bb 9, in the extreme northern part of the county, was drilled through the Nanjemoy formation and encountered only one bed of sand. This sand bed was not considered thick enough to produce the desired quantity of water. On the other hand at North Beach, 6 miles east-southeast of well Bb 9, the Nanjemoy formation is very productive. Over a thousand wells in North Beach and vicinity produce from sands in the Nanjemoy formation and no water shortage has been reported.

The wells which are producing from the Nanjemoy formation are so indicated in Table 2. Most of the Nanjemoy wells along the Chesapeake Bay shore that have an altitude of 5 feet or less are flowing. The hydrostatic head in the Nanjemoy formation, however, is less than that in the Aquia greensand.

In the southern third of the county, most of the drilled wells are open to both the Nanjemoy formation and to deposits of Jackson age. Therefore both formations are probably contributing water to the wells.

R. R. Bennett[25] in 1944 supervised a pumping test on the water-bearing sands of the Nanjemoy formation at Solomons. He says:

> "A pumping test was run on the Amphibious Training Base well 1 [Gd 5] which draws water from the Nanjemoy[26] aquifer. The coefficient of transmissibility of the Nanjemoy at this locality was determined by ob-

[25] Bennett, R. R., op. cit.

[26] Probably from deposits of Jackson age or from both these and Nanjemoy rocks.

serving the recovery of the water level in well 1 after the pumping was shut off. . . . By using the Theis recovery formula the coefficient of transmissibility of the Nanjemoy at well 1 was determined to be 2,046."

Well 1 (Gd 5) is reported to have a yield of 100 gallons a minute, and a specific capacity of 1.0; and well 2 (Gd 4), 120 gallons a minute, and a specific capacity of 1.8 gallons per minute per foot of drawdown.

The figures show that the coefficient of transmissibility of this formation is less than half that of the Aquia greensand.

Quality of the water.—A chemical analysis of the water from well Cc 28, producing from the Nanjemoy formation, is shown in Table 5. The well is located in the northeastern part of the county about 9 miles southeast of the Nanjemoy outcrop along the Patuxent River. This analysis shows the following differences in chemical composition from the analyses of Aquia waters: It is much higher in dissolved solids, in silica, and in calcium; the sodium-potassium ratio is different; its hardness (239 parts per million) is much greater.

In the southern part of the county, as already noted, the wells are open to water from both the Nanjemoy formation and from deposits of Jackson age. The analyses of water from wells Ec 3, Fd 3, and Gd 4 probably represent water from this aquifer of two different ages. The analyses show a somewhat higher silica content than those of water from the Aquia formation, and a somewhat lower silica content than the water from well Cc 28 in the Nanjemoy formation. The water from the Nanjemoy-Jackson aquifer is softer than that from well Cc 28; but these samples were taken much farther down dip, and base exchange, due to the presence of glauconite, has probably altered the water from a hard water to a soft and medium-hard water.

It is probable that the water-bearing sands of the Nanjemoy formation and the deposits of Jackson age are hydrologically connected. On the other hand, the aquifers of the Aquia and Nanjemoy formations are separated hydrologically by the persistent Marlboro clay member.

Salt-water encroachment.—The chief danger of salt-water encroachment into Nanjemoy aquifers is from wells drilled close to sea level along the Chesapeake Bay or Patuxent River shore. Due to rapid shore erosion some of these wells now lie under the bay; others are close enough to tide to have their casing perforated by salt water corrosion. Except in the extreme southern part of the county, all drilled wells having an altitude of five feet or less are flowing wells, so there is no danger of encroachment through them. If, however, the aquifers were heavily pumped, water levels in the wells would decline and salt water could then enter the wells. Just how seriously this would affect the aquifers would depend on the amount of pumpage. At present there are no large industries in Calvert County and ground water is used almost entirely for domestic purposes. The danger of encroachment under these conditions is slight.

In the southern part of the county the Eocene aquifers were heavily pumped during the war. As a result some salt-water encroachment took place. Attention was first called to the situation in May 1946. Well Gd 8, drilled in January 1946, was reported to be salty. It was found that the water from well Gd 8 carried 884 parts per million of chloride, and that water from another well (Gd 27) 250 feet to the south contained 3584 parts per million. Well Gd 9, which lies between the two contaminated wells, showed 17 parts per million. R. R. Bennett investigated the situation and concluded "that the presence of the salt water in wells Gd 8 and Gd 27 was caused by heavy pumpage from the Pleistocene sands during 1943–1944 causing the salt water to move into this formation. The salt water corroded the casings or entered the wells through openings at the couplings or moved downward outside the casings. This could occur because the artesian head on the Eocene sands had also been reduced by the pumpage at the Naval establishments."

Heavy pumping stopped in 1945, and water levels in the wells rose. The following record indicates that the contamination is not spreading.

No.	Depth (feet)	Salinity (Cl-p.p.m.)		Remarks
		May 1946	June 1947	
Gd 27	224	3584–2368	—	At strand line.
Gd 8	300	884	386	
Gd 9	300	17	5	Lies about 75 feet south of Gd 8 Lies about 125 feet north of Gd 27
Gd 10	320	—	4	Lies about 100 feet northeast of Gd 27

Rocks of Jackson age.—Rocks of Jackson (upper Eocene) age are not known to crop out anywhere in the Maryland Coastal Plain. Recent work on oil-well and water-well cuttings shows, however, that these rocks are present in the subsurface. Microfossils of Jackson age are found in well samples from Calvert, Dorchester, Somerset,[27] and St. Marys Counties.

A formation of Jackson age in Virginia, there called Chickahominy formation, has been described by Cushman[28] and Cederstrom.[29] The Chickahominy formation cannot yet be definitely correlated with rocks of Jackson age in Maryland.

Detailed descriptions of well samples from the deposits of Jackson age are given in the section on well samples (see Table 4).

[27] Shifflett, Elaine, op. cit., pp. 25–30.

[28] Cushman, J. A., and Cederstrom, D. J., An upper Eocene foraminiferal fauna from deep wells in York County, Virginia: Virginia Geol. Survey Bull. 67, 1945.

[29] Cederstrom, D. J., Selected well logs in the Virginia Coastal Plain north of James River: Virginia Geol. Survey Circular 3, p. 82, 1945.

The deposits of Jackson age are a series of alternating hard lime-cemented beds and unconsolidated sandy shell beds. The hard beds are generally 6 inches or less in thickness and the unconsolidated beds a foot or more. Well cuttings from the deposits are composed of fragments of lime-cemented quartz-glauconite rock; shell fragments, chiefly medium-gray in color; quartz grains and small amounts of fine-grained green-black shiny glauconite. Glauconite is scarce near the top of the deposit, but is fairly abundant near the bottom.

The rocks of Jackson age are overlain by the Fairhaven diatomaceous earth member of the Calvert formation and underlain by the Nanjemoy formation. Both contacts are indicated by the lithologic change in the well cuttings: the upper contact by a change from diatomaceous earth to hard indurated rocks; the lower contact by the change from hard indurated rocks, carrying a fair amount of green-black glauconite, to argillaceous greensand containing much brown glauconite and some yellow-brown stained quartz.

The thickness of the deposits of Jackson age is shown by well logs to range from 15 feet in well Ec 3, the most northerly of the wells in which it is known to occur, to 43 feet in wells in the southern part of the county. On the southern Eastern Shore it is, according to Anderson,[30] 110 feet thick. As cuttings from these deposits are not found in wells Dc 17 at Prince Frederick and Db 3 near Hallowing Point nor in any sampled wells north of these wells, it is assumed that the deposits pinch out between St. Leonard and Prince Frederick.

Nothing very definite is known about the water-bearing properties of the rocks of Jackson age. Physically they are very sandy and carry very little clay; they are, therefore, likely aquifers. Since nearly all the drilled wells in which deposits of Jackson age occur are uncased in both the Jackson and Nanjemoy rocks, it is probable that both formations are yielding water to the wells. Well Gd 34 at Drum Point and wells Gd 4 and Gd 5 at Solomons may be getting their water from rocks of Jackson age only.

Quality of the water.—No analyses were obtained of water known definitely to come from deposits of Jackson age unmixed with water from the Nanjemoy formation. The depth of well Gd 4 at Solomons indicates that it ends in deposits of Jackson age. However, the analysis is very similar to that of Fd 3 which is believed to be of water from both geologic formations. This suggests that the rocks of Jackson age and those of the Nanjemoy formation are hydrologically connected.

MIOCENE SERIES (CHESAPEAKE GROUP)

Calvert formation.—The Calvert formation takes its name from Calvert County because of its typical development there. It is well exposed for many

[30] Anderson, J. L., Cretaceous and Tertiary subsurface geology: Maryland Dept. Geology, Mines and Water Resources, Bull. 2, p. 18, 1948.

miles along the Calvert Cliffs and at places along the Patuxent River. Most of the wells drilled in Calvert County penetrate the Calvert formation.

The Calvert formation is separated lithologically into two members: an upper, the Plum Point marl; and a lower, the Fairhaven diatomaceous earth. The Plum Point marl consists of a rather homogeneous sandy clay, containing several persistent fossil beds. The Fairhaven diatomaceous earth member is characterized by an abundance of diatoms in a fine-grained siliceous and argillaceous matrix. Diatoms are especially abundant near the base of the member. At places a thin sandy bed carrying phosphate nodules, bone, and sea shells lies at the base of the Calvert formation. A sandy bed at the base of the formation is reported by Shattuck at an unspecified locality in Calvert County. In the Kaylor outcrop, the basal bed is a sandy clay. Sandy beds are reported in several well logs (Ca 2, Cc 1).

No attempt was made to determine the Calvert-Choptank contact from well cuttings, as both formations are very similar lithologically.

Foraminifera and diatoms are well preserved in the cuttings and are helpful in determining the age of the rocks. Foraminifera from the Maryland Miocene have been described by Cushman[31] and Dorsey[32] and the diatoms by Lohman.[32a]

No drilled wells in the county are known to be producing water from Calvert rocks. Well logs and surface exposures show that the rocks are very argillaceous and that sand beds are scarce.

Some dug wells in the county are probably getting water from sandy beds in the Calvert and other Miocene formations, as their depths are greater than the thickness of the Pleistocene or Recent deposits in which they start.

Quality of water.—No analyses of water from Miocene rocks were made. The water from dug wells in the Miocene formation should be little different from that from Pleistocene rocks.

Choptank formation.—The Choptank formation is present on the hills underlying the Pleistocene deposits in the northern part of the county. It occurs in and near the bottom of the stream valleys in the central part of the county and passes under the St. Marys formation in the southern part of the county.

Choptank rocks are very similar lithologically to Calvert rocks. Their hydrologic properties in Calvert County are similar. They are probably the source of water for some dug wells.

St. Marys formation.—The sediments of the St. Marys formation crop out in the stream valleys and are obscured by Pleistocene terrace deposits on the

[31] Anderson, J. L., Cretaceous and Tertiary subsurface geology: Maryland Dept. of Geology, Mines and Water Resources, Bull. 2, pp. 214–225, 267–268, 1948.

[32] Anderson, J. L., op cit., pp. 268-321.

[32a] Anderson, L. J., op. cit., pp. 151–187.

uplands in the extreme southern part of the county. Lithologically they are similar to the sediments of the Calvert and Choptank formations.

The St. Marys formation is not an important water producer in Calvert County. Some dug wells probably obtain their water from the sands of this formation.

QUATERNARY SYSTEM

PLEISTOCENE SERIES

Terrace deposits.—Most of the surface of Calvert County is covered by a veneer of Pleistocene sediments. Along the Chesapeake Bay and along the stream valleys these sediments have been eroded to form terraces at several different levels. The origin of these terraces and the materials of which they were formed have been discussed by Shattuck,[33] Cooke,[34] Campbell,[35] Wentworth,[36] Dryden,[37] Flint,[38] and others.

Shattuck separated the Pleistocene series in Calvert County into three formations: the Sunderland (oldest), Wicomico, and Talbot (youngest). The formations, composed of sand, clay, silt, and gravel, form terraces distinguished by their differences in altitude. The Sunderland formation occupies the high central part of the county; the Wicomico, the sides of the valleys; and the Talbot, the shore and near-shore areas of Chesapeake Bay and the Patuxent River.

There is still some doubt as to the origin of the older terraces. The Talbot formation at places contains sea shells and is in part, at least, of marine origin.

The upper terrace deposits of Calvert County consist chiefly of sandy clay and silt. Gravel beds are found at scattered localities and their distribution and strongly cross-bedded texture suggest their deposition by streams. Gravel is more abundant in the southern half of the county than in the northern half.

The Talbot deposits are better exposed than the Sunderland or Wicomico deposits. They consist largely of sand with some gravel. At Dares Beach roughly parallel sand beds make up the formation; and north of Drum Point sticky

[33] Shattuck, G. B., and others, Pliocene and Pleistocene: Maryland Geological Survey, 1906.

[34] Cooke, C. W., Pleistocene seashores: Washington Acad. Sci. Jour., vol. 20, pp. 389–395, 1930.

[35] Campbell, M. R., Alluvial fan of Potomac River: Geol. Soc. America Bull., vol. 42, pp. 825–852, 1931.

[36] Wentworth, C. K., Sand and gravel resources of the Coastal Plain of Virginia: Virginia Geological Survey Bull. 32, 1930.

[37] Dryden, L., The physical features of Charles County: Maryland Dept. of Geology, Mines and Water Resources, 1948.

[38] Flint, R. F., Pleistocene features of the Atlantic Coastal Plain: Am. Jour. Sci., vol. 238, pp. 752–787, 1940.

clay, containing marine sea shells, characterizes the formation. At Drum Point a bed consisting of tree trunks and other vegetable matter is over two feet thick.

The thicknesses of the Pleistocene deposits in Calvert County given by Shattuck are:

Sunderland	40 feet
Wicomico	38 feet

He does not give a thickness of the Talbot formation. At Dares Beach, where the Talbot formation is seen in contact with Miocene rocks, the thickness is 32 feet. The Pleistocene series may, however, be much thicker at places near the Chesapeake Bay and its estuaries. In the Baltimore area, for example, the Pleistocene series attains a thickness of about 150 feet, and in St. Marys County[39] a thickness of about 140 feet. Well Fd 7 in the southern part of Calvert County showed well cuttings of typical Pleistocene sediments to a depth of 132 feet; well Fe 2 at Cove Point, to a depth of 65 feet.

In many wells the base of the Pleistocene deposits is marked by a thin gravel bed. Chert is characteristically present with the quartz gravel. Where the gravel is absent, particularly in the northern part of the county, it is not possible to determine with any degree of certainty the base of the Pleistocene series.

Pleistocene deposits are the source of water for many of the dug wells in the county and for springs; but no drilled wells are known to produce from them. As already noted some of the deep dug wells may get water from the sands of Miocene age. The Pleistocene deposits are usually a reliable source of water as few wells obtaining water from them have been reported to go dry.

Springs are of minor importance as a source of water for domestic or farm use in the county as their production in low and not dependable. Springs commonly occur where the land surface cuts the water table. They are found, therefore, generally along rather steep slopes of stream valleys or along the eroded shore line of Chesapeake Bay and its estuaries. Springs having a strong flow that persists through the year were noted at Sollers.

Quality of the water.—Chemical analyses of water from wells Bb 1, Bb 6, and Db 6 producing from Pleistocene rocks are given in Table 5.

These analyses show that the waters differ from one another and from the waters of the other formations. All the waters are lower in dissolved solids than those from other formations; well Bb 1 yields water very high in iron; and wells Bb 1 and Db 6 yield water high in nitrate. The water from these wells is soft with the total hardness ranging from 0.71 to 28.0 parts per million.

[39] Ferguson, H. F., Ground water resources of St. Marys County: Dept. Geoolgy, Mines and Water Resources Bull. (in press).

WATER-LEVEL FLUCTUATIONS

The following wells have been maintained in Calvert County as observation wells:

Well number	Depth (feet)	Location
Bb 1	44	Dunkirk
Cb 4	31	Route 2; 1.2 mi. south of Huntingtown
Dc 18	26	Prince Frederick
Ec 4	53	Mutual
Ec 5	33	Route 265; 1.2 mi. south of Hardesty Corner. Well dry—Feb. 1950
Fd 14	455±	Back Creek, north of Solomons
Gd 4	251	Solomons (discontinued)
Gd 5	248	Solomons
Gd 6	493	Solomons
Gd 22	+320	Solomons

Wells Gd 5 and Gd 6 are equipped with automatic recorders. The rest of the wells are measured periodically with a steel tape. Half of the wells provide water-level data on shallow non-artesian aquifers and half on artesian aquifers.

Fluctuations in water level in wells are caused by changes in the height of the water table in non-artesian aquifers and to changes in hydrostatic head in artesian aquifers. Fluctuation in non-artesian wells generally follows a seasonal pattern, where there is little or no pumpage, being high in the spring and low in late summer and fall. This seasonal rise and decline has been observed in wells Bb 1, Cb 4, Dc 18, and Ec 4, all of which yield water occurring under water-table conditions.

Fluctuations in artesian wells in Calvert County are not affected by seasonal differences in rate of recharge, for the wells are situated a long distance from the area of outcrop. In Calvert County at the present time there are no areas of heavy pumpage. During World War II, however, the Naval establishments at Solomons were areas of heavy pumpage from the Eocene aquifers. This caused a drop in water level in domestic wells to a level at which shallow well pumps could no longer be used. As the small diameter of the casing in the wells did not permit conversion of the shallow well pumps to deep well pumps, many well owners were forced to put in drive point wells and get their water from Pleistocene sands, or where possible to lower their pump bases. The situation was relieved somewhat when the Naval authorities agreed to confine their heavy pumping to the Aquia greensands. The water level recovered in the Jackson-Nanjemoy aquifer from which most of the domestic wells in Solomons obtain water.

When at the end of the war heavy pumping in the Solomons area ceased, water levels in the artesian wells rose. A record that was made before the selection of the observation wells listed above gives some data on the recovery of the water level at Solomons. The following table shows this recovery in well Gd 2 which is drilled to the sediments of Jackson age and possibly to sands of the Nanjemoy formation.

Water-level measurements—Well Gd 2, Solomons

Date	Depth to water surface (feet)
1944	
9-25	33.45
10-13	30.94
10-20	30.96
10-27	28.22
11-3	30.43
11-13	30.13
11-22	30.37
11-28	29.58
12-18	20.88
1945	
1-30	15.73
4-2	18.18

Observation well Fd 14, located near Solomons but not close to any heavily pumped wells, showed a rise in water level from April 30, 1947, to April 26, 1950, of 10.33 feet. Periodic tape measurements on wells Gd 5 and Gd 6 show very little variation in depth to water level between October 13, 1949, and September 7, 1950. The records of these two wells show also that the water surface in the well tapping the Aquia greensand averages about 8 feet lower than in that tapping the Jackson-Nanjemoy aquifer.

Changes in tide level cause minor fluctuations of water levels in artesian wells near tide water. For example, the amplitude of fluctuations in wells Gd 5 and 6, between low and high tide, generally ranges from about 0.3 foot to 0.6 foot.

In summation, the observation wells tapping water-table reservoirs have fluctuations that range from less than 1 foot (well Dc 18) to over 15 feet (well Bb 1).

Water-level records on the artesian wells, all of which are in the Solomons area, show a recovery in level since heavy pumpage at the Naval establishments ceased. In well Fd 14 the recovery of the water level was approximately complete by June 1948; well Gd 4, by June 1947; and well Gd 22, by May 1947. Well Fd 14 is located much farther from the pumped area than the other two wells.

T

Records of Wells in

Pumping equipment: B, bucket; C, cylinder; J, jet; N, none; S, suction; T, turbine.
Use of water: C, commercial; D, domestic; F, farming; N, not used; P, public supply; S, school or camp; M, military.
Static Water Level: reported depths are designated by a.
Power: E, electric; G, gasoline; H, hand.

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of screen below land surface (feet)	Water-bearing formation
Ba 1	Kaylor Diatomite Plant	—	—	1	Drilled	—	—	—	—
Ba 2	Vernon Whitington	—	1929	43	Dug	8.8	—	—	Pleistocene
Ba 3	—	—	—	55	do	6.85	—	—	do
Bb 1	Gorman Lyons	—	—	144	do	43.5	48	—	Pleistocene-Miocen
Bb 2	Phil Harris	—	—	120	do	28.0	—	—	do
Bb 3	—	—	—	85	do	22.5	—	—	do
Bb 4	—	—	—	186	do	41.8	—	—	do
Bb 5	H. L. Hickey	—	1929	160	do	17.1	—	—	do
Bb 6	G. Smith	—	—	140	do	24.55	—	—	do
Bb 7	D. Rice	—	—	95	do	36.9	—	—	do
Bb 8	B. McKenny	—	1939	185	do	39.0	—	—	do
Bb 9	Earl Hicks	Ward	1950	130	Drilled	285	2½	(none)	Aquia
Bc 1	M. King	—	—	100	Dug	43.8	—	—	Pleistocene-Miocen
Bc 2	Charles M. Emerson	—	1945	145	do	41.0	—	—	do
Bc 3	Chesapeake Beach Water System	—	—	8	Drilled	—	8	—	—
Bc 4	Do	—	—	8	do	—	3	—	—
Bc 5	Do	—	—	8	do	—	—	—	—
Bc 6	Irving Catterton	Ward	1949	160	do	357	2½	(none)	Aquia (?)
Bc 7	Charles Buckmaster	do	1948	104	do	260	2½	do	Nanjemoy
Bc 8	W. J. Earle	Leatherbury	1948	55	do	230	2	do	Nanjemoy
Bc 9	U. S. Navy	Washington Pump & Well Co.	1944	2	do	335	6	—	Aquia
Ca 1	—	—	—	35	Dug	23.05	—	—	Pleistocene-Miocen
Ca 2	Y.M.C.A. of Baltimore	Shannahan	1949	32	Drilled	468	6	(none)	Aquia
Cb 1	R. Smith	—	1937	90	Dug	36.9	—	—	Pleistocene-Miocen
Cb 2	M. Lacey	—	—	140	do	50.9	—	—	do
Cb 3	Ed Cox	—	1944	45	do	26.2	—	—	do
Cb 4	J. Armiger	—	1944	150	do	31.35	—	—	do
Cb 5	Roland H. Trott	—	1922	180	do	44.4	—	—	do
Cb 6	J. Trott	—	—	135	do	34.8	—	—	do
Cb 7	W. E. Jones	—	1945	20	do	27.8	—	—	do
Cb 8	Joseph F. Allen	Leatherbury	1949	98	Drilled	290	2	(none)	Nanjemoy
Cc 1	William E. Day	do	1947	8	Drilled	211	2	do	Nanjemoy

2

County, Maryland

Water level (feet below land surface)			Pumping Equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
atic	Pumping	Date			Gallons a minute	Date				
—	—	—	N	—	—	—	—	N	—	Flowing well
.75	—	Mar. 29, 1949	B	—	—	—	—	D	—	
.34	—	Apr. 5, 1949	B	—	—	—	—	N	—	
.87	—	Jan. 13, 1947	C, H	—	—	—	—	D	56.5	See table of analyses.
.1	—	Mar. 29, 1949	B	—	—	—	—	D	—	Well reported "sometimes dry in hot weather."
.7	—	Mar. 29, 1949	B	—	—	—	—	D	—	
.7	—	Mar. 29, 1949	—	—	—	—	—	D	—	
.67	—	Mar. 31, 1949	B	—	—	—	—	D	—	Well reported "never dry".
.20	—	Apr. 5, 1949	—	—	—	—	—	N	—	See table of analyses.
.75	—	Apr. 5, 1949	B	—	—	—	—	D	—	
.45	—	Apr. 5, 1949	B	—	—	—	—	D	—	Well reported "never dry".
20[a]	—	May 20, 1950	C, E	138	4	May 20, 1950	—	D	—	See table of well logs.
.4	—	Mar. 30, 1949	B	—	—	—	—	D	—	Well reported "never dry".
.3	—	Mar. 29, 1949	B	—	—	—	—	D	—	Do.
—	—	—	—	—	—	—	—	P	—	
—	—	—	—	—	—	—	—	P	—	
—	—	—	—	—	—	—	—	P	—	
92[a]	—	Apr., 1949	C, E	120	3	Apr., 1949	—	D	—	
95[a]	100[a]	Oct., 1948	C, E	—	3	Oct., 1948	0.6	D	—	See table of well logs.
36[a]	—	Oct. 5, 1948	C, H	60	4	Oct. 5, 1948	—	D	—	Do
—	—	—	T, E	—	60	—	—	M	—	Estimated flow: 10–15 gal. a min., July 19, 1950.
.54	—	Mar. 31, 1949	B	—	—	—	—	D	—	
—	23[a]	Nov. 7, 1949	T	—	53	Nov., 1949		S	—	Static level reported 4 ft. above land surface, Nov. 8, 1949. See table of well logs.
.68	—	Mar. 31, 1949	B	—	—	—	—	D	—	Well reported "never dry".
.9	—	Mar. 31, 1949	B	—	—	—	—	D	—	
.05	—	Apr. 6, 1949	B	—	—	—	—	D	—	Well reported "never dry".
.87	—	Apr. 6, 1949	—	—	—	—	—	D	—	Do.
.7	—	Apr. 6, 1949	B	—	—	—	—	—	—	Do.
.12	—	Apr. 6, 1949	B	—	—	—	—	—	—	Do.
.98	—	Apr. 6, 1949	B	—	—	—	—	D	—	Do.
60[a]	—	Mar. 2, 1949	C, E	100	4	Mar. 2, 1949	—	D	—	See table of well logs.
—	8[a]	Nov. 6, 1947	S	21	8	Nov. 6, 1947	0.9	D	—	Static water level reported 1 ft. above land surface, Nov. 6, 1947. See table of well logs.

