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STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

DIVISION OF WATER POLICY AND SUPPLY

SPECIAL REPORT 30

WATER RESOURCES AND GEOLOGY OF GLOUCESTER COUNTY, NEW JERSEY

Prepared in Cooperation With
United States Department of the Interior
Geological Survey

1969

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WATER RESOURCES AND GEOLOGY OF GLOUCESTER COUNTY, NEW JERSEY

By

WILLIAM F. HARDT and GEORGE S. HILTON

U. S. Geological Survey

SPECIAL REPORT 30

Prepared by the U. S. Geological Survey in cooperation with the State of New Jersey, Department of Conservation and Economic Development, Division of Water Policy and Supply

1969

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT

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LETTER OF TRANSMITTAL

HONORABLE ROBERT A. ROE, *Commissioner*
Department of Conservation and
Economic Development
John Fitch Plaza
Trenton, New Jersey 08625

Dear Sir:

I am transmitting a report entitled "Water Resources and Geology of Gloucester County, New Jersey," which was prepared under the cooperative agreement with the Water Resources Division, U. S. Geological Survey, and the Division of Water Policy and Supply as part of the state-wide program authorized by the 1958 Water Supply Law.

The report summarizes the geology and water resources of Gloucester County. It evaluates the relative importance of the major aquifers and discusses their suitability for future development. Areas where water quality may limit an aquifer's use are also defined.

The information presented in this report is of vital interest and importance to the growth of the County and provides a basis for the safe development of the ground-water resources essential for such growth in southern New Jersey. I therefore recommend that this report be published as a Special Report of the Division of Water Policy and Supply.

Respectfully submitted,
George R. Shanklin
Director and Chief Engineer

May 20, 1969

WATER RESOURCES AND GEOLOGY OF GLOUCESTER COUNTY, NEW JERSEY

By William F. Hardt and George S. Hilton

ABSTRACT

Gloucester County, in the southwestern part of New Jersey adjacent to Philadelphia, Pa., Camden, N. J., and Wilmington, Del. in the lower Delaware River valley, has an area of 339 square miles. It is in the Coastal Plain physiographic province and is underlain by unconsolidated sand and clay of Quaternary, Tertiary, and Cretaceous age. These sediments overlie bedrock which consists of metamorphic and igneous rocks of upper Precambrian(?) age. The unconsolidated formations dip to the southeast and generally thicken oceanward. The older formations are at or near the surface in the vicinity of the Delaware River and are progressively deeper toward the Atlantic Ocean.

Water sufficient for domestic and farm supplies is available anywhere in the county, usually from wells less than 200 feet deep. However, moderate to large amounts of water can be pumped economically only from the Raritan and Magothy Formations, the Cohansey Sand, and the Wenonah Formation and Mount Laurel Sand.

The most important and productive aquifer is the undifferentiated Raritan and Magothy Formations of Late Cretaceous age. The aquifer yields about 75 percent of the ground water used in the county. Wells tapping this aquifer yield up to 1,400 gpm (gallons per minute) and large capacity wells usually can be drilled almost anywhere in the county, however high chlorides may be present in the southeastern parts of the county. Pumping tests indicate that the coefficients of transmissibility range from 30,000 to 68,000 gpd (gallons per day) per foot in the Raritan and Magothy Formations. The aquifer is more permeable in the northwestern part of the county.

The Cohansey Sand of Tertiary age is the second most important aquifer in the county and has the greatest potential for future development. The formation crops out in the sparsely populated southern half of the county and yields of 800 gpm are possible from wells less than 200 feet deep. Pumping tests at Clayton and Williamstown indicate a coefficient of transmissibility of about 60,000 gpd per foot.

The undifferentiated Wenonah Formation and Mount Laurel Sand are capable of yielding 100 to 200 gpm to wells in the area between Pitman and Turnersville. In the county this aquifer is an important source of water for domestic supplies in and near the outcrop area of the formation.

Total ground-water pumpage in the county (1966) was estimated at about 40 mgd (million gallons per day) which consisted of 15.5 mgd for industrial use; 11 mgd for public supplies; 10 mgd for irrigation; and 3.5 mgd for rural domestic supplies.

Precipitation in the county contributes about 2 mgd of water per square mile. This is far more than is needed to recharge water pumped from the ground-water reservoir. Therefore, most of the water that does not return directly to the atmosphere as evapotranspiration enters the streams. Past records indicate that on the average about half the precipitation is evapotranspired and the other half is discharged by streams. Low-flow stream measurements in July 1957 indicate that the minimum total base flow from the county to be 50 to 60 mgd whereas annual average discharge is about 300 mgd.

The chemical quality of ground water is generally acceptable for most uses, although in some areas objectionable amounts of iron, nitrate, and fluoride are found. Near the Delaware River and in the southeastern part of the county, chloride in the water from the Raritan and Magothy Formations may be a future problem.

INTRODUCTION

PURPOSE AND SCOPE

The economic growth of Gloucester County in the lower Delaware Valley has caused an increase in the usage of water that has resulted in local quality-of-water problems. Constant vigilance must be maintained to prevent contamination of the ground-water resources by salt-water encroachment or pollution from industrial activity and concentration of population. The successful solution of such water-supply problems is dependent upon adequate knowledge of the conditions under which the problems developed. Therefore, geohydrologic studies aid in the resolution of problems and provide the foundation for the orderly development of water supplies.

The investigation of the water resources and geology of Gloucester County is part of a comprehensive study of the ground-water resources of the State. These studies are being made by the U. S. Geological Survey in cooperation with the Division of Water Policy and Supply of the New Jersey Department of Conservation and Economic Development. This study, which includes data collected mainly before 1958, has been made to evaluate the water resources—particularly the ground-water resources of the county. The study consisted of determining (1) the character, thickness, and extent of the water-bearing materials, (2) the amount of ground-water pumpage and surface-water outflow, (3) the source, occurrence, movement, quantity, and quality of water, and (4) the possibilities for developing additional ground water.

LOCATION AND GENERAL FEATURES

Gloucester County has an area of 339 square miles and is in the southwestern part of New Jersey in the Atlantic Coastal Plain province. It is bounded on the southwest by Salem County, on the south by Cumberland and Atlantic Counties, on the northeast by Camden County, and on the northwest by the Delaware River (fig. 1).

The economy of the county is chiefly agricultural, although there is some industrial development along the Delaware River at Westville, Woodbury (the county seat), Paulsboro, Gibbstown, and Swedesboro.

The population of the county according to the U. S. Bureau of Census, was 91,727 in 1950 and 134,840 in 1960. The estimated population on July 1, 1966, was 159,630. About half of the population is in the area bounded by the New Jersey turnpike and the Delaware River. The central and southern parts of the county are increasing in population and in industrial activity. The proximity of Gloucester County to the large

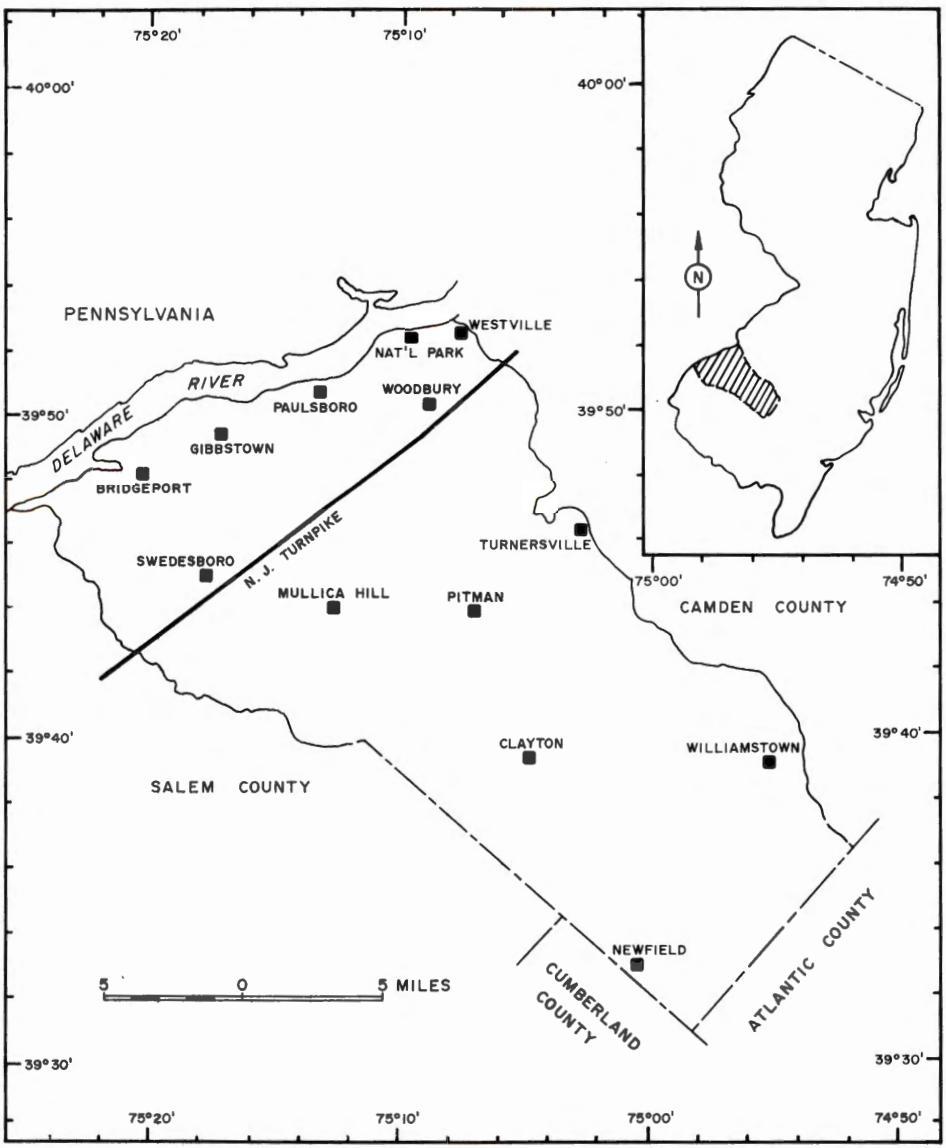

Figure 1.—Map showing location of Gloucester County, New Jersey.

industrial centers of the lower Delaware Valley and to several large cities—Wilmington, Del.; Philadelphia, Pa.; and Camden, N. J.—is of great importance to its future growth.

The climate of Gloucester County is mild. The average annual temperature at Clayton for the 10-year period 1948-57 is 54.9°F. The average monthly maximum temperature is 76.4°F in July, and the average monthly minimum is 34.7°F in January. The prevailing winds are from the southwest. The average annual precipitation at Clayton for 50 years of record, 1908-57, is 44.43 inches; near Swedesboro the average for 11 years of record, 1947-57, is 39.81 inches. The distribution of rainfall is fairly uniform during the year. The average annual snowfall for the period 1905-30 is about 25 inches; for the period 1930-57 it is about 17 inches.

PREVIOUS STUDIES

Information concerning the geology and water resources of Gloucester County is contained in numerous published and unpublished reports. However, prior to the present investigation no intensive study of the water resources of the county had been made. A report by Barksdale and others (1958) and one by Parker and others (1964) describe the hydrogeology of the lower Delaware River Basin. Public water supplies in the county were described by Hardt (1963). Significant reports are included in the selected bibliography at the end of this report.

ACKNOWLEDGMENTS

This study was made under the general supervision of A. N. Sayre, former chief of the Ground Water Branch of the U. S. Geological Survey and George R. Shanklin, director and chief engineer of the Division of Water Policy and Supply, New Jersey Department of Conservation and Economic Development. The field studies were under the immediate supervision of Henry C. Barksdale, district engineer, from the beginning of the investigation until July 1957 and Allen Sinnott, former district geologist.

The writers wish to acknowledge the assistance of Messrs. Meredith E. Johnson, former State Geologist; William Baum, Gloucester County engineer; and Dr. Horace G. Richards, Academy of Natural Sciences, Philadelphia, Pa. The writers also wish to express their appreciation to numerous well drillers, particularly A. C. Schultes and Sons; to water plant superintendents and operators; to various industrial companies, particularly The Texas Co., Mobil Oil Co., E. I. du Pont de Nemours & Co., and Hungerford and Terry; and to many individuals who supplied basic data used in this report.

GEOLOGIC SETTING

Gloucester County is wholly within the Atlantic Coastal Plain physiographic province of the eastern United States (Fenneman, 1938) and is underlain by a wedge of unconsolidated sedimentary rocks. These sedimentary rocks unconformably overlie consolidated rocks or bedrock complex.

The unconsolidated sedimentary rock formations range in age from Cretaceous to Holocene and consist of clay, silt, sand, and gravel of both marine and nonmarine origin. These materials were deposited as the ancient shoreline fluctuated across the gently sloping continental margin. The unconsolidated formations dip to the southeast and thicken oceanward so that each succeeding younger formation is less inclined than the formation upon which it rests.

The consolidated formations are upper Precambrian(?) in age and consist of metamorphic and igneous rocks. These older rocks crop out at or near the Delaware River and occur at progressively greater depths toward the southeast boundary of the county.

The distribution and altitude of these formations are shown on figure 2. The lithology, thickness and water-bearing characteristics are summarized in table 1.

TABLE 1—SUMMARY OF STRATIGRAPHIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS IN GLOUCESTER COUNTY, N. J.

Era	System	Series	Formation	Lithology	Thickness (feet)	Water-bearing characteristics
Cenozoic	Quaternary	Holocene	Alluvium	Mud, black, silt and sand	0-40	No wells tap this formation
			Eolian deposits	Sand, white frosted	0-10	No wells tap this formation
		Pleistocene	Cape May Formation	Sand, gravel, and clay	0-40	Wells yield 10-50 gpm
			—— Unconformity ——			
			Pensauken Formation	Sand and gravel	0-30	Wells yield 10-50 gpm
			—— Unconformity ——			
			Bridgeton Formation	Sand and gravel	0-50	Wells yield 10-50 gpm
			—— Unconformity ——			
	Tertiary	Pliocene (?) and Miocene (?)	Cohansey Sand	Sand, clay and gravel, light colored	0-130	Wells yield up to 800 gpm
			—— Unconformity ——			
		Miocene	Kirkwood Formation	Sand, clay, and some gravel	50-160	Wells yield 10-50 gpm
			—— Unconformity ——			
		Eocene	Manasquan Formation (subsurface)	Sand and clay, glauconitic	0-25	No wells in this formation
		Paleocene	Vincentown Formation	Limy sand and limestone	0-55	Wells yield 10-150 gpm
			Hornerstown Sand	Clay and sand, glauconitic	8-30	Wells in sandy sections may yield 10-50— gpm
			—— Unconformity ——			
Mesozoic	Cretaceous	Upper Cretaceous	Navesink Formation	Clay and sand, glauconitic	0-40	Wells in sandy sections may yield 10-50— gpm
			Mount Laurel Sand	Sand, medium to coarse, glauconitic	65-95	Wells yield up to 200 gpm
			— — Undifferentitated — —	— — — — — — — — — —		
			Wenonah Formation	Sand, fine to medium, micaceous		
			Marshalltown Formation	Clay, sandy in places, glauconitic	10-40	Wells yield at least 40 gpm in some areas (Englishtown Sand included)
			Englishtown Formation	Sand, white and yellow, micaceous, slightly glauconitic	0-50	Wells yield 20-100 gpm
			Woodbury Clay	Clay, black, micaceous	50-80	No wells tap this formation
			Merchantville Formation	Clay, glauconitic, some sandy zones	45-70	Wells yield 15-100 gpm in some areas
			—— Unconformity ——			
			Magothy Formation	Clay, dark colored and sand, light colored (alternating)	150-500—	Wells yield up to 1,400 gpm
			— — - Undifferentiated — —	— — — — — — — — — —		
			Raritan Formation	Clay and sand, variegated (alternating)		
			—— Unconformity ——			
Precambrian		Upper Precambrian (?)	Wissahickon Formation (subsurface)	Banded micaceous schist or gneiss	5,000-8,000	Wells yield little or no water

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

UPPER PRECAMBRIAN(?) ROCKS

Wissahickon Formation

The Wissahickon Formation does not crop out in Gloucester County and the nature of the formation is inferred only from logs of a few wells near the Delaware River and from outcrops beyond the boundaries of the area.

The Wissahickon Formation is composed of several types of metamorphic rocks, but consists largely of schist and gneiss. These rocks contain an abundance of mica, quartz, feldspar, and chlorite and commonly are medium- to coarse-grained. Shades of green and gray are predominant. Numerous fractures and joints, as well as considerable crumpling and folding of individual layers are characteristic structural features. Although the thickness of the Wissahickon Formation is unknown, it is probably on the order of several thousand feet. The Wissahickon Formation is overlain unconformably by the Raritan and Magothy Formations of upper Cretaceous age.

Bedrock contours in the Camden-Philadelphia area indicate that the buried surface of the Wissahickon Formation slopes from 60 to 120 feet per mile. From the Delaware River southward to the New Jersey turnpike in Gloucester County, the slope of the bedrock surface is from 60 to 70 feet per mile, and farther southward the slope increases to about 100 feet per mile.

Only a few wells have penetrated the Wissahickon Formation in the county, and these are adjacent to the Delaware River where the depth to the formation is shallowest. A test well at Woodbury reached the Wissahickon Formation at a depth of 422 feet below the land surface. Of the wells that have penetrated this formation in the county, this is the farthest from the Delaware River.

Ground water occurs in the joints and fractures of the schist and gneiss. These openings constitute a small percentage of the total volume of the rock but provide for some movement of ground water. However, the Wissahickon Formation has a small capacity for storing or yielding water. However, the bedrock is in hydraulic continuity with the overlying sand and gravel, which is the major source of water to the few wells penetrating bedrock in the county.

UPPER CRETACEOUS SERIES

Raritan and Magothy Formations

Geology

The Raritan and Magothy Formations crop out in a belt 0.2 to 3.2 miles wide adjacent to the Delaware River and cover about 32 square miles of surface area in the county. The formations underlie the Delaware River and also crop out in Pennsylvania.

The Raritan and Magothy Formations are considered to be mostly of continental origin. They were deposited largely by the action of streams, although in a few localities at least part of these formations suggest a marine environment. The Raritan Formation is composed of light-colored quartzose sand, clay, and some gravel. The characteristic colors of the Raritan Formation are white, yellow, brown, red, and gray. The Magothy Formation consists of beds of dark-gray or black clay, commonly lignitic, alternating with white micaceous fine sand. In the county, the Raritan and Magothy Formations cannot be differentiated except locally because of similar lithology. The combined thickness of the Raritan and Magothy Formations in Gloucester County may be as much as 500 feet, and the formations thicken downdip toward Salem and Cumberland Counties.

The top of the Magothy Formation dips about 40 to 45 feet per mile to the southeast toward the Atlantic Ocean (fig. 3). The basal part of the Raritan Formation dips about 60 feet or more per mile. The Raritan and Magothy Formations rest unconformably on the Wissahickon Formation and in turn downdip from the outcrop area are overlain unconformably by the Merchantville Formation.

Hydrology

The undifferentiated Raritan and Magothy Formations contain the most important and productive aquifers in Gloucester County. The many industries adjacent to the Delaware River and most of the public water companies in the county obtain ground water from these formations. Wells tapping these formations yield up to 1,400 gpm (gallons per minute). The specific capacities of 85 wells range from 0.8 to 56 gpm per foot of drawdown and average 17 gpm per foot of drawdown. The water-bearing characteristics and thickness of the water-bearing zones (and aquicludes) in these formations vary greatly within short distances. The sand and gravel aquifers range in thickness from a few feet to 100 feet, although the total thickness of the formations may be much greater.

In the outcrop area two water-bearing zones are identified. The upper zone, usually artesian, includes the water-bearing beds in the upper 120

feet of the Raritan and Magothy Formations. Locally, where the upper zone is unconfined and hydraulically connected with the shallow water-table aquifer in the Cape May Formation, the total thickness of the water-bearing zone may be as much as 140 feet. The lower zone is always artesian in Gloucester County and is composed of the water-bearing beds in the lower 200 feet of the formations. Available well data indicate that the upper and lower aquifers are separated by clay beds in the outcrop area but their identification elsewhere in the county is uncertain. However, where the two water-bearing zones can be differentiated, their hydrologic properties are separately described.

In the Paulsboro-Gibbstown area, wells tapping the upper water-bearing zone yield from 180 to 1,400 gpm. E. I. du Pont de Nemours & Co., Hercules Powder Co., Mobil Oil Co., the Borough of Paulsboro, and Greenwich Township Water Department have wells which obtain water from this zone of the Raritan and Magothy Formations. In the National Park-Westville area some wells yield as much as 800 gpm from this upper zone. Wells in the Paulsboro-Gibbstown area tapping the lower water-bearing zone yield from 150 to 1,100 gpm. Most of the wells in the National Park-Westville area are developed in the basal part of the lower zone and yields of wells range from 250 to 1,200 gpm.

In the central and southern parts of the county, wells obtain water from the upper part of the Raritan and Magothy Formations. In the Pitman and Glassboro area, wells yield from 500 to 1,000 gpm. At Clayton one well yields about 700 gpm. The upper water-bearing zone has been tapped by wells at Swedesboro, Wenonah, Mantua, Woodbury, Mullica Hill, and Clarksboro. The lower water-bearing zone has not been developed extensively in the central and southwestern parts of the county because abundant water is available at shallower depths. Water from this zone is probably brackish in the southeastern fifth of the county.

Several pumping tests were made in various parts of the county to determine the hydraulic characteristics of the aquifers. In the National Park area, the coefficient of transmissibility of the lower water-bearing zone is 42,000 gpd per ft and in the upper zone 52,000 gpd per ft. At Gibbstown, the upper zone has a coefficient of transmissibility of 50,000 gpd per ft, and at Clayton, 16 miles downdip, the coefficient is 30,000 gpd per ft. The average coefficient of permeability of the aquifers in the Raritan and Magothy Formations is about 1,000 gpd per sq ft.

A pumping test at the Eagle Point refinery of the Texas Oil Co. near Westville indicated coefficients of transmissibility ranging from 51,000 to 68,000 gpd per ft, coefficients of storage ranging from 1.7×10^{-4} to 9.0×10^{-5}, and permeabilities ranging from 1,000 to 1,400 gpd per sq ft.

All the wells which tap the Raritan and Magothy Formations are in the northern half of the county except for the well at Clayton. About 17 mgd of water was pumped in 1957 from the Raritan and Magothy Formations in the county—at least 60 percent of which was pumped in the area adjacent to the Delaware River.

Recharge, movement, and discharge.—Prior to the development of the aquifers in the Raritan and Magothy Formations, much of the recharge to the aquifers was from precipitation on the high-level intake areas beyond the boundaries of Gloucester County (Barksdale, and others, 1958, p. 102). The water moved southeastward in response to natural gradients until it reached the interface between fresh water and salt water in the downdip part of the formations. Upon reaching this interface, the movement of fresh water was diverted to the southwest and northeast. Because this interface acted as a barrier to the movement of fresh water downdip, Barksdale and others (1958, p. 111) have theorized that the movement of the fresh water in this aquifer ". . . swept around through the parts of the aquifer updip from the salt-water barrier and was discharged into the Raritan River and Bay and into the Delaware River and into the Chesapeake Bay in areas where the aquifers were exposed at levels above that of the salt-water barrier."

With the increased economic development in Gloucester County and nearby areas in recent years, pumpage from water-bearing zones of the Raritan and Magothy Formations has increased. Movement of ground water is influenced by the areas of heavy pumping in and near Gloucester County. Near Woodbury and Clarksboro most of the ground water in the Raritan and Magothy Formations moves north under the influence of industrial pumping on both sides of the Delaware River. Along the river in the Paulsboro-Gibbstown and National Park-Westville areas, water levels are near or below sea level and river water may be recharging the upper water-bearing zone. Wells in the lower water-bearing zone in the Paulsboro-Gibbstown area yield water of poor chemical quality, suggesting interconnection with the river or local contamination.

Quality of water

The water from the Raritan and Magothy Formations is generally low in dissolved solids and is of satisfactory chemical quality for public or industrial use in the northwestern four-fifths of the county. The dissolved solids of 53 samples tested between 1950 and 1967 ranged from 72 to 738 mg/l (milligrams per liter) and 36 of these samples contained less than 260 mg/l. Iron concentrations of 53 samples tested ranged from .02 to 29 mg/l and 38 of these samples contained 1.0 mg/l or less. The hardness of water of 54 samples tested ranged from 8 to 166 mg/l and 41 of these samples contained less than 60 mg/l. Fluoride in excess

of 1.5 mg/l occurred in 12 samples tested. Chemical analyses of water obtained from the aquifers downdip from the recharge area show an increase in bicarbonate (table 8). The quality of water in the Raritan and Magothy Formations is influenced by: the quality of the Delaware River water; the position of the fresh-salt water interface downdip in the southeastern end of the county; industrial contamination in the outcrop area, particularly along both sides of the Delaware River; and contamination from any of the formations overlying the aquifers. Water in these formations is probably somewhat brackish in the southeastern part of the county especially in the lower water-bearing zone. Because more than 75 percent of the ground water pumped in the county is from the Raritan and Magothy Formations, precautions may be necessary to protect the aquifers from artificial contamination or salt-water encroachment.

The Delaware River probably is as important a source of recharge as is precipitation on the outcrop area; therefore, the quality of the river water is of prime importance. During periods of low flow, river water of poor quality is more likely to recharge the aquifers. Near the Gloucester-Salem County boundary, the river water is not suitable for most uses during periods of low flow, which generally occur from September to November. On November 2, 1949, the maximum chloride concentrations at three stations on the Delaware River were: opposite Bridgeport, 2,020 mg/l; opposite Gibbstown, 955 mg/l; and opposite National Park, 178 mg/l (Durfor and Keighton, 1954). During 1957, the maximum chloride concentrations at the three stations were 2,220, 1,080, and 230 mg/l, respectively. In the Gibbstown-Paulsboro area, chloride concentrations are high in the water from the Raritan and Magothy Formations. At Gibbstown, water from well 20 E. I. du Pont de Nemours & Co., which is near the river, ranged in chloride content from 254 mg/l in 1953 to 157 mg/l in 1957 (fig. 4). Well 3, which is about 3,000 feet south of well 20, yields water that ranged in chloride content from 22 to 76 mg/l during the 5-year drought period 1953-57. The fact that the chloride content in water from well 20 had decreased during the 5-year period, is an indication that good-quality water may be entering the aquifer from the river and moving poor quality water toward the area of maximum pumpage. This may explain the steady rise in chloride content in the water from well 3, which is near the area of heavy pumping. Depending upon the chloride content of the river, the areas of poor- and good-quality water may eventually be replaced by water of intermediate quality. At the Mobil Oil Co. refinery in Paulsboro, the chloride content of the water has been relatively uniform, although the pumpage increased from 1953 to 1957 (fig. 4, well 33). Water from well 40 has a chloride content of about 240 mg/l during the 5-year period 1953-57.

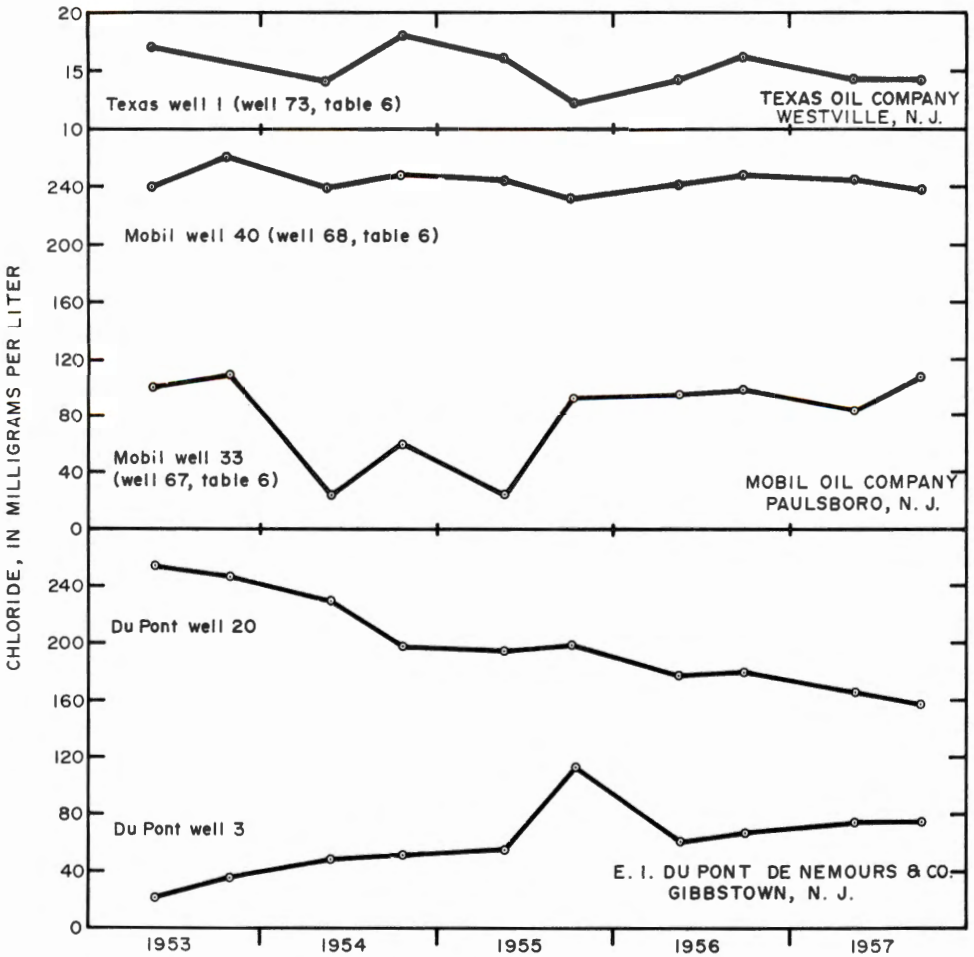

Figure 4.—Graph showing chloride concentrations in water from wells near the Delaware River.

The lower water-bearing zone is not extensively developed in the Gibbstown-Paulsboro area because of the poor quality of the water.

In the National Park-Westville area, the quality of the river water usually is satisfactory for most uses. Much of the pumpage near the river is from the lower water-bearing zone which is probably not interconnected with the river. At the Texas Oil Co. refinery in Westville the chloride content of the water from well 1 was about 15 mg/l from 1953-57 (fig. 4). Available data for 1957 indicate that salt-water encroachment was not taking place in the National Park-Westville area. The river is probably recharging the upper water-bearing zone in this area; hence, the quality of the river water has an important bearing on ground-water quality.

The quality of water in the Raritan and Magothy Formations is controlled also by the fresh-salt water interface across the southern part of the county (Barksdale and others, 1958 fig. 16). This saline water may be derived from the ocean or it may be connate water; nevertheless, any pumping of fresh water reduces the head in the aquifer and allows this water to move updip. The wells at Clayton and Mullica Hill probably will be the first in the county to be affected by this salt-water movement. This is indicated by the configuration of the lines showing dissolved solids and chloride concentrations (fig. 5). At Clayton, the chloride content of the water in well No. 2 was 120 mg/l on July 30, 1957 and 128 mg/l in an adjacent well on February 28, 1969; at Mullica Hill it was 140 mg/l on December 21, 1950 and 144 mg/l on February 28, 1969. Periodic sampling from these two wells are being continued to observe movement of the interface.

Merchantville Formation

The Merchantville Formation crops out in about 14 square miles in the northwestern part of the county in a narrow belt extending northeast-southwest (fig. 2). There are few exposures because the formation is mantled by a veneer of Quaternary deposits. The Merchantville Formation in Gloucester County is commonly green to black glauconitic and micaceous silt and clay or quartzose or glauconitic sandy clay. In the vicinity of Swedesboro, the upper part of the formation is green to gray, fine- to medium-grained sand, containing mostly quartz, some muscovite, and about 10 percent glauconite. At Mantua the upper part of the formation is dark-green to brown fine- to coarse-grained sand and is fossiliferous, glauconitic, and micaceous. Near Wenonah the upper two-thirds of the formation is fine- to medium-grained sand and the lower one-third contains clay. Zones containing fine- to coarse-grained sand are present, and indurated phases of the clay occur within the county.

