WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998

By Pierre J. Lacombe and Robert Rosman

ABSTRACT

Water levels were measured in 848 wells in New Jersey, Pennsylvania, northeastern Delaware, and northwestern Maryland during October to December 1998. The water-level altitudes were used to define the potentiometric surface of 10 confined aquifers in the New Jersey and Delaware Coastal Plain. Lines of equal chloride concentration at 250 and 10,000 milligrams per liter are included to show the extent of freshwater in the confined part of each aquifer. Estimated water withdrawals from the ten confined aquifers are reported for 1978-97. Water-withdrawal maps and potentiometric surface maps and sections, which include lines of equal chloride concentrations, were prepared for the Cohansey aquifer of Cape May County, the Rio Grande water-bearing zone, the Atlantic City 800-foot sand, the Piney Point aquifer, the Vincentown aquifer, the Wenonah-Mount Laurel aquifer, the Englishtown aquifer system, the Upper Potomac-Raritan-Magothy, the Middle and undifferentiated Potomac-Raritan-Magothy, and the Lower Potomac-Raritan-Magothy aquifers in New Jersey and the equivalent aquifers in Delaware and Maryland.

From 1993 to 1998, water levels near the center of the large cones of depression that extend from Middlesex County to Monmouth County rose as much as 47 ft in the Wenonah-Mount Laurel aquifer and 51 ft in the Englishtown aquifer system, thereby decreasing the depth and extent of the cones of depression along the coast. At the same time, water levels declined about 5 to 10 ft in the Upper Potomac-Raritan-Magothy aquifer, and the Middle and undifferentiated Potomac-Raritan-Magothy aquifers in the northern Coastal Plain.

Water levels in Burlington, Camden, and Gloucester Counties declined as much as 67 ft in the regional cone of depression in the Wenonah-Mount Laurel aquifer. Water levels declined as much as 34 ft in the Englishtown aquifer system. In general, water levels in this area rose as much as 51 ft in the Upper Potomac-Raritan-Magothy aquifer, 31 ft in the Middle and undifferentiated Potomac-Raritan-Magothy aquifer, and 44 ft in the Lower Potomac-Raritan-Magothy aquifer.

Water levels in the Vincentown aquifer have remained relatively static since 1993. Water levels in the Cohansey aquifer of Cape May County remained constant in most areas; however, water levels rose near Cape May City after the completion of New Jersey's first desalination well. The use of the desalination well, which is screened in the Atlantic City 800-foot sand, resulted in a large reduction in withdrawals from the Cohansey aquifer after spring 1998. A cone of depression that is centered under the barrier islands of Cape May, Atlantic, and Ocean Counties in the Rio Grande water-bearing zone is mapped for the first time. Water levels in the Atlantic City 800-foot sand declined as much as 11 ft in the Atlantic City-Ocean City area since 1993. Water levels in the Piney Point aquifer declined about 5 ft near Buena, declined 25 ft near Point Pleasant, and rose about 10 ft near Dover, Delaware.

The potentiometric surface and cones of depression in aquifers in Delaware that are equivalent to the Wenonah-Mount Laurel aquifer, and Upper, Middle, and Lower Potomac-Raritan-Magothy aquifers in New Jersey are mapped for the first time in this report series. Water-level altitudes in these aquifers in New Castle County, Delaware, were as low as -170 ft.

INTRODUCTION

Ground-water withdrawals from the confined aquifers in the New Jersey and Delaware Coastal Plain began in the late 1800's. Several regional cones of depression in the potentiometric surfaces of the aquifers have developed as a result of the withdrawals. Before 1978, the cones of depression were mapped locally on a sporadic basis. During 1978, the U.S. Geological Survey (USGS), in cooperation with the New Jersey Department of Environmental Protection (NJDEP), first mapped the potentiometric surfaces of the major aquifers in the New Jersey Coastal Plain and developed a plan to map the potentiometric surfaces of the major confined aquifers at 5-year intervals. In 1984, the plan was expanded to include areas in Delaware in order to map the extent of the cones of depression that extend under the Delaware River. This is the fifth report in the series of reports that show the potentiometric surfaces for the major confined aquifers of the New Jersey Coastal Plain.

Documentation of the potentiometric surface at 5-year intervals provides a means to assess past water-management decisions as well as to develop a firm basis for future water-management decisions.

Purpose and Scope

The purpose of this report is to define the regional potentiometric surfaces during late fall 1998 for 10 confined aquifers of the New Jersey Coastal Plain and the 5 equivalent aquifers in northern Delaware. Water levels were measured in 844 wells during October 18-December 11, 1998, and are listed together with water levels measured during the 1978, 1983, 1988, and 1993 studies. Hydrographs of water levels for 103 observation wells during 1978-98 show long-term changes and seasonal fluctuations for each of the ten aquifers.

The 1998 potentiometric-surface map for each of 10 aquifers is included. The aquifers studied in this investigation include the Cohansey aquifer in southern Cape May County, the Rio Grande water-bearing zone, the Atlantic City 800-foot sand, the Piney Point aquifer, the Vincentown aquifer, the Wenonah-Mount Laurel aquifer, the Englishtown aquifer system, the Upper Potomac-Raritan-Magothy aquifer, the Middle and undifferentiated Potomac-Raritan-Magothy aquifer, and the Lower Potomac-Raritan-Magothy aquifer. Each map shows the location of three lines of equal chloride concentration. One chloride line is in the outcrop/unconfined part of the aquifer, and two chloride lines are in the confined part of the aquifer. Water-level tables and hydrographs, as well as water-withdrawal maps and hydrographs, are provided for each of the 10 aquifers. Supplemental figures show precipitation during 1978-98, highlighting periods of summer droughts. Three potentiometric-surface sections show the vertical ground-water flow directions and the gradients between the aquifers.

Study Area

The study area (fig. 1-1) is about 9,500 mi^2 and includes the Coastal Plain of New Jersey and Pennsylvania, Delaware Bay, Raritan Bay, parts of the Coastal Plain in Maryland, Delaware, and nearshore areas of the Atlantic Ocean. The area of study focuses on Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, Ocean, Salem, and parts of Mercer and Middlesex Counties in New Jersey; Kent and New Castle Counties in Delaware; Bucks, Philadelphia, and Delaware Counties in Pennsylvania; and Cecil, Kent, Queen Annes, and Caroline Counties in Maryland.

Hydrogeologic Framework

The aquifers and confining units included in the study area are part of the wedge-shaped deposits of sand, silt, and clay that range in age from Cretaceous to Quaternary (table 1-1). These deposits are less than 50 ft thick along the western limit of the Coastal Plain and are greater than 6,500 ft thick in southern Cape May County. Zapecza (1989) describes in detail the hydrogeology of New Jersey, and Vroblesky and Fleck (1991) describe in detail the hydrogeology of Delaware and Maryland. Sections A-A', B-B', and C-C' show the positions of the aquifers and confining units in the northern, central, and southern New Jersey Coastal Plain (figs. 1-2 to 1-4).

Precipitation

Monthly precipitation at National Climatic Center stations in Hightstown, Glassboro, and Atlantic City ranged from less than 1 in. to more than 10 in. during 1978-98 (fig.1-5). Mean precipitations during 1978-98 at the three stations were 3.93, 3.72, and 3.33 in., respectively. For this study, droughts are defined as periods of 4 months and longer when precipitation was less than the 20-year mean from 1978 to 1998. These drought periods are highlighted in figure 1-5. Water withdrawals are much greater during the summer months than during the rest of the year; therefore, the summer months also are highlighted. When droughts occur during the summer, large quantities of ground water typically are withdrawn, and low water levels are observed on hydrographs. Summer droughts occurred at all three climate stations in 1980, 1984, and 1998. Summer droughts occurred at two climate stations during 1981, 1982, 1983, and 1993. The summer droughts explain many, but not all, of the exceptionally low summer water levels shown on the hydrographs. During the summer drought of 1998, water levels were exceptionally low in some observation wells in the Atlantic City 800-foot sand, Piney Point aquifer, Wenonah-Mount Laurel aquifer, and Upper, Middle, and Lower Potomac-Raritan-Magothy aquifers.

Methods of Data Collection

Estimated water-withdrawal data were compiled from NJDEP records and stored in the USGS, State Water Use Data System. Estimated water withdrawals in Delaware were provided by the Delaware Department of Natural Resources and Environmental Control. Static water-level altitudes were measured in 792 wells in New Jersey, Pennsylvania, and Maryland by USGS personnel. Water levels were measured in 56 wells in Delaware under the authority of Delaware Geological Survey personnel. Water levels, which were measured during late October to early December 1998, represent the annual average water level. Low water levels typically occur during late summer, and high water levels typically occur during spring. Water levels were measured in public-, industrial-, commercial-, irrigation-, and domestic-supply wells and observation wells.

Wells were selected on the basis of aerial distribution for each aquifer. As in previous studies, water-level altitudes were measured by using steel or electric measuring tapes, which are the most accurate devices, or by using an airline, which is the least accurate. The airline method was used for only a few wells that were inaccessible for measuring with a steel or electric tape.

The pumps in high-capacity supply wells were turned off for at least 1 hour before measurement of the water level in the well. In addition, pumps in all other high-capacity supply wells screened in the same aquifer within 0.25 mi. of the measured well were turned off for at least 1 hour before measurement of the water level. Following USGS methods for water-level measuring, field personnel made several measurements in each well until two similar readings were obtained at least 5 minutes apart to ensure that the water-level measurement reflected the local static water level. In this report, "observation well" means a well that had not been pumped during the previous 24 hours. In addition, "production well" means a well that had not been pumped in the hour before water-level measurement but may have been pumped during the previous 24 hours. In the reports for 1978, 1983, and 1988, the terms "observation well" and "production well" were applied to the original use of the well, not to its use during the investigation.

Water levels were referenced to the land-surface altitude at each well site. The altitude of land surface was used to adapt water levels to the sea-level datum.

The location of the 10,000-mg/L line of equal chloride concentration was estimated by Pope and Gordon (1999) based on a computer model simulation for each major aquifer of the New Jersey Coastal Plain and by Vroblesky and Fleck (1991) for aquifers in the Delaware Coastal Plain. The location of the 250-mg/L chloride line typically is based on published maps that are cited for each aquifer. The 250 mg/L chloride line shows the limit of potable water in each aquifer. If no map was available to show the location of the 250-mg/L chloride line in a particular aquifer, the chloride line was determined from chloride data stored in the U.S. Geological Survey Water Quality Data Base. The 250-mg/L chloride line designates the limit of the fresh drinking water as defined by the NJDEP secondary drinking-water standards (N.J. Department of Environmental Protection, 1989). The surface-water saltwater/freshwater interface near the coastline is based on U.S. Fish and Wildlife Service (1990) wetland delineation maps that separate estuarine and marine wetlands populated by saltwater-tolerant plants from palustrine, lacustrine, and riverine wetlands and upland areas not populated by saltwater-tolerant plants. The locations of the three chloride lines are used to determine the extent of freshwater supplies and the location of the saltwater, density-driven component of ground-water flow.

Conversion of Saltwater Level to Freshwater Level

Water in two of the observation wells measured in this study have chloride concentrations in excess of 10,000 mg/L. Water levels in these wells were converted from a measured saltwater level to a calculated freshwater level. The conversion equation follows a modification of the Ghyben-Herzberg relation (Todd, 1980) to determine the equivalent length of freshwater in a well filled with saltwater:

$$l_f = (\rho_s/\rho_f)\, l_s,$$

where l_f is length of the freshwater column in the well casing, ρ_s is the density of salty water, ρ_f is the density of freshwater, and l_s is the length of saltwater column in the well casing. The density of freshwater is 1.00, and the density of the saltwater increases with increasing concentrations of ions. The varying density is presented in the body of the report.

Description of Data Presented

The data presented and discussed include ground-water withdrawals, extent of freshwater, and ground-water levels for each aquifer (Sheets 2 to 10). Estimated water-withdrawal data are presented as maps and hydrographs for each aquifer. The 250- and 10,000-mg/L chloride lines delineate the extent of freshwater and are shown on the potentiometric-surface maps and sections. Water-level data are presented as tables, hydrographs, maps, and sections to show regional and long-term trends in water levels for each aquifer.

The long term water-withdrawal data, 1997 water-withdrawal data, and long term water-level data are presented with the potentiometric-surface maps to integrate the regional and temporal effects of ground-water withdrawal on the potentiometric surface of an aquifer. Furthermore, the locations of the 250 and 10,000 mg/L chloride lines are included to demonstrate the proximity of saltwater to the major pumping centers.

The water-level tables contain the well-identification number for each well; site location (latitude, longitude, and land-surface altitude); owner's name; local well identifier; year drilled; screen interval; date of 1998 water-level-altitude measurement; water-level altitudes measured for the previous surveys in 1978, 1983, 1988, and 1993, if available; and changes in water levels from 1993 to 1998, if available.

The scale of the 1998 potentiometric-surface maps, like previous maps in this series, is 1:250,000. The maps were prepared from the water-level data listed in respective tables and adapted from water levels simulated by Martin (1984, 1998), Leahy (1979), and Phillips (1987). The simulated potentiometric contours on the maps are represented by the dashed contour lines in the eastern part of most maps and are labeled "approximate". Changes in water levels during 1993-98 of 10 ft or more are discussed in some detail. The accuracy of the potentiometric contours depends on the distribution of wells, the accuracy of land-surface-altitude data, and the accuracy of the water-level measurements. Differences in heads in a few randomly spaced wells may be caused by local variations in withdrawal or recharge, measurement-accuracy limitations, or differences in the recovery periods at recently pumped wells. Seasonal water-level fluctuations and long-term trends in the altitude of the potentiometric surface can be extrapolated from the water-level hydrographs. Water-level hydrographs from observation wells show water-level trends during 1978-98.

Potentiometric surfaces are shown in map view and in three section views for each aquifer. The map view shows water-level altitudes, the near horizontal flow direction, and the near horizontal flow gradient. The framework for each section view was developed from structure maps by Zapecza (1989). The potentiometric surface shown in each section was developed from the potentiometric surface of the aquifer shown in the respective plates in this report and from published water-table maps. The potentiometric-surface section shows the vertical flow directions and flow gradients between the aquifers and through the confining units. The sections also show the near horizontal flow directions and flow gradients within the aquifers.

Section A-A' shows ground-water-flow directions and gradients in the northern Coastal Plain (fig. 1-2). The section location was selected to show the potentiometric surface highs that are west of Freehold (fig. 1-1) and the cones of depression in the Point Pleasant area. The water-table contours are from Watt, Johnson, and Lacombe (1994). Section B-B' shows ground-water-flow directions and gradients for the central New Jersey Coastal Plain (fig. 1-3). The section location was selected to show the cones of depression in the greater Camden County and Atlantic City areas. Water-table contours are from Watt and Johnson (1992) and Johnson and Watt (1996). Section C-C' shows ground-water-flow directions and gradients in Cape May County (fig. 1-4). The section location was selected to show the cones of depression in southern Cape May County. Water levels in the unconfined aquifer and shallowest confined aquifers are from data on file at the USGS New Jersey District office.

Previous Investigations

Previous potentiometric-surface maps in this series show ground-water levels at 5-year intervals from 1978 through 1993: 1978, Walker (1983); 1983, Eckel and Walker (1986); 1988, Rosman, Lacombe, and Storck (1996); and 1993, Lacombe and Rosman (1997).

This series is augmented by water-table maps for the unconfined aquifers within the following basins of the New Jersey Coastal Plain: Mullica River Basin (Johnson and Watt, 1996); Salem River, Raccoon, Oldmans, Alloway, and Stow Creek Basins (Johnson and Charles, 1997); Upper Maurice River Basin (Lacombe and Rosman, 1995); Great Egg Harbor River Basin (Watt and Johnson, 1992); and Toms River, Metedeconk River, and Kettle Creek Basins (Watt, Johnson, and Lacombe, 1994).

Well-Numbering System

The well-numbering system used in this report is based on the system used by the USGS office in New Jersey since 1978. The well number consists of a county code and a sequence number for the well inventoried in that county. The codes for New Jersey, Pennsylvania, and Maryland Counties in this report are

Atlantic, 1	Mercer, 21
Burlington, 5	Middlesex, 23
Camden, 7	Monmouth, 25
Cape May, 9	Ocean, 29
Cumberland, 11	Salem, 33
Gloucester, 15	

Philadelphia County, Pa, P
Caroline County, Md, CO
Cecil County, Md, CE

For example, well number 7-221 is the 221st well inventoried in Camden County. The well numbers used in Delaware are assigned by the Delaware Geological Survey.

Acknowledgments

The authors gratefully acknowledge the cooperation of the water purveyors and well owners for allowing access to their wells for water-level measurements. The authors wish to thank Robert Oberthaler, Diane Zalaskus, Michael Bleicher, Jan Gheen, and Jennifer Myers of the New Jersey Department of Environmental Protection for their assistance and direction in designing the study with respect to New Jersey data. The authors also wish to thank John Talley and Thomas McKenna of the Delaware Geological Survey. John Talley oversaw the collection of water-level data in Delaware; he and Thomas McKenna aided in interpreting the water levels and chloride data for the Delaware part of the study. The authors also wish to thank Stewart Lovell of the Delaware Department of Natural Resources and Environmental Control for providing water-withdrawal data for Delaware. Finally, the authors would like to thank Daniel Soeder, Judy Denver, and Michael Smigaj of the Maryland and Delaware offices of the USGS for providing information about the hydrogeology of Delaware.

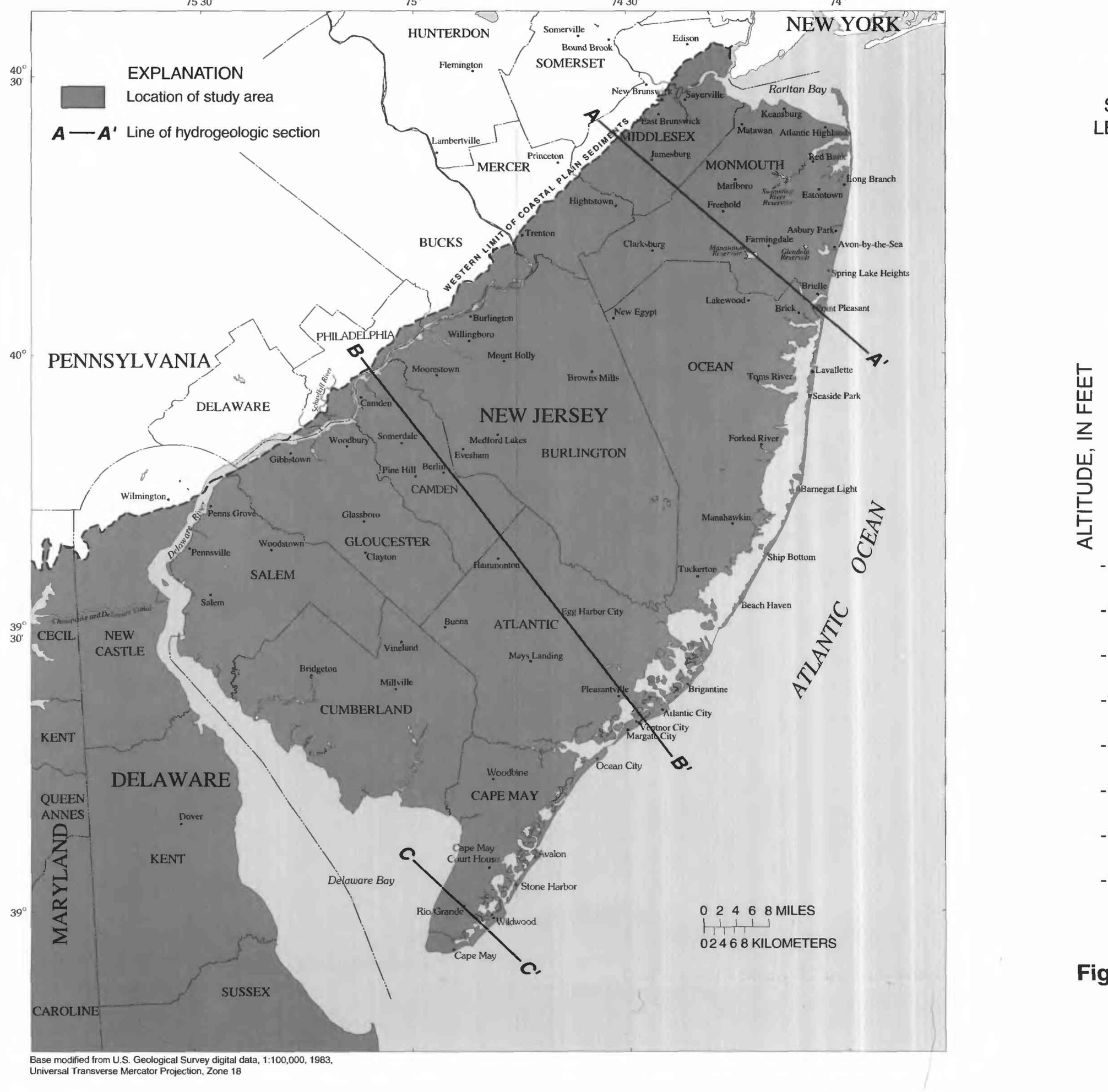


Figure 1-1. Location of study area.

