UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
Room 430, Federal Building
402 East State Street
Trenton, New Jersey 08608

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EVALUATION OF WATER LEVELS IN MAJOR AQUIFERS OF THE NEW JERSEY COASTAL PLAIN, 1978

By Richard L. Walker

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GLOSSARY

Artesian aquifer. An aquifer containing water under sufficient pressure to cause the water level in a well open to the aquifer to rise above the top of the aquifer. Also called confined aquifer.

Cone of depression. A low area in the potentiometric surface usually centered in the area of greatest concentration of withdrawals.

Confining layer (confining bed). A body of relatively impermeable material stratigraphically adjacent to one or more aquifers. The hydraulic conductivity may range from nearly zero to some value several orders of magnitude lower than that of the aquifer.

Head, static. The height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the pressure at a given point. Head, when used alone in this report, is understood to mean static head.

Hydraulic conductivity. A measure of the ability of a material to transmit water.

Hydraulic gradient. The change in static head per unit of distance in a given direction. If not specified, the direction is understood to be that of the maximum rate of decrease in head.

National Geodetic Vertical Datum of 1929 (NGVD of 1929). A geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada, formerly called mean sea level. NGVD of 1929 is referred to as sea level in the text of this report.

Porosity. The porosity of a rock or soil is its property of containing interstices or voids and may be expressed quantitatively as the ratio of the volume of its interstices to its total volume. It may be expressed as a decimal fraction or as a percentage.

Potentiometric surface. A surface which represents the static head in an aquifer. The potentiometric surface is defined by the levels to which water will rise in tightly cased wells open to the aquifer. See head, static.

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM (SI) UNITS

Multiply inch-pound unit	By	To obtain SI unit
foot (ft)	0.3048	meter (m)
feet per mile (ft/mi)	0.189	meters per kilometer (m/km)
mile (mi)	1.609	kilometer (km)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
feet per year (ft/yr)	0.3048	meters per annum (m/a)

EVALUATION OF WATER LEVELS IN MAJOR AQUIFERS OF THE NEW JERSEY COASTAL PLAIN, 1978

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ABSTRACT

Water levels and changes in water levels in the major aquifers are documented and evaluated to provide fundamental data for ground-water investigations and management.

Increased ground-water withdrawals from the major artesian aquifers that underlie the New Jersey Coastal Plain have caused large cones of depression in the artesian heads. These cones of depression are delineated on detailed potentiometric-surface maps produced from water-level data collected in the field in 1978. Water levels for 1978 are compared with those from 1970 or 1973, and water-level changes are evaluated and compared with hydrographs from observation wells.

The Potomac-Raritan-Magothy aquifer system is divided into lower and upper aquifers. These aquifers have large cones of depression centered in Camden, Middlesex, and Monmouth Counties. Measured water levels declined 5 to 20 feet in these areas between 1973 and 1978. The lowest levels measured were 90 feet below sea level in Camden County and 76 feet below sea level in the Middlesex-Monmouth County area.

Deep cones of depression in coastal Monmouth and Ocean Counties in the Englishtown and Wenonah-Mount Laurel aquifers are similar in location and shape, owing to a good hydraulic connection between these aquifers. Measured water levels declined 2 to 31 feet in the Englishtown aquifer and 12 to 26 feet in the Wenonah-Mount Laurel aquifer between 1973 and 1978. The lowest levels measured were 247 feet below sea level in the Englishtown and 195 feet below sea level in the Wenonah-Mount Laurel.

Water levels in the Atlantic City 800-foot sand of the Kirkwood Formation define an extensive elongated cone of depression. Water levels are lower than 70 feet below sea level at Margate and Ventnor, Atlantic County. Measured water-level changes ranged from a decline of 4 feet to a recovery of 9 feet during 1970-78. The lowest head measured in the Cohansey aquifer was 26 feet below sea level at Cape May, Cape May County, situated less than 0.5 mile from salty ground water.

INTRODUCTION

Purpose and Scope

The purpose of this report is to document and evaluate water levels and changes in water levels in the major artesian aquifers of the New Jersey Coastal Plain. Fundamental data for ground-water investigations and management are provided.

Ground water is the source of nearly 80 percent of the potable water supply in the Coastal Plain of New Jersey (Vowinkel, oral communication, 1981). Ground-water withdrawals from Coastal Plain aquifers have increased steadily since 1900. Present (1978) rates exceed 270 million gallons per day (Vowinkel and Foster, 1981, table 6). By the 1950's, the withdrawals produced large regional cones of depression in the major artesian aquifers. Withdrawals increased into the 1970's causing these cones to deepen and expand.

This report presents water-level data and the potentiometric surfaces of the major artesian aquifers in 1978 with reference to earlier years. Water-level data collected in 1978 are evaluated and compared with data collected since 1970. The report was prepared in cooperation with the New Jersey Department of Environmental Protection, Division of Water Resources, as part of a statewide water-resources investigation. Water-level data was collected from October to December, 1978 from wells screened in the major artesian aquifers of the Coastal Plain.

Study Area

The principal area of study is the Coastal Plain of New Jersey (fig. 1). The study area covers about 4,000 sq mi, bounded by the Atlantic Ocean to the east and the Delaware River to the west. The Fall Line marks the northwestern extent of the Coastal Plain. The study area includes Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, Ocean, Salem, and parts of Mercer and Middlesex Counties.

Previous Investigations

The geohydrology and potentiometric head distribution in specific aquifers have been discussed on a county-by-county basis by numerous investigators. Other investigators described the hydrology of the aquifers on a regional basis. Barksdale and others (1958) discussed the ground-water resources adjacent to the Delaware River. Gill and Farlekas (1976) presented geohydrologic maps of the Potomac-Raritan-Magothy aquifer system of the Coastal Plain, including potentiometric maps for 1900, 1956, and 1968. Luzier (1980) used a digital model to simulate head changes in the Potomac-Raritan-Magothy aquifer system. Luzier presented maps of potentiometric heads for 1973 and projected the heads from 1973 to 2000. Farlekas (1979) reported on the geohydrology of the

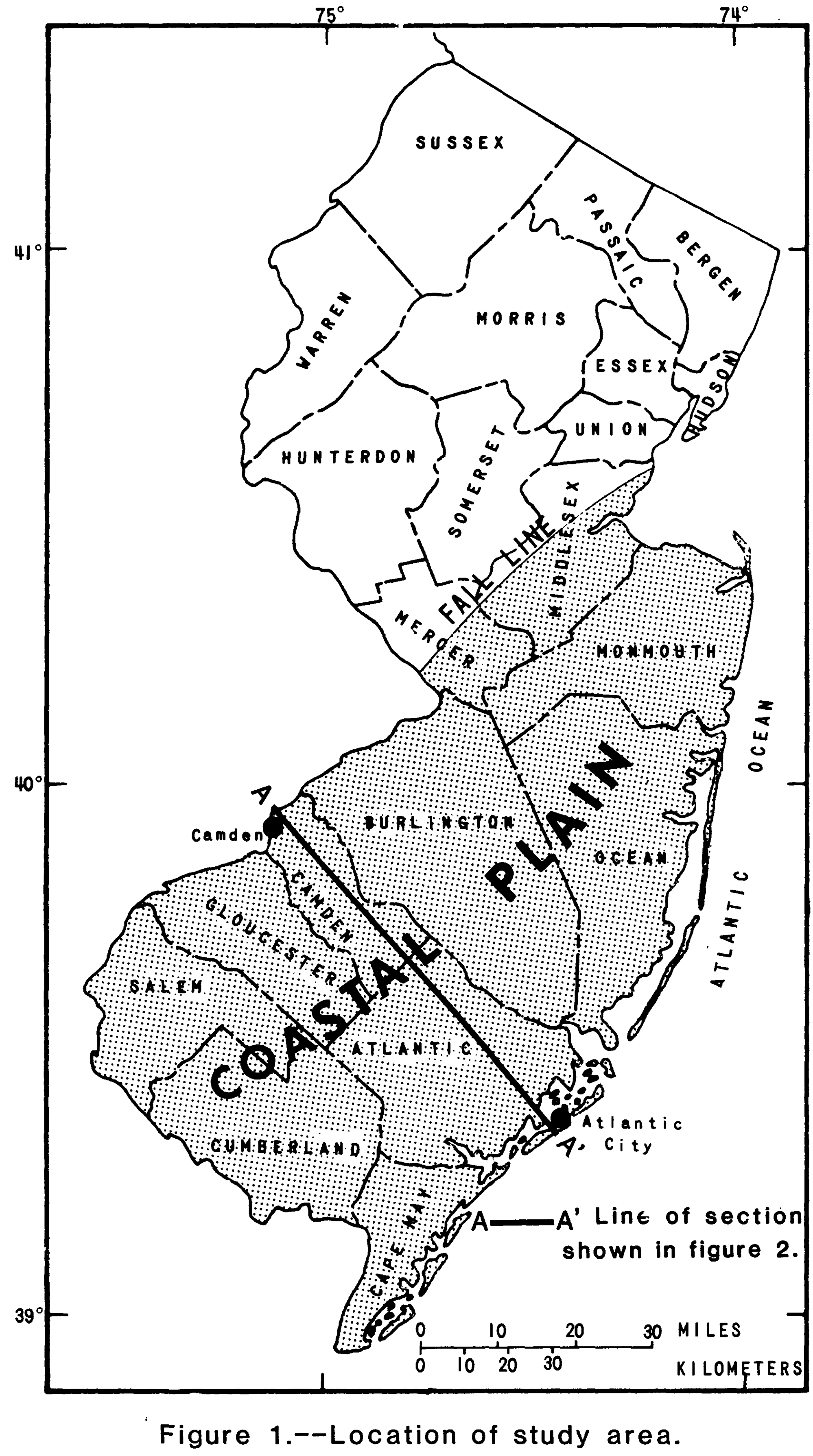


Figure 1.--Location of study area.

Farrington aquifer in the northern Coastal Plain and presented potentiometric surface maps for the Farrington and Old Bridge aquifers of the Potomac-Raritan-Magothy aquifer system for 1959 and 1973.

The geohydrology and potentiometric head distribution for the Englishtown aquifer was discussed for the northern Coastal Plain by Nichols (1976) and for Camden County by Farlekas and others (1976).

Nemickas (1976) reported on the digital simulation of ground-water flow in the Wenonah-Mount Laurel aquifer and presented water-level data for part of the aquifer for 1959 and 1970. Geohydrology and water levels in the Kirkwood aquifers were discussed by Thompson (1928), Barksdale and others (1936), Gill (1962), Clark and others (1968), Anderson and Appel (1969), and Rhodehamel (1973).

Gill (1962) reported on the geology and ground-water resources of Cape May County and presented hydrologic data on the Cohansey aquifer.

Well-Numbering System

The well-numbering system in this report is based on the system used by the U.S. Geological Survey in New Jersey since 1978. The well number consists of a county code number and a sequence number of the well within the county. County codes are Atlantic (1), Burlington (5), Camden (7), Cape May (9), Cumberland (11), Gloucester (15), Mercer (21), Middlesex (23), Monmouth (25), Ocean (29), and Salem (33). Well number 15-137 is a typical example for the 137th well in Gloucester County.

Acknowledgments

The author gratefully acknowledges the assistance of the officials and individuals who provided information about their wells and allowed access to the wells for water-level measurements.

METHODS OF INVESTIGATION

Data Collection

During 1978, static water levels were measured in nearly 1,000 wells that are screened in major artesian aquifers in the Coastal Plain of New Jersey. Data collection began in October and ended in early December. During this time of year, heavy summer pumping has subsided. Water levels generally reach highs in winter and early spring. During fall, water levels approximate the average for the year.

The Ground Water Site Inventory Data File (GWSI) of the U.S. Geological Survey, which contains well data for about 5,500 wells in New Jersey, was used to select wells measured in 1970 or 1973 for water-level measurements in 1978. These wells were evaluated with respect to their areal distribution, aquifer, and proximity to areas of heavy ground-water withdrawal. Where necessary, additional wells were selected to improve the distribution of data points.

To obtain an adequate distribution of measuring sites, many water-supply wells, including public supply, irrigation, industrial, and domestic wells, were measured. About 10 percent of the wells were water-level observation wells.

Various water-level-measuring techniques were used. The most direct and accurate is the wetted steel tape method, which was used for measuring observation and most water-supply wells. For some measurements, an electric tape (water-level finder) was more efficient, although slightly less accurate. The airline method is the least accurate, and the vertical length of the airline must be known. The airline method was used only when a steel or electric tape could not be used.

Nearby pumping was controlled at the time measurements were made. All large-capacity wells screened in the same aquifer within 1 mile were turned off for at least 1 hour before measurements. Several measurements were made in each well to determine if the water level had recovered sufficiently. In most Coastal Plain aquifers, water levels in large-capacity wells can be expected to recover to within 90 to 95 percent of the static head in about 1 hour.

Water levels were referenced to land surface datum at each measuring site. The altitude of land surface was used to adjust the measured water levels to sea-level datum. Altitudes of land surface were obtained from the GWSI file, field checked against topographic maps, and corrected when necessary. Some well owners provided more accurate altitudes from leveling surveys. Most altitudes, however, were estimated from U.S. Geological Survey $7^1/_2$-minute topographic maps and are considered accurate within half the contour intervals (10 or 20 ft) of the map.

Aquifer designations were taken from the GWSI file, and wells are grouped according to aquifer system. In many areas, aquifer designations were revised based on information from recent geohydrologic investigations. The geohydrologic framework of the Coastal Plain is discussed in sections on geohydrology.

Data Presentation

Data presented include water levels and water-level changes, potentiometric surface maps, and water-level hydrographs. These data are grouped by major artesian aquifer and discussed in the six report sections representing these aquifers. A table containing well and water-level data is presented at the end of each section. These tables include the well number for each site, which is used for reference throughout the report, site location, owner name, local well number, year drilled, altitude of land surface, and well depth. Water levels measured in 1978 were compared with levels for earlier years (1970 or 1973). Change in water level for 1970-78 or 1973-78 is given for many sites.

Seasonal water levels may vary as much as 25 ft in some aquifers. Reliable comparisons can be made of water levels measured at the same time of year and these can be used for evaluating water-level trends. Variations in head change in a few randomly spaced wells may be caused by local variations in withdrawal or recharge, measurement accuracy limitations, and variations in the time allowed for water-level recovery before measurements in or near recently pumped wells.

A 1:250,000 scale potentiometric surface map for 1978 is shown for each aquifer. These maps were prepared from the water-level data in the tables. Locations of most wells are shown on the potentiometric maps. The accuracy of the contours is dependent upon the distribution of wells, accuracy of land surface altitude, and the accuracy of the measured water levels. These maps show the potentiometric head distribution for the confined part of each aquifer. Potentiometric maps are useful in defining recharge and discharge areas, the generalized path of ground-water flow from recharge to discharge areas, and the hydraulic gradient along these flow paths. The hydraulic gradient may be used to determine the average ground-water velocity along a given path if the local hydraulic conductivity and porosity of the aquifer are known. The outcrops shown on the potentiometric maps are modified from U.S. Geological Survey Miscellaneous Geologic Investigations Map I-514-B, 1967. The outcrops for the Old Bridge Sand Member of the Magothy Formation and the Farrington Sand Member of the Raritan Formation are from Barksdale and others, 1943, fig. 6.

Water-level hydrographs of selected observation wells for each aquifer for 5- or 8-year periods are given. The observation wells were selected from the U.S. Geological Survey Observation Well Network. The hydrographs were plotted using the lowest recorded monthly and quarterly water levels. Individual hydrographs show seasonal water-level fluctuations and local long-term trends. Together, they show long-term regional trends in each aquifer. Seasonal water-level fluctuations may be caused by natural variations in recharge and evapotranspiration and by variations in the withdrawal of ground water. The datum used in this report is sea level (NGVD of 1929).

SUMMARY OF COASTAL PLAIN GEOHYDROLOGY

The aquifers of the Coastal Plain are the primary source of water supply in the region. They are part of a wedge-shaped mass of sand, silt, and clay, which range in age from Cretaceous to Quaternary (table 1) and lie on a pre-Cretaceous bedrock surface.

Table 1.--Stratigraphic and hydrologic characteristics of geologic units of the New Jersey Coastal Plain[1]

SYSTEM	GEOLOGIC UNIT	LITHOLOGY	HYDROLOGIC CHARACTERISTICS
Quaternary	Alluvial deposits	Sand, silt, and black mud.	Locally may yield small quantities of water to shallow wells.
	Beach sand and gravel	Sand, quartz, light-colored, medium grained, pebbly.	
	Cape May Formation	Sand, quartz, light-colored, heterogeneous, clayey, pebbly, glauconitic.	Thicker sands are capable of yielding large quantities of water.
Tertiary	Pensauken Formation		
	Bridgeton Formation		
	Beacon Hill Gravel	Gravel, quartz, light-colored, sandy.	No known wells tap this formation.
	Cohansey Sand	Sand, quartz, light-colored, medium to coarse-grained, pebbly; local clay beds.	A major aquifer. Ground-water occurs generally under water-table conditions. In Cape May County, the aquifer is under artesian conditions. Inland from the coast and in the northern part of Ocean County, the Cohansey Sand is in hydraulic connection with the Kirkwood Formation, forming the unconfined Kirkwood-Cohansey aquifer system.
	Kirkwood Formation	Sand, quartz, gray to tan, very fine- to medium-grained, micaceous, and dark-colored diatomaceous clay.	Includes a major and minor artesian aquifer near the coast. The major aquifer is the Atlantic City 800-foot sand. The minor aquifer is the Rio Grande water-bearing zone or upper aquifer. The Kirkwood Formation includes up to three confining layers near the coast. Inland from the coast and in the northern part of Ocean County, the Kirkwood Formation is hydraulically connected to the unconfined Cohansey Sand, forming the unconfined Kirkwood-Cohansey aquifer system.
	Piney Point Formation	Sand, quartz and glauconitic, fine- to coarse-grained.	Minor aquifer in New Jersey. Greatest thickness in Cumberland County.
	Shark River Marl	Sand, quartz and glauconite, gray, brown, and green, fine- to coarse-grained, clayey, and green silty and sandy clay.	Locally may yield small quantities of water to wells.
	Manasquan Formation		Locally may yield small to moderate quantities of water to wells.
	Vincentown Formation	Sand, quartz, gray and green, fine- to coarse-grained, glauconitic, and brown clayey, very fossiliferous, glauconite and quartz calcarenite.	Locally may yield small to moderate quantities of water to wells.
	Hornerstown Sand	Sand, glauconite, green, medium- to coarse-grained, clayey.	Locally may yield small quantities of water to wells.
Cretaceous	Tinton Sand	Sand, quartz, and glauconite, brown and gray, fine- to coarse-grained, clayey, micaceous.	No known wells tap this sand.
	Red Bank Sand		Yields small quantities of water to wells in Monmouth County.
	Navesink Formation	Sand, glauconite, and quartz, green, black, and brown, medium- to coarse-grained, clayey.	Locally may yield small quantities of water to wells.
	Mount Laurel Sand	Sand, quartz, brown and gray, fine- to coarse-grained, glauconitic.	A major aquifer in the northern part of the Coastal Plain. A sand unit within the two formations forms the Wenonah-Mount Laurel aquifer.
	Wenonah Formation	Sand, quartz, gray and brown, very fine- to fine-grained, glauconitic, micaceous.	
	Marshalltown Formation	Sand, quartz and glauconite, gray and black, very fine to medium-grained, very clayey.	Leaky confining bed.
	Englishtown Formation	Sand, quartz, tan and gray, fine- to medium-grained; local clay beds.	A major aquifer in the northern part of the Coastal Plain, the Englishtown aquifer consists of two sand units in Ocean and Monmouth Counties.
	Woodbury Clay	Clay, gray and black, micaceous.	The two formations form the Merchantville-Woodbury confining unit, a major confining layer throughout the New Jersey Coastal Plain. Locally the Merchantville may contain a thin water-bearing sand.
	Merchantville Formation	Clay, gray and black, micaceous, glauconitic, silty; locally very fine-grained quartz and glauconitic sand.	
	Magothy Formation	Sand, quartz, light-gray, fine-grained, and dark-gray lignitic clay.	Potomac-Raritan-Magothy aquifer system: Upper aquifer referred to as Old Bridge aquifer in the northern Coastal Plain.
	Raritan Formation	Sand, quartz, light-gray, fine- to coarse-grained, pebbly, arkosic, red, white, and variegated clay.	Major confining layer Middle aquifer referred to as the Farrington aquifer in the northern Coastal Plain is combined with sands of the Potomac Group forming a large lower aquifer, as used in this report.
	Potomac Group	Alternating clay, silt, sand, and gravel.	
Pre-Cretaceous	Pre-Cretaceous basement	Precambrian and lower Paleozoic crystalline rocks, metamorphic schist and gneiss; locally Triassic basalt, sandstone, and shale	Except along Fall Line, no wells obtain water from these consolidated rocks.

[1] Modified after Seaber, 1965, table 3.

These unconsolidated deposits thicken southeastward from less than 50 ft along the Fall Line to more than 6,500 ft in Cape May County (Gill and Farlekas, 1976).

The aquifers crop out in irregular bands, which trend northeast to southwest. In section, they appear as wedge-shaped layers, which dip to the southeast with a gradient of 10 to 100 ft/mi (Parker and others, 1964, p. 42). Several areally extensive confining layers define the lower and upper hydrologic boundaries of the aquifers. Figure 2 illustrates these aquifers and confining layers. Several minor aquifers, both water table and artesian, are not shown in figure 2 and are not discussed in this report.

The aquifers discussed in this report, from oldest to youngest, are

- lower aquifer of the Potomac-Raritan-Magothy aquifer system
- upper aquifer of the Potomac-Raritan-Magothy aquifer system
- Englishtown aquifer
- Wenonah-Mount Laurel aquifer
- Kirkwood aquifers
- Cohansey aquifer

Recharge to the Coastal Plain is largely by infiltration of precipitation on the outcrop areas. Leakage from the overlying surface-water bodies also contributes recharge. At several locations, this recharge is induced by the lowering of potentiometric heads in the aquifers due to withdrawals.

Water is discharged from the Coastal Plain by discharge to overlying surface-water bodies, by evapotranspiration, and by withdrawals from wells.

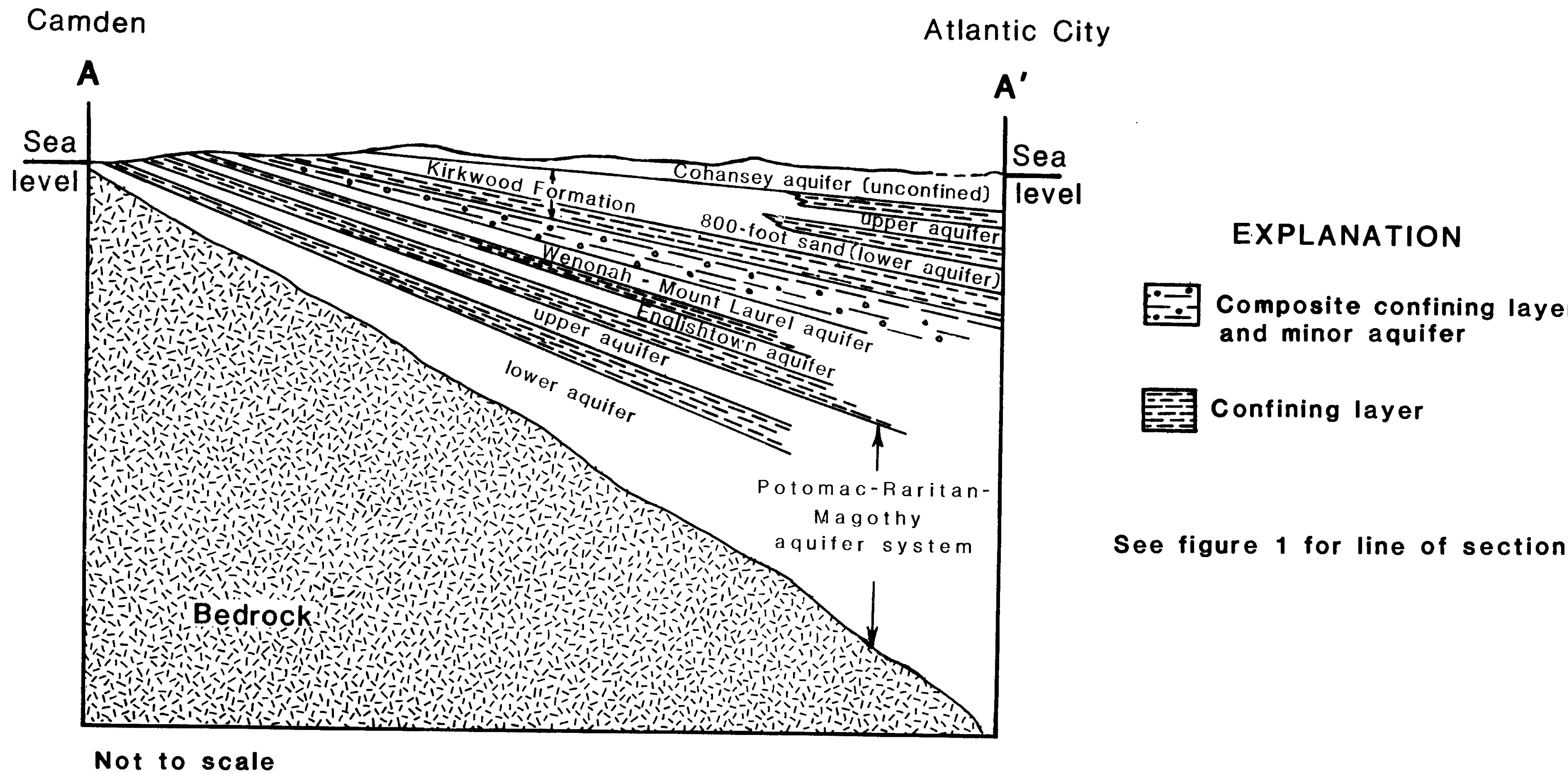


Figure 2.--Diagrammatic hydrogeologic section of the New Jersey Coastal Plain.

Withdrawals since 1900 have caused large cones of depression in several major Coastal Plain aquifers (Meisler, 1980, p. 21). The following table shows withdrawals from the major artesian aquifers. The Kirkwood-Cohansey aquifer system is a water-table aquifer and is not included.

Major ground-water withdrawals from the Coastal Plain of New Jersey by county and aquifer, 1978.[1]
[In million gallons per day]
[Modified from Vowinkel and Foster, 1981, table 6]

County	Potomac-Raritan-Magothy aquifer system	Englishtown aquifer	Wenonah-Mount Laurel aquifer	Kirkwood aquifers[2] (upper and lower aquifer)	Cohansey aquifer (confined)
Atlantic	-----	----	----	9.12	----
Burlington	38.96	0.49	1.14	----	----
Camden	69.57	.76	.88	----	----
Cape May	----	----	----	5.36	6.03
Cumberland	----	----	----	----	----
Gloucester	25.19	----	.02	----	----
Mercer	8.12	----	----	----	----
Middlesex	49.38	----	----	----	----
Monmouth	21.60	6.25	1.31	----	----
Ocean	11.53	4.59	.03	4.22	----
Salem	6.10	----	1.32	----	----
Total	230.45	12.09	4.70	18.70	6.03

[1]Withdrawal data do not include domestic users, unavailable grandfather rights withdrawals, and some withdrawals from the water-table aquifer.
[2]Includes only Rio Grande water-bearing zone and Atlantic City 800-foot sand.

The generalized direction of flow in each of the aquifers may be approximated from the potentiometric maps by drawing lines at right angles to the contours from areas of higher head to areas of lower head. The paths of flow would be roughly parallel to these lines, converging toward the centers of the major cones of depression. In general, water is moving from the outcrop areas and from the confined downdip parts of the aquifers toward the major cones of depression. In some locations, the flow directions are toward natural points of discharge, such as where surface-water bodies overlie outcrop areas.

ARTESIAN AQUIFERS OF THE COASTAL PLAIN

Potomac-Raritan-Magothy Aquifer System

The Potomac-Raritan-Magothy aquifer system is made up of (in ascending order) the Potomac Group and Raritan and Magothy Formations of Cretaceous age. This aquifer system is composed of two major aquifers called the lower and upper aquifers in this report (fig. 2). Farlekas (1979) refers to these aquifers in the northern part of the Coastal Plain as the Farrington and Old Bridge aquifers. The specific composition of these aquifers are covered later in this report. However, in the central and southern coastal plain, the aquifer system has generally been represented as a hydrologic unit (Barksdale and others, 1958). Considerable geologic, lithologic, and hydrologic data have become available in recent years. The data suggest that water-bearing sands in the southern part of the aquifer system function as two or three distinct hydrologic units.

Gill and Farlekas (written communication, 1970) defined three aquifers of the system (lower, middle, and upper) underlying an area of about 400 sq mi southwest of Trenton adjacent to the Delaware River. Gill and Farlekas (written communication, 1970) suggest that the lower and middle aquifers are interconnected in Burlington and Camden Counties adjacent to the Delaware River and show a similarity in potentiometric head. Farlekas and others (1976) also interpreted three aquifers when analyzing the aquifer system in Camden County. More recent work by Zapecza (written communication, 1982) defines the regional hydrologic framework of the Coastal Plain aquifers. Zapecza redefined these three aquifers and extended the correlations over more of the Coastal Plain. The interpretations made by Zapecza indicate:

a. The lower aquifer is recognizable in the subsurface from Salem County north to Burlington County, where the aquifer thins northward, and is absent in the northern Coastal Plain.

b. The middle aquifer is laterally continuous with the Farrington aquifer.

c. The lower and middle aquifers cannot be differentiated in the downdip areas of the southern Coastal Plain.

d. The upper aquifer is laterally continuous with the Old Bridge aquifer.

Water-level data collected in 1973 and 1978 from wells screened in the lower and middle aquifers, show a similarity in potentiometric head over large areas. This similarity suggests some hydraulic connection. Furthermore, the confining layer separating the lower and middle aquifers is thin or absent in places adjacent to the Delaware River (Gill and Farlekas, written communication, 1970). Although the confining layer is well defined in a narrow band stretching from Burlington County to Salem County, it is not well defined in large areas to the east (Zapecza, written communication, 1982). In this report, the lower and middle aquifers are combined and referred to as the lower aquifer of the Potomac-Raritan-Magothy aquifer system.