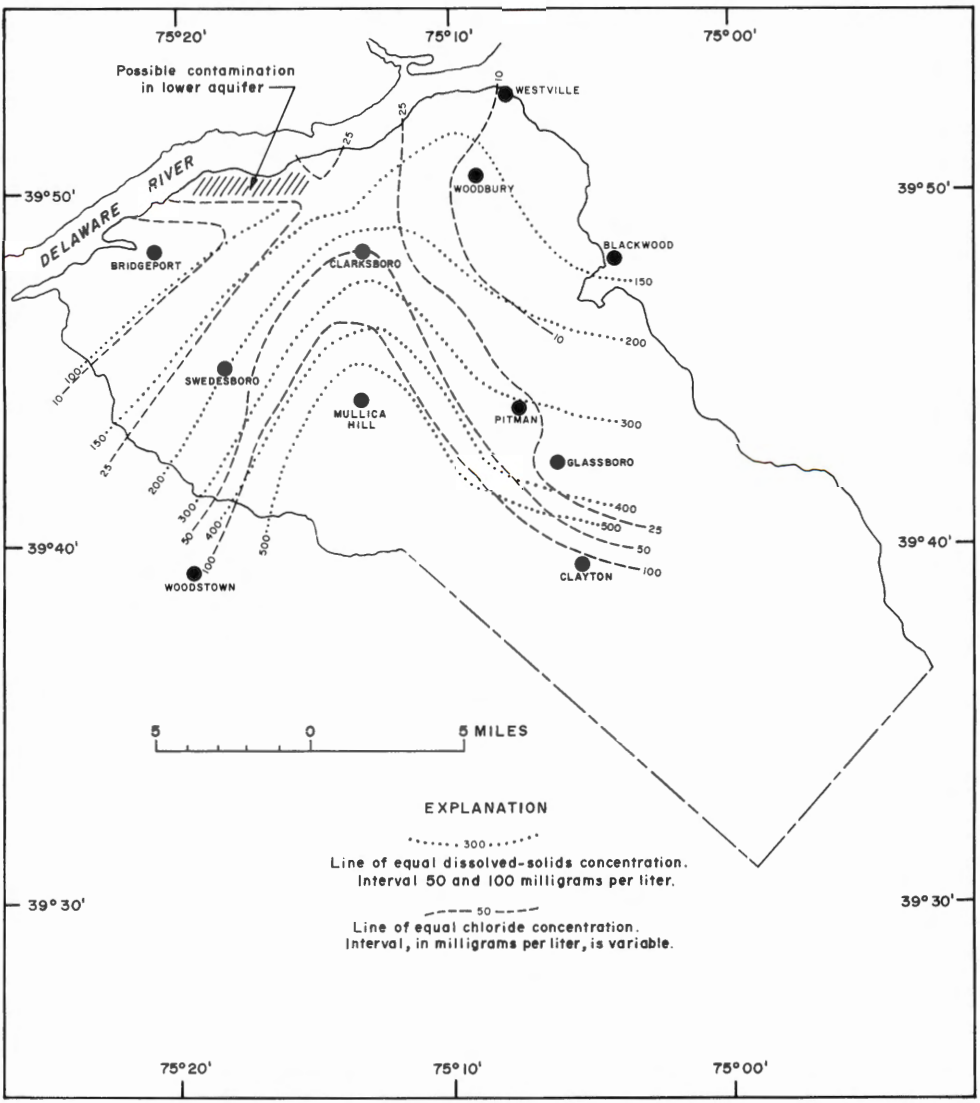

Figure 5.—Map showing dissolved solids and chloride concentrations in the upper aquifer of the Raritan and Magothy Formations, 1957.

The formation dips to the southeast at about 43 feet per mile. It ranges in thickness from 45 to 70 feet; the average thickness is between 50 and 60 feet.

The Merchantville Formation overlies unconformably the Raritan and Magothy Formations and is overlain conformably by the Woodbury Clay.

The Merchantville Formation is a minor aquifer in the county. Records of a few domestic wells in the county showed yields of from 15 to 90 gpm; most of these wells tap the upper sandy sections of the formation. The wells range in depth from 100 to 155 feet and are distributed in a narrow belt across the county from Swedesboro to Mantua to Almonesson. So far as known, no wells obtain water from the Merchantville Formation south of these towns in Gloucester County.

This formation functions chiefly as an aquiclude or confining layer. Together with the overlying Woodbury Clay, it separates the water-bearing sands of the productive Raritan and Magothy Formations from other aquifers. Recharge to the upper sandy zone of the Merchantville Formation downdip from the outcrop area is probably by interformational leakage from the silty sections of the overlying Woodbury Clay and from precipitation on the outcrop area and subsequent movement down gradient through permeable zones. Data are inadequate for exact determinations, but it appears that the static water level in wells tapping the Merchantville is higher than that in the underlying Raritan and Magothy Formations.

The results of an analysis of a water sample from well 70 (table 7) near Mantua show that in 1957 the water was of good chemical quality for domestic purposes. The dissolved solids content is 130 mg/l and the carbonate hardness of the water is 96 mg/l.

Probably not more than 5,000 to 10,000 gpd of water is pumped from the Merchantville Formation. Except for domestic wells in isolated localities near the outcrop area, possibilities for ground-water development are limited. Drilling wells into the Merchantville Formation in the part of the county south of a line between Mullica Hill and Sewell, is not warranted because of the increasing depths to the formation; greater percentages of clay resulting in lower permeabilities; and, most important, the availability of more productive aquifers in other geologic formations at shallower depths.

Woodbury Clay

The Woodbury Clay is exposed in an area of about 15 square miles and ranges from 0.1 to 1 mile in width (fig. 2). The featheredge of the

outcrop is about 4 miles south of the Delaware River in the western part of the county and less than 1 mile from the river at Westville.

The Woodbury Clay is a dark-blue to black, blocky clay. In parts of Gloucester County near the outcrop area this formation consists of a micaceous silty clay or fine sand. Some thin white sand streaks and Late Cretaceous fossils of marine origin have been found in the formation. The Woodbury Clay dips between 38 and 44 feet per mile to the southeast, and at Clayton, about 13 miles downdip from the outcrop it is 600 feet below the surface. The formation ranges in thickness from a few feet at the outcrop to 80 feet elsewhere in the county; its average thickness is about 50 feet.

The clay is overlain conformably by the Englishtown Formation and underlain conformably by the Merchantville Formation. In Gloucester County the outcrop is covered by Quaternary deposits of sand and gravel except where these deposits have been removed by streams.

No wells in Gloucester County are known to obtain water from the Woodbury Clay. This formation with the underlying Merchantville Formation serves chiefly as an aquiclude above the Raritan and Magothy Formations. It is probably the most effective confining layer in the Coastal Plain of New Jersey. However, no clay is completely impermeable and water from the overlying formations may percolate to the underlying Merchantville Formation and the Raritan and Magothy Formations. The physical characteristics of a sample of the Woodbury Clay are listed in table 2.

Englishtown Formation

The Englishtown Formation crops out in a band that is 1 to 2 miles wide in the northeastern part of Gloucester County and is only about half a mile wide in the central part of the county (fig. 2). Two miles west of Swedesboro it is not present at the surface. The formation has been recognized in the subsurface south of Swedesboro, but it is not everywhere present because it has been removed by erosion. About 13 square miles of outcrop area lie within the county.

The Englishtown Formation in its outcrop area consists of fine- to coarse-grained quartzose sand, and local lenses of clay. Mica, glauconite, and lignite are found in some horizons of the sand. In the outcrop area the Englishtown Formation is characterized by shades of yellow and brown, whereas subsurface samples usually are white and gray. A sample from the Englishtown Formation, collected about 4 miles east of Woodbury in Camden County consists predominantly of fine-grained sand (table 2). Downdip from the outcrop area the sand grades into

Table 2.—Laboratory determinations of physical characteristics of a sample of some formations in Gloucester County and adjacent area.

Formation outcrop	Particle size, mm							
			Sand					Gravel
	Clay <.004	Silt .004-.0625	V. fine .0625-.125	Fine .125-.25	Medium .25-.5	Coarse .5-1.0	V. coarse 1.0-2.0	V. fine 2-4
Bridgeton Formation	2.0		0.4	1.2	12.3	60.2	23.1	0.8
Cohansey Sand	.5		4.0	52.9	41.4	1.0	.2	
Kirkwood Formation	2.5		.5	3.2	38.0	49.4	6.1	.3
Vincentown Formation	8.4		4.9	24.4	46.8	13.6	1.9	
Hornerstown Sand	14.5	7.5	1.6	8.4	45.8	22.0	.2	
Navesink Formation	12.0	11.0	2.6	11.4	42.8	19.4	.2	
Mount Laurel Sand	5.0		1.6	5.7	58.8	24.0	4.1	.8
Wenonah Formation	2.6		1.1	35.8	58.2	2.2	.1	
Marshalltown Formation	8.9	23.1	31.4	28.8	6.6	1.0	.2	
Englishtown Formation	1.1		1.9	68.6	27.6	.7	.1	
Woodbury Clay	8.9	39.7	33.6	14.8	2.4	.4	.2	

clay and south of Mullica Hill and Sewell it is difficult to distinguish the Englishtown from the overlying Marshalltown Formation or the underlying Woodbury Clay. These latter formations are conformable with the Englishtown Formation but the gradational change downdip from sand to clay is a distinguishing geologic feature. Although no fossils have been found in the outcrop area of the Englishtown Formation the distribution of recognizable paleontologic assemblages downdip from its outcrop suggests that the Englishtown was deposited under both continental and marine environments. The formation dips about 40 feet per mile to the southeast (fig. 6) and is as much as 50 feet thick in outcrop. The structure contours indicate a shallow trough exists near Mullica Hill.

The Englishtown Formation is a minor aquifer in Gloucester County. Records of about 20 domestic wells that tap the formation show depths ranging from 50 to 160 feet, and an average yield of about 20 gpm. These wells are in a narrow band across the county and 2 to 4 miles downdip from the outcrop. In the vicinity of Barnsboro, Sewell, and Almonesson the Englishtown Formation is hydraulically connected with the lower water-bearing part of the overlying Marshalltown Formation. Wells in this area may yield as much as 100 gpm. It may not be necessary to equip wells with screens in the water-bearing zone of the two formations because of the consolidation of the material.

Recharge to the aquifer is from precipitation on the outcrop area and interformational leakage from the overlying formations. Regionally, a portion of the recharge to the Englishtown is from precipitation on the high-level intake areas in Burlington and Camden Counties, which then moves southeastward toward Gloucester County. This water is discharged into streams such as Raccoon and Mantua Creeks and other streams cut through parts of the Englishtown Formation.

Little ground water is pumped from the Englishtown Formation. Pumpage was probably less than 10,000 gpd in 1957. This withdrawal probably has a very small effect on the pattern of ground-water movement within the Englishtown Formation in the county. The amount of water discharged to streams and underlying formations is unknown. Nevertheless properly located wells could intercept some of the water being discharged to streams. Thus additional domestic wells can be located along the southeastern margin of the outcrop area of the aquifer and for a few miles downdip where there is an appreciable thickness of saturated sands available.

The water from the Englishtown Formation is of good chemical quality, except for a possible undesirable iron content. The iron contents of

4 samples tested are 0.54, 1.6, 2.0, and 3.3 mg/l. The analyses of four water samples collected show dissolved solids concentrations of 45, 91, 126, and 233 mg/l (table 8). The hardness of 4 samples tested are 18, 46, 97, and 154 mg/l. The concentrations of individual chemical constituents differ between wells. This difference probably is due to local recharge, interformational leakage, or the effects of changes in lithology. Present data indicate no danger of salt-water encroachment to this aquifer in Gloucester County. The small amount of pumpage, the small volume of saturated material, and high water levels tend to protect the aquifer from salt-water intrusion.

Ground-water discharge to the streams from the aquifer is at an altitude of 20 to 50 feet above sea level. Any increased pumpage in or near the outcrop area of this aquifer would decrease the ground-water discharge to the streams and thus the more favorably situated streams, such as Raccoon, Mantua, and the south branch of Big Timber Creeks may ultimately be sources of induced recharge.

Marshalltown Formation

The Marshalltown Formation crops out in a narrow belt that ranges from 0.1 to 0.6 mile wide and covers a total area of about 7 square miles (fig. 2). Good exposures may be seen along a small stream at the southern end of Wenonah Lake west of Wenonah. The formation is composed of dark-green to black clay, sandy clay and silt, and is locally micaceous and glauconitic. South of Swedesboro the formation is mostly a clayey and silty sand; from Mullica Hill northeast to Camden County well logs indicate glauconite in addition to silty, clayey sand. Downdip from the outcrop area, there is some indication of increased amounts of clay. An analysis of a sample collected about 2 feet from the base of the Wenonah Formation at Wenonah Lake show 67 percent very fine- to medium-grained sand and 32 percent silt and clay (table 2). Marine fossils of Late Cretaceous age have been found in the formation.

The Marshalltown Formation ranges in thickness from 10 to 40 feet at or near the outcrop and dips southeastward between 35 and 40 feet per mile. It is overlain conformably by the Wenonah Formation and underlain conformably by the Englishtown Formation where present or unconformably by the Woodbury Clay.

In the Coastal Plain of New Jersey the Marshalltown Formation is largely a confining layer for the more permeable parts of the underlying Englishtown Formation and the overlying Wenonah Formation. So far as known, no wells in the county obtain water exclusively from the Marshalltown Formation. However, there are wells which yield from 40 to 100 gpm from a sandy zone that lies within the lower part of the

Marshalltown Formation and the upper part of the Englishtown Formation. These wells are about 100 feet deep and are in a small area southeast of Woodbury near Camden County.

Wenonah Formation and Mount Laurel Sand

Geology

The Wenonah Formation and Mount Laurel Sand in Gloucester County are similar in lithology and are mapped as a geologic unit. The outcrop of the undifferentiated Wenonah Formation and Mount Laurel Sand is parallel to the Delaware River and 4 to 5 miles inland (fig. 2). The outcrop ranges in width from 0.3 to 3.0 miles and covers about 30 square miles. Good exposures of the Mount Laurel Sand underlie the Navesink Formation at Mullica Hill, and the Wenonah Formation is exposed in a road cut 5 miles east of Woodbury on Route 41 between Barrington and Runnemede in Camden County. In Gloucester County the Mount Laurel or upper sand is the predominant formation. It is characterized by medium- to coarse-grained quartzose sands with glauconite generally ranging from less than 5 to about 40 percent. Sand layers, 4 to 5 feet thick, locally contain as much as 90 percent glauconite. The sand ranges from light gray to dark green. The Wenonah Formation is predominant in Camden County and in the northern part of the Coastal Plain. It contains quartz sand that is fine to coarse grained and black, yellow, red, and brown; it is micaceous and contains ferruginous cement layers called "ironstone." Near the contact with the underlying Marshalltown Formation it is a brown silty clay. The Wenonah Formation may contain finer grained material downdip from the outcrop area.

Marine fossils of Cretaceous age have been found in outcrops of both the Wenonah Formation and Mount Laurel Sand. Well drillers can recognize these formations readily by their "salt and pepper" appearance and by fossil shells of belemnites. An analysis of samples from outcrops shows that the Mount Laurel Sand is much coarser grained, and contains more silt than the Wenonah Formation (table 2).

The combined thickness of the Wenonah Formation and Mount Laurel Sand in the county ranges from less than 65 to 95 feet. The dip of the top of the Mount Laurel Sand is about 36 feet per mile to the southeast (fig. 7). The structure contours indicate the top of the Mount Laurel Sand is irregular.

The Mount Laurel Sand is overlain conformably by the Navesink Formation and the Wenonah Formation is underlain conformably by the Marshalltown Formation. A pebble zone occasionally marks the base of the Navesink Formation, and in some places the top of the Marshalltown Formation is marked by the appearance of a dark clay or sandy clay.

Hydrology

The Wenonah Formation and Mount Laurel Sand are hydraulically connected and function effectively as a single aquifer. This aquifer is the main source of domestic water supplies in the north-central part of the county, particularly in the area bounded by Swedesboro and Ewan on the southwest and Almonesson and Turnersville on the northeast. Records of more than 100 wells tapping the Wenonah Formation and Mount Laurel Sand indicate yields up to 200 gpm. Specific capacities of the wells range from 0.4 to 20 gpm per ft of drawdown and average 5 gpm per ft of drawdown. The wells range in depth from 35 to 200 feet below the land surface and are less than 100 feet deep in and near the outcrop area.

The Wenonah Formation and Mount Laurel Sand in Gloucester County is recharged mostly by interformational leakage through the overlying Navesink Formation. Some recharge is contributed by precipitation on the outcrop area, but it is minor and is important only to shallow water-table wells. The map showing contours on the piezometric surface of the Wenonah Formation and Mount Laurel Sand suggests two high-level intake areas downdip from the outcrop area (fig. 7). From the high-level intake area 3 miles west of Mullica Hill, some of the ground water moves southwestward toward Oldmans Creek and into Salem County and some moves eastward toward Raccoon Creek. The recharge area from Ewan through Pitman to Turnersville is near the topographic high which separates the Delaware River basin from the Atlantic Ocean drainage. Water moves from this high-level intake area to Raccoon and Mantua Creeks. Also, some water moves eastward to the south branch of Big Timber Creek and possibly into Camden County. In the area south of Mullica Hill to the Salem County line, a groundwater trough receives water from the two high-level intake areas.

In Gloucester County the Wenonah Formation and Mount Laurel Sand yield adequate quantities of water for domestic and farm use. Public water supply wells tapping this aquifer have been abandoned at Sewell and Pitman, although a small public water company east of Pitman pumps some water from this aquifer. In the east-central part of the county from Pitman to Turnersville, yields of 200 gpm are available and 300 to 400 gpm may be obtained under favorable conditions. Total pumpage of ground water from the Wenonah Formation and Mount Laurel Sand in 1957 was less than 1 mgd.

The rate of ground water withdrawal from this aquifer is small and the static water levels range from 40 to 100 feet above mean sea level. If pumping of ground water from the Wenonah Formation and Mount

Laurel Sand is increased greatly, the discharge of Oldmans, Raccoon, Mantua, and Big Timber Creeks may be decreased.

Quality of water

The results of chemical analyses of nine water samples from the Wenonah Formation and Mount Laurel Sand indicate that the dissolved solids ranged from 46 to 386 mg/l, iron ranged from 0.2 to 5.6 mg/l, and hardness ranged from 14 to 174 mg/l. Six analyses of these nine samples indicated concentrations of dissolved solids and iron less than 130 and 0.6 mg/l, respectively, and five of the nine analyses indicated between 70 and 100 mg/l of hardness (table 8). The concentrations of the individual chemical constituents in these waters vary considerably and, from the data available, no single analysis may be considered typical of water from these formations. This variance in the quality of the water may be caused by local recharge conditions or different lithologies within the formations. In the Harrisonville area, the water contains 174 mg/l of hardness and has an iron content of 3.6 mg/l; at Mullica Hill and Pitman the water has a hardness of 81 and 74 mg/l and an iron content of 0.2 and .79 mg/l respectively. Two miles east of Wenonah, well 36 drilled to a depth of about 40 feet below land surface in the outcrop area, yields water that contains more than 100 mg/l each of chloride and nitrate. The high nitrate content indicates local pollution probably due to leached animal wastes or fertilizers. Pollution of this type is not uncommon in farming and rural areas.

Navesink Formation

The Navesink Formation crops out in a narrow band from 0.2 to 0.5 mile wide across the county in an area of 5 square miles (fig. 2). The formation consists of dark green to black glauconitic sand and clay mixed with varying amounts of quartzose sands. An analysis of a sample collected at the top of the formation at the Inversand pit, 1 mile southeast of Sewell, shows 75 percent fine- to coarse-grained sand and 22 percent clay and silt (table 2). The basal part of the formation may be pebbly; whereas, the upper part is mostly clay. At many localities, the Navesink Formation cannot be distinguished from the overlying Hornerstown Sand because of similar lithology.

The Navesink Formation is overlain unconformably by the Hornerstown Sand and underlain conformably by the Wenonah Formation and Mount Laurel Sand. The formation dips about 33 feet per mile to the southeast and ranges in thickness from less than 1 to 40 feet. At Mullica Hill the Navesink Formation is about 5 feet thick.

In the Coastal Plain of New Jersey, the Navesink Formation and the Hornerstown Sand act largely as confining layers for the deeper, more permeable formations. The hydrologic characteristics of the formation are similar to those of the Marshalltown Formation as these "aquicludes" have a coefficient of permeability of about 50 gpd per sq ft.

In the eastern part of the county between Pitman and Turnersville a few domestic wells have been developed in the basal part of the Navesink Formation but they also include the upper part of the Wenonah Formation and Mount Laurel Sand. The formations are more or less consolidated and well screens are unnecessary in the water-bearing zone. Although the Navesink Formation may yield from 10 to 50 gpm, records indicate that wells which are drilled to include part of the Wenonah Formation and Mount Laurel Sand may yield up to 150 gpm in this area.

PALEOCENE SERIES

Hornerstown Sand

The Hornerstown Sand in Gloucester County has an outcrop area of from 0.1 to 1.0 mile wide and has an extent of about 7 sq mi (fig. 2). It is composed of clay and sand, and as much as 90 percent glauconite. This mineral gives the formation its characteristic dark-green color. A laboratory determination of the physical characteristic of a sample collected from the base of the Hornerstown Sand at the Inversand pit was similar to the results obtained from a sample of the Navesink Formation (table 2).

The formation ranges from 8 to 30 feet thick and the top of it dips to the southeast about 30 feet per mile. In Gloucester County, the Hornerstown Sand and Navesink Formation are difficult to differentiate because of similar lithology and in many well logs the two formations are undifferentiated.

The Hornerstown Sand and Navesink Formation as mentioned previously may be considered as a hydrologic unit. They serve largely as confining layers above the aquifer formed by the Wenonah Formation and Mount Laurel Sand. Locally the Hornerstown Sand and Navesink Formation do not form an effective aquiclude, hence, it is possible for water to move vertically through them. In some localities, yields of 10 to 50 gpm are possible from parts of the Hornerstown Sand. The Hornerstown Sand is hydraulically connected with the overlying, water-bearing Vincentown Formation.

Vincentown Formation

The Vincentown Formation crops out in a few isolated places (fig. 2) and has an area of about 1 sq mi. The outcrops are in Raccoon Creek

near Mullica Hill, in Mantua Creek southeast of Sewell, and in a tributary of Oldmans Creek near State Highway 45 in Salem County 1 mile west of the Gloucester County line. An analysis of a sample of this formation collected in Salem County, 2 miles southwest of Harrisonville, shows mostly medium sand with little clay and silt (table 2).

The formation has two recognizable facies: (1) a quartzose sand with glauconite; and (2) a limy sandstone which contains fossil shells. The limy facies is predominant in Gloucester County. The formation, usually gray or brown in color, is found at depths of less than 100 feet in wells near Harrisonville. Near Ewan and Pitman, the Vincentown Formation is slightly more than 100 feet below the surface. At Turnersville, near the Camden County line, wells less than 100 feet deep tap this aquifer.

The Vincentown Formation ranges in thickness from 0 to 55 feet in the county. It varies in thickness downdip and along the strike. The formation dips to the southeast at about 27 feet per mile (fig. 8). In Gloucester County it is overlain conformably by the Manasquan Formation in the subsurface and unconformably by the Kirkwood Formation in outcrop. The contact with the underlying Hornerstown Sand is slightly unconformable.

The Vincentown Formation is a minor aquifer in Gloucester County, but probably is more productive than the Englishtown or the Kirkwood Formations. The aquifer is largely undeveloped because much of the area in which it is available for development is sparsely settled. Thus it is tapped only by domestic and farm wells in a narrow band from Harrisonville through Pitman to Turnersville. Records of about 20 wells indicate yields ranging from 10 to 150 gpm from depths of 85 to 150 feet below land surface and pumpage in 1957 was probably less than 25,000 gpd. The specific capacity of wells and a laboratory coefficient of permeability indicate moderate amounts of water may be available, particularly where solution openings in the limy facies are large. The higher yielding wells in the Vincentown are near Sewell and Pitman.

The Vincentown Formation is recharged by precipitation on its outcrop outside Gloucester County and by interformational leakage from the overlying Kirkwood Formation which probably provides most of the local recharge. The static water levels in wells downdip in the Vincentown are at a higher altitude than those observed in wells in the outcrop area thus indicating that the outcrop area in Gloucester County is not a place of regional recharge to this aquifer. A generalized map of the piezometric surface of the Vincentown Formation indicates a high-level intake area near Richwood where the formation is overlain by the Kirkwood Formation (fig. 8). Movement of water from this recharge area

is northward toward Raccoon Creek, Edwards Run, and Mantua Creek, and southward toward Clayton. Water moves to Oldmans Creek and into Salem County from another recharge area about 1 mile north of Harrisonville. A comparison of the contours of the piezometric surface in the Vincentown Formation with those in the Wenonah Formation and Mount Laurel Sand shows that there is opportunity for downward vertical leakage.

The results of chemical analyses of four water samples show that the dissolved solids ranged from 86 to 173 mg/l, iron concentrations ranged from 0.16 to 2.4 mg/l, and hardness ranged from 66 to 138 mg/l. The quality of the water from each well is different which suggests local recharge or lithologic changes in the aquifer.

EOCENE SERIES

Manasquan Formation

The Manasquan Formation, so far as is known, is not exposed in Gloucester County. The lithology of the Manasquan Formation is similar to that of the underlying Vincentown; thus, it is difficult to separate these formations. The Manasquan has been identified in the subsurface near Turnersville, where it is about 15 feet thick. Here it is composed of quartzose sand and clay and contains a high percentage of glauconite. The sand is light green and gray mixed with dark green, and very fine- to medium-grained. Marine fossils of Eocene age have been found in the formation. The similarity of the lithology of the Manasquan Formation to that of the underlying Vincentown Formation suggests they may grade or interfinger downdip. The Manasquan Formation dips to the southeast at about 25 feet per mile and is overlain unconformably by the Kirkwood Formation.

So far as known, no wells obtain water from the Manasquan Formation in Gloucester County. Where present the formation functions as a confining layer for the underlying Vincentown Formation.

MIOCENE SERIES

Kirkwood Formation

The Kirkwood Formation has an outcrop area of from 1 to 6 miles wide and includes an area of about 100 square miles—the second largest outcrop area in the county (fig. 2). The formation is composed of clay, silt, and very fine- to coarse-grained quartzose micaceous sand. These materials are found in shades of buff, yellow, white, and pink. Locally, the Kirkwood Formation is well sorted. An analysis of a sample from a

gravel pit near Ewan show medium- to coarse-grained sand (table 2). Downdip, the formation is generally coarser grained.

The thickness of the formation ranges from 50 feet in the outcrop area to about 160 feet in the southern part of the county. The upper part of the Kirkwood Formation dips to the southeast at about 9 to 13 feet per mile and the basal beds dip about 25 feet per mile.

The Kirkwood Formation is a minor aquifer in the county. Records indicate that there are a few domestic wells, 25 to 100 feet deep which yield from 10 to 50 gpm. In and near the outcrop the formation consists largely of clay, silt, and fine sand of low permeability. Although the Kirkwood Formation is thicker and more permeable in the southern part of the county, it is not tapped by wells because water is more readily available from the overlying Cohansey Sand.

The Kirkwood Formation is of hydrologic importance in Gloucester County because its large surface area can absorb precipitation which may be transmitted to the lower aquifers. Some recharge moves downdip to the more permeable parts of the Kirkwood Formation; however, much of the recharge on the outcrop is discharged to the nearby streams.

Results of chemical analyses of water from wells 16 and 26 (table 8) in the outcrop area of the Kirkwood Formation near Richwood and Turnersville show dissolved solids of 64 and 62 mg/l, iron 0.55 and 0.43 mg/l, nitrate 22 and 14 mg/l, and hardness of 28 and 20 mg/l, respectively. Because this aquifer is recharged locally and in places hydraulically connected to underlying aquifers, contamination of the shallow water-table ground-water reservoir by infiltration of sewage, industrial wastes, or other water of poor quality should be avoided in those places.

Locally, domestic and farm supplies can be developed in and near the outcrop area. Pleistocene gravel where present in appreciable thicknesses can be developed in conjunction with the Kirkwood Formation to improve well yields.

MIOCENE(?) AND PLIOCENE(?) SERIES

Cohansey Sand

Geology

The Cohansey Sand crops out in an area of about 150 square miles in Gloucester County (fig. 2). The formation is composed of fine- to coarse-grained quartzose sand, lenses of light-colored clay as much as 25 feet thick, and lenses of gravel. The sand is white, yellow, red, brown, and gray and the clays are shades of red, orange, and gray. Generally, ferruginous cemented zones are found only near contacts with the over-

lying Pleistocene deposits. The Cohansey Sand usually is composed of at least 90 percent silica with subordinate amounts of feldspar, magnetite, and ilmenite. An analysis of a sample collected in a pit at Downer shows about 94 percent fine to medium sand (table 2). The Cohansey Sand dips southeast about 11 feet per mile and ranges in thickness from a few feet in the outcrop area to 130 feet at Newfield.

The Cohansey Sand is underlain by the Kirkwood Formation and overlain unconformably by the Bridgeton Formation of Pleistocene age except in a small area along Mantua Creek east of Pitman, where it is overlain by the Cape May Formation, also of Pleistocene age.

Hydrology

The Cohansey Sand is the second most productive aquifer in the county. However, the amount of water withdrawn is small compared to the quantity potentially available; thus, the aquifer is considered almost undeveloped. Locally, there may be more than one water-bearing zone present; however, the formation is generally regarded as a hydrologic unit. In and near the outcrop area, the Cohansey Sand is hydraulically connected with the underlying Kirkwood Formation. Wells tapping the Cohansey Sand range from 25 to 130 feet deep and yield up to 800 gpm.

Artesian conditions exist locally in the Cohansey Sand because of lenses of clay which act as aquicludes for the more permeable parts of the formation. Pumping tests at Williamstown and Clayton indicate a coefficient of transmissibility of 60,000 gpd per ft and a permeability of nearly 1,000 gpd per sq ft. These figures compare favorably with those for the Raritan and Magothy Formations along the Delaware River.

Recharge to the Cohansey Sand is from precipitation on the outcrop area and ground-water movement is effected to some extent by the topography. In Gloucester County, a topographic and a hydrologic ridge trending southwest to northeast from Hardingville near the Salem County line through Glassboro to Turnersville causes ground water to move northward into Raccoon Creek, Chestnut Branch, Mantua Creek, and the south branch of Big Timber Creek. This ridge is joined by a north-south-trending ridge near Cross Keys. From the high-level intake area near Cross Keys some ground water moves south and discharges into the Great Egg Harbor River and some moves west and discharges into the Maurice River or its tributaries (fig. 9).

The Cohansey aquifer is in equilibrium, or in other words, the long-term recharge equals the long-term discharge. Recharge to the aquifer during the nongrowing season exceeds aquifer discharge. Hence, the amount of water stored in the aquifer usually increases during the nongrowing season. This increase in storage is substantial enough to permit

the water table in most parts of the outcrop area to remain higher than nearby stream channels throughout the growing season. As a result, the dry-weather flow of streams in the Cohansey Sand outcrop area represents ground-water discharge. The volume of ground water discharged to streams from the Cohansey Sand as well as direct storm runoff, is measured by recording gaging stations on the Maurice River at Norma (Salem County) and on the great Egg Harbor River at Folsom (Atlantic County).

Ground water from the Cohansey Sand is utilized largely for domestic and farm supplies, although some ground water is used by industry. The 1957 ground-water pumpage from the aquifer in the county was about 2 to 3 mgd from wells generally 100 to 200 feet deep, although many wells are only 25 to 50 feet deep. The possibilities for future development of water for industry, irrigation, and public supply from the Cohansey Sand are excellent. Wells capable of yielding 1,000 gpm are possible.

The concentration of dissolved solids in ground water from the Cohansey Sand is usually less than 100 mg/l. Results of chemical analyses of six samples (table 8) show that the iron concentration was generally less than 0.5 mg/l and carbonate hardness was 50 mg/l or less. The most undesirable feature of the water is the iron content for which the water must be treated to be rendered suitable for many uses. The temperature of the water is usually between 13° and 14°C.

This aquifer consists of a large thickness of saturated sediments of high porosity and permeability. Any large-scale pumping from the aquifer may decrease the flow of the main streams, such as Great Egg Harbor and Maurice Rivers and in turn may allow increased upstream movement of saline water in the tidal reaches of the streams in Atlantic and Cumberland Counties.

PLEISTOCENE SERIES

The Pleistocene Series consists of the Bridgeton, Pensauken, and Cape May Formations. These formations have similar geohydrologic characteristics and cap the older sediments (fig. 2).

Bridgeton Formation

The Bridgeton Formation crops out in an area of about 100 square miles in the southern half of the county The exposures are irregular and are at altitudes ranging from 100 to 160 feet.

The Bridgeton Formation contains fine- to very coarse-grained quartzose sand and gravel. An analysis of a sample collected 2 miles northeast of

Mullica Hill shows more than 95 percent medium to very coarse sand (table 2). The sands are white, yellow, and brown; usually they are fairly well sorted, and the grains are subangular. The formation has a thickness of as much as 50 feet in the county.

The Bridgeton Formation yields from 10 to 50 gpm of water to wells for domestic and stock supplies. In the southern half of the county, the Bridgeton Formation is hydraulically connected with the underlying Cohansey Sand or the Kirkwood Formation. The Bridgeton Formation is a water-table aquifer and the shape of the water table is a subdued replica of the topography.

Pensauken Formation

The Pensauken Formation crops out in irregular and isolated patches in the north-central part of the county at altitudes of 40 to 120 feet. It includes an area of about 23 square miles (fig. 2). The formation consists of medium- to coarse-grained quartzose sand, and some gravel and clay. The sand grains are usually poorly sorted; subangular with colors of yellow, red, and brown. Locally, the grains of sand and gravel are indurated by ferruginous cement to form "ironstone." The Pensauken Formation is difficult to distinguish from the underlying Bridgeton Formation because of similar lithology. The formation is as much as 30 feet thick in the county. Elsewhere in the State, it attains a thickness in excess of 60 feet.

The hydrology of the Pensauken Formation is similar to that of the Bridgeton Formation. A few wells yield from 10 to 50 gpm of water for domestic use.