TABL

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of screen below land surface (feet)	Water-bearing formation
Cc 2	William E. Day	Leatherbury	1947	8	Drilled	211	2	(none)	Nanjemoy
Cc 3	Walter Dresser, Jr.	do	1948	20	do	231	2	do	do
Cc 4	Do	do	1948	20	do	231	2	do	do
Cc 5	B. Trosell	do	1948	8	do	210	2	do	do
Cc 6	A. Seller	do	1949	8	do	210	2	do	do
Cc 7	Willow Beach Development	—	—	5	do	—	—	—	—
Cc 8	Michael Anselmo	Leatherbury	1948	7	do	210	2	(none)	Nanjemoy
Cc 9	—	—	—	152	Dug	33.0	—	—	Pleistocene-Miocen
Cc 10	L. Jenkins	—	—	140	do	30.0	—	—	do
Cc 11	— Ireland	—	—	135	do	25.1	—	—	do
Cc 12	—	—	—	140	do	29.55	—	—	do
Cc 13	—	—	—	110	Dug	31.65	—	—	Pleistocene-Miocen
Cc 14	Mrs. Carpenter	—	—	130	do	60.11	—	—	do
Cc 15	H. Brown	—	—	125	do	47.75	—	—	do
Cc 16	John Harlan	—	1944	130	do	16.00	—	—	do
Cc 17	U. S. Navy	—	1948	112	Drilled	472	6	—	Aquia
Cc 18	Do	Columbia Pump & Well Co.	—	104	do	476	4	462–476	do
Cc 19	Do	Washington Pump & Well Co.	1941	96	do	462	6	448–462	do
Cc 20	Do	Columbia Pump & Well Co.	1944	96	do	500	4	486–500	do
Cc 21	Boy Scouts of America	Ward (?)	1929	8	do	260	2½	—	Nanjemoy
Cc 22	Do	—	1937	8	do	260	2½	—	—
Cc 23	Page Jett	Ward	1950	130	do	356	2	—	Nanjemoy
Cc 24	John Corbett	Leatherbury	1948	29	do	231	2	(none)	do
Cc 25	— Abner	Ward	1948	88	do	268	2½	do	do
Cc 26	Charles M. Cassidy Co.	Leatherbury	1949	8	do	210	2	do	do
Cc 27	Do	do	1949	8	do	210	2	do	do
Cc 28	J. Cranston	Ward	1948	47	do	273	2½	do	do
Cc 29	Mrs. Barr	do	1947	105	do	340	2½	—	do
Cc 30	Frank F. Young	do	1949	60	do	280	2½	(none)	do
Cc 31	Frank Buehler	Leatherbury	1948	20	do	231	2	do	do
Cc 32	A. DeWitt Baker	Ward	1949	35	do	250	2	do	do
Db 1	Ralph E. Buchmeister	—	1924	138	Dug	35	—	—	—
Db 2	— Parran	L. Rude & Son (?)	t939	3	Drilled	365	—	—	Aquia
Db 3	Mrs. Vertz	do	1948	16	do	419	2½	—	do
Db 4	Board of Education	—	—	80	Dug	30	—	—	Pleistocene-Miocen
Db 5	County Courthouse	Washington Pump & Well Co.	—	147	Drilled	552	8	—	Aquia
Db 6	G. Denton	—	—	158	Dug	23.02	—	—	Pleistocene-Miocen
Db 7	Wilton Freeland	—	1935	165	do	33.7	—	—	do
Db 8	Leroy Bowens, Jr.	—	1948	140	do	28.85	—	—	do
Db 9	—	—	—	25	do	15.3	—	—	do

Continued

Water level (feet below land surface)			Pumping equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
atic	Pumping	Date			Gallons a minute	Date				
—	8[a]	Nov. 8, 1947	S	21	8	Nov. 8, 1947	0.9	D	—	Static water level reported 1 ft. above land surface, Nov. 8, 1947.
20[a]	27[a]	Apr. 21, 1948	S	32	5	Apr. 21, 1948	0.7	D	—	See table of well logs.
21[a]	28[a]	Apr. 19, 1949	S	32	5	Apr. 19, 1949	0.7	D	—	
1[a]	14[a]	Apr. 14, 1948	S	21	10	Apr. 14, 1949	0.8	D	—	See table of well logs.
0[a]	12[a]	Apr. 8, 1949	S	21	10	Apr. 8, 1949	0.8	D	—	Do.
—	—	—	N	—	—	—	—	N	—	Measured flow: 1.4 gal. a min., Mar. 30, 1949.
0[a]	15[a]	May 24, 1948	N	—	10	May 24, 1948	0.7	D	—	
.60	—	Apr. 5, 1949	—	—	—	—	—	N	—	
.26	—	Apr. 5, 1949	—	—	—	—	—	D	—	Well reported "never dry".
.62	—	Apr. 6, 1949	B	—	—	—	—	D	—	
.38	—	Apr. 6, 1949	B	—	—	—	—	D	—	
.19	—	Apr. 7, 1949	B	—	—	—	—	D	—	
.9	—	Mar. 30, 1949	—	—	—	—	—	D	—	
.45	—	Mar. 30, 1949	—	—	—	—	—	D	—	
.56	—	Mar. 30, 1949	B	—	—	—	—	D	—	Well reported "never dry".
—	—	—	T, E	—	25	July, 1950	—	M	—	
—	160[a]	—	T, E	—	25	—	—	—	—	
98[a]	160[a]	June, 1944	T, E	—	40	June, 1944	0.6	—	—	
98[a]	90–160[a]	1944	T, E	—	25	1944	—	M	—	
—	—	—	—	—	—	—	—	S	—	Flowing well
—	—	—	—	—	—	—	—	S	—	Do. (?)
74[a]	—	Oct., 1950	C, H	—	—	—	—	D	—	
18[a]	27[a]	June 23, 1948	E	30	8	June 23, 1948	0.9	D	—	See table of well logs.
86[a]	96[a]	Oct. 23, 1948	C	100	3½	Oct. 23, 1948	0.4	D	—	Do.
1[a]	12[a]	Feb. 16, 1949	S	21	10	Feb. 16, 1949	0.9	D	—	Do.
1[a]	12[a]	Feb. 18, 1949	S	21	10	Feb. 18, 1949	0.9	D	—	Do.
2.46	—	June 20, 1949	—	—	3	1949	—	D	—	See tables of well logs and analyses.
—	—	—	—	—	—	—	—	D	—	
65[a]	—	1949	C, H	90	3	1949	—	D	—	
20[a]	28[a]	Apr. 26, 1949	S, E	23	5	Apr. 26, 1949	0.6	D	—	
45[a]	—	Apr 25, 1949	C	—	3	Apr. 25, 1949	—	D	—	
					—					
3.5	—	July 10, 1946	B		—	—	—	D	60	
—	—	—	—	—	—	—	—	D, C	65	Static level: 10.5 ft. above land surface, July 29, 1946. Estimated flow: 8 gal a min., July 29, 1946.
3.03	—	Oct. 13, 1950	S, E	20	10	1948	—	D	—	See table of analyses.
8.65	—	June 9, 1948	—	—	—	—	—	S	—	
120[a]	240[a]	—	T, E	—	75	—	0.6	P	—	See table of well logs and analyses.
2.84	—	Apr. 6, 1949	B	—	—	—	—	D	—	Do.
9.45	—	Apr. 7, 1949	B	—	—	—	—	D	—	
4.21	—	Apr. 7, 1949	B	—	—	—	—	D	—	Well reported "never dry".
4.2	—	Apr. 6, 1949	B	—	—	—	—	D	—	

TABL

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of screen below land surface (feet)	Water-bearing formation
Db 10	S. Rice	—	1944	40	do	14.2	—	—	Pleistocene-Miocen
Db 11	L. R. Roberts	L. Rude & Son	1948	16	Drilled	390	2½	382–390	Aquia
Db 12	— Frisco	Ward	1949	15	do	351	2½	(none)	do
Db 13	James Bowen	—	1948	145	Dug	49.65	—	—	—
Db 14	Mrs. Frank Parran	—	—	3	Drilled	350	—	—	Aquia
Dc 1	— Cassel	—	—	5	do	—	—	—	—
Dc 2	W. D. Dresser	Ward	1930	12	do	204	1¼	(none)	Nanjemoy
Dc 3	M. Kenneth Buckler	Leatherbury	1930	103	do	340	—	—	do
Dc 4	Nowell Dixon, Jr.	do	1945	160	do	350	—	—	do
Dc 5	F. L. Freeland	do	1932	160	do	340	—	—	do
Dc 6	Frank Mister	Bowen	1946	146	Dug	34.2	—	—	Pleistocene-Miocen
Dc 7	J. G. Smith	More	1942	144	do	28	—	—	do
Dc 8	James Gott	Goman	1940	154	do	35	—	—	do
Dc 9	Robert Cairns	—	1937	126	do	—	—	—	do
Dc 10	D. and M. Ramsey	—	—	164	do	60	—	—	do
Dc 11	G. W. Dorsey	Ward	1896	3	Drilled	225	2	—	Nanjemoy
Dc 12	W. D. Dresser	L. Rude & Son	1946	14	do	210	2½	(none)	do
Dc 13	J. G. Smith	—	1931	31	Drilled	—	—	—	—
Dc 14	G. F. Gravatt	—	1942	140	Dug	37	—	—	Pleistocene-Miocen
Dc 15	Do	—	1938	5	Drilled	180	—	—	Nanjemoy
Dc 16	Do	Columbia Pump & Well Co.	1947	96	do	360	6	350–360	do
Dc 17	A. Goldstein	L. Rude & Son	1947	147	do	555	3–1½	543–555	Aquia
Dc 18	do	—	—	147	Dug	25.99	—	—	Pleistocene-Miocen
Dc 19	G. F. Gravatt	—	—	130	Dug	—	—	—	do
Dc 20	Do	—	—	140	Dug	40.37	—	—	do
Dc 21	Vernon Hance	—	—	130	do	34.45	—	—	do
Dc 22	—	—	—	152	do	41.65	—	—	do
Dc 23	Thomas Parran	—	—	130	do	39.55	—	—	do
Eb 1	—	—	—	140	do	38.8	—	—	Pleistocene-Miocen
Eb 2	L. S. Bowen	—	1943	110	do	53.9	—	—	do
Eb 3	C. Cochran	—	1944	125	do	26.35	—	—	do
Eb 4	H. A. Crane		1950	20	Drilled	399	2½	—	Aquia
Ec 1	G. W. Dorsey	Ward	1920	1	Drilled	225	—	—	Nanjemoy
Ec 2	Do	do	1941	3	do	225	2	(none)	do
Ec 3	H. B. Trueman Lumber Co.	Columbia Pump & Well Co.	1946	109	do	345	6	Screen-no depth	do
Ec 4	Mrs. W. W. Ross	—	1903	173	Dug	52.9	—	—	Pleistocene-Miocen
Ec 5	Benjamin Parran	—	—	127	do	32.60	—	—	do
Ec 6	Do	Leatherbury	1947	26	Drilled	233	3–2	(none)	Nanjemoy-Jackson
Ec 7	E. Gantt	—	1945	140	Dug	41.30	—	—	Pleistocene-Miocen
Ec 8	S. L. Barnett	Ward	1948	10	Drilled	273	1¼	—	Nanjemoy-Jackson

-Continued

Water level (feet below land surface)			Pumping equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
Static	Pumping	Date			Gallons a minute	Date				
9.9	—	Mar. 3, 1949	B	—	—	—	—	D	—	Well reported "never dry".
—	—	—	S, E	20	30	1948	—	D	—	See table of well logs.
—	—	—	S, E	—	—	—	—	D	—	Reported flow: 22 gal. a min., June 17, 1949
39.56	—	June 16, 1949	E	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	N	—	Flowing well.
—	—	—	—	—	—	—	—	D	59.5	Measured flow: 2.8 gal. a min., July 2, 1946.
14[a]	—	1930	S, G	—	—	—	—	P	61	Measured flow: 6 gal. a min., July 5, 1946.
—	—	—	C, E	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	D	—	
20–130[a]	—	1946	C, E	—	—	—	—	D	—	
31.3	—	July 12, 1946	B	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	D	—	
56.4	—	July 11, 1946	B	—	—	—	—	D	60	
—	—	—	C, E	25	4	—	—	C	60	Reported flow: 4 gal. a min., Aug. 12, 1946.
—	11	July 15, 1946	S, E	—	40	July 15, 1946	—	P	—	See table of well logs.
15[a]	—	July, 1946	C, E	—	—	—	—	D	—	
5[a]	—	1942	—	—	—	—	—	D	—	
—	—	—	E	—	—	—	—	P	60.5	
73.22	—	May 6, 1947	—	—	40	May 15, 1947	0.8	P	—	
100[a]	150[a]	May 15, 1947								
130[a]	—	July 15, 1947	C	—	3	July 15, 1947	—	D	—	See table of well logs.
18.89	—	July 9, 1947	H	—	—	—	—	N	—	
—	—	—	—	—	—	—	—	D	—	
34.72	—	May 19, 1949	H	—	—	—	—	D	—	
7.88	—	Apr. 7, 1949	B	—	—	—	—	D	—	Well reported "never dry".
34.85	—	May 19, 1949	B	—	—	—	—	D	—	
35.12	—	June 16, 1949	—	—	—	—	—	D	—	
30.39	—	Apr. 7, 1949	B	—	—	—	—	D	—	
36.70	—	Apr. 7, 1949	B	—	—	—	—	D	—	Well reported "never dry".
17.55	—	Apr. 7, 1949	B	—	—	—	—	D	—	Do.
10[a]	—	May 30, 1950	C	28	8½	—	—	F	—	See table of well logs.
—	—	—	—	—	—	—	—	N	60	Measured flow: 5 gal. a min., Jan. 13, 1947. See table of analyses.
—	—	—	C, E	25	—	—	—	P	—	Reported flow: 10 gal. a min.
125[a]	150[a]	Dec. 18, 1946	T, E	—	60	Dec. 18, 1946	2.4	C	—	See tables of well logs and analyses.
43.90	—	Apr. 7, 1947	E	—	—	—	—	D	—	
28.15	—	May 6, 1947	B	—	—	—	—	F	—	
28[a]	60[a]	Apr. 17, 1947	E	80	3	Apr. 17, 1947	0.1	D	—	See table of well logs.
35.85	—	Apr. 7, 1949	B	—	—	—	—	D	—	Well reported "never dry".
5[a]	20[a]	Dec., 1948	S, E	—	15	Dec., 1948	1.0	D	—	See table of well logs.

TABLE

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of screen below land surface (feet)	Water-bearing formation
Ec 9	H. Williams	—	1934	132	Dug	40.34	—	—	Pleistocene-Miocene
Ec 10	E. F. Reynolds	—	1948	140	do	36.00	—	—	do
Ec 11	Carroll C. Wood	—	1942	145	do	44.83	—	—	do
Ec 12	— Gray	—	—	145	do	42.92	—	—	do
Ec 13	—	—	—	105	do	28.74	—	—	do
Ec 14	Bert Bowen	Ward	1948	3	Drilled	250	1½	(none)	Nanjemoy-Jackson age
Ec 15	Harry Parks	do	1947	3	do	268	—	—	do
Ed 1	Y.M.C.A.—Camp Conoy	Shannahan	1931	62	do	540	6–4½–3	520–540	Aquia
Ed 2	—	—	—	2	do	—	—	—	—
Ed 3	—	—	—	2	do	—	—	—	—
Ed 4	M. E. Rockhill	L. Rude & Son	1941	5	do	500	3–2	—	Aquia
Ed 5	J. Cox	Leatherbury	1948	30	do	330	3–2	(none)	Nanjemoy-Jackson age
Ed 6	Robert C. Hall	L. Rude & Son	1948	5	do	274	2½	do	do
Ed 7	Bancroft Estate	—	—	60	Dug	64.25	—	—	Pleistocene-Miocene
Ed 8	Herbert Johnson	—	1944	50	do	36.70	—	—	do
Ed 9	Woodrow Henderson	—	—	95	—	38.08	—	—	do
Ed 10	—	—	—	3	—	—	1½	—	—
Fc 1	George Gross	—	1928	100	Dug	34.10	—	—	Pleistocene-Miocene
Fd 1	U. S. Navy	Washington Pump & Well Co.	1942	21	Drilled	500.3	8–6	476.5–500.3	Aquia
Fd 2	Mrs. Kenneth Lore	L. Rude & Son	1946	20	do	320	2½	(none)	Nanjemoy-Jackson age
Fd 3	D. Barrett	do	1932	3	do	362	1½	do	do
Fd 4	G. D. Wait	Leatherbury	1947	28	Drilled	252	2		Nanjemoy-Jackson age
Fd 5	Harry B. Richardson	L. Rude & Son	1946	20	do	320	3–2½	(none)	do
Fd 6	Mrs. H. Horseman	—	—	6	do	400	1½	—	do
Fd 7	Benjamin Dowell	L. Rude & Son	1946	18.3	do	320	2½	(none)	do
Fd 8	Dowell Cannery	do	1926	0	do	315	2½	do	do
Fd 9	Mrs. Pendarvis	do	1929	5	do	315	1½	—	do
Fd 10	— Nielson	—	—	1	do	—	—	—	—
Fd 11	Do	—	—	20	do	—	—	—	—
Fd 12	Do	—	—	106	Dug	22.35	—	—	Pleistocene-Miocene
Fd 13	C. V. Short	—	—	1	Drilled	—	—	—	—
Fd 14	W. B. Glascock	L. Rude & Son	—	1.3	do	—	1½	—	—

Continued

Water level (feet below land surface)			Pumping equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
Static	Pumping	Date			Gallons a minute	Date				
1.14	—	May 19, 1949	—	—	—	—	—	D	—	
1.94	—	May 19, 1949	—	—	—	—	—	D	—	
2.08	—	June 16, 1949	B	—	—	—	—	D	—	
8.29	—	June 16, 1949	B	—	—	—	—	D	—	
9.55	—	June 16, 1949	B	—	—	—	—	D	—	
4[a]	—	Dec. 15, 1948	S	—	10	Dec. 15, 1948	—	D	—	
—	—	—	—	—	—	—	—	D	—	Static water level reported 1 ft. above land surface, June 16, 1949.
30[a]	—	—	C, E	60	10	July 10, 1944	—	S	—	See table of well logs.
—	—	—	—	—	—	—	—	—	—	Measured flow: 3.8 gal. a min., Aug. 19, 1946
—	—	—	—	—	—	—	—	—	—	Measured flow: 3 gal. a min., Aug. 19, 1946.
—	—	—	—	—	—	—	—	P	—	Estimated flow: 15–20 gal. a min., Oct. 13, 1950.
46[a]	—	May 22, 1948	—	84	4	May 22, 1948	—	D	—	See table of well logs.
—	—	—	H	—	50	1948	—	D	—	Reported flow: 5 gal. a min., 1948. See table of well logs.
54.41	—	May 19, 1949	B	—	—	—	—	N	—	
32.70	—	May 20, 1949	B	—	—	—	—	D	—	
50.43	—	May 20, 1949	B	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	—	—	Flowing well.
25.20	—	May 19, 1949	B	—	—	—	—	D	—	
10.13[a]	161.73[a]	1942	T, E	170	125	1945	0.8	M	—	See table of well logs.
27[a]	—	Apr. 27, 1946	—	—	25	Apr. 27, 1946	—	D	—	
—	20[a]	July 17, 1946	E	—	—	—	—	C	—	Measured flow: ½ gal. a min., Jan. 13, 1947. See table of analyses.
28[a]	40[a]	Apr. 2, 1947	C	100	3	Apr. 2, 1947	0.3	D	—	See table of well logs.
20.59	—	Jan. 13, 1947	E	—	10	1946	—	D	—	Do.
14.0	—	Aug. 12, 1946	S	—	—	—	—	D	59	
25	—	Sept. 6, 1946	J	—	25	Sept. 3, 1946	—	C	—	See table of well logs.
—	—	—	—	—	3	1926	—	N	—	Well flowed when drilled.
—	—	—	—	—	—	—	—	D	—	Do.
—	—	—	—	—	0.86	Apr. 23, 1947	—	N	64	Well formerly used to operate hydraulic ram.
—	—	—	—	—	—	—	—	D	—	
13.55	—	Apr. 23, 1947	—	—	—	—	—	—	50	
—	—	—	—	—	—	—	—	D	64.7	Flow is used to operate hydraulic ram. Measured flow: 2.5 gal. a min., Apr. 23, 1947.
16.40	—	Apr. 30, 1947	N	—	—	—	—	N	—	