Lower Aquifer of the Potomac-Raritan-Magothy Aquifer System

Geohydrology

The lower aquifer of the Potomac-Raritan-Magothy aquifer system consists mainly of undifferentiated sand, gravel, silt, and clay of the Potomac Group undivided and Raritan Formation. In the outcrop area (pl. 1), the aquifer may include younger surficial material. In the northern Coastal Plain, the lower aquifer is primarily the Farrington aquifer described by Farlekas (1979). The lower aquifer includes essentially all water-bearing zones within the aquifer system below the upper aquifer. The aquifer lies unconformably on pre-Cretaceous bedrock, which acts as the lower confining layer.

The upper confining layer, a thick sequence of silt and clay, separates the lower aquifer from the upper aquifer, and underlies much of the Coastal Plain (Zapecza, written communication, 1982). In the northern part of the Coastal Plain, this confining layer is the Woodbridge Clay Member of the Raritan Formation, which has been traced to southern New Jersey (Farlekas, 1979, p. 20).

Withdrawals from the lower aquifer are greatest in the northwestern parts of Burlington, Camden, Gloucester, and Salem Counties and in Middlesex and Monmouth Counties. Withdrawals diminish southward in Burlington, Camden, Gloucester, Ocean, and Salem Counties where the aquifer is at greater depth and contains salty ground water. Chloride concentrations range from 250 mg/L to 27,000 mg/L (Luzier, 1980, p. 10) and generally increase southward or southeastward and with increasing depth. Luzier (1980) discusses salty ground water in the southern part of the Potomac-Raritan-Magothy aquifer system.

Water Levels

Water levels were measured in 386 wells screened in the lower aquifer (table 2). Well density is greatest southwest of Trenton adjacent to the Delaware River and in parts of Middlesex and Monmouth Counties near Raritan Bay. Wells screened in the lower aquifer are sparse in parts of Burlington, Camden, Cumberland, Monmouth, and Ocean Counties, and no wells are known in Atlantic and Cape May Counties.

The potentiometric map on plate 1 shows two large cones of depression. The largest is centered in Camden County, where water levels are as low as 89 ft below sea level. Nearby smaller cones in Burlington, Gloucester, and Salem Counties have heads from 10 to 84 ft below sea level. The other cone of depression is centered in eastern Middlesex and northwestern Monmouth Counties, where levels are as low as 76 ft below sea level. The two cones coalesce in the vicinity of southern Monmouth and northern Ocean Counties, where levels are about 20 ft below sea level.

The highest water levels (65-88 ft above sea level) are adjacent to the outcrop (pl. 1) in central Mercer and Middlesex Counties.

Well 11-137 in eastern Cumberland County is an observation well screened in a saltwater zone in the lower aquifer. In 1974, the chloride concentration was 11,000 mg/L (Luzier, 1980, p. 9). The water level measured in 1978 was 37 ft below sea level. (See table 2 and figure 4.) However, for contouring the heads in plate 1, the water level was adjusted to an equivalent freshwater head of 20 ft below sea level, based on density, temperature, and pressure at the time of measurement. This is the only well in the lower aquifer where an adjustment was required.

Water-Level Fluctuations

Change in water level from 1973 to 1978 was calculated for 255 of the wells listed in table 2. These changes indicate a general decline in levels in much of the aquifer. Greatest declines (5-20 ft) were generally where the head was lowest.

Large declines, such as in well 5-337 (30 ft), 29-47 (38 ft), and 33-30 (75 ft), are due mostly to changes in local withdrawal. At well sites 29-47 and 33-30, no water was withdrawn from the lower aquifer before 1973. Since 1973, pumping from the lower aquifer at these sites caused large declines. The head decline at well 29-47 (38 ft) is partly related to regional declines. An observation well (29-85) near Toms River, Ocean County, indicates that regional heads declined at least 18 ft. The 75-foot decline noted for well 33-30 in Salem County, which greatly exceeds the 10-foot average decline, is the result of local withdrawal.

The areas of least head change were generally near the outcrop. In a few parts of the aquifer, levels rose in response to reductions in pumping. In a small area north of Pennsville, Salem County, levels recovered as much as 18 ft. Levels in the western part of Camden City, Camden County, recovered an average of 8 ft between 1973 and 1978.

Hydrographs of 10 observation wells screened in the lower aquifer are shown in figures 3 and 4. These hydrographs show a declining trend in water levels throughout the confined parts of the lower aquifer. Well locations are shown on plate 1.

The hydrographs in figure 3 represent wells near large centers of withdrawal and show cyclic seasonal variations combined with a long-term downward trend. The seasonal variations are caused largely by seasonal changes in pumping rather than by variations in recharge (Luzier, 1980, p. 39). The average decline ranged from 1.3 ft/yr in well 33-187, in northern Salem County, to 2.8 ft/yr in well 25-272, near the major cone of depression in eastern Middlesex and northwestern Monmouth County.

The hydrographs in figure 4 show regional water-level changes and little or no seasonal variations because they are downdip from the outcrop and far from large withdrawal centers. However, they show regional water-level changes. The average decline ranged from 1.7 ft/yr in well 11-137, 31 mi south of the cone of depression in Camden County, to 3.6 ft/yr in well 29-85, in northcentral Ocean County. The average decline in well 29-85 is about 1 ft/yr more than the greatest decline in the other wells. This is probably due to the development of nearby water-supply systems in the lower aquifer since 1973. Plate 1 shows the small cones of depression in Ocean County.

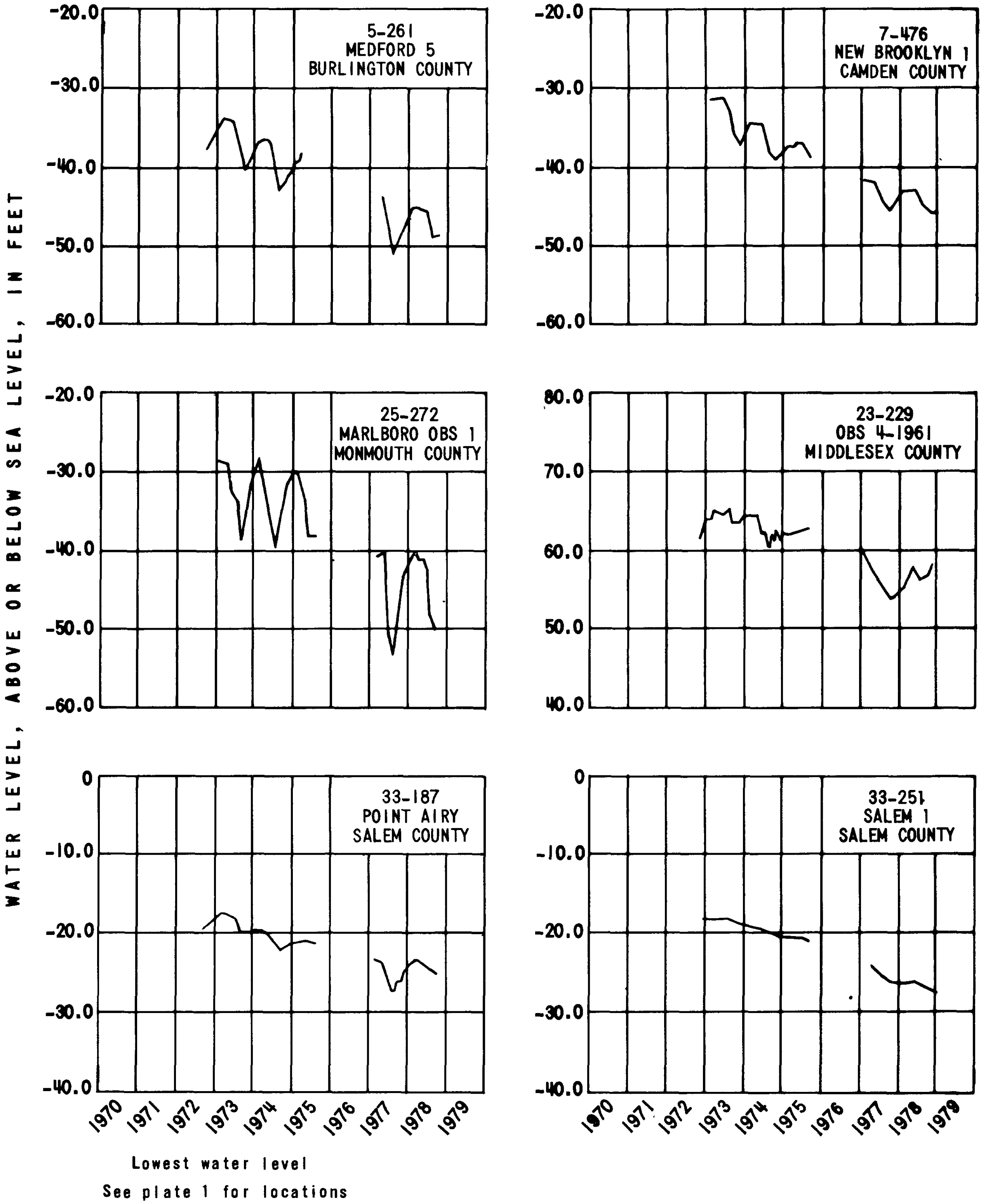
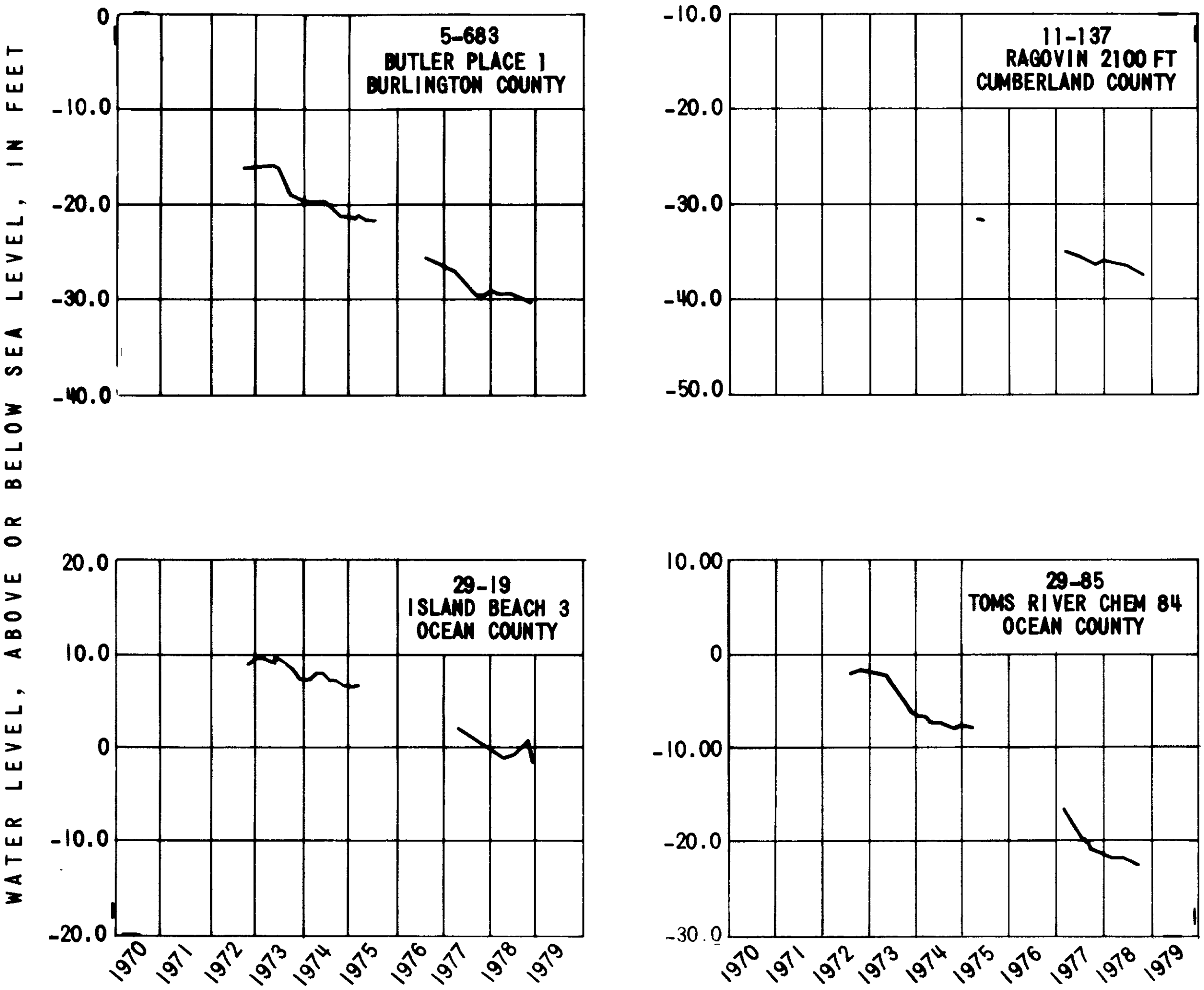


Figure 3.-- Hydrographs of observation wells screened in the lower aquifer of the Potomac-Raritan-Magothy aquifer system, near large centers of withdrawal.



Lowest water level

See plate 1 for locations

Figure 4.-- Hydrographs of observation wells screened in the lower aquifer of the Potomac-Raritan-Magothy aquifer system, far from large centers of withdrawal.

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
5- 40	400405	745517	DELA VALLEY W C	DVWC 16		18	39- 51	7	11/27	7	11/15	0
5- 42	400846	744212	BORDENTOWN W D	GILDER FIELD 1	1955	89	355- 385	1	12/11	6	10/11	5
5- 48	400800	744309	NJ DEPT DEFENSE	NAT GUARD 1	1952	83	- 230[3]	7	12/05	2	10/26	-5
5- 50	400412	745157	GENERAL HOME PR	INDUSTRIES 1	1953	12	- 120[3]	2	11/26	1	11/07	-1
5- 51	400453	745121	BURLINGTON C WD	BCWD 3 1949	1949	9	64- 85	-2	11/20	-1	11/13	1
5- 63	400213	745108	WILLINGBORO MUA	WMUA 1-OBS	1965	45	284- 294	-11	11/27	-16	11/06	-5
5- 98	400525	744938	HERCULES POWDER	HERCULES 3	1961	25	111- 136			1	11/13	
5-101	400538	744946	HERCULES POWDER	HERCULES 1 OBS	1945	19	94- 104	0	11/20	1	11/13	1
5-109	400632	744904	NATIONAL GYPSUM	NAT GYP 2	1955	22	113- 123	-6	11/20	-4	11/17	2
5-110	400632	744904	NATIONAL GYPSUM	NAT GYP 3	1964	22	122- 142	2	11/20	3	11/17	1
5-114	400606	743923	DEMARCO, RALPH	DEMARCO	1958	85	388- 392	-6	11/20	-7	11/03	-1
5-121	400934	744019	NJS REFORMATORY	NJSR 4	1951	97	357- 387			0	10/26	
5-122	400934	744019	NJS REFORMATORY	NJSR 5	1964	75	337- 367			4	10/26	
5-123	395904	750009	NJ WATER CO	DVWC 28	1969	30	226- 261			-5	11/09	
5-125	395929	745922	DELA VALLEY W C	DVWC 10	1961	79	239- 281	-6	11/27	-11	11/09	-5
5-126	395929	745922	NJ WATER CO	DVWC 12-POMONA	1961	73	157- 196[2]	-6	11/27	-8	11/09	-2
5-127	395938	745810	NJ WATER CO	RIVERTON 14	1964	35	179- 229	-7	11/27	-13	11/09	-6
5-130	400002	750044	NJ WATER CO	RIVERTON 13	1963	65	167- 198			-9	11/09	
5-131	400002	750044	DELA VALLEY W C	DVWC 27	1965	60	145- 176			-16	11/09	
5-134	400053	750028	CINNAMINSON TSA	TEST WELL 68 1	1968	5	24- 100			-4	11/09	
5-135	400104	745859	HOEGANAES IRON	HOEGANAES	1951	35	119- 134			7	11/07	
5-137	400147	745934	TAYLOR, H G	TAYLOR 2	1963	14	- 25[3]			12	11/06	
5-140	400241	745546	CHANT, HARRY R	CHANT 1	1965	22	140- 155	4	11/28	2	11/06	-2
5-145	400110	745713	HOLY CROSS H S	HIGH SCHOOL	1958	70	154- 174	7	11/27	2	11/15	-5
5-146	400122	745807	NJ WATER CO	DVWC 19	1959	25	89- 130	2	11/27	3	11/15	1
5-147	400126	745647	NJ WATER CO	FAIRVIEW ST	1970	83	180- 235			-1	11/15	
5-180	400532	744833	WORKMAN, JAMES	WORKMAN 1	1951	41	170- 194	10	11/20	8	11/12	-2
5-187	400703	744832	FLORENCE TWP WD	FTWD 4	1948	30	119- 134	-8	11/20	-3	11/07	5
5-190	400712	744842	FLORENCE TWP WD	FTWD 1	1931	30	99- 119	-7	11/20	2	11/07	9
5-206	400325	744456	CARTY,RONALD		1959	62	370- 380	-19	11/20	-24	11/02	-5
5-209	400412	744323	COLUMBUS W C	COLMBUS 3-1969	1969	73	259- 274			-18	10/25	
5-214	400531	744430	KELLEY, EDWARD	KELLEY		60	- 319[3]	-9	11/20	-10	10/30	-1
5-217	400632	744234	INDUSTRIAL PARK	TURNPIKE JCTN	1958	60	293- 329[2]	0	11/20	-5	10/26	-5
5-228	395630	745855	MAPLE SHADE WD	MSWD 10	1975	40	440- 500			-47	11/08	
5-232	395727	745915	MAPLE SHADE W D	8(MAIN STREET)	1972	20	210- 270			-29	11/09	
5-261	395525	745025	US GEOL SURVEY	MEDFORD 5	1967	73	740- 750	-40	09/21	-48	11/07	-8
5-262	395524	745025	US GEOL SURVEY	MEDFORD 4	1967	72	1125-1145	-40	09/21	-48	11/06	-8
5-264	395704	745812	MOORESTOWN T WD	MTWD 5	1963	38	248- 288			-40	11/13	
5-265	395702	745808	MOORESTOWN T WD	MTWD 6	1963	42	248- 288	-35	11/27	-38	11/13	-3
5-266	395703	745811	MOORESTOWN T WD	MTWD 3	1942	40	269- 299			-42	11/13	
5-268	395751	745832	PRICE BUILDERS	LAYNE 1	1960	70	- 288[3]	-24	11/27	-30	11/15	-6
5-272	395834	745910	MOORESTOWN T WD	7-1969	1969	40	335- 375	-18	11/27	-16	11/24	2
5-273	395835	745643	MOORESTOWN F C	FIELD CLUB 1	1964	70	274- 302	-23	11/27	-27	11/16	-4
5-274	395838	745905	CAMPBELL SOUP	CAMPBELL 1	1958	40	241- 262	-16	11/02	-20	11/24	-4
5-283	395933	745456	MOORESTOWN T WD	SUPPLY 8	1969	65	282- 332	-25	11/29	-27	11/24	-2
5-284	395936	745452	MOORESTOWN T WD	MTWD 4	1960	59	298- 338	-23	11/29	-26	11/24	-3
5-290	395936	744655	MOUNT HOLLY W C	MHWC 6	1972	15	530- 615[2]	-39	11/27	-55	11/14	-16
5-291	395941	744734	HOLLYFORD ICE	1 1946	1946	15	470- 500	-40	11/27	-51	11/14	-11
5-303	395607	745648	MT LAUREL MUA	1	1961	20	558- 589			-57	11/15	
5-304	395608	745644	MT LAUREL MUA	2	1965	20	362- 399[2]			-54	11/15	
5-324	395620	745530	MT LAUREL MUA	3(TEST WELL 1)	1973	40	592- 642	-35	11/30	-43	11/16	-8
5-325	395616	745514	MT LAUREL MUA	4(TEST WELL 2)	1973	35	590- 640	-38	11/30	-48	11/16	-10
5-330	395949	743655	US ARMY FT DIX	FORT DIX 4	1943	140	1056-1086	-42	11/26	-49	11/02	-7
5-331	400034	743621	US ARMY FT DIX	FORT DIX 1	1941	138	916- 960	-27	11/26	-32	11/02	-5
5-332	400106	743720	US ARMY FT DIX	FORT DIX 5	1969	150	1064-1104	-32	11/26	-39	11/02	-7
5-333	400129	743656	US ARMY FT DIX	FORT DIX 2	1941	131	1030-1051	-31	11/26	-47	11/02	-16
5-334	400138	743753	US ARMY FT DIX	FORT DIX 3		165	849- 869	-39	11/26	-41	11/02	-2
5-335	400141	743525	US AIR FORCE	MCGUIRE D	1953	112	1012-1075	-37	11/26	-55	11/02	-18
5-337	400216	743607	US AIR FORCE	MCGUIRE A	1953	128	992-1055	-37	11/26	-67	11/02	-30
5-340	400300	743514	US AIR FORCE	MCGUIRE B	1960	126	780- 835[2]	-30	11/26	-32	11/02	-2
5-344	400546	743446	HOFFMAN LAROCHE	1974 WELL	1974	136	783- 814[2]			-23	11/02	
5-382	395839	744242	IONAC CHEM CO	IONAC CHEM 4	1976	30	773- 824			-61	10/14	
5-388	395939	743742	US ARMY FT DIX	FORT DIX 6	1970	160	1090-1140	-45	11/26	-42	11/02	3
5-393	400209	745740	RIVERSIDE INDUS	FTC 39	1952	15	54- 67			2	11/07	
5-440	400242	744223	RHODIA CORP	RHODIA 1	1964	72	603- 613	-22	11/21	-29	11/13	-7

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
5-634	400041	744809	MOUNT HOLLY W C	MHWC 5	1965	55	- 516[3]	-41	11/28	-56	11/14	-15
5-635	400041	745049	INDEL	INDUCT 1	1961	60	411- 443	-45	11/28	-50	11/12	-5
5-645	400010	745216	WILLINGBORO MUA	WMUA 2-OBS	1965	40	431- 441	-27	11/12	-31	11/07	-4
5-648	400103	745409	WILLINGBORO MUA	WMUA 3-OBS	1965	34	- 318[3]	-18	11/12	-20	11/09	-2
5-649	400122	745308	WILLINGBORO MUA	WMUA 6	1959	39	- 363[3]	-19	11/21	-15	11/09	4
5-651	400139	745325	WILLINGBORO MUA	WMUA 3	1959	28	203- 304[2]	-26	11/21	-20	11/15	6
5-653	400152	745435	WILLINGBORO MUA	WMUA 4	1958	28	177- 280			-11	11/15	
5-658	400158	745307	WILLINGBORO MUA	WMUA 7	1958	19	179- 255[2]	-24	11/21	-13	11/09	11
5-661	400225	745402	WILLINGBORO MUA	WMUA 1	1955	10	147- 199	-9	11/21	-10	11/09	-1
5-667	400250	745321	WILLINGBORO MUA	WMUA 5	1958	39	230- 256	-8	11/21	-11	11/09	-3
5-668	400308	745325	WILLINGBORO MUA	WMUA DCB 28	1955	43	222- 242	-4	11/21	-6	11/09	-2
5-683	395122	743017	US GEOL SURVEY	BUTLER PLACE 1	1964	141	2102-2117	-20	11/08	-30	11/13	-10
5-746	395727	745915	MAPLE SHADE WD	11 MAIN ST	1978	20	389- 450			-29	11/09	
5-749	395508	745539	RAMBLEWOOD CC	3	1972	75	- 425[3]			-60	11/16	
5-751	395546	745622	RAMBLEWOOD CC	2		20	- 325[3]	-50	12/01	-55	11/17	-5
7- 12	395221	750637	BELLMAWR B W D	BBWD 3	1956	35	331- 359[2]	-54	11/29	-53	12/01	1
7- 38	395455	750716	SO JRSY PORT CM	NY SHIP 7	1942	12	188- 229			-23	11/13	
7- 40	395457	750641	CAMDEN CITY W D	CITY 7	1945	21	126- 165			-34	11/12	
7- 46	395512	750640	CAMDEN CITY W D	CITY 11	1942	13	124- 154			-31	11/12	
7- 47	395524	750729	CO.SEWAGE AUTH.	SEWAGE PLANT 1	1954	9	163- 193	-24	11/26	-16	11/09	8
7- 48	395527	750646	CAMDEN CITY W D	CITY 6N	1948	14	111- 135			-26	11/12	
7- 61	395541	750622	CAMDEN CITY W D	CITY 4	1950	41	131- 156	-44	11/27	-37	11/12	7
7- 64	395546	750533	CAMDEN CITY W D	CITY 17	1954	34	230- 265			-38	11/12	
7- 68	395557	750535	CAMDEN CITY W D	CITY 13	1953	30	185- 225			-36	11/12	
7- 70	395557	750629	CAMDEN CITY W D	CITY 3A	1953	15	90- 115	-44	11/29	-26	11/12	18
7- 78	395616	750632	CAMDEN CITY W D	CITY 5N	1963	22	134- 169			-26	11/12	
7- 79	395617	750710	CAMDEN CITY W D	CITY 12	1945	23	136- 166			-17	11/12	
7- 83	395638	750622	CAMDEN CITY W D	CITY 1A	1953	10	135- 170			-33	11/09	
7- 90	395652	750607	CAMDEN CITY W D	CITY 10	1935	10	126- 158	-40	11/29	-31	11/09	9
7- 94	395706	750553	CAMDEN CITY W D	CITY 16	1954	23	149- 179			-32	11/08	
7-106	395719	750517	NJ WATER CO	CAMDEN DIV 45	1950	13	143- 173	-41	11/29	-37	11/09	4
7-108	395722	750514	NJ WATER CO	CAMDEN DIV 10	1932	11	115- 155	-45	11/02	-34	11/09	11
7-109	395722	750523	NJ WATER CO	CAMDEN DIV 46	1950	11	148- 178	-39	11/29	-37	11/09	2
7-110	395725	750521	NJ WATER CO	CAMDEN DIV 49	1955	9	137- 169	-41	12/19	-36	11/09	5
7-121	395252	745943	NJ WATER CO	T-1 BROWNG	1973	80	672- 730[2]			-85	11/08	
7-123	395252	745943	NJ WATER CO	BROWNING 46	1973	81	664- 735[2]			-84	11/08	
7-124	395252	745943	NJ WATER CO	BROWNING 45	1973	77	483- 626[2]			-77	11/09	
7-130	395353	745708	NJ WATER CO	OLD ORCHARD A	1967	71	743- 748	-56	12/04	-67	11/08	-11
7-132	395353	745708	NJ WATER CO	OLD ORCHARD C	1967	71	- 500[3]			-82	11/08	
7-134	395353	745708	NJ WATER CO	OLD ORCHARD 37	1968	68	454- 488	-71	12/04	-80	11/08	-9
7-144	395442	750103	NJ WATER CO	ELLISBURG 13	1960	39	491- 527			-60	11/09	
7-146	395455	745924	NJ WATER CO	KINGSTON 27	1963	40	366- 417	-62	12/04	-68	11/08	-6
7-147	395455	745929	NJ WATER CO	KINGSTON 25	1961	44	309- 367	-59	12/04	-65	11/08	-6
7-163	395609	750028	NJ WATER CO	COLUMBIA 22	1960	39	371- 453	-42	11/29	-46	11/09	-4
7-171	395426	750514	COLLINGSWOOD WD	CWD 7	1965	10	224- 313	-41	11/28	-41	11/07	0
7-172	395426	750514	COLLINGSWOOD WD	CWD 6	1965	10	218- 312	-45	11/27	-46	11/07	-1
7-175	395521	750439	COLLINGSWOOD WD	CWD 1R	1950	25	266- 306	-58	11/28	-51	11/07	7
7-178	395522	750432	COLLINGSWOOD WD	CWD 3	1960	15	257- 287			-44	11/07	
7-179	395526	750424	COLLINGSWOOD WD	CWD 5	1956	10	248- 278	-53	11/28	-46	11/07	7
7-184	394950	745855	NJ WATER CO	GIBBSBORO OB 1	1969	70	1081-1091	-55	12/05	-77	11/13	-22
7-185	394950	745855	NJ WATER CO	GIBBSBORO OB 2	1969	70	940- 950	-55	12/05	-76	11/13	-21
7-186	394950	745855	NJ WATER CO	GIBBSBORO OB 3	1969	70	- 680[3]	-63	12/05	-77	11/13	-14
7-194	395308	750744	NJ ZINC CO	4-DEEP	1958	5	249- 279			-58	07/12[4]	
7-195	395308	750749	NJ ZINC CO	5-DEEP		5	- 175[3]			-59	07/12[4]	
7-221	395356	750738	US GEOL SURVEY	COAST GUARD 1	1966	10	162- 170			-40	11/22	
7-273	395030	750347	NJ WATER CO	OTTERBROOK 29	1965	60	612- 712	-59	11/27	-72	11/08	-13
7-278	395238	750316	NJ WATER CO	HADDON 15	1956	65	452- 594			-72	11/09	
7-281	395242	750323	NJ WATER CO	HADDON 14	1954	76	506- 598	-67	11/29	-72	11/09	-5
7-283	395246	750433	NJ WATER CO	EGBERT	1962	24	445- 455	-61	11/02	-62	11/09	-1
7-289	395403	750322	HADDON TWP W D	HTWD 2	1952	60	439- 470			-64	11/09	
7-290	395406	750317	HADDON TWP W D	HTWD 1	1952	56	436- 468	-66	11/28	-67	11/09	-1
7-292	395406	750332	HADDON TWP W D	HTWD 4	1965	45	417- 448			-63	11/09	
7-302	395319	750140	HADDONFIELD W D	RULON	1956	25	523- 572	-63	11/29	-72	11/08	-9
7-315	395134	750229	NJ WATER CO	MAGNOLIA 16	1964	78	428- 510	-82	11/27	-89	11/08	-7
7-320	395652	750307	MCHVIL PNSK WCM	WOODBINE 1	1963	65	245- 285	-37	11/26	-37	11/14	0