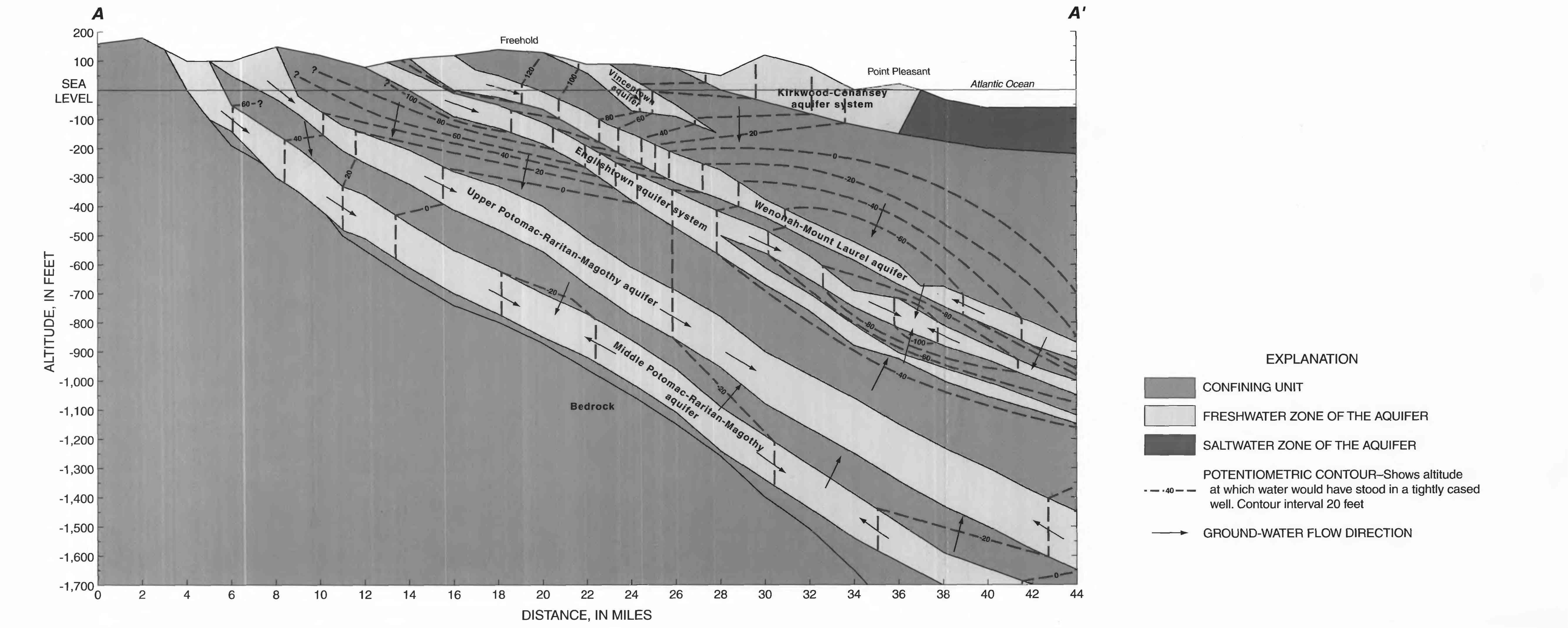


Figure 1-2. Section A-A' showing the potentiometric surface lines in the aquifers of the northern New Jersey Coastal Plain, 1998.

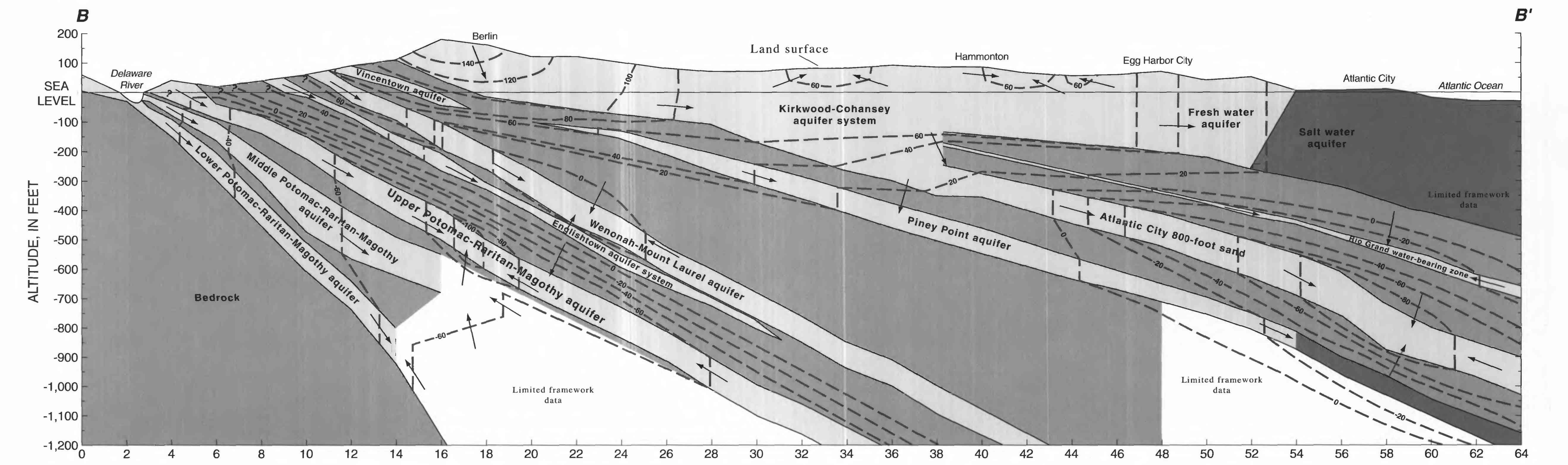


Figure 1-3. Section B-B' showing the potentiometric surface lines in the aquifers of the southern New Jersey Coastal Plain, 1998.

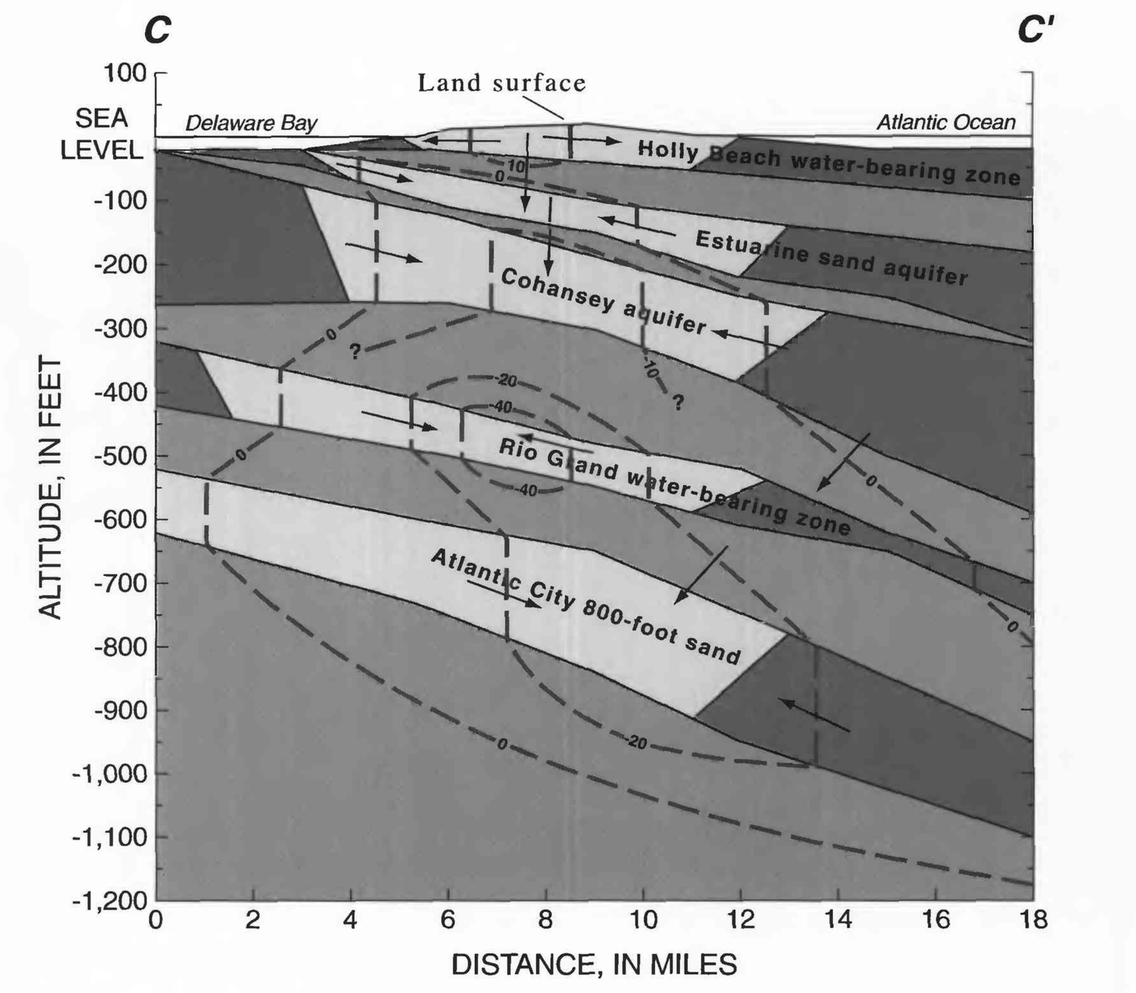


Figure 1-4. Section C-C' showing the potentiometric surface lines in the aquifers of Cape May County, 1998.

Table 1-1. Geologic and hydrogeologic units in the New Jersey Coastal Plain and hydrogeologic units of the Delaware Coastal Plain
[Modified from Zapecza (1989, table 2); shading indicates aquifers in this study]

System	Series	New Jersey geologic unit	New Jersey lithology	New Jersey hydrogeologic unit	New Jersey hydrologic characteristics	Delaware hydrogeologic unit
Quaternary	Holocene	Alluvial deposits	Sand, silt, and black mud	Undifferentiated	Surficial material, commonly hydraulically connected to underlying aquifers. Locally some units may act as confining units. Thicker sands are capable of yielding large quantities of water	
		Beach sand and gravel	Sand, quartz, light-colored, medium- to coarse-grained, pebbly			
	Pleistocene	Cape May Formation	Sand, quartz, light-colored, heterogeneous, clayey, pebbly			Columbia Group
Tertiary	Miocene	Pennsauken Formation		Kirkwood-Cohansey aquifer system	A major aquifer system. Ground water occurs generally under water-table conditions	Chesapeake Group: Pocomok aquifer
		Bridgeton Formation				Manalokin aquifer
		Beacon Hill Gravel	Gravel, quartz, light-colored, sandy			
		Cohansey Sand	Sand, quartz, light-colored, medium- to coarse-grained, pebbly; local clay beds	Cohansey aquifer	In Cape May County, the Cohansey Sand is a confined aquifer	Frederica aquifer
		Kirkwood Formation	Sand, quartz, gray and tan, very fine- to medium-grained, micaceous, and dark-colored diatomaceous clay	Confining unit	Thick diatomaceous clay bed occurs along coast and for a short distance inland. A thin water-bearing sand is present in the middle of this unit	Federalsburg aquifer
				Rio Grande water-bearing zone		
				Confining unit		Cheswold aquifer
				Atlantic City 800-foot sand	A major aquifer along the coast	
				Composite confining unit	Poorly permeable sediments	
	Eocene	Piney Point Formation / Shark River Formation	Sand, quartz and glauconite, fine- to coarse-grained	Piney Point aquifer	Yields moderate quantities of water	Piney Point aquifer
		Manasquan Formation	Clay, silty and sandy, glauconitic, green, gray, and brown, contains fine-grained quartz sand	Composite confining unit	Poorly permeable sediments	Confining unit
	Paleocene	Vincentown Formation	Sand, quartz, gray and green, fine- to coarse-grained, glauconitic, and brown clayey, very fossiliferous, glauconite and quartz calcarene	Vincentown aquifer	Yields small to moderate quantities of water in and near its outcrop area	Vincentown aquifer
		Hornerstown Sand	Sand, clayey, glauconitic, dark green, fine- to coarse-grained	Composite confining unit	Poorly permeable sediments	Confining unit
Cretaceous	Upper Cretaceous	Tinton Sand	Sand, quartz, and glauconite, brown and gray, fine- to coarse-grained, clayey, micaceous			
		Red Bank Sand		Red Bank sand	Yields small quantities of water in and near its outcrop area	
		Navesink Formation	Sand, clayey, silty, glauconitic, green and black, medium- to coarse-grained	Composite confining unit	Poorly permeable sediments	
		Mount Laurel Sand	Sand, quartz, brown and gray, fine- to coarse-grained, slightly glauconitic	Wenonah-Mount Laurel aquifer	A major aquifer	Mount Laurel aquifer
		Wenonah Formation	Sand, very fine- to fine-grained, gray and brown, silty, slightly glauconitic	Marshalltown-Wenonah confining unit	A leaky confining unit	Confining unit
		Marshalltown Formation	Clay, silty, dark greenish-gray, glauconitic quartz sand			
		Englishtown Formation	Sand, quartz, tan and gray, fine- to medium-grained; local clay beds	Englishtown aquifer system	A major aquifer. Two sand units in Monmouth and Ocean Counties	
		Woodbury clay	Clay, gray and black, micaceous silt	Merchantville-Woodbury confining unit	A major confining unit. Locally the Merchantville Formation may contain a thin water-bearing sand	
		Merchantville Formation	Clay, glauconitic, micaceous, gray and black; locally very fine-grained quartz and glauconitic sand			
		Magothy Formation	Sand, quartz, light-gray, fine- to coarse-grained; local beds of dark-gray lignitic clay. Includes Old Bridge Sand Member	Potomac-Raritan-Magothy aquifer system: Upper aquifer	A major aquifer system. In the northern Coastal Plain, the Upper aquifer is equivalent to the Old Bridge aquifer and the Middle aquifer is equivalent to the Farrington aquifer. In the Delaware River Valley, three aquifers are recognized. In the deeper subsurface, units below the Upper aquifer are undifferentiated	Magothy aquifer
						Confining unit
		Raritan Formation	Sand, quartz, light-gray, fine- to coarse-grained pebbly arkosic; contains red, white, and variegated clay. Includes Farrington Sand Member	Middle aquifer		Upper and middle Potomac aquifers
						Confining unit
	Lower Cretaceous	Potomac Group	Alternating clay, silt, sand, and gravel	Lower aquifer		Lower Potomac aquifer
Pre-Cretaceous		Bedrock	Precambrian and Lower Paleozoic crystalline rocks, metamorphic schist and gneiss; locally Triassic sandstone and shale and Jurassic diabase are present	Bedrock confining unit	No wells obtain water from these consolidated rocks, except along Fall Line	Bedrock confining unit

CONVERSION FACTORS, ABBREVIATED UNITS, AND DEFINITIONS OF TERMS

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.59	square kilometer
gallon (gal)	3.785	liter
foot per year (ft/yr)	0.3048	meter per year
cubic foot (ft^3)	0.02832	cubic meter
gallons per minute (gal/min)	0.000228	cubic feet per second
million gallons per day (Mgal/d)	0.0438	cubic meter per second
million gallons per year (Mgal/yr)	3.78×10^3	cubic meter per year

ABBREVIATED UNITS

Chloride concentrations in this report are expressed in milligrams per liter (mg/L)

DEFINITIONS OF TERMS

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.
Altitude: In this report altitude refers to the distance above or below sea level.
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.
Isochlor: Line of equal chloride concentration.

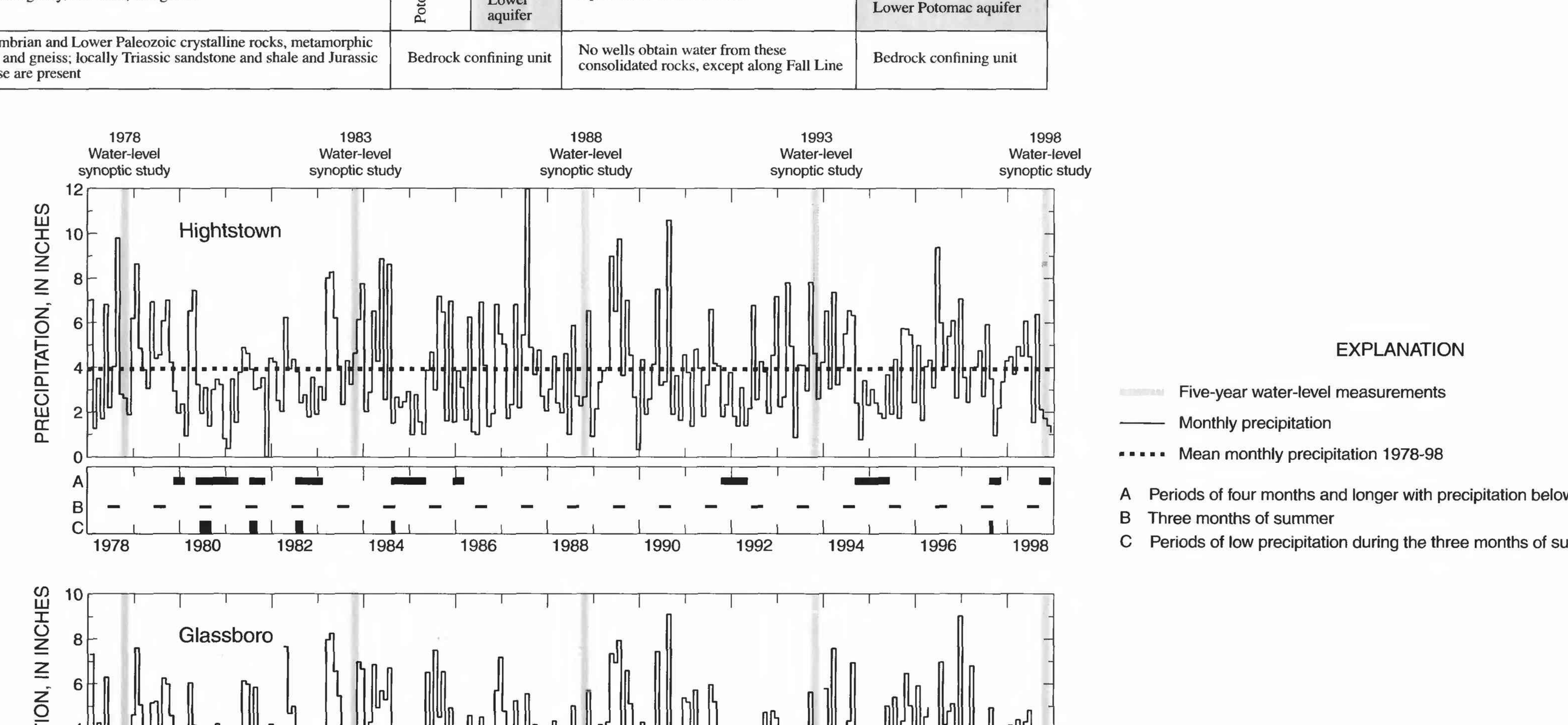


Figure 1-5. Monthly precipitation highlighting periods of low precipitation during the 3 months of summer, New Jersey Coastal Plain,1978-98.