TABLE

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well inches)	Depth of screen below land surface (feet)	Water-bearing formation
Fd 15	Roy Minke	L. Rude & Son	1947	18	do	315	2½	(none)	Nanjemoy-Jackson age
Fd 16	Duke Adams	—	—	28	Dug	36	—	—	Pleistocene-Miocene
Fd 17	Do	—	—	28	do	36	—	—	do
Fd 18	Do	—	—	28	do	36	—	—	do
Fd 19	Do	L. Rude & Son	1947	28	Drilled	300	2½	(none)	Nanjemoy-Jackson age
Fd 20	U. S. Navy	do	Before 1942	17	do	—	1½	do	—
Fd 21	W. C. Bond	do	1947	20	do	315	2½	do	Nanjemoy-Jackson age
Fd 22	William Rekar	do	1948	136	do	461	3	do	do
Fd 23	Howard L. Jones	do	1947	30	do	375	3	do	do
Fd 24	William Rekar	—	—	134	Dug	50.81	—	—	Pleistocene-Miocene
Fd 25	Ernest Thompson	—	1945	100	do	45.35	—	—	do
Fd 26	Alec Barrett	—	—	25	do	22.05	—	—	do
Fd 27	Arthur Dowell	—	—	120	do	51.85	—	—	do
Fd 28	Edward Porch	—	1949	120	Dug	38.55	—	—	do
Fd 29	—	—	—	125	do	22.78	—	—	do
Fd 30	—	—	—	115	do	19.0	—	—	do
Fd 31	Sarah C. Glascock	L. Rude & Son	1949	18	Drilled	320	5–3½	(none)	Nanjemoy-Jackson age
Fd 32	U. S. Navy	—	1944	6	do	490	8–6	466–490	Aquia
Fe 1	R. P. McConnell	L. Rude & Son	1946	5	do	320	2½	(none)	Nanjemoy-Jackson age
Fe 2	Irene Michitoff	do	1946	5	do	320	2½	do	do
Fe 3	Edgar Bowen	do	1946	130	do	400–425	3	do	do
Fe 4	Olga Morosoff	do	1946	5	do	320	2½	do	do
Fe 5	Serge G. Koushnareff	do	1946	5	do	320	2½	do	do
Fe 6	— McKencie	—	—	3	do	—	—	—	—
Fe 7	— Ostenso	L. Rude & Son	1948	5	do	315	2½	(none)	Nanjemoy-Jackson age
Fe 8	Don N. Harry	do	1948	5	do	315	2½	do	do
Fe 9	T. A. Mourt	do	1948	5	do	315	2½	do	do
Fe 10	Mrs. L. G. Tomptson	do	1948	5	do	375	2½	do	do
Fe 11	J. B. Gainer	do	1948	5	do	315	2½	do	do
Fe 12	L. DeFord Smith	do	1948	5	do	315	2½	do	do
Fe 13	J. K. Wright	do	1948	5	do	315	2½	do	do
Fe 14	G. W. Hagelin	—	1919	100	Dug	68.50	—	—	Pleistocene-Miocene
Gd 1	G. Francis Beavan	—	—	12	Drilled	275	1½	—	Nanjemoy-Jackson age
Gd 2	T. V. Thomas	—	—	13	do	250	1½	—	do
Gd 3	U. S. Navy	Washington Pump & Well Co.	1942	15	do	247	6	234–247	do
Gd 4	U. S. Navy	Washington Pump & Well Co.	1942	14.5	Drilled	250¾	8	235¾–250¾	Nanjemoy-Jackson age
Gd 5	Do	do	1942	9.5	do	248	8	233–248	do

—*Continued*

Water level (feet below land surface)			Pumping equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
Static	Pumping	Date			Gallons a minute	Date				
35[a]	—	May 24, 1947	J	—	20	May 24, 1947	—	D	—	See table of well logs.
—	—	—	—	—	—	—	—	D	—	
—	—	—	—	—	—	—	—	D, F	—	
—	—	—	—	—	—	—	—	D	—	
25[a]	—	June 4, 1947	J	—	25	June 4, 1947	—	D	—	See table of well logs.
—	—	—	—	—	—	—	—	N	—	Well covered.
38[a]	—	June 25, 1947	J	—	25	June 25, 1947	—	D	—	See table of well logs.
135[a]	—	June, 1948	—	168	5	June, 1948	—	D	—	Do.
45[a]	—	June 15, 1947	C, H	45	30	June 15, 1947	—	D	—	
47.31	—	June 4, 1948	—	—	—	—	—	N	—	
31.50	—	May 20, 1949	—	—	—	—	—	D	—	
12.85	—	May 20, 1949	—	—	—	—	—	D	—	
44.20	—	May 20, 1949	—	—	—	—	—	D	—	
30.10	—	May 20, 1949	—	—	—	—	—	D	—	
10.33	—	May 20, 1949	—	—	—	—	—	D	—	
16.59	—	May 20, 1949	—	—	—	—	—	D	—	
20[a]	47[a]	Apr. 20, 1949	—	90	30	Apr. 20, 1949	1.1	C	—	
—	—	—	T, E	—	—	—	—	—	—	Pump capacity: 200 gal. a min. See table of well logs.
3[a]	—	Apr. 22, 1946	S	—	30	Apr. 22, 1946	—	D	—	
5[a]	17[a]	July 20, 1946	S	—	20	July 20, 1946	1.7	D	—	See table of well logs.
145[a]	150[a]	Apr. 15, 1946	C	150	10	Apr. 15, 1946	2.0	D	—	
5[a]	15[a]	Aug. 13, 1946	S	—	20	Aug. 13, 1946	2.0	D	—	See table of well logs.
5[a]	15[a]	Aug. 9, 1946	S	—	20	Aug. 9, 1946	2.0	D	—	Do.
6[a]	—	—	—	—	—	—	—	—	—	
6[a]	20[a]	1948	S	25	5	1948	0.4	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
6[a]	20[a]	1948	S	25	10	1948	0.7	D	—	
63.93	—	May 20, 1949	B	—	—	—	—	D	—	
29.45	—	Sept. 25, 1944	S	—	—	—	—	D	—	
33.45	—	Sept 25, 1944	S	—	—	—	—	D	—	
20[a]	55[a]	June 19, 1942	T	—	35	1942	—	M	—	
50[a]	—	Jan. 13, 1944			25	1944				
20[a]	85.4[a]	1942	T, E	135.5	120	1942	1.8	M	—	See tables of well logs and analyses.
40[a]	129[a]	1944			100	1944	1.2			
15[a]	85.5[a]	1942	T, E	—	110	1942	1.6	—		See table of well logs.
56.5	131.5	1944			100	1944	1.3		59	

TABLE

Well number	Owner or name	Driller	Date completed	Altitude (feet)	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of screen below land surface (feet)	Water-bearing formation
Gd 6	U. S. Navy	Washington Pump & Well Co.	1942	10	Drilled	493	8–6	469–493	Aquia
Gd 7	Do	Layne-Atlantic	1943	17	do	551	10–8	504–519 531–541	do
Gd 8	Mrs. H. Harrison	Leatherbury	1946	10	do	269	3–2	(none)	Nanjemoy-Jackson age
Gd 9	Mrs. Sadie Webster	L. Rude & Son	1946	7	do	320	2½	do	do
Gd 10	Mrs. Clarence E. Davis	do	1946	3	do	320	2½	do	do
Gd 11	Mrs. A. J. Elliott	do	—	14	do	—	—	—	—
Gd 12	Chesapeake Biological Laboratory	—	1931	14	do	320	3	—	Nanjemoy-Jackson age
Gd 13	T. R. Langley	—	1902	4	do	—	—	—	—
Gd 14	T. E. Waggarman	L. Rude & Son	1946	11	do	320	2½	(none)	Nanjemoy-Jackson age
Gd 15	Preston Woodburn	do	1946	13	do	320	2½	do	do
Gd 16	Calvert Ice Co.	Washington Pump & Well Co.	1943	5	do	505	8–6	494–505	Aquia
Gd 17	Mrs. Mamie Woodburn	L. Rude & Son	1946	8	do	350	2½	(none)	Nanjemoy-Jackson age
Gd 18	Benjamin Woodburn	do	1946	8	do	320	2½	do	do
Gd 19	Alfred Hill	do	1946	8	do	320	2½	do	do
Gd 20	G. Francis Beavan	—	1944	15	Driven	12	—	—	Pleistocene
Gd 21	Kenneth Lore	L. Rude & Son	1947	3.9	Drilled	333.8	2½	(none)	Nanjemoy-Jackson age
Gd 22	Esso Standard Oil Co.	—	—	0.8	do	320	3	—	do
Gd 23	Rupert Olsen	L. Rude & Son	1947	12.8	do	315	2½	(none)	do
Gd 24	Methodist Episcopal Parsonage	Ward	1947	13	do	290	—	—	do
Gd 25	George Cary	L. Rude & Son	1948	8	do	315	2½	(none)	do
Gd 26	U. S. Navy	do	1938	9	do	320	2½	do	do
Gd 27	Edna Davis	—	—	0.8	do	224	1½	—	do
Gd 28	J. C. Webster's Store	L. Rude & Son	—	2	Drilled	—	—	—	—
Gd 29	Rekar's Hotel	—	—	2	do	—	—	—	—
Gd 30	Joseph Lore	L. Rude & Son	1948	5	do	315	5–3½	(none)	Nanjemoy-Jackson age
Gd 31	Preston Woodburn	—	—	13	do	—	—	—	—
Gd 32	Do	—	—	13	Dug	10	—	—	Pleistocene
Gd 33	George Condiff	L. Rude & Son	1948	10	Drilled	315	2½	(none)	Nanjemoy-Jackson age
Gd 34	Drum Point Beach Cooperative	Washington Pump & Well Co.	1949	30	do	285	8	272.5–285	Jackson age
Gd 35	Do	—	—	40	Dug	17.70	—	—	Pleistocene-Miocene
Gd 36	U. S. Navy	Washington Pump & Well Co.	1944	16	Drilled	505	8–6	—	Aquia
Gd 37	B. P. Lankford	L. Rude & Son	1948	13	do	315	3½	(none)	Nanjemoy-Jackson age

—Continued

Water level (feet below land surface)			Pumping equipment	Depth of pump below land surface (feet)	Yield		Specific capacity (g.p.m./ft.)	Use of water	Temperature (°F.)	Remarks
Static	Pumping	Date			Gallons a minute	Date				
0[a]	63.5[a]	1942	T, E	170	135	1942	2.1	—	65.5	See tables of well logs and analyses
58.9[a]	134[a]	1944			150	1944	2.0			
17[a]	100[a]	Feb. 2, 1943	T	160	200	Feb. 2, 1943	2.4	M	—	See table of well logs.
70[a]	139[a]	Feb. 2, 1944			300	Feb. 2, 1944	4.3			
25[a]	36[a]	Jan. 25, 1946	—	63	5	Jan. 25, 1946	0.5	D	—	
16[a]	19[a]	May 3, 1946	S	—	10	May 3, 1946	3.3	D	—	See table of well logs.
15[a]	—	Aug. 23, 1946	S	—	25	Aug. 23, 1946	—	D	—	Do.
—	—	—	E	—	—	—	—	D	—	
26[a]	—	1931	E	—	—	—	—	D	—	Well was flowing in 1942.
0	—	June 18, 1946	E	—	—	—	—	C	—	Do.
23[a]	—	Aug. 20, 1946	J	—	25	Aug. 20, 1946	—	D	—	See table of well logs.
22[a]	—	Aug. 27, 1946	J	—	25	Aug. 27, 1946	—	D	—	
23[a]	—	—	T	—	—	—	—	C	—	
21[a]	—	Sept. 8, 1946	J	—	25	Sept. 8, 1946	—	D	—	See table of well logs.
21[a]	—	Sept. 20, 1946	S	—	25	Sept. 20, 1946	—	D	—	Do.
20[a]	—	Aug. 30, 1946	S	—	25	Aug. 30, 1946	—	D	—	Do.
13.9	—	Apr. 23, 1947	—	—	—	—	—	N	—	
30[a]	—	May 20, 1947	J —	—	15	May 20, 1947	—	D	—	See table of well logs.
18.37	—	May 20, 1947	—	—	—	—	—	N	—	
30[a]	—	May 30, 1947	J	—	25	May 30, 1947	—	D	—	
—	—	—	—	—	—	—	—	—	—	
22[a]	—	1948	S	25	20	1948	—	D	—	See table of well logs.
18.70	—	Nov. 28, 1950	N	—	—	—	—	N	—	Well covered.
14.76	—	May 23, 1946	—	—	—	—	—	N	—	
—	—	—	—	—	—	—	—	C	—	
—	—	—	—	—	—	—	—	C	—	
16[a]	—	1948	—	60	50	1948	—	C	—	See table of well logs.
—	—	—	—	—	—	—	—	N	—	Abandoned because of decline in water level.
27[a]	—	1948	J	40	20	1948	—	D	—	See table of well logs.
45[a]	160[a]	May 10, 1949	C	200	180	May 10, 1949	1.6	P	—	Do.
13.21	—	May 20, 1949	N	—	—	—	—	N	—	
—	—	—	T	—	—	—	—	M	—	See table of well logs.
25[a]	—	1948	—	60	30	1948	—	D	—	Do.

WELL LOGS

Well logs of Calvert County wells are shown in Tables 3 and 4.

The logs are of two general types—drillers' logs (table 3) and sample logs (table 4). The drillers' logs are furnished by the driller upon completion of the well. These logs are very helpful if the driller is careful to note on the log all changes in lithology, color, and hardness of the rock.

The sample logs are made from a study of well cuttings on the following wells: Bb 9, Ca 2, Cc 1, Cc 28, Db 3, Dc 12, Dc 17, Ec 3, Ed 5, Ed 6, Fd 4, Fd 5, Fd 7, Fd 19, Fd 22, Fe 2, Gd 21, and Gd 30. Most of these well cuttings were taken at regular 10-foot intervals as the well was being drilled. These cuttings are first dried and washed, and then studied under a binocular microscope. Their physical character, color, grain-size, mineral and organic content are recorded. From these records, the characteristics of the different formations are determined. For example, a pale-brown clay bed about 20 feet thick marks the bottom of the Nanjemoy; heavily diatomaceous beds, the base of the Calvert formation; many fragments of hard lime-cemented quartz-glauconite rock, deposits of Jackson age, or of the upper part of the Aquia greensand.

The sizing of the sand is obtained by use of a set of standard screens; and the size terms are based on Wentworth's[40] classification. The color terms and color symbols used in Table 4 are from the Rock-Color Chart prepared by the Rock-Color Chart Committee, National Research Council, 1948.

[40] Wentworth, C. K., A scale of grade and class terms for clastic sediments: Jour. Geol., vol. 30, pp. 377–392, 1922.

TABLE 3

Drillers' Logs of Wells in Calvert County

	Thickness (Feet)	Depth (Feet)
Well number: None; exact location at Chesapeake Beach unknown.* (Altitude: 11 feet)		
Muck and sandy loam	18	18
Light-gray clay	42	60
Dark-gray sand	30	90
Not reported. Flowing water, 3 g.p.m.	2	92
Dark-colored glauconitic sand	30	122
Light-gray clay (small flow of water at 165 feet)	43	165
Dark glauconitic sand	103	268
Light-gray micaceous clay	12	280
Reddish-gray clay	5	285
Reddish-gray sand	8	293
Lost; water rises 17 feet above mean tide	47	340
Dark-colored glauconitic sand with shell fragments. Flow of water 10 g.p.m.	3	343

* Log taken from Maryland Geol. Survey vol. x, pt. 2, p. 402.

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Bb 9 (Altitude: 130 feet)		
Marl, blue	116	116
Sand, clayey, black	104	220
Clay, gray and pink	20	240
Clay and sand, black	17	257
Rock, hard	1	258
Sand, black, and rock, hard	25	283
Rock, hard (water under rock)	2	285
Well Cal-Bc 7 (Altitude: 104 feet)		
Clay, light-yellow, and sand, fine	30	30
Clay, gray	30	60
Clay, blue	120	180
Clay, dark-green	60	240
Sand, black, with traces of lime scale	20	260
Well Cal-Bc 8 (Altitude: 55 feet)		
Clay	15	15
Marl	95	110
Sand, black (water)	120	230
Well Cal-Ca 2 (Altitude: 32 feet)		
Sandy	10	10
Clay, sandy, brown	10	20
Clay, sandy, green	10	30
Marl	10	40
Clay, green, with salt and pepper sand; clay, sandy	255	295
Sand, fine	16	311
Clay, green, and shells	23	334
Rock	1.5	335.5
Hard places and free streaks	10.5	346
Crusty places and free places	31	377
Clay and shells	11	388
Hard place	0.4	388.4
Sand, shell, clay streaks	37.6	426
Sand and shells	12	438
Rock	0.3	438.3
Sand, fine	29.7	468
Well Cal-Cb 8 (Altitude: 98 feet)		
Clay, sandy	40	40
Marl, blue	170	210
Sand, salt and pepper (water)	80	290

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Cc 1 (Altitude: 8 feet)		
Sand, coarse	38	38
Marl, sandy	12	50
Marl, blue	40	90
Sand mixed with marl (water)	121	211
Well Cal-Cc 3 (Altitude: 20 feet)		
Clay	20	20
Marl, blue	90	110
Shell, fine, and marl; sand, salt and pepper	121	231
Well Cal-Cc 5 (Altitude: 8 feet)		
Clay	4	4
Sand, white	16	20
Sand with marly clay (water)	23	43
Marl, blue	47	90
Shell, fine, and marl; sand, salt and pepper	120	210
Well Cal-Cc 6 (Altitude: 8 feet)		
Sand, white	22	22
Sand, marly, white, and clay	23	45
Marl, blue	45	90
Shell, fine; marl; sand, salt and pepper	120	210
Well Cal-Cc 24 (Altitude: 29 feet)		
Clay, brown	20	20
Marl, blue	90	110
Marl mixed with shell	20	130
Sand, salt and pepper; some coarse sand (water)	100	230
Well Cal-Cc 25 (Altitude: 88 feet)		
Clay, yellow	30	30
Clay, gray, a little sand	20	50
Clay, blue	130	180
Clay, blue, occasional shell beds	60	240
Sand, black	28	268
Well Cal-Cc 26 (Altitude: 8 feet)		
Sand, coarse	40	40
Marl	50 (?)	90 (?)
Sand and shells	120 (?)	210
Well Cal-Cc 27 (Altitude: 8 feet)		
Sand, coarse	40	40
Marl	50	90
Sand, fine, and shells	6	96
Sand, salt and pepper (water)	114	210

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Db 3 (Altitude: 16 feet)		
Clay, yellow	10	10
Sand	10	20
Gravel	10	30
Clay	30	60
Sand and gravel	20	80
Clay	30	110
Clay and sand, black	58	168
Sand, black, and clay	142	310
Clay, gray	37	347
Clay, pink	10	357
Sand, black	63	420
Well Cal-Db 11 (Altitude: 16 feet)		
Clay, yellow	10	10
Sand	10	20
Gravel	10	30
Clay	30	60
Sand and gravel	20	80
Clay	30	110
Clay, and sand, black	200	310
Clay, gray	37	347
Clay, pink	10	357
Sand, black (water)	33	390
Well Cal-Ec 3 (Altitude: 109 feet)		
Clay, sandy	20	20
Marl, blue	60	80
Marl, sandy	80	160
Shells, marl	30	190
Marl, blue	75	265
Marl, sandy	55	320
Marl, green	14	334
Sand (water)	8	342
Well Cal-Ec 6 (Altitude: 26 feet)		
Sand and gravel	42	42
Marl	158	200
Sand, salt and pepper (water)	33	233
Well Cal-Ec 8 (Altitude: 10 feet)		
Sand, reddish	10	10
Gravel	20	30
Clay, blue	110	140
Clay, blue, and shells	5	145
Rock	1	146
Sand and shell (water)	20	166

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ec 8 (Altitude: 10 feet) *Continued*		
Sand, dark (water)	92	258
Sand, and clay, greenish	15	273
Well Cal-Ed 1 (Altitude: 62 feet)		
Clay	18	18
Sandy	12	30
Marl, hard	50	80
Clay, blue	186	266
Sandy (water)	13′3″	279′3″
Marl or shell	2″	279′5″
Sand, clayey, coarse, light (water)	6″	279′11″
Shell, thick, hard	3′10″	283′9″
Clay	10′2″	293′11″
Sand, coarse (water)	6	299′11″
Clay; then 3 inches of sand	4′5″	304′4″
Clay, sandy (water)	35′5″	339′9″
Not reported	6′3″	346
(Water)	10	356
Not reported; hard sand at 360 feet	4	360
Clay and 9 inches of clay and sand	1′1″	361′1″
Clay	140′11″	502
Sand, hard	13	515
Sand, free; hard crust and fine shell	7′8″	522′8″
Sand, hard, then free sand	4″	523
Sand, coarse (water)	17	540
Well Cal-Ed 5 (Altitude: 30 feet)		
Clay	5	5
Sand	12	17
Sand, coarse	25	42
Sandy marl and marl	168	210
Rock	2	212
Sand, salt and pepper	118	330
Well Cal-Ed 6 (Altitude: 5 feet)		
Sand and shells	10	10
Sand, green	10	20
Clay	2	22
Shells and sand	20	42
Clay and shells	10	52
Clay, green	42	94
Sand and shells	11	105
Clay, green	84	189
Rock	1	190
Sand, gray	22	212
Sand, black	40	252
Sand, brown (water)	22	274

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 1 (Altitude: 20 feet)		
Sand and gravel	55	55
Marl and shells	175	230
Sand, some shells	17	247
Well Cal-Fd 4 (Altitude: 28 feet)		
Sand, fine, white	40	40
Marl, blue	37	77
Rock	1	78
Marl	122	200
Sand and marl	52	252
Well Cal-Fd 5 (Altitude: 20 feet)		
Clay, brown	10	10
Sand and gravel	10	20
Sand, gray, with shells	105	125
Clay, blue	135	260
Sand, black (water)	60	320
Well Cal-Fd 7 (Altitude: 18 feet)		
Clay, brown	10	10
Sand and gravel	10	20
Clay	5	25
Sand, shells, some wood	35	60
Clay, blue	60	120
Gravel	10	130
Clay and sand, green	38	168
Clay, blue	81	249
Sand, gray	36	285
Sand, black (water)	35	320
Well Cal-Fd 15 (Altitude: 18 feet)		
Clay, yellow	15	15
Sand, gray	10	25
Clay, blue	25	50
Sand and shells	60	110
Clay, blue; some shells	90	200
Sand, gray	62	262
Sand, black (water)	53	315
Well Cal-Fd 19 (Altitude: 28 feet)		
Clay, yellow	20	20
Sand and shells	10	30
Clay	7	37
Sand and shells	53	90
Clay, blue	80	170
Sand, gray	20	190
Sand, water	119	309

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 21 (Altitude: 20 feet)		
Sand, yellow, and clay	18	18
Sand, gray	9	27
Clay, blue	8	35
Sand and shells	45	80
Clay and some shells	100	180
Sand, gray	70	250
Sand, black (water)	65	315
Well Cal-Fd 22 (Altitude: 136 feet)		
Clay and sand	10	10
Sand	95	105
Clay, blue	35	140
Sand and shells	70	210
Clay, blue	46	256
Sand and shells	7	263
Clay, green	94	357
Rock	1	358
Sand, gray	41	399
Sand, black	62	461
Well Cal-Fd 32 (Altitude: 6 feet)		
Sand, yellow, and clay	8	8
Clay, blue	68	76
Sand, coarse, and gravel	49	125
Marl	103	228
Sand and rock	42	270
Clay, blue	32	302
Sand	13	315
Clay, very sticky	125	440
Clay, gray, changing to light brown	15	455
Sand (water)	35	490
Well Cal-Fe 2 (Altitude: 5 feet)		
Sand and sea shells	20	20
Clay, gray	5	25
Sand, sea shells, gravel	60	85
Clay, blue mixed with some shell	187	272
Sand, black	48	320
Well Cal-Fe 4 (Altitude: 5 feet)		
Sand and sea shells	20	20
Clay, gray	5	25
Sand, sea shells, gravel	59	84
Clay, blue; some shells	188	272
Sand, black (water)	48	320
Well Cal-Fe 5 (Altitude: 5 feet)		
Sand and sea shells	20	20