Cape May Formation

The Cape May Formation crops out adjacent to the Delaware River and tributary streams (fig. 2). It is found at altitudes as high as 90 feet along some streams, but usually it is not higher than 70 feet. The outcrop has an area of about 34 square miles in Gloucester County. The Cape May Formation is composed of medium- to coarse-grained quartzose sand with much gravel and minor amounts of clay. The sand and gravel are usually yellow or brown, but sometimes they are gray in color. The clays are yellow, brown, gray, and black. The materials are usually poorly sorted; and the sand grains are subangular. The Cape May materials are not compact or coated with iron oxide as are the older Pleistocene deposits. The formation is as much as 40 feet thick. Along the streams in the interior of the county, the Cape May Formation is about 30 feet thick: In some areas it is difficult to distinguish the Cape May Formation from the Pensauken Formation because of similar lithology.

The Cape May Formation is a minor aquifer in Gloucester County, yielding 10 to 50 gpm of water to domestic wells The outcrop area is flat and recharge from precipitation infiltrates easily through the soil and into the underlying Raritan and Magothy Formations where they are present.

Encroachment of salt water into the Cape May Formation may occur along sections at the Delaware River where the static water levels in the formation are near or below sea level. Therefore, the quality of the Delaware River water is significant to the future development of the Cape May Formation as an aquifer. Because water from the Cape May Formation recharges the Raritan and Magothy Formations, water of poor quality entering the Cape May Formation from the Delaware River could cause a deterioration of the water in the underlying productive aquifers.

HOLOCENE SERIES

Alluvium

There is little alluvial material in Gloucester County. The alluvium is a mixture of silt, clay, organic material, sand, and gravel deposited in tidal flats and along low-gradient stream channels. Along the Delaware River near Westville, the alluvium is 10 to 40 feet thick. Most of the alluvial material is fine silt or clay and its permeability is only a small fraction of that of water-bearing sands. Alluvial deposits retard the movement of brackish water from the Delaware River into the water-bearing sands of the Raritan and Magothy Formations in places along the river where the water levels in this aquifer are below the river level.

Eolian Deposits

Available geologic data indicate that windblown deposits occur locally and are generally thin in the county. They are light-gray, well-sorted sands composed of quartz grains that have been rounded by wind action. The eolian deposits allow water to percolate through them into other formations.

USE OF GROUND WATER

Gloucester County is principally a rural and agricultural county. Industry is concentrated in a 3-mile wide strip along the Delaware River. Industrial pumpage of ground water is expected to continue to increase because of greater industrial activity particularly in areas south of the New Jersey Turnpike.

Pumpage of ground water by public water companies increased from 3.1 mgd in 1948 to 11 mgd in 1966. The number of people served by these companies is increasing steadily as the suburbs surrounding the cities continue to be developed. The three largest public water companies in the county are Woodbury, Paulsboro, and Glassboro. About 30 percent of the population live in the rural areas of the county and water supplies are obtained from wells that are usually less than 100 feet deep and yield 10 to 20 gpm.

Irrigation with ground water is increasing in the central and southern parts of the county In recent years the total acreage of farms has decreased, but the number of irrigated acres of farmland has increased. The possibility of crop failure because of extended droughts during the summer has prompted the farmers to obtain supplemental sources of water.

INDUSTRIAL USE

About 10 mgd of ground water was pumped during 1957 for industrial use in the county. By 1966, industrial use had increased more than 50 percent to about 15.5 mgd (table 3).

The Eagle Point Refinery of the Texas Co. at Westville was the largest industrial user of ground water in the county until 1966 when it was surpassed by the Mobil Co. (table 3). The refinery had six operating wells in 1957. More than 4.4 mgd of ground water was pumped in 1966. These wells range in depth from 289 to 318 feet and when drilled in 1947 each yielded about 1,000 gpm with drawdowns of 34 to 60 feet from static water levels ranging from 35 to 40 feet below the land surface. All the water for the refinery is pumped from the Raritan and Magothy Formations which, locally consist of alternating sand and clay beds. Well 73 and well 74 (table 6) at the refinery obtain water from a sand and gravel zone 30 to 45 feet thick ranging from 250 to 320 feet below the land surface. In one well bedrock was reached about 320 feet below the land surface. In 1950, the water from the pumping wells had concentrations of dissolved solids ranging from 120 to 186 ppm (table 8) and chloride ranging from 9 to 26 mg/l. Analyses made in 1967 indicated that the concentrations of dissolved solids and chloride was still within the above ranges.

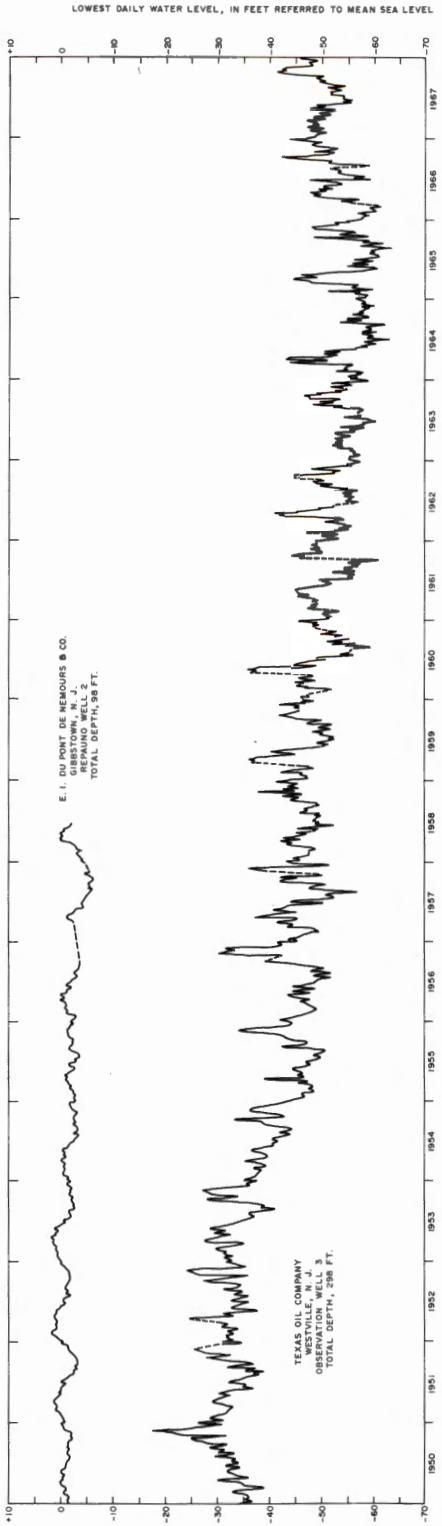

Figure 10.—Hydrograph of the E. I. du Pont de Nemours & Co. Repaupo Well 2 and Texas Oil Company Well 3.

Table 3.—Use of ground-water by largest industries in Gloucester County, N. J.

(Data from records of N. J. Division of Water Policy and Supply)

Water use in millions of gallons

Company	*1955*	*1957*	*1960*	*1964*	*1966*
The Texas Co. (Westville)	1142.087	1426.985	1581.068	1671.443	1607.890
Mobil Co. (Paulsboro)	711.800	1050.246	827.865	977.488	1756.131
E. I. du Pont de Nemours & Co. (Gibbstown)	254.720	270.940	395.570	414.110	398.790
Hercules Powder Co. (Gibbstown)	140.962	156.864	177.583	179.373	225.978
Shell Chemical Co.[1] (Woodbury)				707.673	932.019
Monsanto Chemical Co.[2] (Bridgeport)				412.129	517.993
Owens Illinois Glass Co.[3] (Glassboro)				91.649	232.584
Total	2249.569	2905.035	2982.086	4453.865	5671.385
Average mgd	6.163	7.959	8.170	12.202	15.538

[1]Pumpage record began March 1961.
[2]Pumpage record began October 1961.
[3]Pumpage record began April 1962.

The trend of water-level fluctuations at the Texas Co. Refinery for 1950 to 1967 is shown in figure 10 (well 3). The hydrograph shows that the net decline from 1950 to 1967 was less than 15 feet. The rapid rise of the water level in November reflects a decrease of pumpage owing to boiler shutdown and cleaning. From 1953, to 1965 the long-term trend of the water level has been a gradual decline from the nearly steady conditions of 1950 through 1953. For 1966-67, a slight upward trend is evident.

Another large industrial user of ground water in the county is the Mobil Oil Co. at Paulsboro. Ground-water pumpage in 1966 was about 4.8 mgd (table 3). The refinery is adjacent to the Delaware River and about 5 miles west of the Texas Co. plant. In December 1957 the company had 8 pumping wells, 13 abandoned and sealed wells, and 1 inactive reserve well. An additional 25 shallow wells less than 100 feet deep were abandoned between 1917 and 1922. Six of the eight pumping wells are used for cooling purposes and boiler feed. The boiler water generally is taken from the Delaware River. Two wells supply water for drinking purposes. The pumping wells range in depth from 118 to 266 feet and discharge 500 to 1,100 gpm. The wells obtain water from the Raritan and Magothy Formations and the screen settings range from 95 to 240 feet below the land surface. The total capacity of the eight wells in November 1957 was about 6,600 gpm. Wells 67 and 68 (table 6) at the refinery show specific capacities of about 35 gpm per foot of drawdown for each well. Results of chemical analyses from wells at the refinery (well B, C, and D, table 8) showed an iron content of 0.19, 29, and 1.0 mg/l; chloride content of 38, 23 and 14 mg/l; and sulfate content of 158, 72, and 465 mg/l, respectively. Much of the water is acidic, possibly as a result of contamination.

Two miles west of Paulsboro is the E. I. du Pont de Nemours & Co. Repaupo Works at Gibbstown. As of December 1957, the company had three wells in operation and one well in reserve. Pumpage of ground water was reduced from more than 1.2 mgd in the period 1950 to 1953 to about 0.7 mgd in the period 1955 to 1957 (table 3), however, by 1960 pumpage had again increased to about 1.1 mgd (table 3). Most of the water used in the plant is obtained from the Delaware River. Two of the three wells are used for potable and sanitary purposes, and one well is used for industrial purposes. The wells are about 100 feet deep and discharge from 450 to 500 gpm from the Raritan and Magothy Formations. About 20 wells, 100 feet deep, have been abandoned and sealed. Two other wells are equipped with automatic water-level recorders and a few other wells are not used, except for periodic water-level measurements.

A hydrograph of an observation well at the E. I. du Pont de Nemours & Co. plant (fig. 10, well 2) shows that the water level declined about 5 feet from 1950 to 1957. The yearly highs of the water level occur during the spring and the lows occur during the autumn. Although the ground-water pumpage from 1954-57 was about 0.5 mgd less than the rate of pumpage from 1950-53, the water level did not recover because the area of withdrawal had been shifted closer to the observation well.

The Hercules Powder Co. in Gibbstown receives some water from the city, but most of the water is pumped from wells at the plant. Pumpage of ground water was at a fairly constant rate of about 0.4 mgd from 1955-59 but has gradually increased since then to about .62 mgd in 1966 (table 3).

In recent years the use of ground water for air conditioning has increased, particularly for movie theaters and office buildings. The wells used for this purpose are in operation about four months during the summer and usually each well discharges from 50,000 to 200,000 gpd when in use. Recharge wells may be connected in a closed circuit with the pumping wells in order to return water to the aquifer.

PUBLIC SUPPLY

About 11 mgd of ground water was used for public supply in Gloucester County in 1966, more than 95 percent of which is obtained from the aquifers of the Raritan and Magothy Formations. This includes a minor amount of water purchased by industry from the public water companies. In Gloucester County, about 3.6 mgd of water was pumped for public supply during 1948 and more than 10.9 mgd during 1966. This is more than a 300 percent increase in pumpage in 27 years. The population increased about 47 percent from 1950 to 1960, mostly in the cities. About 50 percent of the people live in the area bounded by the New Jersey turnpike and the Delaware River. There are 25 public water systems in the county of which the Woodbury Water Department is the largest. Other large systems are Paulsboro, Glassboro, Pitman, and Westville (see fig. 17). The average per capita consumption of water from 14 water companies in 1956 was about 64 gpd, in 1966 it was 103 gpd.

Total ground-water pumpage from 1950 to 1966 for all the public water companies shows a steady increase in water consumption (table 4).

IRRIGATION USE

In 1957, there were about 150 surface ponds storing ground water for irrigation use in the county. An estimated 250 farms use ground water for irrigation from wells ranging in depth from 30 to 50 feet. About

5,000 acres in the county were irrigated, with possibly as much as 3,500 acres irrigated with ground water (written communication, George Lamb, January 3, 1958). In 1966 about 15,000 acres were under irrigation (written communication, Richard W. Akeley, July 19, 1966).

Water use for crops in the county is from 0.5 to 1.3 acre-foot per acre. During 1966 it is estimated that about 20 mgd was used for irrigation. Approximately one-half of this amount was from wells.

RURAL USE

Most of the land in the county is occupied by farms and small villages. These areas are not served by public water companies but, instead depend on private wells for their water supply. The estimated population of the county at the end of June 1966 was about 159,600 people, of which 106,300 were supplied water by the public water companies. Thus, in 1966 about 53,300 people obtained water from private wells. Assuming an average per capita consumption of 70 gpd, it is estimated that about 3.5 mgd of ground water was withdrawn from private domestic wells in 1966.

ESTIMATED TOTAL GROUND-WATER USE (1966)

The total amount of ground water used in the county during 1966 is estimated at 40 mgd. Amounts by type of use are summarized from data obtained from N. J. Division of Water Policy and Supply in the following table:

	mgd
Industrial use	15.5
Texas Oil Co., Mobil Oil Co., and E. I. du Pont de Nemours & Co. and Hercules Powder Co.	11
Other industrial supplies	4.5
Public supplies, including some industrial purchases	11
Irrigation use	10
Rural suburban use	3.5
Total	40

TABLE 4—USE OF GROUND WATER BY PUBLIC SUPPLIES (Serving more than 100 persons) IN GLOUCESTER COUNTY, N. J. (1950-1967)

(Source of data: N. J. Division of Water Policy and Supply)

Name	Pumpage	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Populat. Served 1966	% of Consumers Metered 1966	Aquifer
Bridgeport Water Co.	Av. mgd	0.044	0.046	0.030	0.024	0.030	0.032	0.031	0.035	0.028	0.034	0.033	0.028	0.027	0.030	0.028	0.028	0.030	0.029	725	97	Magothy & Raritan
	Tot. mg	16.26	16.68	10.92	8.73	11.15	11.53	11.20	12.74	10.41	12.39	11.97	10.12	9.96	11.07	10.40	10.35	10.87	10.72			
Clayton Water Co.	Av. mgd	0.109	0.120	0.150	0.159	0.215	0.242	0.268	0.253	0.195	0.188	0.185	0.223	0.234	0.252	0.266	0.234	0.266	0.252	4000	100	Cohansey Sand, Magothy and Raritan
	Tot. mg	39.88	44.00	54.96	57.98	78.54	88.38	98.04	92.41	71.14	68.81	67.57	81.30	85.46	91.98	97.53	85.41	97.16	91.98			
Deptford MU Authority	Av. mgd	Started in 1963													0.867	0.935	1.177	1.324	1.165	8464	100	Magothy & Raritan
	Tot. mg														316.46	342.14	429.58	483.43	425.37			
E. Greenwich Twp. W.D.	Av. mgd	0.085	0.106	0.120	0.172	0.152	0.131	0.130	0.198	0.138	0.174	0.160	0.170	0.178	0.219	0.287	0.268	0.334	0.271	3200	93	Magothy & Raritan
	Tot. mg	31.07	38.77	44.10	62.91	55.68	47.86	47.73	72.19	50.43	63.70	58.68	61.89	65.17	80.10	105.01	97.78	122.00	99.06			
Edenwood Water Co.	Av. mgd	Started in 1958								0.063	0.115	0.137	0.127	0.132	0.137	0.162	0.161	0.185	0.167	1500	100	Magothy & Raritan
	Tot. mg									22.89	41.93	50.43	46.24	48.38	49.89	59.21	58.75	67.53	60.92			
Glassboro Water Co.	Av. mgd	0.436	0.495	0.515	0.588	0.646	0.750	0.779	0.917	1.017	1.176	1.267	1.081	1.072	1.105	1.078	0.986	1.126	1.073	12000	99	Magothy & Raritan
	Tot. mg	159.05	180.54	188.39	214.50	235.62	273.77	284.98	334.53	371.36	429.43	463.80	394.56	391.14	403.19	394.73	359.90	411.00	391.50			
Greenfields Water Co.	Av. mgd	Started in 1958								0.140	0.177	0.202	0.171	0.216	0.250	0.298	0.254	0.304	------	2650	100	Magothy & Raritan
	Tot. mg									50.94	64.74	73.90	62.42	79.00	91.41	108.89	92.59	111.05	------			
Greenwich Twp. W. D.	Av. mgd	0.188	0.264	0.307	0.366	0.510	0.512	0.355	0.524	0.540	0.655	0.466	0.475	0.557	0.700	0.778	0.657	0.684	0.688	5000	100	Magothy & Raritan
	Tot. mg	68.80	96.49	112.42	133.41	186.34	186.76	129.79	191.14	197.10	239.05	170.57	173.56	203.29	255.46	284.88	239.83	249.49	251.34			
Mantua Water Co.	Av. mgd	0.034	0.039	0.041	0.042	0.046	0.050	0.053	0.065	0.059	0.063	0.063	0.071	0.077	0.087	0.088	0.091	0.088	0.077	1500	100	Magothy & Raritan
	Tot. mg	12.48	14.29	15.11	15.47	16.92	18.16	19.33	23.56	21.69	22.86	22.96	26.08	28.17	31.77	32.23	33.34	32.13	28.05			
Monroe Mun. Util. Auth.	Av. mgd	0.127	0.140	0.133	0.157	0.174	0.209	0.191	0.197	0.200	0.213	0.246	0.280	0.324	0.345	0.386	0.386	0.387	0.345	4600	99	Cohansey Sand
	Tot. mg	46.45	50.93	48.85	57.31	63.52	76.20	70.06	71.77	72.84	77.61	90.23	102.20	118.28	125.81	141.25	140.95	141.42	125.91			
National Park W. D.	Av. mgd	0.274	0.272	0.272	0.220	0.282	0.192	0.167	0.224	0.192	0.222	0.254	0.180	0.180	0.176	0.204	0.220	0.230	0.214	3750	98	Magothy & Raritan
	Tot. mg	100.19	99.42	99.74	80.50	103.09	70.20	61.11	81.76	70.05	81.23	93.17	65.79	65.81	64.42	74.50	80.26	84.05	78.30			
Newfield Water Dept.	Av. mgd	0.059	0.072	0.084	0.081	0.083	0.087	0.091	0.095	0.090	0.125	0.131	0.130	0.171	0.174	0.212	0.233	0.240	0.283	1350	100	Cohansey Sand
	Tot. mg	21.45	26.10	30.70	29.50	30.26	31.71	33.37	34.81	33.03	45.79	47.97	47.59	62.49	63.41	77.64	85.06	87.57	103.37			
Paulsboro Water Dept.	Av. mgd	0.782	0.797	0.985	1.040	0.996	1.035	1.024	1.153	1.100	1.130	1.068	0.999	1.215	1.328	1.544	1.404	1.409	1.172	9000	87	Magothy & Raritan
	Tot. mg	285.33	290.96	360.65	379.81	363.55	377.83	374.64	421.02	401.70	412.61	390.84	364.59	443.45	484.82	565.27	512.44	514.33	427.72			
Pitman Water Dept.	Av. mgd	0.308	0.324	0.320	0.365	0.400	0.440	0.413	0.485	0.453	0.483	0.487	0.607	0.811	0.921	0.892	0.917	0.951	1.101	8910	99	Magothy & Raritan
	Tot. mg	112.42	118.35	117.18	133.10	146.16	160.81	151.20	177.20	165.41	176.24	178.16	221.43	295.92	336.31	326.61	334.78	347.00	401.98			
Washington Twp. M. U.	Av. mgd	Started in 1960										0.055	0.088	0.130	0.157	0.188	0.187	0.265	0.272	3160	100	Magothy & Raritan
	Tot. mg											20.27	32.27	47.64	57.40	68.78	68.43	96.81	99.25			

TABLE 4—USE OF GROUND WATER BY PUBLIC SUPPLIES (Serving more than 100 persons) IN GLOUCESTER COUNTY, N. J. (1950-1967) —Continued

(Source of data: N. J. Division of Water Policy and Supply)

Name	Pumpage	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Populat. Served 1966	% of Consumers Metered 1966	Aquifer
Sewell Water Co.	Av. mgd	0.026	0.026	0.025	0.027	0.047	0.057	0.088	0.135	0.125	0.127	0.107	0.108	0.113	0.129	0.138	0.149	0.172	0.160	1802	100	Magothy & Raritan
	Tot. mg	9.60	9.68	9.10	9.94	17.31	20.81	32.11	49.33	45.71	46.34	39.18	39.32	41.26	47.06	50.55	54.42	62.98	58.55			
So. Jersey Water Co.	Av. mgd	0.084	0.104	0.101	0.098	0.080	0.054	0.048	0.071	0.113	0.127	0.106	0.136	0.192	0.138	0.148	0.154	0.151	0.143	900	98	Magothy & Raritan
	Tot. mg	30.74	37.96	37.07	35.61	29.15	19.88	17.78	25.79	41.33	46.24	38.94	49.68	70.02	50.39	54.03	56.26	55.04	52.29			
Swedesboro Water Dept.	Av. mgd	0.120	0.140	0.199	0.158	0.212	0.222	0.220	0.277	0.188	0.223	0.238	0.254	0.263	0.309	0.293	0.305	0.308	0.363	2500	100	Magothy & Raritan
	Tot. mg	43.76	51.28	72.97	57.83	77.32	81.04	80.45	100.94	68.79	81.52	87.14	92.89	95.96	112.69	107.23	111.23	112.44	132.49			
Wenonah Water Dept.	Av. mgd	0.079	0.103	0.100	0.107	0.134	0.128	0.124	0.162	0.156	0.192	0.168	0.132	0.123	0.173	0.190	0.175	0.194	0.176	2100	100	Magothy & Raritan
	Tot. mg	28.82	37.63	36.45	39.17	48.95	46.91	45.24	58.98	56.85	70.28	61.62	48.27	44.98	63.04	69.54	63.90	70.86	64.38			
W. Deptford Twp. W. D.	Av. mgd		Started in 1960									0.083	0.210	0.355	0.379	0.415	0.496	0.489	0.712	6800	100	Magothy & Raritan
	Tot. mg											30.53	76.79	129.46	138.24	151.98	181.11	178.39	259.81			
Westville Boro W. D.	AV. mgd	0.272	0.265	0.266	0.278	0.261	0.353	0.422	0.449	0.455	0.485	0.496	0.433	0.486	0.500	0.564	0.575	0.591	0.629	5900	100	Magothy & Raritan
	Tot. mg	99.41	96.84	97.46	101.65	95.28	128.91	154.53	164.03	165.98	177.20	181.56	158.15	177.31	182.47	206.40	210.03	215.69	229.48			
Woodbury Water Dept.	AV. mgd	0.845	0.908	1.053	1.161	1.290	1.418	1.370	1.703	1.370	1.567	1.588	1.449	1.336	1.301	1.454	1.190	1.264	1.220	16500	100	Magothy & Raritan
	Tot. mg	308.49	331.63	385.33	423.74	471.02	517.42	501.36	621.65	500.22	571.94	581.22	528.84	487.79	474.75	532.35	434.25	461.18	445.23			
Colonial Manor W. C.	Av. mgd	0.029	0.035	0.043	0.041	0.044	0.043	0.043	0.053	0.044	0.051	Merged into West Deptford Water Department										Magothy & Raritan
	Tot. mg	10.45	12.67	15.65	15.14	16.05	15.85	15.62	19.29	16.21	18.79	after 1959										
Cooper Village W. C.	Av. mgd		Started in 1956					0.027	0.048	0.054	0.078	0.127	0.151	0.168	Merged into Deptford Municipal							Magothy & Raritan
	Tot. mg							10.02	17.50	19.72	28.29	46.58	55.29	61.24	Utility Authority in 1963							
Oak Valley Water Co.	Av. mgd		Started in 1957						0.113	0.205	0.237	0.300	0.366	0.593	Utility Authority in 1963							Magothy & Raritan
	Tot. mg								41.30	74.96	86.43	109.87	133.79	216.51								
TOTAL	Av. mgd	3.901	4.256	4.744	5.084	5.602	5.955	5.844	7.157	6.925	7.842	7.967	7.869	8.953	9.677	10.548	10.247	10.992	10.512	106311		
	Tot. mg	1424.65	1554.22	1737.05	1856.30	2045.91	2174.03	2138.56	2611.94	2528.76	2863.42	2917.16	2873.06	3268.69	3532.14	3861.15	3740.65	4012.42	3837.70			

1 Bridgeport Water Company: Changed to Pennsgrove Water Co. (Bridgeport Division)
2 Greenfields Water Company: Merged with West Deptford Water Dept. in 1967
3 Formerly Public Water Corp.
4 Population served as reported by public purveyors.

SURFACE DRAINAGE AND ITS RELATIONSHIP TO GROUND-WATER

DRAINAGE BASINS

Gloucester County contains parts of three drainage basins. The northern part of the county is in the Delaware River basin and the southern part is in the Maurice and Great Egg Harbor River basins. The surface drainage in Gloucester County is controlled by a low ridge extending from southwest to northeast across the central part of the county (fig. 11). This ridge separates the Delaware River basin from the Maurice River and Great Egg Harbor River basins; it is 1 mile north of Cross Keys near the Camden County line and extends through Glassboro, Hardingville, and into Salem County. North of this divide all the streams flow to the Delaware River. The main streams are Oldmans, Raccoon, Mantua, and the south branch of Big Timber Creeks. Many small tributaries to these four main streams complete the drainage pattern. Between Bridgeport and National Park, Little Timber Creek, Repaupo Creek (including its tributaries Pargey Creek, London Branch, and Still Run), Nehonsey Brook, Clonmell Creek, and Woodbury Creek flow into the Delaware River. These five streams have small drainage areas that do not extend much farther inland than the New Jersey turnpike. These streams are little influenced by tides except near the Delaware River. The main streams are tidal 5 to 6 miles inland from the river. The tidal effects in Oldmans and Raccoon Creeks extend to the New Jersey Turnpike; Mantua Creek is tidal at Wenonah, and Big Timber Creek (South Branch) is tidal at Almonesson. Near the Delaware River basin divide in the central part of the county, the streams lie at altitudes between 50 and 100 feet. The land surface between the streams is as much as 170 feet above mean sea level. From the drainage divide to the Delaware River the land surface slopes gently down to low banks which generally are 5 to 10 feet high.

South of the drainage divide, the streams flow to the Delaware Bay or directly to the Atlantic Ocean. A north-south trending ridge joins the major divide at Cross Keys and extends south to the corner of the county (about 2 miles east of Newfield). West of this divide is the Maurice River basin. The headwaters of this river basin are in the central part of Gloucester and parts of Salem and Cumberland Counties. The U. S. Geological Survey maintains a stream-gaging station at Norma about 4 miles downstream from Willow Grove Lake. This station records the streamflow from a drainage area of 113 square miles. About 70 square miles of this area lies in Gloucester County.

East of the Maurice River basin is the Great Egg Harbor River basin

which includes the Hospitality Branch sub-basin in Gloucester County. The drainage area of the Great Egg Harbor basin in the county is about 60 square miles of which about 40 square miles is in the sub-basin.

The only important streams in the county that discharge directly into the Great Egg Harbor River are Four Mile and Squankum Branches. The Great Egg Harbor River has its headwaters in Camden County and forms much of the boundary between the two counties.

The stream-gaging station on the Great Egg Harbor River is at Folsom (Atlantic County) about 2 miles upstream from the point where Hospitality Branch enters the Great Egg Harbor River and about 2 miles southeast of the Gloucester County line. This station measures flow from a drainage area of 56.3 square miles of which 20 square miles is in the county. Other records of streamflow data available in the county are: Oldmans Creek near Woodstown, 1931-40; Still Run near Mickleton, 1957-66; and Raccoon Creek near Swedesboro, 1966.

RELATIONSHIP OF STREAM LOW FLOWS TO GROUND-WATER DISCHARGE

All the streams in the southern half of the county receive ground-water discharge from the Cohansey Sand and the Pleistocene sands and gravels. Ground water in these deposits occurs under water table conditions in many areas and the water table is generally above the level of the streams throughout the year. Thus the streams are perennial. Many lakes in the Maurice River basin occur in natural depressions or are formed by an earthen or wooden dam across the stream. These lakes receive ground-water discharge and collect streamflow from upstream areas. The largest and most important lakes in the Maurice River basin in the county are Silver, Wilson, Franklinville, Iona, and Malaga Lakes.

The precipitation records at Clayton and Swedesboro for 1957 indicated it was one of the driest years on record. During the summer, several streams were measured at selected sites throughout the county (table 5). These measurements were made when near-record low flows were occurring, as indicated by the records at the nearby gaging stations, and are a guide to base flows that may be expected to be equalled or exceeded about 99 percent of the time.

In Gloucester County because the water table is relatively close to the land surface little additional storage space is available in the ground-water reservoir. The stream channels intersect the saturated zone and receive water from it until the water table drops to such a low level that the zone no longer feeds the stream. Increased withdrawal of ground water in Gloucester County probably will result in decreased discharge to the streams.

TABLE 5—LOW-FLOW STREAM MEASUREMENTS AT SELECTED SITES IN GLOUCESTER COUNTY, N. J., JULY 1957

Air temperature, 60-80°F; previous precipitation was on July 9, except for minor amount on July 23; E, estimated.
(Site number refers to location on figure 11.)

Site no.	Name of stream	Location	Date of measurement (1957)	Discharge (cfs)	Stream cross section area (sq ft)	Stream width (ft)	Mean velocity (ft/sec)	Type of stream bottom	Specific conductance (micromhos at 25°C)	Water temperature (°F)
1.	Big Timber Creek (South Branch)	0.5 mi. E. of Blackwood Terrace	July 23	12.2	9.65	16.0	1.26	Gravel & sand	115	80
2.	Almonesson Creek	N. end of Almonesson Lake	July 23	1.06	25.5	5.0	.04	Sand & gravel	125	80
3.	Chestnut Branch	0.75 mi. SE. of Mantua	July 23	5.71	15.0	13.0	.38	Sand	300	74
4.	Mantua Creek	0.5 mi. E. of Sewell	July 25	7.71	9.44	16.5	.82	Sand-smooth bottom	280	71
5.	Monongahela Brook	0.4 mi. S. of Wenonah	July 25	2.48	4.96	12.0	.50	Sand	145	69
6.	Left Branch Mantua Creek	0.4 mi. SW. of Mantua	July 25	.47	.55	2.5	.85	Sand	75	68
7.	Edwards Run	1.9 mi. SW. of Mantua	July 25	1.07	1.40	6.5	.76	Sand	175	71
8.	Raccoon Creek	1.75 mi. SE. of Swedesboro	July 25	8.93	14.6	24.0	.61	Sand	160	72
9.	Left Branch Raccoon Creek	1.60 mi. SE. of Swedesboro	July 25	2.09	6.00	9.0	.35	Sand	100	78
10.	Oldmans Creek	4.0 mi. S. of Swedesboro	July 25	2.52	3.79	8.5	.66	Gravel	190	70
11.	Oldmans Creek	2.5 mi. SE. of Harrisonville	July 25	1.25	1.55	6.5	.81	Gravel	130	79
12.	Chestnut Branch	1.0 mi. NW. of Pitman	July 25	5.35	3.88	13.0	1.38	Gravel & small boulders	345	76
13.	Four Mile Branch	1.8 mi. NE. of Williamstown	July 26	2.74	8.36	9.5	.33	Sand & gravel	25	59
14.	Hospitality Branch	Near Cecil	July 26	3.42	13.6	17.0	.25	Sand & gravel	25	62
15.	Great Egg Harbor River	0.5 mi. NE. of Berryland	July 26	18.8	18.9	32.0	1.00	Sand	10	61
16.	Right Fork of Hospitality Branch	0.25 mi. W. of Folsom	July 26	4.11	7.30	8.0	.56	Sand & mud	25	72
17.	Hospitality Branch	0.25 mi. W. of Folsom	July 26	6.63[1/]	12.0	10.0	.53	Sand & mud	20	70
18.	Still Run (Maurice River)	2.0 mi. S. of Franklinville	July 26	10.0	10.8	16.0	.93	Sand	50	70
19.	Scotland Run	1.5 mi. SE. of Franklinville	July 26	2.56	4.13	8.0	.62	Sand	20	72
20.	Indian Branch Scotland Run	2.0 mi. SE. of Franklinville	July 26	2.70	6.62	5.5	.41	Sand	10	63
21.	Pargey Creek	2.3 mi. S. of Gibbstown	July 31	.80 E	----	----	----	Sand & clay	--	--
22.	London Branch, Repaupo Creek	2.0 mi. S. of Gibbstown	July 31	.01	----	----	----	Sand & clay	--	--
23.	Still Run, Repaupo Creek	2.0 mi. S. of Gibbstown	July 31	1.10 E	----	----	----	Sand & clay	--	--
24.	Nehonsey Brook	2.0 mi. SE. of Gibbstown	July 31	.01 E	----	----	----	Sand & clay	--	--
25.	Clonmell Creek	2.3 mi. SE. of Gibbstown	July 31	Dry	----	----	----	Sand & clay	--	--

1/ Includes side flow, estimated 0.25 cfs.