SUMMARY AND CONCLUSIONS

The principal sources of ground-water supply in the New Jersey and northern Delaware Coastal Plain are 10 confined aquifers that underlie the region. Ground-water withdrawals have stressed many of the aquifers, causing the formation of large regional cones of depression and the movement of the saltwater front within the aquifers.

Ground-water-withdrawal data for 1978-97 were compiled from the New Jersey Department of Environmental Protection (NJDEP) and Delaware Department of Natural Resources and Control to compare the water withdrawals from, and the potentiometric surface of, each aquifer. Water-withdrawal hydrographs were used to evaluate the trends in water withdrawal during 1978-97, and water-withdrawal maps were used to show the locations of major withdrawal areas in each aquifer in 1997.

Water levels were measured in 848 wells during late October to early December 1998 and compared with water levels measured during a similar study in 1993. Water levels measured during the 1998 study were used to construct potentiometric-surface maps for the 10 aquifers as well as three potentiometric-surface sections. Water-level hydrographs for 103 observation wells screened in the aquifers were used to evaluate long-term trends in water levels during 1978-98 as well as seasonal trends.

The extent of freshwater was determined from published maps that show the locations of the 250-mg/L chloride lines or from water-quality data available from the USGS Water Quality Data Base. The locations of the 10,000-mg/L chloride lines were derived from published reports.

Water withdrawals from the Cohansey aquifer remained fairly constant, about 6 to 7 Mgal/d during 1978-97. Withdrawals decreased slightly during 1997-98 after a desalination well and plant were completed. The potentiometric surface in 1998 was generally about the same size as in 1993, but water levels were slightly higher near Cape May City. The extent of freshwater continued to decrease, and saltwater intrusion continued to restrict the withdrawal of freshwater, especially in the Villas area where the chloride concentration increased in well 9-187 from 190 to 345 mg/L during 1996-99.

Water withdrawal from the Rio Grande water-bearing zone remained at just below 1 Mgal/d. The potentiometric-surface map shows a regional cone of depression in the aquifer near the shore areas of Atlantic and Cape May Counties. This is a sympathetic cone of depression caused by withdrawals from the Atlantic City 800-foot sand. A local cone of depression is centered on the Wildwood Water Department well field in southern Cape May County. Some water-level altitudes here are less than -40 ft.

Water withdrawals from the Atlantic City 800-foot sand ranged from 18 to 21 Mgal/d during 1978-97. The potentiometric surface forms an elongated cone of depression along the Atlantic shoreline. Water levels declined less than 10 ft in most areas during 1993-98; however, in the area from Atlantic City to Ocean City, water levels declined about 10 to 12 ft. The water-level altitude in the center of the cone of depression was about -100 ft, or more than 10 ft lower than water levels in 1993. The extent of freshwater remained about the same.

Water withdrawals from the Piney Point aquifer ranged from 2 to 3.5 Mgal/d in New Jersey and increased from about 2.2 to 3.0 Mgal/d in Delaware during 1978-97. Five regional cones of depression are present in the aquifer as a result of ground-water withdrawals. Water levels in the centers of the two cones of depression in eastern Ocean County declined from 6 ft to more than 20 ft during 1993-98. The water-level altitude at the center of the cone under Seaside Park is less than -40 ft and under Barnegat Light is less than -60 ft. The water level in the cone of depression in the Buena area has declined about 10 ft since 1993 to an altitude of about -35 ft. The water level in the sympathetic cone of depression in the Atlantic City area declined from -30 to -32 ft probably as a result of continued withdrawals from the overlying Atlantic City 800-foot sand. Water levels in Cumberland County were about 5 ft lower in 1998 than in 1993 as a result of withdrawals in Dover, Delaware, and surrounding areas. The cone of depression in Dover, Delaware, was relatively constant during 1993-98. The extent of freshwater in 1998 probably is about the same as in 1993.

Water withdrawals from the Vincentown aquifer ranged from 0.5 to 1 Mgal/d. The previous potentiometric-surface map was produced in 1988. The configuration of the potentiometric surface in 1998 is nearly identical to that in 1988.

Total water withdrawals from the Wenonah-Mount Laurel aquifer ranged from 5 to 10 Mgal/d during 1978-98. Withdrawals in the northern Coastal Plain decreased from 1.4 to 0.7 Mgal/d during 1978-97 because of NJDEP's mandate to reduce withdrawals. Water-level altitudes at the center of the cone of depression rose as much as 47 ft since 1993 to about -90 ft in the center of the cone in 1998. Water withdrawals from the aquifer in the southern Coastal Plain increased from 3 to 9.5 Mgal/d during 1978-97. As a result of increased withdrawals, the cone of depression centered in the greater Camden County area expanded into Gloucester County. Water levels in the center of this cone of depression declined 20 to 40 ft during 1993-98 to altitudes of about -50 to -80 ft in 1998. Water withdrawals in Delaware were negligible and water-level altitudes ranged from +3 to +32 ft. The extent of freshwater appears to be about the same as in 1988.

Total water withdrawals from the Englishtown aquifer system decreased from 11 to 7 Mgal/d during 1978-98. Withdrawals in the northern Coastal Plain remained constant at about 5 to 6 Mgal/d during 1993-98 as a result of NJDEP's mandate to reduce withdrawals from this aquifer. Water withdrawals in the southern Coastal Plain increased from about 1 to 1.5 Mgal/d during 1993-97. Water levels in the one major cone of depression in the aquifer in the northern counties rose about 60 ft during 1988-93 and about 50 ft during 1993-98. As a result, the altitude of the center of the cone of depression is about -110 ft. The potentiometric surface declined about 5 to 10 ft the greater Camden County area. Chloride concentrations in water samples were less than 25 mg/L in all but one well. Observation well 25-771 installed in 1997 and screened in a lower sand unit of the Englishtown aquifer system at Sandy Hook produced water that contained a chloride concentration of 16,000 mg/L.

Total water withdrawals in the Upper Potomac-Raritan-Magothy aquifer decreased from about 80 to 50 Mgal/d during 1978-98. Water withdrawals in the northern Coastal Plain decreased from 31 to 28 Mgal/d during 1993-97 as a result of NJDEP's mandates. Water withdrawals remained relatively constant at about 30 Mgal/d in the southern Coastal Plain counties. Water withdrawals in Delaware were less than 0.5 Mgal/d. Decreased withdrawals in the northern counties resulted in generally constant water levels during 1993-98. The minimum water-level altitude in the northern counties was -42 ft in well 29-134. The cone of depression in the greater Camden County area had a minimum altitude of -102 ft. Water levels have risen about 20 to 30 ft in the greater Camden area since 1993. The minimum water-level altitude was about -25 ft in the cone of depression in the Salem and New Castle Counties.

Water withdrawals from the undifferentiated and Middle Potomac-Raritan-Magothy aquifer in the northern Coastal Plain decreased from 95 to 70 Mgal/d during 1978-98 because of the NJDEP mandate to decrease withdrawals. The decrease in withdrawals caused the potentiometric surface at the center of the cone of depression to rise about 60 ft during 1988-93, but then it declined about 5 ft during 1993-98. Water levels in the cone of depression centered under the greater Camden County area rose as much as 20 ft during 1993-98. Water-level altitudes at the center of the cone of depression were about -90 ft during 1993 and -60 ft during 1998. The extent of freshwater remained about the same as in 1993. The water-level altitude at the center of the cone of depression in southern Salem and New Castle Counties was about -60 ft.

Water withdrawals from the Lower Potomac-Raritan-Magothy aquifer decreased from 69 to 42 Mgal/d during 1982-97. As a result of decreased withdrawals from this and other aquifers in the Potomac-Raritan-Magothy aquifer system, the center of the cone of depression decreased in size in the greater Camden area, and water levels rose as much as 44 ft. The water-level altitude in the center of the cone of depression in the lower Potomac aquifer of Delaware was -179 ft. The extent of freshwater remained about the same as in 1993.

REFERENCES CITED

Cushing, E.M., Kantrowitz, I.H., and Taylor, K.R., 1973, Water Resources of the Delmarva Peninsula: U.S. Geological Survey Professional Paper 822, 58 p., 12 pls.

Eckel, J.A., and Walker, R.L., 1986, Water levels in major artesian aquifers of the New Jersey Coastal Plain, 1983: U.S. Geological Survey Water-Resources Investigations Report 86-4028, 62 p., 7 pls.

Gill, H.E., and Farlekas, G.M., 1976, Geohydrologic maps of the Potomac-Raritan-Magothy aquifer system in the New Jersey Coastal Plain: U.S. Geological Survey Hydrologic Investigations Atlas HA-557, 2 sheets, scale 1:500,000.

Johnson, M.L., and Watt, M.K., 1996, Hydrology of the unconfined aquifer system, Mullica River Basin, New Jersey, 1991-92: U.S. Geological Survey Water-Resources Investigations Report 94-4234, 6 sheets.

Johnson, M.L., and Charles, E.G., 1997, Hydrology of the unconfined aquifer system, Salem River Area: Salem River and Raccoon, Oldmans, Alloway, and Stow Creek Basins, New Jersey, 1993-94: U.S. Geological Survey Water-Resources Investigations Report 96-4195, 5 sheets.

Lacombe, P.J., and Carleton, G.B., 1997, Saltwater intrusion into fresh ground-water supplies, Southern Cape May County, New Jersey, 1890-1991, *in* Borden, R.C., and Lyke, W.L., eds., Future availability of groundwater resources: American Water Resources Association Technical Publication Series TPS-92-1 p. 287-297.

Lacombe, Pierre J., and Rosman, Robert, 1995, Hydrology of the unconfined aquifer system in the upper Maurice River basin and adjacent areas in Gloucester County, New Jersey, 1986-87: U.S. Geological Survey Water-Resources Investigations Report 92-4128, 5 sheets.

Lacombe, P.J., and Rosman, Robert, 1997, Water levels in, extent of freshwater in, and water withdrawals from eight major confined aquifers, New Jersey Coastal Plain, 1993: U.S. Geological Survey Water-Resources Investigations Report 96-4206, 8 pls.

Leahy, P.P., 1979, Digital model of the Piney Point aquifer in Kent County, Delaware: Delaware Geological Survey Report of Investigations 29, 80 p.

Martin, Mary, 1984, Simulated ground-water flow in the Potomac aquifers, New Castle County, Delaware: U.S. Geological Survey Water-Resources Investigations Report 84-4007, 85 p.

Martin, Mary, 1998, Ground-water flow in the New Jersey Coastal Plain: U.S. Geological Survey Professional Paper 1404 H, 146 p.

Meisler, Harold, 1989, The occurrence and geochemistry of salty ground water in the northern Atlantic Coastal Plain (regional aquifer-system analysis) U.S. Geological Survey Professional Paper 1404-D, 51 p., 6 pls.

N.J. Department of Environmental Protection, 1985, General Water Supply Management Regulations, Water Supply Management Act, N.J.S.A. paragraph 7:19-6 to 19-13,: Trenton, N.J., N.J. Department of Environmental Protection, Division of Water Resources.

N.J. Department of Environmental Protection, 1989, Safe Drinking Water Act; New Jersey Administrative Code 7:10-1 through 16.12, N.J. Department of Environmental Protection, Division of Water Resources.

Phillips, S.W., 1987, Hydrogeology, degradation of ground-water quality, and simulation of infiltration from the Delaware River into the Potomac aquifers, Northern Delaware: U.S. Geological Survey Water-Resources Investigations Report 87-4185, 86 p.

Pope D.A., and Gorden, A.D., 1999, Simulation of ground-water flow and movement of the freshwater-saltwater interface in the New Jersey Coastal Plain: U.S. Geological Survey Water-Resources Investigations Report 98-4216, 159 p.,

Pucci, A.A., Pope, D.A., and Gronberg, J.M., 1994, Hydrogeology, simulation of regional ground-water flow, and saltwater intrusion, Potomac-Raritan-Magothy aquifer system, northern Coastal Plain of New Jersey: New Jersey Geological Survey, Geological Survey Report GSR 36, 209 p.

Rosman, Robert, Lacombe, P.J., and Storck, D.A., 1996, Water levels in the major artesian aquifers of the New Jersey Coastal Plain, 1988: U.S. Geological Survey Water-Resources Investigations Report 85-4060, 74 p., 7 pls.

Schaefer, F.L., 1983, Distribution of chloride concentrations in the principal aquifers of the New Jersey Coastal Plain, 1977-81: U.S. Geological Survey Water-Resources Investigations Report 83-4061, 56 p.

Todd, D.K., 1980, Groundwater hydrology: New York, John Wiley & Sons, 535 p.

U.S. Fish and Wildlife Service, 1990, Digital wetlands delineation maps (data base); U.S. Fish and Wildlife Service, St. Petersburg, Fla.

U.S. Geological Survey,1967, Engineering geology of the Northeast Corridor, Washington, D.C., to Boston Massachusetts: Coastal Plain and surficial deposits: U.S. Geological Survey Miscellaneous Investigations Map 514-B, 8 sheets, scale 1:250,000.

Vroblesky, D.A., and Fleck, W.B., 1991, Hydrogeologic framework of the Coastal Plain of Maryland, Delaware, and the District of Columbia: U.S. Geological Survey Professional Paper 1404-E, 45 p., 2 pls.

Walker, R.L., 1983, Evaluation of water levels in major aquifers of the New Jersey Coastal Plain, 1978: U.S. Geological Survey Water-Resources Investigations Report 82-4077, 56 p.

Watt, M.K., and Johnson, M.L., 1992, Water resources of the unconfined aquifer system of the Great Egg Harbor River Basin, New Jersey, 1989-90: U.S. Geological Survey Water-Resources Investigations Report 91-4126, 5 pls.

Watt, M.K., Johnson, M.L., and Lacombe, P.J., 1994, Hydrology of the unconfined aquifer system, Toms River, Metedeconk River, and Kettle Creek Basins, New Jersey, 1987-90: U.S. Geological Survey Water-Resources Investigations Report 93-4110, 5 sheets.

Woodruff, K.D., 1969, The occurrence of saline groundwater in Delaware aquifers: Delaware Geological Survey Report of Investigations 13, 45 p.

Zapecza, O.S., 1989, Hydrogeologic framework of the New Jersey Coastal Plain: U.S. Geological Survey Professional Paper 1404-B, 49 p., 24 pls.

Cohansey Aquifer

The Cohansey aquifer of Cape May County, defined by Zapecza (1989), does not crop out in New Jersey. The updip limit is in Delaware Bay and northern Cape May County. The downdip limit is east of the Atlantic Ocean shoreline in Cape May County. The aquifer does not exist in Delaware.

Water withdrawal and extent of freshwater

Water withdrawals from the Cohansey aquifer in Cape May County are primarily from public-supply and industrial-supply wells in the southern part of the county (fig. 2-1). Estimated water withdrawals during 1978-97 were about 6 to 7 Mgal/d (fig. 2-2). Water withdrawals by Wildwood Water Utility and Lower Township Municipal Utilities Authority (MUA) have increased since 1978; however, withdrawals by Cape May City Water Utility have decreased because saltwater has intruded from the south. During mid-1998, Cape May City completed the first of two desalination wells and began operating a desalination plant. As a result, water withdrawals from the Cohansey aquifer decreased in late 1998 by as much as 1 Mgal/d.

The location of the 250-mg/L chloride line showing the extent of freshwater (fig. 2-3) was mapped by Lacombe and Carleton (1997). The 250-mg/L chloride line has moved farther inland in the Villas and Cape May City area. The chloride concentration in water from well 9-187 in Villas increased from 190 to 345 mg/L during 1996-99. The chloride concentration increased to about 40 mg/L in water from well 9-45 (Cape May City public supply well 5) during summer 1998. The location of the 10,000-mg/L chloride line is outside the location of the 250-mg/L line.

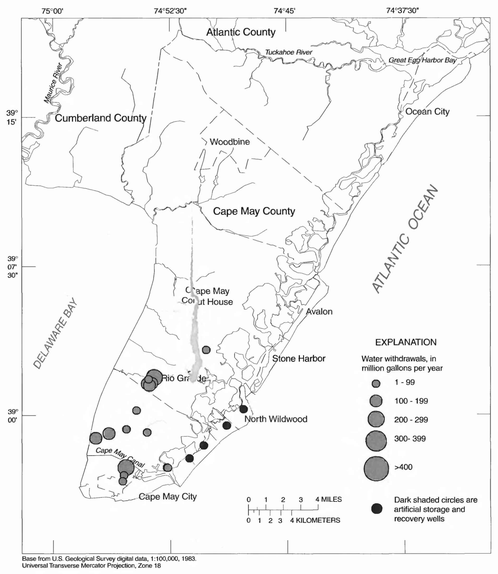


Figure 2-1. Estimated water withdrawals from the Cohansey aquifer, Cape May County, New Jersey, 1997.

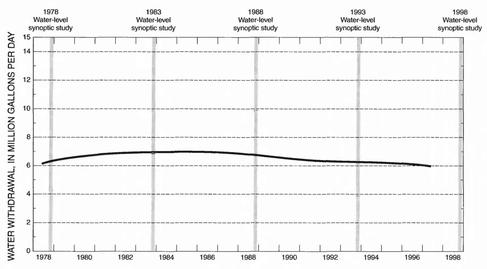


Figure 2-2. Estimated water withdrawals from the Cohansey aquifer, 1978-97.

Water Levels

Water-level-altitude measurements for 39 wells screened in the Cohansey aquifer (table 2-1) (reverse side of sheet 2) were used to map the potentiometric surface (fig. 2-3). Maps of simulated water levels by Martin (1998, fig. 50) were modified to close the contours south and west of the Cape. The locations of the 0-ft and -10-ft contour lines are about the same as those mapped for 1993 (Lacombe and Rosman, 1997). The map shows a major cone of depression centered under the southern part of the Cape. Within this cone is a localized cone of depression centered on the public-supply well (well 9-54) of Lower Township MUA. Water-level altitudes at the Cape May City and Wildwood pumping centers in the Cape May City and Rio Grande quadrangles are about -15 to -19 ft. The maximum water-level altitude was +13 ft at well 9-350.

Section C-C' (fig. 1-4) shows a downward hydraulic gradient from the overlying estuarine sand aquifer to the Cohansey aquifer and a downward gradient from the Cohansey aquifer to the Rio Grande water-bearing zone. Active saltwater intrusion is occurring along the western coast of the Cape in this aquifer.

Water-level changes from 1993 to 1998 were calculated for 31 wells (table 2-1). Water levels declined 1 to 5 ft in 3 wells, remained the same in 4 wells, rose 1 to 10 ft in 24 wells. The reason for the rise in water levels can be attributed to Cape May City's appreciable reduction in withdrawals from the Cohansey aquifer after the city began withdrawing water with high concentrations of chloride from a deeper aquifer and began operating a desalination plant in early 1998. Also, Cape May City is no longer purchasing water from Lower Township MUA, resulting in a reduction in withdrawals for Lower Township. In addition, many of the communities are actively involved in water conservation.

Hydrographs for observation wells 9-60, 9-80, and 9-150 show that water levels have been below sea level since the mid-1980's (fig. 2-4). The hydrograph for well 9-60 shows annual high water levels of -9 to -14 ft and annual low water levels of -17 to -28 ft. Well 9-80 shows high water levels of +1 to -4 ft and low water levels of -5 to -9 ft. Well 9-150 shows an increase in high water levels from -18 to -11 ft during 1978-85. Well 9-150 is near Cape May City Water Utility public-supply wells, where water withdrawals decreased during 1993-98 because of saltwater intrusion.

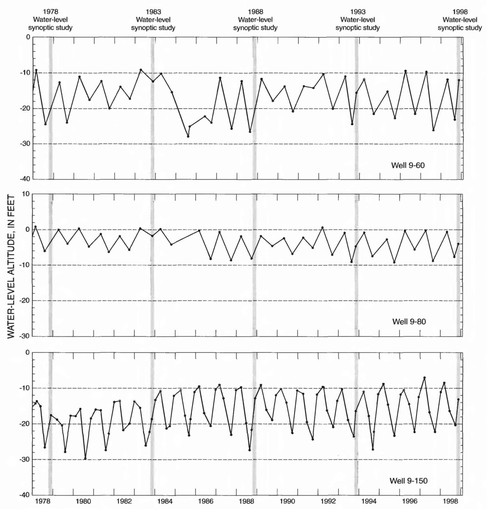


Figure 2-4. Water-level hydrographs for observation wells screened in the Cohansey aquifer, Cape May County, 1978-98.