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
7-329	395628	750406	MCHVIL PNSK WCM	BROWNING 2A	1965	20	110- 140			-32	11/14	
7-332	395711	750220	MCHVIL PNSK WCM	MARION 2	1963	60	223- 258	-45	11/26	-47	11/14	-2
7-335	395720	750225	MCHVIL PNSK WCM	MARION 1	1957	61'	243- 278	-34	11/26	-33	11/14	1
7-341	395752	750411	MCHVIL PNSK WCM	DELA GARDEN 2	1955	39	115- 145	-27	11/27	-28	11/14	-1
7-348	395801	750119	MCHVIL PNSK WCM	PARK AVE 3	1958	19	240- 275	-31	11/26	-40	11/14	-9
7-354	395811	750549	CITIES SERVICE	PETTY IS OBS		12	- 143[3]	0	11/02	1	11/15	1
7-359	395835	750308	CAMDEN CITY W D	PUCHACK 5	1924	30	136- 181	-24	11/29	-20	11/19	4
7-367	395840	750307	CAMDEN CITY W D	PUCHACK 3	1924	10	127- 175			-26	11/19	
7-368	395848	750347	CAMDEN CITY W D	DELAIR 1	1960	10	103- 139[2]	-18	11/30	-13	11/19	5
7-370	395853	750348	CAMDEN CITY W D	DELAIR 3	1930	8	87- 129[2]	-14	11/30	-13	11/19	1
7-373	395901	750320	CAMDEN CITY W D	MORRIS 6	1932	14	98- 133	-14	11/30	-14	11/19	0
7-375	395910	750307	CAMDEN CITY W D	MORRIS 8		10	- 124[3]	-13	11/30	-15	11/19	-2
7-379	395919	750302	CAMDEN CITY W D	MORRIS 10	1960	16	75- 115			-16	11/19	
7-382	395929	750253	CAMDEN CITY W D	MORRIS 4A	1960	8	95- 134	-5	11/30	-12	11/19	-7
7-390	395944	750211	CAMDEN CITY W D	MORRIS 1		9	- 107[3]	-4	11/30	-6	11/19	-2
7-412	394922	745630	NJ WATER CO	ELM TREE 2	1963	149	1082-1092	-51	11/02	-62	11/16	-11
7-476	394215	745617	US GEOL SURVEY	NEW BROOKLYN 1	1960	111	1485-1495	-36	11/15	-46	11/16	-10
7-517	395243	750724	BROOKLAWN B W D	BBWD 4	1967	13	288- 319	-56	11/30	-56	11/09	0
7-523	395152	750542	BELLMAWR WD	BBWD 5	1977	75	458- 557			-62	12/01	
7-527	395556	750537	CAMDEN CITY W D	PARKSIDE 18	1976	40	258- 288			-37	11/12	
7-528	395835	750302	CAMDEN CITY W D	PUCHACK 7	1975	20	140- 180			-23	11/19	
11-137	392512	745212	DE ROSA	RAGOVIN 2100FT	1964	85	2083-2093			-37	11/17	
15- 24	395115	750706	DEPTFORD T MUA	DTMUA 4	1971	40	282- 345	-44	11/28	-48	11/09	-4
15- 69	394920	751619	GREENWICH T W D	GTWD 3(NEW 4)	1959	10	108- 168	-8	11/28	-9	11/14	-1
15- 72	394936	751747	E I DUPONT	REPAUNO 3	1950	6	91- 101			-1	11/17	
15- 76	394939	751704	HERCULES CHEM	4 1970	1970	15	90- 121[2]			0	11/14	
15- 96	394959	751650	HERCULES CHEM	GIBBSTOWN OB 2	1953	10	129- 134	-7	11/28	-6	11/14	1
15- 97	395000	751636	HERCULES CHEM	GIBBSTOWN TH 8	1954	6	102- 108	-2	11/28	-1	11/14	1
15-137	394535	752054	PURELAND W CO	PURE 2(3-1973)	1973	29	158- 208	-2	11/30	-5	11/16	-3
15-139	394608	752135	PURELAND W CO	TEST WELL 3	1970	8	301- 345	-9	11/30	-9	11/16	0
15-140	394608	752135	PURELAND W CO	TEST WELL 4	1970	8	132- 184	1	11/30	0	11/16	-1
15-143	394551	752313	PURELAND W CO	LANDTECT TW-6C	1970	19	106- 149	1	11/30	3	11/16	2
15-144	394613	752129	PURELAND W CO	1-1973	1973	8	81- 136[2]			-2	11/16	
15-146	394648	752318	PURELAND W CO	LANDTECT TW-9	1970	5	82- 101	-3	11/30	-3	11/16	0
15-158	394733	752351	MONSANTO CHEM	BRIDGEPORT W2	1961	11	57- 82	-21	12/04	-16	11/22	5
15-163	394747	752410	MONSANTO CHEM	BRIDGEPORT OB3	1960	5	- 118[3]	-17	12/04	-16	11/22	1
15-166	394755	752108	PENNS GROVE W C	BRIDGEPORT 2	1955	5	65- 85	2	11/29	2	11/16	0
15-170	394854	751906	CAMDEN LIME CO	REPAUP 1	1970	8	86- 106			2	11/15	
15-175	394839	752145	AM DREDGING CO	RACCOON IS T 1	1972	8	100- 120	-1	11/29	0	11/15	1
15-207	395156	751053	NATIONAL PK W D	NPWD 2	1956	30	241- 282			-31	11/14	
15-210	394921	751419	PAULSBORO W D	6-1973	1973	15	185- 227[2]	-12	11/29	-14	11/15	-2
15-212	394931	751449	PAULSBORO W D	PWD 4	1951	15	192- 220	-20	11/29	-22	11/15	-2
15-213	394950	751422	PAULSBORO W D	PWD 5	1957	10	135- 175			-10	11/15	
15-279	394857	751250	SHELL CHEM CO	SHELL OBS 7	1962	17	315- 320	-21	12/27	-23	11/08	-2
15-282	394913	751105	W DEPTFORD T WD	5 KINGS HIWAY	1973	55	388- 450	-26	08/23	-30	11/15	-4
15-296	394942	751317	SHELL CHEM CO	SHELL OBS 5	1962	21	321- 326	-14	11/13	-16	11/08	-2
15-308	395044	751242	PENNWALT CORP	TEST WELL 8	1969	10	231- 271			-14	12/13	
15-309	395045	751255	PENNWALT CORP	TEST WELL 5	1969	10	- 288[3]			-13	12/13	
15-311	395104	751244	PENNWALT CORP	TEST WELL 7	1969	10	- 243[3]	-11	11/30	-10	12/13	1
15-312	395107	750946	W DEPTFORD T WD	6 RED BANK AVE	1973	20	322- 372	-50	11/27	-58	11/15	-8
15-313	395136	750944	W DEPTFORD T WD	WDTWD 2	1961	23	307- 353	-54	11/27	-53	11/15	1
15-316	395159	750907	TEXAS OIL CO	EAGLE PT OBS 1	1948	32	288- 298	-49	10/03	-67	12/13	-18
15-323	395232	750942	TEXAS OIL CO	EAGLE PT OBS 3	1948	21	255- 275	-40	10/03	-52	08/15	-12
15-326	395216	750739	WESTVILLE W D	5-1971	1971	12	243- 277	-47	11/29	-47	11/16	0
15-327	395221	750737	WESTVILLE W D	WWD 4	1957	16	286- 313	-57	11/29	-55	11/16	2
15-331	394955	750908	WOODBURY W D	RAILROAD 5	1960	35	405- 457	-41	11/26	-44	11/14	-3
15-347	394932	751722	GREENWICH TWD	GTWD 5 (2-A)	1977	20	82- 117			-1	11/14	
15-349	394650	752316	PURELAND W CO	LANDTECT 2	1970	5	170- 220	-6	11/30	-6	11/16	0
15-350	394550	752313	PURELAND W CO	LANDTECT 1	1970	20	234- 284			-8	11/16	
15-354	394717	752117	ROLLINS ENVIR	DP 2	1976	13	80- 90			6	11/16	
15-357	394957	751737	E I DUPONT	OBS 7		4	- 105[3]	-5	11/23	-4	11/14	1
15-358	394958	751811	E I DUPONT	OBS 10		3	- 88[3]			-3	11/17	
15-359	395015	751727	E I DUPONT	C POWER 22		5	- 103[3]	1	11/29	1	11/17	0
15-382	394739	752232	MONSANTO CHEM	OBS 1(T-5)	1960	10	70- 90			-4	11/22	
21- 12	401536	742920	E WINDSOR MUA	6 TWIN RIVERS	1971	115	520- 560			28	10/19	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
21- 22	401702	743106	E WINDSOR MUA	EWMUA 3	1965	100	337- 367	43	12/05	47	10/19	4
21- 25	401717	743352	KENTILE CO	KENTILE 1	1954	100	205- 226[2]	67	12/05	65	10/26	-2
21- 26	401725	743159	E WINDSOR MUA	EWMUA 2	1964	100	260- 290			74	10/19	
21- 27	401730	743202	E WINDSOR MUA	EWMUA 1	1964	98	279- 295			73	10/19	
21- 30	400954	743853	GARDEN STATE WC	CROSSWICKS WC1	1959	23	268- 299			20	10/11	
21- 34	401033	743740	N J TURNPIKE AU	6N-1R	1972	91	291- 311	2	12/05	5	10/18	3
21- 39	401048	744036	STAUFFER CHEM C	1 (KEYE TEX)	1964	55	179- 199			13	10/20	
21- 43	401103	744155	BORDENTOWN W D	WHITE HORSE 2	1965	10	118- 138	-4	12/11	-4	10/11	0
21- 62	401353	743951	GARDEN STATE WC	PARK AVENUE 11	1969	100	162- 207[2]	38	12/05	42	10/11	4
21- 75	401420	744002	GARDEN STATE WC	PAXSON AVE 12	1974	76	120- 137			51	10/11	
21- 92	401152	744528	CHAMPALE INC	YARD WELL	1961	27	70- 80	-2	12/05	-1	10/25	1
21- 99	401159	743403	ENGLAND,ROBERT	ENGLAND NO 2	1966	118	404- 434	34	12/05	18	10/20	-16
21-101	401238	743448	PRINCETN MEM PK	MEMORIAL PK 1	1966	135	366- 421	43	12/05	30	10/19	-13
21-120	401555	743704	ELIZABETHTWN WC	WWWC 1-1965	1965	80	96- 121	75	12/06	77	12/05	2
21-145	401717	743352	KENTILE CO.	KENTILE 2	1954	100	205- 226[2]			67	10/26	
23- 1	403408	741326	US METLS AND RF		1954	15	- 42[3]			11	10/19	
23- 9	401800	743206	DANSER,FRANK	IRR-1950	1950	100	250- 280	71	11/15	71	10/16	0
23- 11	401818	742932	CARTER WALLACE		1956	115	255- 285			54	10/18	
23- 13	401841	743355	STULTZ, STANLEY	1-1954(CLIFRD)	1954	100	133- 163	73	11/14	73	10/18	0
23- 16	401842	743055	CRANBURY TWP WD	CTWD 1A	1972	95	230- 260	70	11/14	66	10/20	-4
23- 17	401843	743055	CRANBURY TWP WD	CTWD 3	1963	98	268- 298	72	11/14	67	10/20	-5
23- 28	401924	742909	CARTER WALLACE	CW 5	1964	105	298- 335	65	11/14	60	10/18	-5
23- 29	401916	742920	NJ TURNPIKE AU	7S-1		125	- 385[3]			57	10/18	
23- 33	401923	743247	DYAL, LEROY	DYAL 1 (1951)	1951	90	170- 180	72	11/15	66	10/24	-6
23- 50	402432	742212	ANHEUSER BUSCH	BUSCH 5	1963	37	215- 265			-44	07/03[4]	
23- 56	402437	742535	E BRUNSWICK TWD	TEST 2		97	- 175[3]	5	11/13	-2	11/02	-7
23- 57	402441	742448	CIAK BROS	COLONIAL OAKS	1954	122	216- 241	-19	11/13	-28	11/02	-9
23- 58	402448	742700	MIDDLESEX CO	TAMARACK 1-75	1975	108	87- 107			30	10/17	
23- 63	402501	742440	E BRUNSWICK TWD	EBTWD 1	1951	110	181- 221	-21	11/13	-29	11/02	-8
23- 64	402503	742812		BEECHER OBS	1941	85	35- 40			66	10/16	
23- 66	402527	742411	COLLINS, EDWARD	COLLINS	1954	140	198- 223			-7	11/02	
23- 70	402553	742717	FISCHER, ROBERT	FISCHER	1936	73	- 21[3]	58	11/02	57	11/20	-1
23- 72	402635	742402	SMITH,LAWRENCE	SMITH 2-1972	1972	80	120- 130			-14	10/17	
23- 73	402649	742524	PREMIUM PLASTIC	1 PREM PLASTIC	1956	80	72- 82	26	11/15	21	10/17	-5
23- 94	402239	742530	HELME PRODUCTS	5-1962 (OLD 2)	1962	60	183- 193	21	11/14	13	10/25	-8
23- 97	402247	742503	DUHERNAL W CO	DUHRNL OBS 49F	1946	39	236- 301[2]	10	11/21	2	11/20	-8
23-114	402319	742246	DUHERNAL W CO	DUHRNL OBS 52F	1945	25	- 237[3]	-25	11/21	-33	07/03[4]	-8
23-132	402335	742136	DUHERNAL W CO	DUHRNL OBS 56F	1947	25	262- 267	-34	11/21	-44	10/20	-10
23-136	402345	742050	OLD BRIDGE MUA	OLD BRIDGE 5	1957	30	280- 312	-40	11/15	-51	10/27	-11
23-146	402350	741834	OLD BRIDGE MUA	BROWNTOWN 3	1966	80	435- 480	-51	11/15	-55	10/20	-4
23-171	402404	742204	DUHERNAL W CO	DUHERNAL BF	1946	15	240- 300			-53	07/03[4]	
23-176	402411	741925	OLD BRIDGE MUA	OBS 1-1972	1972	45	321- 363	-53	11/15	-61	10/20	-8
23-179	402436	742041	OLD BRIDGE MUA	OBS 2-1972	1972	10	250- 292	-53	11/15	-61	10/27	-8
23-194	402536	742018	PERTH AMBOY W D	RUNYON 1	1930	18	- 160[3]	-73	11/02	-76	09/07	-3
23-202	402625	741611	NJ DEPT CONSERV	CHEESQUAKE SP1	1957	11	299- 320			-65	10/19	
23-206	402700	741459	OLD BRIDGE MUA	LAWRENCE HAR 9	1954	60	360- 395	-65	11/16	-75	10/20	-10
23-226	402013	742834	CITIES SERVICE	2	1967	132	330- 364			61	10/25	
23-229	402015	742757	MONROE TWP MUA	OBS 4-1961	1961	147	319- 330	65	11/13	58	11/20	-7
23-232	402023	742858	MONROE TWP MUA	FORSGATE 11	1961	130	272- 314	77	11/13	66	10/25	-11
23-236	402038	742345	NJ HOME FOR BOY	BOYS HOME 4	1963	95	410- 440	-1	11/14	1	10/16	2
23-238	402038	742755	FORSGATE FARMS	FARM WELL 4-R	1964	140	337- 367			63	10/25	
23-240	402051	742746	MONROE TWP MUA	12-1961	1961	145	305- 353	61	11/13	58	10/25	-3
23-243	402123	742215	DUHERNAL W CO	DUHRNL OBS 41F	1944	45	- 348[3]			-16	10/20	
23-255	403046	741827	CARBORUNDUM CO	1	1955	15	57- 67	7	11/14	7	10/16	0
23-257	403052	741654	ALL STAR DAIRY	ALL STAR 1	1932	61	- 158[3]	-33	11/16	-29	10/16	4
23-261	403150	741603	CHEVRON OIL CO	1	1951	30	74- 83			6	10/18	
23-262	403150	741603	CHEVRON OIL CO	WELL 1 OBS		30	72- 82	1	11/16	7	10/18	6
23-264	403200	741620	CHEVRON OIL CO	WELL 2 OBS		45	96- 106	-7	11/16	0	10/18	7
23-265	403211	741613	CHEVRON OIL CO	11		14	- 90[3]	5	11/16	2	10/18	-3
23-266	403212	741635	CHEVRON OIL CO	3	1951	57	87- 96	27	11/16	26	10/18	-1
23-267	403212	741635	CHEVRON OIL CO	WELL 3 OBS		57	86- 96	45	11/16	51	10/18	6
23-270	403231	741616	AMER CYANMID CO	TEST 2		12	- 57[3]	3	11/16	-5	10/18	-8
23-284	402022	743306	SIMONSON BROS.	1	1952	90	- 90[3]			81	10/24	
23-289	402056	742937	MONROE TWP MUA	15(KIMBRY-CLK)	1956	134	94- 124	80	11/13	73	10/25	-7
23-291	402109	743013	MONROE TWP MUA	OBS 1-1961	1961	107	192- 203	81	11/01	73	10/20	-8

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
23-295	402125	742920	GREFCO INC	LAKES CARBON 1	1966	120	187- 233			77	10/18	
23-298	402129	742901	STAUFFER CHEM	1	1965	120	217- 237			71	10/18	
23-302	402138	742940	MONROE TWP MUA	FORSGATE 14	1955	115	170- 200	88	11/13	82	10/18	-6
23-306	402147	742847	PHELPS DODGE CO	PHELPS DODGE 3	1968	120	191- 201	80	12/06	75	10/18	-5
23-315	402204	743024	S BRUNSWICK MUA	13	1971	103	103- 138	87	11/15	77	10/18	-10
23-316	402206	743515	AEROCHEM CORP	AEROCHEM 2	1961	120	- 100[3]	89	12/05	88	10/23	-1
23-319	402220	742950	S BRUNSWICK MUA	12	1963	93	95- 115	69	11/15	77	10/18	8
23-322	402230	743040	S BRUNSWICK MUA	11	1963	122	110- 135	83	11/15	80	10/18	-3
23-329	402315	742652	DEY BROTHERS	2	1955	115	215- 248	44	11/15	35	10/17	-9
23-348	402605	741957	SAYREVILLE W D	OBS WELL 101	1968	34	269- 279	-57	11/14	-60	10/20	-3
23-350	402608	741955	SAYREVILLE W D	OBS WELL 102	1968	30	267- 277	-64	11/15	-69	10/20	-5
23-353	402611	741955	SAYREVILLE W D	OBS WELL 103	1968	35	262- 273			-64	10/20	
23-365	402633	742120	DUHERNAL W CO	DUH SAY 4	1931	6	- 160[3]			-52	10/19	
23-370	402631	742053	HERCULES POWDER	HERCULES 6	1946	20	164- 194	-48	11/14	-53	10/20	-5
23-376	402649	742025	HERCULES POWDER	HERCULES 3	1928	41	180- 220	-52	11/14	-58	10/19	-6
23-380	402659	742020	HERCULES POWDER	HERCULES 2	1927	48	181- 237[2]	-52	11/14	-56	10/19	-4
23-384	402705	742023	HERCULES POWDER	HERCULES 1REBT	1939	59	170- 225			-50	10/19	
23-386	402701	741917	E I DUPONT	6	1930	102	253- 314	-56	11/14	-63	10/25	-7
23-389	402710	741910	E I DUPONT	5	1928	107	249- 304[2]	-51	11/14	-65	10/24	-14
23-391	402713	742032	HERCULES POWDER	HERCULES 4	1928	47	163- 226[2]	-50	11/14	-56	10/20	-6
23-392	402715	741924	E I DUPONT	1	1924	102	237- 291	-61	11/14	-69	10/25	-8
23-393	402715	741932	E I DUPONT	3	1925	94	244- 285[2]	-58	11/14	-62	10/24	-4
23-401	402744	741628	SAYREVILLE W D	MORGAN P	1967	44	254- 288			-75	10/20	
23-404	402745	741645	SAYREVILLE W D	MORGAN OBS 1	1966	23	238- 248	-57	11/16	-73	10/20	-16
23-411	402822	741630	SOUTH AMBOY W D	SAWD 8	1947	10	209- 234	-73	11/13	-68	10/20	5
23-415	402835	741815	NATIONAL LEAD C	4	1952	108	220- 251	-59	11/13	-60	10/23	-1
23-418	402843	741808	NATIONAL LEAD C	3	1934	117	240- 270	-60	11/13	-60	10/23	0
23-419	402854	741804	NATIONAL LEAD C	2	1934	104	220- 253	-59	11/13	-58	10/23	1
23-423	402943	741808	NATIONAL LEAD C	CL TEST 1	1956	30	75- 84	-50	11/13	-47	10/23	3
23-425	402729	741937	DUHERNAL W CO	DUHRNL OBS 60F	1966	149	282- 287	-41	11/14	-47	10/25	-6
23-429	402923	741648	JERS CENTRAL PL	WERNER STA 6	1969	22	154- 177	-45	11/13	-35	10/20	10
23-430	402923	741651	JERS CENTRAL PL	7-1972	1972	12	135- 165	-50	11/13	-40	10/20	10
23-432	402557	742138	SOUTH RIVER W D	SRWD 4	1975	18	149- 180[2]			-50	10/24	
23-438	402559	742142	SOUTH RIVER W D	SRWD 5	1977	20	132- 182			-49	10/24	
23-439	402633	742200	SOUTH RIVER W D	SO RIVER 2	1967	21	121- 126	-35	11/15	-40	11/20	-5
23-440	402648	742226	B&E CAB CO	1	1922	15	- 195[3]	-26	11/14	-32	10/19	-6
23-441	402748	742306	HERBERT SAND CO	HSC 3	1964	6	49- 52	5	11/14	2	10/16	-3
23-445	402328	742318	SPOTSWOOD WD	TW 4F-76	1976	12	195- 264[2]			-30	07/03[4]	
23-452	402401	742243	SCHWEITZER, P J	8	1947	36	226- 276			-38	07/03[4]	
23-456	402404	742235	SCHWEITZER, P J	1R	1956	21	235- 275			-51	07/03[4]	
23-462	403043	741842	UNION CARBIDE	CARBIDE 1	1965	15	47- 57	7	11/16	12	10/17	5
23-480	403236	741617	AMER CYANMID CO	CYAN WDBRG P1	1910	10	- 28[3]			-5	10/18	
23-482	403242	741617	AMER CYANMID CO	TEST 1		11	- 76[3]	3	11/14	-3	11/02	-6
23-484	403406	741433	PORT READING CO	READING 6		10	- 42[3]			0	10/19	
23-492	402129	742823	BASF-WYANDOTTE	BASF 3	1978	130	230- 276			68	10/18	
23-502	402432	742215	ANHEUSER BUSCH	BUSCH 7	1978	30	210- 260			-52	07/03[4]	
23-510	402234	743114	IBM CORP	GW-20	1978	119	30- 60			84	10/18	
23-511	402232	743114	IBM CORP	GW-18A	1978	118	65- 95			82	10/18	
23-514	402755	742258	HERBERT SAND	NEW-2-76	1976	5	25- 35			3	10/16	
25- 55	401744	742135	ENGLISHTWN B WD	ENGLISHTOWN 1	1963	70	651- 671	2	11/13	-7	10/19	-9
25-153	402444	741010	W KEANSBURG W C	W KEANSBURG 4	1970	65	635- 690[2]			-47	10/16	
25-228	401733	741818	GORDONS CRNR WC	GORDONS OBS	1975	146	730- 746			-20	10/20	
25-230	402004	741853	GORDONS CRNR WC	5-1972	1972	125	580- 670	-17	11/13	-41	10/20	-24
25-247	401902	741811	GORDONS CRNR WC	GORDONS 2	1964	146	762- 832			-26	10/20	
25-262	402102	741353	MARLBORO S HOSP	STATE HOSP 15	1966	140	730- 810	-23	11/15	-36	10/24	-13
25-268	402117	741511	MARLBORO T MUA	2-PROD	1972	114	632- 698[2]	-27	11/14	-40	10/23	-13
25-269	402122	741511	MARLBORO T MUA	1-PROD	1972	111	647- 716[2]	-32	11/14	-41	10/23	-9
25-272	402208	741452	MARLBORO T MUA	OBS 1	1972	117	670- 680			-44	10/23	
25-297	402603	741422	ABERDEEN W D	MATAWAN TWP 1	1956	80	447- 487	-59	11/15	-71	10/20	-12
25-318	402700	735958	NATIONAL PK SER	FT HANCOCK 2	1906	8	600- 724			-2	10/20	
25-320	402705	735959	NATIONAL PK SER	FT HANCOCK 5A	1970	14	838- 878	-2	11/16	-4	10/20	-2
25-416	401128	743057	FIELDS,J. & SON	FIELDS 1	1958	120	128- 537[2]			21	10/27	
25-453	402632	741051	UNION BEACH WD	3-77	1977	10	480- 532			-73	10/19	
25-466	402610	741351	ABERDEEN W D	3-77	1977	56	420- 470			-70	10/20	
29- 19	394829	740535	US GEOL SURVEY	IS BEACH 3	1962	9	2736-2756	10	11/15	0	11/09	-10

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 2.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI- TUDE	LOCATION LONGI- TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI- TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI- TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
29- 47	400433	740833	BRICK TWP MUA	OBS 1	1973	8	1709-1749[2]	2	11/16	-36	11/01	-38
29- 85	395929	741421	TOMS RIVER CHEM	TRCHEM 84	1968	67	1460-1480	-5	11/09	-23	11/09	-18
29-118	400105	742244	LAKEHURST N A S	LAKE NAS 32	1964	100	-1583[3]	-13	11/28	-23	10/31	-10
29-132	400329	741949	CLAYTON SAND	SCM 3	1962	95	1606-1728	-27	11/20	-33	10/26	-6
29-133	400329	741945	CLAYTON SAND	SCM 2	1961	95	1320-1477	-28	11/20	-23	10/26	5
29-135	400333	741942	CLAYTON SAND	SCM 4	1962	95	1342-1552	-33	11/20	-23	10/26	10
29-440	400504	741324	NJ WATER CO	LAKEWOOD 10	1972	72	1357-1602[2]	-5	12/08	-20	11/03	-15
29-490	395900	742055	AM SMELTNG & RF	2	1972	89	1436-1636	-33	11/20	-41	11/01	-8
29-491	395900	742102	AM SMELTNG & RF	1	1972	89	1460-1660	-34	09/04	-44	11/02	-10
29-492	395906	742138	AM SMELTNG & RF	OBS 1	1972	97	1561-1611	-25	11/20	-36	11/02	-11
29-575	400652	741717	JACKSON TWP MUA	JACKSON 9	1978	134	1276-1430			-35	10/26	
29-576	400652	741717	JACKSON TWP MUA	JACKSON 8	1977	140	1276-1462			-27	10/26	
29-580	400424	740822	BRICK TWP MUA	OBS 2	1976	8	1730-1780			-36	11/01	
29-581	400821	742634	JACKSON TWP MUA	MUA 10-77	1977	130	876- 976[2]			-1	10/26	
33- 30	392744	753153	PUBLIC SERV E-G	ART ISLAND	1968	15	825- 830	-9	12/03	-84	05/18[4]	-75
33- 64	393912	752436	E I DUPONT	COURSE LAND 3A	1966	30	568- 578	-10	08/31	-14	11/28	-4
33- 65	393912	752436	E I DUPONT	COURSE LAND 3B	1966	30	501- 512	-10	08/31	-14	11/28	-4
33- 66	393912	752436	E I DUPONT	COURSE LAND 3C	1966	30	375- 386	-10	08/31	-14	11/28	-4
33- 67	393936	752437	E I DUPONT	COURSE LAND P1	1966	10	445- 601[2]	-14	12/04	-17	11/28	-3
33- 69	394139	752349	NJ TURNPIKE AU	SERVICE IN-1	1953	40	313- 333	-18	12/07	-19	11/14	-1
33- 70	394141	752343	NJ TURNPIKE AU	SERVICE 1N-2		40	- 330[3]	-16	12/07	-20	11/14	-4
33- 71	394151	752407	NJ TURNPIKE AU	2-1S	1953	38	- 344[3]			-19	11/14	
33- 72	394154	752351	NJ TURNPIKE AU	SERVICE 1S-1	1953	40	342- 368			-19	11/14	
33- 80	394542	752510	AIR REDUCTION	AIRCO 1	1963	12	112- 132			-2	11/30	
33- 82	394542	752603	BRIDGE,BRUCE H	BRIDGE	1957	12	- 205[3]	-14	12/04	-11	11/27	3
33- 85	394556	752530	B F GOODRICH CO	6 (PW-2)	1967	10	109- 129			-8	11/30	
33- 86	394557	752523	B F GOODRICH CO	4 (PW-3)	1967	13	169- 189			-10	11/30	
33- 93	394612	752521	B F GOODRICH CO	TEST 7	1967	5	- 180[3]			-10	11/30	
33-107	393620	753310	NJ DEPT CONSERV	FT MOTT SP 1	1900	8	300- 320	-9	12/04	-20	11/17	-11
33-119	394009	753043	PENNSVILLE T WD	PTWD 2	1949	7	210- 230			-46	11/21	
33-122	394045	753018	ATLAN CITY ELEC	DEEPWATER 3R	1970	10	165- 235	-78	12/05	-60	11/21	18
33-125	394051	753030	ATLAN CITY ELEC	DEEPWATER 5	1953	10	149- 219[2]	-78	12/05	-61	11/21	17
33-127	394100	753030	ATLAN CITY ELEC	DEEPWATER 6	1958	10	158- 188	-68	11/26	-57	11/21	11
33-131	394109	753009	E I DUPONT	CHAMBERS OB2-1	1965	7	237- 247	-56	12/05	-48	11/21	8
33-132	394109	753009	E I DUPONT	CHAMBERS OB2-2	1965	7	192- 200	-62	12/05	-52	11/21	10
33-140	394131	753009	E I DUPONT	CHAMBERS OB3-2	1965	5	341- 347	-69	12/05	-71	11/21	-2
33-141	394131	753009	E I DUPONT	CHAMBERS OB3-3	1965	5	197- 207	-61	12/05	-49	11/21	12
33-164	393928	752147	RICHMAN ICE CRM	RICHMAN 2	1946	20	- 446[3]	-20	11/30	-29	11/28	-9
33-165	393942	752234	E I DUPONT	COURSE LAND 4A	1966	47	634- 644	-9	09/04	-14	11/28	-5
33-166	393942	752234	E I DUPONT	COURSE LAND 4B	1967	47	568- 578	-9	09/04	-14	11/28	-5
33-167	393942	752234	E I DUPONT	COURSE LAND 4C	1966	47	430- 440	-9	09/04	-14	11/27	-5
33-187	394037	751915	US GEOL SURVEY	POINT AIRY	1958	73	664- 672	-20	11/28	-25	11/12	-5
33-198	394117	752207	DUBOIS BROTHERS	IRR 74	1974	51	337- 362			-21	11/13	
33-251	393348	752755	US GEOL SURVEY	SALEM 1	1965	3	- 709[3]	-18	10/04	-27	11/28	-9
33-298	393952	752429	E I DUPONT	COURSE LAND P2	1966	9	385- 635	-16	12/04	-18	11/28	-2
33-299	393957	752432	E I DUPONT	COURSE LAND 1A	1966	26	604- 614	-14	12/04	-15	11/28	-1
33-300	393957	752432	E I DUPONT	COURSE LAND 1B	1966	25	507- 517	-9	12/04	-12	11/28	-3
33-301	393957	752432	E I DUPONT	COURSE LAND 1C	1966	26	404- 415	-8	12/04	-11	11/28	-3
33-302	394000	752439	E I DUPONT	COURSE LAND 2A	1966	30	583- 593	-13	12/04	-14	11/28	-1
33-303	394000	752439	E I DUPONT	COURSE LAND 2B	1966	30	533- 544	-6	12/04	-9	11/28	-3
33-304	394000	752439	E I DUPONT	COURSE LAND 2C	1966	30	435- 445	-5	12/04	-8	11/28	-3
33-305	394013	752459	E I DUPONT	COURSE LAND P3	1966	14	381- 457	-11	12/04	-13	11/28	-2
33-308	394058	752918	E I DUPONT	RANNEY 2	1955	18	394- 480	-35	12/05	-29	11/21	6
33-317	394127	752953	E I DUPONT	LAYNE 2	1939	5	138- 159			-31	11/21	
33-328	394157	752918	E I DUPONT	CARNEY PT 1	1967	5	175- 195			-21	11/21	
33-330	394205	752657	PENNS GROVE WSC	LAYTON 11	1944	16	- 394[3]			-38	11/22	
33-346	394256	752718	PENNS GROVE WSC	LAYNE 1	1956	19	317- 357	-36	12/07	-34	11/22	2
33-354	393904	751946	WOODSTOWN W D	WWD 2	1946	45	670- 705	-26	11/29	-35	11/14	-9
33-362	393926	751927	WOODSTOWN W D	3-75	1975	60	692- 712			-28	11/14	
33-363	392732	752940	PUBLIC SERV E-G	OWH	1974	5	- 944[3]			-53	05/18[4]	
33-364	392743	753158	PUBLIC SERV E-G	PW5	1974	17	765- 840			-78	05/18[4]	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

Upper Aquifer of the Potomac-Raritan-Magothy Aquifer System

Geohydrology

The upper aquifer of the Potomac-Raritan-Magothy aquifer system underlies the Coastal Plain of New Jersey, from the outcrop of the Magothy Formation (pl. 2) to the southeast. The upper aquifer is composed of sand with some silt and clay, mainly of the Magothy Formation of Late Cretaceous age. In the outcrop the aquifer may include younger surficial material. In the northern part of the Coastal Plain the upper aquifer consists primarily of the Old Bridge Sand Member of the Magothy Formation. Southeast of the outcrop, the aquifer may include the underlying Sayreville Sand Member of the Raritan Formation (Farlekas, 1979, p. 22). According to Zapecza (written communication, 1982), the upper aquifer thickens from less than 50 ft along the outcrop to greater than 200 ft in northeastern Monmouth County. The aquifer has an average thickness of 150 ft in the central part of the Coastal Plain and thins southward.