Delaware River Basin

The total measured base flow into the Delaware River from the county (table 5; sites 1-10) between July 23 and 25, 1957 was 44.2 cfs (cubic feet per second) or more than 28 mgd. Four small streams between Bridgeport and Paulsboro had little flow, and Clonmell Creek was dry on July 31, 1957. The largest flow, 12.2 cfs, was from South Branch Big Timber Creek; the flow from Raccoon Creek (including flow from left Branch) was 11.0 cfs. All the streams flowing into the Delaware River were not measured, but it is estimated that the total surface flow into the river during this period was in the order of 50 to 75 cfs or about 32 to 48 mgd.

Two streams, Oldmans Creek and Chestnut Branch of Mantua Creek, in the Delaware River basin were each measured at two different sites—near their headwaters and downstream near the area of tidal influence of the Delaware River. A measurement on Oldmans Creek near the northwestern edge of Algonkin Lake on July 25, 1957 showed a flow of 1.25 cfs (table 5, site 11). A flow of 2.52 cfs was measured 4.5 miles downstream (table 5, site 10). The increase of 1.27 cfs between the sites is obtained from the Kirkwood Formation, the Hornerstown Sand, and Navesink Formation, and a small area of the Wenonah Formation and Mount Laurel Sand. Chestnut Branch of Mantua Creek was measured about 1 mile northwest of Pitman (table 5, site 12) and 3.5 miles downstream near Wenonah (table 5, site 3). The increase in flow between the two sites was 0.36 cfs, which is equivalent to only 160 gpm. This relatively small increase is believed to be the effect of evapotranspiration at Marl Lake as no irrigation or other diversion of water was observed.

A stream-gaging station maintained by the Geological Survey on Mantua Creek at Kressey Lake near Pitman measures the surface flow from a drainage area of 6.75 square miles. About two-thirds of the drainage area is in the outcrop area of the Kirkwood Formation, and the rest is in the outcrop area of the Cohansey Sand. Most of the overland runoff in the drainage area is from the Kirkwood Formation, which has a lower infiltration capacity than the Cohansey Sand. There is good correlation between daily precipitation and streamflow from this station. A hydrograph for 1955 shows the total runoff, estimates of ground-water discharge, and daily precipitation at nearby Clayton (fig. 12). Most of the surface flow during the year is from ground-water discharge and the average discharge (1940-67) is 11.1 cfs. A hydrograph of monthly mean discharges (fig. 13) for the 10-year period 1946-55 shows that the lowest monthly flow for this period averaged 5.39 cfs in July 1955 and the highest monthly flow averaged 18.6 cfs in March 1952. The minimum flow of record (1940-67) for 1 day was 2.5 cfs in 1966 and the maximum flow for 1 day was 4,200 cfs in 1940.

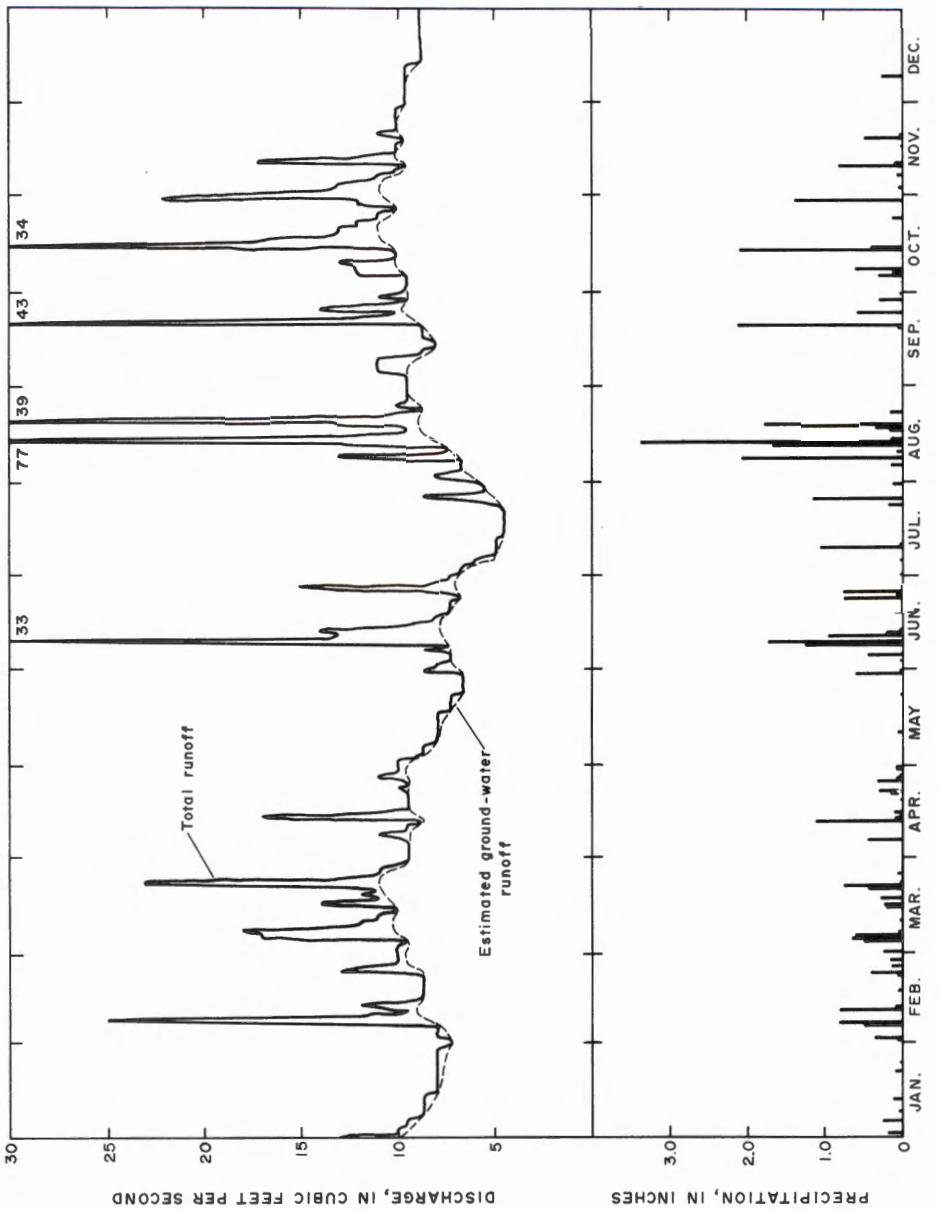

Figure 12.—Graphs showing the discharge for Mantua Creek at Pitman, estimated ground-water runoff, and precipitation at Clayton, 1955.

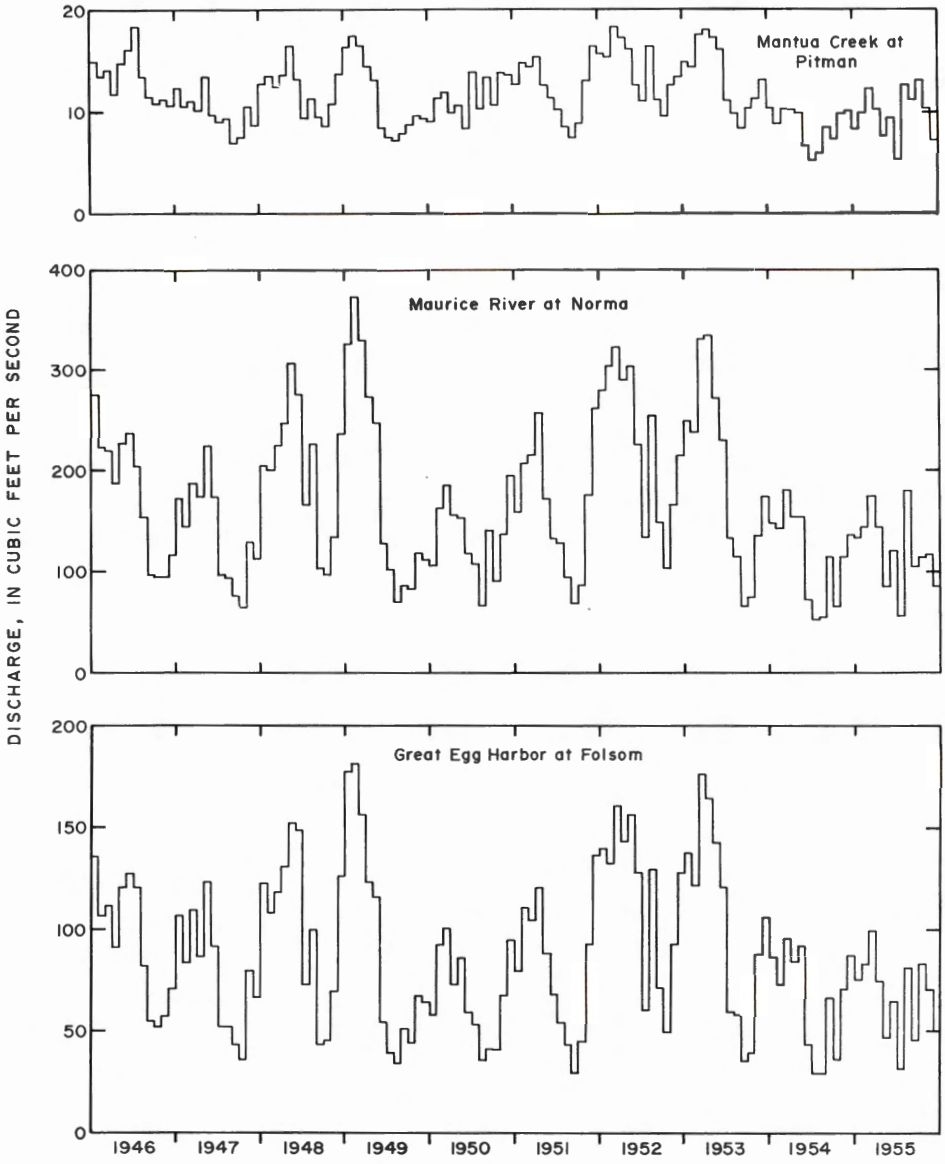

Figure 13.—Graphs showing monthly mean discharge for Mantua Creek at Pitman, Maurice River at Norma, and Great Egg Harbor River at Folsom, 1946-55.

Maurice River Basin

Nearly all the base flow out of the Gloucester County part of the Maurice River basin was measured at three sites (fig. 11). Still Run (table 5, site 18) was measured at Route 40, and Scotland Run and Indian Branch (table 5, sites 13 and 20) were measured upstream from Malaga Lake because the level of the lake was below the spillway at the time of the measurement (July 1957). The total measured base flow was 15.3 cfs (about 10 mgd) including 10 cfs from Still Run. These streams are tributaries of the Maurice River and derive their water from the Cohansey Sand and Pleistocene sand and gravel.

A comparison of the daily precipitation at nearby Clayton and the streamflow from the gaging station on the Maurice River at Norma for 1956 shows the rapid response to precipitation and the effects of recharge to the aquifers (fig. 14). The estimated daily ground-water discharge to the stream during 1956 ranged from about 57 to perhaps as much as 185 cfs. A hydrograph of monthly mean discharges for the 10-year period 1946-55 shows the lowest monthly flow averaged 52.0 cfs in July 1954 (fig. 13). The highest monthly flow averaged 371 cfs in February 1949. The minimum flow of record (1932-67) for 1 day was 23 cfs in 1964 and 1966 and the maximum 1 day flow was 7,360 cfs in 1940. The average discharge (1932-67) is 164 cfs.

Great Egg Harbor River Basin

The base flow from the Gloucester County part of Great Egg Harbor River basin measured near the Gloucester-Atlantic County line on July 26, 1957 was about 30 cfs or 19 mgd. This included nearly 11 cfs (7 mgd) of streamflow from Hospitality and Marsh Lake Branches which drain about 40 square miles in Gloucester County (table 5, site 16 and 17). At Berryland (table 5, site 15) the discharge of the Great Egg Harbor River was 18.8 cfs (12 mgd), of which about 10 cfs was inflow from Camden County. About 2 miles northeast of Williamstown and 8 miles upstream from Berryland, Four Mile Branch had a flow of 2.74 cfs (table 5, site 13). Excluding the inflow from Camden County, there was an increase in flow of about 6 cfs between sites 13 and 15 which is attributed to ground-water discharge and inflow from Squankum Branch and Minor drainages.

Hospitality Branch was measured near Cecil (table 5, site 14) and 4 miles downstream at Folsom (table 5, site 17). The increase in flow between the two sites was 3.21 cfs and is believed to be ground-water discharge from the Cohansey Sand and Pleistocene deposits into Faraway and White Oak Branches which are tributary to Hospitality Branch.

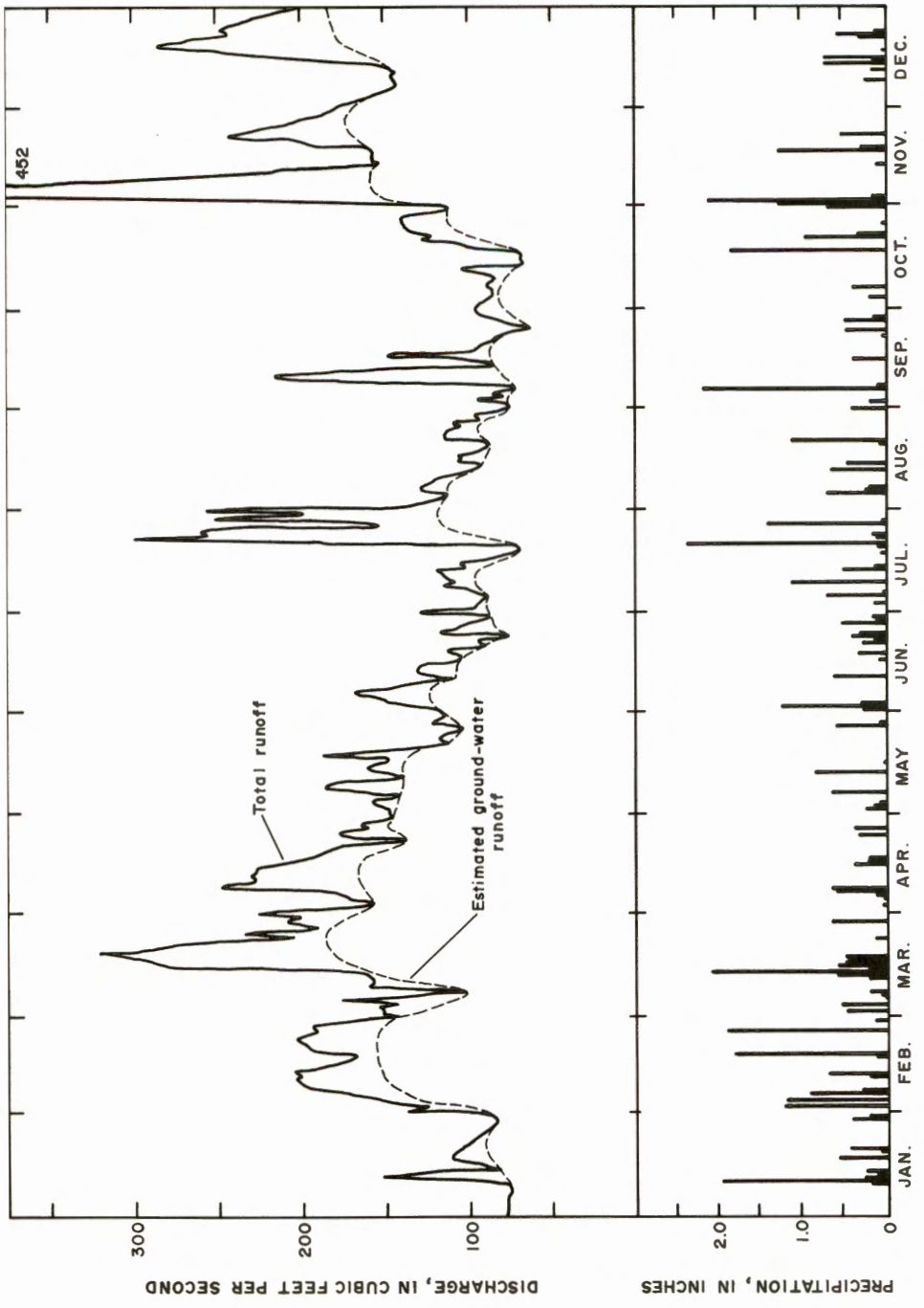

Figure 14.—Graphs showing the discharge for Maurice River at Norma, estimated ground-water runoff, and precipitation at Clayton 1956.

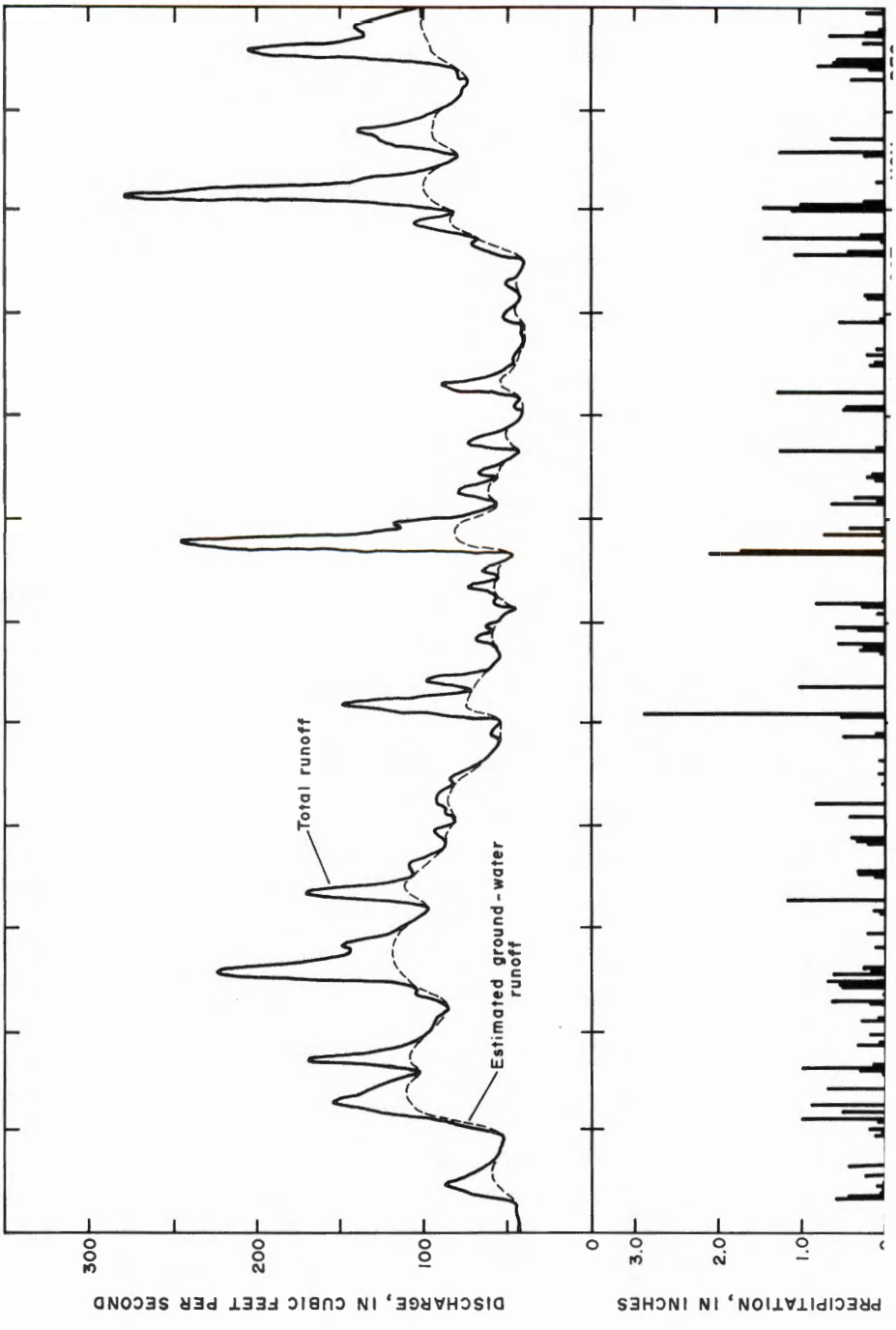

Figure 15.—Graphs showing the discharge for Great Egg Harbor River at Folsom, estimated ground-water runoff, and precipitation at Hammonton, 1956.

The gaging station at Folsom on the Great Egg Harbor River measures the streamflow from a drainage area of 56.3 square miles, of which 20 square miles are in Gloucester County. The estimated daily groundwater discharge in 1956 ranged from 39 to 120 cfs (fig. 15). A comparison of precipitation data at nearby Hammonton and daily discharge of the river at the gaging station for 1956 shows that precipitation infiltrates and moves through the aquifers and overland to the nearby streams. A hydrograph of the monthly mean discharge for the 10-year period 1946-55 shows that the lowest monthly flow averaged 20.3 cfs in September 1951 (fig. 13). The highest monthly flow averaged 178 cfs in January 1949. The maximum flow of record (1925-67) for 1 day was 1,440 cfs in 1940 and the minimum flow for 1 day was 15 cfs in 1957. The average discharge (1925-67) is 83.8 cfs.

The temperature of the water in the streams ranged from 59° to 80°F during the period of low-flow measurements of July 1957. An indication of the chemical quality of water was obtained by measuring the specific conductance. The specific conductance of the water for all the streams was 345 micromhos or less (roughly equivalent to 200 mg/l of dissolved solids). The water samples from streams flowing south in the Maurice and Great Egg Harbor River basins of Gloucester County had specific conductances ranging from 10 to 50 micromhos. This water is from the Cohansey Sand and Pleistocene sands and gravels and moves only short distances through the aquifer before it discharges into these streams. The water samples collected from streams flowing north to the Delaware River had specific conductances ranging from 100 to 345 micromhos. This water is mostly derived from the Kirkwood and Wenonah Formations and Mount Laurel Sand. Because of the low gradients of the streams, mean velocities ranged from 0.04 fps (foot per second) at Almonesson Creek to 1.38 fps at Chestnut Branch of Mantua Creek.

WATER BUDGET

An approximate long-term water-budget evaluation of the hydrologic cycle can be applied to the basins in Gloucester County. This budget can be expressed mathematically as:

$$P = Q + R + ET + S,$$

in which

P = precipitation
Q = pumpage withdrawals in the basin from aquifers that receive recharge from precipitation in the basin of interest
R = runoff, measured at gaging stations
ET = evapotransporation
S = change in storage in the water-table aquifer

If pumpage is negligible or ground water is returned to the aquifer in the drainage area above the gaging station and if the water table is in equilibrium—that is, discharge equals recharge, then the water-budget equation reduces to:

$$P = R + ET.$$

Gloucester County can expect, on the average, about 44 inches of precipitation each year (about 2 mgd per square mile). The runoff figure shown below is the average discharge for the 10-year period (1946-55) converted to million gallons per day per square mile of drainage basin. On the basis of the assumptions made, the evapotranspiration (ET) is equal to the difference between the precipitation and the runoff, or

$$ET = P - R.$$

Drainage basin	*Area (square miles)*	*Average discharge (1946-55) (cfs)*	*P — R = ET (mgd per sq mi)*
Mantua Creek at Pitman	6.75	11.7	2 — 1.12 = 0.88
Maurice River at Norma	113	167	2 — 0.95 = 1.05
Great Egg Harbor River at Folsom	56.3	87.2	2 — 1.00 = 1.00

These figures indicate that, on the average, about half of the precipitation on the drainage areas is lost to evapotranspiration and half leaves the basin as runoff. At the gaging station on Mantua Creek at Pitman, which has a small drainage area, runoff is more rapid than at Maurice River or Great Egg Harbor River stations, and thus there is probably less time for evapotranspiration. These differences are shown in the calculations.

Measurements made during July 23-31, 1957 indicate that the base flow from the 200 square miles of drainage area of the Delaware River basin in Gloucester County was about 45 cfs; and the base flow from the 130 square miles of drainage area of the Maurice and Great Egg Harbor River basins in Gloucester County was about 35 cfs. The runoff for each basin was about 0.16 mgd per square mile from base flow measured in July 1957. For the Great Egg Harbor River basin including Hospitality Branch the base flow was 0.19 mgd per square mile, and for Maurice River basin in the county it was about 0.14 mgd per square mile. The total measured base flow in July 1957 from the county was 80 cfs (about 52 mgd). This ground-water discharge is probably close to the minimum outflow from the county.

SUMMARY AND CONCLUSIONS

The future growth and economy of Gloucester County are dependent to a large extent on the available water supply. In Gloucester County nearly all of the water supplies are now derived from ground water. Surface water is not used except by a few industries adjacent to the Delaware River and by some farmers who utilize irrigation ponds. The low relief of the county and the high porosity of the surficial Coastal Plain sediments make large surface-water reservoirs impractical. Much of the streamflow is derived from ground-water discharge which can be intercepted by wells before it reaches the streams. Although large quantities of water are available from the Delaware River, the high chloride content during times of low-flow make this source unsuitable for some purposes and the future water supply for the county will probably come primarily from ground-water sources.

Analysis of streamflow records for the 10-year period 1946-55 of the Maurice River at Norma (Salem County) and the Great Egg Harbor River at Folsom (Atlantic County) compared with base flow measurements made in 1957 for flow to the Delaware River, indicates that about 290 mgd of water flows out of Gloucester County and parts of adjacent counties. For the 10-year period 1946-55 the lowest monthly average flow was about 95 mgd and the lowest daily outflow was about 62 million gallons. In July 1957, during the drought, about 52 mgd of outflow from the county was measured.

The base flow of the streams in Gloucester County is water that has been discharged from the aquifers. The minimum measured base flow from the county (50-60 mgd) is all ground water that has been temporarily stored in the aquifers during periods of high precipitation and which has had an opportunity to migrate to and discharge into the streams. However, during average years, much of the average streamflow of 290 mgd is derived from this source. During 1966, about 40 mgd of water was pumped from the aquifers in the county. It is thus indicated that the amount of ground-water use can be increased many-fold without endangering the perennial ground-water supply.

Most of the ground water available for use is derived from precipitation. According to records, a long-term average of about 2 mgd of water falls on each square mile in the county. About half of this amount is lost to evapotranspiration and the other half is stream runoff. Theoretically the stream runoff is what is available for use. Gloucester County has a land area of 329 square miles. Thus, theoretically, 329 mgd is available for development from all sources not counting Gloucester County's share of the Delaware River. Because of the sandy character of the surficial de-

posits in the county, much of the precipitation, other than that lost to evapotranspiration and except during periods of torrential downpours, has an opportunity to percolate to the water table and thence to areas of discharge. Because the aquifers are essentially full, much of the water that infiltrates to the water table is discharged, within a short distance, into the surface streams and is carried either to the Delaware River or to the Atlantic Ocean. The development of the ground-water resources would tend to lower the water table and make more room available for storage of water that is presently being discharged from the county. However, it is indicated that such development could ultimately decrease the flow of the streams and might, especially in the tidal reaches of the streams, allow saline waters to move farther inland.

Moderate to large amounts of water can be pumped economically anywhere in the county from the various aquifers. The Cohansey Sand with a surface area of 150 square miles in the county is almost undeveloped and is an extremely important potential source of large ground-water supplies. Because of its large surface area and shallow water table, the aquifer is susceptible to contamination and care is required for its proper development. The Raritan and Magothy Formations are extensively developed in the northern part of the county, particularly in the industrialized areas along the Delaware River where there are problems of salt-water encroachment and artificial contamination. If preventative measures to maintain low-chloride concentrations in the river are not adequate, the ground-water supplies along the lower reaches of the Delaware River, which include southern Gloucester County, will be the first affected.

If pumpage can be more uniformly spread throughout the county by proper spacing of new wells, increased amounts of ground water can be pumped safely. For example, a population increase of 100,000 people would necessitate an increase in supply of about 10 mgd. The total requirement for this hypothetical development would be 50 mgd. This amount of water is a little less than the base streamflow from the county. With the use of Delaware River water, there is a large amount of water available for development in the county.

Results of chemical analyses of most ground water samples indicated concentration of iron that would require its removal for many domestic uses and hardness concentrations that would have to be decreased for some industrial uses. As the county grows economically and in population, water problems will increase—mainly in the distribution and storage of the water. The quality of the water and the regimen of the Delaware River is of prime interest to the future of the county. If the water is used intelligently there is an adequate water supply for the foreseeable future.

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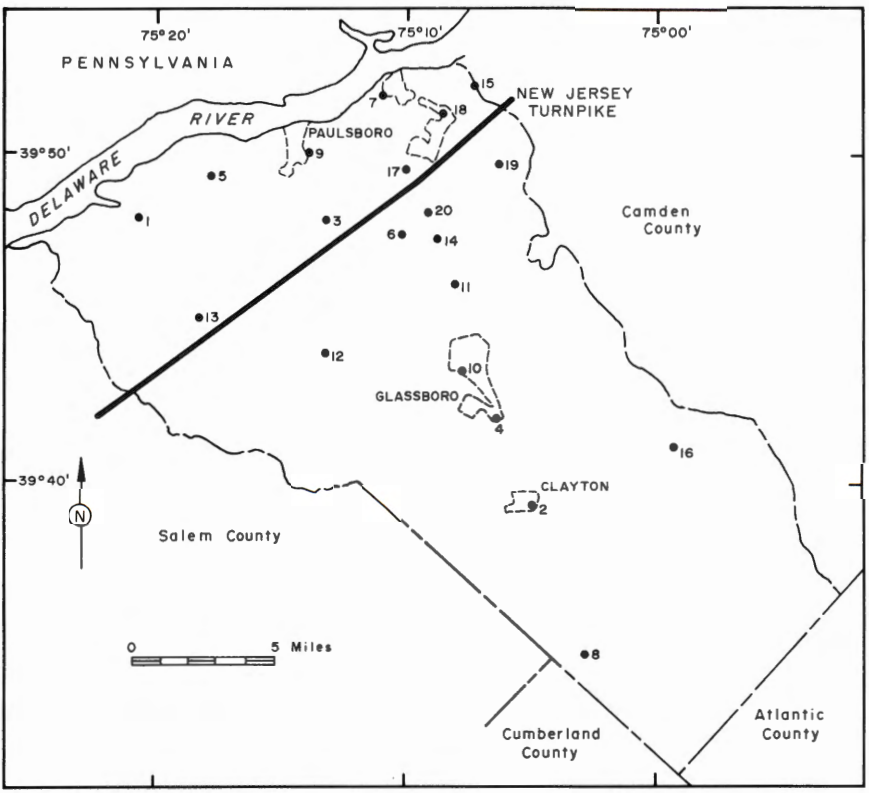

(From HARDT, 1963)

1. Penns Grove Water Supply Co.
2. Clayton Water Dept.
3. E. Greenwich Twp. Water Dept. (Clarksboro)
4. Glassboro Water Dept.
5. Greenwich Twp. Water Dept. (Gibbstown)
6. Mantua Water Co.
7. National Park Water Co.
8. Newfield Water Dept.
9. Paulsboro Water Dept.
10. Borough of Pitman Water Dept.
11. Sewell Water Co.
12. S. Jersey Water Supply Co. (Mullica Hill)
13. Swedesboro Water Dept.
14. Wenonah Water Dept.
15. Westville Water Dept.
16. Monroe Municipal Utilities Authority
17. Woodbury Water Dept.

Other water companies near Woodbury

18. West Deptford Twp. Water Dept.
19. Cooper Village Water Co.
20. Oak Valley Water Co.

Figure 17.—Location of selected public water supplies in Gloucester County, New Jersey.

SELECTED WELL RECORDS

Records from selected wells in the county are tabulated for the purpose of providing geohydrologic information (table 6). The records are typical of the many hundreds of wells in the county. Figure 16 shows the location of 78 selected wells in the county. Results of chemical analyses and well logs of selected wells are given in tables 7 and 8, respectively.

TABLE 6—RECORDS OF SELECTED WELLS IN GLOUCESTER COUNTY, N. J.