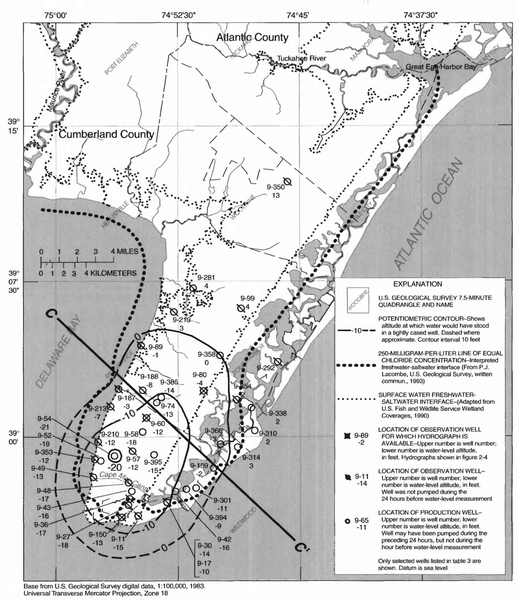


Figure 2-3. Potentiometric surface of the Cohansey aquifer, Cape May County, 1998.

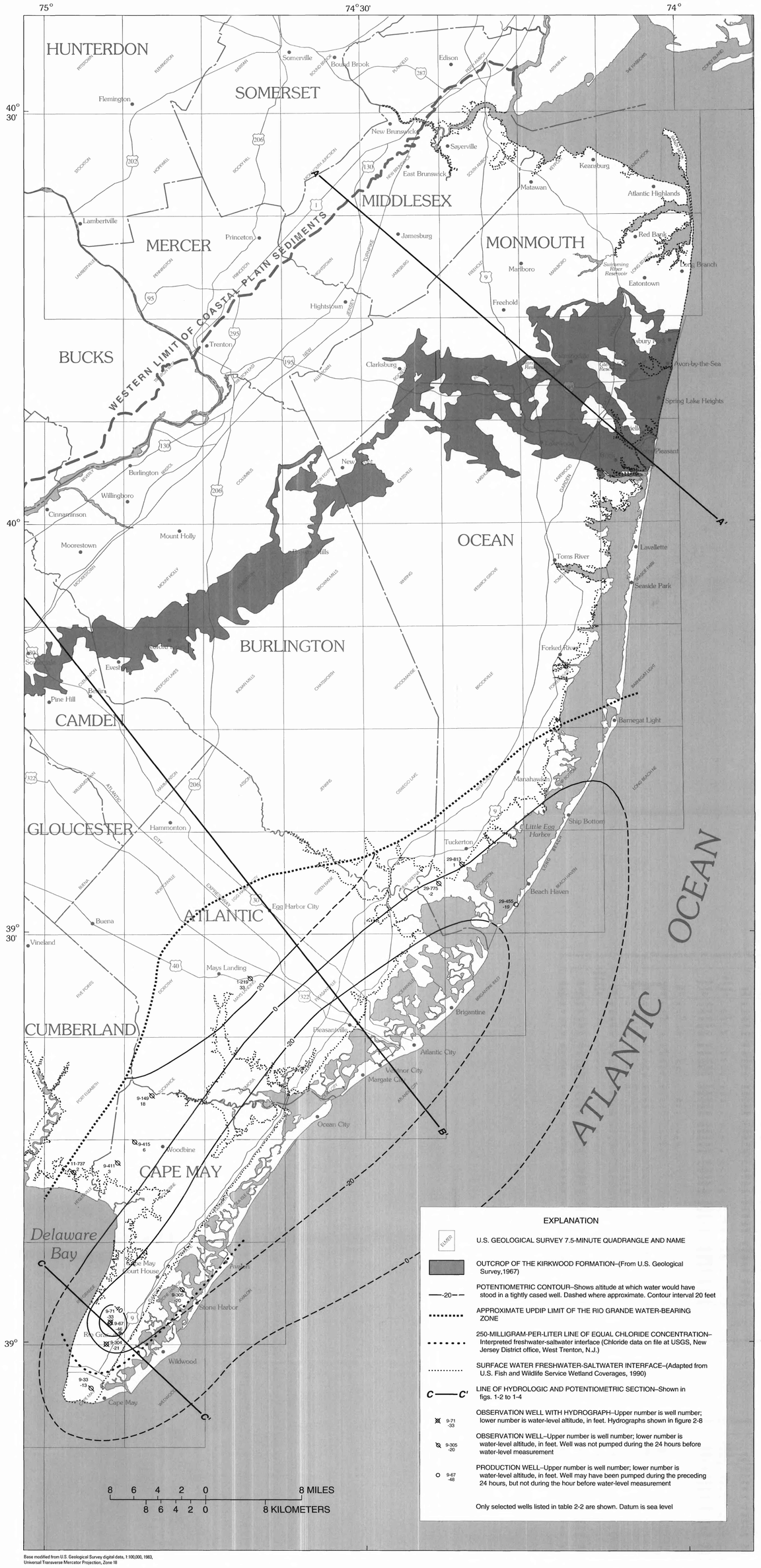


Figure 2-7. Potentiometric surface of the Rio Grande water-bearing zone, 1998.

Rio Grande Water-Bearing Zone

The Rio Grande water-bearing zone, defined by Zapecza (1989), does not crop out in New Jersey. The updip limit extends from central Ocean County to western Cumberland County, and the downdip limit is offshore of Ocean, Atlantic, and Cape May Counties. The aquifer does not exist in Delaware. This aquifer was not included in previous water-level synoptic studies.

Water withdrawal and extent of freshwater

Most water withdrawals from the Rio Grande water-bearing zone are made by the public-water suppliers in Wildwood, Long Beach, and Little Egg Harbor (fig. 2-5). A few local well owners also withdraw from the aquifer, but the volume is insignificant. Water withdrawal was less than 1 Mgal/d during 1978-98 (fig. 2-6). The location of the 250-mg/L chloride line (fig. 2-7) was modified from maps made in 1991 by P.J. Lacombe. (Maps are on file at the USGS, New Jersey District office.) The location of the 10,000-mg/L chloride line has not been determined, but it may be at or near the location of the 10,000-mg/L chloride line in the Atlantic City 800-foot sand.

Water Levels

Water-level data for 13 wells screened in the aquifer are listed in table 2-2 (reverse side of sheet 2). The data were used to define the 1998 potentiometric surface (fig. 2-7). The potentiometric surface of the Atlantic City 800-foot sand was used to help construct the shape of the contours in eastern Atlantic County and in offshore areas. The potentiometric-surface map shows an elongated cone of depression in the aquifer. The long axis of the cone of depression is centered under the barrier islands of Cape May, Atlantic, and southern Ocean Counties. The cone of depression for the most part is sympathetic to the cone of depression in the Atlantic City 800-foot sand; that is, water-level changes in the Rio Grande water-bearing zone correlate positively with water-level changes in the Atlantic City 800-foot sand. A local cone of depression is centered on the Wildwood mainland well field; the minimum water-level altitude at the well field is -46 ft. The maximum water-level altitude, about +33 ft, was measured in central Atlantic County.

A downward hydraulic gradient from the water-table aquifer to the Rio Grande water-bearing zone and a downward hydraulic gradient from the Rio Grande water-bearing zone to the Atlantic City 800-foot sand is shown in Section B-B' (fig.1-3). A downward hydraulic gradient from the Cohansey aquifer and upward hydraulic gradient from the Atlantic City 800-foot sand is shown in Section C-C' (fig.1-4).

Hydrographs for two observation wells show water-level altitudes during the early 1990's (fig. 2-8). Water levels in observation wells 9-71 and 9-304 were below sea level and fluctuated seasonally. This fluctuation reflects the large water withdrawals by Wildwood Water Department during the summer at the height of the tourist season and the modest water withdrawals during the rest of the year. Long-term data are insufficient to indicate the 1978-97 trend in water levels from these hydrographs.

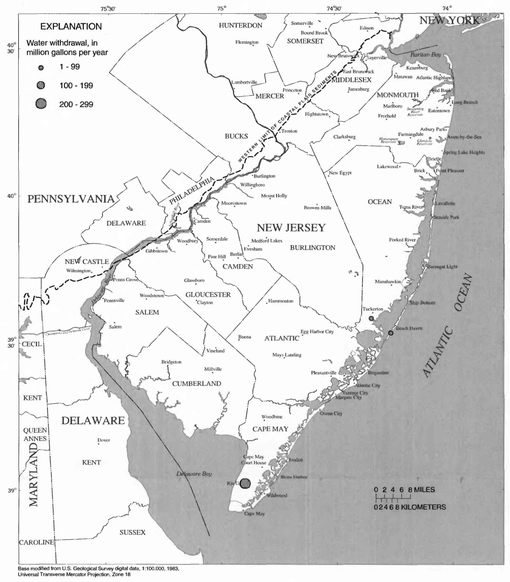


Figure 2-5. Estimated water withdrawals from the Rio Grande water-bearing zone, 1997.

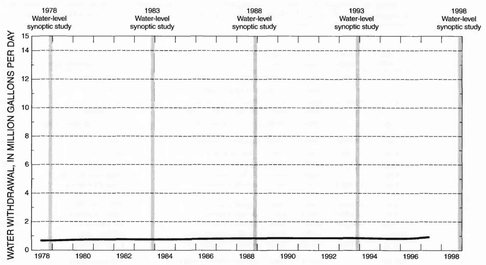


Figure 2-6. Estimated water withdrawals from the Rio Grande water-bearing zone, 1978-97.

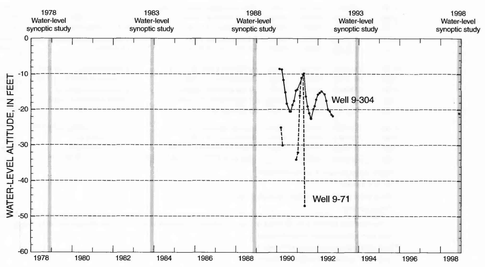


Figure 2-8. Water-level hydrographs for observation wells screened in the Rio Grande water-bearing zone, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998

by
Pierre J. Lacombe and Robert Rosman

2001

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

WATER-RESOURCES INVESTIGATIONS REPORT 00-4143
Atlantic City 800-foot sand - SHEET 3 OF 10
Lacombe, P.J. and Rosman, Robert, 2001
Water levels in, extent of freshwater in, and water withdrawals from ten confined aquifers, New Jersey and Delaware Coastal Plain, 1998

Atlantic City 800-foot Sand

The Atlantic City 800-foot sand is defined by Zapecza (1989). It does not crop out in New Jersey. The updip limit extends from central Ocean County to eastern Cumberland County, and the downdip limit is offshore of Ocean, Atlantic, and Cape May Counties. The aquifer does not exist in Delaware.

Water withdrawals from the Atlantic City 800-foot sand are made predominantly by barrier-island communities from Stone Harbor to Barnegat Light (fig. 3-1). A few inland communities and industries also withdraw water from the aquifer. Water withdrawals from the aquifer increased from 18 to 21 Mgal/d during 1978-88, then decreased to 18 Mgal/d during 1988-97 (fig 3-2). The decrease during 1988-97 could be due to smaller withdrawals or incomplete data. Water withdrawals increased from about 5 to 7 Mgal/d in Cape May County and from 3.5 to 4.5 Mgal/d in Ocean County, but decreased from 9 to 7 Mgal/d in Atlantic County during 1978-97.

The location of the 250-mg/L chloride line (fig. 3-3) was modified from maps made in 1991 by P.J. Lacombe and S.D. McAuley. (Maps are on file at the USGS, New Jersey District office.) The 250-mg/L chloride line is 4 mi southeast of public-supply wells in Stone Harbor. The location of the 10,000-mg/L chloride line was simulated by use of a saltwater model of the aquifers of the New Jersey Coastal Plain (Pope and Gordon, 1999, fig. 31).

Water Levels

Water-level data for 62 wells screened in the aquifer are listed in table 3-1 (reverse side of sheet 3). The data were used to define the 1998 potentiometric surface (fig. 3-3). Maps of simulated water levels by Martin (1998, fig. 49) and Pope and Gordon (1999) were adapted to close the contours east of Ocean, Atlantic, and Cape May Counties. The potentiometric-surface map shows an elongated cone of depression in the aquifer. The long axis is centered under the barrier islands of Cape May, Atlantic, and southern Ocean Counties. The elongated cone of depression can be divided into three segments. The northern segment is centered under the communities from Barnegat Light to Beach Haven. The water-level altitude near the center of the northern part of the elongated cone is about -30 ft. The middle segment of the cone is centered under the barrier-island communities from Brigantine to Ocean City, including users in the greater Atlantic City area.

The minimum water-level altitude at the center of the cone is -103 ft. The southern segment of the cone is centered under the communities of Stone Harbor and Avalon, where the minimum water-level altitude is about -50 ft. The maximum water-level altitude, about +26 ft, was measured near Manahawkin in southern Ocean County.

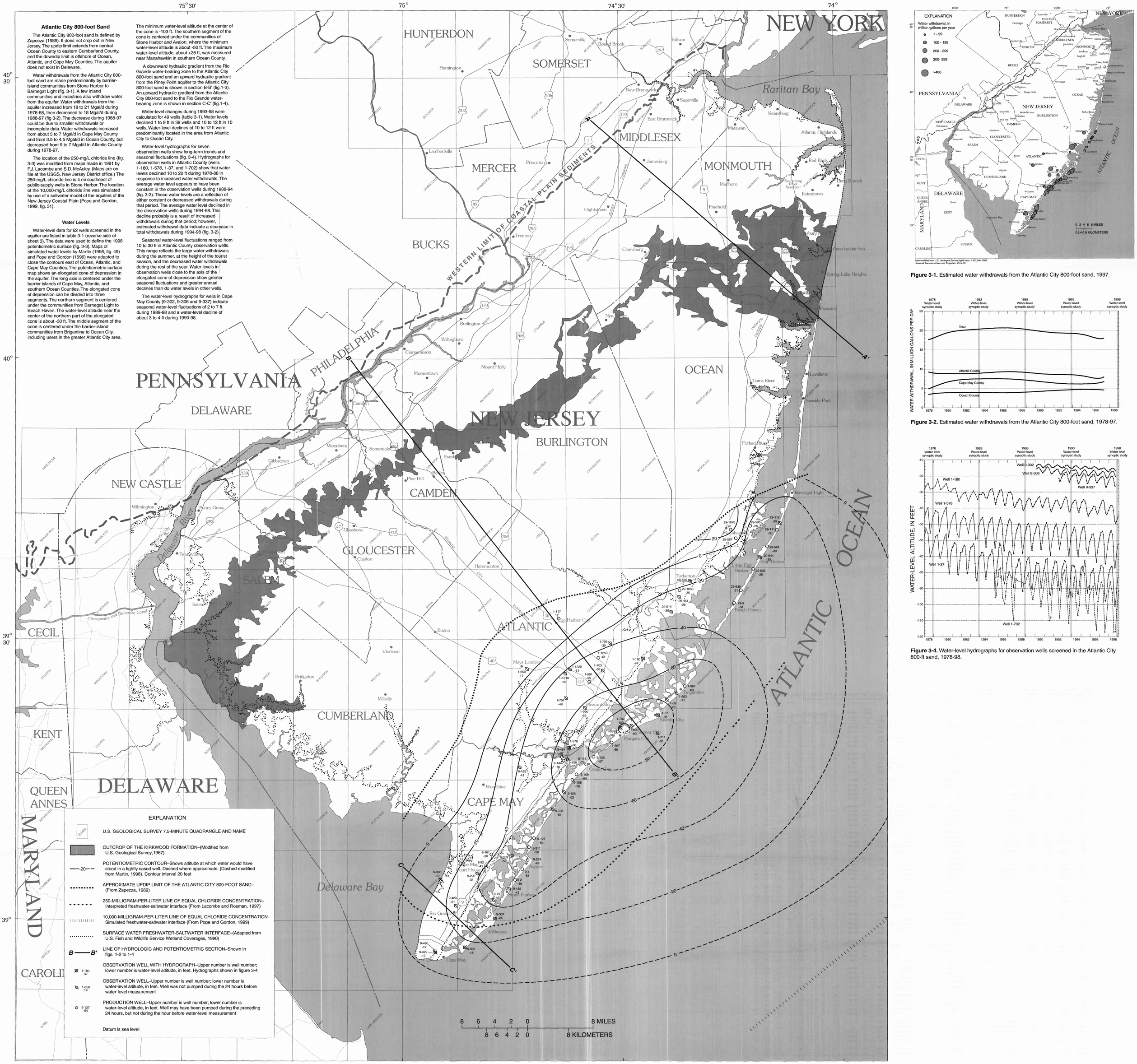
A downward hydraulic gradient from the Rio Grande water-bearing zone to the Atlantic City 800-foot sand and an upward hydraulic gradient from the Piney Point aquifer to the Atlantic City 800-foot sand is shown in section B-B' (fig.1-3). An upward hydraulic gradient from the Atlantic City 800-foot sand to the Rio Grande water-bearing zone is shown in section C-C' (fig.1-4).

Water-level changes during 1993-98 were calculated for 49 wells (table 3-1). Water levels declined 1 to 9 ft in 39 wells and 10 to 12 ft in 10 wells. Water-level declines of 10 to 12 ft were predominantly located in the area from Atlantic City to Ocean City.

Water-level hydrographs for seven observation wells show long-term trends and seasonal fluctuations (fig. 3-4). Hydrographs for observation wells in Atlantic County (wells 1-180, 1-578, 1-37, and 1-702) show that water levels declined 10 to 20 ft during 1978-88 in response to increased water withdrawals. The average water level appears to have been constant in the observation wells during 1988-94 (fig. 3-3). These water levels are a reflection of either constant or decreased withdrawals during that period. The average water level declined in the observation wells during 1994-98. This decline probably is a result of increased withdrawals during that period; however, estimated withdrawal data indicate a decrease in total withdrawals during 1994-98 (fig. 3-2).

Seasonal water-level fluctuations ranged from 10 to 30 ft in Atlantic County observation wells. This range reflects the large water withdrawals during the summer, at the height of the tourist season, and the decreased water withdrawals during the rest of the year. Water levels in observation wells close to the axis of the elongated cone of depression show greater seasonal fluctuations and greater annual declines than do water levels in other wells.

The water-level hydrographs for wells in Cape May County (9-302, 9-306 and 9-337) indicate seasonal water-level fluctuations of 2 to 7 ft during 1989-98 and a water-level decline of about 3 to 4 ft during 1990-98.



EXPLANATION

- U.S. GEOLOGICAL SURVEY 7.5-MINUTE QUADRANGLE AND NAME
- OUTCROP OF THE KIRKWOOD FORMATION–(Modified from U.S. Geological Survey,1967)
- -20- POTENTIOMETRIC CONTOUR–Shows altitude at which water would have stood in a tightly cased well. Dashed where approximate. (Dashed modified from Martin, 1998). Contour interval 20 feet
- APPROXIMATE UPDIP LIMIT OF THE ATLANTIC CITY 800-FOOT SAND–(From Zapecza, 1989)
- 250-MILLIGRAM-PER-LITER LINE OF EQUAL CHLORIDE CONCENTRATION–Interpreted freshwater-saltwater interface (From Lacombe and Rosman, 1997)
- 10,000-MILLIGRAM-PER-LITER LINE OF EQUAL CHLORIDE CONCENTRATION–Simulated freshwater-saltwater interface (From Pope and Gordon, 1999)
- SURFACE WATER FRESHWATER-SALTWATER INTERFACE–(Adapted from U.S. Fish and Wildlife Service Wetland Coverages, 1990)
- B——B' LINE OF HYDROLOGIC AND POTENTIOMETRIC SECTION–Shown in figs. 1-2 to 1-4
- 1-180 -47 OBSERVATION WELL WITH HYDROGRAPH–Upper number is well number; lower number is water-level altitude, in feet. Hydrographs shown in figure 3-4
- 1-650 14 OBSERVATION WELL–Upper number is well number; lower number is water-level altitude, in feet. Well was not pumped during the 24 hours before water-level measurement
- 9-127 -54 PRODUCTION WELL–Upper number is well number; lower number is water-level altitude, in feet. Well may have been pumped during the preceding 24 hours, but not during the hour before water-level measurement

Datum is sea level

Base modified from U.S. Geological Survey digital data, 1:100,000, 1983,
Universal Transverse Mercator Projection, Zone 18

Figure 3-3. Potentiometric surface of the Atlantic City 800-foot sand, 1998.