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fe 5 (Altitude: 5 feet) *Continued*		
Clay, gray	5	25
Sand, shells, and gravel	59	84
Clay mixed with some shells	188	272
Sand, black	48	320
Well Cal-Gd 4 (Altitude: 14.5 feet)		
Sandy clay	15	15
Sand and gravel	35	50
Marl	178	228
Sand (water)	23	251
Well Cal-Gd 5 (Altitude: 9.5 feet)		
Top soil	2	2
Clay, yellow	8	10
Sand, fine	4	14
Sandy, marl	20	34
Marl, sticky, blue	46	80
Sand	21	101
Marl, blue	6	107
Shells and gravel	5	112
Sandy marl	28	140
Marl, green	77	217
Sand	31	248
Well Cal-Gd 6 (Altitude: 10 feet)		
Clay	15	15
Sand and gravel	25	40
Marl	185	225
Rock, sand, and shells	35	260
Marl	191	451
Sand (water)	42	493
Well Cal-Gd 7 (Altitude: 17 feet)		
Clay, red	15	15
Sand, fine	15	30
Clay, blue, and shells	200	230
Mud, soft, black, and sand	137	367
Sand, black	8	375
Sand, silty, black	25	400
Clay, blue, and sand	66	466
Greensand (water)	59	525
Rock, hard	1	526
Sand, hard	4	530
Trap rock, hard	1	531
Sand, white (water)	11	542
Shale, hard	4	546
Sand, white	5	551
Clay, blue	19	570

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 9 (Altitude: 7 feet)		
Clay, yellow	10	10
Sand, white, and gravel	30	40
Clay with some sand, gray	10	50
Sand, gray	25	75
Shells and sand mixed	25	100
Sand, mixed with clay	20	120
Clay, blue	10	130
Sand, white, with shells	60	190
Sand, black (water)	130	320
Well Cal-Gd 10 (Altitude: 3 feet)		
Sand and clay	10	10
Sand, white, and gravel	15	25
Clay, gray	7	32
Sand, gray, and shells	28	60
Clay, gray	30	90
Sand	10	100
Clay, blue	25	125
Sand, gray	125	250
Sand, black (water)	70	320
Well Cal-Gd 14 (Altitude: 11 feet)		
Clay, brown	12	12
Sand and gravel	10	22
Sand and shells	19	41
Sand, gray	84	125
Clay, blue	80	205
Sand, gray	67	272
Sand, black (water)	48	320
Well Cal-Gd 17 (Altitude: 8 feet)		
Clay, brown	10	10
Sand and gravel	30	40
Sand, sea shells, wood	30	70
Sand and gravel	48	118
Clay, blue	122	240
Sand, gray	45	285
Sand, black (water)	35	320
Well Cal-Gd 18 (Altitude: 8 feet)		
Clay, brown	10	10
Sand and gravel	30	40
Sand, sea shells, some wood	30	70

TABLE 3—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 18 (Altitude: 8 feet) *Continued*		
Sand and gravel	48	118
Clay, blue	122	240
Sand, gray	45	285
Sand, black	35	320
Well Cal-Gd 19 (Altitude: 8 feet)		
Clay, brown	5	5
Sand and gravel; rock at 40 feet	35	40
Sand and shells	20	60
Clay, gray	25	85
Clay, blue	165	250
Sand, gray	50	300
Sand, black (water)	20	320
Well Cal-Gd 21 (Altitude: 4 feet)		
Clay, yellow	15	15
Sand, gray	15	30
Clay, blue	15	45
Sand and shells	47	92
Clay, blue, and some shells	108	200
Sand, gray	115	315
Sand (water)	19	334
Well Cal-Gd 23 (Altitude: 13 feet)		
Clay, yellow	15	15
Sand, gray	10	25
Clay, blue	10	35
Sand and gravel	10	45
Clay	5	50
Sand and shells	60	110
Clay, some shells	80	190
Sand, gray	35	225
Sand, black (water)	90	315
Well Cal-Gd 25 (Altitude: 8 feet)		
Clay, yellow	10	10
Sand, gray	12	22
Clay, gray	6	28
Sand and shells	37	65
Clay, gray	21	86
Sand and shells	24	110
Clay, green	100	210
Sand, gray	60	270
Sand, black	45	315

TABLE 3—*Concluded*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 30 (Altitude: 5 feet)		
Clay, yellow	10	10
Sand, blue	20	30
Clay, blue	15	45
Sand and sea shells	48	93
Clay, blue	107	200
Sand, gray	50	250
Sand (water)	65	315
Well Cal-Gd 33 (Altitude: 10 feet)		
Clay, yellow	11	11
Sand, gray	13	24
Clay	6	30
Sand and shells	33	63
Clay, gray	22	85
Sand and shells	30	115
Clay, green	95	210
Sand, gray	60	270
Sand, black	45	315
Well Cal-Gd 34 (Altitude: 30 feet)		
Sand	38	38
Clay, blue	33	71
Sand and shells	35	106
Marl	143	249
Marl and shells	14	263
Sand (water)	22	285
Well Cal-Gd 36 (Altitude: 10 feet)		
Clay	15	15
Sand, yellow, and gravel	40	55
Marl and sand	180	235
Sand (water)	30	265
Marl	198	463
Sand (water)	37	500
Well Cal-Gd 37 (Altitude: 13 feet)		
Clay, yellow	10	10
Sand, yellow	11	21
Clay, gray	5	26
Sand and shells	39	65
Clay, gray	15	80
Sand and shells	38	118
Clay, green	94	212
Sand, gray	58	270
Sand, black	45	315

TABLE 4

Logs of Wells in Calvert County from Which Well-cuttings Samples Were Obtained

	Thickness (Feet)	Depth (Feet)
Well Cal-Bb 9 (Altitude: 130 feet)		
Recent or Pleistocene series:		
Sand and clay, weak yellowish-orange (10YR/7/6).		
Sand, chiefly fine-grained, but also much very fine-grained; quartz grains, clear, somewhat iron-stained, subrounded to rounded; glauconite, scarce, green-black, smooth, rounded; a little kyanite	10	10
Sand and clay, very pale-brown (10YR/7/3); some gravel		
Sand, chiefly very fine-grained; quartz grains, chiefly clear, some opaque white, subrounded and subangular; altered feldspar, scarce; chert, rare; some iron-cemented quartz aggregates; glauconite, very rare, fine and very fine	10	20
Miocene series:		
Calvert formation:		
Sandy clay, pale-brown (2.5Y/6/2).		
Sand, chiefly fine-grained; quartz grains, clear and cloudy, some black-stained, subangular; glauconite, scarce, very fine; pyrite, rare; bone fragments, common; sponge spicules and shell fragments, scarce	5	25
Sandy clay, sand, gravel, and shell fragments.		
Sand, chiefly fine-grained, but also much medium-grained; quartz, clear, white, cloudy, iron-stained, subrounded to subangular; pyrite, fine-grained, rare; shell fragments, common, chiefly barnacles, rare Pectens; aragonite probably from *Isognomom maxillata;* sharks' teeth; Ostracoda, rare; sponge spicules, common	5	30
Sandy clay, yellowish-gray (5Y/7/2).		
Sand, chiefly fine-grained, but also much very fine-grained; quartz, clear, subangular; glauconite, medium-grained, common, chiefly yellow-green, but also some green-black	10.5	40.5
Sand and clay, yellowish-gray (5Y/7/2).		
Sand, chiefly fine-grained, but also much very fine-grained; quartz, clear; some quartz grains black-stained; bone fragments, rare; sponge spicules, rare	10.5	51
Sandy clay, yellowish-gray (5Y/8/1); some diatomaceous earth.		
Sand, very fine-grained; quartz, chiefly clear; glauconite, rare; muscovite, fairly common; echinoid spines, rare; diatoms, common; Foraminifera, rather common	31.5	82.5
Sand and clay, light olive-gray (5Y/6/2); some phosphate nodules; shell fragments.		
Sand, chiefly fine-grained; quartz grains, chiefly clear, subangular; phosphate nodules and casts, fairly common;		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Bb 9—*Continued*		
some bone fragments and teeth; radiolaria, common, diatoms, scarce	10.5	93
Sandy clay, pale-olive (5Y/6/2.5). Sand, chiefly very fine-grained; quartz, clear; glauconite, very rare; bone fragments, rare	12	105
Sand and clay, weak yellow (5Y/7/3). Sand, chiefly medium and fine-grained; quartz, partly cloudy, subangular; rose quartz, rare; glauconite, rare; phosphate nodules, rare; shell fragments, fairly common; bone, rare	10	115
Eocene series:		
Nanjemoy formation:		
Greensand, olive-gray (5Y/4/1). Sand, chiefly medium-grained; quartz, clear and cloudy, generally green-stained, subangular to subrounded; glauconite, chiefly medium- and fine-grained, but also some coarse and very fine-grained; coarse glauconite, green-black and yellowish-green, botryoidal, smooth, shiny; medium-grained glauconite, yellow-green, botryoidal to rounded; fine-grained glauconite, yellow-green, pellet-like; very fine-grained glauconite, light green, pellet-like; pieces of lime-cemented greensand; some phosphate nodules; pyrite, rare; shell fragments, rare	21.5	136.5
Greensand, olive-gray (5Y/4/1). Sand, chiefly medium-grained; quartz, clear and cloudy, commonly green-stained; pyrite, rare. Cf. sample at 136 for distribution of glauconite	10.5	147
Coarse greensand, olive-gray (5Y/4/1). Sand, chiefly very coarse-grained; quartz, chiefly cloudy and green-stained, rounded; glauconite, very abundant, medium- to very fine-grained, chiefly dusky-green, botryoidal, rounded, and pellet-like	10.5	157.5
Greensand, olive-gray (5Y/4/1). Sand, chiefly medium-grained; abundant glauconite, medium- to fine-grained; muscovite, fairly common	10.5	168
(No sample)	10	178
Clayey greensand, olive-gray (5Y/4/1). Sand, chiefly fine-grained, but also much medium-grained; glauconite, abundant, coarse- to very fine-grained; coarse glauconite, green-black; medium, dusky-green and green-black; fine, dusky- to yellow-green	11	189
Clayey greensand, olive-gray (5Y/4/1). Sand, medium- to fine-grained; glauconite, abundant, coarse- to very fine-grained, dusky-green and yellowish-green	21	210

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Bb 9—*Continued*		
Sand, olive-gray (5Y/4/1); glauconitic.		
Sand, chiefly medium-grained, but also much fine-grained; quartz, clear, some green-stained, subrounded to subangular; glauconite, rather abundant, coarse- to very fine-grained, dusky-green, dull, botryoidal to pellet-like	10.5	220.5
Sandy clay, olive-gray (5Y/4/1).		
Sand, medium- to fine-grained; glauconite about 60 per cent of sample; mica, fine, rather common	10.5	231
Clay, very pale-brown (7.5YR/7.5/2). A little sand and glauconite	10.5	241.5
Eocene series:		
Aquia greensand:		
Greensand.		
Sand, chiefly medium-grained; quartz grains, chiefly dusky-yellow-stained, smooth, rounded; glauconite, about 40 per cent of sample, medium- to very fine-grained, chiefly dusky-green, but some green-black and dusky yellow	21	262.5
Greensand, bluish-gray.		
Sand, chiefly medium-grained, also much fine-grained; quartz grains, chiefly green- and dusky-yellow-stained; glauconite, abundant, coarse- to fine-grained; some Foraminifera	10.5	273
Clayey greensand, light-olive-gray (5Y/5.5/1).		
Sand, chiefly medium-grained; glauconite, fairly abundant, chiefly medium- and fine-grained, green-black and dusky-green, shiny, pellet-like; many fragments of lime-cemented quartz-glauconite rock; Foraminifera, fairly common	15	288
Well Cal- Ca 2 (Altitude: 32 feet)		
Recent and Pleistocene series:		
Sand, gravel, and clay, weak yellowish-orange (10YR/7/3).		
Gravel, chiefly white opaque quartz; sand, quartz, cloudy and clear, subrounded	20	20
Miocene series:		
Sandy clay, pale-olive (5Y/6/2).		
Little sand; quartz, clear, pitted, subangular; glauconite, rare, yellow-green; bone, common; diatoms, common	10	30
Sandy clay-marl, pale-olive (5Y/6/2).		
Sand, chiefly medium- to fine-grained; quartz, clear, subangular; glauconite, fairly common, fine-grained, chiefly light yellow-green; muscovite, fairly common; shell fragments, abundant; bone fragments, fairly common; Foraminifera, fairly common	10	40