The lower confining layer is a thick sequence of silt and clay that separates the upper and lower aquifers. In the northern Coastal Plain this confining layer is the Woodbridge Clay Member of the Raritan Formation.

Overlying the upper aquifer of the Potomac-Raritan-Magothy aquifer system is the Merchantville-Woodbury confining bed. The Merchantville Formation and the Woodbury Clay of Late Cretaceous age form an effective confining layer separating the upper aquifer from the overlying Englishtown aquifer. This layer thickens from about 40 ft where it crops out, to 325 ft downdip (Gill and Farlekas, 1976).

Withdrawals from the upper aquifer are greatest in the northwestern parts of Burlington, Camden, and Gloucester Counties and in parts of Middlesex, Monmouth, and Salem Counties. Withdrawals are limited to these areas because of saltwater at some locations and available water from aquifers at shallower depths. Withdrawals in northern Monmouth County resulted in a reduction in freshwater head causing saltwater intrusion into the aquifer from Raritan Bay (Schaefer and Walker, 1981).

Water Levels

Water levels were measured in 279 wells screened in the upper aquifer of the Potomac-Raritan-Magothy aquifer system (table 3). Well density is greatest in the western part of the aquifer in Burlington, Camden, Gloucester, Middlesex, and Monmouth Counties. Well density is less in parts of Mercer, Monmouth, Ocean, and Salem Counties. No wells are known in Atlantic, Cape May, and Cumberland Counties.

Three prominent cones of depression are in the upper aquifer (pl. 2). The largest cone is centered in mid-Camden County where heads are as low as 90 ft below sea level. This cone in the upper aquifer is directly above the cone in the lower aquifer of the Potomac-Raritan-Magothy aquifer system (pl. 1). This may be caused by similar pumping in the two aquifers, a strong hydraulic connection between the aquifers, or both. In southwestern Gloucester and Salem Counties the heads are in part controlled by water-table conditions in and near the outcrop, but are also influenced by the pumping centered in Camden County.

Two other cones are in northern Monmouth County near Raritan Bay and in central Monmouth County. Heads are as low as 40 ft below sea level near Raritan Bay and 43 ft below sea level in central Monmouth County. These cones coalesce in northcentral Monmouth County. Heads are about 20 ft below sea level in this area, as well as in areas toward the southwest in the direction of the major cone centered in Camden County. These two smaller cones lie to the southeast and south of the large cone in the lower aquifer (pl. 1). Several smaller cones in the lower aquifer in Burlington and Salem Counties do not appear to influence the head distribution in the upper aquifer, indicating an ineffective hydraulic connection between upper and lower aquifers in these areas.

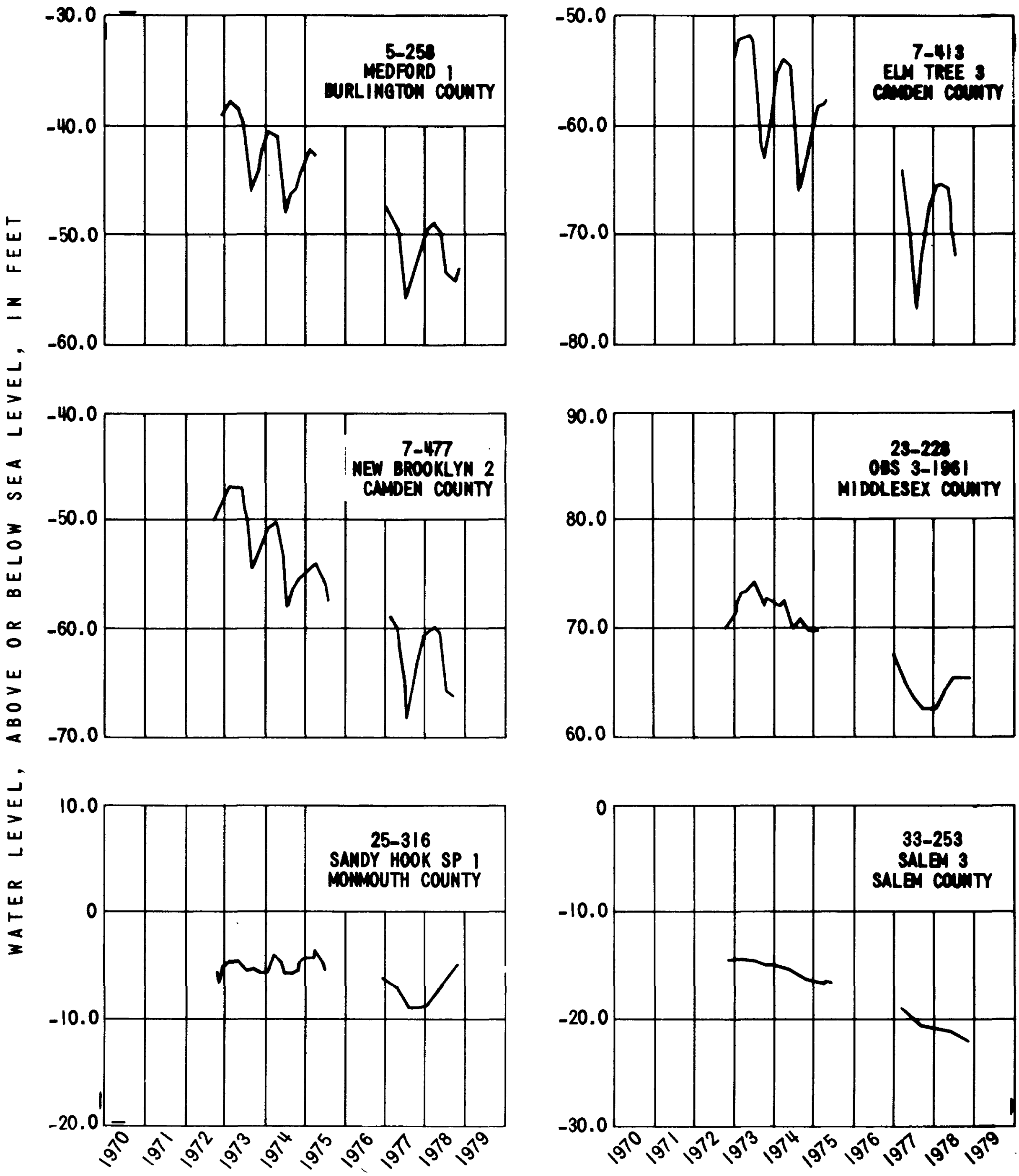
The highest heads are greater than 70 ft above sea level in southeastern Mercer and southern Middlesex Counties adjacent to the topographically high parts of the outcrop area (pl. 2). The highest heads in the upper aquifer generally coincide with high heads in the lower aquifer.

Water-Level Fluctuations

Change in water level from 1973 to 1978 was calculated for 167 of the wells (table 3). These values show a general decline in levels in much of the aquifer. Greatest declines were generally where head was lowest. In Burlington, Camden, and Gloucester Counties, near the large cone of depression, heads declined about 5 to 18 ft due to withdrawals. Near the potentiometric lows in Monmouth County the heads declined less than 10 ft. The areas of least decline or change are generally near the outcrop in parts of Burlington, Gloucester, Mercer, Middlesex, and Salem Counties. A few sites in eastern Monmouth County show small declines, possibly because of the use of surface water for public supply.

Hydrographs of six observation wells screened in the confined parts of the upper aquifer are shown in figure 5. In general, these hydrographs show a steady decline in water levels caused by withdrawals from the upper aquifer. Wells 5-258, 7-413, and 7-477, near the large cone of depression centered in Camden County (pl. 2.), show an average decline of about 2.5 to 3.0 ft/yr. Cyclic seasonal variations are caused by changes in pumping.

Wells 23-228, 25-316, and 33-253 are far from the large cones (pl. 2) and show a slower rate of decline. Well 33-253 in Salem County (fig. 5) shows a downward trend of 1.7 ft/yr. Well 23-228 is near the outcrop of the upper aquifer in Middlesex County (pl. 2). Although the well is not near a prominent cone, the decline is probably due to heavy pumping nearby. The patterns of the hydrographs for wells 23-228 (fig. 5) and 23-229 (screened in the lower aquifer at the same location, fig. 3) appear similar, although water levels are 8 ft lower in the lower aquifer. The similarity in the hydrographs and the difference in head in 1978 suggests vertical leakage between the aquifers. In well 23-228 and well 25-316 in northeastern Monmouth County, levels started recovering in early 1978. Well 25-316 shows an average decline of 0.5 ft/yr during 1973-78.



Lowest water level

See plate 2 for locations

Figure 5.-- Hydrographs of observation wells screened in the upper aquifer of the Potomac-Raritan-Magothy aquifer system.

TABLE 3.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE UPPER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
5- 70	400313	745004	BURLINGTON TWP	TEST 1	1970	60	140- 200			-13	11/14	
5- 76	400324	745152	HEAL,CHARLES JR	HEAL	1955	50	59- 80			-3	11/07	
5- 84	400342	744948	MASONIC HOME	MASONIC 1	1921	79	174- 194			8	11/12	
5-116	400708	743836	CHESTRFD SCHOOL	1	1957	102	247- 253	9	11/20	7	10/24	-2
5-160	400315	745408	NJ WATER CO	DVWC 22	1963	45	102- 123	8	11/27	15	11/15	7
5-165	395233	745418	EVESHAM M U A	EMUA 4	1970	110	464- 500	-73	11/29	-75	11/14	-2
5-167	395247	745157	EVESHAM M U A	PROD 5	1973	50	458- 555[2]			-70	11/14	
5-169	395322	745300	EVESHAM M U A	TEST 12-1972	1972	50	455- 475			-69	11/14	
5-170	395333	745440	EVESHAM M U A	EMUA 1	1956	89	369- 389	-66	12/05	-68	11/14	-2
5-171	395344	745503	EVESHAM M U A	EMUA 2	1963	100	405- 435	-64	12/05	-69	11/14	-5
5-173	395412	745619	LINCOLN HOMES	B.T. ROBERTS 2	1957	93	322- 375	-56	12/01	-66	11/08	-10
5-174	395432	745709	EVESHAM M U A	EMUA 3	1967	60	291- 331	-60	12/04	-69	11/08	-9
5-198	395720	744822	MOUNT HOLLY W C	LLWS 2	1960	10	336- 356			-45	11/14	
5-207	400356	744039	VAN MATER, CHAS	CRESANT FARMS		95	- 325[3]			-13	10/31	
5-211	400438	744519	O'BOYLE TRUCKIN	S J GROVE 1	1970	80	- 220[3]	-3	11/27	-5	11/07	-2
5-212	400515	744109	SCHOOL DISTRICT	N BURL CO HIGH	1959	83	290- 310	-12	11/23	-13	11/02	-1
5-216	400603	744326	LOUNSBERRY,L	ED PHARES	1949	95	- 196[3]			-2	10/30	
5-218	400718	744453	RIVER FRT MOTEL	MOTEL		60	- 100[3]	-6	11/20	-2	10/26	4
5-229	395630	745855	MAPLE SHADE WD	MSWD 9	1975	40	160- 200			-47	11/09	
5-249	395209	745043	LAKES W C	LWC 3	1968	55	523- 541	-49	12/08	-65	11/02	-16
5-251	395316	744946	MEDFORD W C	MWC 4(1968)	1968	49	506- 536	-49	11/26	-57	11/20	-8
5-252	395413	744922	MEDFORD W C	MWC 3	1957	48	506- 536	-47	11/26	-65	11/20	-18
5-253	395430	744850	MEDFORD LEAS	1-1972	1972	32	447- 471			-58	11/20	
5-258	395524	745025	US GEOL SURVEY	MEDFORD 1	1963	71	400- 410	-45	09/23	-52	11/06	-7
5-285	395924	744702	MOUNT HOLLY W C	MHWC 4	1964	16	307- 342	-48	11/27	-40	11/14	8
5-289	395935	744651	MOUNT HOLLY W C	MHWC 3	1953	19	316- 346	-47	11/27	-34	11/14	13
5-310	395728	745504	NJ TURNPIKE AU	MAINT 2	1952	40	120- 160			-40	11/14	
5-313	395830	745302	HAINES, WM JR	FARM WELL 2	1967	25	- 238[3]			-46	11/16	
5-315	395845	745240	HAINES, WM JR	FARM WELL 1	1958	55	200- 238	-32	11/30	-39	11/17	-7
5-383	395839	744249	PERMUTIT CORP	IONAC CHEM 2	1960	30	490- 521	-45	11/23	-34	10/14	11
5-438	400218	744604	THE GOLF FARM		1957	41	220- 230	-32	11/27	-22	11/07	10
5-446	400328	744636	INTERSTATE S-P	INTERSTATE 1	1960	75	220- 245	-13	11/26	-14	11/07	-1
5-707	395307	745339	MT. LAUREL MUA	5	1976	70	405- 441			-69	11/14	
5-728	395819	744341	MOBILE ESTATES	FIELD PUMP	1972	55	485- 500			-31	10/30	
5-730	400741	744300	INTERSTA. WASTE	MONITOR 9	1978	75	- 135[3]			5	10/26	
5-731	400739	744228	INTERSTA. WASTE	MONITOR 8	1978	91	118- 128			2	10/26	
5-745	400157	744819	BC COUNTRY CLUB	CLUB 1R	1974	102	260- 290			-18	11/14	
5-747	395921	745243	DITTMAR	1949	1949	80	- 257[3]			-39	11/24	
5-748	395848	745407	USS RANCOCAS	RANCOCAS 1	1959	80	- 170[3]	-47	11/29	-35	11/08	12
5-772	400134	744911	NJ TURNPIKE AU	INTERCHANGE 5R	1952	68	175- 185	-18	11/27	-15	11/14	3
7- 15	394648	745622	BERLIN WATER D	11-1972	1972	150	675- 745			-78	11/01	
7- 19	394738	745614	BERLIN WATER D	BWD 10	1967	145	645- 713			-75	11/16	
7- 30	395447	750711	SO JRSY PORT CM	NY SHIP 5A	1940	11	82- 100	-27	11/27	-22	11/13	5
7-114	395231	745910	WOODCREST CT CL	CLUB 2	1955	75	354- 385	-67	11/30	-75	11/05	-8
7-117	395229	745712	NJ WATER CO	HUTTON HILL 1	1965	158	552- 562	-65	11/02	-75	11/17	-10
7-120	395237	750031	HUSSMAN REFRIDG	HUSSMAN	1957	67	276- 306			-83	11/12	
7-131	395353	745708	NJ WATER CO	OLD ORCHARD B	1967	71	- 342[3]	-65	12/04	-74	11/08	-9
7-133	395353	745708	NJ WATER CO	OLD ORCHARD 36	1968	80	299- 349	-64	12/04	-73	11/08	-9
7-143	395441	750104	NJ WATER CO	ELLISBURG 16	1957	40	187- 220			-61	11/09	
7-148	395455	745929	NJ WATER CO	KINGSTON 28	1964	44	175- 207	-59	12/04	-63	11/08	-4
7-149	395502	750221	N J NATIONAL GD	1	1956	15	96- 111			-52	11/15	
7-151	395514	750213	GARDEN STATE RA	RACE TRACK	1944	30	- 158[3]	-48	11/27	-51	11/13	-3
7-162	395608	750025	NJ WATER CO	COLUMBIA 24	1961	34	- 167[3]			-46	11/07	
7-193	395256	750633	CRSCENT TRLR PK	1	1952	20	59- 71			-39	11/09	
7-243	394712	750413	CAMDEN COUNTY	LAKELAND 2		25	- 386[3]	-68	11/26	-78	11/08	-10
7-245	394717	750420	CAMDEN COUNTY	LAKELAND 1		50	- 420[3]	-59	11/26	-70	11/08	-11
7-252	394759	750158	GAR ST WC-BLKWD	BLACKWOD DIV 6	1971	75	407- 477	-61	11/28	-73	11/09	-12
7-274	395030	750347	NJ WATER CO	OTTERBROOK 39	1968	60	269- 349	-79	11/27	-81	11/08	-2
7-275	395231	750312	NJ WATER CO	HADDON 20	1958	61	236- 267	-78	11/29	-77	11/09	1
7-279	395238	750317	NJ WATER CO	HADDON 30	1965	65	224- 275			-76	11/09	
7-285	395248	750433	NJ WATER CO	EGGBERT 18	1958	24	144- 191	-61	11/29	-63	11/09	-2
7-293	395418	750336	HADDON TWP BD E	HADDON TWP HS1	1966	15	142- 162	-55	11/27	-56	11/15	-1
7-299	395322	750158	HADDONFIELD W D	LAYNE 2	1956	65	206- 246	-76	11/29	-80	11/08	-4
7-310	394928	750024	NJ WATER CO	LAUREL 13	1954	77	394- 456	-72	11/27	-76	11/08	-4
7-311	394928	750027	NJ WATER CO	LAUREL 15	1964	75	395- 473[2]			-80	11/08	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH

TABLE 3.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE UPPER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
7-322	395358	750447	NJ WATER CO	OAKLYN TEST	1961	33	101- 111	-52	11/29	-52	11/07	0
7-392	394641	745909	PINE HILL MUA	PHMUA 1	1962	150	627- 669	-65	12/04	-71	11/07	-6
7-398	394726	745911	PINE HILL MUA	PHMUA 2-1972	1972	200	668- 698	-69	12/04	-81	11/08	-12
7-404	395055	750420	NJ WATER CO	RUNNEMEDE 19	1958	67	297- 339	-75	11/27	-78	11/13	-3
7-410	395041	750056	NJ WATER CO	SOMERDALE 14	1956	95	- 441[3]	-77	11/27	-90	11/08	-13
7-411	395238	750121	TAVISTOCK CLUB	COUNTRY CLUB 1	1968	30	219- 247	-70	11/27	-77	11/12	-7
7-413	394922	745630	NJ WATER CO	ELM TREE 3	1963	149	706- 717	-59	11/02	-69	11/16	-10
7-422	395124	745952	NJ WATER CO	ASHLAND 17	1958	68	379- 421	-78	12/05	-87	11/13	-9
7-426	395129	745906	NJ WATER CO	VOORHEES 21	1959	129	422- 482	-73	12/05	-84	11/13	-11
7-477	394215	745617	US GEOL SURVEY	NEW BROOKLYN 2	1961	111	829- 839	-53	11/15	-64	11/16	-11
15- 1	393912	750522	CLAYTON W D	CWD 3	1956	133	746- 800[2]	-56	11/28	-62	11/21	-6
15- 3	394015	750559	CLAYTON W D	4-1973	1973	140	670- 740	-53	11/28	-63	11/21	-10
15- 6	394627	750813	WOODBURY W D	SEWELL 1A	1967	20	263- 308	-47	11/26	-52	11/14	-5
15- 8	394628	750813	WOODBURY W D	SEWELL 2A	1973	21	244- 307	-50	11/26	-50	11/14	0
15- 9	394746	750511	DEPTFORD T MUA	5-1971	1971	78	414- 447	-56	08/20	-59	11/09	-3
15- 11	394814	750914	DEPTFORD T MUA	DTMUA 2	1958	58	255- 281	-39	11/28	-47	11/09	-8
15- 28	394755	751327	E GREENWICH W D	EGWD 2	1956	70	191- 216	-18	11/30	-21	11/08	-3
15- 60	394206	750758	GLASSBORO W D	GWD 3	1956	150	562- 612	-51	11/27	-60	11/20	-9
15- 62	394241	750642	GLASSBORO W D	GWD 2	1947	145	562- 602	-56	11/27	-66	11/20	-10
15- 63	394308	750702	GLASSBORO W D	GWD 4	1961	146	549- 599	-55	11/28	-63	11/20	-8
15-127	394346	750959	LEONARD,WM	LEONARD 5	1958	140	- 524[3]	-36	11/27	-46	11/22	-10
15-129	394409	751328	SO JERSEY W C	SJWC 1	1950	35	- 263[3]	-22	11/27	-25	11/22	-3
15-147	394706	751951	SHOEMAKER, R A	1	1954	10	33- 39	-3	11/30	-4	11/20	-1
15-183	394431	750911	PITMAN CNTY CLB	COUNTRY CLUB 1	1967	85	378- 408	-46	11/28	-51	12/06	-5
15-191	394629	750859	SEWELL W C	SWC 2	1965	60	336- 368	-57	11/26	-60	11/09	-3
15-192	394641	751109	EDENWOOD W C	EWC 1	1957	88	315- 337	-27	11/27	-37	11/08	-10
15-194	394732	751037	MANTUA WATER CO	MWC 3	1969	10	233- 265	-45	11/29	-48	11/09	-3
15-226	394411	750745	PITMAN W D	PWD P2	1947	130	475- 515	-65	11/28	-67	12/06	-2
15-227	394426	750747	PITMAN W D	PWD P3	1960	99	447- 487	-65	11/28	-60	12/06	5
15-236	394434	751843	SWEDESBORO B WD	SBWD 3	1969	75	241- 312[2]	-17	11/29	-21	11/15	-4
15-238	394438	751833	SWEDESBORO B WD	SBWD 2	1940	30	217- 240			-21	11/15	
15-240	394510	751838	DEL MONTE CORP	9	1963	30	190- 231	-12	11/30	-22	11/15	-10
15-242	394512	751830	DEL MONTE CORP	6	1944	25	267- 298			-21	11/15	
15-248	394339	750433	WASHINGTON TMUA	WTMUA 5	1973	125	559- 618			-63	11/21	
15-253	394437	750249	WASHINGTON TMUA	6(FRIES MLS 1)	1964	152	584- 652	-56	11/30	-65	11/21	-9
15-261	394520	750218	WASHINGTON TMUA	WTMUA 1	1959	100	581- 612	-65	11/30	-72	11/08	-7
15-268	394732	750447	WASHINGTON TMUA	4-1972	1972	77	369- 417[2]			-72	11/21	
15-275	394751	750912	WENONAH WATER D	WWD 2	1951	50	268- 310	-46	11/27	-51	11/15	-5
15-276	394821	751026	W DEPTFORD T WD	WDTWD 4	1963	60	242- 288	-39	11/27	-39	11/15	0
15-281	394912	751026	W DEPTFORD T WD	WDTWD 3	1957	61	227- 243			-35	11/15	
15-297	394942	751317	SHELL CHEM CO	SHELL OBS 6	1962	21	113- 118	-9	12/27	-11	11/08	-2
15-303	395030	751236	PENNWALT CORP	TEST WELL 1	1969	10	- 114[3]	-7	11/30	-6	12/13	1
15-330	394858	750845	WOODBRY HGTS BO	1 HELEN AVE	1972	40	190- 235			-44	11/16	
15-332	395017	750928	WOODBURY W D	PARKING LOT 3	1946	50	148- 188	-9	11/26	-31	11/14	-22
15-339	394350	751910	GRASSO,J S	1	1969	90	247- 267	-17	12/03	-19	11/13	-2
15-345	394642	751823	MUSUMECI,PETER	1	1954	62	94- 100	-11	12/04	-12	11/16	-1
15-348	394910	751541	GREENWICH TWD	GTWD 6	1978	20	105- 135			-9	11/14	
15-355	394822	751247	E GREENWICH W D	EGWD 3		42	205- 245			-28	11/08	
21- 4	401408	743114	PRNCTON TURF FM	S.KRISTAL 1973	1973	145	290- 330			49	04/30[4]	
21- 7	401458	743152	CONOVER DAIRY	1-1949	1949	145	241- 251			53	10/20	
21- 16	401604	743358	E WINDSOR MUA	EWMUA 4	1962	90	125- 145	74	12/05	71	10/19	-3
21- 18	401558	743003	CAPAZELLO FARMS	1-IRR	1941	110	- 250[3]			52	10/17	
21- 19	401608	743354	E WINDSOR MUA	EWMUA 5	1966	90	133- 181	74	12/05	71	10/19	-3
21- 21	401631	743246	MCGRAW HILL PUB	MCGRAW HILL 1	1958	97	153- 173	59	12/05	57	10/23	-2
21- 33	401030	743753	N J TURNPIKE AU	6N-2	1956	85	164- 184	5	12/05	8	10/18	3
21- 46	401119	743810	CHRYANOWSKI,L S	1-1957	1957	60	138- 141			32	11/02	
21- 81	401621	743129	HIGHTSTOWN W D	HIGHTSTOWN 1	1946	100	181- 205	76	12/06	75	10/17	-1
21- 84	401621	743129	HIGHTSTOWN W D	HIGHTSTOWN 2	1947	100	181- 205	77	12/06	77	10/17	0
21- 95	401052	743525	ALLENTOWN W D	AWD 1	1952	70	- 273[3]	27	11/13	24	10/25	-3
21-102	401240	743741	MERCER MOBLE HM	1973 WELL	1973	110	145- 155			43	10/30	
21-103	401309	743702	SUB PRO NAT GAS	SUBURBAN 1	1953	110	183- 186	62	12/05	61	10/20	-1
21-104	401344	743236	GELLER AL	1953	1953	120	245- 248			47	10/25	
21-130	401844	743543	DRUMAND, ALEX	E HAHN 1	1956	90	92- 95	45	11/06	45	10/26	0
21-144	401622	743130	HIGHTSTOWN	OBS FOR T3	1977	100	- 200[3]			74	10/17	
23- 15	401842	743055	CRANBURY TWP WD	CTWD 2	1917	95	- 110[3]	74	11/14	59	10/20	-15

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[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