Figure 3-1. Estimated water withdrawals from the Atlantic City 800-foot sand, 1997.

Figure 3-2. Estimated water withdrawals from the Atlantic City 800-foot sand, 1978-97.

Figure 3-4. Water-level hydrographs for observation wells screened in the Atlantic City 800-ft sand, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998
by
Pierre J. Lacombe and Robert Rosman
2001

Piney Point Aquifer

The Piney Point aquifer in New Jersey is defined by Zapecza (1989). The aquifer does not crop out in New Jersey or Delaware. The updip limit is in central Ocean, Burlington, Camden, Gloucester, and Salem Counties. The downdip limit is offshore of Ocean, Atlantic, and Cape May Counties. In Delaware, the updip limit of the Piney Point aquifer is in central Kent County (Leahy, 1979), and the downdip limit in Delaware extends into southern Sussex County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Water withdrawals from the Piney Point aquifer in New Jersey were made predominantly in Lavallette, Seaside Heights, Barnegat Light, and other communities in the central Barnegat Bay area as well as by Buena, N.J., and Dover, Delaware (fig. 4-1). Other areas made small water withdrawals. Estimated water withdrawals from the aquifer in New Jersey ranged from about 2 to about 3.5 Mgal/d during 1978-97 (fig. 4-2). In Ocean County water withdrawals increased from about 1.7 Mgal/d in 1988 to 3 Mgal/d in 1997. Withdrawals in Buena increased from about 0.1 Mgal/d in 1978 to 0.4 Mgal/d in 1998. Water withdrawals from the Piney Point aquifer in the Dover, Delaware, area increased from about 2.2 Mgal/d in 1978 to 3 Mgal/d in 1994 and decreased to 2.5 Mgal/d in 1998 (Stewart Lovell, Delaware Department of Natural Resources and Environmental Control, oral commun., 1999)

The location of the 250-mg/L chloride line (fig. 4-3) was modified from Woodruff (1969) and from Schaefer (1983). Freshwater extends more than 15 mi downdip from the Buena area and probably is 12 mi downdip from the Barnegat Light area, about the same location as in 1993. The location of the 10,000-mg/L chloride line was simulated by Pope and Gordon (1999, fig. 29) based on a saltwater model simulation of the aquifers underlying the New Jersey Coastal Plain.

Water Levels

Water-level data for 45 wells screened in the Piney Point aquifer are listed in table 4-1 (reverse side of sheet 4). The water levels in these wells were used to define the 1998 potentiometric surface (fig. 4-3). Maps of simulated water levels by Martin (1998, fig. 50) and Pope and Gordon (1999) were modified to close the potentiometric contours east of Seaside Park. Simulated water levels shown on maps from Leahy (1979) were modified to close the contours in the Dover, Delaware, area.

The potentiometric-surface map shows five regional cones of depression in the aquifer. The northernmost cone of depression is centered under Seaside Park; the minimum water-level altitude is about -76 ft. The water levels in this area have dropped more than 20 ft during 1993-98. The cone of depression centered under Barnegat Light has a minimum water-level altitude of -44 ft, which is 6 ft lower than in 1993. The westernmost cone of depression in the Piney Point aquifer in New Jersey is centered under the Buena area. The minimum water-level altitude near the center of the cone of depression in the Buena area is about -35 ft, which is about 10 ft lower than in 1993. The largest cone of depression in the Piney Point aquifer in New Jersey is near Atlantic City and is centered under the elongated cone of depression of the Atlantic City 800-foot sand (fig. 3-3). The water-level altitude in well 1-834 declined from -30 to -32 ft during 1993-98. No withdrawals were made from the Piney Point aquifer in this area. Therefore, this cone probably is a sympathetic cone of depression, a result of withdrawals from the Atlantic City 800-foot sand. The cone in the Piney Point aquifer in this area is similar to the sympathetic cone of depression shown in this area for the Rio Grande water-bearing zone.

The deepest and broadest cone of depression in the aquifer is centered under Dover, Delaware. The cone is drawn to reflect the shape of the cone that was mapped in 1975 by Leahy (1979). Water-level altitudes near the center of the cone are about -177 ft. On the basis of water levels in well Id 55-01, the depth of the cone of depression in 1998 appears to be the same as it was in 1993. The Dover area cone of depression extends northward into Cumberland County, N.J. Water levels have declined in observation wells 11-96, 11-44, and 11-163 in Cumberland County at a constant rate of about 1 ft per year during 1978-97 (fig. 4-4). The maximum water-level altitude measured in the aquifer during this study was +120 ft in well 5-676 in Burlington County.

A downward hydraulic gradient from the Kirkwood-Cohansey aquifer system to the Piney Point aquifer and a downward gradient from the western part of the Piney Point aquifer to the Wenonah-Mount Laurel aquifer is shown in section B-B' (fig.1-3). In the eastern part of the aquifer, the hydraulic gradient is upward from the Piney Point aquifer to the Atlantic City 800-foot sand.

Water-level changes during 1993-98 were calculated for 32 wells. Water levels declined 1 to 9 ft in 17 wells and 15 to 30 ft in 5 wells, rose from 1 to 6 ft in 5 wells, and remained the same in 5 wells. Water-level declines of 10 ft or more occurred in the major withdrawal areas of Toms River-Seaside Park and Buena.

During 1978-98, water levels declined steadily about 25 ft at wells 11-44 and 11-163 in central Cumberland County (fig. 4-4). The average annual decline is about 1.25 ft per year. Water levels in well 11-96 near the shoreline in Cumberland County declined steadily during 1978-93, but were unchanged during 1993-98. Water levels in well Id 55-01 in Dover, Delaware, generally declined during 1978-91, but rose during 1991-98 (fig. 4-5). The rise in water levels in well Id55-01 and the stabilization of water levels in well 11-96 are in response to the decrease in water use since the early 1990's in the Dover, Delaware, area. Water levels in well Nc13-03 and Kc31-01 were steady during the 1990's (fig. 4-5).

Water-levels altitudes in observation well 29-585 near the cones of depression at Seaside Park and Barnegat Light were fairly constant, about +15 ft, before 1989, but declined about 8 ft during 1989-96 because of increased withdrawals from some nearby supply well(s). In early 1997 withdrawals were reduced in the nearby wells, and water levels quickly recovered in well 29-585 to mid-1984 levels. Water-level hydrographs for wells 29-425 and 5-676 in western Ocean and eastern Burlington Counties show that the water-level altitudes remained at about +120 ft during 1978-98.

In summary, water levels measured in 1998 ranged from 5 ft higher to 30 ft lower than water levels measured in 1993. Water levels declined in 21 wells and rose in 6 wells. The cones of depression in eastern Ocean County in 1998 were deeper than in 1993 and had expanded to include more of the Toms River area. The cone of depression in the Buena area was about 10 ft deeper in 1998 than it was in 1993, possibly as a result of increases in local withdrawals. The Atlantic City area cone of depression deepened by about 2 ft near well 1-834 during 1988-93. The cone of depression in the Dover, Delaware, area appears to have stabilized during 1993-98.

Figure 4-3. Potentiometric surface of the Piney Point aquifer, 1998.

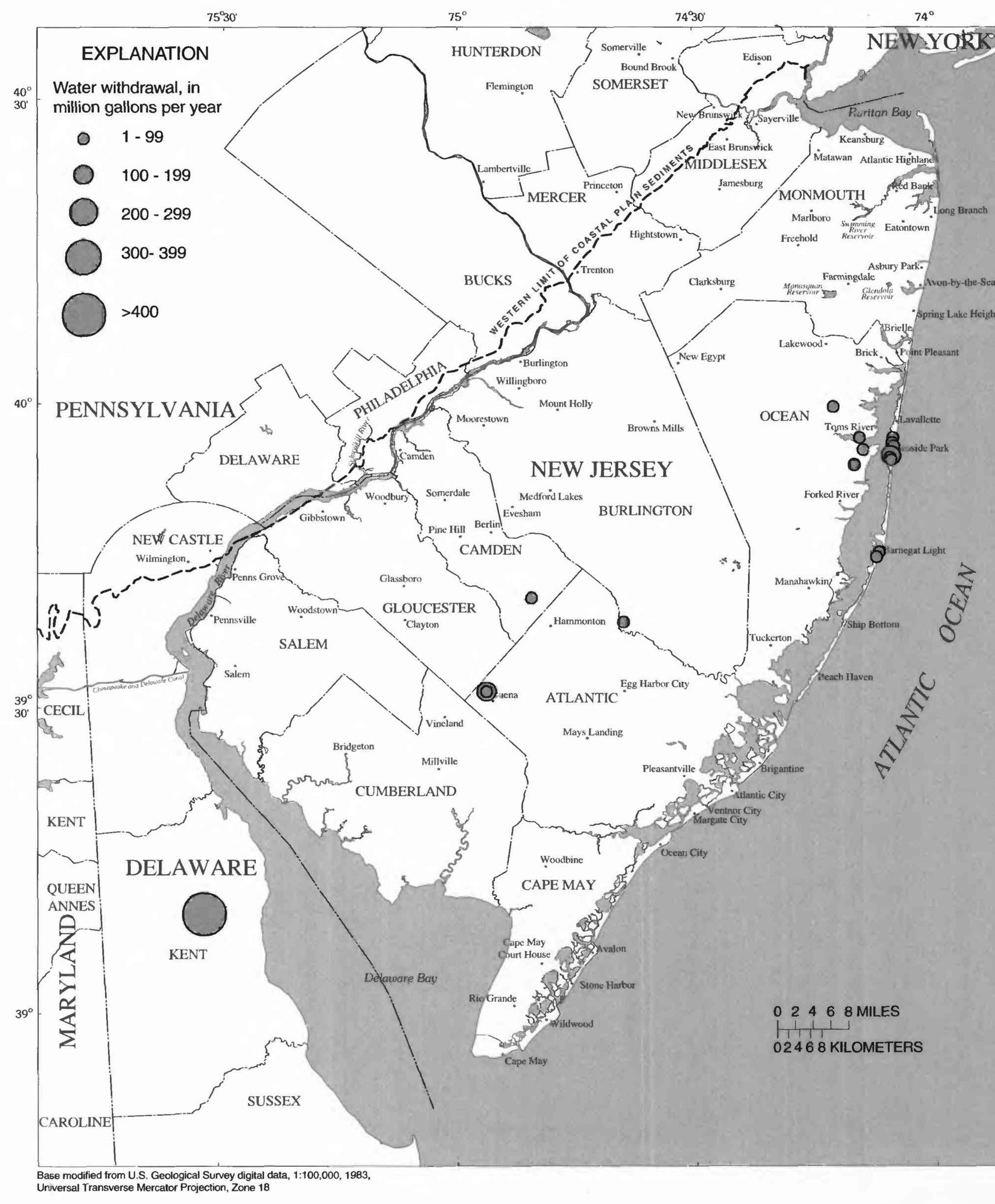


Figure 4-1. Estimated water withdrawals from the Piney Point aquifer, 1997.

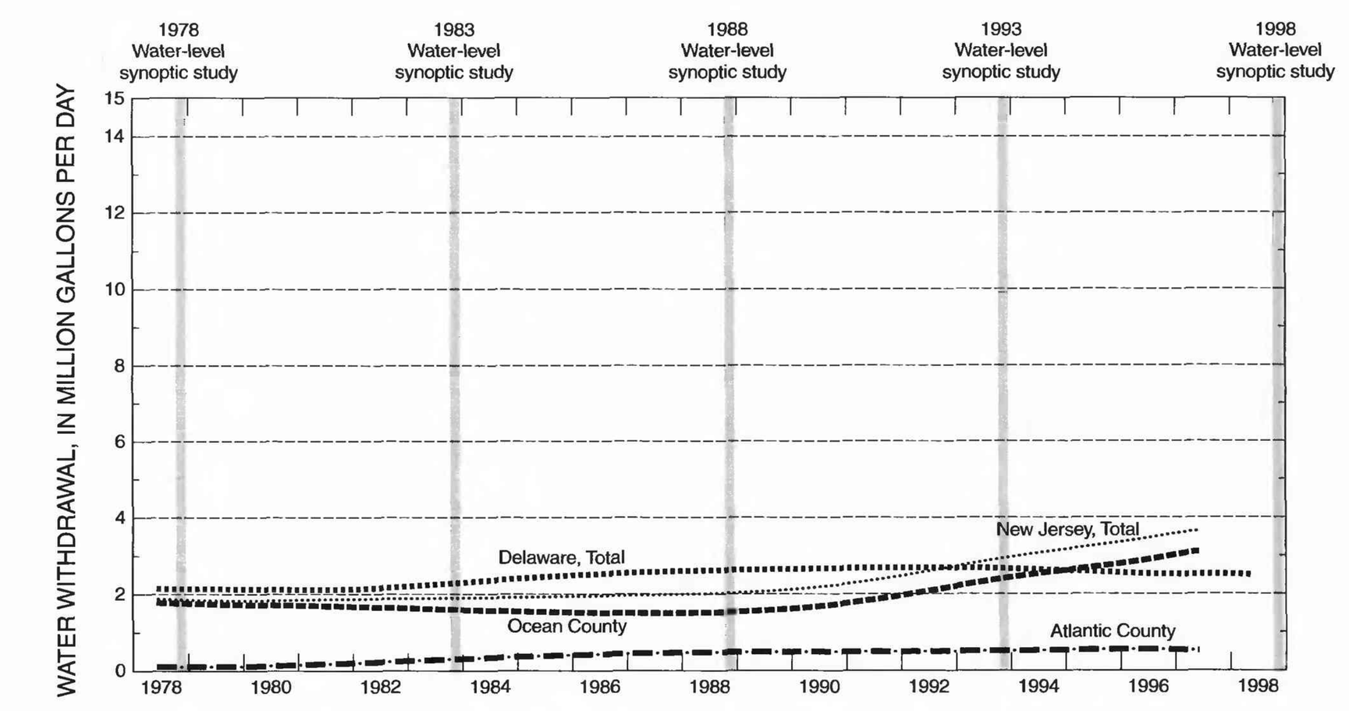


Figure 4-2. Estimated water withdrawals from the Piney Point aquifer in New Jersey and Delaware, 1978-97.

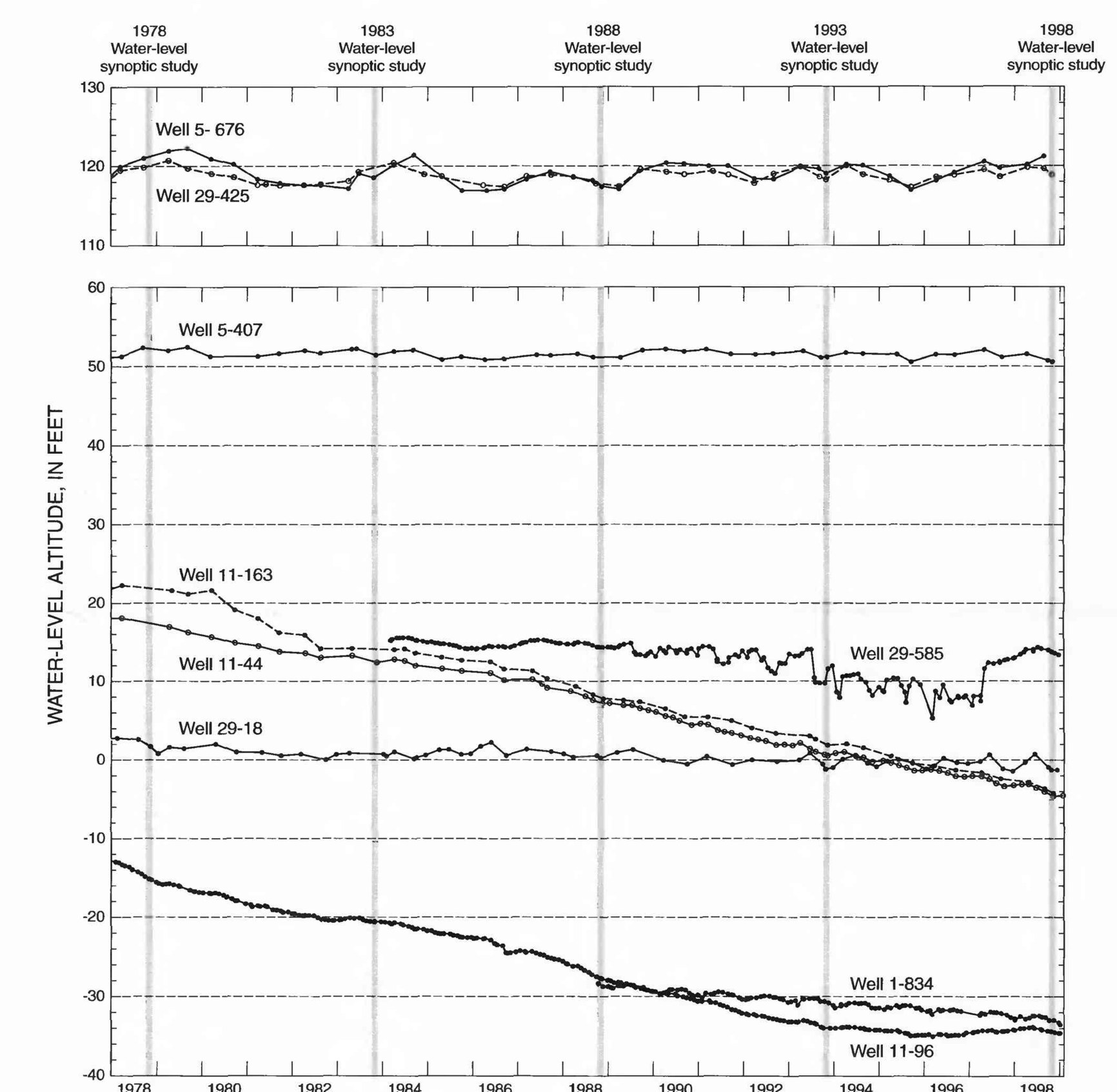


Figure 4-4. Water-level hydrographs for observation wells screened in the Piney Point aquifer in New Jersey, 1978-98.