Screen setting: OH, open hole
Drawdown: Neg, negligible
Use of water: D, domestic; F, farm; In, industrial; Ir, irrigation; Ps, public supply
Quality of water: G, good; F, fair; P, poor; * chemical analysis available

Well No.	Location	Owner or tenant	Map grid	Driller	Date completed	Altitude of land surface (ft)	Total Depth of well (ft)	Diameter of well (in)	Depth to which well is cased (ft)	Screen setting (ft)	Static water level below land surface	Yield (gpm)	Drawdown (ft)	Water-bearing materials	Formation	Use of water	Quality of water	Remarks	Well No.
1	1-1/2 mi. E. of Newfield	Anthony Fabrizio	N-11	Gus Hauser	4- 3-50	115	129	5	77	77-127	16	300	27	Sand and clay	Cohansey Sand	Ir	G		1
2	2 mi. NE. of Newfield	John Leshay	M-10	Gus Hauser	6- 3 51	120	113	4	86	86-111	10	200	10	Coarse sand	Cohansey Sand	Ir	G		2
3	3 mi. NW. of Newfield	E. Dominguez	L-10	Gus Hauser	4-20-53	105	48	4	38	38-44	23	40	3	Coarse sand and stone	Cohansey Sand	D	G		3
4	1/2 mi. S. of Franklinville	Franklin Twp. Board of Ed.	K-9	A. C. Schultes	3- 6-52	112	90	6	71	70-90	21	60	19	Fine sand	Cohansey Sand	PS	G*	Originally drilled to 119 feet.	4
5	1-1/2 mi. NW. of Franklinville	Frank Schober, Jr.	K-9	Haines & Moore	2- 4-53	115	32	4	22	25-31	13	20	6	Fine to medium sand	Bridgeton Formation and Cohansey Sand	F	G	2 tons of pebbles put in well.	5
6	3-1/2 mi. E. of Franklinville	Freese Bros.	M-9	John North	1931 or 32	130	58	4	38	38-58	4	250	16	Medium to coarse sand	Cohansey Sand	Ir	G*		6
7	4 mi. NE. of Newfield	Peets Gladiola Farm	O-10	Gus Hauser	5- 7-54	125	148	4	111	111-131	19	150	--	Fine sand	Cohansey Sand	Ir	G	Originally drilled to 148 feet - well abandoned.	7
8	5 mi. E. of Newfield	Leno Zuccarini	O-10	Rudy Skypala	5- 9-55	115	96	2-1 3/4	86	90-96	22	20	1	Sand	Cohansey Sand	D	G*	Nearby irrigation well yields 250 gpm, 10 feet drawdown.	8
9	Berryland	Ritz Court Motel	P-9	Rudy Skypala	4- 6-55	85	63	4	59	49-59	10	20	4	Sand	Cohansey Sand	D	G*	Water is treated for iron	9
10	3 mi. E. of Williamstown	Gustav Carlson	O-7	L. Panciera	12-28-54	113	65	3	59	59-65	11	40	1	Sand	Cohansey Sand	D	G		10
11	2-1/2 mi. W. of Williamstown	David Duncan	L-7	Gus Hauser	8- 9-53	135	58	4	44	44-54	9	90	1	Coarse sand	Cohansey Sand	D	G		11
12	3 mi. S. of Glassboro	Robert E. Searle	I-7	Fred Capel	3- 6-54	145	58	4-3	48	51-58	18	75	Neg.	Coarse sand	Cohansey Sand	D	G		12
13	3 mi. SW. of Glassboro	Louis J. Gerlack	H-7	Haines & Moore	11-23-51	135	46	4	33	41-45	27	12	15	Fine sand	Bridgeton Formation and Cohansey Sand	D	G*	2-1/2 tons of pebbles put in well.	13
14	1 mi. S. of Ewan	Henry Powell	H-7	H. Robbins	10- 6-49	100	230	4	220	OH	26	50	Neg.	Green sand	Mount Laurel Sand and Wenonah Formation	D	G		14
15	Ewan	Norman Lacy	H-7	Haines & Moore	12-13-56	110	146	4	116	OH	35	20	5	Limestone and limesand	Vincentown Formation	D	G*		15
16	3 mi. W. of Glassboro	Mary Williamson	I-6	Haines & Moore	9-20-52	141	52	4	39	45-51	27	15	3	Medium to coarse sand	Bridgeton Formation and Kirkwood Formation	D	G*		16
17	3 mi. W. of Glassboro	Samuel Allen, Jr.	H-6	Fred Capel	6-28-55	135	125	4	108	OH	26	75	--	Limerock, sand and shells	Vincentown Formation	D	G		17
18	3 mi. W. of Glassboro	William Toppin	H-6	Fred Capel	9- 3-50	135	200	4	184	OH	45	25	--	Sand and stones	Mount Laurel Sand and Wenonah Formation	D	G	Well abandoned and plugged.	18
19	2-1/2 mi. W. of Glassboro	George Reuter	I-6	Haines & Moore	5-29-51	140	150	6	121	OH	43-1/2	40	24-1/2	Limestone and limesand	Vincentown Formation	In	G	Used in cold storage plant.	19
20	Pitman	Clarence Kane	I-6	Fred Capel	7-26-54	130	135	4	115	OH	36	100	--	Limestone and limesand	Vincentown Formation	D	G*		20

TABLE 6—RECORDS OF SELECTED WELLS IN GLOUCESTER COUNTY, N. J.—Continued

Screen setting: OH, open hole
Drawdown: Neg, negligible
Use of water: D, domestic; F, farm; In, industrial; Ir, irrigation; Ps, public supply
Quality of water: G, good; F, fair; P, poor; * chemical analysis available

Well No.	Location	Owner or tenant	Map grid	Driller	Date completed	Altitude of land surface (ft)	Total Depth of well (ft)	Diameter of well (in)	Depth to which well is cased (ft)	Screen setting (ft)	Static water level below land surface	Yield (gpm)	Drawdown (ft)	Water-bearing materials	Formation	Use of water	Quality of water	Remarks	Well No.
21	1 mi. N. of Pitman	Stella Brown	I-5	Fred Capel	5-11-53	88	105	4	61	OH	20	150	--	Stones and sand	Navesink Formation and Mount Laurel Sand and Wenonah Formation	D	G*		21
22	Cross Keys	John Sofia	M-6	Haines & Moore	11- 4-55	154	51	4	39	44-50	14	18	10	Fine and coarse sand	Bridgeton Formation and Cohansey (?) Sand	D	G*		22
23	1-1/2 mi. S. of Turnerville	William Kressel	L-5	Haines & Moore	9-18-53	140	54	4	40	43-49	25	15	4	Fine sand	Bridgeton Formation and Cohansey (?) Sand	D	G	7 tons of pebbles put in well.	23
24	2 mi. SW. of Turnerville	Frank Hess	K-5	Haines & Moore	4-23-49	155	56	4	46	49-55	27	15	15	Medium to fine sand	Cohansey Sand	D	G	5 tons of pebbles put in well.	24
25	2-1/2 mi. E. of Pitman	John Barrett, Sr.	K-5	Haines & Moore	11-19-47	140	250	4-3	228	OH	72	20	10	Sand	Mount Laurel Sand and Wenonah Formation	D	G*		25
26	1-1/2 mi. SW. of Turnerville	Fred Foster, Jr.	K-5	Haines & Moore	2-25-52	151	61	4	44	56-60	35	15	20	Very fine sand	Cohansey Sand and Kirkwood Formation	D	G*	11 tons of pebbles put in well.	26
27	Turnerville	Primrose Motel	L-4	Fred Capel	7- 1-55	83	190	4	164	OH	30	150	--	Stones, shells, and sand	Navesink Formation and Mount Laurel Sand and Wenonah Formation	D	G*		27
28	Turnerville	Ruth Sagers	L-4	Fred Capel	9-24-53	89	105	3	75	OH	23	50	--	Limestone and sand	Vincentown Formation and Hornerstown Sand	D	G*		28
29	1-1/2 mi. NW. of Turnerville	William Micheal	K-4	Fred Capel	5-10-52	80	140	4	122	OH	20	100	--	Stones, shells and sand	Mount Laurel Sand and Wenonah Formation	D	G		29
30	2 mi. NE. of Pitman	Carlton Gant	J-5	Fred Capel	5- 1-53	81	125	4	107	OH	16	90	--	Medium to coarse sand	Mount Laurel Sand and Wenonah Formation	D	G		30
31	3-1/2 mi. NE. of Pitman	Russell Grasmick	J-4	Gus Hauser	2-24-54	100	125	4	106	OH	44	90		Medium to coarse sand	Mount Laurel Sand and Wenonah Formation	D	G		31
32	1 mi. E. of Sewell	H. F. Morris	J-4	H. Robbins	9- 5-50	60	352	4	342	342-352	100	75	--	Sand	Magothy and Raritan Formations	D	G		32
33	Barnsboro	Walter Reiger	I-5	Fred Capel	10- 5-55	140	135	4	105	OH	101	25	Neg.	Sand, stones, and shells	Mount Laurel Sand and Wenonah Formation	D	G		33
34	Blackwood	Blackwood Water Department	K-3	A. C. Schultes	8-15-48	20	380	8	348	335-371	24	600	40	Medium to coarse sand	Magothy and Raritan Formations	PS	G*	Water sample from similar depth well 100 feet away.	34
35	Blackwood Terrace	Robert A. Greer	K-3	E. Robbins	10-21-55	44	132	4	120	120-132	30	30	10	Sand	Englishtown Formation	D	G*		35
36	1-1/2 mi. NE. of Wenonah	New Sharon Fire Co.	J-3	Fred Capel	12-31-53	82	35	4	30	30-35	10	25	Neg.	Sand and clay	Mount Laurel Sand and Wenonah Formation	D	F*	Originally drilled to 50 feet.	36
37	1-1/2 mi. NE. of Wenonah	William Lafferty	J-3	A. C. Schultes	11-30-48	80	307	6	287	287-306	90	100	10	Coarse sand	Magothy and Raritan Formations	D	G	Originally drilled to 316 feet.	37
38	1-1/2 mi. NE. of Wenonah	Marion Thompson	J-3	Fred Capel	4-15-53	102	107	4	83	OH	23	25	Neg.	Medium sand, glauconitic	Marshalltown and Englishtown Formations	D	G*		38
39	Mantua	Emma Hunter	H-4	H. Robbins	1-27-55	45	145	4	135	OH	20	20	Neg.	Fine sand, small shells	Merchantville Formation	D	G		39

TABLE 6—RECORDS OF SELECTED WELLS IN GLOUCESTER COUNTY, N. J.—Continued

Screen setting: OH, open hole
Drawdown: Neg, negligible
Use of water: D, domestic; F, farm; In, industrial; Ir, irrigation; Ps, public supply
Quality of water: G, good; F, fair; P, poor; * chemical analysis available

Well No.	Location	Owner or tenant	Map grid	Driller	Date completed	Altitude of land surface (ft)	Total Depth of well (ft)	Diameter of well (in)	Depth to which well is cased (ft)	Screen setting (ft)	Static water level below land surface	Yield (gpm)	Drawdown (ft)	Water-bearing materials	Formation	Use of water	Quality of water	Remarks	Well No.
40	2 mi. S. of Mantua	Francis Yahrling	H-4	Fred Capel	12-14-55	80	160	4	134	OH	46	100	--	Fine sand, and shells	Englishtown and Marshalltown Formations	D	G*		40
41	1-1/2 mi. S. of Clarksboro	Harold S. Carter	G-4	Haines & Moore	5- 2-56	80	37	4	22	31-36	11	20	10	Silty sand	Mount Laurel Sand and Wenonah Formation	D	G*	3 tons of pebbles in well.	41
42	2 mi. NE. of Mullica Hill	Alfred Caltabiano	G-5	Haines & Moore	4-18-52	140	128	4	105	OH	75	20	5	Sand	Mount Laurel Sand and Wenonah Formation	F	P	Water high in iron.	42
43	1 mi. E. of Mullica Hill	William Hazelton	G-5	Fred Capel	1-24-55	85	325	4-2	315	315-325	86	150	--	Fine and coarse sand, stones	Magothy and Raritan Formations	D	G		43
44	1 mi. S. of Mullica Hill	Christian Church	G-6	Haines & Moore	8-17-50	92	105	3	84	OH	32	15	3	Sand	Mount Laurel Sand and Wenonah Formation	D	F*		44
45	2 mi. S. of Mullica Hill	John G. Vasta	G-6	Fred Capel	8-19-54	80	130	4	116	OH	20	150	--	Sand and stones	Mount Laurel Sand and Wenonah Formation	D	G		45
46	1/2 mi. E. of Harrisonville	James A. Hopkins	F-7	Haines & Moore	10-22-51	81	148	4	133	OH	14	25	10	Sand	Mount Laurel Sand and Wenonah Formation	F	G		46
47	Harrisonville	Eloda C. Keen	F-7	Haines & Moore	9-12-51	83	135	4	114	OH	17	20	5	Sand	Mount Laurel Sand and Wenonah Formation	D	F*	Water treated for iron and hardness	47
48	1 mi. N. of Harrisonville	Steaker Farms	F-7	Gus Hauser	8-30-50	120	149	4	70	OH	31	66	25	Stones, shells, and marl	Vincentown Formation and Hornerstown Sand	D	G*		48
49	2 mi. N. of Harrisonville	James A. Allen	F-6	Haines & Moore	4- 2-55	130	144	4	103	138-143	36	20	10	Sand	Mount Laurel Sand and Wenonah Formation	D	P	Water high in iron.	49
50	1 mi. NW. of Harrisonville	Harry J. Marino	E-7	Fred Capel	9-18-54	90	358	4-3	295	348-358	117	200	--	Sand and stones	Magothy and Raritan Formations	D	F	Well abandoned. Yielded dirty water.	50
51	1-1/2 mi. NW. of Harrisonville	Alfio Sorbello	E-6	Haines & Moore	8-16-55	120	115	4	102	109-114	33	15	19	Sand	Mount Laurel Sand and Wenonah Formation	F	P	Water high in iron.	51
52	3 mi. S. of Swedesboro	Joseph Maccarone	D-7	Haines & Moore	4- 3-54	63	254	4	238	247-253	64-1/2	20	5-1/2	Coarse sand	Magothy and Raritan Formations	F	F*	Water high in iron.	52
53	2 mi. S. of Swedesboro	Clarence String	D-6	Fred Capel	4-15-54	120	85	4	76	OH	39	25	Neg.	Sand and stones	Mount Laurel Sand and Wenonah Formation	D	G*		53
54	2 mi. S. of Swedesboro	S. A. Stewart	D-6	Haines & Moore	6- 2-52	90	75	4	60	68-74	40	20	5	Silty sand	Mount Laurel Sand and Wenonah Formation	D	G		54
55	2-1/2 mi. W. of Swedesboro	Frank Catalano	C-6	Gus Hauser	8-27-54	50	118	4	108	108-114	50	15	58	Coarse sand	Magothy and Raritan Formations	D	G		55
56	2 mi. W. of Swedesboro	Casella Bros. Inc.	C-5	Haines & Moore	1-19-53	50	122	4	107	115-121	61	15	4	Fine and coarse sand, gravel	Magothy and Raritan Formations	F	F*	Water high in iron.	56
57	3 mi. NW. of Swedesboro	Frank Muscumeci	C-5	Haines & Moore	11-13-51	15	35	4	22	28-34	12	15	5	Coarse sand and small gravel	Cape May Formation	D	G*		57
58	2-1/2 mi. SW. of Bridgeport	Edward Black, Jr.	B-4	Haines & Moore	4-25-53	20	67	4	53	60-66	14	20	10	Coarse sand and some clay	Magothy and Raritan Formations	D	G		58
59	2 mi. E. of Swedesboro	Walter H. Butler	E-5	Haines & Moore	5- 7-55	60	229	4-3	218	222-228	64	20	6	Sand	Magothy and Raritan Formations	F	G		59
60	2 mi. NE. of Swedesboro	N. J. Turnpike Authority Sta. 2	E-5	Gus Hauser	9- 1-51	80	83	6	69	69-83	14	40	1	Coarse sand, some clay	Englishtown Formation	D	P*	Originally drilled to 91 feet.	60

TABLE 6—RECORDS OF SELECTED WELLS IN GLOUCESTER COUNTY, N. J. —Continued

Screen setting: OH, open hole
Drawdown: Neg, negligible
Use of water: D, domestic; F, farm; In, industrial; Ir, irrigation; Ps, public supply
Quality of water: G, good; F, fair; P, poor; * chemical analysis available

Well No.	Location	Owner or tenant	Map grid	Driller	Date completed	Altitude of land surface (ft)	Total Depth of well (ft)	Diameter of well (in)	Depth to which well is cased (ft)	Screen setting (ft)	Static water level below land surface	Yield (gpm)	Drawdown (ft)	Water-bearing materials	Formation	Use of water	Quality of water	Remarks	Location	Well No.
61	2 mi. N. of Swedesboro	Peter M. Musumeci	D-4	Haines & Moore	11- 6-54	62	101	4	87	94-100	65	15	3	Sand	Magothy and Raritan Formations	D	F	Water high in iron.		61
62	1-1/2 mi. SE. of Bridgeport	Raymond Shoemaker	D-4	Gus Hauser	8-28-54	10	43	4	33	33-39	9	65	2	Medium sand	Cape May Formation and Magothy and Raritan Formations	D	G			62
63	Repaupo	Logan Twp. Board of Education	D-3	Haines & Moore	9-28-51	15	45	4	32	38-44	19	20	4	Sand and gravel	Cape May Formation and Magothy and Raritan Formations	PS	F	Static Water level 6/10/57, 17 feet; water high in iron		63
64	2 mi. SW. of Clarksboro	Edgar Thompson	F-4	A. C. Schultes	2-18-52	70	183	4	173	173-183	80	75	6	Medium sand	Magothy and Raritan Formations	D	F			64
65	Gibbstown	E. I. duPont de Nemours Co.	E-2	A. C. Schultes	6- 5-49	10	105	8	84	84-103	8	140	65	Sand and gravel	Magothy and Raritan Formations	In	F	Owner's "W", originally drilled to 165 feet (abandoned).		65
66	Gibbstown	E. I. duPont de Nemours Co.	E-3	Sprague & Henwood	1- ?-36	10	105	10	75	75-105	16	225	40	Coarse sand and gravel	Magothy and Raritan Formations	In	F*	Owner's "O", well plugged.		66
67	Paulsboro	Mobil Oil Co.	F-2	Layne-N.Y.	11- 1-26	15	253	24-16, 10	169	169-236	26	1,106	31	Coarse sand and gravel	Magothy and Raritan Formations	In	G*	Originally drilled to 253 feet; owner's "33".		67
68	Paulsboro	Mobil Oil Co.	F-2	Layne-N.Y.	3- 2-44	20	228	24-16	195	195-225	18	1,051	30	Coarse sand and gravel	Magothy and Raritan Formations	In	F*	Originally drilled to 267 feet, owner's "40".		68
69	1-1/2 mi. NW. of Mantua	Paul T. Kornman	H-3	Fred Capel	10-10-54	40	155	4-3	145	146-155	52	150	--	Fine and coarse sand, stones	Magothy and Raritan Formations	D	G			69
70	1 mi. N. of Mantua	Samuel Campbell	H-3	Gus Hauser	8-13-53	40	126	4	100	OH	37	80	1	Dark green marl	Merchantville Formation	D	G*			70
71	1-1/2 mi. SW. of Woodbury	Harbor Pipe Line Co.	H-3	C. Mollitor	2- 2-54	65	190	6	176	176-187	73	100	37	Coarse sand and fine gravel	Magothy and Raritan Formations	In	G			71
72	1-1/2 mi. W. of Woodbury	Thomas Borden	H-2	H. Robbins	1- 8-52	40	120	4	100	100-120	40	70	--	Coarse sand	Magothy and Raritan Formations	D&F	G			72
73	1-1/2 mi. W. of Westville	Texas Oil Co.	I-1	Layne-N.Y.	10-23-47	15	288	12	248	248-288	39	1,110	34	Coarse sand and gravel	Magothy and Raritan Formations	In	G*	Originally drilled to 298 feet; owner's "1".		73
74	1-1/2 mi. W. of Westville	Texas Oil Co.	I-2	A. C. Schultes	1-10-49	20	320	16	280	280-318	35	1,200	76	Coarse sand and stones	Magothy and Raritan Formations	In	G*	Originally drilled to 327 feet; owner's "6".		74
75	Westville	Atlantic Ser. Sta. (Williams Bros.)	J-2	H. Robbins	10-25-51	40	116	3	106	106-116	40	20	Neg.	Sand	Magothy and Raritan Formations	In	G			75
76	1 mi. E. of Woodbury	N & P Super Farms 2	J-2	A. C. Schultes	6-14-49	40	219	6	200	200-219	50	300	20	Medium sand and gravel	Magothy and Raritan Formations	F	G	Well 1 abandoned.		76
77	2 mi. SE. of Woodbury	Walter Potts	J-2	H. Robbins	4- 4-49	60	130	4	120	OH	50	50	10	Green sand	Merchantville Formation	D	G			77
78	3 mi. SE. of Woodbury	Leroy Lloyd	J-3	Fred Capel	10- 7-52	55	55	3	47	OH	4	25	Neg.	Medium sand	Marshalltown and Englishtown Formations	D	G			78

Table 7.—Records of selected public supply wells in Gloucester County.

WELL 1

Owner: Penns Grove Water Supply Company.

Location: South end of Railroad Ave. at Penn. R. R. in Bridgeport.

Well data: Owner's No. 1; completed in June 1930 by Artesian Well Drilling Co.; depth, 43 feet; diameter, 10 inches; slotted pipe screen from 30.5 to 40.5 feet; Deming Triplex, direct-suction pump with capacity of 130 gpm.

Pumping-test data: Tested in June 1930: static water level, 5.2 feet below land surface; yield, 150 gpm with a drawdown of 15 feet after 36 hours pumping; specific capacity, 10 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 2

Owner: Penns Grove Water Supply Company.

Location: South end of Railroad Ave. at Penn. R. R. tracks in Bridgeport.

Well data: Owner's No. 2; completed in January 1955 by Layne-New York Co.; depth, 127 feet pulled back to 88.4 feet; diameter, 10 inches; screened from 65.4 to 85.4 feet; deep-well turbine pump and 10-horsepower automatic motor; pump set at 30 feet.

Pumping-test data: Tested in March 1955: Static water level, 6 feet below land surface; yield, 190 gpm with a drawdown of 11 feet after 4 hours pumping; specific capacity, 17.3 gpm/ft.

Remarks: Airline length, 38 feet. Chemical analyses available (table 8).

WELL 3

Owner: Clayton Water Dept.

Location: Chestnut St. pumping station in Clayton.

Well data: Owner's No. 2; completed in August 1942 by John Rulon, Philadelphia, Pa.; depth, 103 feet; diameter, 16 and 10 inches; screened from 81.5 to 103 feet; deep-well turbine pump and 15-horsepower electric motor; pump setting at 73 feet.

Pumping-test data: Tested in August 1942; static water level, 26 feet below land surface; yield, 450 gpm with a drawdown of 40 feet after 9 hours pumping; specific capacity, 11.3 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 4

Owner: Clayton Water Dept.

Location: Chestnut St. pumping station in Clayton.

Well data: Owner's No. 3; completed in November 1956 by A. C. Schultes & Sons; depth, drilled 1,010 feet, pulled back to 800 feet; diameter, 12 and 8 inches; everdur screen with 0.030-inch openings from 746 to 761 feet and 785 to 800 feet; deep-well turbine and 100-horsepower electric motor.

Remarks: Chemical analysis available (table 8).

WELL 5

Owner: East Greenwich Twp. Water Dept.

Location: Northwest corner of Salem Ave. and Cohawkin Rd. in Clarksboro.

Well data: Owner's No. 1; completed in August 1931 by Layne-New York Co.; depth, 205 feet; diameter, 16 and 10 inches; screened from 185 to 205 feet; deep-well turbine pump and 40-horsepower electric motor with a capacity of 400 gpm; pump setting, 115 feet.

Pumping-test data: Tested in August 1931; static water level, 65 feet below land surface; yield, 410 gpm with a drawdown of 33 feet after 8 hours pumping; specific capacity, 12.4 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 6

Owner: East Greenwich Twp. Water Dept.

Location: Eglinton Ave. and Salem Ave. in Clarksboro.

Well data: Owner's No. 2; completed in March 1956 by Layne-New York Co.; depth, 218 feet, diameter, 16 inches; screened from 191 to 216 feet; deep-well turbine pump and 50-horsepower electric motor with a capacity of 500 gpm.

Pumping-test data: Tested in February 1956: static water level, 77 feet below land surface; yield, 536 gpm with a drawdown of 20 feet after 12 hours pumping; specific capacity, 26.8 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 7

Owner: Borough of Glassboro Water Department.

Location: Main and High St. rear of Public Works Bldg. in Glassboro.

Well data: Owner's No. 1; completed in November 1927 by Layne-New York Co.; depth, 654 feet; diameter, 18 and 13 inches; screen from 604 to 654 feet; deep-well turbine pump and 50-horsepower electric motor with capacity of 350 gpm; pump setting, 180 feet.

Pumping-test data: Tested in November 1927: static water level, 145 feet below land surface; yield, 363 gpm with a drawdown of 13 feet after 8 hours pumping; specific capacity of 27.9 gpm/ft.

WELL 8

Owner: Borough of Glassboro Water Department.

Location: Main St. and Delsea Dr. at storage tank in Glassboro.

Well data: Owner's No. 2; completed in August 1947 by Layne-New York Co.; depth, 604 feet; diameter, 18 and 12 inches; screened from 562 to 602 feet; deep-well turbine pump and 50-horsepower electric motor with a capacity of 550 gpm; pump setting, 206 feet.

Pumping-test data: Tested in August 1947: static water level, 154 feet below land surface; yield, 584 gpm with a drawdown of 25 feet after 8 hours pumping; specific capacity, 23.4 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 9

Owner: Borough of Glassboro Water Department.

Location: Deptford and Harvard Rds. in Glassboro.

Well data: Owner's No. 3; completed in January 1956 by Layne-New York Co.; depth, 615 feet; diameter, 12 inches; screened from 562 to 612 feet; deep-well turbine pump and 75-horsepower electric motor with a capacity of 700 gpm; pump setting, 227 feet.

Pumping-test data: Tested in December 1955: static water level, 166 feet below land surface; yield, 740 gpm with a drawdown of 30 feet after 1½ hours pumping; specific capacity, 24.7 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 10

Owner: Greenwich Twp. Water Dept.

Location: Gibbstown-Washington and Walnut Aves. at Municipal Bldg.

Well data: Owner's No. 2; completed in February 1944 by Layne-New York Co.; depth, 100 feet (originally drilled to 106 feet); diameter, 24 and 16 inches; screened from 76 to 96 feet; deep-well turbine pump and 40-horsepower electric motor with capacity of 500 gpm.

Pumping-test data: Tested in February 1944: static water level, 22 feet below land surface; yield, 524 gpm with a drawdown of 22 feet after 8 hours pumping; specific capacity, 23.8 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 11

Owner: Greenwich Twp. Water Dept.

Location: Gibbstown-Harmony Rd. and Morse Ave. in Gibbstown.

Well data: Owner's No. 3; completed in May 1950 by A. C. Schultes & Sons; depth, 98 feet; diameter, 16 inches; screen with 0.040-inch openings from 69 to 98 feet; deep-well turbine pump and 60-horsepower electric motor with a capacity of 600 gpm.

Pumping-test data: Tested in May 1950: static water level, 20 feet below land surface; yield, 700 gpm with a drawdown of 50 feet after 8 hours pumping; specific capacity 14.0 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 12

Owner: Mantua Water Co.

Location: 200 feet south of Mantua Creek and west of Rt. 45 in Mantua.

Well data: Owner's No. 1; completed in August 1940 by A. C. Schultes & Sons; depth 235 feet; diameter, 8 inches; screen from 214 to 235 feet; direct suction pump (air), 25-horsepower, with a capacity of 100 to 200 gpm.

Pumping-test data: Tested in August 1940: static water level 17 feet below land surface; yield, 460 gpm.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 13

Owner: Mantua Water Co.

Location: 25 feet west of standpipe on South McCarthy Ave. in Mantua.

Well data: Owner's No. 2; completed in May 1954 by A. C. Schultes & Sons; depth, 316 feet; diameter, 8 inches; screen with 0.030-inch openings from 295 to 316 feet; deep-well turbine pump and 25-horsepower electric motor with a capacity of 250 gpm; pump set at 140 feet.

Pumping-test data: Tested in December 1953: static water level 90 feet below land surface; yield, 287 gpm with a drawdown of 40 feet after 4 hours pumping; specific capacity, 7.2 gpm/ft.

Remarks: Surface altitude, 75 feet. Chemical analysis available (table 8).

WELL 14

Owner: National Park Water Co.

Location: 300 feet south of Grove Ave. on Woodlawn Ave. in National Park.

Well data: Owner's No. 1; completed in September 1950 by A. C. Schultes & Sons; depth, 85 feet; diameter, 8 inches; screen with 0.040-inch openings from 64 to 85 feet; deep-well turbine pump and 25-horsepower electric motor with a capacity of 300 gpm.

Pumping-test data: Tested in September 1950: static water level, 4.5 feet below land surface; yield, 500 gpm with a drawdown of 58.5 feet after 8 hours pumping; specific capacity, 8.5 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 15

Owner: National Park Water Co.

Location: Lakehurst and Grove Ave. at standpipe in National Park.

Well data: Owner's No. 2; completed in April 1956 by A. C. Schultes & Sons; depth, 282 feet; diameter 12 and 8 inches; screened from 241 to 282 feet; deep-well turbine pump and electric motor; pump setting, 125 feet.

Pumping-test data: Tested in April 1956: static water level, 52 feet below land surface; yield, 636 gpm with a drawdown of 31 feet after 8 hours pumping; specific capacity, 20.5 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 16

Owner: The Borough of Newfield Water Dept.

Location: Catawba Ave. and Church St. in Newfield.

Well data: Owner's No. 2; completed in May 1936 by Artesian Well Drilling Co.; depth, 135 feet; diameter, 12 inches; screened from 102 to 134 feet; deep-well turbine pump and 20-horsepower electric motor with a capacity of 350 gpm.

Pumping-test data: Tested in May 1936: static water level, 27 feet below land surface; yield 480 gpm with a drawdown of 8.5 feet; specific capacity, 56.5 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 17

Owner: The Borough of Paulsboro Water Department.

Location: Lincoln Ave. and N. Delaware St. at storage tank in Paulsboro.

Well data: Owner's No. 2; completed in September 1930 by Layne-New York Co.; depth, 105 feet, diameter, 18 inches; screened from 70 to 100 feet; deep-well turbine pump and 50-horsepower electric motor with a capacity of 500 gpm.

Pumping-test data: Tested in September 1930: static water level, 19 feet below land surface; yield, 780 gpm with a drawdown of 44 feet after 8 hours pumping; specific capacity, 17.7 gpm/ft. Well redeveloped March 8, 1948: static water level, 13 feet below land surface; yield, 500 gpm with a drawdown of 59 feet; specific capacity, 8.5 gpm/ft. Redeveloped again May 10, 1950: static water level, 9.5 feet below land surface; yield, 465 gpm with a drawdown of 63.5 feet; specific capacity, 7.3 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 18

Owner: The Borough of Paulsboro Water Department.

Location: Lincoln Ave. and N. Delaware St. at storage tank in Paulsboro.

Well data: Owner's No. 3; completed in August 1942 by Layne-New York Co.; depth, 160 feet; diameter, 18 inches; screened from 115 to 140 feet; deep-well turbine pump and 60-horsepower electric motor with a capacity of 700 gpm.

Pumping-test data: Tested in July 1942: static water level, 19 feet below land surface; yield, 640 gpm with a drawdown of 21 feet after 8 hours pumping; specific capacity, 30.5 gpm/ft. Well redeveloped on May 15, 1940: static water level, 20 feet; yield, 800 gpm with a drawdown of 33 feet; specific capacity, 24.3 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 19

Owner: The Borough of Paulsboro Water Department.

Location: Intersection on Summit and Elizabeth Ave. in Paulsboro.

Well data: Owner's No. 1; completed in March 1951 by A. C. Schultes & Sons; depth, 220 feet; diameter, 12 inches; screen with 0.060-inch openings from 192 to 220 feet; deep-well turbine pump and 30-horsepower electric motor with a capacity of 600 gpm.

Pumping-test data: Tested in March 1951: static water level, 30 feet below land surface; yield, 1,000 gpm with a drawdown of 120 feet after 24 hours pumping; specific capacity, 8.3 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 20

Owner: The Borough of Paulsboro Water Department.

Location: At rear of Borough Hall on South Delaware St. in Paulsboro.

Well data: Owner's No. 5; completed in September 1957 by Layne-New York; depth, 178 feet, originally drilled to 196 feet; diameter, 12 inches; screened from 135 to 175 feet; centrifugal pump and 40-horsepower electric motor.

Pumping-test data: Tested in September 1957: static water level, 15 feet below land surface; yield, 900 gpm with a drawdown of 38 feet after 8 hours pumping; specific capacity, 23.7 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 21

Owner: The Borough of Pitman Water Dept.

Location: North Summit and East Holly Aves. at standpipe in Pitman.

Well data: Owner's No. P1; completed in March 1926 by Layne-New York Co.; depth, 514 feet; diameter, 16 inches; bottom of screen at 514 feet; deep-well turbine pump and 50-horsepower electric motor with a capacity of 500 gpm.

Pumping-test data: Tested in March 1926: static water level, 140 feet below land surface; yield, 651 gpm with a drawdown of 10 feet after 9½ hours pumping; specific capacity, 65.1 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 22

Owner: The Borough of Pitman Water Dept.

Location: Esplanade Ave. opposite High School in Pitman.

Well data: Owner's No. P2; completed in August 1947 by Layne-New York Co.; depth, 515 feet; diameter, 20 and 12 inches; screened from 475 to 515 feet; deep-well turbine pump and 50-horsepower electric motor with capacity of 500 gpm.

Pumping-test data: Tested in June 1947: static water level, 144 feet below land surface; yield, 500 gpm with a drawdown of 14 feet after 8 hours pumping; specific capacity, 35.7 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 23

Owner: The Borough of Pitman Water Dept.

Location: Southwest corner of Laurel and Wesley Aves. at standpipe in Pitman.

Well data: Owner's No. PG1; completed in 1937 or 1938 by A. C. Schultes & Sons; depth, 527 feet; diameter, 12 and 10 inches; screened from 486 to 524 feet; deep-well turbine pump and 50-horsepower electric motor with capacity of 500 gpm.

Pumping-test data: Static water level, 135 feet below land surface; yield, 500 gpm; no additional data available.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 24

Owner: Sewell Water Company.

Location: East side of Chestnut Branch of Mantua Creek at pumping station in Sewell.

Well data: Owner's No. 1; completed in 1939; depth, 100 feet; diameter, 8 inches.

Pumping-test data: No data available.

Remarks: Chemical analysis available (table 8). Well abandoned.