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ca 2—*Continued*		
Somewhat sandy clay, pale-olive (5Y/5/2). Little sand; quartz, clear; glauconite, very rare; phosphatic shell-casts, scarce; bone, rare	10	50
Eocene series:		
Nanjemoy formation:		
Clayey greensand, weak-olive (5Y/4/2); micaceous. Sand, chiefly medium-grained; also much fine-grained; quartz, clear, smooth; a little rose quartz; glauconite, fairly common, chiefly fine- and very fine-grained; moderate yellow-green; irregular to pellet-like; muscovite, fairly common	10	60
Glauconitic sand, weak-olive (5Y/4/2); micaceous. Sand, chiefly medium-grained; also much fine-grained; quartz, clear, pitted, subangular to subrounded; rose quartz, rare; glauconite, fairly common, chiefly fine- and very fine-grained, moderate yellow-green, pellet-like; muscovite, rather common	10	70
Clayey greensand, weak-olive (5Y/4/2); micaceous. Little sand, chiefly medium- and fine-grained; quartz, clear, rounded; glauconite, fairly common, chiefly medium- to fine-grained, dark greenish-yellow and green-black, shiny, chiefly pellet-like; muscovite, fairly common	10	80
Clayey greensand, weak-brown (2.5Y/4/2). Sand, chiefly medium- and fine-grained; quartz, clear, subangular to subrounded; a few light-yellowish quartz grains; glauconite, abundant, medium- to very fine-grained, greenish-yellow and dark-green; muscovite, common	10	90
Clayey greensand, weak-olive (5Y/4/2). Sand, chiefly medium- to very fine-grained; quartz, clear and yellow-stained; glauconite, abundant, chiefly medium- and fine-grained, yellow-green, moderate yellow-green, dusky-green, and green-black, botryoidal and rounded to pellet-like; muscovite, rather common	30	120
Clayey greensand, weak-olive (5Y/4/2). Sand, chiefly medium-grained; also much fine-grained; quartz, clear and yellow-stained; glauconite, abundant, chiefly medium- and fine-grained, dusky-green chiefly, some green-black, shiny, botryoidal to pellet-like	10	130
Glauconitic clay, weak-olive (5Y/4/2)	10	140
Clayey greensand, weak-olive (5Y/4/2). Sand, chiefly medium-grained, also much fine-grained; pebbles, few, quartz, smooth rounded (5 mm max. diameter); quartz grains, clear to cloudy, many stained green, smooth, rounded to subrounded; glauconite, very abundant, chiefly medium- and fine-grained, green-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ca 2—*Continued*		
black and dusky-green, shiny, botryoidal, rounded, and pellet-like	20	160
Clay, weak-olive (5Y/4/2); glauconitic. Cf. sample at 160	10	170
Clayey greensand, weak-olive (5Y/4/2). Sand, chiefly medium-, but also much fine-grained; some quartz granules; glauconite, abundant, chiefly medium- and fine-grained, also some coarse-grained, green-black in medium and coarse grade, dusky green in fine grade, botryoidal, rounded, and pellet-like	10	180
Clayey greensand, olive-gray (5Y/4.5/1). Sand, grade about equal amounts of very coarse, coarse, medium; very coarse, chiefly clear, rounded to subrounded quartz grains; glauconite, abundant, chiefly medium- and fine-grained, green-black in coarser grades, dusky-green in finer, botryoidal, rounded, and pellet-like	30	210
Greensand, olive-gray (5Y/4/1). Sand, chiefly medium-grained; glauconite, very abundant in all grades from coarse to very fine; green-black in coarse and medium grade; dusky-green in fine and very fine; botryoidal, rounded, and pellet-like	30	240
Greensand, olive-gray (5Y/4/1); some clay. Sand, chiefly medium grade; glauconite, abundant, coarse-, medium-, and fine-grained, green-black in coarse to dusky-green in fine grade, shiny, botryoidal, rounded, and pellet-like	30	270
Clay, light-olive-gray (5Y/6/1)	10	280
Clay, pale-brown (10YR/6/2)	20	300
Eocene series:		
Aquia greensand:		
(No sample)	10	310
Clayey greensand; some shell fragments. Sand, chiefly medium-grained; quartz grains smooth, rounded, many yellow-stained; glauconite, abundant, chiefly medium-grained, much fine-grained, chiefly dusky-green, some dark yellowish-green, and moderate yellow-brown, botryoidal, rounded, and pellet-like; some shell fragments and pieces of hard lime-cemented quartz-glauconite rock; Foraminifera scarce	10	320
Clay, glauconitic; a few shell fragments	10	330
Clayey greensand, pale-brown (2.5Y/5/2). Chiefly shell fragments and pieces of lime-cemented quartz-glauconite rock; sand, chiefly medium-grained; quartz, clear, subangular to subrounded; yellow quartz grains, few; glauconite, fairly abundant, chiefly medium grade,		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ca 2—*Continued*		
green-black, some yellow-brown, shiny, botryoidal, and rounded; Foraminifera, common	70	400
Clayey greensand, pale-olive (5Y/5/2.5).		
Chiefly pieces of lime-cemented quartz-glauconite rock; many yellow-brown and yellow-stained quartz grains; glauconite, moderate yellow-brown, but in cemented rock, green-black; Foraminifera, fairly common	10	410
Greensand, pale-brown (2.5Y/5.5/2); some clay.		
Sand, chiefly medium-grained; also much fine-grained; quartz, chiefly yellow-stained, subangular to subrounded; glauconite, rather abundant, chiefly medium- and fine-grained, yellow-green and dusky-green, some moderate yellow-brown, rounded, shiny; some shell fragments and pieces of lime-cemented quartz-glauconite rock; Foraminifera, fairly common	32	442
Greensand, light brownish-gray (2.5Y/5/1); many shell fragments.		
Sand, chiefly medium-grained, but also much fine-grained; constituents as in immediately preceding sample; Foraminifera, rather scarce	16	458
(No sample)	10	468
Well Cal-Cc 1 (Altitude: 8 feet)		
Pleistocene series:		
(No sample)	8	8
Sand, weak-yellow (5Y/7/3), and gravel.		
Chiefly coarse gravel, and some coarse to medium sand. Pebbles average about 5 mm in diameter, chiefly quartz pebbles, subangular to subrounded, about 30 per cent transparent, rest cloudy; medium-grained quartz, more rounded	14	22
(No sample)	6	28
Miocene series:		
Calvert formation:		
Clay, sandy, pale-brown (2.5Y/6/2).		
Little sand; grains chiefly medium, but much fine; sand, mostly clear, rounded to subrounded quartz grains; glauconite grains, very rare	4	32
(No sample)	6	38
Clay, sandy, pale-brown (2.5Y/6/2).		
Sand, fair amount; medium- and fine-grained, quartz grains, subangular to rounded; some quartz grains black-stained and having black inclusions; glauconite, rare, dark-green; some bone fragments	4	42
(No sample)	6	48
Sand, clayey, pale-brown (2.5Y/6/2).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Cc 1—*Continued*		
Sand, medium-fine; cf. sample at 42	4	52
(No sample)	6	58
Diatomaceous earth, weak-yellow (5Y/7/2)	34	92
(No sample)	6	98
Sand, pale-olive (5Y/5/2), and shell fragments.		
Chiefly shell fragments; quartz sand, coarse medium-grained; quartz grains generally clear, subangular to subrounded, pitted; bone, little; Foraminifera, few	4	102
(No sample)	6	108
Sand, pale-olive (5Y/5/2), and shell fragments.		
Sand, medium-fine; quartz grains, clear, subrounded, pitted; glauconite grains, light-green, rare; pyrite, a little; bone fragments, few; Foraminifera, very few	4	112
Eocene series:		
Nanjemoy formation:		
(No sample)	6	118
Sand, pale-olive (5Y/5/2.5); a little clay; a few shell fragments.		
Sand, coarse; some brown pebbles (diameter, 6 mm); quartz grains, rounded, pitted; glauconite, medium-grained, yellow-brown; Foraminifera, few	4	122
(No sample)	6	128
Sand, weak-olive (5Y/4/2.5); some clay.		
Sand, chiefly medium-grained, but also much coarse and fine; quartz grains, clear, smooth, rounded and subrounded; glauconite, chiefly medium-grained, brown, a little dark-green, dull, rounded to irregular; a little pyrite; a little muscovite, fine-grained	4	132
(No sample)	6	138
Greensand, weak-olive (5Y/4/2).		
Sand, chiefly medium-grained, but also much fine-grained; glauconite, abundant, chiefly medium- and fine-grained, green-black, irregularly rounded; a little yellow-brown glauconite; quartz, smooth rounded, clear, some grains yellow-stained; a little muscovite; Foraminifera, scarce	4	142
(No sample)	6	148
Clayey greensand, weak-olive (5Y/4/2).		
Sand, medium- and fine-grained; glauconite, very abundant in medium- and fine-grained sizes; glauconite, chiefly green-black, irregular; quartz grains, yellow-stained, rounded; muscovite, rather common; Foraminifera, few	4	152
(No sample)	6	158
Greensand, weak-olive (5Y/4/2).		
Sand, poorly sorted; glauconite, fairly abundant (about 30% of sample), medium- and fine-grained, green-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Cc 1—*Continued*		
black and pale-olive, irregular; quartz, transparent, smooth, shiny, subrounded, somewhat pitted, some of the grains brown-stained; coarse-grained muscovite present, also flakes of green mica; Foraminifera, very few	4	162
(No sample)	6	168
Greensand, weak-olive (5Y/4/2).		
Cf. sample at 162	4	172
(No sample)	6	178
Greensand, olive-gray (5Y/4/1).		
Sand, chiefly medium, but also much coarse and fine; glauconite, abundant, chiefly medium- and fine-grained, chiefly green-black, a little pale-olive, rounded to disk-shaped; quartz, clear, shiny, irregularly rounded to subangular, some grains yellow-tinged; muscovite present, but less than in preceding sample; a little pyrite; Foraminifera, very scarce	4	182
(No sample)	6	188
Clay, olive-gray (5Y/3/1).		
Very little sand	4	192
(No sample)	6	198
Greensand, olive-gray (5Y/3.5/1).		
Cf. sample at 182	13	211
Well Cal-Cc 28 (Altitude: 47 feet)		
Recent and Pleistocene series:		
Sand, very pale-orange (10YR/8/2).		
Sand, chiefly medium- but also much fine-grained	10	10
Sand, weak yellowish-orange (2.5Y/7/3); a little clay.		
Sand, chiefly fine-grained, but also much medium-grained; coarse quartz gravel from 18–21 feet; Foraminifera, scarce	11	21
Miocene series:		
Calvert formation:		
Clayey sand, weak-yellow (5Y/7/2); shell fragments.		
Sand, chiefly fine-grained quartz; Foraminifera, scarce	10.5	31.5
Sand, weak-yellow (5Y/7/3); a few shell fragments.		
Sand, chiefly fine-grained; Foraminifera, scarce	10.5	42
Sandy clay, weak-yellow (5Y/8/2), diatomaceous.		
Chiefly clay; Foraminifera, scarce	10.5	52.5
Clay, weak yellow-green (10Y/6/2); a little sand.		
Foraminifera, scarce	21	73.5
Diatomaceous earth, weak yellow-green (10Y/7/2)	42	115.5
Clayey sand, dusky yellow-green (10Y/5/2); a few shell fragments.		
Sand, chiefly medium-grained, but also much fine-grained;		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Cc 28—*Continued*		
quartz grains, clear, shiny, smooth, but lightly pitted surfaces, subrounded to subangular; a few clear ovoid grains; shell fragments, worn	10.5	126
Eocene series:		
Nanjemoy formation:		
Clayey greensand, pale-olive (5Y/5/2); a few shell fragments.		
Sand, chiefly medium- and fine-grained; quartz, chiefly clear, subrounded to subangular; glauconite (about 50 per cent of sample), chiefly light-green, some green-black, rather irregularly shaped; pyrite, scarce; muscovite, noticeable; Foraminifera, few	21	147
Clayey sand, dusky yellow-green (10Y/5/2)	6	153
Clayey greensand, pale-olive (5Y/5/2).		
Sand, chiefly medium-grained, but also much fine-grained; quartz grains, chiefly clear, but some cloudy and milky, subangular to subrounded; glauconite, much, chiefly fine- and very fine-grained, green-black, a few yellow-green grains, shiny, botryoidal	36	189
Clayey greensand, olive-gray (5Y/4/1).		
Sand, chiefly medium-grained; quartz grains, clear and cloudy, some of them yellow-stained; glauconite, abundant, chiefly fine- and very fine-grained, green-black, shiny, botryoidal	20	209
Greensand, olive-gray (5Y/3/1).		
Sand, chiefly medium but also much coarse-grained; quartz, clear to cloudy, some green-stained, rounded; glauconite, chiefly medium- and fine-grained, a fair amount of coarse-grained, green-black, shiny, botryoidal	23	232
Clayey greensand, olive-gray (5Y/3/1).		
Sand, chiefly medium-grained; quartz, clear and partly cloudy, subangular; glauconite, abundant, chiefly medium- and fine-grained, some coarse-grained	20	252
Clayey greensand, olive-gray (5Y/3.5/1).		
Sand, chiefly medium-grained, but much fine-grained; glauconite, abundant, chiefly medium- to very fine-grained, green-black, rather dull, rounded to botryoidal; Foraminifera, fairly common	10.5	262.5
Clayey greensand, olive-gray (5Y/4/1).		
Sand, chiefly medium-grained; glauconite, abundant, chiefly medium- and fine-grained, a small amount of coarse-grained; Foraminifera, few	10.5	273
Well Cal-Db 3 (Altitude: 16 feet)		
Recent and Pleistocene series:		
Sand, moderate-yellow (2.5Y/7.5/5), clay and gravel.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Db 3—*Continued*		
Much sand, chiefly medium- and fine-grained; pebbles (8 mm max. diameter), chiefly opaque white and gray quartz; quartz sand grains, chiefly cloudy, some iron-stained, some gray; a little muscovite	10.5	10.5
Sand, weak yellowish-orange (10YR/7/5), gravel, a little clay.		
Cf. sample at 10.5; somewhat more and coarse-grained muscovite	10.5	21.0
Sand and gravel.		
Quartz gravel, size up to 8 mm; most grains translucent, iron-stained; some gray quartz	10.5	31.5
Miocene series:		
Calvert formation:		
Sand and a little clay, light olive-gray (5Y/6/1.5); a little gravel; some wood.		
Sand, chiefly fine-grained; quartz grains, chiefly translucent, some clear, a few white opaque, pitted, subrounded; glauconite, scarce, dark-green and yellow-brown, shiny; muscovite noticeable; vivianite, rare; diatoms, rare	21	52.5
Sandy clay, light yellowish-brown (2.5Y/6/3).		
Sand, chiefly medium and fine-grained; quartz, translucent, subrounded; glauconite, scarce, dusky-green, rounded; muscovite, fairly common, coarse- and medium-grained	10.5	63
Sand, light yellowish-brown (2.5Y/6/8).		
Sand, chiefly medium-grained; quartz, clear, smooth, pitted; yellow and rose quartz grains, few; glauconite, fairly common, green-black, dull, smooth rounded	10.5	73.5
Sand, light yellowish-brown (2.5Y/6/3).		
Sand, chiefly coarse- and medium-grained; quartz, translucent, rounded to subrounded, pitted, dull; quartz grains, green-stained, some light-yellow, a few rose quartz; glauconite, fine and very fine-grained abundant, much medium-grained, green-black, rounded, dull; some coarse-grained muscovite; diatoms, rare	10.5	84
Diatomaceous earth, weak-yellow (5Y/8/3).		
Diatoms, abundant; Radiolaria, rare	10.5	94.5
Clay, pale-olive (5Y/5/2.5).		
Not much sand, grade very coarse and very fine; phosphate nodules; many bone fragments; quartz grains, clear, subangular to angular; Radiolaria, common	10.5	105
Eocene series:		
Nanjemoy formation:		
Clayey greensand, olive-gray (5Y/4/1.5).		
Sand, poorly sorted, grade about equal parts from very coarse to very fine; quartz, chiefly cloudy, smooth, ir-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Db 3—*Continued*		
regularly rounded; glauconite, abundant, chiefly medium- and fine-grained, dull green, irregular; muscovite, common; Foraminifera, fairly common, small	10.5	115.5
Clayey greensand, olive-gray; a little gravel. Sand, poorly sorted; chiefly medium- and fine-grained. Cf. sample at 115.5; Radiolaria, few, Foraminifera, scarce and small	10.5	126
Greensand, moderate olive-brown (5Y/4.5/3). Sand, chiefly medium-grained; quartz, clear, subrounded, generally yellow-stained; glauconite about 50 per cent of sample; coarse-, medium-, and fine-grained, olive-brown (2.5Y/4/4), somewhat shiny, irregular; muscovite, fairly common in all grade sizes; Foraminifera, rare	21	147
Clayey greensand, weak-olive (5Y/4/2). Sand, poorly sorted; quartz, smooth, rounded, chiefly yellow-stained; glauconite (about 50 per cent of sample), chiefly medium- and fine-grained, larger sized grains are yellow-brown, smaller sized green-black, dull to barely shiny, rounded to irregular, and pellet-like; a few shell fragments; Foraminifera, scarce and very small	10.5	157.5
Clayey greensand, weak-brown (2.5Y/4/2). Sand, chiefly coarse and medium-grained; a few shell fragments; cf. sample at 157.5; Foraminifera, abundant	10.5	168
Clayey greensand, weak-brown (2.5Y/3/2.5). Sand, chiefly medium-grained; quartz, clear, subrounded, much of it yellow-stained; glauconite, abundant, chiefly medium-grained, chiefly green-black, partly shiny, subrounded, pellet-like in fine grade; Foraminifera, scarce	10.5	178.5
Clayey greensand, brownish-gray (2.5Y/3/1). Sand, chiefly medium-grained; glauconite, abundant, chiefly medium- and fine-grained, green-black, rounded; Foraminifera, fairly common	5	183.5
(No sample)	5.5	189
Clay, olive-gray (5Y/3/1); some glauconite. Small amount of sand, chiefly medium-grained; glauconite, green-black	63	252
Sandy clay, olive-gray; some gravel. (Thin streak of gravel at 257 feet.) Much sand, chiefly very coarse- and coarse-grained; glauconite abundant but less than in immediately preceding samples; glauconite grains green-black, smooth, rounded	10.5	262.5
Clayey greensand, olive-gray (5Y/3/1). Sand, chiefly coarse-grained, but also much medium- and very coarse-grained; quartz, clear, smooth, subrounded to subangular, some grains green-stained; glauconite,		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Db 3—*Continued*		
very abundant, chiefly medium- and fine-grained, but also much coarse-grained, green-black, botryoidal to rounded, partly shiny	31.5	294
Clay, pale-olive (5Y/5/2); glauconitic.		
Sand in small amount; quartz, clear and cloudy, subangular to subrounded, irregular; glauconite, much less than in immediately preceding samples, chiefly fine- and very fine-grained, green-black, rounded and pellet-like, rather dull; Foraminifera, scarce and small	21	315
Clay, light-olive-gray (5Y/6.5/1)	15.5	330.5
Clay, weak-orange (7.5YR/7/3); mixed gray and pale-brown clay	7.5	338
Aquia greensand:		
Greensand and clay, pale-brown (2.5Y/5/2).		
Chiefly medium-grained sand; quartz, subrounded, etched, some yellow-stained grains; glauconite, abundant, chiefly fine- and very fine-grained, green-black, shiny, rounded to flattened	8.5	346.5
Greensand, light brownish-gray (10YR/5/1.5).		
Sand, chiefly medium-grained; quartz, subrounded, irregular, much of it stained moderate-yellow or weak yellowish-orange; glauconite, abundant, chiefly fine- and very fine-grained, green-black, shiny, rounded to irregular, also rare moderate-brown glauconite	10.5	357
Greensand, pale-brown (10YR/5/2.5); fragments of lime rock.		
Sand, chiefly medium-grained; quartz, much of it yellow- or brown-stained, some green-stained; glauconite, abundant, coarse- and medium-grained, chiefly green-black, some moderate-brown, shiny, botryoidal and rounded; fine-grained muscovite fairly common; pyrite, rare; shell fragments, rare	10.5	367.5
Greensand, pale-brown (10YR/5/2); pieces of lime rock.		
Sand, chiefly medium-grained, but also much coarse-grained; quartz grains, irregular, some etched, many stained yellow or green; glauconite, abundant, coarse- and medium-grained, green-black, shiny, botryoidal; fragments of lime-cemented quartz and glauconite; Foraminifera, rare	10.5	378
Greensand, pale-brown (10YR/5/2); pieces of lime rock.		
Sand, chiefly medium-grained, but also much coarse. Cf. sample at 378. Some Bryozoa; small Foraminifera, abundant	21	399
Greensand, pale-brown (10YR/5/2).		
Sand, chiefly medium-grained; quartz grains, clear, subrounded to angular, many green-stained; glauconite, abundant, chiefly coarse- and medium-grained, green-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Db 3—*Continued*		
black, partly shiny, botryoidal to rounded; pyrite, rare; muscovite, scarce; Foraminifera, scarce	20	419
Well Cal-Dc 12 (Altitude: 14 feet)		
Miocene series:		
Calvert formation:		
(No sample)	100	100
Diatomaceous earth, weak-yellow (5Y/8/2)	30	130
Sand; a few shell fragments.		
Sand, chiefly medium-grained; quartz, transparent, pitted, subrounded; medium-gray shell fragments; some bone fragments; Foraminifera, rare and small	10	140
Sandy marl, pale-olive (5Y/6/2); shell fragments, abundant.		
Sand, chiefly medium-grained; quartz grains, clear, showing dark inclusions, smooth, pitted, subangular to rounded; many shell fragments; diatoms, fairly abundant; a few bone fragments	10	150
Eocene series:		
Nanjemoy formation:		
Greensand, pale-olive (5Y/4/2).		
Sand, medium-grained; glauconite, fairly abundant, chiefly medium- and fine-grained, yellow-brown, rounded; quartz grains, clear, subangular, some stained yellow-brown; muscovite, coarse, fairly abundant; a few shell and bone fragments; Foraminifera, common	10	160
Greensand, weak-brown (2.5Y/4.5/3).		
Sand, coarse and medium-grained; glauconite, abundant, yellow-brown in coarse sizes, green-black in very fine size; a few shell fragments; muscovite, fairly common; Foraminifera, rare	10	170
Greensand, pale-brown (2.5Y/5/3).		
Much sand, medium and coarse-grained; cf. sample at 170 feet.		
Sand, predominantly medium and coarse-grained; glauconite, abundant, yellow-brown, shiny; quartz grains, many stained yellow-brown; Foraminifera, rare	40	210
Well Cal-Dc 17 (Altitude: 147 feet)		
Recent and Pleistocene series:		
Sand, dusky yellowish-orange (7.5YR/5.5/6), and a little clay.		
Sand, chiefly coarse- and medium-sized; rounded quartz grains, somewhat iron-stained	3	3
Pleistocene series:		
Sand, dusky yellowish-orange (7.5YR/5.5/6), and a little clay.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Dc 17—*Continued*		
Sand, chiefly coarse- and medium-sized quartz grains	3	6
Sand, dusky yellowish-orange (7.5YR/5.5/6), and a little clay.		
Sand, chiefly coarse; some fine-grained, subangular quartz grains	3	9
Sand, dusky yellowish-orange (7.5YR/6/8), and a little clay.		
Sand, chiefly medium-sized quartz grains, subangular to rounded; much of the quartz is translucent	3	12
Sand, dusky yellowish-orange (7.5YR/6/8), and a little clay.		
Sand, chiefly medium-sized, subangular to rounded quartz grains	3	15
(No sample). Drill encountered heavy gravel at 17 feet, and well lost circulation; casing driven to 22 feet. The gravel probably marks the base of the Pleistocene series	6	21
Miocene series:		
Sand and clay, light yellow-brown (2.5Y/6/4); some shell fragments.		
Sand, medium- to fine-grained, subrounded quartz grains	1	22
Sandy clay, light olive-gray.		
Sand, fine- and very fine-grained; Foraminifera, rare; echinoid spines, rare	10.5	32.5
Sandy-clay marl, light olive-gray (5Y/5/1); (shell bed from 38 to 43 feet).		
Sample predominantly shell fragments; pecten, barnacle, and mother-of-pearl fragments, common; also pieces of bone; Foraminifera are very rare and very small; quartz grains, fairly abundant, brilliant	10.5	43
Sand, yellowish- to light olive-gray (5Y/6.5/1); many shell fragments.		
Sand, chiefly medium and fine-grained quartz, much of it transparent and brilliant; Foraminifera, rare	10.5	53.5
Sand, light olive-gray (5Y/6/1); shell fragments.		
Sand, fine-grained; much mother-of-pearl	10.5	64
Sandy clay, light olive-gray (5Y/6.5/1); some shell fragments.		
Sand, chiefly fine- and very-fine grained quartz; Foraminifera, rare and very small	10	74
Sandy clay, weak-yellow (5Y/7/2).		
Sand, medium and fine-grained quartz; much of the quartz is sparkling; Foraminifera, rare and very small	10.2	84.2
Sandy clay, pale-olive (5Y/6.5/2).		
Sand, predominantly very fine-grained; Foraminifera, rare and small	10.5	94.7

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Dc 17—*Continued*		
Sandy clay, weak-yellow (5Y/7/2).		
Sand, very fine-grained; Foraminifera, common	10.5	105.2
Sandy clay, light olive-gray (5Y/6/2); some shell fragments.		
Sand, fine- and very fine-grained; Foraminifera, common..	10.6	115.8
Sandy clay, pale-olive (5Y/6/2).		
Little sand in sample; Foraminifera, abundant	11.6	127.4
Sandy clay, pale-olive (5Y/5/2.5).		
Little sand in sample; Foraminifera, abundant	10.2	137.6
Sandy clay, pale-olive (5Y/5/2.5); shell fragments; hard, cemented material.		
Sand is medium and fine-grained quartz; Foraminifera, common. Drill encountered hard bed at 144 feet, followed by sea shell bed	10.2	147.8
Sand and clay, pale-olive (5Y/6.5/2); shell fragments abundant starting at 156 feet.		
Chiefly shell fragments, much mother-of-pearl; Foraminifera, fairly common	10.4	158.2
Sandy clay, pale-olive (5Y/6.5/2); shell fragments abundant ending at 167 feet.		
Chiefly shell fragments; sand, medium-fine-grained; Foraminifera, scarce and small; Ostracoda, rare	10.4	168.6
Sandy clay, dusky-yellow (5Y/6/3).		
Sand is fine- and very fine-grained quartz; a little fine muscovite; Foraminifera, rare and very small	10.5	179.1
Sandy clay, weak-yellow (5Y/7/2.5); shell fragments.		
Sand, fine- to very fine-grained; Foraminifera, scarce, small	10.5	189.6
Sandy clay, weak-yellow (2.5Y/7/2).		
Sand, very fine quartz grains; Foraminifera, scarce, small	9.9	199.5
Sandy clay, weak-yellow (5Y/7/2.5).		
Sand, very fine-grained; a few shell fragments; a little muscovite; Foraminifera, fairly common	9.9	209.4
Diatomaceous earth, weak-yellow (5Y/7/2.5).		
Diatoms, abundant; Foraminifera, rare	10.5	219.9
Diatomaceous clay, pale-olive (5Y/6/2).		
Diatoms, abundant; Foraminifera, fairly common, small	10.5	230.4
Diatomaceous earth, weak-yellow (5Y/7/2).		
Diatoms, abundant; Foraminifera, common	10.2	240.6
Clay and sand, pale-olive (5Y/6/2); some shell fragments; clay to 246 feet, followed by sand.		
Sand, chiefly quartz of coarse- and medium-grain; most of the quartz transparent; some carries black irregular inclusions	10.7	251.3

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Dc 17—*Continued*		
ocene series:		
Nanjemoy formation:		
Sandy, glauconitic clay, pale-olive (5Y/5/2); some shell fragments.		
Much sand, predominantly medium-grained, but also much fine-grained; glauconite, rather abundant (60 per cent), green-black, somewhat shiny; quartz is generally clear; a little pyrite and muscovite; a little lime-cemented quartz and glauconite; Foraminifera, rare, small; hard bed at 256 feet	9	260.3
Clayey greensand, light olive-gray (5Y/5/1); much sand.		
Sand, predominantly medium-grained; glauconite, chiefly fine-grained, some medium-grained, green-black and a little moderate-green and moderate-yellow-brown, rounded and irregular; quartz, chiefly clear, some yellow-stained, subrounded, pitted; pieces of lime-cemented quartz and glauconite; a little muscovite and pyrite	9.3	269.6
Clayey greensand, pale-olive (5Y/5/2).		
Sand grade, medium-coarse; glauconite, about 50 per cent weak brown (10YR/3/2) in coarse grains, green-black in fine grains, smooth, irregular; quartz, smooth, subrounded, much of it stained yellow-brown, much of it carrying black inclusions; a little muscovite; Foraminifera, rare, small	21	290.6
Clayey greensand, sticky, olive-gray (5Y/4.5/1).		
A fair amount of sand in sample; grain size ranges from very coarse to very fine; glauconite, moderate yellowish-brown (10YR/5/3) in coarse sizes, green-black in fine sizes; glauconite, most abundant in fine sizes; Foraminifera, rare	9.5	300.1
Clayey greensand, pale-olive (5Y/5/2).		
More sandy than preceding sample; grain size, medium-fine; glauconite, about 50 per cent; little coarse glauconite, mostly medium-fine grain; coarse glauconite, yellow-brown, rest chiefly green-black and olive-green, shapes irregular; some quartz grains, yellow-stained, some green-stained; muscovite, fine-grained, little; Foraminifera, rare	9.5	309.6
Clayey greensand, pale-olive (5Y/5/2).		
Cf. sample at 309.6, but muscovite more abundant; Foraminifera, common	9.8	319.4
Clayey greensand, light olive-gray (5Y/5/1); shell fragments.		
Sample very sandy; grain size predominantly medium; shell fragments, fairly abundant; glauconite, more than 70 per cent, chiefly in medium size, pellet-like, dark-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Dc 17—*Continued*		
green and yellow-green; very little quartz; Foraminifera, common	4.6	324
(No sample)	1	325
Greensand, olive-gray (5Y/4/1); a few shell fragments. Grain size chiefly medium, but also much fine; glauconite, abundant, chiefly medium- to very fine-grained, little coarse; glauconite, disk-like and pellet-like, green-black, a few yellowish-green grains; quartz, smooth, transparent, subrounded, little of it yellow-stained; muscovite, fine-grained, rather abundant	10.2	335.2
Clayey greensand, weak-olive (5Y/3/2). Cf. sample at 335.2	10.2	345.4
Clayey greensand, weak olive-green (10Y/3/2). Very sandy, grain size chiefly medium, but also much coarse and very fine; glauconite, abundant in all sizes; glauconite, predominantly green-black, partly rounded, botryoidal, and disk-like in coarse size, irregular and shot-like in fine size	10.6	356
Clayey greensand, weak olive-green (10Y/3/2). Very sandy, chiefly medium-grained; glauconite, abundant; cf. sample at 356	41.9	397.9
Clayey greensand, olive-gray (5Y/4/1). Very sandy, chiefly medium-grained sand; glauconite, very abundant in all sizes except very coarse; glauconite, green-black, botryoidal, some disk shapes; quartz, chiefly in fine and very fine sizes; muscovite, fairly abundant, fine-grained	21	418.9
Clayey greensand, olive-gray (5Y/3.5/1). Very sandy, chiefly medium-grained; glauconite, abundant, botryoidal to disk-shaped, green-black, dull; Foraminifera, very rare	21	439.9
Clayey greensand, light olive-gray (5Y/5/1). Very sandy, chiefly medium-grained, but also much fine; glauconite forms about 50 per cent of the sample and is green-black	10.5	450.4
Clayey greensand, olive-gray (5Y/3.5/1). Very sandy, chiefly medium-grained, but much coarse- and fine-grained; glauconite, abundant, green-black, irregular to rounded; fine-grained muscovite present; Foraminifera, very rare	21	471.4
(This sample contains material from both the Nanjemoy and Aquia formations.)		
Clayey greensand and pale-olive (5Y/5/2.5) clay; some pale-brown clay.		
The base of the Nanjemoy formation is probably marked by a hard cemented rock at 476 feet depth.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Dc 17—*Continued*		
The washed residue is chiefly medium-grained sand; glauconite forms over 50 per cent; glauconite, green-black, rounded, botryoidal, shiny, shot-like in medium and fine grain; quartz, subangular, transparent, some grains yellow- or green-stained; some hard, cemented fragments	10.5	481.9
Eocene series:		
Aquia greensand:		
Greensand and pale-olive clay.		
Cf. sample at 481.9; Foraminifera, very rare	10.5	492.4
Clayey greensand, light-olive-brown (5Y/5/3); some hard lime-cemented fragments; sea shells at 493 feet.		
Sand grain chiefly medium; glauconite, about 50 per cent medium and fine grain, green-black, a few yellow-brown and dark yellowish-green grains; quartz grains subangular, many yellow-stained, some green-stained; Foraminifera, very rare	10.5	502.9
Clayey greensand, pale-olive (5Y/5/2.5).		
Very sandy, predominantly medium grain; glauconite, about 65 per cent of the sand; glauconite, green-black, shiny, botryoidal to rounded; quartz, subangular, transparent, much of it etched, some stained yellow-brown; some muscovite, very fine-grained; Foraminifera, very rare	10.5	513.4
Clayey greensand, pale-olive (5Y/5/2); many pieces of lime-cemented quartz and glauconite.		
Grain size of sand predominantly medium; glauconite, abundant, green-black, shiny, rounded; quartz, subangular, some of it yellow-brown and green-stained; Foraminifera, very rare; Ostracoda, rare	10.4	523.8
Glauconitic clay, pale-brown (2.5Y/5.5/2); some shell fragments; a few pieces of lime-cemented quartz and glauconite grains.		
Little sand, medium-grained; glauconite, abundant, green-black, botryoidal to rounded; quartz grains etched, transparent; echinoid spines; some Ostracoda; Foraminifera, abundant	31.5	544.8
Clayey greensand, pale-brown (2.5Y/5/2), much lime-cemented material.		
Very sandy, grains chiefly medium; glauconite, abundant, medium grain, yellow-brown chiefly, some olive-green and green-black, shiny, pellet-like to botryoidal; quartz grains, angular to subrounded, some of them yellow-stained; pieces of lime-cemented yellow-brown glauconite and quartz; Foraminifera, scarce	10.5	555.3