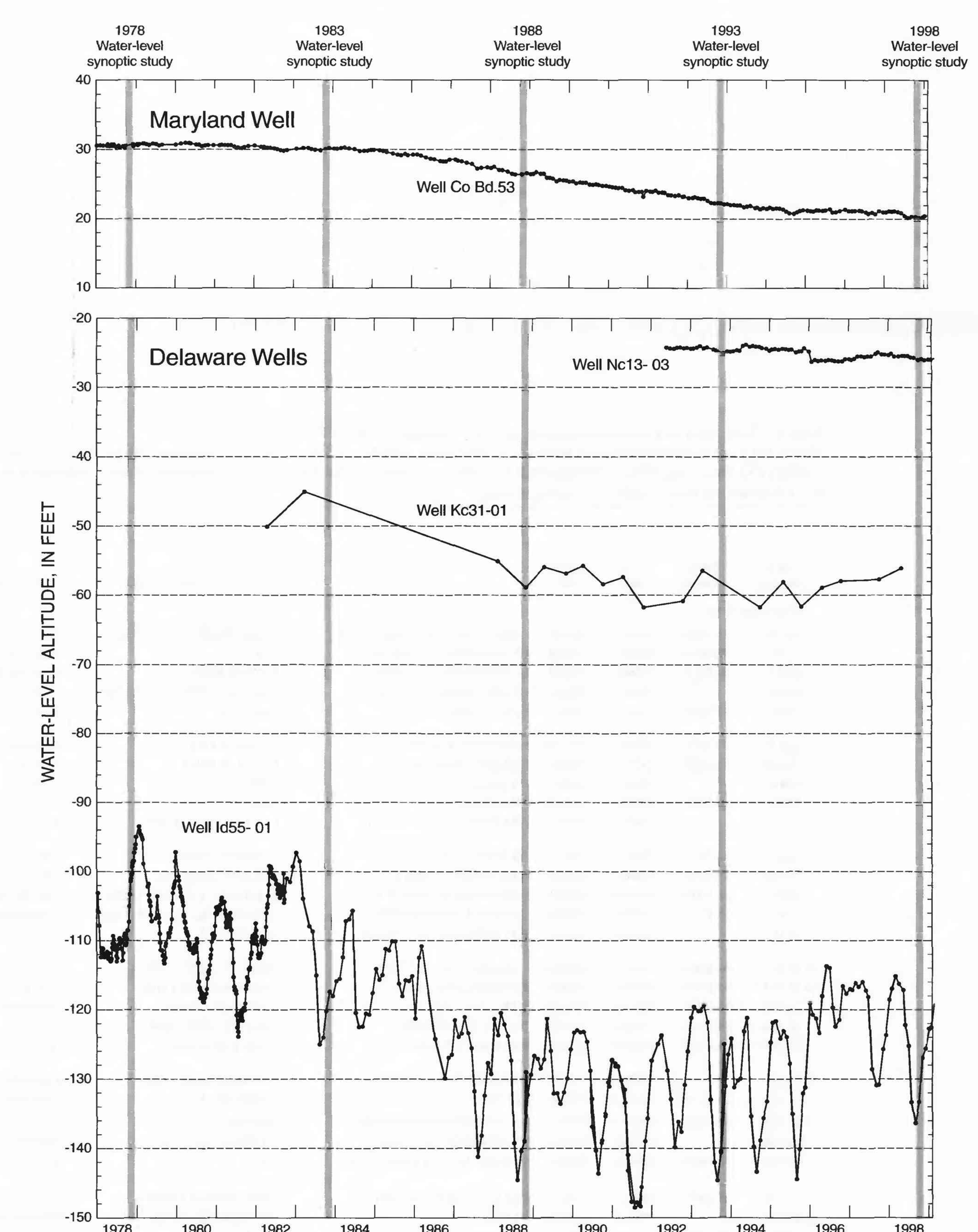


Figure 4-5. Water-level hydrographs for observation wells screened in the Piney Point aquifer in Delaware and Maryland, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998

by

Pierre J. Lacombe and Robert Rosman

2001

Vincentown Aquifer

The Vincentown aquifer in New Jersey is defined by Zapecza (1989). The aquifer crops out or is a subcrop within the outcrop of the Vincentown Formation in New Jersey. The downdip limit of the aquifer is 6 to 8 mi. southeast of the outcrop area. The aquifer is well defined in northern Ocean and southern Monmouth Counties, but is less well defined in the rest of the Coastal Plain. In Delaware, Vroblesky and Fleck (1991) refer to this aquifer as the Aquia and Rancocas aquifer. The downdip limit of the aquifer in Delaware extends to central Kent County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Water withdrawals from the Vincentown aquifer are made predominantly by the public suppliers in Jackson and Aldrich Townships in the Farmingdale quadrangle near the Manasquan Reservoir; with a small amount withdrawn by a nearby golf course (figs. 5-1 and 5-3). Estimates of withdrawals from the aquifer in New Jersey during 1978-97 were 0.5 to 1.0 Mgal/d (fig. 5-2). This aquifer is of limited extent and is little used, but it is an important source for local users. Water withdrawals from the Vincentown aquifer in Delaware and Maryland (locally referred to as the Aquia and Rancocas aquifer) were reported to be about 7 Mgal/d (Cushing and others, 1973), but most of the withdrawals were made outside the study area.

The 250-mg/L chloride line is not shown for this aquifer (fig. 5-3) because all water samples collected from the Vincentown aquifer contained chloride concentrations less than 50 mg/L. The location of the 10,000-mg/L chloride line was not estimated for this aquifer.

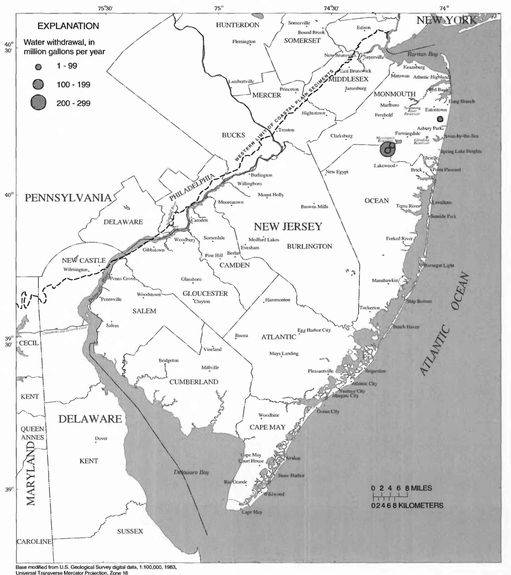
Water Levels

Water-level data for 23 wells screened in the Vincentown aquifer are listed in table 5-1 (reverse side of sheet 5). The water levels in these wells were used to define the 1998 potentiometric surface (fig. 5-3). Maps of simulated water levels by Martin (1998, fig. 47) and Pope and Gordon (1999, fig. 27) were modified to define the potentiometric surface in areas of New Jersey where water-level data were insufficient.

The potentiometric-surface map shows high water levels in the Adelphia quadrangle and low water levels where streams cross the outcrop area, such as in the New Egypt, Farmingdale, and Long Branch quadrangles. Water levels are depressed in some wells in the Adelphia quadrangle near the pumping centers. The maximum water-level altitude measured in the aquifer during this study was +141 ft in well 29-660. The minimum water level measured was 1 ft in well 33-240. A downward hydraulic gradient from the water-table aquifer to the Vincentown aquifer and a downward gradient from the Vincentown aquifer to the Wenonah-Mount Laurel aquifer is shown in section A-A' (fig.1-2).

Cushing and others (1973) show a potentiometric surface for the aquifer in Delaware and eastern Maryland. On the basis of their map, water-level altitudes ranged from about +2 to +55 ft.

Water-level changes during 1988-98 were calculated for eight wells. Water levels declined 2 to 4 ft in two wells and 12 ft in one well (table 5-1). Water levels rose from 1 to 6 ft in three wells and 14 ft in one well. Hydrographs show that water levels remained constant in wells 29-139 and 5-1250 during 1990-98. Water levels in well 25-636 rose about 15 ft during 1988-89, then remained constant during 1990-98 (fig. 5-4).



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983,
Universal Transverse Mercator Projection, Zone 18

Figure 5-1. Estimated water withdrawals from the Vincentown aquifer, 1997.

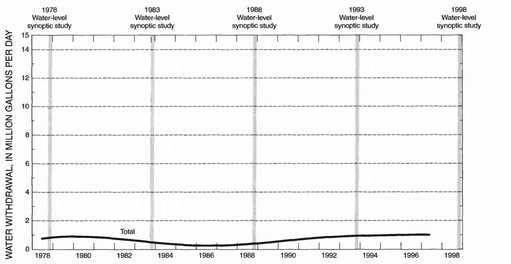


Figure 5-2. Estimated water withdrawals from the Vincentown aquifer, 1978-97.

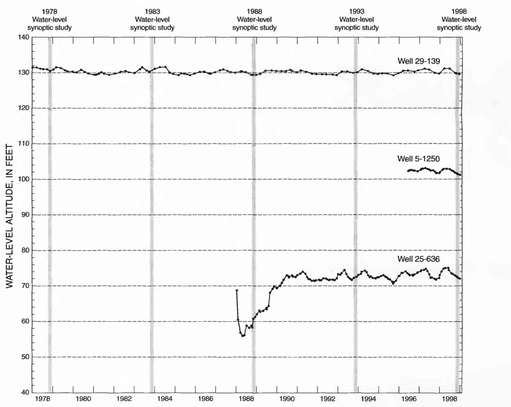
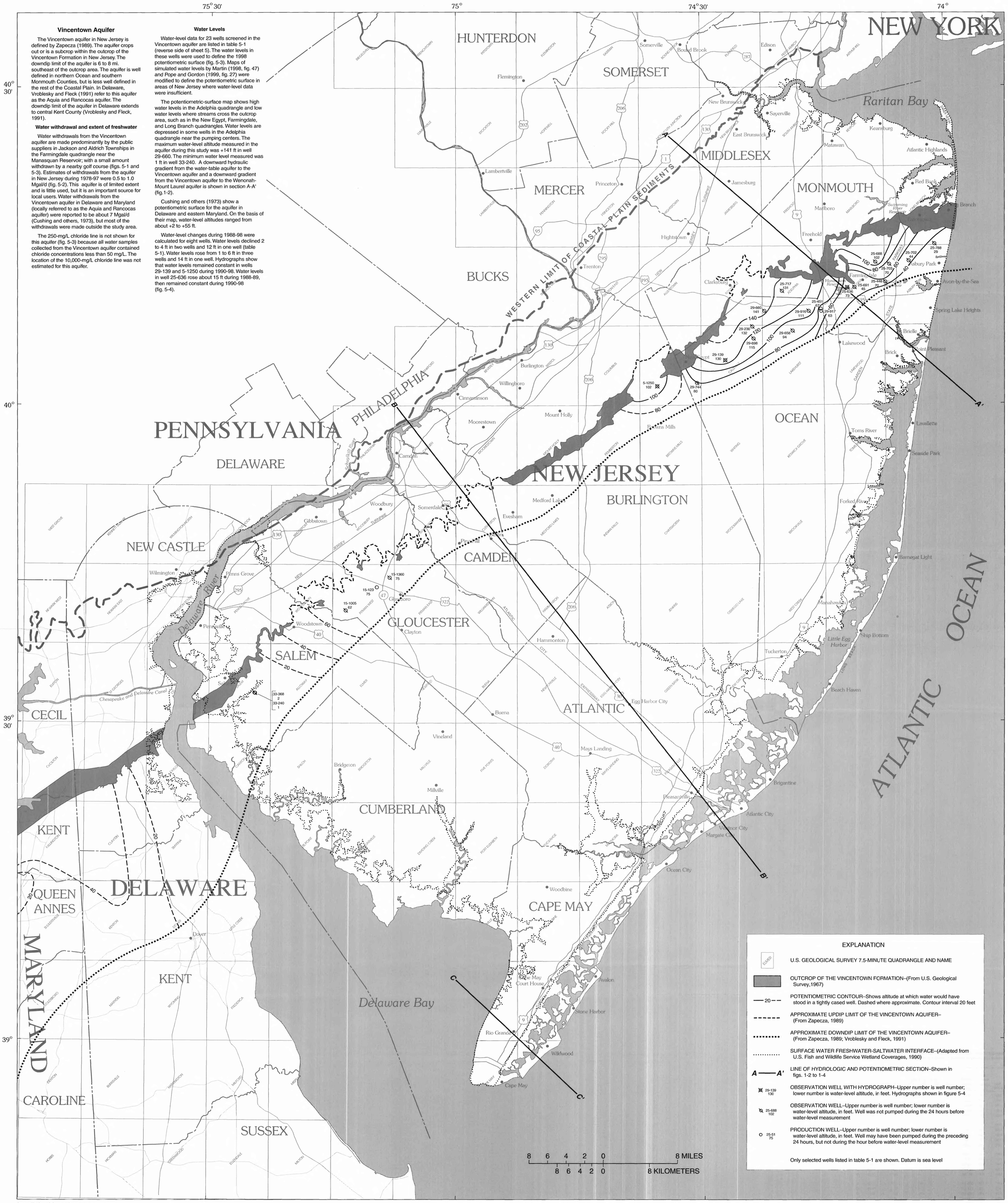


Figure 5-4. Water-level hydrographs of wells screened in the Vincentown aquifer, 1978-98.



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983,
Universal Transverse Mercator Projection, Zone 18

Figure 5-3. Potentiometric surface of the Vincentown aquifer, 1998.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998
by
Pierre J. Lacombe and Robert Rosman
2001

Wenonah-Mount Laurel Aquifer

The Wenonah-Mount Laurel aquifer in New Jersey is defined by Zapecza (1989). The aquifer crops out within the exposures of the Wenonah and Mount Laurel Formations in New Jersey. The aquifer is well defined in the offshore areas of Monmouth and Ocean Counties, but is less well defined in Atlantic, Cumberland, and Cape May Counties. Vroblesky and Fleck (1991) refer to this aquifer in Delaware as the Servern aquifer, and the Delaware Geological Survey refers to it as the Mount Laurel aquifer. The downdip limit in Delaware extends southeast of Sussex County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Wells that withdraw water from the Wenonah-Mount Laurel aquifer lie in a band from southern Monmouth County to central Salem County (fig.6-1). The major centers for withdrawal are in coastal Monmouth County and central Burlington, Camden, and Gloucester Counties. Total water withdrawals in the Coastal Plain increased from about 6 to 10 Mgal/d during 1980-97 (fig. 6-2). Withdrawals in the northern counties decreased from about 1.4 to 0.7 Mgal/d during 1980-97. Water withdrawals in the southern counties increased from about 3 to 9.5 Mgal/d during 1978-97. During 1994-97 water withdrawals increased 2.5 Mgal/d from about 7 to 9.5 Mgal/d. These increased withdrawals are the greatest for any of the aquifers in the New Jersey Coastal Plain during this time. Water withdrawals in Delaware were less than 0.02 Mgal/d during 1978-97 (Stewart Lovell, DNREC, written commun., 1999)

The location of the 250-mg/L chloride line in southern Cumberland and Salem Counties (fig. 6-3) was determined from chloride data for four wells. (The four wells are not shown in figure 6-3 because they are now sealed.) The location of the 250-mg/L chloride line in the northern Coastal Plain could not be determined because no observation wells were available in the downdip area. The location of the 10,000-mg/L chloride line was simulated by Pope and Gordon (1999) based on a saltwater model of the aquifers of the New Jersey Coastal Plain.

Water levels

Water levels were measured for 110 wells in New Jersey and 8 wells in Delaware (table 6-1) (reverse side of sheet 6). The water-level altitudes in these wells were used to define the 1998 potentiometric surface (fig. 6-3). Maps of simulated water levels by Martin (1998, fig. 48) and Pope and Gordon (1999) were modified to close the contours in the eastern part of each cone of depression. The potentiometric-surface map shows three major cones of depression. The northern cone of depression has two centers. One is near Spring Lakes Heights, and the other is west of Point Pleasant. The water-level altitude is about -80 ft at the center of the two cones. This is a rise of 20 to 40 ft since 1993.

The central cone of depression with a minimum water-level altitude of -36 ft is centered under the community of Browns Mills (fig. 6-3). The southern cone of depression is elongated and underlies central Burlington, Camden, and Gloucester Counties. The southern cone of depression lies within the 0-ft water-level-altitude contour in 1998. This elongated cone of depression contains three smaller local cones of depression. The northernmost local cone of depression is in the Medford Lakes quadrangle and has a minimum water-level altitude of -47 ft. The two southern local cones of depression are centered within the Pitman East quadrangle. The minimum water-level altitudes are -81 and -47 ft. The maximum water-level altitude measured for the aquifer was +146 ft in well 25-412.

A downward hydraulic gradient from the Wenonah-Mount Laurel aquifer to the Englishtown aquifer system is shown in section A-A' (fig.1-2). An upward hydraulic gradient from the Englishtown aquifer system to the Wenonah-Mount Laurel aquifer is shown in section B-B' (fig.1-3). Both sections show a downward hydraulic gradient from the Kirkwood-Cohansey aquifer to the shallow part of the Wenonah-Mount Laurel aquifer.

Changes in water levels during 1993-98 were calculated for 89 wells screened in the aquifer. In Monmouth and Ocean Counties, water levels rose 1 to 47 ft in 25 wells, declined 1 to 3 ft in 6 wells, and remained the same in 4 wells. Water levels rose 10 ft or more in 11 wells. Water levels rose 21 to 46 ft in 9 wells that are along the shoreline of southern Monmouth County near the center of the regional cone of depression. The water level rose 18 ft in well 25-405, which is in western Monmouth County, possibly as a result of a decrease in local withdrawals.

Changes in water levels also were calculated for 54 wells in Burlington, Camden, Gloucester, and Salem Counties. Water levels declined 1 to 67 ft in 38 wells, rose 1 to 69 ft in 11 wells, and remained the same in 5 wells. Water-level declines greater than 10 ft occurred in 15 wells; all the wells are in or near the elongated cone of depression. Water levels rose more than 10 ft in eight wells. Five of the eight wells are in the Browns Mills quadrangle. Three of the wells are in the southern Clementon quadrangle. Water levels in each of the three wells decreased appeciably during 1988-93. Wells with water-level changes of more that 25 ft are high-capacity production wells or are near such wells; therefore, the water levels could have been affected by withdrawals shortly before measurements were made in 1993 or 1998.

Water-level hydrographs for nine USGS observation wells for 1978-98 indicate that annual water-level altitudes remained fairly constant or decreased less than 2 ft in wells 29-140, 7-118, and 33-252 (figs. 6-4 and 6-5). Water levels declined about 10 ft in well 33-20 and about 70 ft in well 7-478 during 1978-93. Water levels rose 20 and 30 ft, respectively, in wells 25-353 and 25-637 during 1990-94 and rose an additional 15 ft during 1994-98. The water-level hydrograph for well 25-486 shows that the water level rose 90 ft from -180 to -90 ft during 1990-94. Seasonal water-level fluctuations were greatest near the center of the cone of depression.

The potentiometric surface of the Wenonah-Mount Laurel aquifer rose about 20 ft in eastern Monmouth and Ocean Counties and declined more than 40 ft in the greater Camden area during 1993-98. The cone of depression in Monmouth and Ocean Counties has decreased in size as a result of NJDEP mandated reductions in withdrawals from this and deeper aquifers after 1988 (New Jersey Department of Environmental Protection, 1985). Upon completion of the Manasquan reservoir in 1991, water users in the northern Coastal Plain began to withdraw less water from the confined aquifers and to withdraw more water from surface-water reservoirs. The result of reduced withdrawals has been a rise in water levels near the center of the cone of depression and a decrease in the extent of the cone of depression. The cone of depression in the Wenonah-Mount Laurel aquifer has expanded in the greater Camden area as a result of the NJDEP mandate to reduce withdrawals from the Upper, Middle, and Lower Potomac-Raritan-Magothy aquifers in that area (New Jersey Department of Environmental Protection, 1985). Under this mandate, the major water users decreased withdrawals in the Upper, Middle and Lower Potomac-Raritan-Magothy aquifers and increased withdrawals from the Wenonah-Mount Laurel aquifer and the Delaware River.

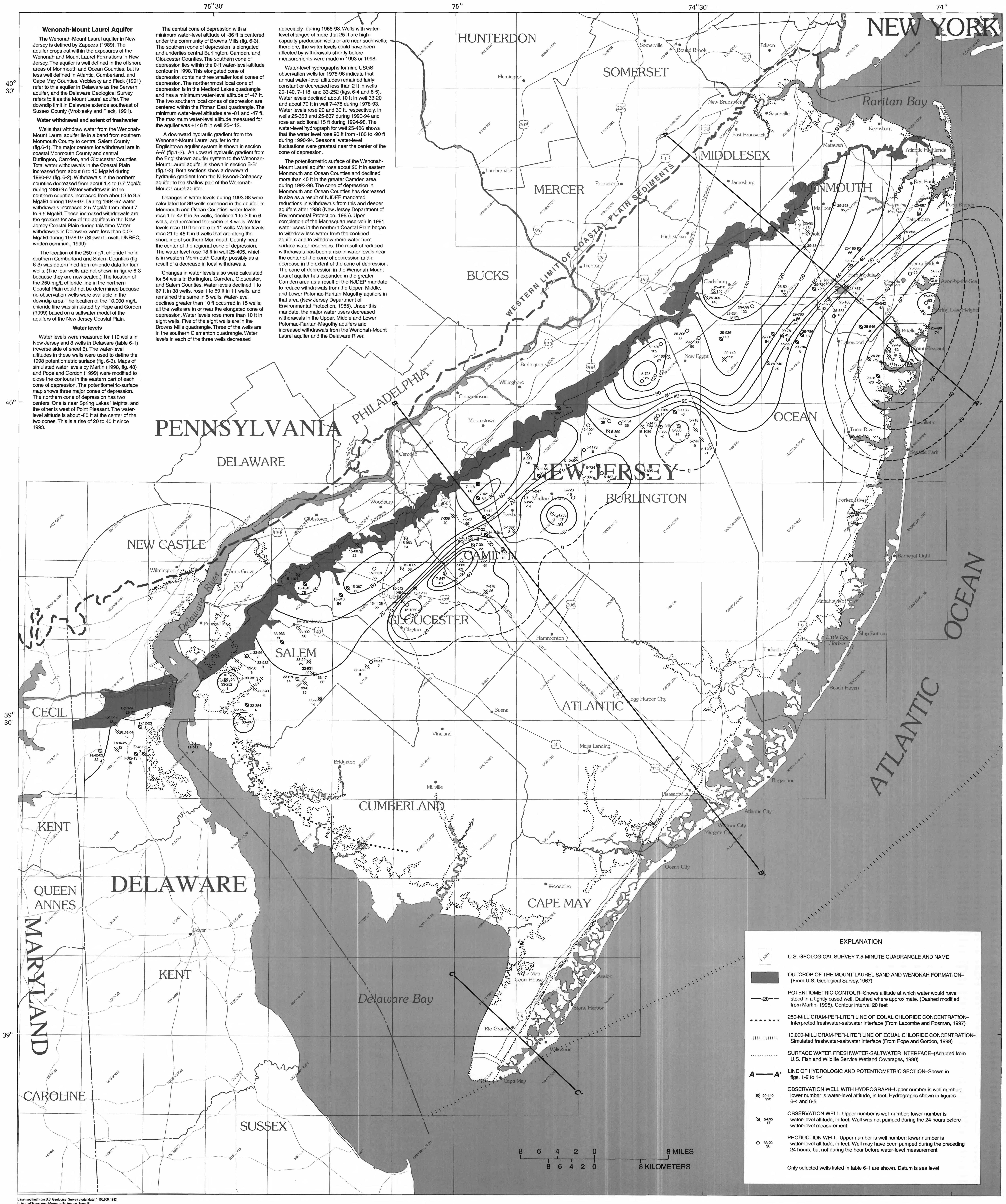


Figure 6-3. Potentiometric surface of the Wenonah-Mount Laurel aquifer, 1998.