WELL 25

Owner: Sewell Water Company.

Location: East of Mantua-Sewell Rd. (Rt. 42) and Warren Ave. at standpipe in Sewell.

Well data: Owner's No. 4; completed in July 1951 by A. C. Schultes & Sons; depth, 377 feet; diameter, 10 inches; screened from 352 to 377 feet; deep-well turbine pump and 30-horsepower electric motor with a capacity of 300 gpm; pump setting, 150 feet.

Pumping-test data: Tested in July 1951: static water level, 95 feet below land surface; yield, 600 gpm with a drawdown of 50 feet after 24 hours pumping; specific capacity, 12.0 gpm/ft.

WELL 26

Owner: South Jersey Water Supply Company.

Location: Glassboro Rd. at Raccoon Creek in Mullica Hill.

Well data: Owner's No. 3; completed in August 1953 by John Rulon, Philadelphia, Pa.; depth, 270 feet; diameter, 10 inches; screened from 234 to 265 feet; deep-well turbine pump and 20-horsepower electric motor with a capacity of 250 gpm.

Pumping-test data: Tested in August 1953: static water level, 35 feet below land surface; yield, 400 gpm with a drawdown of 20 feet after 8 hours pumping; specific capacity, 20.0 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 27

Owner: The Borough of Swedesboro Water Dept.

Location: West side of Park Ave. at intersection of East Ave. in Swedesboro.

Well data: Owner's No. 1; completed in February 1933 by Artesian Well Drilling Co.; depth, 224 feet; screened from 175 to 220 feet; deep-well turbine pump and electric motor.

Pumping-test data: Tested in February 1933: static water level, 37 feet below land surface; yield, 592 gpm with a drawdown of 15.9 feet after 8 hours pumping; specific capacity, 37.2 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 28

Owner: The Borough of Swedesboro Water Dept.

Location: East side of Park Ave. at intersection of East Ave in Swedesboro.

Well data: Owner's No. 2; completed in June 1940 by Artesian Well Drilling Co.; depth, 244 feet; diameter, 10 inches; screened from 216 to 240 feet; deep-well turbine pump and 30-horsepower electric motor with a capacity of 350 gpm; pump setting, 50 feet.

Pumping-test data: Tested in June 1940: static water level, 33 feet below land surface; yield, 400 gpm with a drawdown of 5 feet after 10 hours pumping; specific capacity, 80.0 gpm/ft drawdown.

Remarks: Surface altitude, 30 feet.

WELL 29

Owner: The Borough of Wenonah Water Dept.

Location: N. Clinton Ave. and Buttonwood St. at standpipe in Wenonah.

Well data: Owner's No. 1; completed in October 1944 by A. C. Schultes & Sons; depth, 320 feet; diameter, 12 inches, screened from 280 to 320 feet; deep-well turbine pump and 20-horsepower electric motor; pump setting, 136 feet.

Pumping-test data: Tested in May 1944: static water level, 90 feet below land surface; yield, 500 gpm with a drawdown of 30 feet after 24 hours pumping; specific capacity, 16.7 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 30

Owner: The Borough of Wenonah Water Dept.

Location: Ogden Road and Penn Reading R. R. in Wenonah.

Well data: Owner's No. 2; completed in February 1951 by A. C. Schultes & Sons; depth, 310 feet; diameter, 12 inches; screen with 0.040-inch openings from 270 to 310 feet; deep-well turbine pump and 15-horsepower electric motor with a capacity of 150 gpm.

Pumping-test: Tested in February 1951: static water level, 67 feet below land surface; yield, 1,200 gpm with a drawdown of 40 feet after 8 hours of pumping; specific capacity, 30.0 gpm/ft.

Remarks: Chemical analysis available (table 8).

WELL 31

Owner: The Borough of Westville Water Dept.

Location: Crown Point Ave. behind Borough Hall in Westville.

Well data: Owner's No. 1; completed in 1930; depth, 112 feet; diameter, 8 inches; screened from 69 to 112 feet; deep-well turbine pump and 20-horsepower electric motor with a capacity of 225 gpm; pump setting, 60 feet.

Pumping-test data: Tested in 1930: static water level, 16 feet below land surface; yield, 250 gpm with a drawdown of 22 feet; specific capacity, 11.4 gpm/ft.

Remarks: Chemical analysis available (table 8). Surface altitude, 16 feet.

WELL 32

Owner: The Borough of Westville Water Dept.

Location: Crown Point Ave. behind Borough Hall in Westville.

Well data: Owner's No. 2; completed in October 1934; depth 118 feet; diameter, 8 inches; screened from 78 to 118 feet; deep-well turbine pump and 20-horsepower electric motor with a capacity of 280 gpm.

Pumping-test data: Tested in October 1934: static water level, 18 feet below land surface; yield, 335 gpm with a drawdown of 38 feet after 36 hours pumping; specific capacity, 8.8 gpm/ft.

Remarks: Surface altitude, 16 feet.

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 33

Owner: The Borough of Westville Water Dept.

Location: Crown Point Ave. and River Dr. in Westville.

Well data: Owner's No. 3; completed in July 1945 by Artesian Well Drilling Co.; depth, 140 feet; diameter, 10 inches; screened from 115 to 138 feet; deep-well turbine pump and electric motor.

Pumping-test data: Tested in June 1945: static water level, 24.5 feet below land surface; yield, 500 gpm with a drawdown of 28 feet after 2 hours pumping; specific capacity, 17.8 gpm/ft.

Remarks: Surface altitude, 16 feet.

WELL 34

Owner: The Borough of Westville Water Dept.

Location: Crown Point Ave. behind Borough Hall in Westville.

Well data: Owner's No. 4; completed in December 1957 by A. C. Schultes & Sons; depth, 313 feet; diameter, 10 inches; screened from 286.5 to 313 feet; vertical turbine pump and 75-horsepower electric motor with a capacity of 750 gpm.

Pumping-test data: Tested in December 1957: static water level, 50.8 feet below land surface; yield, 1,205 gpm with a drawdown of 94.8 feet after 8 hours pumping; specific capacity, 12.7 gpm/ft.

Remarks: Well originally drilled to 320 feet. Chemical analysis available (table 8).

WELL 35

Owner: Monroe Municipal Utilities Authority.

Location: Blue Bell Road, north of Chestnut St. in Williamstown.

Well data: Owner's No. 3; completed in 1935; depth, 130 feet; diameter, 12 inches; screened from 97 to 132 feet, estimated; deep-well turbine pump and 25-horsepower electric motor with a capacity of 333 gpm; pump setting, 75 feet.

Pumping-test data: Tested in 1935: static water level, 25 feet below land surface; yield, 350 gpm with a drawdown of 12 feet; specific capacity, 29.1 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 36

Owner: Monroe Municipal Utilities Authority.

Location: Washington Ave., 200 feet west U. S. 322 in Williamstown.

Well data: Owner's No. 4; completed in November 1951 by A. C. Schultes & Sons; depth, 106 feet; diameter, 12 inches; screen with 0.030 and 0.060-inch openings from 69 to 106 feet; deep-well turbine pump and electric motor.

Pumping-test data: Tested in November 1951: static water level, 12.5 feet below land surface; yield, 805 gpm with a drawdown of 20 feet after 24 hours pumping; specific capacity, 40.3 gpm/ft.

Remarks: Chemical analysis available (table 8). Analysis is from abandoned well, 10 feet away.

WELL 37

Owner: The City of Woodbury Water Dept.

Location: Sewell Pumping Station, bank of Mantua Creek, 4 miles south of Woodbury.

Well data: Owner's No. 1; completed in December 1934 by John Rulon, Philadelphia, Pa.; depth, 314 feet; diameter, 16 inches; screened from 271 to 314 feet; deep-well turbine pump and 30-horsepower electric motor with capacity of 1,050 gpm.

Pumping-test data: Tested in December 1934: static water level, 12.7 feet below land surface; yield, 1,250 gpm with a drawdown of 41.6 feet; specific capacity, 30.1 gpm/ft.

Remarks: Chemical analysis is from well 2 (table 8).

WELL 38

Owner: The City of Woodbury Water Dept.

Location: W. Barber and Lupton Ave. in Woodbury.

Well data: Owner's No. 3; completed in April 1946 by A. C. Schultes & Sons; depth, 188 feet; diameter, 16 inches; screened from 148 to 188 feet; deep-well turbine pump and 50-horsepower electric motor with capacity of 700 gpm.

Pumping-test data: Tested in April 1946: static water level, 54 feet below land surface; yield, 1,100 gpm with a drawdown of 54 feet after 10 hours pumping; specific capacity, 20.4 gpm/ft.

Remarks: Chemical analysis available (table 8).

Table 7.—Records of selected public supply wells in Gloucester County—cont'd.

WELL 39

Owner: The City of Woodbury Water Dept.

Location: Northeast corner of Oak and Tatum Sts. in Woodbury.

Well data: Owner's No. 4; completed in January 1953 by A. C. Schultes & Sons; depth, 167 feet; diameter, 16 inches; screen with 0.040- and 0.070-inch openings from 129 to 167 feet; deep-well turbine pump and electric motor.

Pumping-test data: Tested in January 1953: static water level, 28 feet below land surface; yield, 1.056 gpm with a drawdown of 47 feet after 8 hours pumping; specific capacity, 22.5 gpm/ft.

WELL 40

Owner: The City of Woodbury Water Dept.

Location: North bank of Woodbury Creek near Penn. Reading R. R. tracks.

Well data: Owner's No. Test Hole; completed in December 1952 by A. C. Schultes & Sons; depth, 440 feet; diameter, 8 inches; screened from 390 to 410 feet.

Pumping-test data: Tested in December 1952: static water level, 50 feet below land surface; yield, 100 gpm with a drawdown of 6 feet.

Remarks: Casing removed and hole plugged.

TABLE 8—RESULTS OF CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS IN GLOUCESTER COUNTY, N. J.

(Analyses by U. S. Geological Survey, results in milligrams per liter except as indicated.)

Public Supply Wells[6]

Well	Date of collection	Temperature (°C)	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Well
[3] Potable Water Standards				0.3							250	250	1.5	20	500	170				
4	6- 4-57	16	9.0	0.53	3.4	3.8	1.8	0.6	26	0	1.7	3.2	0.1	2.5	38	24	2	39	6.2	4
6	6- 4-57	13	7.7	.13	2.1	3.7	3.2	2.8	2	0	4.2	7.0	.0	19	52	20	18	91	5.2	6
8	5-30-57	14	8.1	1.5	1.3	2.2	8.6	1.2	3	0	.2	7.0	.1	22	62	12	10	88	5.3	8
9	5-30-57	14	10	[1] .93	.8	.4	1.0	.4	5	0	1.7	2.8	.1	.3	20	2	0	21	6.2	9
13	5-29-57	16	10	.68	2.6	2.7	3.2	1.6	4	0	.4	6.1	.1	17	57	18	14	71	5.7	13
15	5-29-57	14	23	.99	27	2.2	1.6	2.6	89	0	8.4	2.1	.1	.0	106	70	4	174	7.5	15
16	5-29-57	18	6.2	.55	4.7	4.0	2.5	1.3	14	0	.2	5.5	.0	22	64	28	16	85	6.3	16
20	5-29-57	--	18	.79	28	1.0	1.6	2.1	83	0	8.3	3.1	.3	.4	86	74	6	168	7.6	20
21	5-29-57	14	17	.28	29	.8	1.9	1.9	91	0	8.1	2.0	.1	.4	93	76	2	169	7.4	21
22	5-30-57	16	9.4	1.3	2.1	2.7	2.4	1.0	14	0	.6	4.6	.3	6.2	40	16	4	52	6.2	22
25	5-30-57	--	20	.38	25	3.7	4.2	4.5	101	0	8.1	2.2	.3	.5	108	78	0	178	6.8	25
26	5-29-57	15	8.8	.43	4.7	2.1	5.5	1.1	6	0	2.7	10	.2	14	62	20	15	89	5.7	26
27	5-29-57	17	13	.28	25	4.0	4.4	4.6	100	0	8.6	2.0	.3	.3	109	79	0	186	7.5	27
28	5-29-57	16	18	.16	25	1.0	2.6	2.4	56	0	19	5.6	.5	.0	107	66	20	161	7.5	28
34	5- 1-51	16	10	.11	14	2.9	21	6.3	103	0	15	1.8	.4	1.2	124	47	0	203	7.8	34
35	5-29-57	13	11	2.0	34	2.9	2.6	4.6	120	0	9.0	2.4	.3	.1	126	97	0	212	6.6	35
36	5-28-57	21	5.2	1.3	14	15	66	7.2	6	0	3.8	104	.2	118	386	96	92	623	5.6	36
38	5-28-57	15	52	1.6	17	1.0	2.0	3.4	50	0	11	2.6	.2	.3	91	46	6	117	6.6	38
40	5-28-57	14	28	.54	51	6.5	2.0	5.1	187	0	11	4.5	.5	.4	233	154	1	320	7.2	40
41	5-28-57	18	7.1	.49	7.6	4.0	3.5	2.7	12	0	1.5	13	.1	22	96	36	26	122	5.9	41
44	5-30-57	16	29	.20	31	.9	1.5	4.0	84	0	14	5.2	.6	1.6	129	81	12	192	7.2	44

TABLE 8—RESULTS OF CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS IN GLOUCESTER COUNTY, N. J. —Continued

(Analyses by U. S. Geological Survey, results in milligrams per liter except as indicated.)

Public Supply Wells[6]

Well	Date of collection	Temperature (°C)	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Well
47	8-30-57	18	30	3.6	67	1.6	1.6	1.8	206	0	10	3.3	.3	1.1	220	174	5	346	7.7	47
48	5-29-57	14	27	2.4	55	.4	2.6	2.2	154	0	12	4.1	.1	.2	173	138	12	286	7.8	48
52	5-29-57	15	15	1.8	54	7.8	18	6.0	214	0	41	3.6	.2	.8	253	166	0	424	6.9	52
53	5-30-57	14	14	.54	3.4	1.5	2.5	3.3	4	0	.8	8.0	.0	12	46	14	11	47	5.1	53
56	5-29-57	15	20	2.9	27	5.9	8.6	5.2	121	0	15	2.6	.1	.2	145	92	0	232	6.3	56
57	5-29-57	16	7.3	.52	36	7.4	4.8	5.2	1	0	63	19	.2	48	212	120	120	339	4.6	57
60	5-28-57	19	25	3.3	4.2	2.0	1.0	2.9	13	0	9.4	1.8	.3	.3	45	18	8	56	5.9	60
66	8-20-51	13	10	.15	7.8	5.0	54	2.9	5	0	12	96	.0	6.2	208	40	36	373	5.8	66
67	9-15-52	16	--	---	16		[4]/56		25	0	16	87	---	.6	---	39	11	418	5.9	67
68	7- 9-51	15	12	5.0	30	11	152	3.2	1	0	112	242	.3	.2	556	120	119	1,060	4.6	68
70	6-28-57	17	11	.52	31	4.4	9.5	7.4	155	0	1.9	1.5	.2	1.5	130	96	0	258	7.9	70
73	3-15-50	--	8.9	.16	7.2	1.9	34	5.2	93	0	11	14	.5	.2	128	26	--	217	7.3	73
74	8-15-50	14	11	.60	7.0	1.2	60	3.6	108	0	9.0	40	.8	.5	186	22	0	329	7.8	74
A[2]	8-20-51	--	14	3.3	15	7.4	137	3.5	17	0	82	184	.1	15	470	67	54	796	7.2	A[2]
B[2]	7- 9-51	15	18	.19	19	18	24	3.7	0	0	158	38	.2	19	312	121	121	524	3.8	B[2]
C[2]	7- 9-51	16	5.2	29	16	15	35	3.1	97	0	72	23	.2	.2	234	102	22	395	7.0	C[2]
D[2]	7- 9-51	14	12	1.0	12	7.2	195	3.2	0	0	465	14	.3	16	738	59	59	1,240	3.5	D[2]
E[2]	3-15-50	14	8.6	.12	6.6	2.1	46	4.0	102	0	8.8	26	.6	.5	154	25	--	269	7.7	E[2]
F[2]	3-15-50	14	10	.70	7.2	1.8	36	4.3	94	0	9.9	17	.5	.5	132	26	--	224	8.0	F[2]
G[2]	3-15-50	14	9.2	2.5	6.7	1.7	47	4.0	104	0	9.8	26	.6	.2	154	24	--	267	8.0	G[2]
H[2]	4- 6-50	13	9.5	.73	8.6	2.1	29	4.4	96	0	12	9.2	.5	.6	120	31	--	202	7.8	H[2]

TABLE 8—RESULTS OF CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS IN GLOUCESTER COUNTY, N. J.

(Analyses by U. S. Geological Survey, results in milligrams per liter except as indicated.)

Public Supply Wells[6]

Well	Date of collection	Temperature (°C)	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Well
1[7]	5-19-51	--	13	.21	8.4	4.6	6.8	1.0	12	0	23	9.5	0.1	11	82	40	30	134	6.5	1
	7-12-67	14	10	1.6	17	10	18	5.5	5	0	43	20	0.1	59	205	84	80	312	6.5	
2[7]	7-12-67	14	8.4	.35	8.5	7.0	6.2	2.9	4	0	24	10	0.1	28	120	50	47	167	6.1	2
3[9]	4-23-51	13	7.9	.02	4.6	4.0	21	6.2	7	0	12	18	0.1	50	121	28	22	174	5.2	3
4[7]	7-30-57	23	14	.50	2.6	1.3	216	7.5	382	0	0	120	2.0	.1	543	12	0	977	7.7	4
	7-12-67	21	9.8	.95	2.4	1.2	222	7.2	369	4	.6	129	1.6	.2	568	11	0	961	8.5	
5[7]	5- 7-51	14	9.8	.24	12	3.1	102	3.5	227	0	5.0	54	1.2	.9	313	43	0	523	7.8	5
6[7]	7-13-67	13	9.8	.26	5.6	7.1	4.8	3.1	1	0	38	7.8	.0	12	94	43	42	162	4.6	6
8[7]	5- 7-51	18	12	.11	3.0	1.0	118	4.6	292	0	6.2	19	1.6	7	315	12	0	515	8.1	8
	7-17-67	17	9.5	.30	1.8	.8	115	5.5	279	9	2.7	18	.2	.8	319	8	0	502	8.5	
9[7]	7-17-67	17	10	.17	2.4	1.0	150	6.3	318	7	2.4	56	1.6	.8	417	10	0	659	---	9
10[7]	8-14-67	15	6.2	.04	12	7.2	14	5.7	6	0	42	18	.0	28	165	60	55	227	5.5	10
11[7]	9-21-51	15	8.3	.02	3.0	5.2	4.3	3.1	0	0	21	6.9	.0	17	72	29	29	121	4.4	11
	7-13-67	23	11	1.2	11	3.3	119	7.3	245	0	4.5	72	3.2	.3	375	41	0	605	8.2	
12[7]	9-21-51	16	8.5	.45	8.0	2.0	71	5.2	191	0	4.0	19	1.5	.3	221	28	0	356	8.0	12
13[7]	7-17-67	14	9.8	.09	8.5	2.2	82	5.5	189	6	6.1	26	2.0	.8	241	30	0	391	8.5	13
14[7]	4-25-51	14	7.4	.42	6.0	5.8	14	4.2	7	0	25	21	.0	20	111	39	33	175	5.8	14
15[7]	7-13-67	13	11	.09	6.5	1.5	60	3.2	120	0	8.4	34	.8	.2	187	22	0	312	8.0	15
16[9]	4-23-51	13	5.5	.01	1.2	.8	2.7	.4	5	0	1.0	4.2	.0	5.0	25	8	4	34	6.4	16
17[7]	4-11-51	14	7.6	.02	9.6	5.2	11	3.9	0	0	33	19	.1	20	124	45	45	196	4.5	17
	7-12-67	14	6.9	.29	13	6.2	15	3.3	2	0	46	22	.1	17	156	58	57	235	4.8	
18[7]	4-11-51	13	7.6	2.3	5.8	3.5	48	2.2	0	0	27	77	.1	5.2	194	29	29	342	4.5	18
	7-12-67	14	7.3	4.2	4.7	3.7	14	2.4	2	0	21	18	.0	12	96	27	25	153	5.1	
19[7]	8-14-67	17	9.1	.60	8.1	2.0	172	5.0	168	0	27	170	2.5	.4	479	28	0	855	7.6	19
20[7]	8-14-67	14	5.8	4.8	11	6.6	28	6.9	0	0	76	43	.1	.2	187	55	55	365	3.8	20
21[7]	4-17-51	17	11	.03	4.2	.8	102	5.0	238	0	3.2	26	2.0	1.0	285	14	0	449	8.1	21
	7-17-67	17	8.7	.14	2.9	1.7	107	5.4	254	6	4.3	20	2.0	.5	297	14	0	457	8.5	
22[7]	7-17-67	15	9.1	.47	3.4	1.2	102	5.4	245	5	4.3	24	3.0	.7	285	14	0	449	8.5	22

TABLE 8—RESULTS OF CHEMICAL ANALYSES OF WATER FROM SELECTED WELLS IN GLOUCESTER COUNTY, N. J.—Continued

(Analyses by U. S. Geological Survey, results in milligrams per liter except as indicated.)

Public Supply Wells[6]

Well	Date of collection	Temperature (°C)	Silica (SiO_2)	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Well
23 7/	5- 7-51	17	12	.02	3.6	1.4	118	5.3	274	0	3.0	34	1.2	.8	317	15	--	523	8.2	23
24 8/	8-15-50	--	18	5.6	34	1.2	2.2	2.8	83	0	20	5.9	.5	.2	133	90	22	208	7.6	24
26 7/	12-21-50	14	9.7	1.4	9.2	2.4	196	8.1	323	0	6.5	140	1.4	.8	538	33	0	967	8.2	26
27 7/	5 -7-51	14	11	2.6	23	5.1	41	5.4	118	0	18	43	.3	.5	202	78	0	367	7.4	27
	7-13-67	14	11	2.1	20	4.4	11	4.9	104	0	14	2.6	.3	.2	135	68	0	192	8.2	
29 7/	4-17-51	--	10	.16	7.6	1.3	58	5.1	162	0	7.0	7.6	1.2	.3	186	24	0	288	7.6	29
	7-1' -67	13	9.6	.29	7.3	2.0	60	5.8	173	0	6.9	12	1.6	.0	205	26	0	308	8.2	
30 7/	7-17-67	11	9.5	.17	7.5	2.1	58	5.8	171	0	6.9	12	1.6	.3	190	27	0	307	8.2	30
31 7/	10-11-50	14	9.9	1.8	23	5.0	12	5.8	90	0	20	12	.4	1.4	137	78	4	246	7.6	31
34 7/	7-13-67	14	9.1	---	12	2.3	25	5.2	90	0	15	7.5	.4	.4	121	40	0	191	8.0	34
35 9/	4-23-51	13	8.2	.03	2.6	3.1	6.2	1.5	1	0	.8	5.4	.0	32	66	19	18	89	4.8	35
36 9/	4-23-51	--	7.7	.03	3.6	5.1	9.8	2.7	4	0	1.0	13	.1	41	98	30	27	141	4.9	36
37 7/	4-25-51	16	10	.03	5.6	2.1	79	5.2	196	0	5.0	21	1.6	1.0	234	23	0	374	8.0	37
38 7/	5- 7-51	--	8.9	.37	21	4.1	32	5.5	146	0	14	6.5	.7	.8	165	69	0	276	7.5	38
	7-12-67	13	9.3	.44	19	3.8	25	6.4	112	0	18	7.6	.7	.6	147	63	0	237	7.8	

1/ Sample may be affected by an iron removal unit.

2/ Records not in table 6. --A--duPont Co. H-C, TD 103'; B--Mobil Oil Co. well 28, TD 136'; C--Mobil Oil Co. well 36, TD 138';
D--Mobil Oil Co. well 46, TD 266'; E--Texas Co. well 2, TD 289', F--Texas Co. well 3, TD 289'; G--Texas Co. well 4, TD 289'; H--Texas Co. well 5, TD 283'.

3/ N. J. State Dept. of Health, Potable Water Standards, 1962.

4/ Value represents Na -- K.

5/ See table 6.

6/ See table 7.

7/ Wells screened in Magothy-Raritan Formations.

8/ Wells screened in Mount Laurel Sand and Wenonah Formation.

9/ Wells screened in Cohansey Sand.

Table 9.—Logs of selected wells in Gloucester County, N. J.

Well 1, Anthony Fabrizio, Newfield
Altitude, 115 feet; total depth, 129 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Bridgeton Formation:		
Gravel	16	16
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand	27	43
Loam	22	65
Clay, yellow	1	66
Clay, brown	1	67
Clay, black	20	87
Clay and sand	3	90
Gravel, small	5	95
Clay, yellow	3	98
Clay, black	2	100
Clay, yellow	2	102
Clay, and sand, mixed	3	105
Sand, loamy	7	112
Sand, clean	14	126
Clay and sand, mixed	3	129

Well 2, John Leshay, Newfield
Altitude, 120 feet; total depth, 113 feet

Pleistocene:		
Bridgeton Formation:		
Topsoil	10	10
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Clay	11	21
Sand, reddish	9	30
Sand, coarse and gravel	50	80
Stones and gravel	1	81
Stones and clay	4	85
Sand, coarse, tan	28	113

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 3, E. Dominguez, Newfield
Altitude, 105 feet; total depth, 48 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Bridgeton Formation:		
Dirt, brown	4	4
Dirt, brown and stone	6	10
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, yellow	13	23
Sand, coarse, brown	9	32
Sand, very coarse and stones	16	48

Well 4, Franklin Twp. Board of Education, Franklinville
Altitude, 112 feet; total depth, 119 feet

Pleistocene:		
Bridgeton Formation:		
Sand	12	12
Gravel	3	15
Gravel mixed with clay	2	17
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Clay, sandy	5	22
Gravel, small	4	26
Sand, brown	16	42
Sand, red	2	44
Sand, fine	38	82
Miocene:		
Kirkwood Formation:		
Clay, gray, soft	23	105
Sand	3	108
Clay, soft, mucky	8	116
Sand, fine, white	3	119

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 5, Frank Schober, Jr., Franklinville
Altitude, 115 feet; total depth, 32 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Miocene(?):		
Bridgeton Formation and Cohansey Sand, undifferentiated:		
Clay and gravel	5	5
Sand, medium	25	30
Sand, fine	2	32

Well 7, Peets Gladiola Farm, N.E. of Newfield
Altitude, 125 feet; total depth, 148 feet
(well abandoned)

Pleistocene:		
Bridgeton Formation:		
Gravel, brown	7	7
Sand, coarse, yellow	5	12
Sandstone, iron-cemented, gravel, brown	2	14
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, brown and white, mixed	18	32
Sand, yellow and clay	61	93
Sand, brown and clay	19	112
Sand, fine, gray-brown	8	120
Sand, very fine, brown	13	133
Miocene:		
Kirkwood Formation:		
Clay, soft	15	148

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 8, Leno Zuccarini, Piny Hollow
Altitude, 115 feet; total depth, 96 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Bridgeton Formation:		
Gravel	6	6
Sand	6	12
Clay and gravel	2	14
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand	12	26
Sand, fine with clay	25	51
Sand	2	53
Clay	6	59
Sand	37	96

Well 9, Ritz Court Motel, Berryland
Altitude, 85 feet; total depth, 63 feet

Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand	21	21
Clay	29	50
Sand	13	63

Well 10, Gustav Carlson, East of Williamstown
Altitude, 113 feet; total depth, 65 feet

Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Topsoil and stones	4	4
Sand, fine, yellow with large stones	7	11
Sand, yellow, some water	2	13
Mud, fine, yellow, bits of clay	14	27
Clay, white and stones	4	31
Sand, fine, white	11	42
Sand, fine, yellow	10	52
Sand, yellow and brown, water-bearing	13	65

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 11, David Duncan, W. of Williamstown
Altitude, 135 feet; total depth, 58 feet

	Thickness (feet)	*Depth (feet)*
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, fine, yellow	13	13
Sand, fine, pink, clean	13	26
Sand, fine, yellow, sandstone, iron-cemented	12	38
Sand, fine, orange, sandstone, iron-cemented	8	46
Sand, coarse, pink, sandstone, iron-cemented	12	58

Well 12, Robt. E. Searle, Aura
Altitude, 145 feet; total depth, 58 feet

Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, fine, yellow	4	4
Sand, fine, yellow and clay	26	30
Sand, fine, white and clay	17	47
Sand, coarse, brown	11	58

Well 13, Louis J. Gerlack, SW. of Glassboro
Altitude, 135 feet; total depth, 46 feet

Pleistocene and Miocene(?):		
Bridgeton Formation and Cohansey Sand, undifferentiated:		
Sand, fine	46	46

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 14, Henry Powell, S. of Ewan
Altitude, 100 feet; total depth, 230 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Clay, yellow	20	20
Mud, black	30	50
Marl, green	70	120
Mud, black	30	150
Paleocene:		
Vincentown Formation:		
Rock	20	170
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Clay, brown	50	220
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, green	10	230

Well 15, Norman Lacy, Ewan
Altitude, 110 feet; total depth, 146 feet

Miocene(?) and Pliocene(?):		
Cohansey(?) Sand:		
Sand, fine	9	9
Miocene:		
Kirkwood Formation:		
Clay, gray	3	12
Clay, black	4	16
Sand, fine, black	24	40
Clay, black	61	101
Paleocene:		
Vincentown Formation:		
Shells, and limesand	7	108
Limestone and limesand	38	146

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 16, Mary Williamson, W. of Glassboro
Altitude, 141 feet; total depth, 52 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Miocene:		
Bridgeton and Kirkwood Formations, undifferentiated:		
Sand and gravel	27	27
Sand, medium to coarse	25	52

Well 17, Samuel Allen, Jr., W. of Glassboro
Altitude, 135 feet; total depth, 125 feet

Miocene:		
Kirkwood Formation:		
Gravel and sand	35	35
Clay, green	2	37
Clay, black	18	55
Clay, green, sand and shells	15	70
Quicksand, gray and shells	15	85
Mud, brown and shells	13	98
Paleocene:		
Vincentown Formation:		
Limerock, sand, shells	27	125

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 18, William H. Toppin, W. of Glassboro
Altitude, 135 feet; total depth, 200 feet (well abandoned)

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Sand, red, brown	43	43
Clay, hard, blue and black	17	60
Quicksand, mud, black and shells	40	100
Paleocene:		
Vincentown Formation:		
Shell rock, soft (3″ of hard shell rock above and below this zone)	17	117
Shell rock, soft	9	126
Shell rock, very hard	2	128
Shell rock, soft	12	140
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Marl	35	175
Rock, black	5	180
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sandrock, white	5	185
Sand, "salt and pepper," stones, green	7	192
Sand, "salt and pepper"	8	200

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 19, George Reuter, W. of Glassboro
Altitude, 140 feet; total depth, 150 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Bridgeton(?) Formation:		
Sand, fine	21	21
Sand, coarse	9	30
Miocene:		
Kirkwood Formation:		
Sand, fine and some clay	25	55
Clay, black	46	101
Sand, fine, black	8	109
Clay, black	11	120
Paleocene:		
Vincentown Formation:		
Limestone, layers and limesand	30	150
Marl		>150

Well 20, Clarance Kane, Pitman
Altitude, 130 feet; total depth, 135 feet

Pleistocene and Miocene(?):		
Bridgeton Formation and Cohansey Sand, undifferentiated:		
Topsoil	5	5
Gravel, orange	25	30
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	15	45
Quicksand, black	25	70
Quicksand, gray	36	106
Clay, green, mixed with marl	9	115
Paleocene:		
Vincentown Formation:		
Limestone and limesand	20	135

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 21, Stella Brown, N. of Pitman
Altitude, 88 feet; total depth, 105 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Quicksand, white	11	11
Quicksand, yellow	13	24
Quicksand, black	14	38
Clay, green	10	48
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Marl, blue	8	56
Marl, black	5	61
Rock, black, stones	11	72
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Stones, green, and belemnites	13	85
Sand, "salt and pepper"	20	105

Well 22, John Sofia, Cross Keys
Altitude, 154 feet; total depth, 51 feet

Pleistocene and Miocene(?):		
Bridgeton Formation and Cohansey(?) Sand, undifferentiated:		
Topsoil	2	2
Sand, fine	36	38
Sand, fine and coarse	13	51

Well 23, William V. Kresel, S. of Turnersville
Altitude, 140 feet; total depth, 54 feet

Pleistocene and Miocene(?):		
Bridgeton Formation and Cohansey(?) Sand, undifferentiated:		
Sand, gravel, and clay	5	5
Sand, and gravel	14	19
Sand, fine and sandstone	8	27
Sand, fine	27	54

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 24, Frank Hess, SW. of Turnersville
Altitude, 155 feet; total depth, 56 feet

	Thickness (feet)	*Depth (feet)*
Miocene(?) and Pliocene(?):		
Cohansey(?) Sand:		
Sand, medium to fine	56	56

Well 25, John Barrett, Sr., E. of Pitman
Altitude, 140 feet, total depth, 250 feet

Pleistocene:		
Bridgeton Formation:		
Topsoil	2	2
Clay and gravel	8	10
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, fine	70	80
Miocene:		
Kirkwood Formation:		
Clay, black	20	100
Sand, fine, black	15	115
Clay, black	61	176
Paleocene:		
Vincentown Formation:		
Limestone	1	177
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Marl and clay	49	226
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand with belemnites	24	250