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ec 3 (Altitude: 109 feet)		
Recent and Pleistocene series:		
Coarse sand, dark yellowish-orange (7.5YR/6/8); a little gravel.		
Gravel, chiefly quartz, 5 mm maximum diameter, smooth, rounded to sharply angular, cloudy; a few pieces of chert, grains much iron-stained; sand, grain chiefly coarse	10	10
Miocene series:		
Sand and clay, dark yellowish-orange (10YR/6/6).		
Sand, chiefly fine-grained, rounded, pale milky and gray	10	20
Clay and sand, dusky yellowish-orange (7.5YR/6/6).		
Little sand; sand chiefly fine-grained, greatly iron-stained	10	20
Sand and clay, dusky yellowish-orange (7.5YR/6/6).		
Sand, rather abundant, fine-grained; quartz grains, battered, translucent and transparent	10	40
Clay and sand, dusky yellowish-orange (7.5YR/6/6).		
Sand grain, fine to very fine; quartz, subrounded, rather dull, translucent, grains greatly iron-stained	10	50
Clay and sand, pale-brown (2.5Y/6/3); a few shell fragments.		
Little sand, grain very fine	10	60
Clay, light olive-gray (5Y/5.5/1)	10	70
Sandy clay, pale-olive (5Y/5.5/2.5); fragments of hard lime-cemented quartz grains.		
Sand, chiefly fine-grained; most of sample hard pieces of lime-cemented quartz grains; quartz, smooth, subrounded to subangular, pitted; a few shell fragments; a little bone	10	80
Sandy clay, light brownish-gray (2.5Y/5/1); some shell fragments.		
Much sand, chiefly fine-grained; quartz grains, clear, subangular to subrounded, pitted; shell fragments chiefly pieces of pectens and barnacles; Foraminifera, scarce	10	90
Marly clay, light brownish-gray; many shell fragments and pieces of hard rock.		
Little sand, chiefly fine-grained	10	100
Sandy clay, light olive-gray (5Y/6/2).		
Little sand, chiefly fine-grained; quartz, clear, pitted, subrounded; a few shell and bone fragments; a few echinoid spines; Foraminifera, common	20	120
Sandy clay, light olive-gray (5Y/6/2).		
Much sand, chiefly fine-grained; quartz, clear, subangular, pitted; diatoms, few	10	130
Sandy clay, light olive-gray (5Y/6/2).		
Little sand; muscovite, common; Foraminifera, rare	10	140
Clay, slightly sandy, pale-olive (5Y/6/2.5).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ec 3—*Continued*		
Diatoms, few; Foraminifera, common	5	145
Clay, slightly sandy, pale-olive (5Y/6/2).		
Diatoms, common	10	155
(No sample)	10	165
Clay, slightly sandy, pale-brown (2.5Y/5/2).		
Diatoms, scarce; Foraminifera, rare	10	175
Clay, weak-brown (2.5Y/4/2.5); a few shell fragments.		
Foraminifera, very rare	10	185
Shell fragments, clay, and sand, light brownish-gray.		
Sand, fine-grained; quartz, clear, pitted, angular to subangular	10	195
Diatomaceous earth, light brownish-gray (5Y/6/5)	5	200
Diatomaceous earth, yellowish-gray (5Y/8/2)	20	220
Diatomaceous earth, pale-olive (5Y/6/2.5); somewhat sandy	30	250
Diatomaceous earth, yellowish-gray	10	260
Diatomaceous earth, light olive-gray (5Y/6/2).		
A tooth and a piece of bone; phosphate internal cast of gastropod shell	10	270
Eocene series:		
Deposits of Jackson age:		
Sand, pale-brown (2.5Y/5/2); little clay.		
Sand, medium- and fine-grained; quartz grains, smooth, transparent, irregular to subrounded, much pitted; bone fragments, scarce; Foraminifera, rare; a hard bed at 275 feet	10	280
Sand, pale-brown (2.5Y/5/2); a little clay; a few shell fragments.		
Sand, medium-grained; quartz grains, clear, subangular, smoothly rounded edges, black inclusions in a few grains; pieces of hard lime-cemented sand; a little pyrite	4	284
Sandy clay, pale-brown (2.5Y/5/2).		
Sand, medium- and fine-grained; quartz grains, rounded, smooth and pitted; glauconite, scarce, chiefly fine-grained, light and dark green, rounded and botryoidal; muscovite, fairly common; a little pyrite; Ostracoda, rare; Foraminifera, scarce	6	290
Nanjemoy formation:		
Sandy clay, weak-brown (2.5Y/3/2).		
Sand grade, medium and fine; glauconite, abundant, yellow-brown, botryoidal to irregular, somewhat shiny; quartz, chiefly coarse-grained, subrounded, much of it yellow-stained; Foraminifera, fair	10	300
Sandy clay, weak-brown (2.5Y/3/2).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ec 3—*Continued*		
Little sand, grade medium and fine; glauconite, yellow-brown, smooth rounded, and botryoidal rounded; quartz grains, chiefly yellow-stained; Foraminifera, rare.	20	320
Greensand, weak-brown (2.5Y/4/4), clayey.		
Sand, fair amount, grade medium- and fine-grained; glauconite, fairly abundant, chiefly medium-grained; yellow-brown and olive, smooth, irregularly rounded	7	327
Greensand, moderate yellowish-brown, clayey; a few shell fragments.		
A fair amount of sand, coarse-grained; glauconite, fairly abundant, chiefly medium- and fine-grained, yellow-brown, a few green-black grains, rounded, partly shiny; quartz, subangular, clear, some grains yellow-stained	8	335
(No sample)	5	340
Clayey greensand, moderate yellow-brown (10YR/5/6.5); a few shell fragments.		
Sand, grain coarse and medium; glauconite, abundant, yellow-brown.		
At 345 feet a layer of gravel and granules (thickness not known); about 50 per cent of this material is +2 mm, the maximum 5 mm	5	345
Well Cal-Ed 5 (Altitude: 30 feet)		
Pleistocene series:		
(No sample)	8	8
Sand and clay, weak yellowish-orange (10YR/7.5/5).		
Sand, chiefly fine-grained; some medium- and very fine-grained; quartz grains, clear and cloudy, subangular to subrounded, a few white opaque grains	4	12
(No sample)	6	18
Sand and clay, weak yellowish-orange (10YR/7.5/5).		
Sand, poorly sorted, very coarse- to medium-grained; quartz granules, common; quartz sand grains, rounded to subangular; a few rounded gray quartz grains	4	22
(No sample)	6	28
Sand and a little clay, weak yellowish-orange (2.5Y/8/5).		
Sand, chiefly medium-grained, but also much fine-grained; quartz grains, clear and brilliant, pitted, subangular; some grains slightly iron-stained	4	32
(No sample)	6	38
Sand and a little clay, yellowish-gray (5Y/7.5/2).		
Sand, medium- and fine-grained; quartz, clear, brilliant, chiefly subangular	4	42
Miocene series:		
(No sample)	6	48
Clay and sand, weak-yellow (5Y/7/2).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ed 5—*Continued*		
Sand, chiefly fine and also much very fine; quartz grains, subrounded, pitted; some quartz grains brilliant, some stained black	4	52
(No sample)	6	58
Clay and sand, pale-olive (5Y/6.5/2); a few shell fragments.		
Sand, chiefly fine-grained	4	62
(No sample)	6	68
Sandy clay, pale-olive (5Y/6.5/2); many shell fragments.		
Sand, chiefly fine-grained; many shell fragments; a few pieces of bone	4	72
(No sample)	6	78
Sandy clay, pale-olive (5Y/6/2); shell fragments.		
Sand, chiefly fine	4	82
(No sample)	6	88
Clay, pale-olive (5Y/6/2.5)	34	122
(No sample)	6	128
Sandy clay, pale-olive (5Y/5/2.5); many shell fragments.		
Sand, chiefly medium- and fine-grained quartz; many shell fragments and clay aggregates	24	152
(No sample)	6	158
Sandy clay, weak-yellow (5Y/7/2).		
Sand, chiefly fine-grained quartz; quartz, clear, pitted, subangular	4	162
(No sample)	6	168
Sandy clay, pale-olive (5Y/6/2).		
Sand, chiefly fine-grained quartz; quartz, clear, pitted, subangular; many of the quartz grains are black-stained	4	172
(No sample)	6	178
Diatomaceous earth and clay, weak-yellow (5Y/7/2)	44	222
Eocene series:		
Deposits of Jackson age:		
(No sample)	6	228
Clayey sand, light olive-gray (5Y/6/1); many fragments of lime-cemented quartz rock.		
Sand, chiefly medium-grained; quartz, clear, smooth, subrounded to subangular; many quartz grains carry inclusions; glauconite, fairly common, chiefly fine-grained, green-black, very shiny; lime-cement, chiefly brown; pyrite, common	14	242
(No sample)	6	248
Nanjemoy formation:		
Greensand, olive-gray (5Y/4/1).		
Sand, poorly sorted, very coarse- to fine-grained; quartz grains, clear, stained yellow-brown; glauconite, very abundant, coarse- to very fine-grained, yellow-brown, shiny, rounded; pyrite, scarce, fine-grained; fragments		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ed 5—*Continued*		
of lime-cemented quartz-glauconite rock, fairly common	4	252
(No sample)	6	258
Clayey greensand, light olive-gray (5Y/5/1).		
Sand, chiefly medium-grained, but also much coarse- and fine-grained. Cf. sample at 252 for constituents	4	262
(No sample)	6	268
Clayey greensand, olive-gray (5Y/4.5/1).		
Sand, chiefly medium- and fine-grained; glauconite, very abundant, coarse- to very fine-grained, chiefly yellow-brown, but a little dark-green, shiny, rounded, some botryoidal grains; quartz, rather scarce, chiefly yellow-stained; mica, noticeable	4	272
(No sample)	6	278
Clayey greensand, olive-gray (5Y/4/1).		
Sand, poorly sorted, very coarse-, medium- and fine-grained fractions are about equal; very coarse part chiefly granules; glauconite, abundant, brown, shiny, smooth, rounded	4	282
(No sample)	6	288
Greensand, olive-gray (5Y/4.5/1) and weak-brown (10YR/5/2).		
Sand, chiefly very coarse, but also much coarse; very coarse part chiefly quartz of granule size, smooth, yellow-stained; coarse part about 20 per cent glauconite, brown, very shiny, botryoidal and rounded; quartz, yellow-stained, smooth; glauconite in medium part, brown, very shiny	4	292
(No sample)	6	298
Clayey greensand, light olive-gray (5Y/5/1).		
Sand, chiefly medium- and fine-grained, but also much coarse; quartz, chiefly clear, yellow-stained, smooth, round; glauconite, chiefly fine- and very fine-grained, but also much medium, chiefly brown, some dark-green, shiny, rounded to botryoidal; some fragments of hard rock	4	302
(No sample)	6	308
Clayey greensand, light olive-gray (5Y/5/1).		
Sand, not abundant, chiefly medium- and fine-grained but also some granules	4	312
(No sample)	6	318
Clayey greensand, light olive-gray (5Y/5/1).		
Sand, chiefly medium-grained, but also much coarse and fine; glauconite, chiefly fine- and very fine-grained, some medium-grained; constituents as at 302	4	322
(No sample)	6	328
Glauconitic clay, olive-gray (5Y/4.5/1).		
Sand part, small	2	330

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ed 6 (Altitude: 5 feet)		
Recent and Miocene series:		
Clay, pale-brown (10YR/6.5/2); a few shell fragments.		
Sand, little, chiefly medium grade; quartz grains, subrounded, chiefly cloudy, some clear, pitted; glauconite, one piece only; shell and bone fragments, few	10	10
Miocene series:		
Clayey sand, pale-olive (5Y/6.5/2).		
Sand, much, chiefly fine-grained, but also much medium-grained; quartz grains, chiefly clear, subrounded to subangular, a few ovoid quartz grains; a few shell fragments; some bone	11	21
Sandy marl, pale-olive (5Y/6.5/2); shell fragments, abundant.		
Sand, chiefly medium-grained; quartz, clear, brilliant, subrounded; a few bone fragments; a few sponge spicules; Foraminifera, scarce	21	42
Sandy marl, pale-brown (2.5Y/6/2); many shell fragments.		
Sand, chiefly fine-grained, but also much very fine; quartz, clear, subrounded, somewhat pitted; glauconite, very rare, yellow-green, rounded; bone fragments, fairly common; sponge spicules, rare; Foraminifera, abundant	10.5	52.5
Sandy marl, pale-olive (5Y/5/2); many shell fragments.		
Sand, chiefly fine- to very fine-grained; quartz, subangular to ovoid, clear, pitted; glauconite, very rare, yellow-brown, rounded; bone fragments, Ostracoda, sponge spicules, and Foraminifera, rare	10.5	63
Clay, pale-olive (5Y/6/2); shell fragments.		
Little sand; shell fragments, about 40 per cent of washed sample; Foraminifera, rather abundant	10.5	73.5
Clay, pale-olive (5Y/5.5/2).		
Little sand; shell fragments, abundant; quartz, very little; sponge spicules, scarce; echinoid spines, fairly common; Foraminifera, abundant	10.5	84
Sandy clay, pale-olive (5Y/5.5/2); many shell fragments.		
Sand, fairly abundant, chiefly medium- and fine-grained, but also much very fine-grained; quartz, clear, subrounded to ovoid; bone, rare; sponge spicules and Foraminifera, rare	10.5	94.5
Sand, light olive-gray (5Y/6.5/1); shell fragments, abundant.		
Sand, chiefly medium-grained; quartz, subangular to subrounded; Foraminifera, rare	10.5	105
Sandy clay, pale-olive (5Y/6/2.5); many shell fragments.		
Sand, medium- and fine-grained; quartz, clear, angular to rounded, ovoid; bone fragments, scarce; sponge spicules,		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Ed 6—*Continued*		
rare; Foraminifera, very scarce and small	10.5	115.5
Sandy clay, dusky-yellow (5Y/6/3). Sand, chiefly fine- and very fine-grained, but also much medium-grained; quartz, clear; shell fragments, common; bone, scarce; echinoid spines, rare; Foraminifera, rare	10.5	126.0
Sandy clay, dusky-yellow (5Y/6.5/3). Little sand; shell and bone fragments, few; Foraminifera, fairly abundant, small	10.5	136.5
Sandy clay, dusky-yellow (5Y/6/3). Sand, medium- to very fine-grained; quartz, clear and cloudy, some pale milky, pitted; some shell fragments; a little bone; Foraminifera, rare	10.5	147
Clay, dusky-yellow (5Y/6/3); shell fragments. Foraminifera, small, fairly abundant	10.5	157.5
Clay, dusky-yellow (5Y/6.5/3); shell fragments. Diatoms, fairly common; Foraminifera, rather scarce	10.5	168
Clay, pale-olive (5Y/6/2); diatomaceous. Foraminifera, fairly abundant	10.5	178.5
Clay, dusky-yellow (5Y/6.5/3). Sand, very small amount, very fine-grained; diatoms, rare; Foraminifera, scarce	10.5	189
Eocene series:		
Deposits of Jackson age:		
Sand, light olive-gray (5Y/6/1); shell fragments. Much sand, chiefly coarse- and medium-grained; quartz, clear, subrounded, smooth to shiny; glauconite, rare, medium- and fine-grained, green-black and light yellow-green, rounded, pellet-like; pyrite, fairly common; pieces of lime-cemented quartz-glauconite rock, scarce; shell fragments, chiefly medium-gray; Foraminifera, rare	10.5	199.5
Sand, pale-olive (5Y/6/2); shell fragments; pieces of lime-cemented quartz rock. Sand, chiefly coarse- and medium-grained; quartz, clear, shiny, smooth, subangular to subrounded; glauconite, fairly common, chiefly medium- and fine-grained, mixed light-green and green-black, rounded and pellet-like, dull; pyrite, rather common; shell fragments, chiefly medium-gray; Foraminifera, scarce	10.5	210
Nanjemoy formation:		
Greensand, weak-brown (2.5Y/4/2). Sand, chiefly coarse- and medium-grained, but also much coarse-grained; quartz, clear and yellow-stained, rounded to subangular; glauconite, abundant, coarse- to fine-grained, moderate yellow-brown, shiny, rounded and pellet-like	21	231