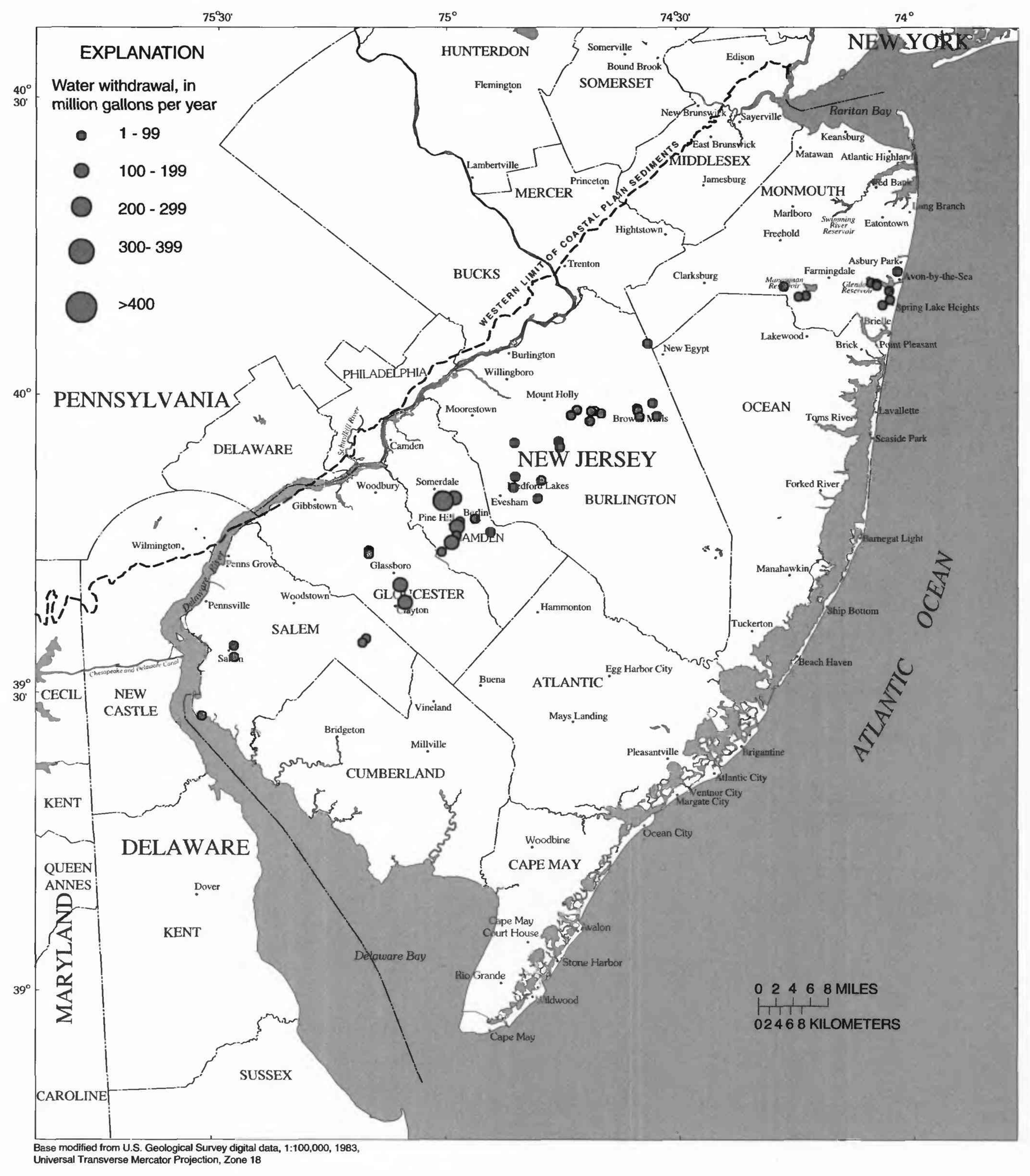


Figure 6-1. Estimated water withdrawals from the Wenonah-Mount Laurel aquifer, 1997.

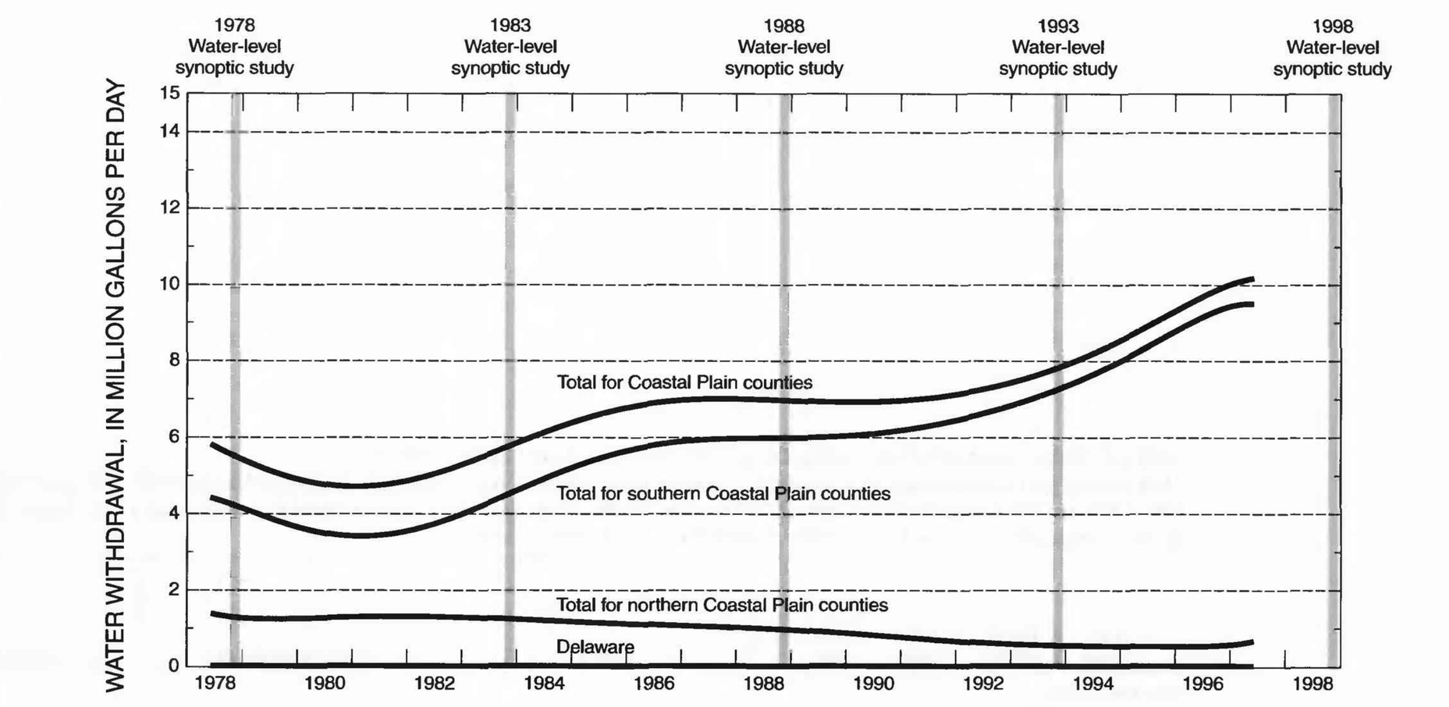


Figure 6-2. Estimated water withdrawals from the Wenonah-Mount Laurel aquifer, 1978-97.

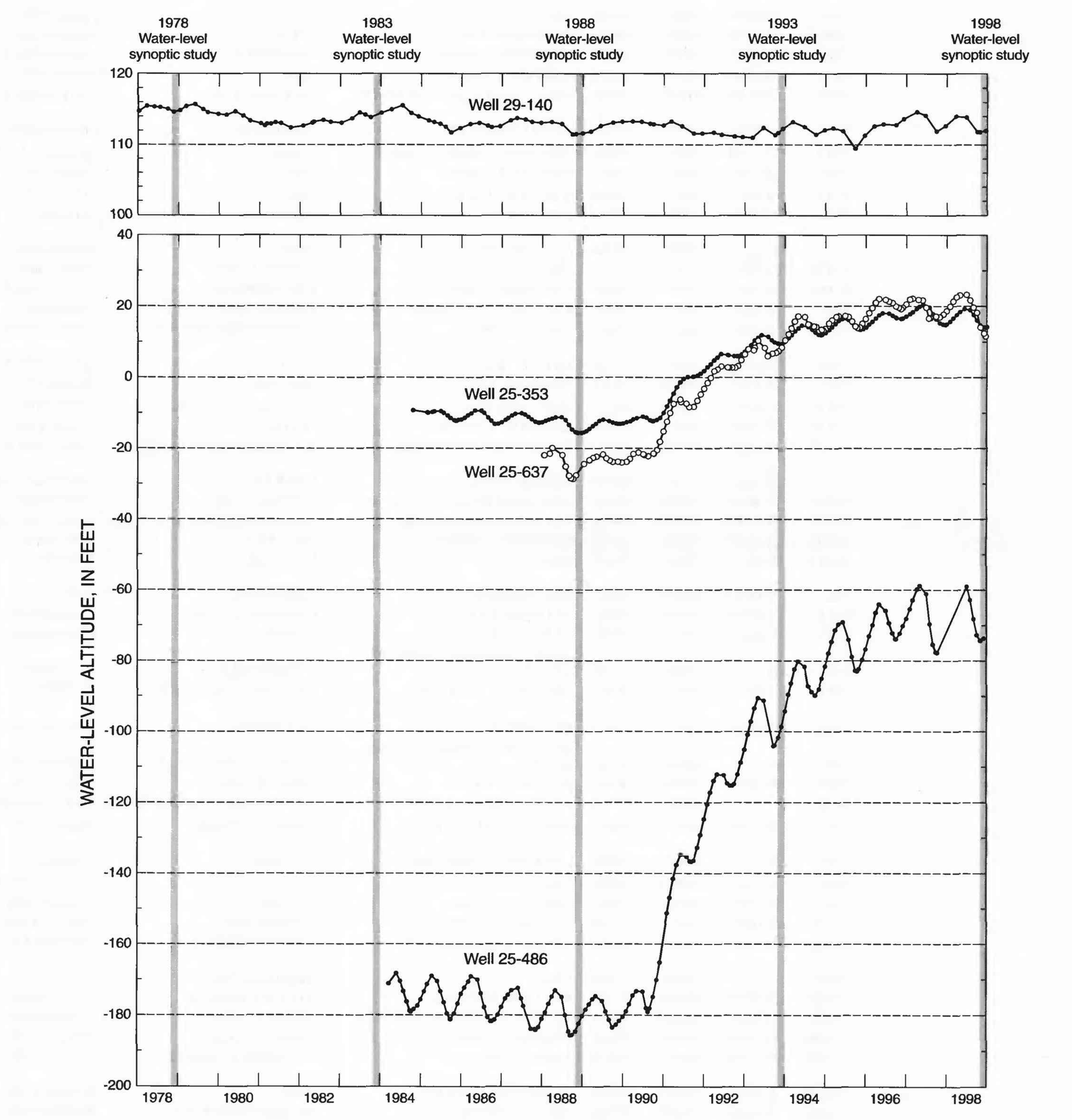


Figure 6-4. Water-level hydrographs for observation wells screened in the Wenonah-Mount Laurel aquifer in the northern counties, 1978-98.

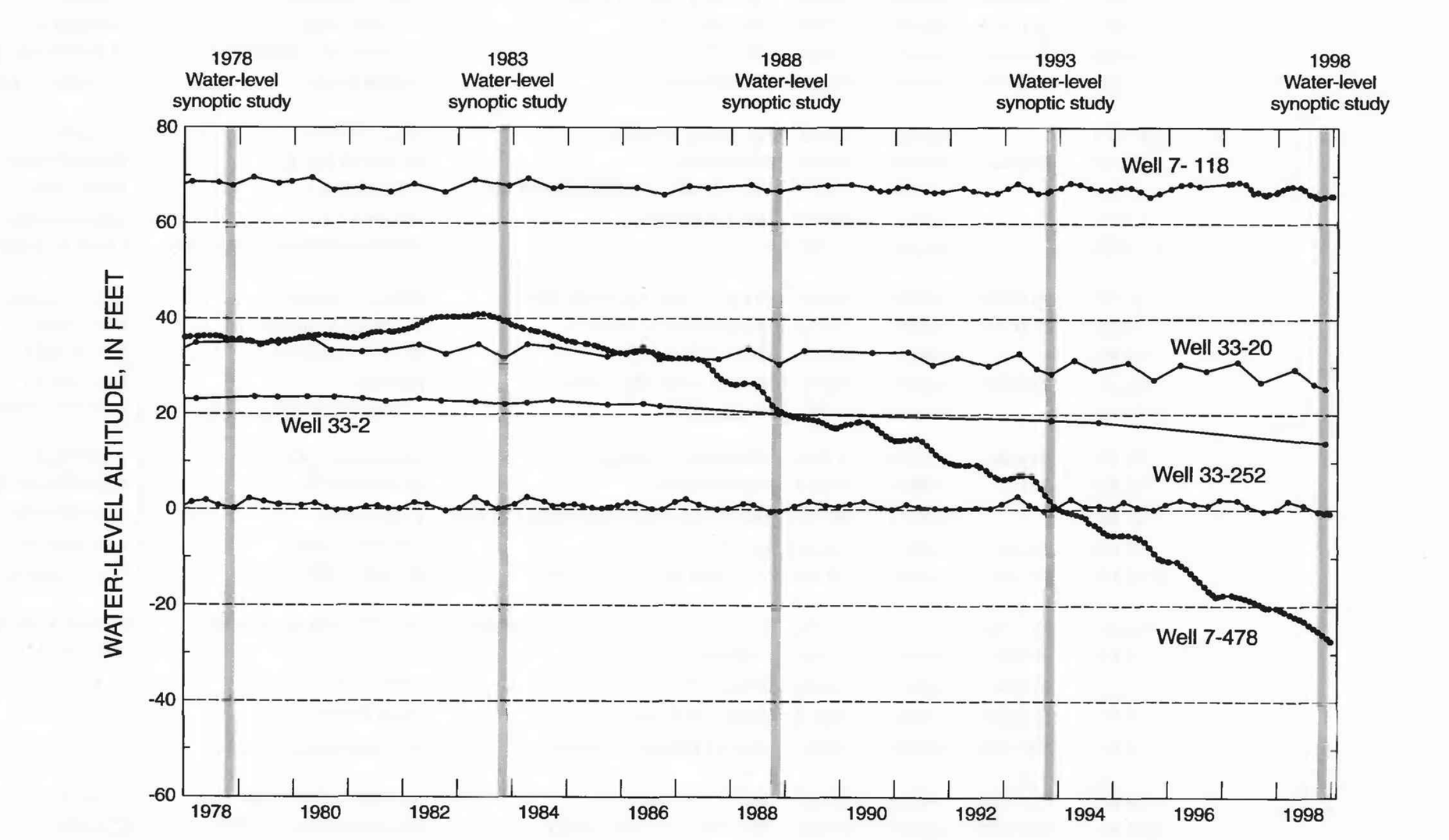


Figure 6-5. Water-level hydrographs for observation wells screened in the Wenonah-Mount Laurel aquifer in the southern counties, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWAL FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998

by

Pierre J. Lacombe and Robert Rosman

2001

Englishtown Aquifer System

The Englishtown aquifer system in New Jersey is defined by Zapecza (1989). The outcrop is within the Englishtown Formation. The downdip limit of the aquifer is about 35 miles southeast of its outcrop area in the northern Coastal Plain and about 25 miles southeast of its outcrop area in the southern Coastal Plain. From the northern Coastal Plain to central Ocean County, the Englishtown aquifer system is a single aquifer, but it is divided by a confining unit into upper and lower aquifers in central and southern Ocean County. The aquifer system yields little water in the southern Coastal Plain, and it is not a viable aquifer in Delaware.

Water withdrawal and extent of freshwater

Water withdrawals from the Englishtown aquifer system are made predominantly in Monmouth and northern Ocean Counties; however, some withdrawals are made from a few wells in central Burlington and Camden Counties (fig. 7-1). Total withdrawals decreased from about 11 to 7 Mgal/d during 1978-93 and remained at about 7 Mgal/d during 1993-97 (fig. 7-2). Water withdrawals in the northern Coastal Plain decreased from about 10.5 to 5.5 Mgal/d during 1978-94 and remained about 5.5 Mgal/d during 1994-97. Water withdrawals in the southern Coastal Plain remained fairly constant at less than 1 Mgal/d during 1978-91 and increased to about 1.5 Mgal/d during 1992-97. In Delaware, no water withdrawals were reported.

Concentrations of chloride exceeded 25 mg/L in samples from only one well in the Englishtown aquifer system. All other water samples from wells contained concentrations of chloride that were much lower than 25 mg/L. A water sample from well 25-771 on Sandy Hook contained a chloride concentration of 16,000 mg/L. The saltwater is below a 5-ft-thick clay lens so that water in the upper part of the Englishtown aquifer system is fresh, and water in the lower part is salty at this location. Well 25-771 was installed in 1997. Therefore, water-quality data for this well were not included in the simulations by Pope and Gordon (1999), and a 10,000-mg/L chloride line was not simulated for this aquifer.

Water Levels

Water-level data for 79 wells screened in the Englishtown aquifer system are listed in table 7-1 (reverse side of sheet 7). Water levels in these wells were used to define the potentiometric surface in 1998 (fig. 7-3). Maps of simulated water levels by Martin (1998, fig. 46, p. 87) and (Pope and Gordon, 1999) were adapted to close the potentiometric-surface contours east of Monmouth and Ocean Counties. The potentiometric-surface map shows a major cone of depression in eastern Monmouth and northern Ocean Counties. This cone encompasses three local cones of depression. The largest of the three cones of depression is elongated, is centered under shore communities from Lavallette to Spring Lake Heights, and had a minimum water-level altitude of about -104 ft in 1998. The two local cones of depression are near Lakewood, N.J. They are small, circular, and centered under single wells. The minimum water-level altitudes were -106 ft and -118 ft.

A small local cone of depression is present around well 25-105 in the Freehold quadrangle. This may be an ephemeral cone of depression. The maximum water-level altitude measured during the 1998 water-level synoptic study was +113 ft at well 25-787 in western Monmouth County.

The water level in well 25-771 at Sandy Hook was converted from a measured altitude of -2 ft to a freshwater equivalent altitude of +1 ft (table 7-1). This was done because the water contained a chloride concentration of about 16,000 mg/L and, therefore, had a density of 1.011 grams per cubic centimeter.