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 26, Fred Foster, Jr., SW. of Turnersville
Altitude, 151 feet; total depth, 61 feet

	Thickness (feet)	*Depth (feet)*
Miocene(?) and Pliocene(?):		
Cohansey Sand:		
Sand, medium	36	36
Miocene:		
Kirkwood Formation:		
Sand, very fine	25	61

Well 27, Primrose Motel, Turnersville
Altitude, 83 feet; total depth, 190 feet

Pleistocene:		
Pensauken(?) Formation:		
Sand, coarse, yellow	20	20
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	25	45
Quicksand, black	25	70
Clay, gray	12	82
Eocene:		
Manasquan Formation:		
Clay, green, and marl, mixed	18	100
Paleocene:		
Vincentown Formation:		
Limestone and limesand	20	120
Hornerstown Sand:		
Shell marl, blue	14	134
Marl, black and shells	19	153
Upper Cretaceous:		
Navesink Formation:		
Rock, black, stones and shells, green	17	170
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, gray, stones, green and belemnite	10	180
Sand, "salt and pepper," belemnites	10	190

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 28, Ruth Sagers, Turnersville
Altitude, 89 feet; total depth, 105 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	50	50
Quicksand, black	10	60
Eocene:		
Manasquan Formation:		
Clay and sand, gray-green	15	75
Paleocene:		
Vincentown Formation:		
Limestone and limesand	20	95
Hornerstown Sand:		
Sand, black and shells	10	105

Well 29, William J. Micheal, NW. of Turnersville
Altitude, 80 feet; total depth, 140 feet

Pleistocene:		
Pensauken Formation:		
Sand and gravel	25	25
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	5	30
Quicksand, black	15	45
Paleocene:		
Vincentown Formation:		
Limestone and shells	18	63
Hornerstown Sand:		
Marl, blue, shells	22	85
Marl, black	15	100
Upper Cretaceous:		
Navesink Formation:		
Rock, black, stones and shells	5	105
Marl, black, shells	14	119
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, white, belemnited shells	3	122
Sand, "salt and pepper"	18	140

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 30, Carlton Gant, Hurffville
Altitude, 81 feet; total depth, 125 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Pensauken Formation:		
Sand, medium to coarse, yellow-brown	14	14
Miocene:		
Kirkwood Formation:		
Sand, fine, orange-brown, mica 2 percent	6	20
Sand, very fine to fine, silty, orange	30	50
Clay, sandy, brown, some shells	6	56
Paleocene:		
Vincentown Formation:		
Sand, silty, gray	14	70
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Sand, coarse, glauconitic, fossiliferous 3 percent, quartz 15 percent, glauconite 80 percent	14	84
Sand, glauconitic, dark green, fossiliferous, quartz 20 percent, glauconite 70 percent, fossil fragments 10 percent	6	90
Sand, green, 98 percent glauconite, some pyrite ..	15	105
Sand, medium (to 60 percent), glauconite, fossil fragments 10 percent, quartz (to 20 percent) ..	5	110
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, glauconitic and fossiliferous, quartz, medium to coarse (to 70 percent), glauconite 20 percent, fossil fragments 5 percent, "salt and pepper" color	5	115
Sand, fossiliferous, quartz, medium (to 90 percent), glauconite 3 percent, fossil fragments 5 percent, "salt and pepper" color	10	125

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 31, Russell Grasmick, NE. of Pitman
Altitude, 100 feet; total depth, 125 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Topsoil	1	1
Sand, yellow	3	4
Sand, brown	5	9
Sand, pink	6	15
Clay, yellow and sand	5	20
Sand, yellow	6	26
Mud, yellow	29	55
Paleocene:		
Hornerstown Sand:		
Clay, green, some sand	25	80
Upper Cretaceous:		
Navesink Formation:		
Clay, blue-green, some sand	21	101
Sand, black, pieces of shells	2	103
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, hard, various colors	22	125

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 32, H. F. Morris, E. of Sewell
Altitude, 60 feet; total depth, 352 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Miocene:		
Cape May and Kirkwood Formations, undifferentiated:		
Clay, yellow	30	30
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation undifferentiated:		
Marl, green	40	70
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, white	80	150
Marshalltown and Englishtown Formations, Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, blue	150	300
Magothy and Raritan Formations, undifferentiated:		
Clay, gray	42	342
Sand, white	10	352

Well 33, Walter Reiger, Barnsboro
Altitude, 140 feet; total depth, 135 feet

Miocene:		
Kirkwood Formation:		
Gravel and sand	30	30
Quicksand, yellow	40	70
Quicksand, black	6	76
Paleocene and Upper Cretaceous:		
Vincentown(?) Sand, Hornerstown Sand and Navesink Formation, undifferentiated:		
Clay, green	7	83
Marl, blue	7	90
Marl, black	12	102
Rock, black, stones, green and white	8	110
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, gray, stones, green, shells	10	120
Sand, "salt and pepper"	15	135

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 34, Blackwood Water Department, Blackwood
(Gloucester-Camden County line)
Altitude, 20 feet; total depth, 380 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Pensauken Formation:		
Sand, brown and stones	15	15
Sand, fine and stones	10	25
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Marl(?) green, sand	55	80
Marshalltown Formation:		
Clay, sandy	20	100
Clay and marl, green	15	115
Englishtown Formation:		
Sand, fine	15	130
Marl, green	20	150
Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, blue	40	190
Marl, green	40	230
Clay, blue	70	300
Magothy and Raritan Formation, undifferentiated:		
Stones, coarse	10	310
Clay	15	325
Clay, sandy	10	335
Sand, fine	5	340
Sand, medium to coarse	40	380

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 35, Robert A. Greer, Blackwood Terrace
Altitude, 44 feet; total depth, 132 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Navesink Formation:		
Clay, black	30	30
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Clay(?), sandy, green	50	80
Marshalltown Formation:		
Iron sand	20	100
Clay, green	10	110
Englishtown Formation:		
Sand, white	22	132

Well 36, New Sharon Fire Co., NE. of Wenonah
Altitude, 82 feet; total depth, 50 feet

Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, yellow	5	5
Sand, yellow-green and clay	10	15
Sand, brown and clay	25	40
Sand, red-brown	10	50

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 37, William Lafferty, NE. of Wenonah
Altitude, 80 feet; total depth, 316 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Gravel, yellow	4	4
Clay and gravel	5	9
Sand, yellow	35	44
Marshalltown Formation:		
Marl, black	33	77
Englishtown Formation and Woodbury Clay, undifferentiated:		
Clay, blue	83	160
Hardpan	21	181
Merchantville Formation:		
Clay and hardpan	11	192
Clay, blue	64	256
Magothy and Raritan Formations, undifferentiated:		
Clay and sand	34	290
Sand, coarse	26	316

Well 38, Marion J. Thompson, NE. of Wenonah
Altitude, 102 feet; total depth, 107 feet

Pleistocene:		
Pensauken Formation:		
Sand, medium, silty, orange	15	15
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, medium, silty, brown	33	48
Sand, fine to medium, brown, quartz 90 percent	17	65
Marshalltown Formation:		
Sand, clayey, gray, quartz 70 percent, clay 30 percent	20	85
Sand, green, glauconite 80 percent, quartz 15 percent	5	90
Sand, green, glauconite 50 percent, quartz 30 percent, fossil fragments 10 percent	5	95
Englishtown Formation:		
Sand, 60 percent, glauconite 30 percent, fossil fragments 10 percent	12	107

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 39, Emma Hunter, Mantua
Altitude, 45 feet; total depth, 145 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, fine to medium, dark yellowish-orange, slightly micaceous and glauconitic, angular-subrounded	20	20
Marshalltown Formation:		
Sand, fine, with scattered coarse grains and pebbles to 3/8 inch, olive gray, moderately micaceous, glauconitic	10	30
Silt, sandy, clayey, dark gray with olive tinge, micaceous, glauconitic	10	40
Englishtown Formation:		
Clay, medium olive gray, micaceous, moderately glauconitic, silty, with approximately 10 percent coarse grains and pebbles to 3/8 inch. Pebbles may be contamination	40	80
Quartz, angular, glauconite, mica, lignite, broken shell fragments, several small black curved teeth or pincers. No forams noted	10	90
Woodbury Clay:		
Clay, silty, medium dark gray, finely micaceous, very slightly glauconitic and fossiliferous	40	130
Merchantville Formation:		
Sand, fine, medium olive, moderate glauconitic, highly fossiliferous. Fossiliferous fragments, only small 1/8 inch pieces	10	140
Sand, fine, light olive, lightly glauconitic, micaceous fossiliferous	5	145

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 40, Francis Yahrling, S. of Mantua
Altitude, 80 feet; total depth, 160 feet

	Thickness (feet)	*Depth (feet)*
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Gravel and clay	6	6
Clay, green and marl	32	38
Marl, black	7	45
Rock, black and stones, green	10	55
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, white, stones, green, belemnites	10	65
Sand, "salt and pepper," belemnites	40	105
Marshalltown Formation and Englishtown Formation, undifferentiated:		
Clay, black and sand	15	120
Sand, fine, black and shells	40	160
Mud, black		>160

Well 41, Harold S. Carter, S. of Clarksboro
Altitude, 80 feet; total depth, 37 feet

Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, silty	37	37

Well 42, Alfred Caltabiano, NE. of Mullica Hill
Altitude, 140 feet; total depth, 128 feet

Miocene:		
Kirkwood Formation:		
Topsoil and stones	3	3
Sand, fine	37	40
Sand, fine and clay	19	59
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Clay, green and marl	39	98
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand with belemnites	30	128

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 43, William S. Hazelton, E. of Mullica Hill
Altitude, 85 feet; total depth, 325 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Topsoil	3	3
Sand, yellow, clay and stones	4	7
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Marl, sand, green	3	10
Clay, green mixed with marl	20	30
Marl, green	10	40
Marl, chocolate	5	45
Rock, black and stones	10	55
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, white, and stones	10	65
Sand, yellow	28	93
Sand, rock, gray	7	100
Sand, greenish yellow	17	117
Sand, gray and clay and shells	23	140
Marshalltown Formation:		
Sand, marl, black and clay	30	170
Sand, marl, fine, gray and clay	20	190
Englishtown Formation:		
Sand, fine, gray	14	204
Woodbury Clay:		
Sand, fine, green and clay	6	210
Clay, black	50	260
Merchantville Formation:		
Clay, black	20	280
Clay, sandy, green	30	310
Magothy and Raritan Formations, undifferentiated:		
Sand, fine to coarse and stones	15	325

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 44, Christian Church, Mullica Hill
Altitude, 92 feet; total depth, 105 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Sand, fine	32	32
Paleocene and Upper Cretaceous:		
Vincentown (?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Clay, black	8	40
Marl, green	25	65
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand and marl, belemnites	15	80
Sand with belemnites	25	105

Well 45, John G. Vasta, S. of Mullica Hill
Altitude, 80 feet; total depth, 130 feet

Pleistocene:		
Pensauken Formation:		
Gravel	15	15
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	5	20
Quicksand, black	20	40
Paleocene:		
Vincentown Formation:		
Limestone and limesand	25	65
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Marl, black and shells	10	75
Clay, green, mixed with marl	10	85
Marl, black	12	97
Rock, black and shells	8	105
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, white (sand?)	7	112
Rock, black and stones, green	3	115
Sand, "salt and pepper"	15	130

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 46, James A. Hopkins, E. of Harrisonville
Altitude, 81 feet; total depth, 148 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Pensauken Formation:		
Sand and gravel	10	10
Miocene:		
Kirkwood Formation:		
Clay, black	45	55
Paleocene:		
Vincentown Formation:		
Limestone and limesand	33	88
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Marl	47	135
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, with belemnites	13	148

Well 47, Eloda C. Keen, Harrisonville
Altitude, 83 feet; total depth, 135 feet

Pleistocene:		
Pensauken Formation:		
Sand	6	6
Miocene:		
Kirkwood Formation:		
Clay, yellow	10	16
Clay, black	24	40
Paleocene:		
Vincentown Formation:		
Limestone and limesand	28	68
Paleocene and Upper Cretaceous:		
Hornerstown Sand and Navesink Formation, undifferentiated:		
Marl	47	115
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand with belemnites	20	135

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 48, Steaker Farms, N. of Harrisonville
Altitude, 120 feet; total depth, 149 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Sand and clay	34	34
Clay, black	56	90
Paleocene:		
Vincentown Formation and Hornerstown Sand, undifferentiated:		
Limestone and shells	5	95
Marl, green	54	149

Well 49, James A. Allen, N. of Harrisonville
Altitude, 130 feet; total depth, 144 feet

Miocene:		
Kirkwood Formation:		
Gravel	3	3
Sand, fine, and clay	38	41
Clay, black	28	69
(possibility of some Pleistocene deposits)		
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Marl and clay	11	80
Clay, green	9	89
Marl, green and clay	16	105
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand and marl, with belemnites	13	118
Sand with belemnites	26	144

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 50, Harry J. Marino, NW. of Harrisonville
Altitude, 90 feet; total depth, 358 feet (well abandoned)

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Quicksand, yellow	10	10
Clay, yellow	3	13
Quicksand, yellow	22	35
Quicksand, black	15	50
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Clay, green	10	60
Marl, black	10	70
Marl, blue	10	80
Marl, black	15	95
Rock, black and stones, green	10	105
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Rock, white, stones and belemnites	10	115
Sand, "salt and pepper," (high Fe water)	15	130
Sand, "salt and pepper"	35	165
Marshalltown Formation:		
Clay, black and sand, shells	31	196
Englishtown Formation:		
Sand, yellow (high Fe water)	16	212
Woodbury Clay and Merchantville Formation, undifferentiated:		
Marl, mud, black	113	325
Magothy and Raritan Formations, undifferentiated:		
Marl mud, green	19	344
Sand, white and stones	14	358

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 51, Alfio Sorbello, NW. of Harrisonville
Altitude, 120 feet; total depth, 115 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Sand and gravel	10	10
Clay	4	14
Sand, fine	14	28
Clay and sand	20	48
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand, and Navesink Formation, undifferentiated:		
Marl and clay, green	53	101
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand with belemnites	14	115

Well 52, Joseph Maccarone, S. of Swedesboro
Altitude, 63 feet; total depth, 254 feet

Pleistocene:		
Pensauken Formation:		
Sand	18	18
Gravel	5	23
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, fine and clay	17	40
Sand, medium and clay	9	49
Sand, silty	10	59
Marshalltown Formation:		
Clay, with some sand	53	112
Englishtown Formation:		
Sand, fine, dirty and clay	26	138
Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, black	104	242
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse	12	254

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 53, Clarence String, S. of Swedesboro
Altitude, 120 feet; total depth, 85 feet

	Thickness (feet)	*Depth (feet)*
Miocene:		
Kirkwood Formation:		
Clay, yellow	5	5
Quicksand, orange	5	10
Quicksand, white	5	15
Quicksand, yellow	28	43
Paleocene and Upper Cretaceous:		
Vincentown(?) Formation, Hornerstown Sand and Navesink Formation, undifferentiated:		
Clay, green	10	53
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, black and white, stones	3	56
Sand, yellow-gray and stones	20	76
Sand, red-brown and stones	9	85

Well 54, S. A. Stewart, S. of Swedesboro
Altitude, 90 feet; total depth, 75 feet

Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand and clay	12	12
Sand, silty	23	35
Sandstone and sand	10	45
Sand, silty	30	75

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 55, Frank Catalano, W. of Swedesboro
Altitude, 50 feet; total depth, 118 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation		
Sand, fine, orange	10	10
Gravel, pea size and sand	6	16
Upper Cretaceous:		
Woodbury Clay:		
Clay, black	45	61
Merchantville Formation:		
Marl, dark green, streaks of clay	20	81
Clay, black	9	90
Marl, hard, green and black	9	99
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse, gray	19	118

Well 56, Casella Brothers, W. of Swedesboro
Altitude, 50 feet; total depth, 122 feet

Pleistocene:		
Pensauken Formation:		
Sand, silty to medium, some pebbles, dirty and poorly sorted, yellow-orange	5	5
Clay, sandy blocky, light green, with few pebbles, subangular and dirty	5	10
Upper Cretaceous:		
Woodbury Clay:		
Sand, very fine to medium, dark gray, uniform, micaceous and clean	58	68
Merchantville Formation:		
Sand, fine to medium, yellow-green, glauconitic, uniform, clean	10	78
Sand, very fine to medium, dark green, micaceous, clean	30	108
Magothy and Raritan Formations, undifferentiated:		
Sand, fine to coarse, light gray, some gravels and pebbles, quartz 90 percent	14	122

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 57, Frank H. Muscumeci, NW. of Swedesboro
Altitude, 15 feet; total depth, 35 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Sand, fine	12	12
Sand, coarse and gravel, small thin layers of clay	23	35

Well 58, Edward Black, Jr., SW. of Bridgeport
Altitude, 20 feet; total depth, 67 feet

Pleistocene:		
Cape May Formation:		
Sand, coarse	22	22
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Clay	24	46
Sand, coarse	5	51
Clay and some sand	4	55
Sand, coarse, thin layers of clay	12	67

Well 59, Walter H. Butler, E. of Swedesboro
Altitude, 60 feet; total depth, 229 feet

Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand	19	19
Marshalltown Formation:		
Clay	4	23
Sand and stones	7	30
Sand, fine, silty	20	50
Englishtown Formation, Woodbury Clay, and Merchantville Formation, undifferentiated:		
Clay, black and sand, fine	45	95
Clay, black	112	207
Magothy and Raritan Formations, undifferentiated:		
Sand	4	211
Clay, black	1	212
Sand	17	229

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 60, N. J. Turnpike Authority, NE. of Swedesboro
Altitude, 80 feet; total depth, 91 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Mud, yellow	43	43
Marshalltown Formation:		
Mud, black	23	66
Englishtown Formation:		
Sand, coarse, gray, layers of clay	17	83
Woodbury(?) Clay:		
Clay, gray and sand, mixed	8	91

Well 61, Peter M. Musumeci, N. of Swedesboro
Altitude, 62 feet; total depth, 101 feet

Pleistocene:		
Pensauken Formation:		
Sand, medium	12	12
Upper Cretaceous:		
Woodbury Clay:		
Sand, fine, silty	24	36
Merchantville Formation:		
Clay, black	55	91
Magothy and Raritan Formations, undifferentiated:		
Sand	10	101

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 62, Raymond Shoemaker, SE. of Bridgeport
Altitude, 10 feet; total depth, 43 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Sand and gravel	10	10
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Mud, yellow	9	19
Sand, coarse, gray and pebbles	17	36
Sand, coarse, gray	6	42
Clay, black, iron pyrites and wood	1	43

Well 63, Logan Twp. Board of Education, Repaupo
Altitude, 15 feet; total depth, 45 feet

Pleistocene and Upper Cretaceous:		
Cape May, Magothy and Raritan Formations, undifferentiated:		
Sand and gravel	20	20
Sand and gravel, traces of clay	25	45

Well 64, Edgar Thompson, SW. of Clarksboro
Altitude, 70 feet; total depth, 183 feet

Pleistocene:		
Cape May Formation:		
Sand and gravel	20	20
Upper Cretaceous:		
Woodbury Clay:		
Clay, black	18	38
Clay, gray	25	63
Clay, black and marl	21	84
Merchantville Formation:		
Clay, black	75	159
Magothy and Raritan Formation, undifferentiated:		
Clay, gray and sand	12	171
Sand, medium, gray	12	183

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 65, E. I. duPont de Nemours & Company, Gibbstown
Altitude, 10 feet; total depth, 105 feet—Well W

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Gravel, yellow	12	12
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, white, yellow and clay	10	22
Clay, gray	3	25
Clay, stones, gray	12	37
Sand and gravel	5	42
Clay, gray	22	64
Sand and gravel	2	66
Sand and clay	5	71
Stones and gravel	6	77
Sand, fine (.020 sieve)	15	92
Gravel and stones, small	5	97
Stones, large and gravel	8	105
Clay, white		>105

Well 66, E. I. duPont de Nemours & Company, Gibbstown
Altitude, 10 feet; total depth, 105 feet—Well O
(Abandoned and plugged)

Pleistocene:		
Cape May Formation:		
Clay, sandy, brown	25	25
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, fine, white (water-bearing)	30	55
Clay, sandy, coarse	5	60
Gravel, small, sand, brown, clay, trace	5	65
Sand, white and brown	10	75
Gravel, coarse, some clay	30	105

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 67, Mobil Oil Co., Paulsboro
Altitude, 15 feet; total depth, 253 feet (owner's 33)

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand and gravel, red	10	10
Sand, white and gravel	37	47
Gravel, very coarse	21	68
Sand, fine and gravel	20	88
Gravel, very coarse	10	98
Clay	1	99
Sand, coarse, white and gravel	41	140
Clay	22	162
Sand, coarse and gravel	87	249
Clay	4	253
(Possibility some of the sand and gravel above the first clay layer is Pleistocene, Cape May Formation.)		

Well 68, Mobil Oil Co., Paulsboro
Altitude, 20 feet; total depth, 267 feet (owner's 40)

Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse	51	51
Hardpan	1	52
Sand, coarse, and gravel, muddy	46	98
Clay, sandy, soft, white	13	111
Sand, coarse, and gravel	8	119
Clay balls, yellow and sand, fine	22	141
Clay, tough, red	39	180
Sand, coarse, and gravel	51	231
Clay	2	233
Clay and gravel	8	241
Sand, coarse, and gravel	16	257
Clay, tough	10	267
(Possibility some of the sand and gravel above the first clay layer is Pleistocene, Cape May Formation.)		

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 69, Paul T. Kornman, NW. of Mantua
Altitude, 40 feet; total depth, 155 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Englishtown Formation:		
Sand, yellow	8	8
Sand, red-brown	22	30
Woodbury Clay:		
Mud, gray-black	40	70
Clay, gray	20	90
Merchantville Formation:		
Mud, black and sand	10	100
Clay, green and marl, sand	30	130
Clay, black and mud sand	5	135
Magothy and Raritan Formations, undifferentiated:		
Sand, fine to coarse, white and stones	20	155

Well 70, Samuel Campbell, N. of Mantua
Altitude, 40 feet; total depth, 126 feet

Upper Cretaceous:		
Englishtown Formation:		
Clay, brown	8	8
Sand, gray	1	9
Clay, black	26	35
Woodbury Clay:		
Clay, black	58	93
Merchantville Formation:		
Marl, dark green	33	126

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 71, Harbor Pipe Line Co., SW. of Woodbury
Altitude, 65 feet; total depth, 190 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Upper Cretaceous:		
Pensauken and Englishtown Formations, undifferentiated:		
Loam	6	6
Sand and gravel	17	23
Stone, hard, brown	7	30
Clay, red and sand	6	36
Woodbury Clay and Merchantville Formation, undifferentiated:		
Marl, sandy	121	157
Magothy and Raritan Formations, undifferentiated:		
Sand	4	161
Marl and chunks of sand	13	174
Sand, coarse, hard and gravel, fine	16	190

Well 72, Thomas Borden, W. of Woodbury
Altitude, 40 feet; total depth, 120 feet

Pleistocene:		
Cape May Formation:		
Sand and gravel	25	25
Upper Cretaceous:		
Woodbury Clay and Merchantville Formation, undifferentiated:		
Marl, green	25	50
Clay, black	40	90
Clay, gray and sand, fine	10	100
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse, white	20	120

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 73, Texas Oil Company, W. of Westville
Altitude, 15 feet; total depth, 298 feet (owner's 1)

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Clay, soft, and streaks of sand	27	27
Sand, gravel and clay	16	43
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, some clay	14	57
Sand, and streaks of gravel	17	74
Sand, coarse and gravel	37	111
Clay, tough, red and white	37	148
Sand	4	152
Clay, tough, red	67	219
Sand	2	221
Clay, sandy	16	237
Sand, coarse, and gravel, fine	45	282
Clay	2	284
Sand, coarse and gravel	8	292
Clay	6	298

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 74, Texas Oil Company, W. of Westville
Altitude, 20 feet; total depth, 327 feet (owner's 6)

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Sand and topsoil	4	4
Clay	12	16
Sand and gravel	3	19
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Clay, gravel, and sand	40	59
Gravel, sand and wood	11	70
Clay	2	72
Sand and gravel	34	106
Sand, gravel and clay	10	116
Clay	9	125
Sand and gravel	13	138
Clay	34	172
Clay and sand, hard	11	183
Clay, red	93	276
Sand, and gravel, coarse	32	208
Clay and sand streaks	12	320
Upper Precambrian(?):		
Wissahickon Formation:		
Mica, sand and rock	7	327

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 75, Atlantic Service Station (William Bros.), Westville
Altitude, 40 feet; total depth, 116 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Upper Cretaceous(?):		
Cape May or Pensauken and Englishtown(?) Formations, undifferentiated:		
Clay, yellow and stones	40	40
Upper Cretaceous:		
Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, black	20	60
Marl, green	20	80
Clay, black	20	100
Clay, gray	6	106
Magothy and Raritan Formations, undifferentiated:		
Sand	10	116

Well 76, N. & P. Super Farms, E. of Woodbury
Altitude, 40 feet; total depth, 219 feet (abandoned)

Pleistocene:		
Pensauken Formation:		
Fill	8	8
Sand and stones	4	12
Upper Cretaceous:		
Englishtown Formation, Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, blue	101	113
Marl, black	5	118
Clay, blue and gravel	8	126
Clay, gray	6	132
Clay, blue	23	155
Hardpan	4	159
Magothy and Raritan Formations, undifferentiated:		
Gravel, coarse	21	180
Clay, gray and sand	12	192
Clay, white	3	195
Gravel, coarse and sand	2	197
Sand, medium	8	205
Gravel, coarse	14	219

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 77, Walter Potts, SE. of Woodbury
Altitude, 60 feet; total depth, 130 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Pensauken Formation:		
Clay(?), yellow	20	20
Upper Cretaceous:		
Marshalltown Formation:		
Clay, black	35	55
Englishtown Formation:		
Iron sand	15	70
Woodbury Clay:		
Clay, black	50	120
Merchantville Formation:		
Sand, green	10	130

Well 78, Leroy Lloyd, SE. of Woodbury
Altitude, 55 feet; total depth, 55 feet

Pleistocene:		
Pensauken Formation:		
Sand, medium to coarse, yellow	10	10
Sand, medium to fine, yellow	10	20
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, medium, yellow, micaceous	10	30
Marshalltown Formation:		
Clay, micaceous, gray	10	40
Clay, micaceous, sand, medium, gray	10	50
Englishtown(?) Formation:		
Sand, medium, and micaceous, dark gray	5	55

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 65, E. I. duPont de Nemours & Company, Gibbstown
Altitude, 10 feet; total depth, 105 feet—Well W

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Gravel, yellow	12	12
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, white, yellow and clay	10	22
Clay, gray	3	25
Clay, stones, gray	12	37
Sand and gravel	5	42
Clay, gray	22	64
Sand and gravel	2	66
Sand and clay	5	71
Stones and gravel	6	77
Sand, fine (.020 sieve)	15	92
Gravel and stones, small	5	97
Stones, large and gravel	8	105
Clay, white		>105

Well 66, E. I. duPont de Nemours & Company, Gibbstown
Altitude, 10 feet; total depth, 105 feet—Well O
(Abandoned and plugged)

Pleistocene:		
Cape May Formation:		
Clay, sandy, brown	25	25
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, fine, white (water-bearing)	30	55
Clay, sandy, coarse	5	60
Gravel, small, sand, brown, clay, trace	5	65
Sand, white and brown	10	75
Gravel, coarse, some clay	30	105

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 67, Mobil Oil Co., Paulsboro
Altitude, 15 feet; total depth, 253 feet (owner's 33)

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand and gravel, red	10	10
Sand, white and gravel	37	47
Gravel, very coarse	21	68
Sand, fine and gravel	20	88
Gravel, very coarse	10	98
Clay	1	99
Sand, coarse, white and gravel	41	140
Clay	22	162
Sand, coarse and gravel	87	249
Clay	4	253
(Possibility some of the sand and gravel above the first clay layer is Pleistocene, Cape May Formation.)		

Well 68, Mobil Oil Co., Paulsboro
Altitude, 20 feet; total depth, 267 feet (owner's 40)

Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse	51	51
Hardpan	1	52
Sand, coarse, and gravel, muddy	46	98
Clay, sandy, soft, white	13	111
Sand, coarse, and gravel	8	119
Clay balls, yellow and sand, fine	22	141
Clay, tough, red	39	180
Sand, coarse, and gravel	51	231
Clay	2	233
Clay and gravel	8	241
Sand, coarse, and gravel	16	257
Clay, tough	10	267
(Possibility some of the sand and gravel above the first clay layer is Pleistocene, Cape May Formation.)		