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-ED 6—*Continued*		
Greensand, weak-brown (2.5Y/3/2).		
Sand, chiefly medium-grained; quartz, chiefly clear or yellow-stained, subrounded to subangular; glauconite, abundant, chiefly medium- and fine-grained, but also some coarse-grained, moderate yellow-brown, considerable green-black in fine-grained portion, rounded to pellet-like; shell fragments, few; pyrite, scarce	21	252
Greensand, weak-brown (2.5Y/4/2).		
Sand, chiefly very coarse- to coarse-grained; quartz, clear and yellow-stained, smooth, subrounded; glauconite, abundant, coarse- to fine-grained, yellow-brown, some olive-brown, shiny, botryoidal to rounded and pellet-like (fine); lime-cemented fragments, rare; shell fragments, few	10.5	262.5
Greensand, moderate yellowish-brown (10YR/4.5/3).		
Sand, chiefly very coarse- and coarse-grained; quartz, clear, yellow-stained, subangular to subrounded; glauconite, fairly abundant, chiefly fine-grained, yellow-brown, shiny, rounded to pellet-like (in fine grain)	10.5	273
Well Cal-Fd 4 (Altitude: 28 feet)		
Recent and Pleistocene series:		
(No sample)	8	8
Sand, weak yellowish-orange (10YR/7.5/5).		
Sand, chiefly fine-grained; quartz grains, clear, rounded to subangular, some quartz grains iron-stained; glauconite, scarce, rounded	4	12
(No sample)	6	18
Clayey sand, weak yellowish-orange (10YR/7/5).		
Sand, chiefly fine-grained; quartz, clear, rounded to subangular; a few shell fragments and pieces of bone	4	22
(No sample)	6	28
Miocene series:		
Sandy marl, weak yellowish-orange (2.5Y/7/4).		
Sand, chiefly medium- and fine-grained; quartz, clear, subrounded to subangular; shell and bone fragments, common	4	32
(No sample)	6	38
Clayey sand, weak-yellow (5Y/7/2); shell fragments.		
Sand, poorly sorted; many shell fragments; quartz, clear and cloudy, rounded to subangular	4	42
(No sample)	6	48
Sandy clay, weak-yellow (5Y/7/2).		
Sand, chiefly fine-grained; some shell fragments	4	52
(No sample)	6	58
Sandy clay, weak-yellow (5Y/8/2).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 4—*Continued*		
Chiefly shell fragments and lime-cemented quartz rocks; some diatoms	24	82
(No sample)	6	88
Clay, pale-olive (5Y/6/2); some shell fragments	14	102
(No sample)	6	108
Clay, pale-olive (5Y/5/2), diatomaceous	24	132
Clay, weak-yellow (5Y/7/2.5), diatomaceous	70	202
(No sample)	6	208
Clayey sand, pale-olive (5Y/6/2).		
Sand, chiefly coarse-grained, but also much medium-grained; quartz grains, clear, rounded to angular; bone, fairly common; Foraminifera, scarce	4	212
Eocene series:		
Deposits of Jackson age:		
(No sample)	16	228
Sandy clay, dusky-yellow (5Y/6/3).		
Sand, a fair amount, chiefly very coarse- and coarse-grained; quartz, clear, angular; glauconite, fairly common, green-black, rounded	4	232
(No sample)	6	238
Clayey sand, weak-olive (2.5Y/4/2).		
Pieces of lime-cemented quartz-glauconite rock, abundant; quartz grains, clear and cloudy, dull, rounded to angular; glauconite, fairly abundant, chiefly medium- and fine-grained, dull, green-black and brown, rounded; shell fragments, scarce	4	242
(No sample)	6	248
Greensand, weak-olive (2.5Y/4/2).		
Sand, chiefly coarse- and very coarse-grained; quartz, chiefly brown, subrounded; glauconite, abundant, chiefly medium- and fine-grained, but also some coarse and very coarse-grained	4	252
Well Cal-Fd 5 (Altitude: 20 feet)		
Recent and Pleistocene series:		
Sand and clay, weak yellowish-orange (10YR/7/6).		
Sand, chiefly very fine-grained, but also much fine-grained; quartz, clear, cloudy and milky, chiefly subangular; a few siderite pellets; pieces of shell, scarce	10.5	10.5
Clay, yellowish-gray (5Y/7/1)	12.5	23.0
Miocene series:		
Sand, pale-olive (5Y/6/2); abundant shell fragments.		
Sand, chiefly fine-grained; quartz grains, clear and cloudy, subangular to subrounded, pitted; Foraminifera, scarce; Ostracoda, scarce	19	42
Sand, weak-yellow (5Y/7/2), abundant shell fragments.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 5—*Continued*		
Sand, chiefly medium- and fine-grained; quartz, clear and cloudy, subangular to subrounded; opalescent quartz grains, rare; bone fragments, scarce; Foraminifera, scarce	31.5	73.5
Sand, pale-olive (5Y/6/2); some clay.		
Sand, chiefly fine-grained; quartz, clear and cloudy, subangular to subrounded	21	94.5
Sand, yellowish-gray; some clay; shell fragments, scarce.		
Sand, chiefly fine-grained; quartz, clear and cloudy, subangular to subrounded	10.5	105
Sand, light olive-gray (5Y/6/1).		
Sand, chiefly fine- to very fine-grained	21	126
Sand, yellowish-gray (5Y/7/1); shell fragments, very abundant.		
Sand, not abundant, fine- and very fine-grained; quartz, transparent, subrounded; many barnacle fragments; Foraminifera, common	10.5	136.5
Sand, light olive-gray; a little clay; shell fragments, abundant.		
Many shell fragments; pieces of hard lime-rock, common; bone-fragments, common; Foraminifera, common	10.5	147
Sandy clay, light olive-gray (5Y/5/1); shell fragments and hard lime-cemented rock.		
Sand, chiefly medium- to very fine-grained; quartz, clear, smooth, rounded to subrounded; some quartz grains are black-stained; Foraminifera, common	42	189
Clay, weak-yellow (5Y/7/2.5).		
Foraminifera, fairly common	10.5	199.5
Clay, weak-yellow (5Y/8/2), diatomaceous	21	220.5
Sand and clay, light olive-gray (5Y/6/1); shell fragments, fairly abundant.		
Sand, chiefly fine-grained, but also much coarse-grained; quartz grains, chiefly transparent, smooth, shiny, rounded to subrounded; a few quartz grains have black inclusions; glauconite, scarce, green-black, shiny, rounded; shell fragments, medium-gray, fairly abundant	10.5	231
Clay, weak-yellow (5Y/8/2.5).		
Sponge spicules, fairly common; Foraminifera, fairly abundant	10.5	241.5
Clayey sand, light olive-gray (5Y/6/1.5); shell fragments, abundant.		
Sand, poorly sorted, coarse- to fine-grained; quartz, clear, brilliant, smooth, subrounded	10.5	252
Clayey sand, pale-olive (5Y/5/2); shell fragments, fairly abundant.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 5—*Continued*		
Sand, chiefly medium-grained, but also much coarse-grained; a few pebbles up to 6 mm; quartz grains, clear, subangular to subrounded	10.5	262.5
Diatomaceous clay (5Y/8/2.5)	2.5	265
Eocene series:		
Deposits of Jackson age:		
Hard lime-cemented rock	8	273
Sand, light olive-gray (5Y/6/1); abundant shell fragments.		
Sand, chiefly medium and coarse-grained; quartz, clear, brilliant, smooth, rounded; glauconite, rather scarce, green-black, rounded; pyrite, scarce	10.5	283.5
Nanjemoy formation:		
Greensand, weak-brown (2.5Y/4.5/2), and granules.		
Chiefly sand and granules; quartz, pebbles up to 6 mm in diameter, stained yellow-brown, smooth, oval, clear to opaque; glauconite, medium-grained, common	21	304.5
Greensand, weak-brown (2.5Y/4.5/2); some clay.		
Sand, poorly sorted, very coarse- to fine-grained; cf. sample at 304.5; muscovite, noticeable; Foraminifera, common	21	325.5
Well Cal-Fd 7 (Altitude: 18 feet)		
Pleistocene series:		
(No sample)	10	10
Sand and gravel, yellowish-gray (2.5Y/6.5/2); some wood.		
Sand, grade chiefly medium, but also much granule and coarse grade; gravel (9 mm maximum diameter), mixed white opaque and medium-light yellowish-gray quartz; coarse quartz, both transparent and translucent, many grains etched	11	21
Miocene series:		
Sand, yellowish-gray (5Y/7/2).		
Sand, grade medium, but also much fine; quartz grains transparent and translucent, yellowish medium-gray, subrounded to subangular; a little chert; a small amount of muscovite	10	31
Sand, yellowish-gray (5Y/7/2); some bluish clay.		
Sand, grade chiefly medium, but also much fine; quartz, subrounded to subangular, much of it pitted; transparent quartz fairly abundant; a little muscovite; a few Bryozoa	8	39
Sandy clay, light brownish-gray (10YR/6/1.5).		
Sand, grade chiefly fine; a little muscovite; Foraminifera, very rare	12.5	51.5
Sticky clay, light olive-gray (5Y/6/1.5).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 7—*Continued*		
A few diatoms and pieces of wood; Foraminifera, rare	22	73.5
Sandy clay, light olive-gray (5Y/6.5/1).		
Quartz, cloudy, subangular to rounded; glauconite grains, few, dull green-black, ovoid; muscovite, a little; a few bone fragments; Foraminifera, rare	10.5	84
Sandy clay, light brownish-gray (2.5Y/6/1).		
Sand, grade chiefly fine; glauconite, about 15 per cent of sand, fine- and very fine-grained, dull, green-black; a fair amount of muscovite	10.5	94.5
Sand and clay, pale-brown (2.5Y/6/2); glauconitic and micaceous.		
Much sand, chiefly medium- and fine-grained; quartz, subangular to subrounded, pitted; glauconite (about 20 per cent), green-black, smooth, pellet-like, shiny; some muscovite; vivianite, as a stain on sand grains, fairly widespread; a few large diatom frustules	10.5	105
Sand, pale-brown (2.5Y/6/2).		
Sand, grade chiefly coarse; quartz, chiefly yellowish-gray, but some opaque white and yellow-orange grains, smooth, and pitted; glauconite (about 20 per cent), green-black, shiny, rounded to botryoidal, chiefly medium- and fine-grained	10.5	115.5
Sand, pale-brown (2.5Y/6/2); a little gravel.		
Sand, grade chiefly coarse, but also much medium; cf. sample at 115.5	10.5	126
Sand and gravel, yellowish-gray (2.5Y/6.5/2).		
Chiefly gravel and coarse sand; gravel (maximum diameter 9 mm), mixed opaque white, yellowish-gray quartz, and a little dark chert; coarse quartz grains, generally cloudy, subangular; glauconite, fairly abundant, chiefly medium- and fine-grained, green-black, disk-like and pellet-like; a little mica; a few pieces of kyanite	6	132
Miocene series:		
Sandy clay, light olive-gray (5Y/5/2).		
Much sand, grade chiefly medium-, also much fine-grained; quartz, smooth, clear, very shiny, somewhat pitted, subrounded; glauconite, scarce, flat, green-black; bone fragments, common; Foraminifera, common	4.5	136.5
Sandy clay, light olive-gray (5Y/6/2), and shell fragments.		
Much sand, chiefly medium grade; quartz stained, clear, shiny to brilliant; shell fragments, not abundant; some bone fragments; Foraminifera, common	10.5	147
Sandy clay, pale-brown (2.5Y/5.5/2).		
A fair amount of sand, medium-grained but also much fine-grained; quartz, clear, brilliant, rounded, smooth, some-		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 7—*Continued*		
what stained; a few fragments of bone; Foraminifera, abundant	10.5	157.5
Sandy clay, light olive-gray (5Y/5/2). Much sand, fine-grained, but also much medium- and very fine-grained; quartz, smooth, pitted, shiny; a fair amount of fine-grained muscovite; a few bone and shell fragments; Foraminifera, common	10.5	168
Diatomaceous earth, pale-olive (5Y/6/2.5); a little sand. Diatoms, very abundant; Foraminifera, rare	10.5	178.5
Diatomaceous earth, weak-yellow (5Y/6.5/3). Very small amount of sand; some bone fragments; very abundant diatoms; Foraminifera, rare	31.5	210
Marl, light olive-gray (5Y/6/2). Sample chiefly shell fragments; a small amount of quartz; quartz, clear, shiny to brilliant, subangular; a few pieces of glauconite, dark- and light-green; bone, fairly common; diatoms and Foraminifera, common	10.5	220.5
Eocene series:		
Deposits of Jackson age:		
Sand, light brownish-gray (2.5Y/5/1). Sand, chiefly medium-grained, but also much coarse-grained; quartz, brilliant, subangular to subrounded, pitted, somewhat stained; a few shell fragments; a little hard lime cement; a fair amount of bone; Foraminifera, rare	10.5	231
Sand and fragments of lime-cemented sand rock, light olive-gray (5Y/5.5/1); abundant shell fragments. Chiefly fragments of rock consisting of quartz and glauconite grains set in a lime cement; quartz grains, clear, smooth, shiny, subrounded; glauconite, fine- and very fine-grained, green-black, shiny, pellet-like; a small amount of pyrite; abundant shell fragments; Foraminifera, scarce	10.5	241.5
Lime rock and sand, light olive-gray (5Y/5.5/1). Cf. sample at 241.5	10.5	252
Sand and marl, pale-olive (5Y/6/2); many shell fragments, medium-gray. Sand, chiefly medium-grained, but also much quartz; quartz grains, smooth, subrounded to subangular, edges rounded and polished; glauconite, fairly common, chiefly fine-grained, green-black, pellet-like, partly shiny to dull; a few fragments of echinoderm plates; Foraminifera, rare	10.5	262.5
Nanjemoy formation:		
Sand, pale-olive (5Y/5/2), and shell fragments; fragments of lime rock.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
We l Cal-Fd 7—*Continued*		
Sand, much medium-grained; quartz, chiefly stained yellow-brown, smooth, rounded, battered; glauconite, abundant, chiefly medium- and fine-grained, chiefly shiny yellow-brown in medium grade and green-black in fine grade, pellet-like and rounded; Foraminifera, scarce	10.5	273
Greensand, brownish-gray (2.5Y/4/1).		
Sand, poorly sorted, grade from very coarse to fine; quartz, chiefly stained yellow-brown; glauconite, abundant, coarse-, medium- and fine-grained, chiefly yellow-brown but much green-black in medium- and fine-grained sizes; a little muscovite; Foraminifera, rare	10.6	283.6
Greensand, weak-brown (2.5Y/4/1).		
Cf. sample at 283.6	10.4	294
(No samples)	26	320
Well Cal-Fd 19 (Altitude: 28 feet)		
Pleistocene series:		
(No sample)	25	25
Sand, weak yellowish-orange (1Y/7/8); a little clay.		
Sand, chiefly fine-grained; quartz grains, clear and translucent (about 50 per cent each), subrounded, slightly iron-stained	6.5	31.5
Miocene series:		
Sand, weak yellowish-orange (1Y/7/8); a little clay.		
Sand, chiefly fine-grained, but also much medium-grained; quartz, chiefly transparent, smooth, subrounded to subangular, slightly iron-stained	10.5	42
Sand, weak yellowish-orange (2.5Y/7/4.5); a few shell fragments.		
Sand, chiefly fine-grained, but also much medium-grained; quartz, chiefly clear, subangular to subrounded; bone and shell fragments, rare; Foraminifera, rare	10.5	52.5
Sand, weak-yellow (5Y/7/2.5).		
Sand, chiefly fine-grained; quartz, chiefly clear, subrounded; glauconite, very scarce; shell fragments, echinoid spines, and Foraminifera, scarce	10.5	63
Sand, pale-olive (5Y/6/2); many shell fragments; a little clay.		
Sand, chiefly fine-grained, clear, subangular; bone fragments, common; Foraminifera, scarce	10.5	73.5
Sand, pale-olive (5Y/6/2.5); much clay; some shell fragments.		
Sand, fine- to very fine-grained	10.5	84
Sandy clay, pale-olive (5Y/5/2.5).		
Sand, fine- to very fine-grained; Foraminifera, scarce	21	105
Clay, pale-olive (5Y/5.5/2.5).		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 19—*Continued*		
Foraminifera, fairly abundant	10.5	115.5
Clay, pale-olive (5Y/5/2); shell fragments, fairly common.		
Bone fragments, fairly common; echinoderm spines, rather abundant; Foraminifera, fairly abundant	10.5	126
Sand, pale-olive (5Y/5/2.5); fair amount of clay and shell fragments.		
Sand, chiefly medium-grained; quartz, clear, smooth, subrounded; some quartz grains black-stained and carry black inclusions; bone, scarce; diatoms, scarce; Foraminifera, fairly common	10.5	136.5
Sandy clay, pale-olive (5Y/5/2.5).		
Sand, chiefly fine-grained, but also much medium-grained; quartz, clear, smooth, subrounded, pitted; some quartz grains have black inclusions; a few shell and bone fragments; diatoms, fairly common; Foraminifera, rare	10.5	147
Clay, pale-olive (5Y/6/2.5); few shell fragments.		
Diatoms, common; Foraminifera, scarce	61.6	208.6
Clay, light olive-gray (5Y/6/2); some lime-cemented quartz rock	10.2	218.8
Eocene series:		
Deposits of Jackson age:		
Sand, pale-olive (5Y/6/2.5), and lime-cemented quartz rock.		
Sand, chiefly medium-grained; quartz grains, clear, subangular, somewhat pitted; Foraminifera, scarce	10.6	229.4
Sand, light olive-gray (5Y/6/1), and much lime-cemented quartz glauconite rock; shell fragments.		
Sand, chiefly medium-grained; quartz, clear, subrounded, smooth; some quartz grains contain inclusions; glauconite, common, medium- and fine-grained; green-black, shiny, in medium grade and light-green in fine grade; pyrite, scarce; shell fragments, common, medium-gray; bone, fairly common; Foraminifera, scarce	10.6	240
Sand, light olive-gray (5Y/6/1); much lime-cemented quartz-glauconite rock; medium-gray shell fragments.		
Sand, chiefly medium- and fine-grained; quartz, clear, subangular, shiny; some ovoid quartz grains; glauconite, common, medium- and fine-grained, green-black and light-green; a few smooth, ovoid, brown glauconite grains; pyrite, scarce; Foraminifera, scarce	10.5	250.5
Nanjemoy formation:		
Greensand, weak-olive (5Y/4/2.5).		
Sand, coarse- to medium-grained; a few yellow-brown quartz granules and pebbles (maximum diameter 9 mm); glauconite, very abundant, chiefly coarse and medium grade, yellow-brown, shiny, irregular to oval; a little		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 19—*Continued*		
fine-grained green-black glauconite; quartz, not abundant, chiefly yellow-brown or stained yellow-brown, smooth, subrounded; Foraminifera, scarce	58.6	309.1
Well Cal-Fd 22 (Altitude: 136 feet)		
Recent and Pleistocene series:		
Sand, dusky yellowish-orange (9YR/6/6).		
Sand, chiefly fine-grained; quartz, subrounded	10.5	10.5
Pleistocene series:		
Sand, weak yellowish-orange (10YR/8/5).		
Sand, chiefly medium-grained; quartz, subrounded to subangular; some clear quartz grains; most grains slightly iron-stained	10.5	21
Sand, weak yellowish-orange (10YR/8/3.5).		
Sand, chiefly medium-grained; quartz, subrounded, clear	10.5	31.5
Miocene series:		
Sand, weak yellowish-orange (10YR/8/3.5).		
Sand, chiefly medium-grained, but also much fine-grained; quartz, chiefly transparent	10.5	42
Sand, weak yellowish-orange (10YR/8/3.5).		
Sand, chiefly medium-grained; quartz, clear, subrounded, a few pieces of gray quartz; a few shell fragments	10.5	52.5
Sand, weak yellowish-orange (1Y/8/5).		
Sand, chiefly medium-grained; quartz, subangular to subrounded; some dark-gray quartz grains carrying inclusions	10.5	63
Sand, weak yellowish-orange (1Y/7/3).		
Sand, chiefly medium-grained; quartz grains, clear, subrounded to rounded, smooth; a few gray quartz grains; a few limonite-cemented aggregates	10.5	73.5
Sand, weak yellowish-orange (1Y/7/4).		
Sand, chiefly medium-grained; quartz grains, smooth, rounded to subangular, clear and cloudy, some gray grains	10.5	84
Sand, weak yellowish-orange (1Y/7/4).		
Sand, chiefly fine-grained, but also much medium-grained; quartz, clear, subangular, some grains limonite-stained	10.5	94.5
Sand, weak yellowish-orange (2.5Y/7/3).		
Sand, chiefly fine-grained, but also much medium-grained; quartz, clear, subrounded, smooth, pitted; a little gray quartz; a few grains of quartz carrying inclusions	10.5	105
Clayey sand, pale-brown (2.5Y/6/2).		
Sand in fair amount; quartz, clear and cloudy; a little pale milky quartz; some gray quartz; some pyrite; muscovite, fairly common; some iron-cemented quartz aggregates	10.5	115.5
Sand and clay, pale-brown (2.5Y/5.5/2); granules.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd22—*Continued*		
Sand chiefly granule size or very coarse; quartz, transparent and cloudy, some white opaque and grayish, rounded, pitted; some pyrite and limonite; a little muscovite, fine; bone and tooth fragments	10.5	126
Clayey sand, pale-brown (2.5Y/6/2).		
Sand, much, chiefly coarse- and medium-grained; quartz, chiefly subangular, edges rounded, cloudy; a few medium-gray quartz grains; a few bone fragments	10.5	136.5
Clayey sand, pale-olive (5Y/6/2); shell fragments.		
Sand, chiefly medium-grained; quartz, clear and cloudy, rounded, smooth, pitted; shell fragments, abundant; a few bone fragments	21	157.5
Clayey sand, pale-olive (5Y/6/2); some shell fragments.		
Much sand, chiefly coarse- and medium-grained; quartz, clear, smooth, rounded and pitted; pieces of lime cement	10.5	168
Clayey sand, weak-yellow (5Y/7/2); shell fragments.		
Chiefly shell fragments; quartz grains, mostly medium-grained; much lime-cemented quartz grains and bone fragments; Foraminifera, fairly common	10.5	178.5
Clayey sand, weak-yellow (5Y/7/2).		
Much sand, chiefly medium- and fine-grained; quartz, very clear, subangular to subrounded, pitted; some shell fragments; Foraminifera, scarce	31.5	210
Clayey sand, pale-olive (5Y/6/2).		
Cf. sample at 210; Foraminifera, common	10.5	220.5
Clayey sand, pale-olive (5Y/6/2).		
Much sand, chiefly fine- and medium- to very fine-grained; quartz, clear and brilliant, subrounded, etched; some pale-yellow quartz grains; some shell and bone fragments; Foraminifera, scarce	10.5	231
Clayey and sandy marl, pale-olive (5Y/6/2).		
Chiefly shell fragments; Foraminifera, abundant	21	252
Sandy clay, pale-olive (5Y/6.5/2); shell fragments.		
Much sand, chiefly medium- and fine-grained; quartz, brilliant, subrounded, rounded edges; some quartz grains black-stained and some carrying black inclusions; diatoms, fairly abundant; Foraminifera, scarce	10.5	262.5
Clay, pale-olive (5Y/6/2); shell fragments.		
Shell fragments, abundant; diatoms and Foraminifera, scarce	10.5	273
Sandy clay, weak-yellow (5Y/7/2.5); diatomaceous.		
Fair amount of sand, chiefly fine- and very fine-grained; quartz, irregular, subrounded, clear; some pale yellow quartz grains; some black-stained quartz grains; shell		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 22—*Continued*		
fragments, fairly abundant; diatoms, abundant; Foraminifera, rare	21	294
Sandy clay, weak yellow-green (10Y/7/2); diatomaceous; shell fragments.		
A fair amount of sand, chiefly very fine-grained; quartz, subrounded, some clear grains, some rose quartz; muscovite, fairly common; some bone and tooth fragments; diatoms, abundant; Foraminifera, rare to fairly common	42	336
Sandy clay, weak yellow-green (10Y/7/2); diatomaceous; pebbly.		
Pebbles, up to 14 mm in diameter; shell fragments, abundant; Foraminifera, abundant	10.5	346.5
Eocene series:		
Deposits of Jackson age:		
Sandy clay, weak-yellow (5Y/7/2.5); diatomaceous; pebbly; shell fragments.		
A fair amount of sand; chiefly shell fragments and pebbles; quartz grains, medium-sized, cloudy; Foraminifera, common	10.5	357
Sand, weak-yellow (5Y/7/2); pebbles; shell fragments.		
Quartz pebbles (6 mm maximum diameter); fragments hard, yellowish lime-rock; medium-gray shell fragments; quartz, coarse- and medium-grained, clear, subangular to rounded, smooth; glauconite, common, chiefly fine-grained, green-black, shiny, rounded to rounded botryoidal; some light-green glauconite as alteration of green-black; pyrite, rather scarce; Foraminifera, rare	10.5	367.5
Sand, light brownish-gray; shell fragments.		
Medium-gray shell fragments; a few pebbles; quartz grains, chiefly clear, irregular, smooth; glauconite, fairly common, chiefly fine-grained but also some medium-grained, green-black, shiny, smooth, rounded; some pieces of hard lime-cemented quartz and glauconite grains; Foraminifera, very rare	10.5	378
Sand, light olive-gray; shell fragments; a few pebbles.		
Sand, much, chiefly medium grade, but some pebbles have maximum diameter of 10 mm; quartz grains, smooth, rounded, some grains stained yellow; glauconite, fairly common, medium- and fine-grained, chiefly green-black; a few light-green and brown glauconite grains; a little pyrite; Foraminifera, rather common, but poorly preserved	10.5	388.5
Nanjemoy formation:		
Greensand, pale-brown (10YR/5/2); a few pebbles and shell fragments.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fd 22—*Continued*		
Much sand, chiefly very coarse-grained, but much coarse and medium-grained; quartz granules and pebbles up to 13 mm, smooth, shiny, chiefly yellow-brown or gray; glauconite, very abundant, coarse- and medium-grained, chiefly yellow-brown, but some green-black, shiny, rounded; Foraminifera, scarce	10.5	399
Greensand, moderate yellowish-brown (10YR/4/3).		
Sand, chiefly medium-grained; glauconite, very abundant, yellow-brown, shiny, smooth, rounded; fine glauconite, mixed yellow-brown and green-black; Foraminifera, scarce	10.5	409.5
Greensand, brownish-gray (10YR/4/1).		
Chiefly coarse- and medium-grained. Cf. sample at 409.5	10.5	420
Greensand, weak-brown (2.5Y/4/2).		
Chiefly medium-grade; yellow-brown glauconite, abundant; Foraminifera, scarce	10.5	430.5
Greensand, weak-brown (2.5Y/4/2).		
Chiefly very coarse- to coarse-grained, but also much medium; glauconite, abundant	10.5	441
Well Cal-Fe 2 (Altitude: 5 feet)		
Pleistocene series:		
(No sample)	25	25
Clayey sand, weak-yellow (5Y/7/3); shell fragments.		
Sand, chiefly fine-grained; quartz, chiefly cloudy, some pale milky and grayish, subangular to subrounded, smooth, dull; a little rose quartz; shell fragments, common; a few bone fragments; Foraminifera, rare	5	30
Sand, yellowish-gray (2.5Y/8/2); a little clay; a few shell fragments.		
Sand, chiefly medium-grained, but also much coarse-grained; cf. preceding sample for constituents	10	40
(No sample)	18	58
Sand, weak yellowish-orange (10YR/7.5/5); a little clay.		
Sand, chiefly medium-grained; quartz, chiefly cloudy, subangular to subrounded, edges of grains rounded; some quartz grains yellow-stained; Foraminifera, rare	2	60
Sand, light yellowish-brown (10YR/6/3); gravel; a few shell fragments.		
Sand, chiefly coarse-grained; quartz, chert, gneiss fragments; gravel, maximum 8 mm in diameter	5	65
Miocene series:		
Shell fragments; a little quartz sand; sponge spicules and echinoderm plates, fairly abundant; Foraminifera, scarce	9	74
Clay, light olive-gray (5Y/6/1); shell fragments.		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fe 2—*Continued*		
Sand, fine- and very fine-grained; quartz, clear and cloudy, angular; muscovite and biotite, fairly common; Foraminifera, common	10	84
Clay, light olive-gray (5Y/5/1); shell fragments, abundant; Foraminifera, fairly common	10	94
Clay, pale-olive (5Y/5/2).		
Foraminifera, common	42.5	136.5
Clay, pale-olive (5Y/5/2); abundant shell fragments (shell bed 144–147 feet).		
Chiefly shell fragments; a little quartz, clear, subrounded to subangular, pitted, smooth; some quartz grains with dark inclusions; Foraminifera, common	10.5	147
Diatomaceous earth, weak-yellow (5Y/7/2.5); a little sand and clay.		
Diatoms, common; Foraminifera, scarce	10.5	157.5
Sandy clay, weak-yellow (5Y/7.5/2.5); diatomaceous.		
Sand, fine-grained, but also much very fine-grained; quartz grains, clear, shiny, pitted, subangular to subrounded; bone fragments, scarce; diatoms, fairly common; Foraminifera, rare	10.5	168
Diatomaceous earth, weak-yellow (5Y/7.5/2)	73.5	241.5
Eocene series:		
Deposits of Jackson age:		
Shell fragments and much lime-cemented quartz.		
Quartz grains, clear, rounded to subangular; muscovite, fine-grained, little; shell fragments, chiefly medium-gray; bone, little; Foraminifera, common	10.5	252
Sand, pale-olive (5Y/6/1); medium-gray shell fragments.		
Chiefly shell fragments and some lime-cemented quartz; quartz grains, chiefly clear, smooth, pitted, subangular to subrounded; glauconite, fairly common, chiefly medium- and fine-grained, green-black, smooth, rounded; Foraminifera, few	10.5	262.5
Sand, light olive-gray; medium-gray shell fragments.		
Sand, coarse medium-grained; quartz, clear, some milky grains, subangular to subrounded; glauconite, fairly common, chiefly fine-grained, green-black, smooth, rounded; lime-cemented quartz and glauconite, common; Foraminifera, scarce	21	283.5
Nanjemoy formation:		
Greensand, pale-brown (2.5Y/5/2); shell fragments.		
Sand, medium- and fine-grained; quartz, smooth, etched, subrounded, some stained yellow-brown; glauconite, very abundant, coarse- and medium-grained chiefly, brown in coarse grades, green-black in fine grade, smooth, rounded		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Fe 2—*Continued*		
to pellet-like; shell fragments, common; Foraminifera, scarce	10.5	294
Greensand, pale-brown (2.5Y/5/2); shell fragments.		
Sand, medium- to coarse-grained; quartz, coarse, yellow-stained; glauconite, very abundant, brown, shiny, smooth; Foraminifera, rare	10.5	304.5
Well Cal-Gd 21 (Altitude: 4 feet)		
(No sample)	231	231
Eocene series:		
Deposits of Jackson age:		
Sand, light olive-gray (5Y/6.5/1.5); shell fragments, fairly abundant.		
Sand, chiefly medium- to fine-grained; quartz, clear, shiny, subrounded, somewhat pitted; glauconite, rather abundant, medium- and fine-grained, green-black, shiny, rounded; lime-cemented quartz-glauconite rock fragments, fairly common; medium-gray shell fragments, abundant; Foraminifera, scarce	21	252
Sand, light olive-gray (5Y/6.5/1); shell fragments.		
Sand, chiefly medium-grained; quartz, clear, smooth; glauconite, fairly common, medium- to fine-grained, shiny, green-black; lime-cemented quartz-glauconite rock common, medium-gray shell fragments, abundant	21	273
Nanjemoy formation:		
Greensand, brownish-gray (2.5Y/4/1); some clay.		
Sand, chiefly medium- and fine-grained; quartz, stained yellow-brown, opaque and clear; glauconite abundant, chiefly medium- and fine-grained, but also fairly common coarse-grained, chiefly yellow-brown, but considerable green-black, dull, pellet-like in fine-grained part; muscovite, scarce; shell fragments, few; Foraminifera, fairly common	10.5	283.5
Greensand, brownish-gray (2.5Y/4/1); a little clay.		
Sand, medium- to fine-grained; glauconite, abundant, chiefly medium- and fine-grained, moderate yellow-brown, glossy, some green-black pellets in fine-grained part	10.5	294
Greensand, weak-brown (2.5Y/4/2).		
Sand, poorly sorted, granules to fine; quartz, chiefly yellow-brown, smooth, subrounded; glauconite, chiefly medium- and fine-grained, brown, glossy, rounded	30.3	324.3
Greensand, weak-brown (2.5Y/4/2).		
Sand, chiefly medium-grained; quartz, brown-stained; glauconite, abundant, yellow-brown, glossy, rounded	9.4	333.7