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WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
23- 18	401841	742905	CARTER WALLACE	CW 2	1957	98	161- 201	68	11/14	60	10/18	-8
23- 22	401857	742908	CARTER WALLACE	CW 9	1951	120	- 209[3]	66	11/14	59	10/18	-7
23- 24	401858	743015	DANSER,CLENDON	1	1959	115	- 152[3]	62	11/14	76	10/25	14
23- 32	401918	743048	BARCLAY FARMS	1 (C.DANSER)	1954	120	- 152[3]	73	11/14	69	10/26	-4
23- 35	402010	742838	CITIES SERVICE	1	1956	138	167- 197			69	10/25	
23- 96	402239	742540	HELME PRODUCTS	4R	1972	40	32- 42			38	10/25	
23- 98	402051	742604	NJ WATER CO	JAMESBURG 6	1954	50	99- 120	49	11/13	47	10/16	-2
23-101	402030	742115	MOLDER FISH	1973	1973	50	211- 223			17	10/23	
23-109	402302	742256	DUHERNAL W CO	DUHERNL OBS 26	1942	24	- 101[3]	3	11/21	1	10/27	-2
23-140	402247	742132	DUHERNAL W CO	DUHERNL OBS 23	1941	34	- 78[3]			13	10/27	
23-142	402346	741832	OLD BRIDGE MUA	BROWNTOWN 1	1967	90	199- 249			8	10/27	
23-144	402347	742241	DUHERNAL W CO	DUHERNAL 6	1938	18	51- 71	-7	11/21	1	10/27	8
23-145	402348	742050	OLD BRIDGE MUA	11-1972	1972	30	80- 120			8	10/28	
23-159	402358	742156	DUHERNAL W CO	DUHERNAL OBS 5	1938	20	55- 63	2	11/21	0	10/27	-2
23-161	402358	742211	DUHERNAL W CO	DUHERNAL 2	1938	18	62- 73	-6	11/21	-17	10/27	-11
23-163	402359	742220	DUHERNAL W CO	DUHERNAL 3	1938	22	61- 76			-15	10/27	
23-172	402404	742205	DUHERNAL W CO	DUHERNAL 1	1938	13	55- 75			-22	10/27	
23-173	402406	741620	MADISON T BD ED	IRA-71	1971	60	173- 193	-3	11/15	-4	10/19	-1
23-174	402407	741920	OLD BRIDGE MUA	BROWTOWN OBS	1961	45	- 150[3]	12	11/15	10	10/23	-2
23-180	402439	742124	DUHERNAL W CO	DUHERNAL OBS 1	1938	19	57- 67	4	11/21	4	10/27	0
23-182	402449	741819	BOWNE, CLYDE	BROWNTOWN	1932	31	66- 71	19	11/06	17	11/20	-2
23-190	402526	741603	NAPPI TRUCK CO	2-1965	1965	140	- 253[3]			5	10/23	
23-203	402632	741459	OSCHWALD BRICK	1	1914	50	156- 200			-1	11/01	
23-205	402700	741459	OLD BRIDGE MUA	LAWRENCE HAR 8	1948	60	193- 213	-4	11/16	-6	10/20	-2
23-208	402712	741806	OLD BRIDGE MUA	1-HOPE PK.	1956	140	167- 181			23	10/23	
23-228	402015	742757	MONROE TWP MUA	OBS 3-1961	1961	147	128- 138	73	11/02	66	11/20	-7
23-237	402038	742755	FORSGATE FARMS	FORSGATE FARM4	1954	140	178- 222			47	10/25	
23-244	402131	742245	REESE, AUGUST	1971	1971	60	152- 158			-2	10/17	
23-245	402202	742305	MONROE TWP MUA	RELIABLE 1	1963	55	131- 161	19	11/13	20	10/27	1
23-250	402252	742301	DUHERNAL W CO	DUHERNL OBS 10	1938	22	83- 93	11	11/21	9	10/27	-2
23-292	402109	743013	MONROE TWP MUA	OBS 2-1961	1961	107	93- 104	83	11/01	77	10/20	-6
23-296	402126	742939	QUALITY EGG CO	2 (ABEEL,J.F.)		115	- 97[3]			104	10/18	
23-343	402553	742033	NJ WATER POLICY	SUN BISCUIT 5	1968	17	36- 39	9	11/02	8	10/19	-1
23-344	402558	742013	SAYREVILLE W D	SWD 2	1957	22	76- 82	17	11/02	15	10/24	-2
23-351	402608	741957	SAYREVILLE W D	SWD 1		35	- 37[3]	19	11/02	22	10/28	3
23-359	402618	741952	SAYREVILLE W D	SAYREVILLE D	1958	29	64- 75			21	10/20	
23-369	402630	741949	SAYREVILLE W D	SAYREVILLE H	1960	45	67- 83			35	10/20	
23-383	402703	741859	E I DUPONT	8A	1954	97	97- 116	43	11/14	40	10/25	-3
23-403	402745	741631	SAYREVILLE W D	SWD Q-1973	1973	40	78- 136[2]	18	11/13	10	10/20	-8
23-413	402824	741631	SOUTH AMBOY W D	SAWD 9	1965	10	25- 47	6	11/13	8	10/20	2
23-414	402825	741632	SOUTH AMBOY W D	SAWD 10	1967	10	38- 48	1	11/13	9	10/20	8
23-427	402900	741644	SWAN HILL ICE C	SWAN HILL 1	1922	20	40- 52	14	11/13	13	10/20	-1
23-433	402555	742133	NJ WATER POLICY	SO RIVER 4	1968	20	30- 33	8	03/12	7	10/24	-1
23-442	402252	742432	SPOTSWOOD WD	3-73	1973	30	63- 78[2]			20	10/27	
23-444	402326	742313	DUHERNAL W CO	DUHERNAL 9	1938	14	62- 72	10	11/21	10	10/27	0
23-447	402329	742319	SPOTSWOOD WD	SWWD 1	1957	18	64- 85	11	11/13	14	10/27	3
23-490	401925	742620	MONROE TWP MUA	8-R	1974	167	287- 325			51	10/17	
23-494	402338	742315	SPOTSWOOD WD	5	1978	23	83- 97			12	10/27	
23-500	402018	743021	S BRUNSWICK TWP	BROADWAY T	1978	105	131- 161			68	10/18	
23-507	401801	743154	DANSER,FRANK	UNUSED DOM		105	- 130[3]			69	10/16	
23-508	401801	743154	DANSER,FRANK	DOMEST-73	1973	105	- 90[3]			68	10/16	
23-509	402530	741602	NAPPI TRUCK CO	MARZ MASON	1961	130	126- 136			6	10/28	
23-517	401923	742830	KAISER AG CHEM	KAISER	1962	120	165- 196			61	10/18	
25- 3	401002	743554	TOTTEN FARM	TOTTEN 1	1975	90	210- 243			15	10/23	
25- 8	402441	740233	ATLAN HIGH W D	AHWD 3	1946	15	547- 572	-16	11/15	-15	10/24	1
25- 13	401137	740121	AVON WATER DEPT	AWD 4	1974	29	1105-1165			-16	10/31	
25- 34	401558	740908	NAD EARLE	NAD EARLE 2(B)	1944	135	810- 836	-24	11/16	-24	10/18	0
25- 36	401604	741144	HOMINY HIL FARM	1 MERCER,H D	1942	109	- 686[3]	-35	11/16	-35	10/20	0
25- 37	401610	741205	HOMINY H GOLF C	GLF CLB 2-1963	1963	137	686- 706			-30	10/19	
25- 45	401742	741228	FLOCK AND SONS	1	1963	66	649- 677	-32	11/16	-31	10/19	1
25- 56	401744	742135	ENGLISHTWN B WD	ENGLISHTOWN 2	1965	70	363- 384	12	11/13	9	10/19	-3
25- 62	401134	741014	ROKEACH & SONS	4-DEEP	1961	75	831- 885	-25	12/08	-25	10/25	0
25- 82	401412	741606	FREEHOLD TWP WD	KOENIG LANE 1	1957	130	619- 670	-34	11/14	-43	10/25	-9
25- 85	401436	741525	3M COMPANY	1	1957	120	653- 700	-42	11/14	-39	10/25	3
25- 89	401452	741727	CLAYTON, WM D	CLAYTON 1	1955	185	582- 612	-58	11/13	-58	11/02	0

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[2]MULTIPLE SCREENS
[3]WELL DEPTH

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WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
25- 91	401516	741530	BROCKWAY GLASS	BROCKWAY 2	1969	140	632- 685	-41	11/14	-38	10/24	3
25- 97	401625	741501	FREEHOLD TWP WD	6-OLD SO.GULF2	1966	195	596- 656	-39	11/14	-42	10/25	-3
25- 99	401633	741728	FREEHOLD BOR WD	FREEHOLD 3	1964	110	482- 567	-24	11/14	-26	10/24	-2
25-101	401635	741721	FREEHOLD BOR WD	FREEHOLD 5	1970	123	518- 572	-27	11/14	-31	10/24	-4
25-103	401646	741737	FREEHOLD TWP WD	7-74	1974	107	478- 575			-53	10/25	
25-111	402532	740932	W KEANSBURG W C	W KEANSBURG 1	1957	59	326- 366	-32	11/14	-39	10/16	-7
25-112	402537	740933	W KEANSBURG W C	W KEANSBURG 2	1960	44	312- 352	-32	11/12	-40	10/16	-8
25-116	402400	735912	HIGHLANDS W D	HWD 2 NEW	1961	10	600- 660	-12	11/16	-15	10/25	-3
25-118	402401	735934	HIGHLANDS W D	HWD 1	1949	15	649- 709	-15	11/16	-15	10/29	0
25-119	402403	735923	HIGHLANDS W D	HWD 3	1973	15	719- 779			-13	10/25	
25-121	402023	741100	S.S. WHITE DIV.	1 (PENNWALT)	1960	80	560- 590	-29	11/16	-26	10/18	3
25-146	402327	741114	BELL TELE CO	CRAWFRD HILL 1	1962	280	555- 585			-31	10/23	
25-154	402445	741019	W KEANSBURG W C	W KEANSBURG 3	1964	73	400- 430			-39	10/23	
25-175	401246	741516	ADELPHIA W C	1(HOVBILT CO)	1969	100	681- 762			-29	11/01	
25-177	401255	741147	SCHROTH, EMIL A	SCHROTH	1969	95	781- 801			-16	11/01	
25-196	402628	740744	KEANSBURG W D	KWD 3	1942	12	308- 348			-40	05/17[4]	
25-197	402535	741214	KEYPORT BORO WD	KEYPORT 7	1976	35	304- 354			-27	10/18	
25-199	402542	741220	KERR GLASS CO	REPLACEMENT 2	1964	20	285- 315			-34	10/18	
25-201	402615	741055	ESSIE CONST. CO	LEX LUCAS 1	1965	20	250- 282	-28	11/15	-23	10/17	5
25-202	402623	741147	KEYPORT BORO WD	KEYPORT BORO 5	1955	20	204- 267			-14	10/23	
25-203	402626	741146	KEYPORT BORO WD	KEYPORT BORO 1	1927	11	211- 271	-23	11/14	-14	10/23	9
25-206	402625	741145	KEYPORT BORO WD	KEYPORT BORO 4	1939	15	225- 249			-14	10/23	
25-207	402626	741145	KEYPORT BORO WD	KEYPORT BORO 6	1970	11	247- 277	-19	11/14	-14	10/23	5
25-214	401429	742146	MANALAPAN T W D	LAMBS RD 1	1971	190	585- 641	-2	11/14	-6	10/19	-4
25-218	401557	742318	BOY SCOUTS AMER	QUAIL HILL 2	1967	250	510- 527			20	10/16	
25-220	401537	742012	BATTLEGROUND CC	IRRIGATION	1967	120	539- 569	-19	11/13	-21	10/19	-2
25-244	401850	741459	GORDONS CRNR WC	GORDON WC7	1969	160	524- 594			-35	10/20	
25-251	401908	741510	GORDONS CRNR WC	GORDON WC9	1971	125	478- 575[2]			-35	10/20	
25-252	401909	741512	GORDONS CRNR WC	GORDON WC8	1969	125	506- 577	-39	11/13	-37	10/20	2
25-259	402034	741420	MARLBORO S HOSP	STATE HOSP 12	1950	155	508- 593			-18	10/24	
25-282	402507	741344	BAYSHORE	BAYSHORE 1	1976	10	245- 260			-13	10/19	
25-284	402515	741450	MATAWAN BORO WD	MATAWAN BORO 3	1956	90	231- 271			-7	10/18	
25-288	402349	741232	ABERDEEN T MUA	MATAWAN MUA 3	1967	83	345- 425			-31	10/17	
25-292	402359	741233	ABERDEEN T MUA	MATAWAN MUA 1	1962	87	341- 414			-33	10/17	
25-293	402403	741245	ABERDEEN T MUA	MATAWAN MUA 2	1962	70	316- 354			-32	10/17	
25-294	402428	741345	MATAWAN BORO WD	MATAWAN BORO 1	1944	20	222- 252	-23	11/19	-23	10/19	0
25-295	402427	741348	MATAWAN BORO WD	MATAWAN BORO 2	1943	20	228- 258			-22	10/19	
25-314	402500	740811	ENGI PREC CASTG	1-1964	1965	20	354- 364			-38	10/17	
25-316	402536	735905	STATE OF NJ	SANDY HOOK SP1	1965	11	371- 397	-2	09/20	-5	10/20	-3
25-317	402612	740511	SEA COAST PROD.	SMITH 1	1946	10	- 420[3]			-12	10/23	
25-321	402706	735952	NATIONAL PK SER	FT HANCOCK 4	1941	5	332- 486			-4	10/20	
25-322	401157	742418	RESTINE, P J	RESTINE 1	1956	210	667- 697	3	11/13	4	11/01	1
25-332	401930	735841	MON BCH CLD STR	MBCS 1971 DEEP	1971	10	817- 850			-13	12/05	
25-333	401214	740355	MONMOUTH CON WC	JUMPING BR 5	1956	35	- 870[3]	-27	11/15	-22	10/31	5
25-334	401214	740355	MONMOUTH CON WC	JUMPING BR 4	1951	23	1013-1065	-23	11/15	-21	10/31	2
25-343	401232	740101	ASBURY PARK W D	LAYNE 2R-1956	1956	20	1084-1124			-13	10/30	
25-345	401233	740100	MONMOUTH CON WC	LAYNE 3-1958	1958	20	1085-1125	-16	11/15	-14	10/30	2
25-358	402047	740420	RED BANK W D	1B-1950	1950	40	637- 687			-29	10/25	
25-360	402054	740320	RED BANK W D	4-75	1975	146	668- 759[2]			-31	10/25	
25-362	401312	742802	ROOSEVELT W D	ROOSEVELT 3	1956	198	442- 472			28	11/01	
25-363	401315	742812	ROOSEVELT W D	ROOSEVELT 2	1935	160	415- 445			28	11/01	
25-419	402632	741049	UNION BEACH W D	UBWD 1 1962	1962	10	235- 285			-22	10/19	
25-420	402634	741051	UNION BEACH WD	UBWD 2 1969	1969	10	262- 289			-16	10/19	
25-424	402641	740911	INT FLAVOR FRAG	I F F 2	1955	10	302- 326			-31	10/17	
25-434	400926	740749	STATE OF N J	ALLAIRE S P 3	1967	40	1004-1029			-31	10/31	
25-436	400952	740725	BRISBANE C T C	3-1971	1971	60	990-1033	-22	11/16	-26	10/31	-4
25-456	402640	740904	INT FLAVOR FRAG	IFF-3R	1976	10	277- 316			-34	10/17	
25-457	401551	742212	KNOB HILL C C	KNOB 1-74	1974	108	475- 495			13	10/19	
25-459	402219	740337	NAVESINK C C	1-78	1978	80	551- 612[2]			-23	08/08	
25-462	402717	740816	KEANSBURG AMUSE	1-69	1969	10	200- 250[2]			-13	10/18	
29- 70	395905	740359	OCEAN CO W C	MONTEREY 1	1967	5	1375-1495[2]			-21	11/03	
29-100	395956	740344	OCEAN CO W C	NORMANDY 3	1954	8	1428-1479	-10	11/19	-18	10/30	-8
29-134	400333	741942	CLAYTON SAND	SCM 1	1961	95	746- 962	-30	11/20	-24	10/26	6
29-238	400824	742630	JACKSON TWP MUA	JACKSON 7	1974	130	584- 648[2]			-10	10/26	
29-453	395808	740416	LAVALLETTE W D	LWD 4	1960	5	1358-1515	-21	11/19	-19	11/06	2

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 3.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE UPPER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM--CONTINUED

WELL NUMBER	LOCATION LATITUDE	LOCATION LONGITUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTITUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTITUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
29-504	400210	740310	OCEAN CO W C	MANTOLOKING 7	1960	5	1263-1368[2]	-16	11/19	-18	10/30	-2
29-524	400409	740406	PT PLEASANT W D	PPWD 7	1967	8	1183-1260	-29	11/19	-20	11/04	9
29-531	400454	740414	PT PLEASANT W D	PPWD 5	1960	18	1256-1342	-18	11/19	-19	11/04	-1
33- 75	394258	752200	BOY SCOUTS AMER	AUBURN HILL CP	1941	17	129- 134	-6	12/03	-11	11/14	-5
33- 76	394328	752446	DAWSON,H W	DAWSON 1	1957	27	118- 123	4	12/10	3	11/22	-1
33-105	393458	752945	DILWORTH,J R	DILWORTH	1950	10	- 263[3]	-15	11/30	-21	11/21	-6
33-109	393734	753149	SIEGFRIED CHEM	1973-1	1973	5	116- 131			-2	11/20	
33-111	393746	752955	PENNSVILLE T WD	HOOK RD OBS	1971	10	190- 235	-12	01/30[4]	-14	11/28	-2
33-117	393954	753013	PENNSVILLE T WD	PTWD 3	1956	7	87- 102	-3	12/05	-4	11/21	-1
33-126	394057	752950	E I DUPONT	RANNEY 7	1966	15	52- 140[2]	0	12/05	1	11/21	1
33-128	394102	752946	E I DUPONT	RANNEY 6	1966	15	50- 60	-2	12/05	-3	11/22	-1
33-135	394110	752955	E I DUPONT	RANNEY 5	1963	16	47- 116	0	12/05	2	11/21	2
33-253	393348	752755	US GEOL SURVEY	SALEM 3	1965	3	335- 340	-14	10/04	-22	11/28	-8
33-325	394149	752918	E I DUPONT	CARNEY PT 3	1933	5	- 102[3]	-9	12/07	-7	11/22	2
33-333	394208	752859	E I DUPONT	CARNEY PT 5	1957	5	- 81[3]	-5	12/07	-2	11/22	3
33-342	394236	752721	NJ WATER POLICY	PENNS GROVE 24	1941	18	46- 51	-4	11/13	-5	11/28	-1
33-355	393914	751930	WOODSTOWN ICE C	C1	1927	58	- 360[3]	-20	11/29	-29	11/09	-9
33-360	393750	753131	PENNSVILLE T WD	5	1979	10	101- 117			-7	11/21	
33-361	394205	752700	PENNS GROVE WSC	SCULTZ 4	1978	13	54- 64			-9	11/22	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1974

Englishtown Aquifer

Geohydrology

The Englishtown Formation is composed largely of medium to fine grained quartz sand and clayey silt of Late Cretaceous age. The outcrop of the Englishtown Formation (pl. 3) stretches in an irregular band from Raritan Bay to the Delaware River.

Several lithofacies of the Englishtown Formation have been recognized in New Jersey. Probably the most significant are the upper and lower sand and interbedded clayey silt facies described by Nichols (1976, p. 12-15). The Englishtown aquifer is composed of the upper and lower sand facies of the Englishtown Formation (Nichols, 1976, p. 20). In this report, as in Nichols' (1977) analysis of the Englishtown aquifer, the areal head distribution is represented by the upper sand in southern Monmouth and northern Ocean and Burlington Counties because of limited data for the lower sand.

The greatest thickness of the aquifer is about 140 ft in parts of northern and southern Monmouth and northern Ocean Counties (Nichols, 1976, fig. 11, p. 23). The aquifer thins southward and is absent in the deeper subsurface of the southeastern Coastal Plain (Zapecza, written communication, 1982).

According to Nichols (1976, p. 43), the underlying sequence of sediments, including the combined thickness of the Merchantville Formation and the Woodbury Clay, acts as the lower confining layer for the Englishtown aquifer.

The overlying Marshalltown Formation and the fine grained lower part of the Wenonah Formation form a leaky upper confining layer separating the Englishtown aquifer from the overlying Wenonah-Mount Laurel aquifer. Nemickas (1976) and Nichols (1977) discuss leakage through this layer. Vertical leakage from overlying beds provides a significant source of recharge to the Englishtown aquifer (Nichols, 1977, p. 62).

Withdrawals from the Englishtown aquifer are greatest in southeastern Monmouth County and northeastern Ocean County where the upper sand is the principal aquifer. However, two wells (29-438, 29-449) are screened in both the upper and lower sands near Lakewood. At Lavallette two wells (29-452, 29-454) withdraw water from only the lower sand. Irrigation, domestic, and other wells are in and near the outcrop. No known large-capacity wells exist south of Camden County.

Water Levels

Water levels were measured in 85 wells screened in the Englishtown aquifer (table 4). Most wells are near the coast in southern Monmouth and northern Ocean Counties. A few are in Burlington, Camden, and Middlesex Counties. No wells were measured in Atlantic, Cape May, Cumberland, Gloucester, Mercer, and Salem Counties.

The lowest heads in the Englishtown aquifer are near Point Pleasant in northern Ocean County (pl. 3). Locally, heads are lower than 200 ft below sea level; the lowest measured head was 247 ft below sea level. Heads are also low near Lakewood, Ocean County (160-230 ft below sea level). The highs (greater than 120 ft above sea level) are southeast of the outcrop in Monmouth County.

The lowest heads in the Englishtown aquifer are about 140 ft lower than in either aquifer of the Potomac-Raritan-Magothy aquifer system. However, withdrawals from the Englishtown are about 5 percent of the withdrawal from the Potomac-Raritan-Magothy aquifer system. The transmissivity of the Englishtown is relatively low (Nichols, 1976, p. 59), contributing significantly to its lower heads.

Water levels were measured in two water supply wells in the Lakewood area (29-438 and 29-449). These wells are screened in both the lower and upper sands, and the water levels are a composite of the heads in both sands. The level in a nearby observation well (29-441), screened in only the lower sand, is 14 ft higher than well 29-438 and 34 ft higher than well 29-449. Therefore, the composite heads in these water-supply wells may be higher than the heads in the upper sand.

In east central Ocean County where the upper sand thins and is not used for water supply, wells (29-452, 29-454, 29-534) screened in the lower sand show heads from 78 to 119 ft below sea level.

Water-Level Fluctuations

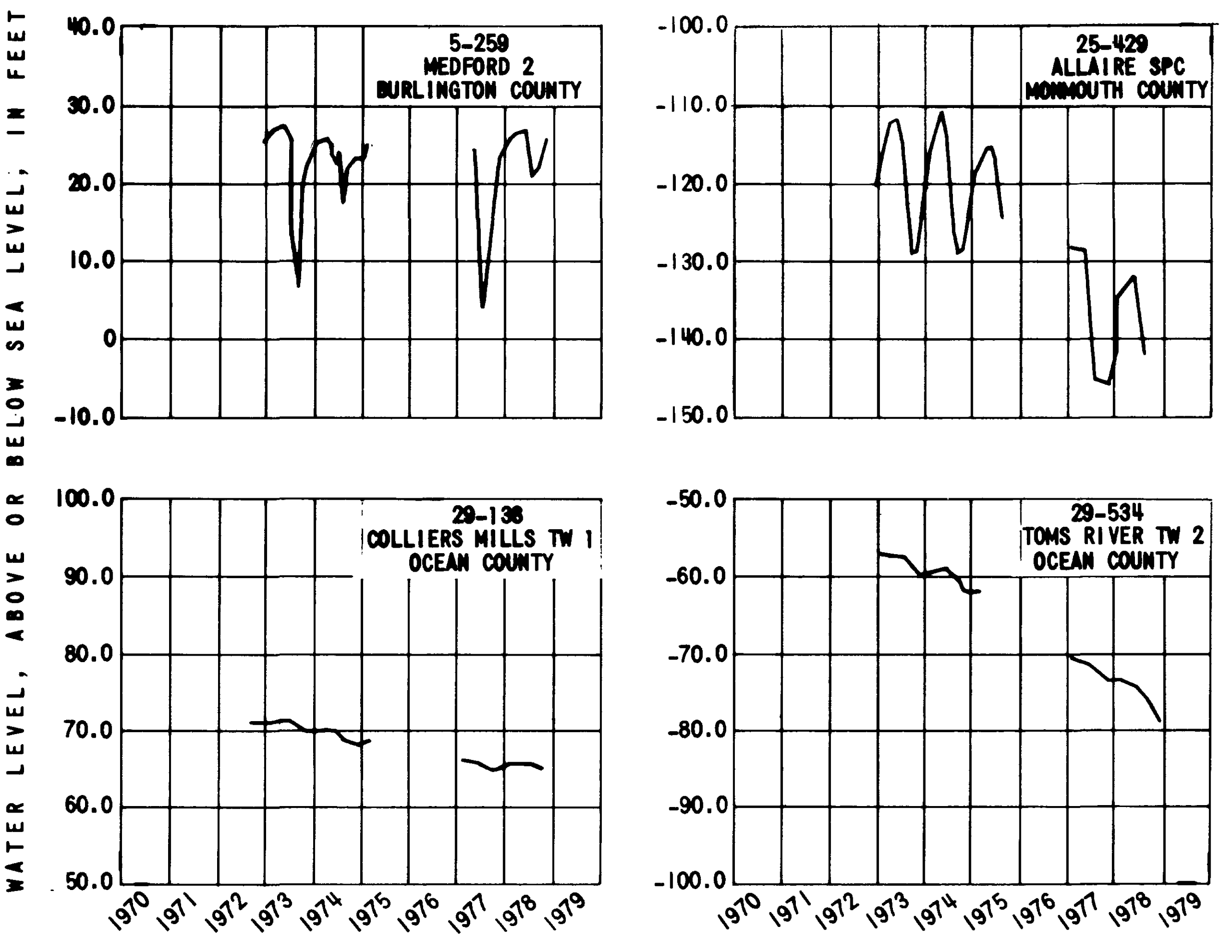
Change in water level from 1973 to 1978 was calculated for 56 of the wells (table 4). The changes show a general decline in potentiometric heads in most of the aquifer. Greatest head declines (2 to 31 ft) were generally where the head was lowest (pl. 3). In Ocean County declines in the lower sand ranged from 19 to 31 ft in three wells (29-452, 29-454, and 29-534). The smallest head changes were generally in the northern and western parts of the aquifer near the outcrop.

Figure 6 shows hydrographs of four observation wells (5-259, 25-429, 29-138, 29-534) screened in the Englishtown aquifer; locations are on plate 3. The hydrographs show unique patterns relating to their proximity to pumping wells and large withdrawal centers. Well 5-259 in northern Burlington County is far from the large pumping center. The large seasonal variations in well 5-259 in 1973 and 1977 are probably due to pumping at a nearby irrigation well and do not represent regional seasonal variations for the aquifer. The long-term trend (fig. 6) shows little or no change.

Observation well 29-138 in northwestern Ocean County is about 12 mi west of Lakewood. The hydrograph shows small cyclic seasonal variations and declining water levels (1.2 ft/yr). Levels at this site respond to regional pumping in the Englishtown aquifer.

Well 25-429 is close to areas of lowest head (pl. 3). The hydrograph shows an average decline of 3.8 ft/yr. Seasonal variations of 15 to 18 ft/yr are probably caused by seasonal withdrawal changes 3 to 4 mi east of the site and similar regional changes where head was lowest.

Well 29-534, screened in the lower sand facies in northern Ocean County, is 7.5 mi southwest of the nearest pumping wells (29-452 and 29-454) at Lavallette. The hydrograph shows an average decline of 3.5 ft/yr. The decline is similar to well 25-429, screened in the upper sand north of heavy pumping centers. Seasonal fluctuations for well 29-534 are similar to well 29-138, screened in the upper sand in western Ocean County, demonstrating possible hydraulic continuity of the lower sand with the updip parts of the aquifer. Unpublished data show about 4 percent of withdrawals from the Englishtown aquifer in Ocean and Monmouth Counties in 1978 were from the lower sand. The lower sand is lithologically and hydrologically continuous with the aquifer over some undefined areas in southern Monmouth County (Nichols, 1976, p. 22). Therefore, levels in well 29-534 are affected by pumping elsewhere in the Englishtown aquifer. The decline in August 1978 is probably a response to increased withdrawals at the Lavallette wells during July, August, and September 1978. The annual withdrawal from the Lavallette wells increased about 40 percent between 1977 and 1978.



Lowest water level
See plate 3 for locations

Figure 6.-- Hydrographs of observation wells screened in the Englishtown aquifer.