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 69, Paul T. Kornman, NW. of Mantua
Altitude, 40 feet; total depth, 155 feet

	Thickness (feet)	*Depth (feet)*
Upper Cretaceous:		
Englishtown Formation:		
Sand, yellow	8	8
Sand, red-brown	22	30
Woodbury Clay:		
Mud, gray-black	40	70
Clay, gray	20	90
Merchantville Formation:		
Mud, black and sand	10	100
Clay, green and marl, sand	30	130
Clay, black and mud sand	5	135
Magothy and Raritan Formations, undifferentiated:		
Sand, fine to coarse, white and stones	20	155

Well 70, Samuel Campbell, N. of Mantua
Altitude, 40 feet; total depth, 126 feet

Upper Cretaceous:		
Englishtown Formation:		
Clay, brown	8	8
Sand, gray	1	9
Clay, black	26	35
Woodbury Clay:		
Clay, black	58	93
Merchantville Formation:		
Marl, dark green	33	126

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 71, Harbor Pipe Line Co., SW. of Woodbury
Altitude, 65 feet; total depth, 190 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Upper Cretaceous:		
Pensauken and Englishtown Formations, undifferentiated:		
Loam	6	6
Sand and gravel	17	23
Stone, hard, brown	7	30
Clay, red and sand	6	36
Woodbury Clay and Merchantville Formation, undifferentiated:		
Marl, sandy	121	157
Magothy and Raritan Formations, undifferentiated:		
Sand	4	161
Marl and chunks of sand	13	174
Sand, coarse, hard and gravel, fine	16	190

Well 72, Thomas Borden, W. of Woodbury
Altitude, 40 feet; total depth, 120 feet

Pleistocene:		
Cape May Formation:		
Sand and gravel	25	25
Upper Cretaceous:		
Woodbury Clay and Merchantville Formation, undifferentiated:		
Marl, green	25	50
Clay, black	40	90
Clay, gray and sand, fine	10	100
Magothy and Raritan Formations, undifferentiated:		
Sand, coarse, white	20	120

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 73, Texas Oil Company, W. of Westville
Altitude, 15 feet; total depth, 298 feet (owner's 1)

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Clay, soft, and streaks of sand	27	27
Sand, gravel and clay	16	43
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Sand, some clay	14	57
Sand, and streaks of gravel	17	74
Sand, coarse and gravel	37	111
Clay, tough, red and white	37	148
Sand	4	152
Clay, tough, red	67	219
Sand	2	221
Clay, sandy	16	237
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Clay	6	298

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 74, Texas Oil Company, W. of Westville
Altitude, 20 feet; total depth, 327 feet (owner's 6)

	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Cape May Formation:		
Sand and topsoil	4	4
Clay	12	16
Sand and gravel	3	19
Upper Cretaceous:		
Magothy and Raritan Formations, undifferentiated:		
Clay, gravel, and sand	40	59
Gravel, sand and wood	11	70
Clay	2	72
Sand and gravel	34	106
Sand, gravel and clay	10	116
Clay	9	125
Sand and gravel	13	138
Clay	34	172
Clay and sand, hard	11	183
Clay, red	93	276
Sand, and gravel, coarse	32	208
Clay and sand streaks	12	320
Upper Precambrian(?):		
Wissahickon Formation:		
Mica, sand and rock	7	327

Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 75, Atlantic Service Station (William Bros.), Westville
Altitude, 40 feet; total depth, 116 feet

	Thickness (feet)	*Depth (feet)*
Pleistocene and Upper Cretaceous(?):		
Cape May or Pensauken and Englishtown(?) Formations, undifferentiated:		
Clay, yellow and stones	40	40
Upper Cretaceous:		
Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, black	20	60
Marl, green	20	80
Clay, black	20	100
Clay, gray	6	106
Magothy and Raritan Formations, undifferentiated:		
Sand	10	116

Well 76, N. & P. Super Farms, E. of Woodbury
Altitude, 40 feet; total depth, 219 feet (abandoned)

Pleistocene:		
Pensauken Formation:		
Fill	8	8
Sand and stones	4	12
Upper Cretaceous:		
Englishtown Formation, Woodbury Clay and Merchantville Formation, undifferentiated:		
Clay, blue	101	113
Marl, black	5	118
Clay, blue and gravel	8	126
Clay, gray	6	132
Clay, blue	23	155
Hardpan	4	159
Magothy and Raritan Formations, undifferentiated:		
Gravel, coarse	21	180
Clay, gray and sand	12	192
Clay, white	3	195
Gravel, coarse and sand	2	197
Sand, medium	8	205
Gravel, coarse	14	219

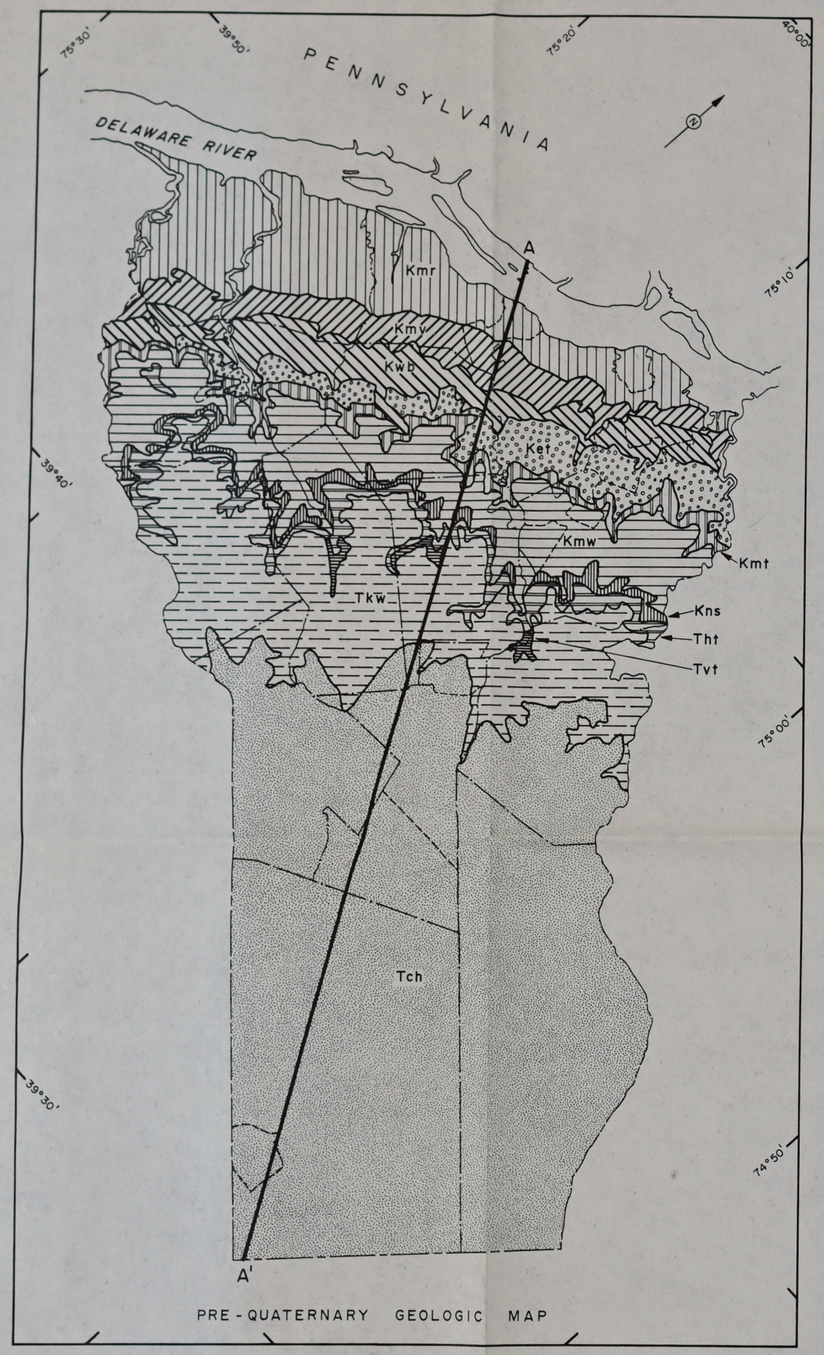
Table 9.—Logs of selected wells in Gloucester County, N. J.—Continued

Well 77, Walter Potts, SE. of Woodbury
Altitude, 60 feet; total depth, 130 feet

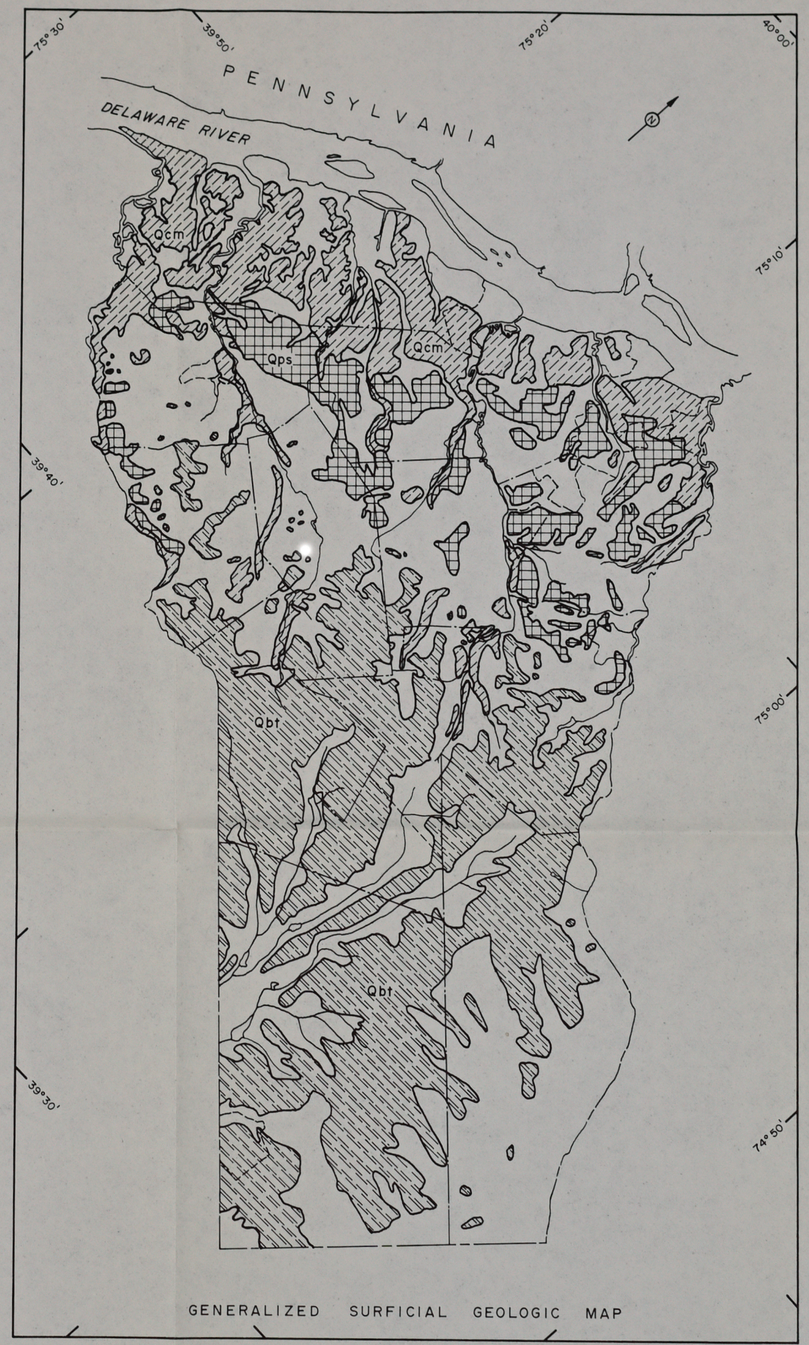
	Thickness (feet)	*Depth (feet)*
Pleistocene:		
Pensauken Formation:		
Clay(?), yellow	20	20
Upper Cretaceous:		
Marshalltown Formation:		
Clay, black	35	55
Englishtown Formation:		
Iron sand	15	70
Woodbury Clay:		
Clay, black	50	120
Merchantville Formation:		
Sand, green	10	130

Well 78, Leroy Lloyd, SE. of Woodbury
Altitude, 55 feet; total depth, 55 feet

Pleistocene:		
Pensauken Formation:		
Sand, medium to coarse, yellow	10	10
Sand, medium to fine, yellow	10	20
Upper Cretaceous:		
Mount Laurel Sand and Wenonah Formation, undifferentiated:		
Sand, medium, yellow, micaceous	10	30
Marshalltown Formation:		
Clay, micaceous, gray	10	40
Clay, micaceous, sand, medium, gray	10	50
Englishtown(?) Formation:		
Sand, medium, and micaceous, dark gray	5	55



PRE-QUATERNARY GEOLOGIC MAP



GENERALIZED SURFICIAL GEOLOGIC MAP

EXPLANATION

QUATERNARY	Holocene	Qal	Alluvium
	Pleistocene	Qcm	Cape May Formation
		Qps	Pensauken Formation
		Qbt	Bridgeton Formation
			Pre-Quaternary
TERTIARY	Miocene (?) and Pliocene (?)	Tch	Cohansey Sand
	Miocene	Tkw	Kirkwood Formation
	Paleocene	Tvt	Vincentown Formation
		Tht	Hornerstown Formation
		Kns	Navesink Formation
CRETACEOUS	Upper Cretaceous	Kmw	Mount Laurel Sand and Wenonah Formation
		Kmt	Marshalltown Formation
		Ket	Englishtown Formation
		Kwb	Woodbury Clay
		Kmv	Merchantville Formation
		Kmr	Magothy and Raritan Formations
PRECAMBRIAN	Upper Precambrian	Wgn	Wissahickon Formation

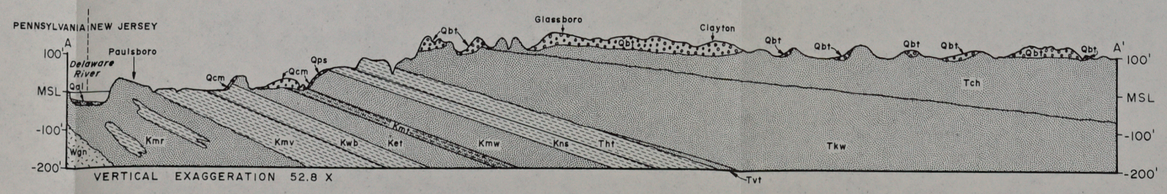
A-A' Profile line of generalized geologic section

Unit contains major aquifers

Unit contains minor aquifers

Unit primarily an aquiclude

Bedrock



0 1 2 3 4 MILES

Modified by W. F. HARDT after the Geologic Map of New Jersey (1950)

Figure 2.—Generalized geologic maps and cross-section of Gloucester County, N. J.

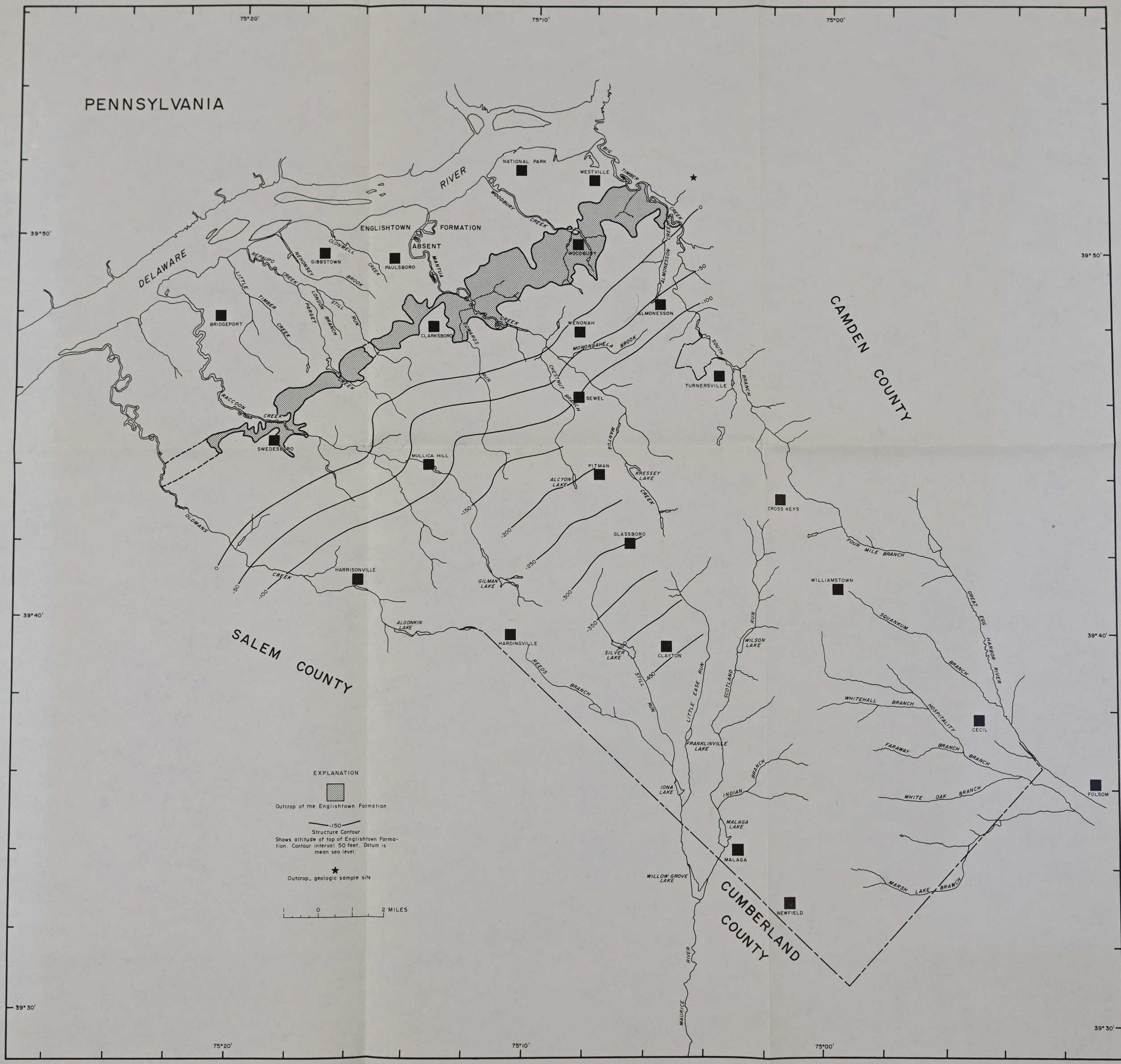


Figure 6.—Map showing generalized structure contours on top of the Englishtown Formation.

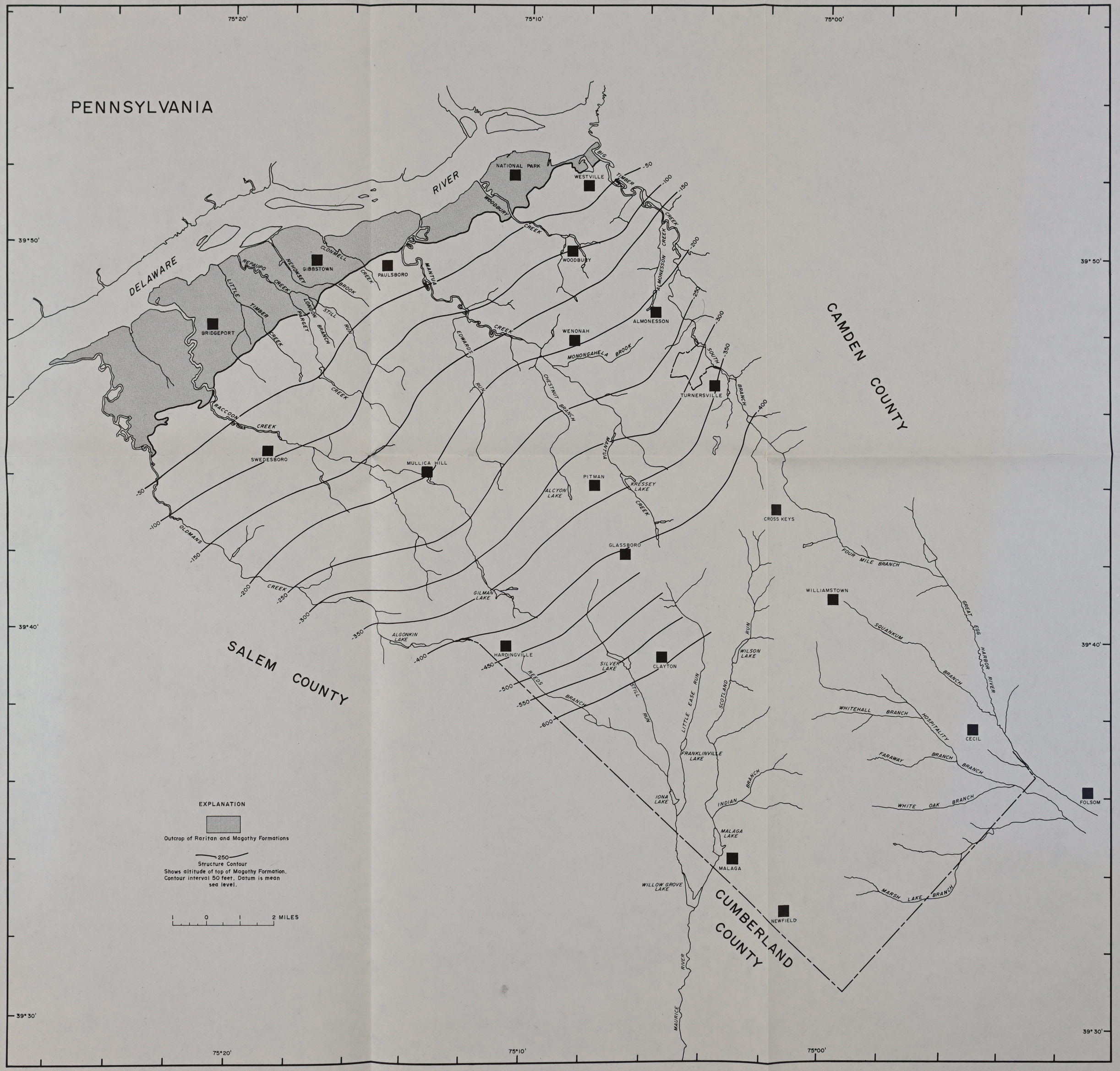


Figure 3.—Map showing generalized structure contours on top of the Magothy Formation.

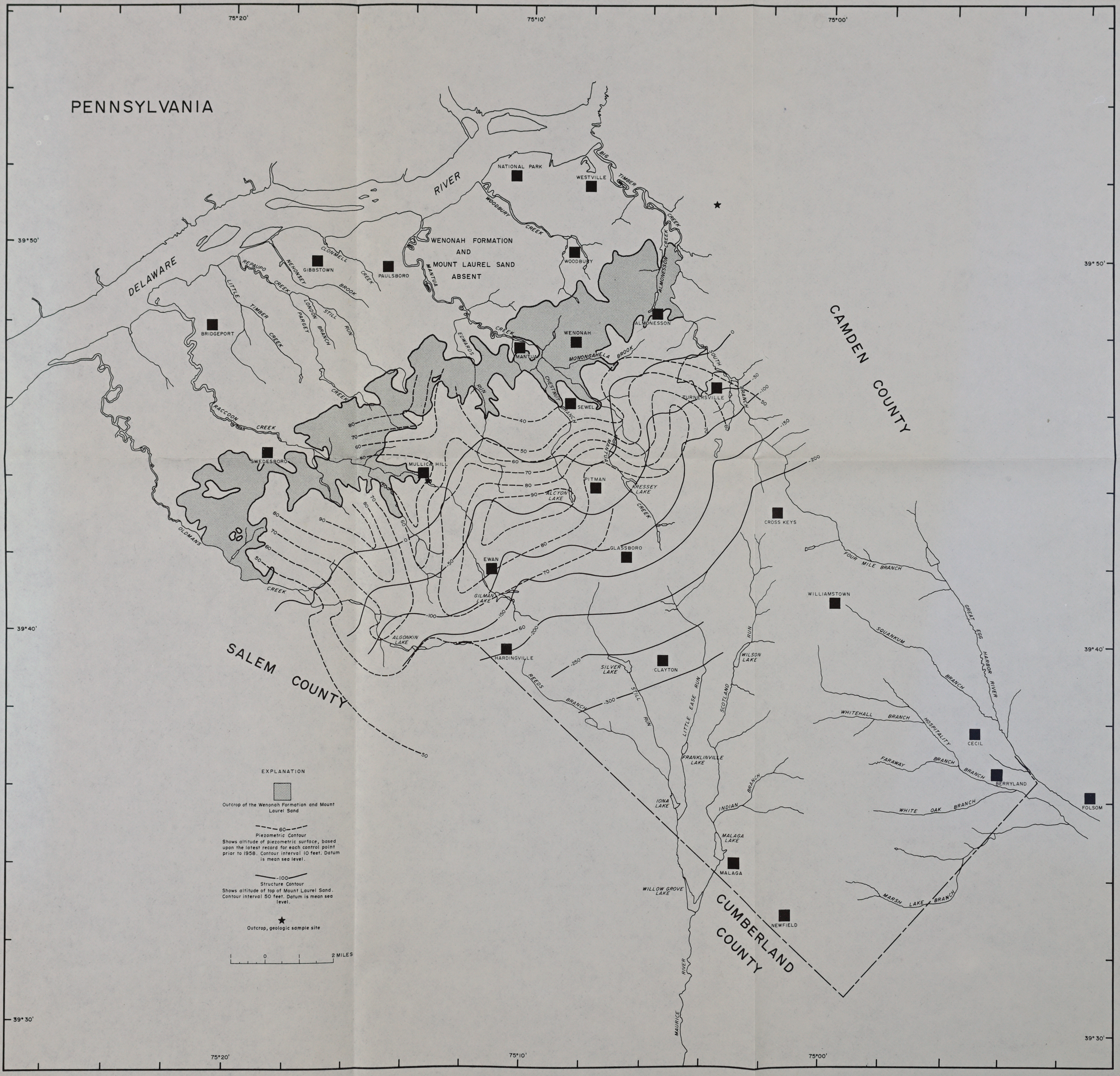


Figure 7.—Map showing generalized contours on the piezometric surface of the Wenonah Formation and Mount Laurel Sand and generalized structure contours on top of the Mount Laurel Sand.

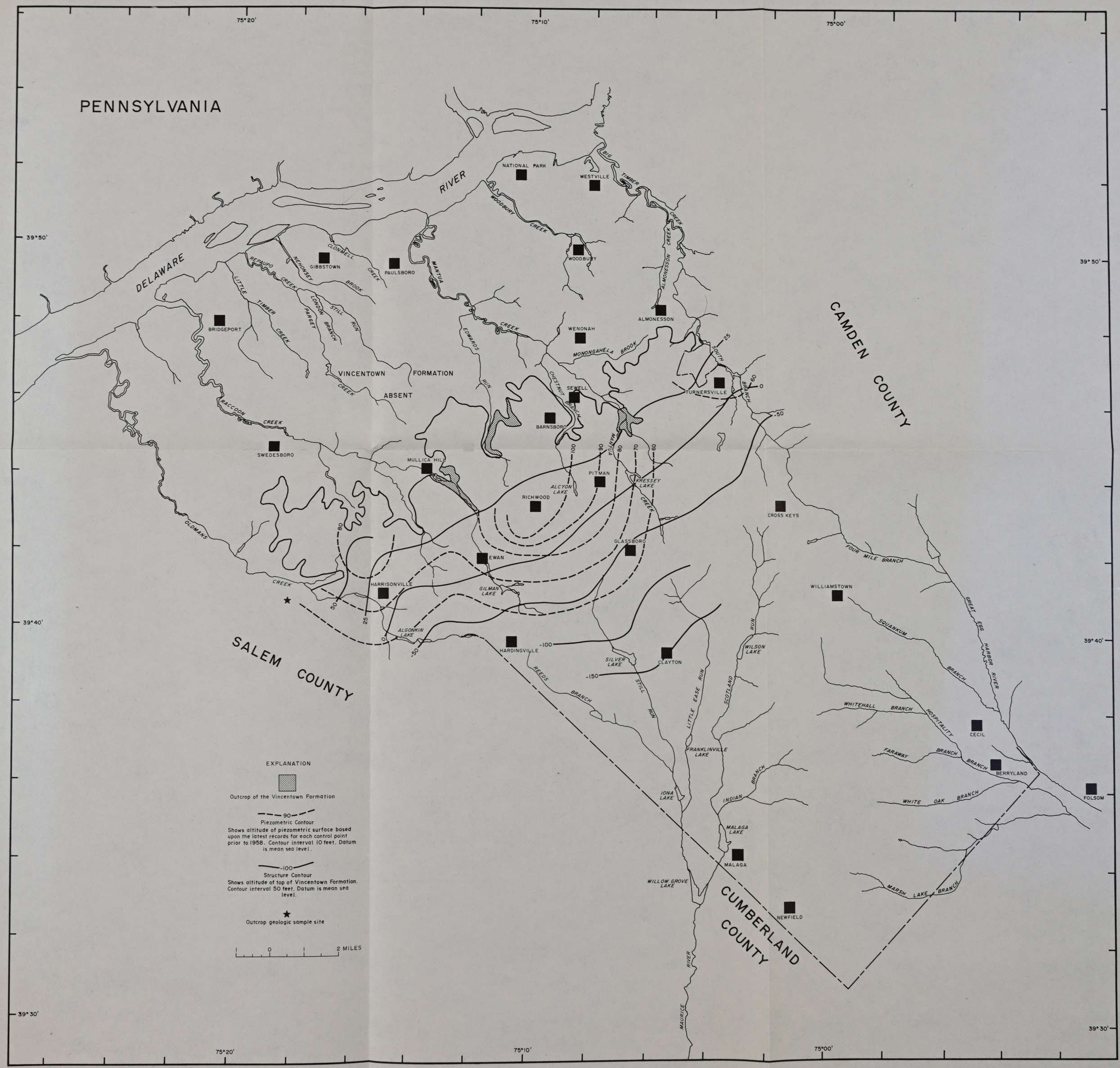


Figure 8.—Map showing generalized contours on the piezometric surface and generalized structure contours on top of the Vincentown Formation.

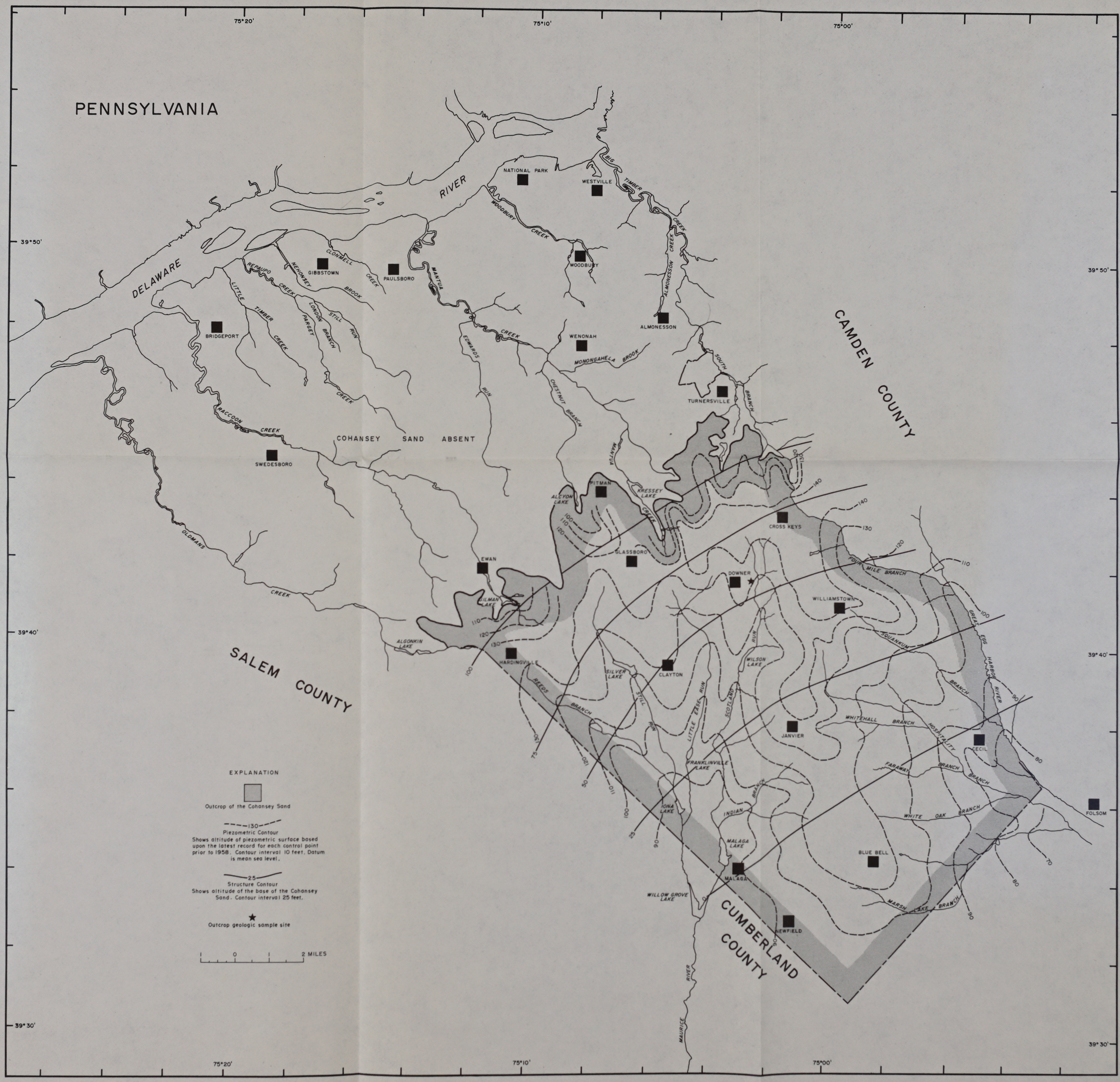


Figure 9.—Map showing generalized contours on the water table and generalized structure contours on the base of the Cohansey Sand.

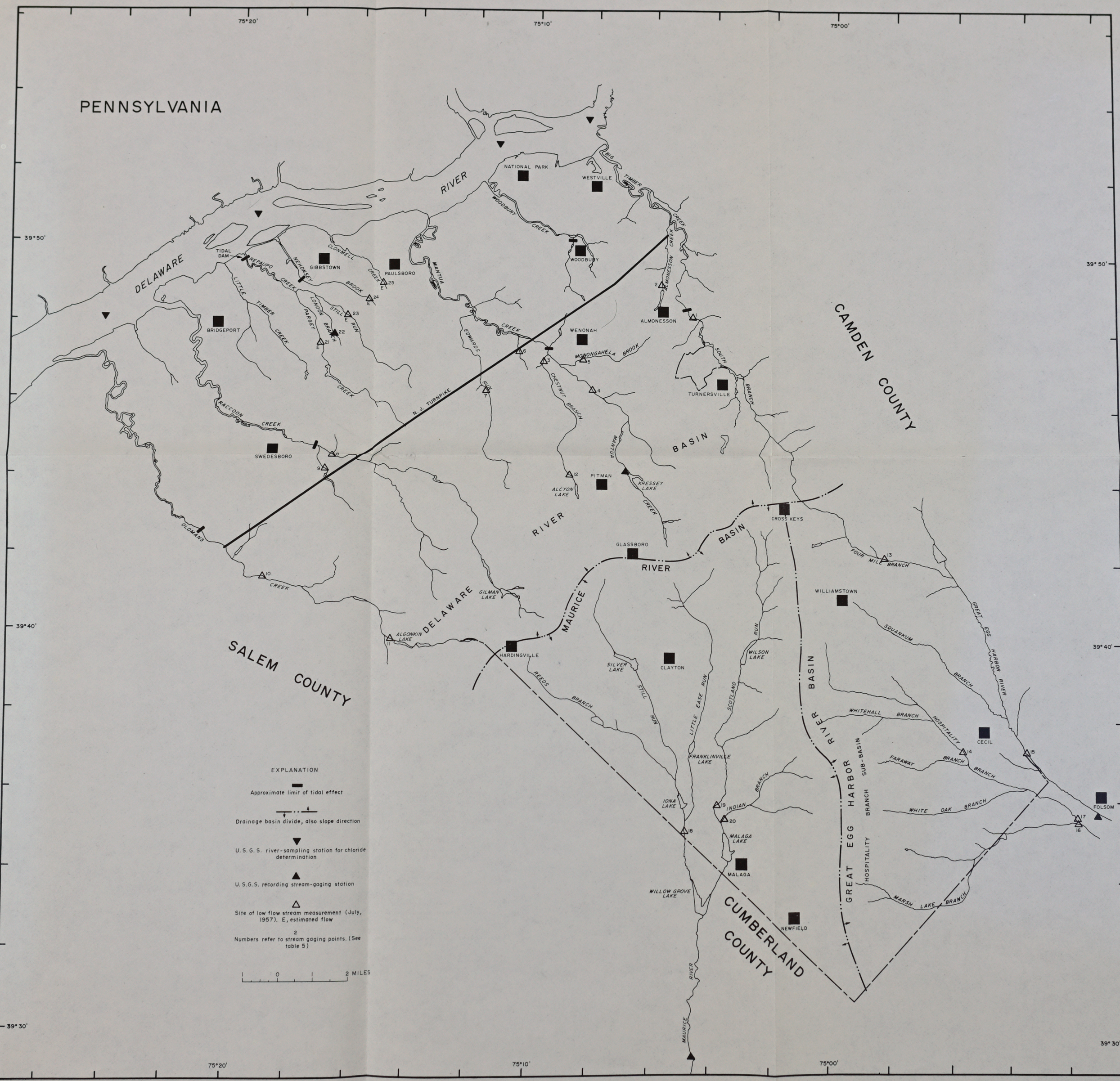


Figure 11.—Map showing surface drainage.

EXPLANATION

O_1
Well

$\bullet_{13}$
Chemical analysis available

1 0 1 2 MILES

WM. H. BAUM
COUNTY ENGINEER
MODIFIED BY W.F.H. (1958)

Figure 16.—Map showing location of selected wells.