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 30 (Altitude: 5 feet)		
Miocene series:		
(No sample)	63	63
Clayey sand, pale-brown (2.5Y/5.5/2); micaceous. Sand, chiefly medium-grained, but also much fine-grained; quartz grains, translucent, some rock quartz and milky quartz, shiny, subangular; glauconite, little, moderate olive-green (5GY/3/4), fairly shiny, smooth, rounded and pellet-like; muscovite, fairly common; phosphatic nodules, few	10.5	73.5
Clayey sand, pale-olive (5Y/5.5/2); micaceous. Sand, chiefly fine-grained; quartz grains, translucent and clear, subangular to subrounded; glauconite, little, moderate olive-green (5GY/3/4), rounded and pellet-like; mica, common; phosphate nodules, few; limonite, scarce; bone, rare	10.5	84
Clayey sand, light brownish-gray (2.5Y/5.5/1); slightly micaceous. Sand, chiefly medium- and fine-grained; quartz, cloudy, dull, subrounded to subangular, etched; glauconite, little (about 10 per cent, moderate olive-green (5GY/3/4) and green-black, dull, rounded to pellet-like; mica, fairly common	10.5	94.5
Clayey sand, pale-olive (5Y/6/2); micaceous. Sand, chiefly fine-grained, but also much medium-grained; quartz grains, cloudy or white opaque, some clear, dull to somewhat shiny, angular to rounded; glauconite, rather abundant, chiefly medium-grained, moderate olive-green (5GY/3/4), pellet-like; muscovite, coarse- and medium-grained; vivianite, rare; bone, rare	10.5	105
Sand, pale-brown (2.5Y/6.5/2). Sand, chiefly medium-grained; quartz grains, partly cloudy, white, and yellowish opaque, some clear, smooth, rounded; glauconite, rather scarce, chiefly fine-grained, olive-green and green-black, shiny, smooth; muscovite, fairly common, coarse-grained	10.5	115.5
Sand, pale-brown (2.5Y/6/2); micaceous. Sand, chiefly coarse-grained; quartz grains, translucent, some clear, pitted, subangular; glauconite, fairly abundant, chiefly fine- and medium-grained, green-black, somewhat shiny, rounded and botryoidal to pellet-like, a few disk-like pieces; muscovite, fairly common, medium-grained	10.5	126
Clayey sand, pale-olive (5Y/6/2); a few shell fragments. Sand, chiefly medium-grained; quartz grains, chiefly cloudy, some grains black-stained, shiny, pitted, subrounded;		

TABLE 4—*Continued*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 30—*Continued*		
bone fragments, fairly common	10.5	136.5
Clayey sand, pale-olive (5Y/5/2).		
Sand, chiefly medium-grained; quartz grains, cloudy, also a few clear rounded grains, chiefly subangular to angular; bone fragments, scarce	10.5	147
Clayey sand, pale-olive (5Y/5.5/2); shell fragments.		
Sand, chiefly medium-grained; quartz, clear, pitted, subrounded to subangular, some partly black-stained quartz grains; shell fragments, few; bone fragments, scarce	21	168
Clay, dusky-yellow (5Y/6.5/3).		
A few quartz and green-black glauconite grains; bone fragments, common	10.5	178.5
Clay, dusky-yellow (5Y/6.5/3).		
A little clear quartz and bone fragments	10.5	189
Clay, weak-yellow (5Y/7.5/3)	10.5	199.5
Clay, pale-olive (5Y/5.5/2)	10.5	210
Clayey sand, pale-olive (5Y/5.5/2).		
Sand, chiefly medium-grained; quartz grains, clear, subrounded to subangular; bone fragments, common; some shell fragments	10.5	220.5
Clayey sand, pale-olive (5Y/6/2).		
Sand, chiefly medium-grained; quartz grains, chiefly clear, some cloudy, pitted, subrounded to subangular; glauconite, a trace, fine-grained, green-black; a few shell fragments; bone, rare	10.5	231
Eocene series:		
Deposits of Jackson age:		
Sand, light olive-gray (5Y/6/1); shell fragments.		
Sand, chiefly medium-grained; quartz grains, clear, smooth; glauconite, fairly abundant, medium- and fine-grained, green-black and moderate olive-green, shiny, smooth, pellet-like; shell fragments (medium-gray), abundant; pieces of lime-cemented quartz and glauconite grains, common; Ostracoda and Foraminifera, rare	10.5	241.5
Sand, light olive-gray (5Y/6/1); shell fragments.		
Sand, chiefly medium-grained; quartz grains, clear, smooth, subrounded to subangular; glauconite, abundant, medium- and fine-grained, green-black, shiny, smooth, rounded; shell fragments, many, chiefly medium-gray; some pieces of hard lime-rock	21	262.5
Nanjemoy formation:		
Sand, light brownish-gray (2.5Y/5/1); shell fragments, abundant.		
Sand, chiefly medium-grained; quartz grains, clear, subrounded, irregular, some yellow-stained; glauconite,		

TABLE 4—*Concluded*

	Thickness (Feet)	Depth (Feet)
Well Cal-Gd 30—*Continued*		
abundant; coarse-grained glauconite, moderate yellow-brown, smooth, shiny; medium-grained glauconite, mixed moderate yellow-brown and green-black; fine-grained glauconite, green-black, pellet-like; shell fragments, abundant, medium-gray; Foraminifera, scarce........	21	283.5
Sand, weak-brown (2.5Y/4/2).		
Sand, chiefly medium-grained; glauconite, abundant, coarse- to medium-grained; coarse-grained, moderate yellow-brown, shiny, subrounded, botryoidal, and ovoid; medium-grained, yellow-brown, rounded, irregular; fine-grained, mixed brown and olive-green, pellet-like......	21	304.5
Sand, moderate olive-brown (2.5Y/4.5/4); a few shell fragments.		
Sand, chiefly very coarse to coarse-grained, but also much medium-grained; quartz, chiefly very coarse- and coarse-grained, yellow stained, smooth, subrounded; glauconite, abundant, chiefly medium- and fine-grained; medium-grained, moderate yellow-brown, somewhat shiny, subrounded; fine-grained, pellet-like, green-black.........	10.5	315

TABLE 5

Analyses of ground waters in Calvert County

(parts per million)

Well No.	Owner	Depth (feet)	Date collected	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Dissolved solids	Total hardness as $CaCO_3$	Hydrogen-ion concentration (pH)	Specific conductance (K × 10^5 at 25° C.)	Analyst
Cal-Bb 1	Gorman Lyons	43.5	Jan. 13, 1947	5.1	6.8	5.5	2.7	5.2	7.3	2	14	7.8	21.0	.1	73	25.0	5.1	11.6	U.S.G.S.
Cal-Bb 6	G. Smith	24.5	Mar. 27, 1950	15.0	.1	27.0	.8	2.6	6.8	95	2	3.2	.8	.1	107	.71	7.3	171.0	Do.
Cal-Cc 28	J. Cranston	273.0	Mar. 27, 1950	57.0	.46	63.0	20.0	3.4	11.0	255	44	4.2	.4	.1	333	239.0	7.9	492.0	Do.
Cal-Db 3	Mrs. Vertz	419.0	Mar. 27, 1950	13.0	.51	22.0	6.2	9.8	15.0	162	10	2.0	.8	.2	154	108.0	7.9	277.0	Do.
Cal-Db 5	County Courthouse	600.0	Jan. 13, 1947	9.8	*.05	22.0	12.0	9.8	16.0	158	12	1.1	.7	.2	153	104.0	8.0	27.9	Do.
Cal-Db 6	G. Denton	23.0	Mar. 27, 1950	8.2	.16	5.6	3.5	8.0	3.6	6	4.1	14.0	28.0	.1	96	28.0	5.8	134.0	Do.
Cal-Ec 1	G. W. Dorsey	225.0	Jan. 13, 1947	40.0	*.11	28.0	11.0	3.9	12.0	136	14	2.2	.1	.2	173	115.0	8.2	25.9	Do.
Cal-Ec 3	H. B. Trueman Lumber Co.	345.0	Mar. 23, 1949	40.0	.21	23.0	11.0	3.7	1.6	132	11	2.5	1.6	.2	168	103.0	7.7	246.0	Do.
Cal-Fd 3	D. Barrett	320.0	Jan. 13, 1947	18.0	*.02	8.6	4.2	59.0	12.0	177	27	1.5	.2	.4	221	39.0	8.2	35.0	Do.
Cal-Gd 4	U. S. Navy	250.0	Jan. 13, 1947	19.0	3.8	10.0	4.8	50.0	13.0	187	12	3.1	.1	.3	204	45.0	8.0	32.7	Do.
Cal-Gd 6	Do.	493.0	Jan. 13, 1947	11.0	.43	2.4	.7	52.0	6.4	124	8.4	2.6	.3	.2	156	9.0	8.7	25.5	Do.

* Iron in solution.

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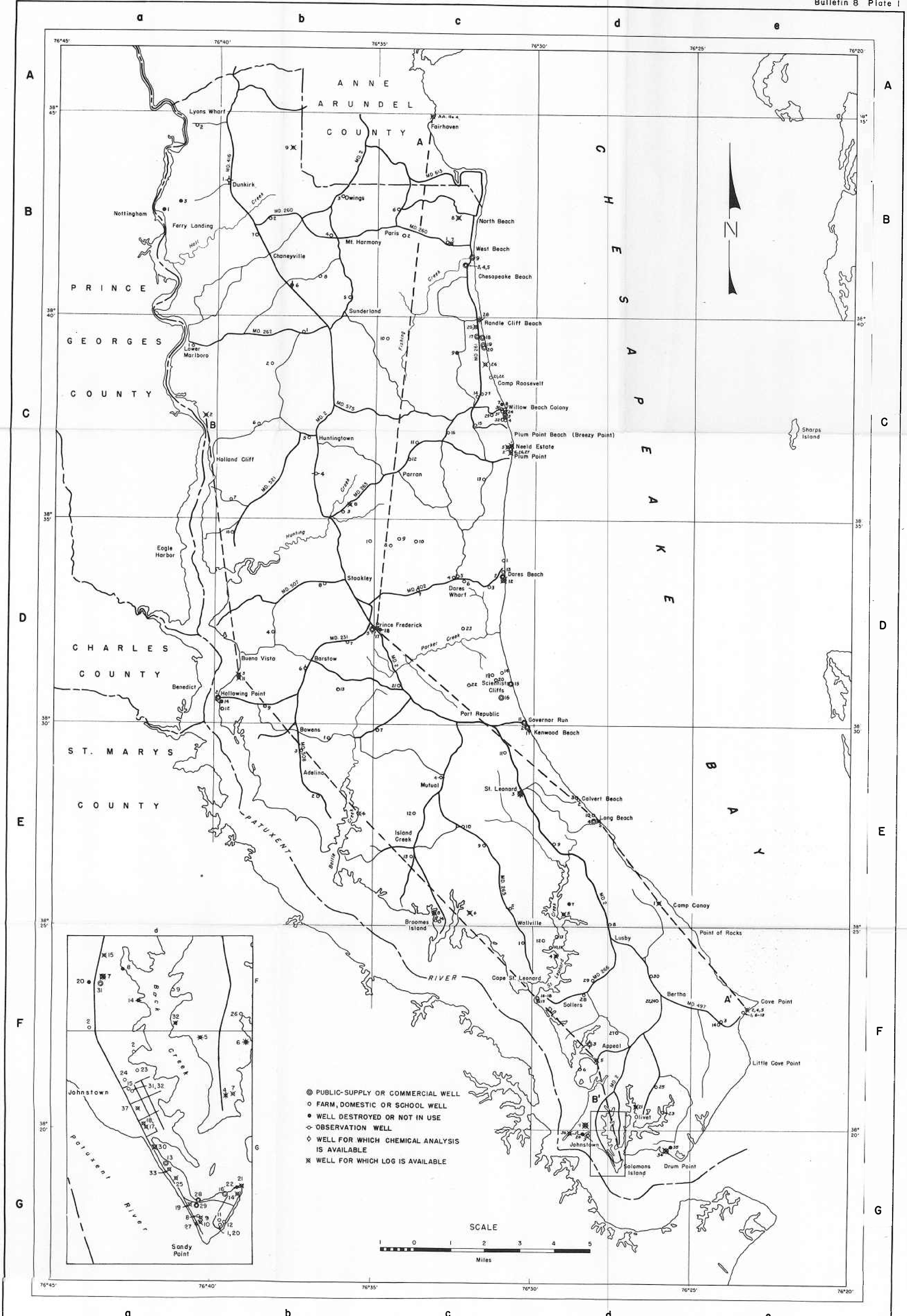
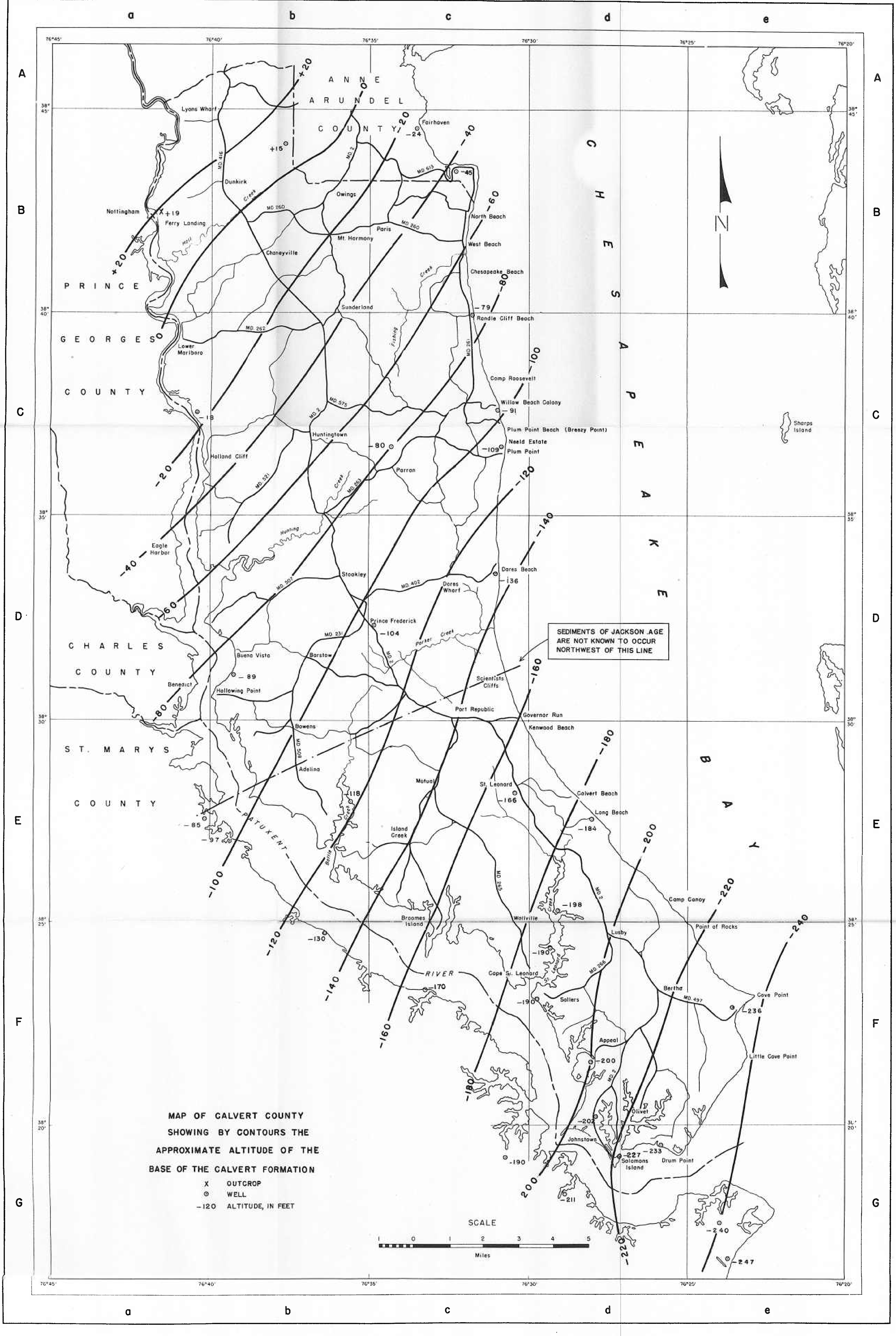
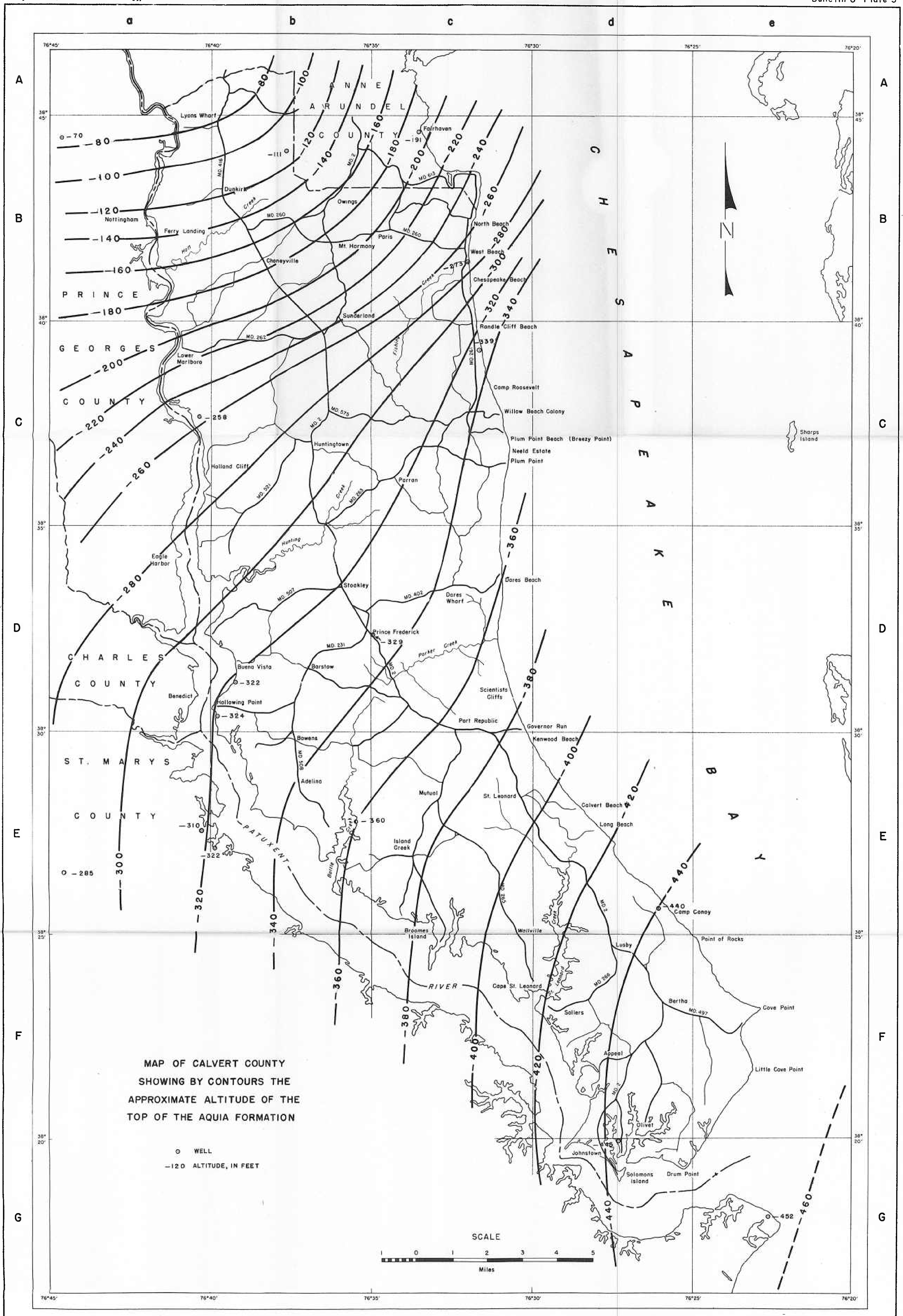
* Page numbers in italics indicate detailed descriptions.


ANNE ARUNDEL COUNTY
PRINCE GEORGES COUNTY
CHARLES COUNTY
ST. MARYS COUNTY
CHESAPEAKE BAY
PATUXENT RIVER
N
PUBLIC-SUPPLY OR COMMERCIAL WELL
FARM, DOMESTIC OR SCHOOL WELL
WELL DESTROYED OR NOT IN USE
OBSERVATION WELL
WELL FOR WHICH CHEMICAL ANALYSIS IS AVAILABLE
WELL FOR WHICH LOG IS AVAILABLE
SCALE
Miles
Lyons Wharf
Fairhaven
Dunkirk
Owings
North Beach
Nottingham
Ferry Landing
Paris
Mt. Harmony
West Beach
Chaneyville
Chesapeake Beach
Sunderland
Randle Cliff Beach
Lower Marlboro
Camp Roosevelt
Willow Beach Colony
Huntingtown
Plum Point Beach (Breezy Point)
Neeld Estate
Plum Point
Holland Cliff
Parran
Eagle Harbor
Dares Beach
Stoakley
Dares Wharf
Prince Frederick
Bueno Vista
Barstow
Benedict
Hallowing Point
Scientists Cliffs
Port Republic
Governor Run
Kenwood Beach
Bowens
Adelina
Mutual
St. Leonard
Calvert Beach
Long Beach
Island Creek
Broomes Island
Wallville
Camp Conoy
Point of Rocks
Lusby
Cape St. Leonard
Sollers
Bertha
Cove Point
Appeal
Little Cove Point
Olivet
Johnstown
Solomons Island
Drum Point
Sharps Island
Sandy Point
Back Creek
Patuxent River
MD. 2
MD. 4
MD. 260
MD. 261
MD. 262
MD. 263
MD. 264
MD. 265
MD. 231
MD. 402
MD. 497
MD. 506
MD. 507
MD. 508
MD. 521
MD. 516
MD. 575
MD. 416
Fishing Creek
Hunting Creek
Parker Creek
Battle Creek
St. Leonard Creek
Hall Creek
76°45'
76°40'
76°35'
76°30'
76°25'
76°20'
38°45'
38°40'
38°35'
38°30'
38°25'
38°20'


ANNE ARUNDEL COUNTY
PRINCE GEORGES COUNTY
CHARLES COUNTY
ST. MARYS COUNTY
CHESAPEAKE BAY
PATUXENT RIVER
SEDIMENTS OF JACKSON AGE ARE NOT KNOWN TO OCCUR NORTHWEST OF THIS LINE
SCALE
Miles
MAP OF CALVERT COUNTY
SHOWING BY CONTOURS THE
APPROXIMATE ALTITUDE OF THE
BASE OF THE CALVERT FORMATION
X OUTCROP
⊙ WELL
-120 ALTITUDE, IN FEET


MAP OF CALVERT COUNTY
SHOWING BY CONTOURS THE
APPROXIMATE ALTITUDE OF THE
TOP OF THE AQUIA FORMATION
○ WELL
—120 ALTITUDE, IN FEET
SCALE
Miles
ANNE ARUNDEL COUNTY
PRINCE GEORGES COUNTY
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