TABLE 4.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE ENGLISHTOWN AQUIFER

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
5-195	395833	745042	THOMAS, ALFRED	THOMAS D-1	1954	60	70- 74	24	11/24	25	11/14	1
5-197	395653	744921	JONES, LESTER		1953	41	148- 159	28	06/25	26	11/09	-2
5-202	395804	744811	ELEC PART SPECI	ELECTRONIC P 1	1953	33	101- 121			9	11/08	
5-205	395909	744807	PLASTICON CORP	1955 WELL	1955	45	97- 107	17	11/28	18	11/09	1
5-259	395524	745025	US GEOL SURVEY	MEDFORD 2	1963	73	253- 263	19	09/23	25	11/07	6
5-387	395943	744120	PEM T BDED		1973	42	208- 228			44	11/01	
5-437	400210	744138	KAUFFMAN MINTER		1960	74	94- 105			62	11/01	
5-733	400412	743822	BRIGHT VIEW FAR	3		139	203- 205			77	10/31	
5-753	400541	743642	WEIDEL REAL EST	1		95	- 141[3]			71	11/06	
5-754	395941	743250	US ARMY FT DIX	RANGE HQ 7	1975	100	418- 447			50	11/03	
7-166	394807	745806	CLEMENTON W D	CWD 9	1954	150	367- 457[2]	19	12/04	0	11/06	-19
7-529	394832	745915	CLEMENTON W D	CWD11	1978	60	250- 283			6	11/06	
23-211	401819	742248	VLCEJ, STEPHEN	1972	1972	105	43- 49			90	10/17	
23-516	402122	741846	NOVAK	HULSART		110	- 19[3]	98	11/05	94	11/20	-4
25- 1	401401	740025	ALLENHURST W D	AWD 4	1950	17	525- 565	-73	11/15	-86	10/31	-13
25- 5	401346	740034	MONMOUTH CON WC	APWD 4	1963	8	540- 580	-80	11/15	-89	10/31	-9
25- 9	402441	740234	ATLAN HIGH W D	AHWD 2	1923	15	- 200[3]	7	11/15	10	10/24	3
25- 16	401037	740148	BELMAR BORO WD	BWD 3 ELEC(12)	1949	20	563- 594	-170	11/21	-188	10/30	-18
25- 23	401040	740146	BELMAR BORO WD	BWD 13	1973	20	555- 605	-171	11/21	-183	10/30	-12
25- 26	401102	740045	BELMAR BORO WD	BWD 4 ELEC(11)	1941	15	601- 671	-150	11/21	-165	10/30	-15
25- 28	400623	740429	BRIELLE WATER D	BWD 3	1967	90	770- 820	-202	11/21	-219	11/03	-17
25- 30	400645	740345	BRIELLE WATER D	BWD 2	1950	33	690- 750	-202	11/21	-233	11/03	-31
25- 38	401622	741156	HOMINY H GULF C	GLF CLB 1-1941	1941	126	328- 338	61	11/16	60	10/19	-1
25- 46	401747	741221	CEDAR DR EL SCH		1963	122	212- 232	72	11/16	70	10/20	-2
25- 47	401803	740814	ROSENBERG, M	ROSENBERG 1	1957	80	322- 342	32	11/16	35	10/18	3
25- 54	401742	740232	OLD ORCHARD C C	OLD ORCHARD 1	1952	40	360- 380			10	10/30	
25- 64	401155	741011	FARMINGDALE W D	FARMINGDALE 4	1970	85	410- 470	-66	11/15	-73	10/25	-7
25- 79	401331	741944	CLAYTON, WM D	CLAYTON 2	1955	170	303- 333			123	11/02	
25- 80	401415	741501	WORTHINGTON BIO	1-1967	1967	120	294- 334	77	11/14	75	11/01	-2
25- 90	401513	741528	BROCKWAY GLASS	BROCKWAY 1	1956	140	240- 260	86	11/14	89	10/24	3
25- 96	401624	741502	FREEHOLD TWP WD	5-OLD SO.GULF1	1964	200	327- 356	88	11/14	87	10/25	-1
25-105	401654	741736	FREEHOLD TWP WD	POINT IVY 1	1967	130	150- 212[2]	112	11/14	104	10/25	-8
25-107	401701	741417	MUELLER,DR.R.W.	DURAND,E. 1960	1960	163	249- 257	76	11/16	81	10/30	5
25-132	402202	741002	BELL TELE CO	BELL LAB 2	1960	120	191- 221	75	11/17	64	10/20	-11
25-150	402432	740848	LILY TULIP CUP	LILY TULIP 2	1962	65	97- 122	34	11/17	36	10/22	2
25-151	402439	740849	LILY TULIP CUP	LILY TULIP 1	1962	60	101- 126			33	10/22	
25-161	400745	741333	HOWELL T BD ED	KENT RD	1955	110	558- 582			-101	11/02	
25-162	400815	741043	NJ NATURAL GAS	1-1973	1973	69	500- 560	-100	11/24	-114	10/30	-14
25-213	401253	742122	BLUE STAR STABL	1969	1969	165	275- 285			117	11/03	
25-216	401518	742230	MANALAPAN T W D	MANALAPAN 1	1967	122	113- 174[2]	119	11/05	119	11/22	0
25-217	401545	742137	LAWN ELECT CO	1-1958	1958	100	- 83[3]			98	10/23	
25-239	401838	741324	MARLBORO IND PK	1	1963	128	201- 231	90	11/15	108	10/26	18
25-250	401918	741529	GORDONS CRNR WC	VILLAGE 215	1964	139	185- 215	100	11/05	100	11/03	0
25-256	401937	741428	MARLBORO S HOSP	STATE HOSP 4		125	- 124[3]			88	10/24	
25-263	402103	741351	MARLBORO S HOSP	STATE HOSP 13	1953	140	142- 168	87	11/16	87	10/24	0
25-264	402103	741357	MARLBORO S HOSP	STATE HOSP 6	1936	135	162- 184	90	11/15	92	10/24	2
25-306	402232	740831	HARMYK AND SONS	HARMYK 2	1963	225	315- 335			51	10/20	
25-353	401542	740530	US ARMY	F MONMUTH 1NCO	1972	140	314- 327	-5	11/16	-7	11/01	-2
25-371	400800	740231	SEA GIRT W D	SGWD 4	1949	18	685- 715	-190	11/21	-209	10/26	-19
25-374	400804	740227	SEA GIRT W D	SGWD 5	1963	20	660- 710	-191	11/21	-205	10/26	-14
25-383	400849	740207	SPRING LAKE W D	SLWD 1	1940	15	631- 711	-213	11/16	-205	10/26	8
25-384	400845	740210	SPRING LAKE W D	SLWD 2	1941	15	640- 700	-194	11/16	-207	10/26	-13
25-385	400915	740146	SPRING LAKE W D	SLWD 3	1941	20	640- 705	-182	11/16	-197	10/26	-15
25-386	400952	740149	SPRING LAKE W D	SLWD 4	1967	15	600- 670	-178	11/16	-186	10/26	-8
25-388	400845	740312	SPRING LK HT WD	SPRING LK HGT3	1966	25	630- 680			-204	10/27	
25-389	400859	740308	SPRING LK HT WD	SPRING LK HGT2	1953	60	660- 711	-194	11/21	-203	10/27	-9
25-408	401007	743201	THECKER, DUNCAN	D T ASSOC 1	1969	105	96- 119	98	11/24	101	04/30[4]	3
25-414	401119	743108	VANHISE, MR	1954	1954	140	126- 131			114	10/24	
25-427	400824	740508	WALL TWP W D	ALLENWOOD 2	1959	80	658- 710	-202	11/16	-204	10/25	-2
25-428	400823	740455	WALL TWP W D	ALLENWOOD 1	1959	100	623- 740[2]			-219	10/25	
25-429	400834	740834	US GEOL SURVEY	ALLAIRE S P C	1963	98	623- 633	-127	11/06	-143	11/03	-16
25-441	401028	740638	WALL TWP W D	RT 34 WELL	1968	120	549- 649	-136	11/20	-162	10/25	-26
25-442	401053	740341	WALL TWP W D	IMPERIAL PARK 2	1943	70	627- 657	-147	11/20	-164	10/25	-17
25-461	402432	740848	LILY TULIP CUP	TEST FOR 2	1962	65	- 130[3]			35	10/22	
25-463	402240	741539	GARRISON	DUG-1924	1924	110	- 24[3]			93	10/23	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 4.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE ENGLISHTOWN AQUIFER--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
29- 5	400405	740242	OCEAN CO W C	BAY HEAD 5	1947	10	750- 834	-237	11/19	-226	10/26	11
29- 35	400358	740812	BRADLEES CORP	BRADLEES WELL	1969	25	670- 710			-177	10/27	
29-138	400414	742702	US GEOL SURVEY	COLL MILLS TW1	1964	137	417- 427	70	11/09	65	11/13	-5
29-229	400712	741512	JACKSON TWP MUA	JACKSON 1	1961	110	511- 557			-84	10/26	
29-233	400742	741639	JACKSON TWP MUA	JACKSON 4	1965	80	448- 500			-52	10/26	
29-430	400220	741154	LAKWD TMUA	S LAKEWOOD 1	1969	90	752- 817			-178	11/02	
29-431	400250	741044	LAKWD TMUA	S LAKEWOOD 2	1963	40	680- 762[2]	-177	11/28	-202	11/02	-25
29-433	400312	741123	LAKWD TMUA	S LAKEWOOD 3	1966	45	673- 741			-207	11/02	
29-434	400354	741310	LAKEWOOD W C	LWC 7	1964	85	697- 757	-229	11/28	-227	11/01	2
29-438	400443	741352	LAKEWOOD W C	LWC 8	1965	78	600- 758[2]			-152	11/01	
29-441	400505	741114	LAKEWOOD W C	LWC OBS	1966	30	726- 736	-135	11/28	-136	11/01	-1
29-449	400614	741157	LAKEWOOD W C	LWC 9	1968	55	569- 698[2]	-163	11/28	-170	11/01	-7
29-450	400622	741349	LAKEWOOD W C	LWC 6	1960	70	520- 582	-110	11/28	-135	11/01	-25
29-451	400636	741515	LAKEWOOD TWP	ST GABRIELS 1	1957	60	510- 530	-92	11/24	-102	11/03	-10
29-452	395741	740437	LAVALLETTE W D	LWD 3	1948	7	1120-1180	-86	11/19	-117	11/06	-31
29-454	395808	740421	LAVALLETTE W D	LWD 2	1931	5	1009-1136	-90	11/19	-119	11/06	-29
29-519	400401	743200	NEW EGYPT WC	1	1907	65	214- 239			52	11/03	
29-530	400454	740413	PT PLEASANT W D	PPWD 6	1965	20	730- 790			-236	11/04	
29-532	400459	740359	PT PLEASANT W D	PPWD 3	1946	10	748- 798	-249	11/19	-247	11/04	2
29-534	395609	741240	US GEOL SURVEY	TOMS RIVER TW2	1965	18	1080-1146	-59	11/09	-78	11/01	-19

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS

Wenonah-Mount Laurel Aquifer

Geohydrology

The Wenonah Formation and overlying Mount Laurel Sand of Late Cretaceous age are composed primarily of fine- to coarse-grained sand. The Mount Laurel Sand is a coarser sand unit than the Wenonah Formation, and is the principal component of the aquifer (Nemickas, 1976, p. 8). These units crop out as an irregular band from Raritan Bay to the Delaware River (pl. 4).

The Wenonah Formation and Mount Laurel Sand are hydraulically connected (Nemickas, 1976, p. 8) and their combined sand thickness forms the Wenonah-Mount Laurel aquifer. The aquifer is about 40 ft thick near Raritan Bay and along the outcrop. The aquifer thickens downdip and southward to about 130 ft in northcentral Salem County. The subsurface thickness exceeds 100 ft south of Camden County (Zapecza, oral communication, 1980).

The Marshalltown Formation and the fine grained lower part of the Wenonah Formation form the leaky lower confining layer separating the Wenonah-Mount Laurel aquifer from the underlying Englishtown aquifer. This confining layer transmits significant quantities of water from the Wenonah-Mount Laurel aquifer to the Englishtown aquifer (Nemickas, 1976, and Nichols, 1977).

The Navesink Formation lies directly above the Wenonah-Mount Laurel aquifer and is the basal unit of the upper confining layer. In addition to the Navesink Formation the upper confining layer can include most or only a few of the following geologic units: the Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, Manasquan Formation, Shark River Marl, Piney

Point Formation, and the basal clay of the Kirkwood Formation. Locally, some units may act as minor aquifers. However, for this report all units that lie stratigraphically between the top of the Wenonah-Mount Laurel aquifer and the base of the Kirkwood-Cohansey aquifer system or Atlantic City 800-foot sand of the Kirkwood Formation (fig. 2) are considered to act as a confining layer (Zapecza, written communication, 1982). Recharge to the Wenonah-Mount Laurel aquifer is mainly from vertical leakage from overlying units (Nemickas, 1976, p. 17).

Withdrawals from the Wenonah-Mount Laurel aquifer are greatest in parts of Burlington, Camden, Monmouth, and Salem Counties (about 1.1 Mgal/d per county in 1978). Gloucester County withdrawal was less than 0.1 Mgal/d. Nemickas (1976, p. 37) indicates that about two thirds of the total decline (1959-70) in the Wenonah-Mount Laurel aquifer can be attributed to withdrawals from the Englishtown aquifer. Nichols (1977, p. 62-64) showed that from 1959 to 1970, losses by leakage through the lower confining layer to the Englishtown aquifer were significant.

Water Levels

Water levels were measured in 93 wells tapping the Wenonah-Mount Laurel aquifer (table 5). Approximately 90 percent of the wells measured were in Burlington, Camden, Monmouth, and Salem Counties. Five wells are in Gloucester County, five, in Ocean County, and one, in Cumberland County. No wells were measured in Atlantic, Cape May, Mercer, or Middlesex Counties.

The lowest observed heads were near Avon-by-the-Sea and Spring Lake Heights, southern Monmouth County, where levels ranged from 140 ft to 195 ft below sea level (wells 25-336 and 25-391). These lows are in the northern part of the most extensive cone in the aquifer. The configuration and position of the major cones in plate 4 are similar to the major cones in the Englishtown aquifer (pl. 3). They are centered where little or no water is withdrawn from the Wenonah-Mount Laurel aquifer and where the heavy concentration of withdrawal is from the Englishtown aquifer. This similarity of head distributions and the absence of significant local withdrawal from the Wenonah-Mount Laurel aquifer indicates a strong hydraulic connection between the two aquifers.

Lesser cones exist where small municipal supplies are withdrawn from the Wenonah-Mount Laurel aquifer in Burlington and Salem Counties (pl. 4). The lowest potentiometric levels ranged from 4 to 42 ft below sea level.

The highest levels are along the outcrop generally coincident with the topographic highs in Burlington and Monmouth Counties. Levels are greater than 120 ft above sea level in Burlington County and 140 ft in Monmouth County.

The position and configuration of several potentiometric contours in Lakewood and coastal Ocean County were approximated because of insufficient data.

Water-Level Fluctuations

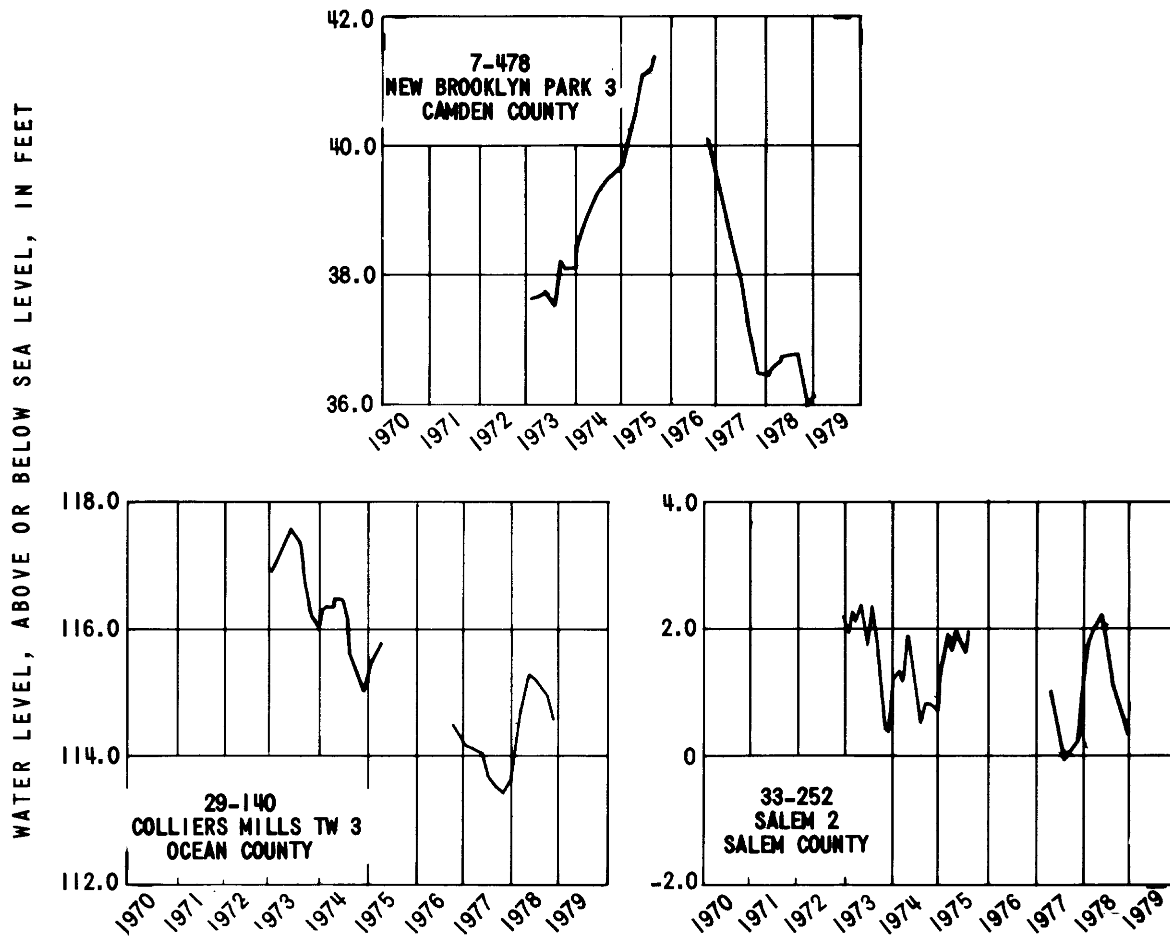
Change in water level from 1973 to 1978 was calculated for 45 of the wells (table 5). The greatest change was in Monmouth County, north and west of the center of the large cones of depression shown in plate 4, where levels declined between 12 and 26 ft. In central Burlington County near the small potentiometric low shown in plate 4, head declines ranged from 3 to 13 ft. The heads were unchanged near the outcrop from Monmouth to Salem County.

Hydrographs of three observation wells screened in the Wenonah-Mount Laurel aquifer are shown in figure 7 and their locations are shown on plate 4. Well 29-140 is in northwestern Ocean County approximately 20 mi west of the cone of depression in Monmouth County. The hydrograph shows cyclic seasonal variations with declines of approximately 0.6 ft/yr. This well is 6 mi downdip from the outcrop near topographic highs. Nemickas (1976, p. 17) states that recharge to the aquifer is largely from downward vertical leakage. The aquifer receives recharge where topographic and potentiometric highs coincide. The seasonal variations shown on the hydrograph are interpreted as a response to evapotranspiration and recharge in the water-table aquifer. The seasonal effects of evapotranspiration and recharge are transmitted to the aquifer by downward vertical leakage through the composite upper confining layer.

A shallow water table probably influences the seasonal fluctuations of levels in the Wenonah-Mount Laurel aquifer near the outcrop. However, declines for well 29-140 are most likely due to the hydraulic relationship between the Wenonah-Mount Laurel aquifer and the Englishtown aquifer. At well 29-140 the head in the Englishtown was 50 ft lower than the Wenonah-Mount Laurel in 1978. The difference in head is inducing significant leakage through the lower confining layer to the Englishtown aquifer.

The hydrograph for well 7-478 shows the effects of withdrawals from the aquifer in southcentral Camden County. Farlekas and others (1976, p. 72 and 74) showed that declining trends in water levels were mainly caused by increased withdrawals 3.5 to 6 mi north of the observation well. Changes in levels between 1975 and 1978 can also be attributed to variations of withdrawal. Levels rose about 2 ft in 1975 in response to a reduction in nearby withdrawals. The water level declined about 5 ft between 1975 and 1978, corresponding to increased withdrawals beginning in late 1975 and continuing into 1978.

The hydrograph for well 33-252 represents the shallow part of the artesian system at Salem, Salem County (pl. 4). The graph shows no change in water level for the long term. Seasonal variations are influenced by vertical leakage from the overlying water-table aquifer. The closest significant pumping ceased in late 1969. Therefore, the effects of withdrawals are not apparent.



Lowest water level
See plate 4 for locations

Figure 7.-- Hydrographs of observation wells screened in the Wenonah-Mount Laurel aquifer.

TABLE 5.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE WENONAH-MOUNT LAUREL AQUIFER

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
5-247	395145	745111	LAKES W C	LWC2	1950	52	180- 200			36	11/02	
5-257	395516	745103	JOHNSON, W E JR	JOHNSON NEW	1965	80	- 90[3]	26	11/29	27	11/07	1
5-352	395801	744120	PEMBERTON WD	PBWD 3	1968	62	132- 163	37	11/26	38	10/31	1
5-354	395813	743950	SUNBURY VILLAGE	SVWC 1	1953	65	178- 198	47	07/09	43	10/31	-4
5-355	395826	744109	PEMBERTON WD	PBWD 1	1939	81	155- 185	42	07/10	39	10/31	-3
5-359	395727	744118	LAKE VALLEY WC	LVWC 1	1967	70	181- 242[2]			36	10/31	
5-361	395707	743246	PEMBRTON TWP WD	CTRY LKS 5	1959	82	329- 345			-14	11/02	
5-365	395752	743452	PEMBRTON TWP WD	PTWD 4	1960	93	290- 330			16	11/02	
5-366	395755	743239	PEMBRTON TWP WD	PTWD 4 INCH OB	1972	90	301- 323			-42	11/02	
5-371	395756	743814	BURLINGTON CO I	BURL. CCI 4	1970	80	366- 386	24	11/20	11	11/01	-13
5-375	395807	743837	BURLINGTON CO I	BUR CO INST 3	1956	70	343- 378	27	11/20	19	11/01	-8
5-378	395815	743840	BURLINGTON CO I	5-1972	1972	65	328- 368	29	11/20	21	11/01	-8
5-379	395821	743409	PEMBRTON TWP WD	PTWD 2	1947	63	257- 282	7	12/27	-5	11/02	-12
5-380	395835	743511	PEMBRTON TWP WD	PTWD 3	1955	112	277- 303	18	12/27	21	11/02	3
5-389	395958	743933	PEMB TWP HIGH S		1959	80	140- 150	67	07/09	64	11/01	-3
5-427	395330	744205	HAMPTON LAKE WC	HLWC 2	1972	70	260- 348			11	10/31	
5-428	395342	744253	HAMPTON LAKE WC	HLWC 1	1954	49	247- 268	29	07/09	19	10/31	-10
5-430	395541	744415	VINCENTOWN WC	VINCENTOWN	1923	40	- 153[3]			30	11/01	
5-442	400248	743827	HUTCHINSON, C B	HUTCHINSON	1960	180	124- 134	125	11/21	125	10/31	0
5-464	395114	744542	ALLEN,AMOS	TRAILER PARK 1	1969	130	- 381[3]			38	11/02	
5-695	395328	743720	SUNY PINE CONT	TEST HOLE 1-74	1974	111	428- 496			33	11/01	
5-701	400215	743721	MC PHERSON	MCPHERSON EAST	1918	121	- 138[3]	123	11/21	126	11/02	3
5-720	395116	744541	ALLEN,AMOS	ALLEN 2	1978	135	- 410[3]			30	11/02	
5-724	395413	744231	HAMPTON LAKE WC	HLWC 3	1977	43	198- 275			18	10/31	
5-725	400212	743708	WRIGHTSTOWN MUA	WMUA 2	1971	135	142- 162	109	12/10	118	11/02	9
5-744	395639	742953	J.J. WHITE	DOMEST '66	1966	112	- 456[3]			9	11/09	
7- 22	394738	745614	BERLIN WATER D	BWD 8	1952	147	310- 360	36	12/06	34	11/14	-2
7-118	395229	745712	NJ WATER CO	HUTTON HILL 2	1965	158	137- 147	70	11/02	69	11/17	-1
7-180	394923	745714	US AIR FORCE	RADAR 2	1960	193	280- 310			63	11/15	
7-181	394927	745715	US AIR FORCE	RADAR 1	1959	191	- 290[3]	58	11/20	57	11/15	-1
7-228	394556	745835	CAMDEN CO BD ED	VOC&TECH H S 1	1967	145	325- 400			40	11/07	
7-307	394928	750021	NJ WATER CO	LAUREL 8	1920	77	105- 125	58	11/27	56	11/08	-2
7-308	394928	750021	NJ WATER CO	LAUREL 10	1923	77	- 126[3]	54	11/27	57	11/08	3
7-391	394639	745750	L CAMDEN CO REG	OVERBROOK HS 1	1971	160	315- 335			28	11/15	
7-401	394722	745810	PINE VALLEY G C	GOLF CLUB	1955	85	- 267[3]	40	12/04	36	11/09	-4
7-414	394922	745630	NJ WATER CO	ELM TREE 26	1960	150	237- 275	49	12/05	60	11/13	11
7-421	395109	745715	RADIO CORP AMER	RCA	1955	175	220- 234	91	11/30	91	11/08	0
7-428	395148	745615	OWENS,FRANK	DECAU,T 1	1957	115	127- 147	82	11/30	83	11/19	1
7-449	394618	745413	IVYSTONE W W	WATER WKS 3-65	1965	159	420- 460			20	11/09	
7-478	394215	745617	US GEOL SURVEY	NEW BROOKLYN 3	1961	111	520- 530	38	11/15	36	11/16	-2
7-526	394934	745852	LINDNWLD BO MUA	SEWAGE PL2	1972	78	138- 158			63	11/30	
11- 72	392442	751916	CUMBERLAND CO	SHEPPARDS 1	1972	32	- 638[3]	9	10/11	10	11/28	1
15- 14	394827	750758	THOMPSON,MARION		1953	102	83- 107			75	11/07	
15- 31	394001	751234	MOOD RICHARD J	1	1954	120	- 285[3]			68	11/22	
15-125	394324	751315	CHRIST CHURCH	1	1950	92	84- 105			57	11/21	
15-256	394452	750243	GINO'S REST	1	1970	150	278- 310			52	12/07	
15-336	394257	751825	STRING,CLARENCE	STRING 1	1954	120	76- 85			81	11/14	
25- 11	401136	740120	AVON WATER DEPT	AWD 2	1925	22	419- 501	-133	11/16	-146	10/31	-13
25- 14	401138	740125	AVON WATER DEPT	AWD 1	1925	28	424- 504	-132	11/16	-145	10/31	-13
25-164	400839	741440	ALDRICH W CO	ALDRICH W CO 1	1956	125	349- 370			-30	10/27	
25-168	400957	741317	ALDRICH W CO	ALDRICH W CO 2	1960	150	354- 440[2]	-62	11/14	-56	10/27	6
25-173	401244	741135	N J CONCRETE		1965	90	226- 257			23	10/31	
25-179	401354	741224	NJ LATVIAN CLUB	LATVIAN	1963	120	270- 280	68	11/15	67	10/31	-1
25-182	401629	741015	DISEPALO,MARTIN	1	1963	125	229- 236	66	11/16	65	10/26	-1
25-185	401438	741025	NAD EARLE	TRANS DEPOT S7	1958	119	229- 250	61	11/16	59	10/26	-2
25-243	401848	741324	F.J. IENTILE		1949	120	- 80[3]			88	10/26	
25-335	401215	740409	WARDELL DAIRY	WARDELL 1	1941	80	465- 480	-94	11/16	-118	10/31	-24
25-336	401216	740108	MONMOUTH CON WC	OCEAN GROVE 21	1954	20	395- 430			-140	10/31	
25-366	402048	740109	RUMSON C CLUB	RUMSON C C 1	1910	15	- 165[3]	5	11/15	13	10/24	8
25-391	400928	740211	SPRING LK HT WD	SPRING LK HGT4	1974	20	485- 561			-195	10/27	
25-392	400617	743037	HOPKINS,RUSSELL			90	- 87[3]			93	06/29[4]	
25-396	400658	743135	RUTGERS UNIV	1	1970	122	92- 102	85	12/10	85	11/03	0
25-405	401000	742908	PUNK BROS	3	1964	158	- 124[3]			127	10/31	
25-412	401045	742821	ERB, GEORGE H	1	1966	190	100- 140			149	10/31	
25-426	400817	740744	G THOMPSON M H	GERALDINE M H2		120	- 580[3]			-108	10/30	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

TABLE 5.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE WENONAH-MOUNT LAUREL AQUIFER--CONTINUED

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI-TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
25-435	400942	740756	STATE OF N J	ALLAIRE S P 4	1973	63	385- 414			-84	10/31	
25-437	400953	740726	BRISBANE C T C	BRISBANE 2R	1963	70	405- 425	-73	11/16	-85	10/31	-12
25-443	401055	740351	WALL TWP W D	IMPERIAL PARK1	1959	75	435- 465	-121	11/20	-147	10/25	-26
25-444	400831	740615	WALL TWP SCHOOL		1949	134	460- 476			-107	10/26	
25-465	401107	740356	WALL TWP WD	IMPERIAL 3-T	1978	65	430- 460			-153	10/26	
25-478	400642	741312	AMERADA HESS	2-79	1979	65	377- 392			-115	04/09[4]	
29- 31	400239	740721	BRICK TWP BD ED	EMMA YOUNG 1	1965	17	605- 625			-113	11/02	
29- 37	400429	740652	ST DOMINICS CH	1	1964	20	576- 591			-136	10/26	
29-140	400414	742702	US GEOL SURVEY	COLL MILLS TW3	1964	135	257- 267	116	11/09	115	11/13	-1
29-227	400604	741915	MEADOWBRK VILL	HOLMANSVILLE 1	1966	110	- 358[3]	48	11/16	42	10/27	-6
29-234	400745	742542	GREAT ADVENTURE	GA 2	1974	140	180- 200			123	11/01	
33- 2	393202	751630	CUMBERLAND CO	BOSTWICK NO 3	1972	85	462- 472			23	11/16	
33- 20	393534	751752	HORNER,EPHRAIM	HORNER		77	- 283[3]	29	11/30	33	11/16	4
33- 22	393534	751018	ELMER WC	EWC 3	1963	105	460- 500	29	12/03	28	12/07	-1
33- 34	392742	753200	PUBLIC SERV E-G	PW 1		17	248- 298			-16	05/18[4]	
33- 35	392744	753206	PUBLIC SERV E-G	PW 2	1970	20	230- 281			-14	05/18[4]	
33- 38	392808	752208	HOLLY MOUNT INC	1-1973	1973	100	441- 527			6	11/20	
33- 44	393446	752721	MANNINGTN MILLS	SCHULTES 3	1959	10	96- 127			-4	11/21	
33- 50	393538	752640	SALEM MEM HOSP	HOSP 1-1950	1950	20	73- 97			5	11/20	
33- 51	393538	752642	SALEM MEM HOSP	HOSP 2-1954	1954	20	82- 112			5	11/20	
33- 56	393606	752524	MANNINGTN T E S	MTES 1	1959	25	- 93[3]			7	11/20	
33-192	394051	752148	KELLY BROTHERS	2-1954	1954	60	45- 65	46	11/29	44	11/13	-2
33-241	393253	752422	SALEM CITY W D	QUINTON		10	- 248[3]			6	11/22	
33-244	393404	752811	SALEM CITY W D	SWD 4	1947	10	93- 124	-1	12/03	1	11/22	2
33-245	393337	752719	SALEM CITY W D	SCWD 5	1961	8	96- 168	1	08/20	0	11/22	-1
33-249	393342	752718	SALEM CITY W D	SWD 2	1936	5	110- 150	-5	12/03	0	11/22	5
33-252	393348	752755	US GEOL SURVEY	SALEM 2	1965	3	91- 96	1	10/04	1	11/28	0
33-279	393622	751531	GARRISON HENRY		1922	120	- 425[3]			40	11/16	

[1]DATUM IS SEA LEVEL
[3]WELL DEPTH
[4]WATER LEVEL MEASURED IN 1979

Kirkwood Aquifers

Geohydrology

The Kirkwood Formation of middle Miocene age is composed of sand, silt, clay, and some gravel. The formation crops out as an irregular band from southern coastal Monmouth County to the Delaware River (pl. 5). Westward the water-bearing sands are hydraulically connected to the overlying unconfined Cohansey Sand, forming the Kirkwood-Cohansey aquifer system (Rhodehamel, 1973, p. 23). The water-bearing sands of the Kirkwood Formation become confined and more permeable toward the coast where two distinct artesian aquifers have been identified (fig. 2).

The upper aquifer or Rio Grande water-bearing zone (Gill, 1962, p. 18) has been identified in Cape May and Cumberland Counties. The upper aquifer has been traced northward to Ocean County (Zapecza, written communication, 1981). However, the principal aquifer of the Kirkwood Formation is the lower aquifer (Atlantic City 800-foot sand, Thompson, 1928). The correlation of these two aquifers with water-bearing sands of the Kirkwood as near as 20 mi west of the coastline is unclear. Therefore, the extent of these aquifers is limited to coastal areas.

The water-supply potential of the Rio Grande water-bearing zone (upper aquifer) is greatest in Cape May County. The aquifer is a medium- to coarse-grained sand and has an average thickness of 50 ft (Gill, 1962, p. 18). Saltwater intrusion has limited the use of the upper aquifer in southern and eastern Cape May County. In general, the upper aquifer is sparsely used northward due to thinning and a reduction in grain size. Although a few wells are screened in the upper aquifer northward to southern Ocean County, the aquifer is of minor importance outside of Cape May County.

The Atlantic City 800-foot sand (lower aquifer) is a medium- to coarse-grained sand, identified as one continuous hydrologic unit from Cape May to southern Ocean County (Anderson and Appel, 1969, p. 48). The thickness of the aquifer ranges from about 50 ft along its western boundary, 10 to 20 mi west of the coastline, to about 150 ft along the barrier islands, and is as much as 250 ft thick in Cape May County (Zapecza, oral communication, 1980).

The hydraulic conductivity of the 800-foot sand is greatest in the Atlantic City area and, in general, declines rapidly in all directions (Gill, 1962, p. 46). The sand has been defined as a barrier beach deposit (Rhodehamel, 1973; Anderson and Appel, 1969) and grades into finer grained material northward and northwestward.

The Alloway Clay Member is the basal marine clay in the Kirkwood Formation in Atlantic, Camden, Cumberland, Gloucester, and Salem Counties (Nemickas and Carswell, 1976, p. 3). It is characterized as a dark brown or gray-brown to light tan silty clay ranging from 64 to 152 ft thick (Nemickas and Carswell, 1976, p. 2). In Cape May County, Gill (1962, p. 17) identifies a tough brown clay, 70 to 140 ft thick, below the 800-foot sand. Zapecza (written communication, 1982) identifies a confining bed beneath the aquifers of the Kirkwood Formation that appears to correlate with the Alloway Clay Member of the Kirkwood Formation and form part of the lower confining layer for the Atlantic City 800-foot sand.

A blue silty diatomaceous clay unit, ranging from 40 to 280 ft thick, lies directly above the 800-foot sand in Cape May County (Gill, 1962, p. 18). The clay unit confines the 800-foot sand (lower aquifer) from the overlying Rio Grande water-bearing zone (upper aquifer) in Cape May County. The upper aquifer becomes very thin (less than 20 ft) northward of Cape May County. Therefore, the upper confining unit includes the thickness of silty clay facies of the Kirkwood Formation lying stratigraphically between the Atlantic City 800-foot sand and the unconfined Kirkwood-Cohansey aquifer system (Zapecza, written communication, 1982). Although the extent of this upper confining unit is unknown, the western boundary has been approximated by Zapecza (written communication, 1980). The boundary extends from Barnegat Light, west of Egg Harbor City, to the Cape May-Cumberland County line at Delaware Bay. Water levels suggest that water-bearing sands of the Kirkwood Formation are largely unconfined west of this boundary.

The 800-foot sand is probably recharged primarily by vertical or lateral movement of water from the Kirkwood Formation west of the limit of the upper confining layer (fig. 2). Some recharge is probably through the confining layers induced by head differentials in the coastal areas.

During 1978, about 55 percent of withdrawals from the 800-foot sand were near Atlantic City. Withdrawals on or near the barrier islands in Cape May and Ocean Counties account for 25 and 20 percent, respectively, of the total from the 800-foot sand.

Water Levels

Water levels were measured in 122 wells screened in the Kirkwood Formation. Table 6 contains data for 53 wells screened in the Atlantic City 800-foot sand. Most wells are on or near the barrier islands of Atlantic, Cape May, and Ocean Counties. Table 7 contains data for the remaining wells in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, and Ocean Counties.

The potentiometric map of the Atlantic City 800-foot sand (pl. 5) shows an elongated regional cone from Cape May to southern Ocean County. The lowest heads (greater than 70 ft below sea level) were near Margate and Ventnor, Atlantic County. In the northeastward extension of the cone, near Ship Bottom, Ocean County, levels were lower than 30 ft below sea level. The highest levels in the 800-foot sand were greater than 25 ft above sea level at Egg Harbor City, Atlantic County.

Wells 1-219, 1-227, 9-71, 9-149, 11-116, 29-455, 29-465, and 29-552 (table 7) are screened in sands of the confined upper aquifer of the Kirkwood Formation. This well data can be used to examine the head relationship between the 800-foot sand and the upper aquifer. Levels in the 800-foot sand are 9 ft lower than those in the upper aquifer near Tuckerton, Ocean County (wells 29-464 and 29-465, pl. 5). It is likely that this relationship exists throughout the 800-foot sand. The head differential is probably greater in heavily pumped areas on or near the barrier islands.

Data for 62 wells (table 7) screened in the basal parts of the unconfined Kirkwood-Cohansey aquifer system were analyzed. These data show that surface drainage influences levels in the aquifer system. Therefore, the head distribution was not interpreted in the unconfined system because of insufficient data points.

Water-Level Fluctuations

Change in water level from 1973 to 1978 were calculated for 43 wells (tables 6 and 7). In general, the changes in the aquifers indicate no significant regional water-level trend. However, some changes were noted in the 800-foot sand.

Heads recovered 5 to 9 ft near Atlantic City between 1970 and 1978. Head changes ranged from -4 to +9 ft along the barrier islands of Cape May County. Heads showed little change in the 800-foot sand in Ocean County, except for wells 29-111 and 29-112, which show head declines of 13 and 6 ft, respectively. The level in observation well 29-17 (table 7), about 6 mi northward, declined 1 ft. However, well 29-17 is in the unconfined part of the Kirkwood. This change may be due to fluctuations of natural recharge.

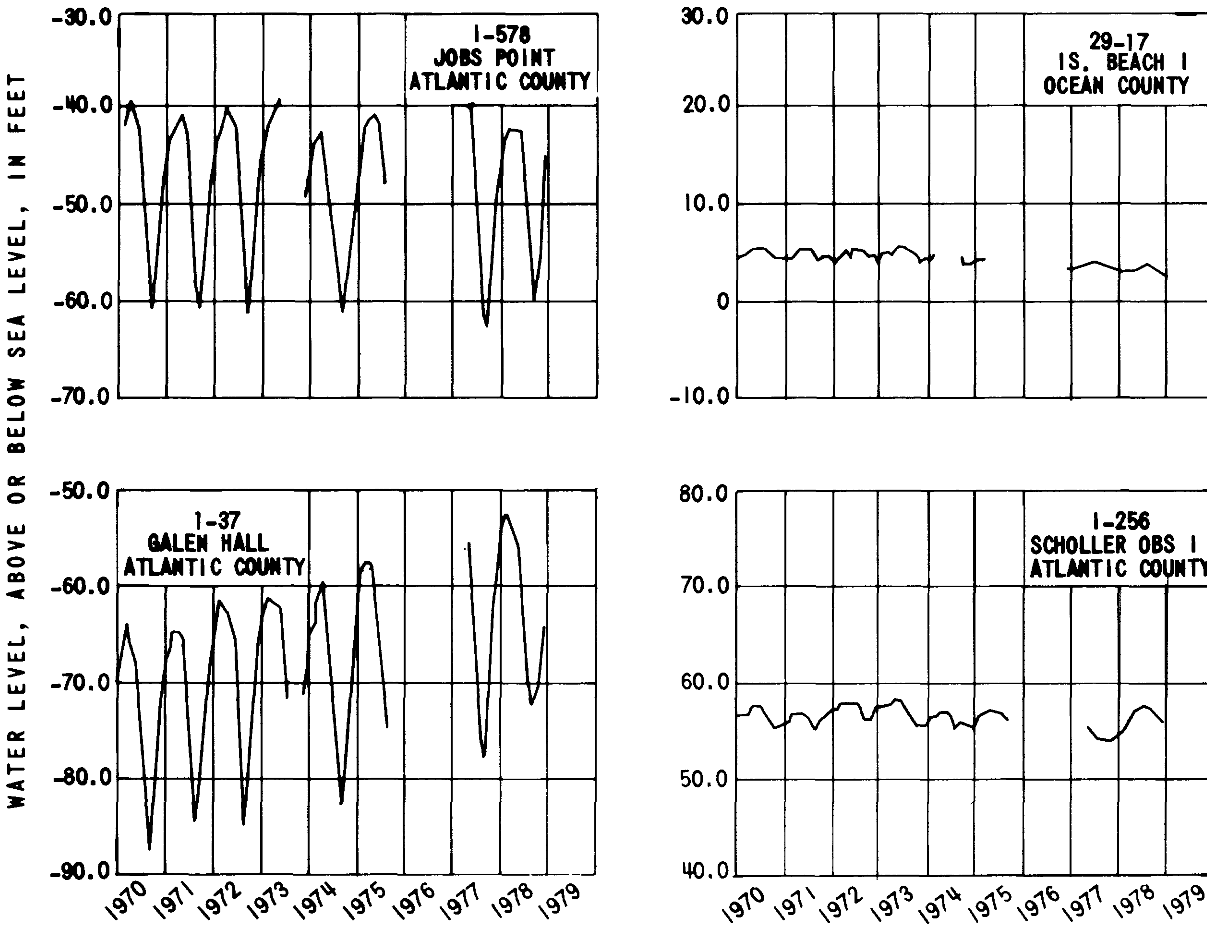
In northern Ocean County levels in the basal part of the Kirkwood may have declined as much as 17 ft. However, this is based only on data from well 29-68 (table 7) measured using the airline method.

Hydrographs of levels in four observation wells screened in the Kirkwood aquifers are shown in figure 8. Well locations are shown in plate 5. Wells 1-37 and 1-578 are screened in the 800-foot sand.

Well 1-37 is on the northern end of the barrier island near the center of the large cone at Atlantic City. The hydrograph varied seasonally about 25 ft/yr because of changes in pumping. Thompson (1928, p. 60) shows the relationship of pumpage to seasonal fluctuations in the 800-foot sand. Levels recovered steadily (approximately 1.3 ft/yr) from 1970 to 1978. The hydrograph shows that the actual change in water level may be somewhat greater than the values in table 6 indicate. This demonstrates that hydrographs are important when evaluating the changes in an aquifer where heads fluctuate greatly.

Well 1-578 is west of the barrier islands near the Atlantic-Cape May County line. The hydrograph's seasonal pattern is similar to well 1-37 with a 20-ft fluctuation range. However, there was no discernible declining or rising trend at well 1-578.

Wells 1-256 and 29-17 hydrographs show small irregular seasonal variations and a very slight downward trend. Both wells are screened in sands near the base of the Kirkwood just west of the approximate boundary of the 800-foot sand, where the Kirkwood is part of the unconfined Kirkwood-Cohansey aquifer system. These wells are 6 to 8 mi from the nearest significant withdrawal. The seasonal variations appear to be related to variations in recharge rather than pumping. The yearly lows in well 29-17 occur later than the other wells. This may suggest a poor interconnection of this zone with the 800-foot sand or a distant connection with the water table closer to the outcrop. The slight downward trend noted (well 29-17) may suggest some hydraulic connection with the 800-foot sand. However, the time lag of the seasonal fluctuations should be smaller if these units are effectively interconnected.



Lowest water level
See plate 5 for locations

Figure 8.-- Hydrographs of observation wells screened in the Kirkwood aquifers.

TABLE 6.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE ATLANTIC CITY 800-FOOT SAND OF THE KIRKWOOD FORMATION

WELL NUMBER	LOCATION LATI-TUDE	LOCATION LONGI-TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1970 WATER LEVEL ALTI-TUDE[1] (FT)	1970 WATER LEVEL DATE	1978 WATER LEVEL ALTI-TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
1- 15	392058	742711	PRESIDENT HOTEL	PRESIDENT	1955	10	780- 831			-51	12/13	
1- 37	392151	742459	ATLANTIC C WD	GALEN HALL	1904	10	782- 837	-72	12/01	-65	11/27	7
1- 39	392336	742330	BRIGANTINE W D	NEW 4	1966	10	733- 788	-54	11/15	-60	11/20	-6
1- 40	392342	742328	BRIGANTINE W D	BAYSHORE 3	1952	10	706- 766			-58	11/20	
1- 41	392431	742153	BRIGANTINE W D	ROOSEVELT 1	1925	9	736- 827[2]			-45	11/20	
1- 42	392456	742122	BRIGANTINE W D	BWD 2-14TH ST	1929	12	718- 778			-40	11/20	
1-116	393211	743829	EGG HAR WTR WKS	EGG HARBOR 3	1942	45	342- 394	23	11/06	25	11/15	2
1-117	393206	743836	EGG HAR WTR WKS	OW41 5	1964	45	350- 432			28	11/15	
1-121	391852	743216	SEAVIEW HRBR WC	1958 WELL	1958	5	740- 780			-82	11/22	
1-180	392754	742701	US GEOL SURVEY	OCEANVILLE 1	1959	27	560- 570	-34	10/28	-28	11/27	6
1-366	391821	743207	LONGPORT W D	LONGPORT OBS		6	- 803[3]	-73	10/27	-64	11/27	9
1-367	391859	743122	LONGPORT W D	LONGPORT 2	1947	10	750- 800	-73	11/18	-66	11/22	7
1-372	391933	743058	MARGATE CITY WD	MCWD 7	1963	5	760- 800	-78	11/18	-72	11/22	6
1-565	392438	743047	ATLANTIC CO WC	1950 ACWD 14	1950	8	610- 660			-53	11/21	
1-566	392434	743032	ATLANTIC C WD	ACWD 600	1925	12	- 565[3]	-47	12/01	-39	11/27	8
1-568	392437	743051	ATLANTIC C WD	ACWD 15	1961	8	583- 633			-44	11/21	
1-578	391826	743709	US GEOL SURVEY	JOBS POINT	1959	10	670- 680	-47	12/01	-45	11/28	2
1-598	392032	742855	VENTNOR CITY WD	VCWD 9	1965	8	740- 800			-72	11/21	
1-600	392045	742840	VENTNOR CITY WD	VCWD 8	1931	8	750- 810			-69	11/21	
9- 2	390420	744435	AVALON WATER D	AVALON WD 7-71	1971	5	821- 861			-36	11/21	
9- 4	390528	744338	AVALON WATER D	AVALON WD 6	1968	10	880- 920	-36	11/17	-40	11/21	-4
9- 5	390545	744326	AVALON WATER D	AVALON 8-76	1976	8	784- 839			-34	11/21	
9- 8	390621	744248	AVALON WATER D	AVALON WD 3	1930	10	845- 925			-35	11/21	
9- 92	390525	744851	NEPTUNUS WC	NEPTUNUS WC 7	1967	15	681- 791	-30	11/17	-32	11/20	-2
9-100	390641	744415	MIDDL TWP W DIS	AVALON M WW 1	1963	5	763- 815	-37	11/17	-37	11/21	0
9-106	391343	743755	OCEAN CITY NJWC	OCEAN CITY 7	1924	8	760- 810	-43	11/18	-46	11/21	-3
9-109	391535	743611	OCEAN CITY NJWC	OCEAN CITY 9	1946	8	749- 809			-49	11/21	
9-110	391604	743539	OCEAN CITY NJWC	OCEAN CITY 12	1965	7	- 814[3]			-53	11/21	
9-124	391712	743340	OCEAN CITY NJWC	OCEAN CITY 13	1970	8	757- 840	-71	11/18	-66	11/21	5
9-127	390847	744200	SEA ISLE C W D	SICWD 4	1954	7	742- 830	-39	11/17	-38	11/20	1
9-132	390301	744545	STONE HARBOR WD	STONE HARBOR 4	1955	10	830- 880	-40	11/17	-31	11/20	9
9-133	390314	744532	STONE HARBOR WD	STONE HARBOR 2	1924	10	- 890[3]	-28	11/17	-32	11/20	-4
9-135	390323	744525	STONE HARBOR WD	STONE HARBOR 3	1949	9	837- 877	-28	11/17	-30	11/20	-2
9-144	391703	743756	ATL CITY ELEC	ACEC 5	1975	9	650- 690			-47	12/14	
9-148	391707	743756	ATL CITY ELEC	ACEC 3-LAYNE 4	1964	9	645- 675			-47	12/14	
9-166	390351	744504	STONE HARBOR WD	SHWD 5	1976	7	820- 860			-33	11/20	
29- 9	393346	741430	BEACH HAVEN W D	BHWD 8	1957	5	572- 656[2]			-28	10/30	
29- 12	393346	741434	BEACH HAVEN W D	BHWD 7	1940	5	544- 668[2]			-23	10/30	
29-111	394134	740832	HARVEY CDRS W D	HCWD 4	1968	5	465- 500	-13	11/04	-26	11/03	-13
29-112	394218	740808	HARVEY CDRS W D	HCWD 3	1956	5	451- 493	-14	11/04	-20	11/03	-6
29-457	393510	741327	LONG BEACH W C	TERRACE 3	1970	8	465- 650[2]			-26	11/03	
29-458	393510	741330	LONG BEACH W C	TERRACE 1	1949	5	523- 578			-28	11/03	
29-459	393510	741330	LONG BEACH W C	TERRACE 2	1949	5	523- 577			-28	11/03	
29-460	393724	741151	LONG BEACH W C	BRANT BEACH 2	1951	6	530- 580			-23	11/03	
29-462	393253	742308	MYSTIC ILAND WC	MYSTIC 3	1969	8	509- 553			-20	11/02	
29-464	393428	742202	LITTLE EGG HMUA	MYSTIC 2	1963	25	485- 542	-8	11/05	-10	11/02	-2
29-544	393839	741052	SHIP BOTTOM W D	SBWD 4	1953	5	536- 578			-31	10/31	
29-549	393848	741053	SHIP BOTTOM W D	SBWD 5	1974	8	527- 588[2]			-30	10/31	
29-557	394042	741411	STAFFORD TWP WC	STAFFORD 3	1965	8	385- 428	20	06/26	22	11/02	2
29-559	393912	741022	SURF CITY W D	SCWD 3	1947	5	516- 557	-27	11/04	-26	10/31	1
29-560	393938	741006	SURF CITY W D	SCWD 4	1964	5	514- 554			-29	10/31	
29-561	393948	740954	SURF CITY W D	SCWD 5-1970	1970	10	521- 562			-25	10/31	
29-565	393610	742031	TUCKERTON WW CO	TWWC4	1949	10	460- 497[2]			-4	11/02	

[1]DATUM IS SEA LEVEL
[2]MULTIPLE SCREENS
[3]WELL DEPTH

TABLE 7.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE KIRKWOOD AQUIFERS

WELL NUMBER	LOCATION LATI- TUDE	LOCATION LONGI- TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1970 WATER LEVEL ALTI- TUDE[1] (FT)	1970 WATER LEVEL DATE	1978 WATER LEVEL ALTI- TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
1-219	392653	744252	HAMILTON TWP WD	TEST-1-73	1973	20	- 378[3]			19	06/01[4]	
1-227	392709	744439	HAMILTON TWP WD	HTMUA 5	1966	10	316- 347			0	11/15	
1-256	393333	744426	SCHOLLER BROS	OBS 1	1955	93	254- 275	56	11/20	56	11/27	0
1-280	393759	744824	HAMMONTON W D	2	1917	110	256- 300	60	09/04	74	11/06	14
1-281	393759	744824	HAMMONTON W D	1	1922	110	255- 315	74	11/09	76	11/03	2
1-292	393833	744651	HAMMONTON W D	4	1967	90	201- 241			66	11/03	
1-349	394041	744604	ST OF NJ	MULLICA 2D	1975	59	145- 150			56	11/13	
5- 12	393945	743126	HARRISVILLE	IW1	1966	15	- 375[3]			18	11/08	
5-458	394858	743746	BIRCHES CRNBERY	BIRCHES 1		77	- 90[3]	74	11/09	74	11/02	0
5-459	395017	743853	BIRCHES CRNBERY	BIRCHES 2	1968	92	44- 88[2]	81	11/09	82	11/08	1
5-511	394009	743251	STATE OF NJ	MULLICA 6D	1975	42	245- 250			33	11/08	
5-612	394305	743357	STATE OF NJ	MULLICA 13D	1975	41	267- 272			36	11/08	
7-430	394204	744921	STATE OF NJ	MULLICA 7D	1975	94	115- 120			79	11/13	
7-479	394215	745617	US GEOL SURVEY	NEW BROOKLYN 4	1961	111	200- 210	110	11/20	110	11/16	0
9- 71	390138	745348	WILDWOOD W D	RIO GRANDE 23		8	- 523[3]	-11	11/17	-12	11/21	-1
9-149	391816	744953	MORRIS APRIL BR		1948	12	250- 290			12	11/16	
11- 22	392650	751331	BRIDGETON WD	BWD 12	1967	58	99- 129			31	11/18	
11- 43	392732	750929	CUMBERLAND CO	VOCAT SCH 1	1971	82	133- 138			77	11/18	
11- 45	392726	750729	PIZZO, JOSEPH	2	1967	110	100- 150			67	11/17	
11- 52	391420	751023	FORTESCU REALTY	FORTESCUE 4	1974	8	283- 303			7	11/22	
11- 60	391838	750701	PA GLASS SAND	OBS 2	1964	75	300- 340	16	11/08	50	11/21	34
11- 77	392523	751723	ERNEST, WILBERT	1	1973	105	110- 145			51	11/20	
11- 79	392733	751621	HOLDINGS, J	HOLDING 1	1967	80	44- 124[2]			53	11/18	
11- 97	391830	751208	CUMBERLAND CO	JONES ISLAND 1	1971	10	166- 171			1	11/24	
11-114	392211	750604	INGRALDI, PETER	2	1969	80	120- 150			52	11/29	
11-116	391118	745705	MOORES BEACH FD	FIRE DEPT		5	295- 315	5	11/18	9	11/16	4
11-123	391356	745751	NJ DEPT OF INST	LEESBURG SPF 1	1967	13	248- 268			19	11/16	
11-161	392527	750642	CUMBERLAND CO	FAIR GROUNDS 1	1971	80	171- 176			63	05/03[4]	
11-169	392724	751236	BRIDGTN WD	TEST 3-75	1975	100	123- 192[2]			57	11/21	
11-180	392953	751324	SEABROOK FARMS	SEABROOK 3B	1963	95	155- 185			67	11/20	
11-185	392958	751317	SEABROOK FARMS	SEABROOK 13	1944	108	155- 180			79	11/20	
11-225	392811	750236	VINELAND W D	9-1968	1968	69	151- 181	55	11/10	59	11/16	4
11-233	392909	750005	VINELAND W D	12-1971	1971	83	144- 174			63	11/16	
11-254	393208	750245	VINELAND W D	10-1968	1968	90	130- 160			76	11/24	
11-266	392446	751552	CUMBERLND MANOR	MANOR 1	1937	100	114- 124			33	11/20	
11-273	392724	751236	BRIDGETON WD	BWD 15		100	150- 190			58	11/21	
11-275	392138	751338	LANING BROTHERS	LANING 1-R	1978	30	- 150[3]			14	11/21	
11-276	392217	750417	MILLVILLE W D	AIRPORT 1	1942	70	179- 181			33	11/16	
11-277	392216	750412	MILLVILLE W D	AIRPORT 2	1942	75	168- 170			41	11/16	
15- 55	393649	750651	CLEMICK,A	1	1968	135	20- 120			113	12/08	
25-425	400706	740442	BENNET SAND CO	2	1968	98	155- 170			42	11/02	
25-464	400801	740231	SEA GIRT W D	SGWD 6	1972	19	92- 123			2	10/26	
29- 17	394829	740535	US GEOL SURVEY	IS BEACH 1	1962	9	377- 397	5	11/09	4	11/09	-1
29- 22	395422	740458	SHORE WATER CO	SWC 1	1954	10	175- 200			7	11/03	
29- 28	400121	740602	BRICK TWP MUA	(SHORE ACRES2)	1959	6	198- 213	1	11/04	4	11/01	3
29- 30	400213	740637	PINELAND W C	PWC 1	1959	12	90- 103			4	11/01	
29- 62	395719	741233	TOMS RIVER W C	TRWC 16	1963	5	196- 226			-17	11/02	
29- 68	395803	741024	TOMS RIVER W C	TRWC 15	1958	25	195- 225	15	11/03	-2	11/06	-17
29- 98	395945	741222	TOMS RIVER W C	DUGANS 23	1970	80	254- 275			1	11/10	
29-131	400314	741952	CLAYTON SAND	SCM 5	1960	105	66- 91			73	10/26	
29-141	400416	742701	US GEOL SURVEY	COLL MILLS TW4	1964	135	46- 71	127	10/15	130	11/13	3
29-230	400724	742342	ST VLADIMIR CEM	CEMETERY 1	1964	150	85- 100			133	11/06	
29-455	393206	741548	LONG BEACH W C	LBTWD 2	1963	5	426- 451	-15	11/05	-17	10/31	-2
29-465	393509	742048	LITTLE EGG HMUA	HOLLY LAKE	1956	20	308- 329			-1	11/02	
29-509	394613	741215	INDIAN SURF BCH	INDIAN SURF 1	1959	8	133- 153			11	10/31	
29-511	394616	741215	INDIAN SURF BCH	INDIAN SURF 2	1967	10	129- 150			21	10/31	
29-514	394742	741120	US GEOL SURVEY	GARDEN S PKY 2	1962	44	- 317[3]			32	10/26	
29-515	395558	741013	PINE BEACH W U	PBWU 1	1963	30	135- 197			3	11/06	
29-521	400536	740252	PT PLEAS BCH WD	PPBWD 9	1950	5	96- 134[2]	2	11/04	-1	10/31	-3
29-523	400551	740243	PT PLEAS BCH WD	PPBWD 10	1966	5	87- 130[2]	-9	11/04	-9	10/31	0
29-533	400501	740455	PT PLEASANT W D	PPWD 4	1952	7	45- 75	4	11/04	-3	11/04	-7
29-538	395636	740439	SEASIDE HGTS WD	SHWD 1R 1963	1963	5	144- 175			2	11/06	
29-552	394008	741303	STAFFORD TWP WC	STAFFORD 1	1953	5	226- 235			11	11/03	
29-578	395530	741220	BEACHWOOD W D	BWD 5	1975	60	207- 248[2]			19	11/02	
29-579	400512	740251	PT PLEAS BCH WD	PPBWD 11	1972	5	130- 142			-7	10/31	
33-209	393013	750816	PARVIN STE PARK	PW B	1960	75	- 154[3]			68	12/06	
33-211	393018	750803	PARVIN STE PARK	PW A	1945	73	- 80[3]			63	12/06	
33-212	393038	750800	PARVIN STE PARK	OFFICE WELL		75	- 90[3]	67	11/10	74	12/06	7
33-230	393320	750809	PAULITIS,C	PAULITIS 1	1967	120	84- 156	96	11/10	103	12/07	7

[1]DATUM IS SEA LEVEL [2]MULTIPLE SCREENS [3]WELL DEPTH [4]WATER LEVEL MEASURED IN 1979

Cohansey Aquifer

Geohydrology

The Cohansey Sand is composed of sediments from coarse gravels to dense clays of Miocene age (Owens and Minard, 1979, p. D6). The Cohansey Sand overlies the Kirkwood Formation and is present throughout the Coastal Plain southeast of the outcrop of the Kirkwood Formation (pl. 5). The southeasterly limits of the Cohansey outcrop lie northward and westward of the Cape May County boundary.

Throughout most of its outcrop the Cohansey Sand is a water table, or locally, semiartesian aquifer and is part of the Kirkwood-Cohansey aquifer system (Rhodehamel, 1973, p. 23). Only the artesian part of the Cohansey in Cape May County is discussed in this report. The Cohansey Sand is the most productive aquifer in Cape May County. It thickens from about 50 ft in the northwestern part of the county to as much as 225 ft at Avalon (Gill, 1962, p. 19). Gill (1962) noted that the most permeable material lies near the base of the aquifer, although its average hydraulic conductivity declines markedly south of Rio Grande in Cape May County.

In Cape May County the uppermost unit of the Kirkwood Formation is a diatomaceous clay ranging in thickness from 65 to 260 ft (Gill, 1962, p. 18). This unit forms a relatively impermeable layer separating the Cohansey Sand from the Rio Grande water-bearing zone of the Kirkwood Formation.

The confining bed above the Cohansey Sand in Cape May County has relatively low permeability and is very thin near Cape May City (Gill, 1962, p. 119). This bed separates the Cohansey from the overlying sediments of Pleistocene age which provide the primary source of recharge to the aquifer. Much of the recharge in the southern part of the County is downward vertical leakage through the confining bed induced by the lowering of heads in the Cohansey aquifer (Gill, 1962, p. 109-110).

Withdrawals from the Cohansey aquifer are south of Cape May Court House. In 1978, 46 percent of withdrawals were near Cape May City. Most of the remaining withdrawals were at the Wildwood City Water Department pumping station near Rio Grande.

Water Levels

Water levels were measured in 14 wells screened in the confined part of the Cohansey aquifer in Cape May County (table 8). Most wells were near Cape May City. A few wells, distributed more sparsely, are near Rio Grande and as far north as Cape May Court House.

Two heavily pumped areas are shown on the potentiometric surface map (fig. 9). Water levels were 26 ft below sea level at the center of the cone of depression at Cape May City. The cone elongates northward and includes the area near Rio Grande. At well 9-58 the lowest head was 18 ft below sea level. This level, however, is presumed to be affected by drawdown from a nearby pumping well. The other levels in the Rio Grande area were 13 ft below sea level.

The cone at Cape May City is important because of the nearby (within 0.5 mi) freshwater/saltwater interface in the aquifer. Gill (1962) discusses saltwater intrusion into the principal aquifers of Cape May County. Chloride data collected by the U.S. Geological Survey in 1977 show that saltwater continues to threaten the water supplies near Cape May City.

The highest level was 4 ft above sea level north of Cape May Court House. However, data presented by Gill (1962, p. 108) indicate heads in northwestern Cape May County can be greater than 30 ft above sea level.

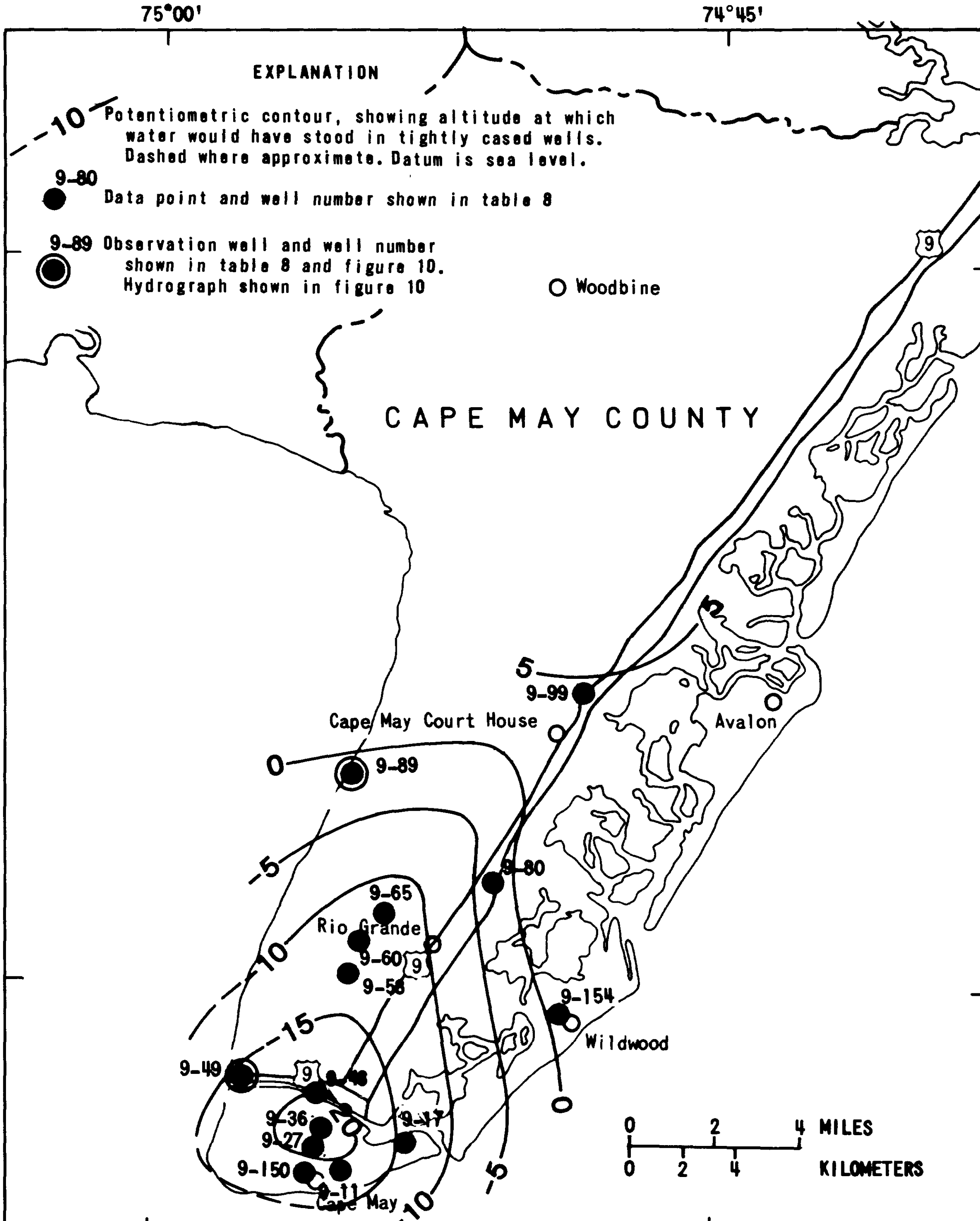
Water-Level Fluctuations

Change in water levels from 1973 to 1978 was calculated for eight of the wells (table 8). Heads near the two pumping centers declined approximately 2 ft between 1973 and 1978. However, this is not considered significant since the daily fluctuations of levels due to tide or pumping may be as large. Head declines diminish north of Rio Grande, and no change was observed near Cape May Court House.

Hydrographs of the observation wells screened in the Cohansey aquifer are shown in figure 10 and their locations are shown in figure 9. Well 9-49 is northwest of the center of the cone. Its hydrograph shows a slight downward trend of 0.3 ft/yr. Levels fluctuate seasonally as much as 15 ft due to pumping variations. This indicates that during the summer, the months of heaviest water use, water levels are probably lower than 40 ft below sea level near the center of the cone (fig. 9).

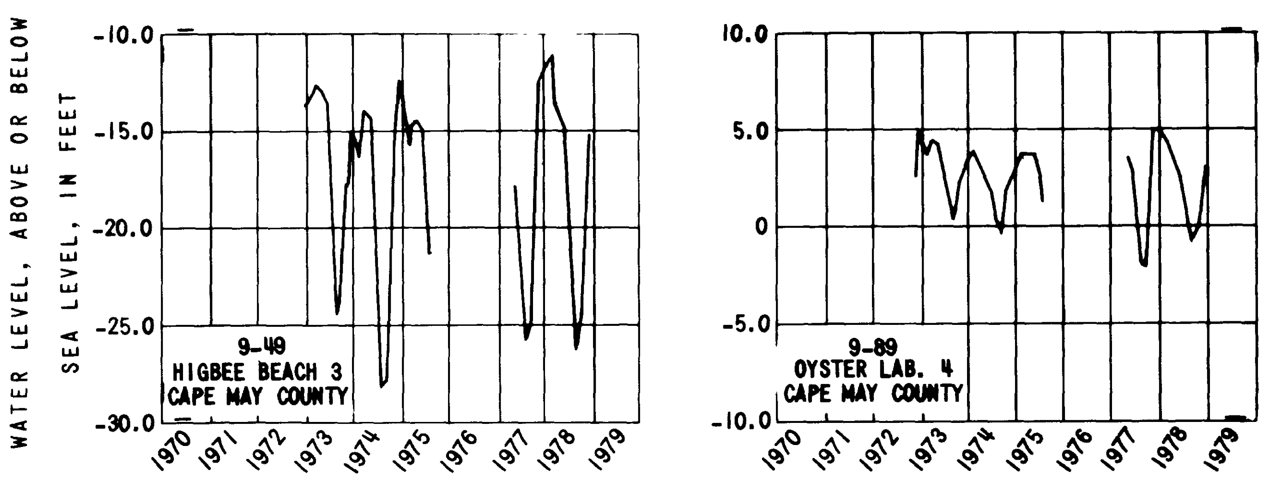
The hydrograph for well 9-89 shows similar cyclic seasonal variations of about 5 ft/yr. It also shows a slight decline of about 1 ft between 1973 and 1978.

Well 9-49 probably responds primarily to pumping in the Cape May City area, whereas well 9-89 responds to the pumping near Rio Grande.



Base from U.S. Department of Agriculture, Soil Conservation Service, 1980, 1:250,000

Figure 9.-- Potentiometric surface of the Cohansey aquifer, Cape May County, 1978.



Lowest water level

See figure 9 for locations

Figure 10.-- Hydrographs of observation wells screened in the Cohansey aquifer in Cape May County.

TABLE 8.--WATER-LEVEL DATA FOR WELLS SCREENED IN THE COHANSEY AQUIFER IN CAPE MAY COUNTY

WELL NUMBER	LOCATION LATI- TUDE	LOCATION LONGI- TUDE	OWNER	LOCAL NUMBER	YEAR DRILLED	ALTITUDE[1] LAND SURFACE (FT)	SCREEN INTERVAL (FT)	1973 WATER LEVEL ALTI- TUDE[1] (FT)	1973 WATER LEVEL DATE	1978 WATER LEVEL ALTI- TUDE[1] (FT)	1978 WATER LEVEL DATE	CHANGE IN WATER LEVEL (FT)
9- 11	385612	745457	CAPE MAY C W D	CMCWD 1 OBS	1940	7	281- 321	-17	11/30	-19	04/11[2]	-2
9- 17	385651	745310	US COAST GUARD	USCG 1	1943	11	292- 322			-14	11/21	
9- 27	385643	745533	CAPE MAY C W D	CMCWD 1	1950	12	277- 306			-21	12/13	
9- 36	385701	745528	CAPE MAY C W D	CMCWD 2	1966	10	- 282[3]			-26	12/13	
9- 48	385748	745533	US GEOL SURVEY	CANAL 5	1957	18	242- 252	-18	11/30	-18	04/11[2]	0
9- 49	385804	745742	US GEOL SURVEY	HIGBEE BEACH 3	1957	6	241- 250	-14	11/30	-16	11/28	-2
9- 58	390015	745440	CAPE MAY CO	1		20	- 279[3]			-18	11/21	
9- 60	390058	745427	US GEOL SURVEY	AIRPORT T7	1957	13	242- 257	-11	11/30	-13	11/21	-2
9- 65	390130	745350	WILDWOOD WD	RIO GRANDE 34	1966	12	172- 242			-13	11/21	
9- 80	390211	745055	US GEOL SURVEY	CAPE MAY 42CC	1957	14	242- 252	-1	10/26	-2	11/21	-1
9- 89	390425	745446	US GEOL SURVEY	OYSTER LAB 4	1957	7	195- 210	-1	11/30	-2	11/22	-1
9- 99	390608	744838	US GEOL SURVEY	COUNTY PK T8	1957	11	215- 230	4	10/11	4	11/20	0
9-150	385607	745552	US GEOL SURVEY	WCM 1	1957	7	283- 293	-16	11/30	-18	11/28	-2
9-154	385932	744851	WILDWOOD W D	WWD 2	1928	10	293- 354			1	12/14	

[1]DATUM IS SEA LEVEL
[2]WATER LEVEL MEASURED IN 1979
[3]WELL DEPTH

SUMMARY AND CONCLUSIONS

The purpose of this report is to document and evaluate water levels and changes in water levels in the major artesian aquifers of the New Jersey Coastal Plain. The report provides fundamental data for ground-water investigations and management.

The principal sources of water supply in the Coastal Plain of New Jersey are the major artesian aquifers that underlie the region. Increased withdrawal has stressed these aquifers, causing large regional cones of depression.

Hydrologic data collected in 1970, 1973, and 1978 were evaluated for six aquifers. Water levels measured in 1978 were used to develop potentiometric-surface maps for the major artesian aquifers. Water-level hydrographs from observation wells screened in the major artesian aquifers were used to evaluate seasonal and long-term trends.

The Potomac-Raritan-Magothy aquifer system can be separated into upper and lower aquifers. The largest cones of depression are in these aquifers. Heads are lowest in the Camden and the Middlesex-Monmouth County areas where levels reached 90 and 76 ft below sea level, respectively.

The lowest levels in the Wenonah-Mount Laurel and Englishtown aquifers ranged from 195 to 247 ft below sea level in coastal Monmouth and Ocean Counties. The potentiometric lows for the Wenonah-Mount Laurel aquifer were generally in the same areas as those for the Englishtown aquifer. This is due primarily to the lowering of heads in the Englishtown aquifer and the resultant leakage of water from the Wenonah-Mount Laurel to the Englishtown.

The 1978 potentiometric heads for the Atlantic City 800-foot sand of the Kirkwood Formation define an extensive elongated cone of depression that encompasses the barrier islands from Cape May to Ocean County. The lowest heads were greater than 70 ft below sea level near Margate and Ventnor in Atlantic County.

A cone in the Cohansey aquifer is centered near Cape May City. Heads were about 26 ft below sea level. The cone, although small in comparison to those in other aquifers, is significant because of its proximity to salty ground water.

Water levels measured in 1978 were compared with levels for earlier years (1970 or 1973) and hydrographs were examined. Heads in most of the Potomac-Raritan-Magothy aquifer system have declined 5 to 20 ft between 1973 and 1978. Declines in the Englishtown aquifer were widespread and generally ranged from 2 to 31 ft. During the same period, heads in the Wenonah-Mount Laurel aquifer declined between 12 and 26 ft northwest of the large cone in Monmouth and Ocean Counties.

Analysis of 1970 to 1978 data for wells screened in the Kirkwood aquifers show no significant regional change in water levels. However, head changes in the Atlantic City 800-foot sand along the barrier islands ranged from -4 to +9 ft.

Heads in the heavily used confined areas of the Cohansey aquifer declined less than 2 ft between 1973 and 1978.

Future interpretation of the potentiometric head distribution in the aquifers would be improved if observation wells were drilled at strategic locations. These locations are in Monmouth and Ocean Counties in the Potomac-Raritan-Magothy aquifer system and the Englishtown and Wenonah-Mount Laurel aquifers. If the potentiometric head distribution in the artesian aquifers were evaluated every 5 years, and if select observation wells were monitored frequently, valuable data could be provided for continued management of ground water in the Coastal Plain aquifers.

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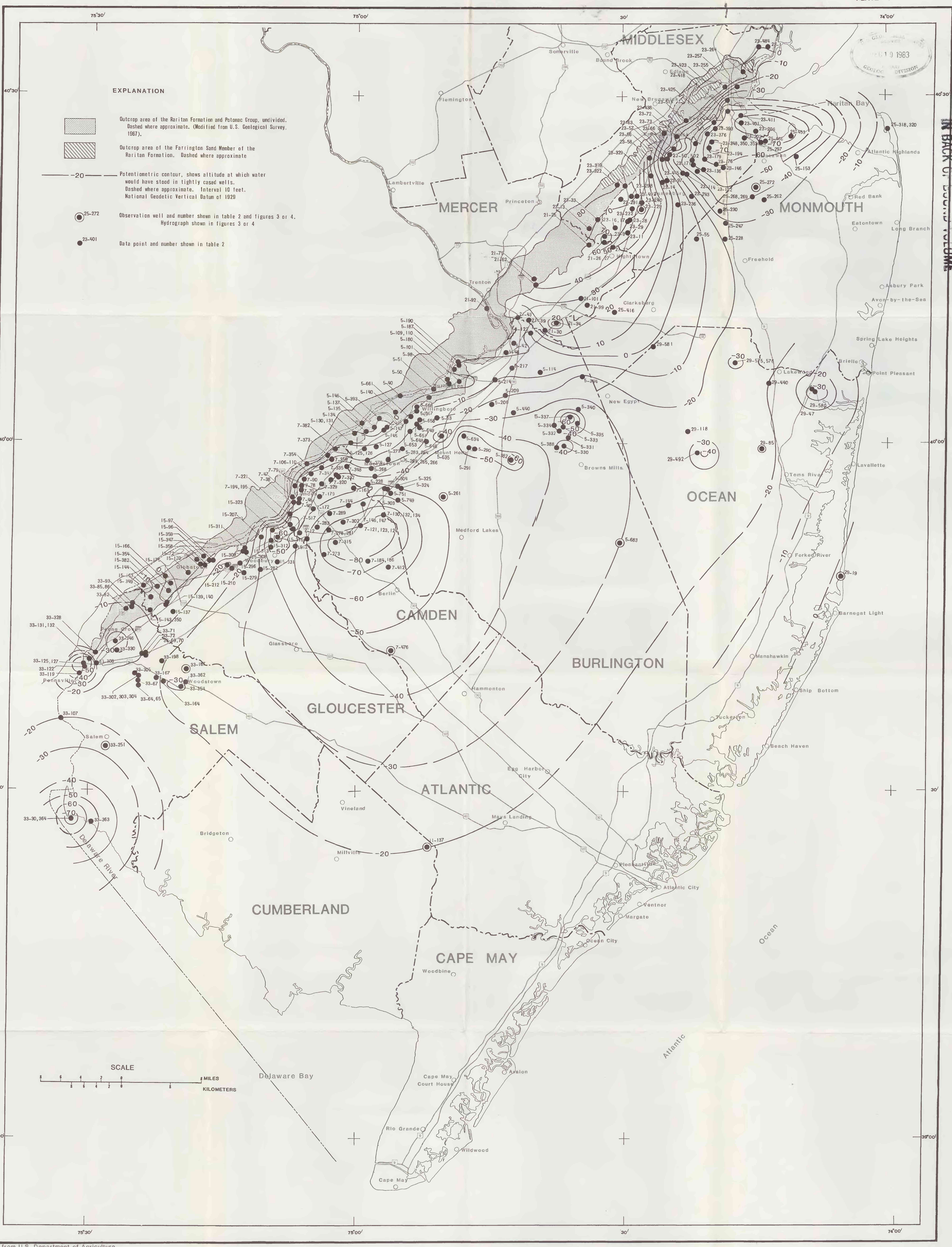
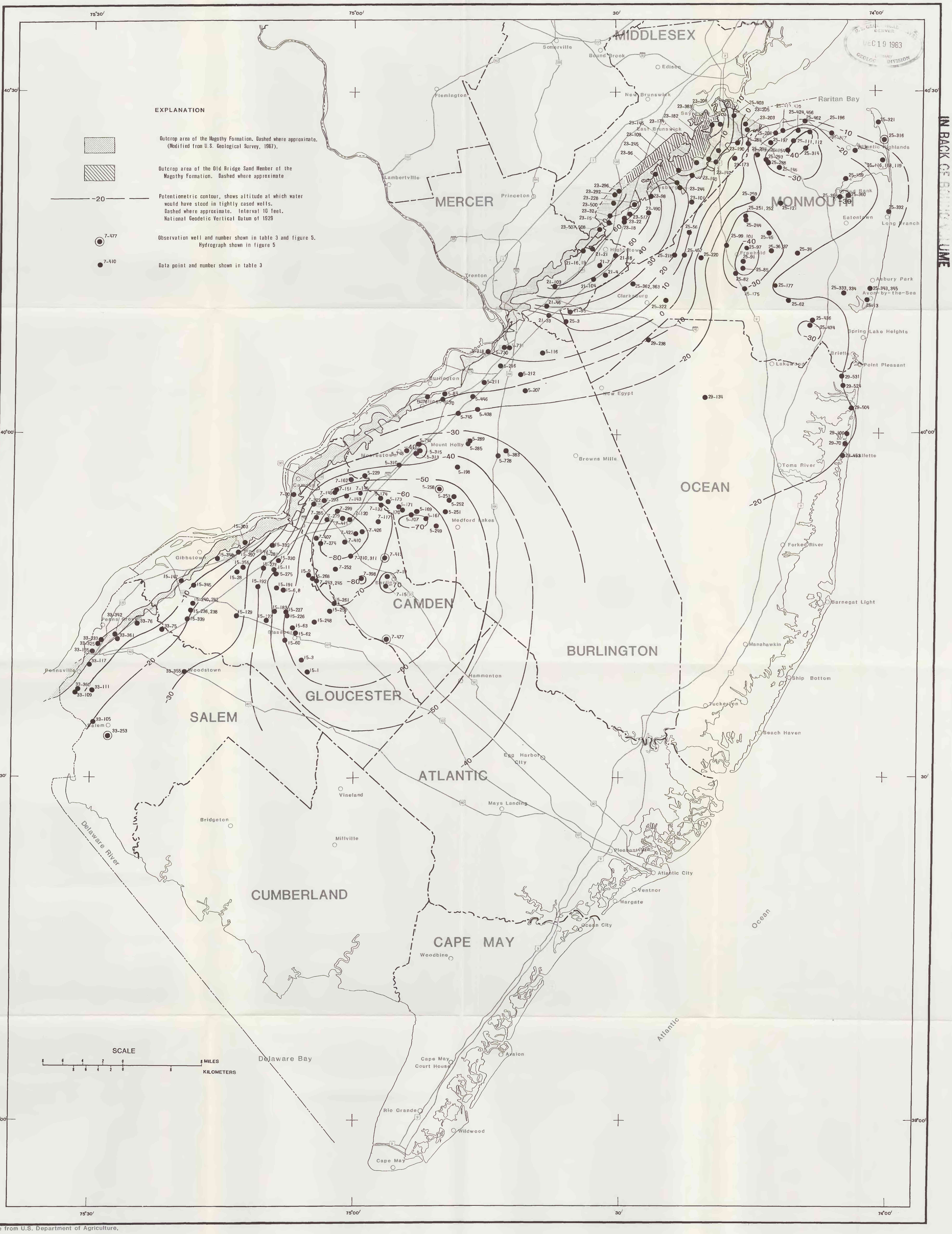


Base from U.S. Department of Agriculture, Soil Conservation Service, 1980, 1:250,000

POTENTIOMETRIC SURFACE OF THE LOWER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM, 1978.



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POTENTIOMETRIC SURFACE OF THE UPPER AQUIFER OF THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM, 1978.

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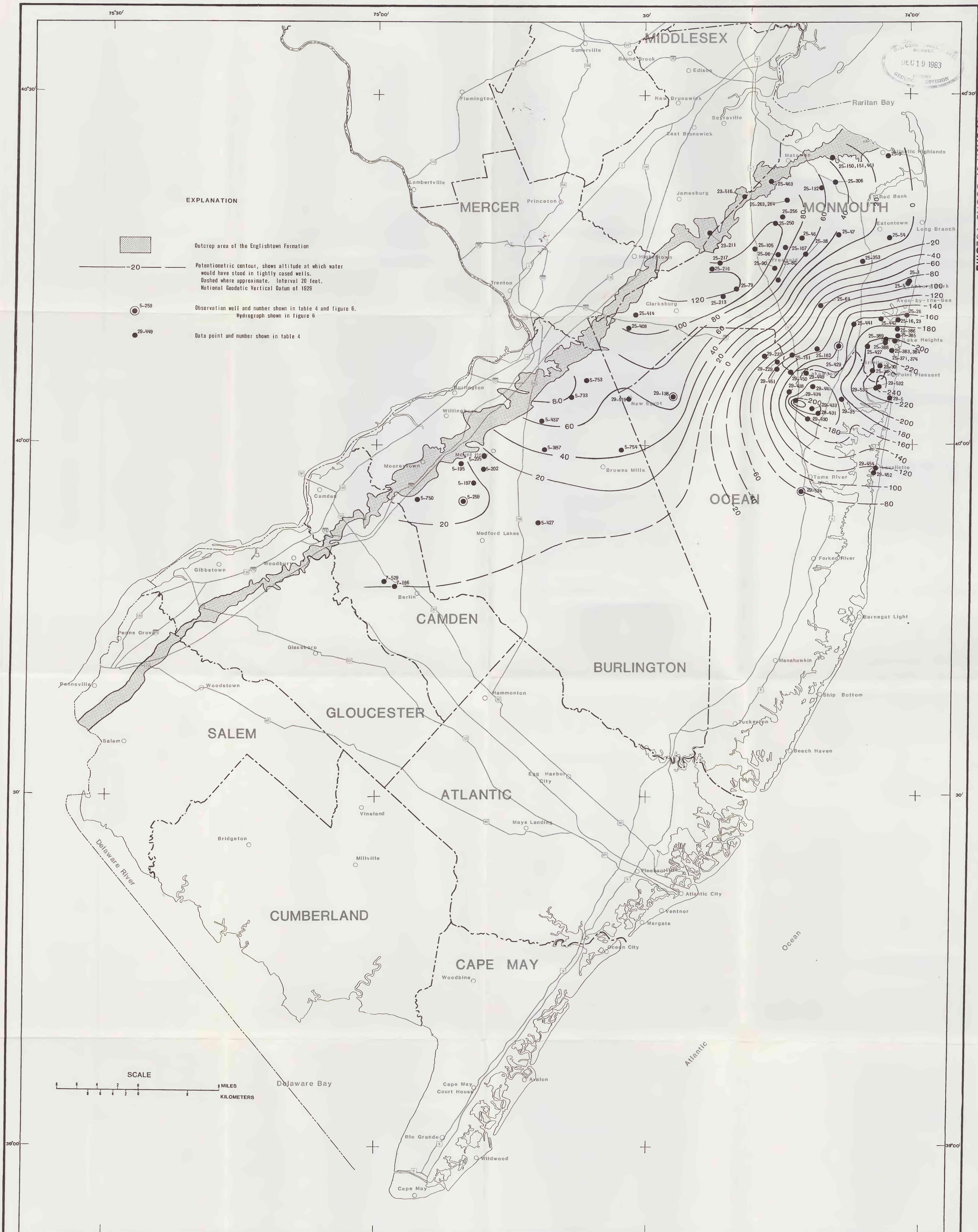

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POTENTIOMETRIC SURFACE OF THE ENGLISHTOWN AQUIFER, 1978.

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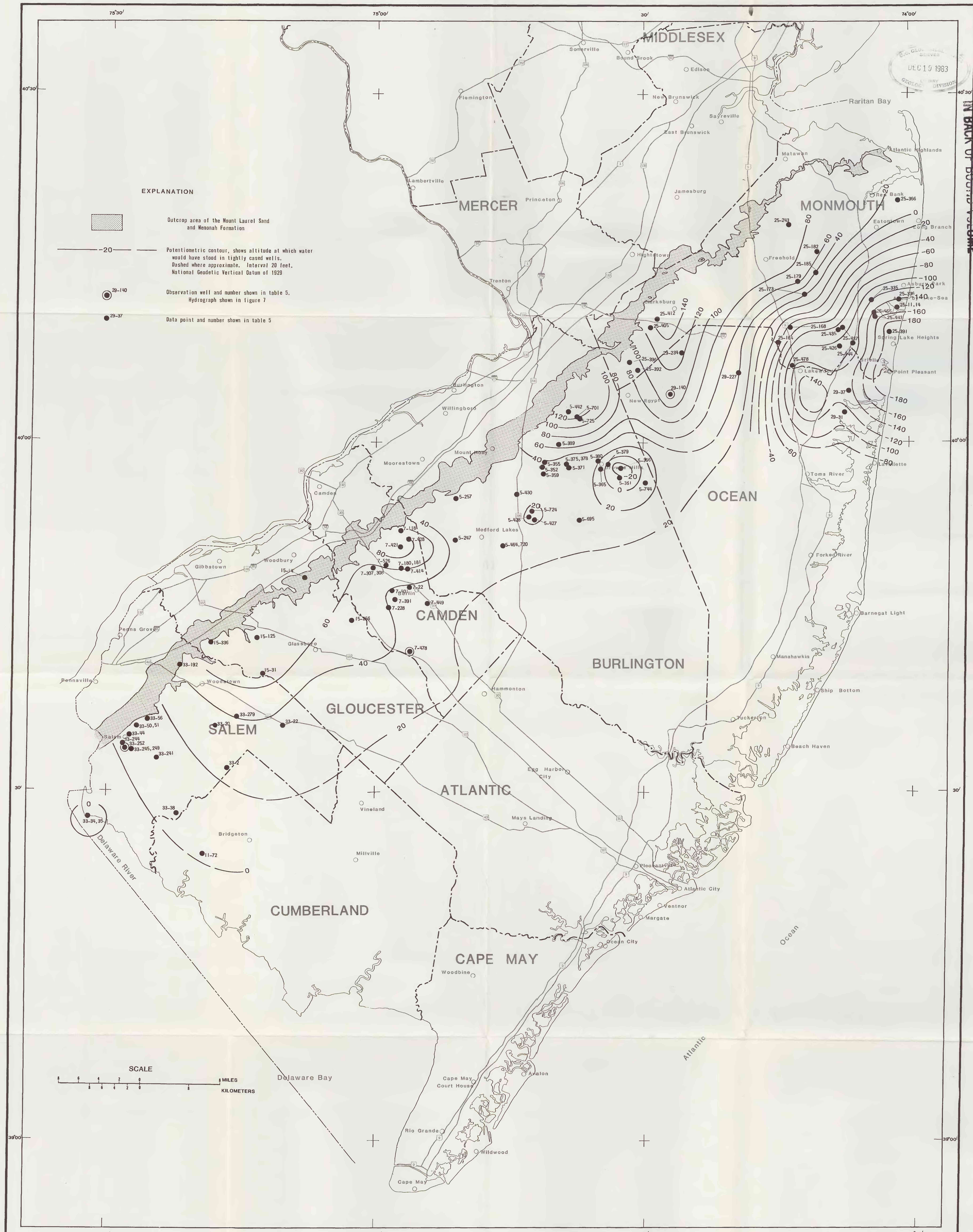
WATER-RESOURCES INVESTIGATIONS 82-4077
PLATE 4



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POTENTIOMETRIC SURFACE OF THE WENONAH–MOUNT LAUREL AQUIFER, 1978.

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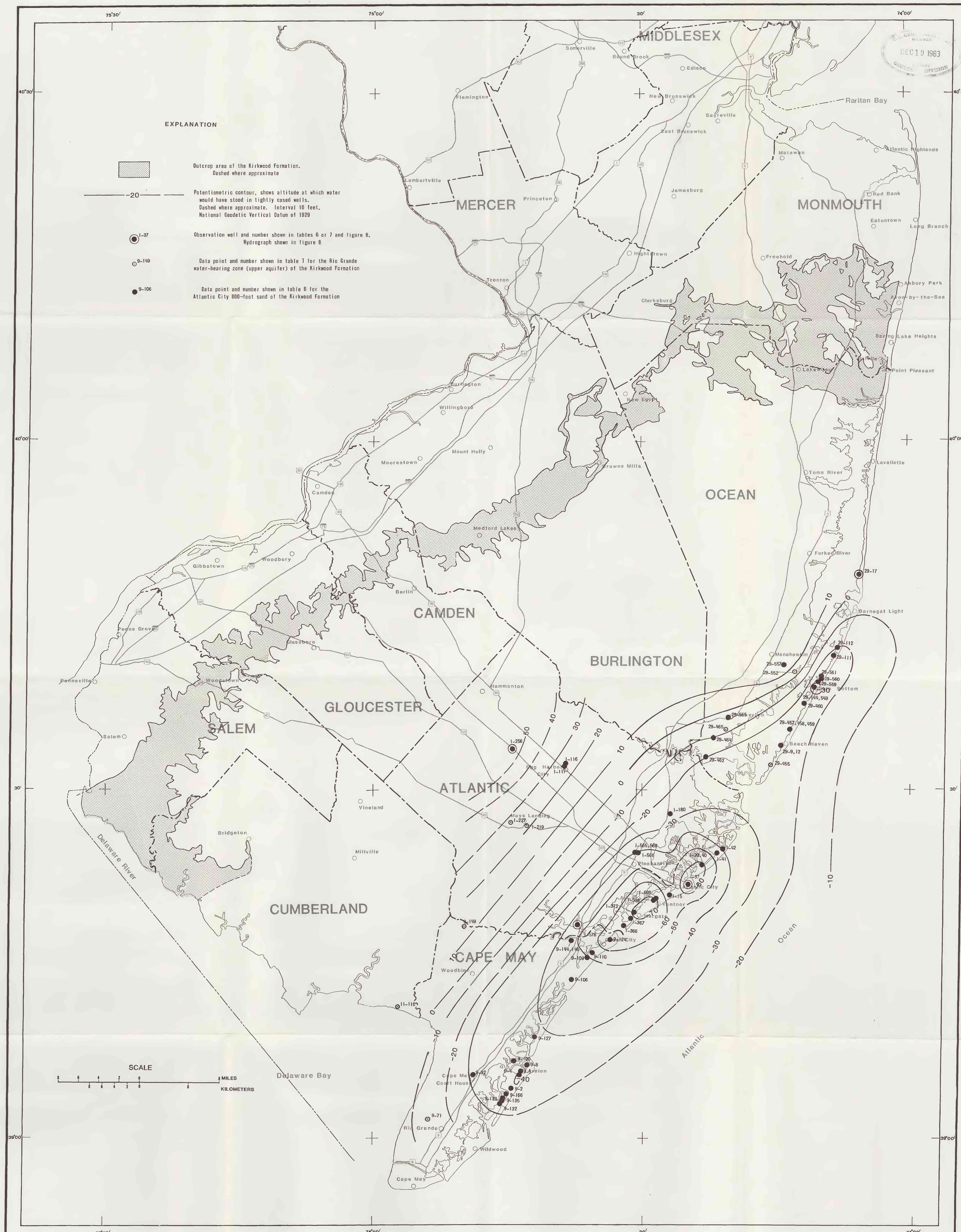
WATER-RESOURCES INVESTIGATIONS 82-4077
PLATE 5



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POTENTIOMETRIC SURFACE OF THE ATLANTIC CITY 800-FOOT SAND OF THE KIRKWOOD FORMATION, 1978.