A downward hydraulic gradient from the Wenonah-Mount Laurel aquifer to the Englishtown aquifer system is shown in section A-A' (fig.1-2). The section also shows a downward hydraulic gradient from the Englishtown aquifer system to the Upper Potomac-Raritan-Magothy aquifer in the updip area and an upward hydraulic gradient in the downdip area. A downward hydraulic gradient from the Wenonah-Mount Laurel aquifer to the Englishtown aquifer system in the updip area and a upward hydraulic gradient from the Englishtown aquifer system to the Wenonah-Mount Laurel aquifer in the downdip area is shown in section B-B' (fig.1-3) . A downward hydraulic gradient from the Englishtown aquifer system to the Upper Potomac-Raritan-Magothy aquifer also is shown.

Water-level changes during 1993-98 were calculated for 60 of the 79 wells screened in the aquifer. In Monmouth and Ocean Counties, water levels rose 1 to 9 ft in 6 wells, rose 10 to 40 ft in 20 wells, and rose 40 to 49 ft in 4 wells. The greatest changes in water levels were in wells near the center of the major cone of depression where water levels declined from 1 to 10 ft in 7 wells. Most water-level declines occurred in wells in the Freehold, Marlboro, and Long Branch quadrangles. Water levels remained the same in five wells.

Water-level changes during 1993-98 were calculated for 14 wells in Burlington, Camden, Gloucester, and Salem Counties. Water levels declined 1 to 8 ft in 11 wells and did not change in 2 wells. The water level declined 18 ft in well 7-672 in the Clementon quadrangle, possibly as a result of withdrawals in a nearby production well.

Water-level hydrographs for nine observation wells show long-term and seasonal trends during 1978-98 (fig. 7-4). Annual high water-level altitudes decreased about 5 ft in wells 25-250, 23-104, 5-259, and possibly 25-715 during 1978-98. These four wells are far from the major cone of depression in eastern Monmouth and northern Ocean Counties. Water levels declined in well 25-429 and probably declined in wells 25-638 and 29-530 during 1978-90; however, during 1991-96, water levels rose 50 ft in well 25-638, 90 ft in well 25-429, and at least 120 ft in well 29-530. Water levels in these three wells remained constant during 1997-98. The rise in water levels during 1990-96 is the result of the NJDEP's mandate to reduce withdrawals from the Englishtown aquifer system and deeper aquifers and to substitute surface water from reservoirs in Monmouth County (New Jersey Department of Environmental Protection, 1985). The mandated reduction of withdrawals resulted in an increase in water levels near the center of the cone of depression and a decrease in the extent of the cone of depression. Water levels in the aquifer appear to have stabilized at the new, lower withdrawal rates.

Water levels in well 29-138 declined 5 ft during 1978-92 and rose 10 ft during 1992-98. Water levels in well 29-534 declined about 10 ft during 1978-92 and rose 25 ft during 1992-98. Well 29-138 is distant from the large cone of depression, and well 29-534 is in the lower aquifer of the Englishtown aquifer system. The recovery lag between 1990 when water levels began to rise in wells 29-530, 25-429 and 25-638 and 1992 when water levels began to rise in wells 25-715 and 29-138 reflects the connection between the heavily used part of the aquifer and the less used, more distal part of the aquifer.

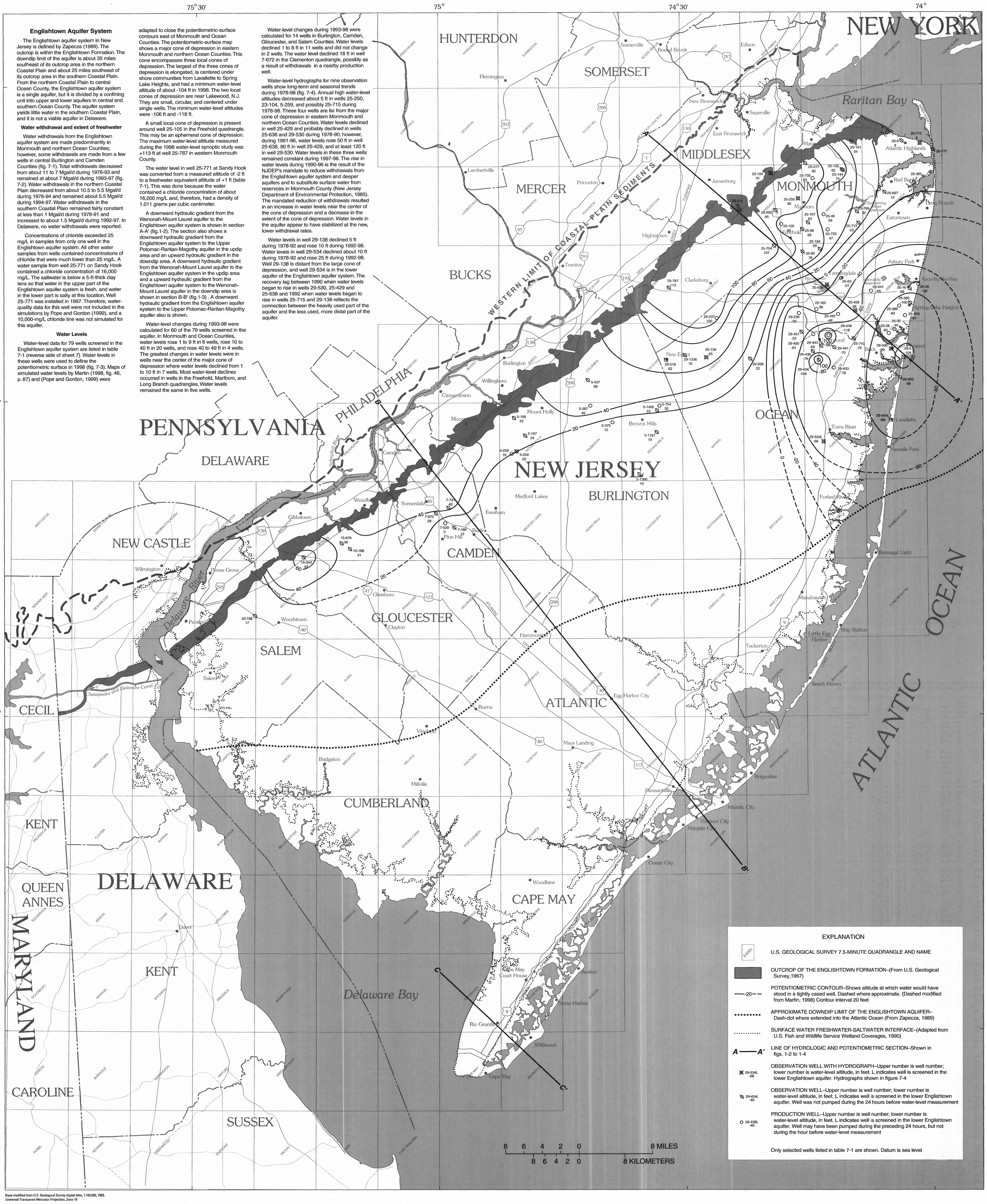


Figure 7-3. Potentiometric surface of the Englishtown aquifer system, 1998.

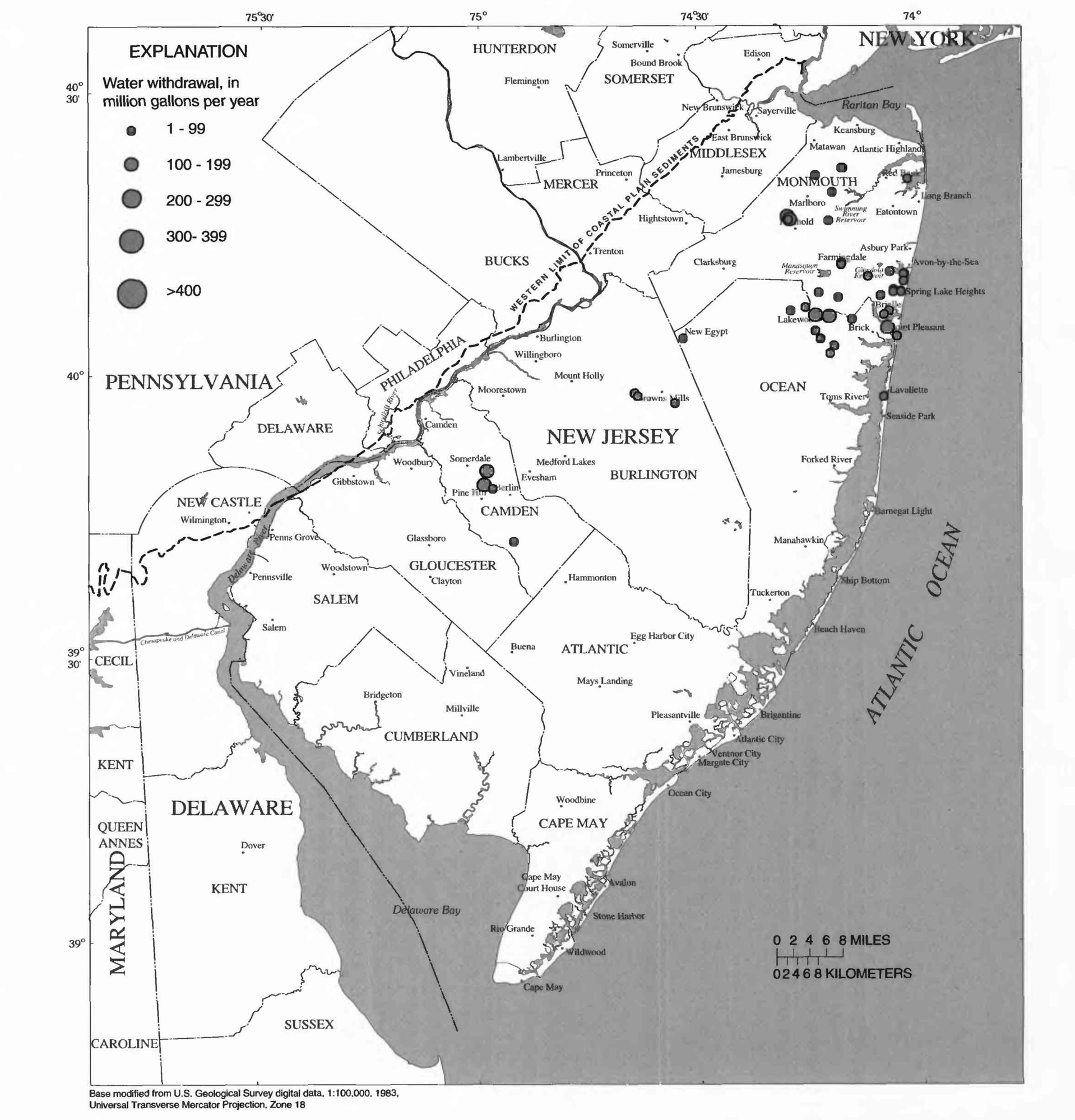


Figure 7-1. Estimated water withdrawals from the Englishtown aquifer system, 1997.

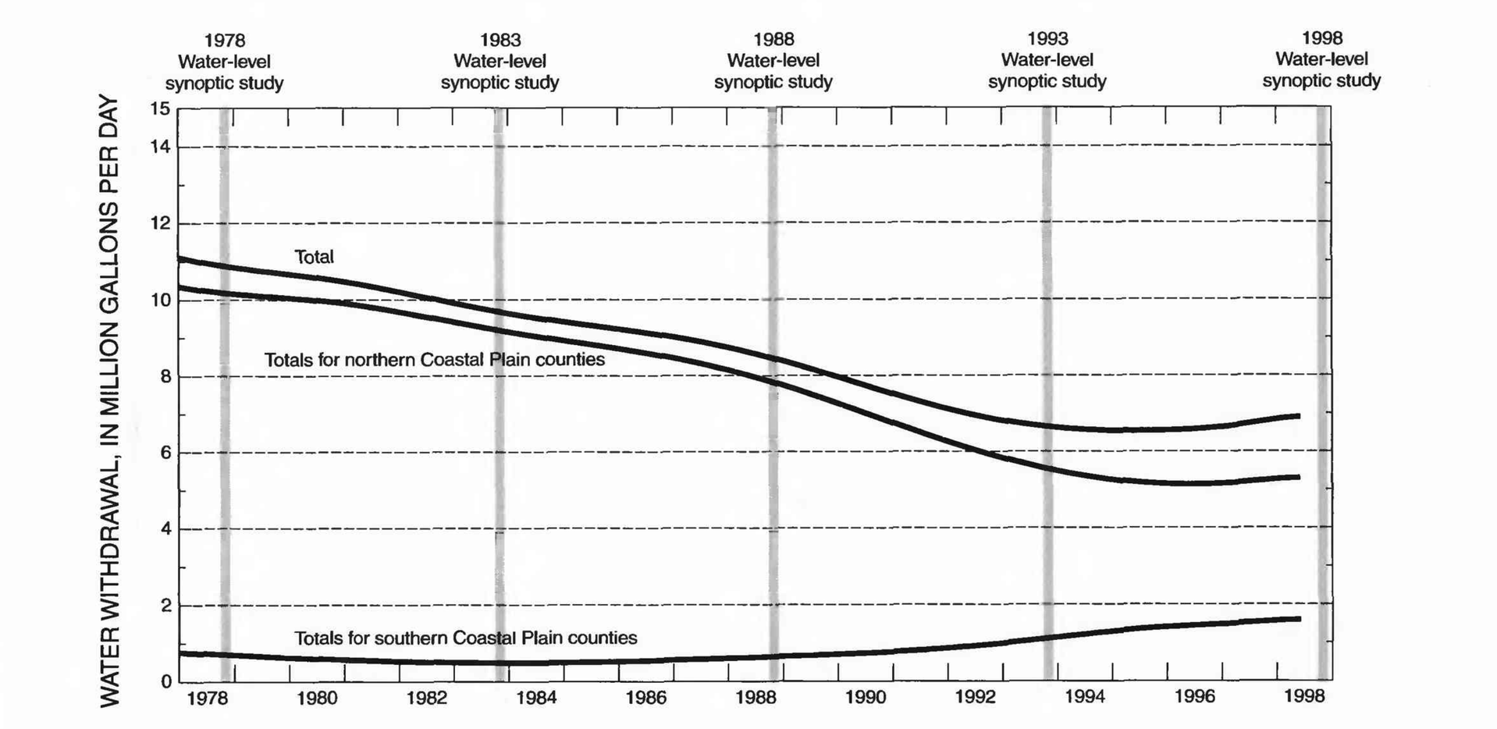


Figure 7-2. Estimated water withdrawals from the Englishtown aquifer system, 1978-98.

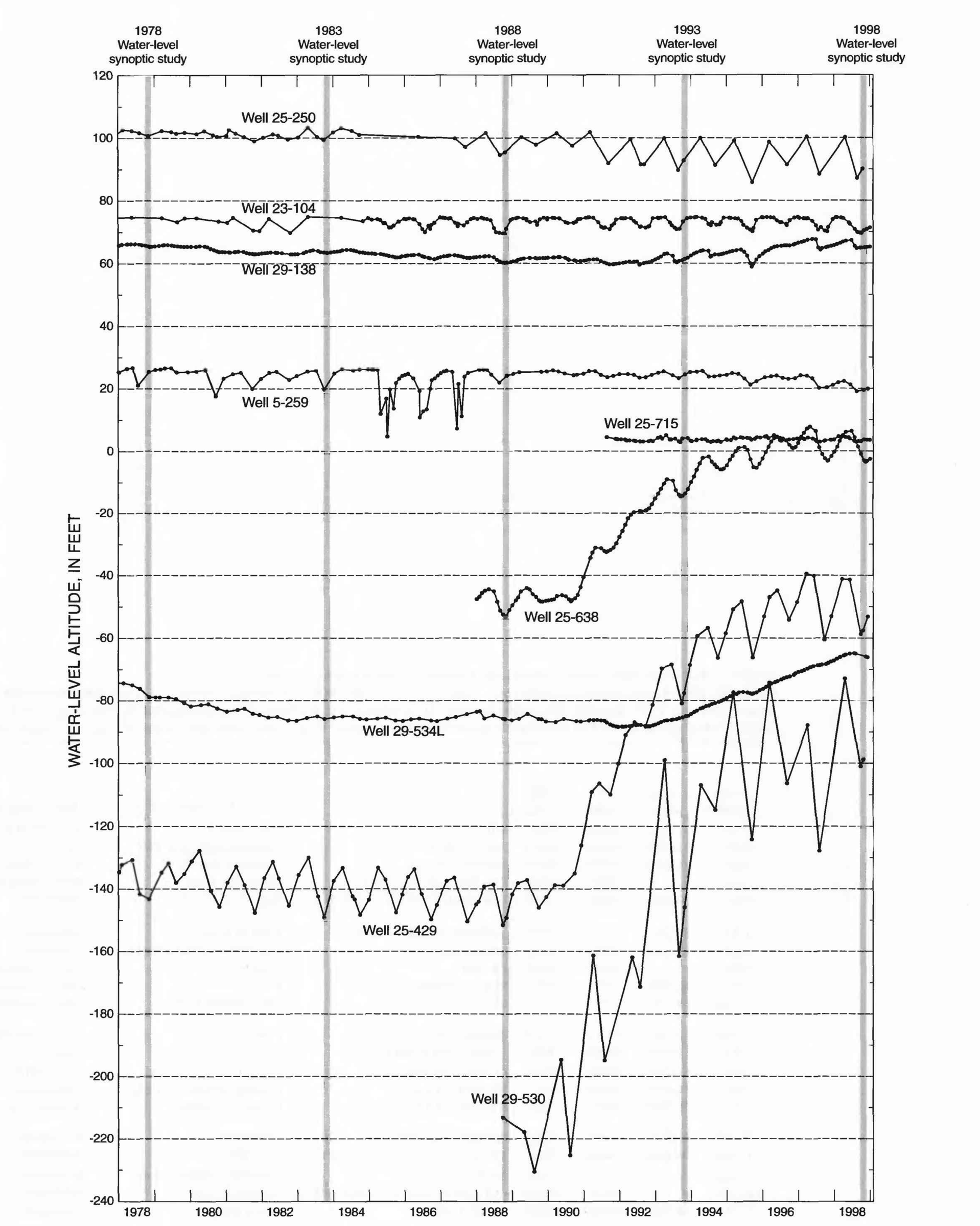


Figure 7-4. Water-level hydrographs for observation wells screened in the Englishtown aquifer system, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998
by
Pierre J. Lacombe and Robert Rosman
2001

Upper Potomac-Raritan-Magothy Aquifer

The Upper Potomac-Raritan-Magothy aquifer in New Jersey is defined by Zapecza (1989). Its outcrop and subcrop area has not been completely mapped. The aquifer crops out primarily within the Magothy Formation, but in places, it crops outs along with the western edge of the Potomac and Raritan Formations. In Monmouth and Middlesex Counties, the aquifer is locally referred to as the Old Bridge aquifer. The aquifer is well defined in the offshore areas of Monmouth and Ocean Counties, but less well defined in Atlantic, Cumberland, and Cape May Counties. In Delaware, Vroblesky and Fleck (1991) and Martin (1984) refer to it as the Magothy aquifer. The updip limit of the aquifer is within the Magothy Formation outcrop. The downdip limit extends into eastern Sussex County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Water withdrawals in the Upper Potomac-Raritan-Magothy aquifer are made primarily in a band from Raritan Bay to Maryland (fig. 8-1). In the northern Coastal Plain, withdrawals are made predominantly in southeastern Middlesex, Monmouth, and northeastern Ocean Counties. In the central Coastal Plain, withdrawals are made predominantly in central Burlington, Camden, and Gloucester Counties. Minor withdrawals are made in the Salem County, New Jersey, and New Castle County, Delaware.

Estimated water withdrawals in New Jersey ranged from about 77 to 82 Mgal/d during 1978-87, then steadily decreased to about 55 Mgal/d in 1997 (fig. 8-2). Withdrawals in northern counties decreased from about 51 to 25 Mgal/d during 1985-97. Water withdrawals in the southern counties remained at about 30 to 32 Mgal/d during 1978-93 and decreased to about 25 Mgal/d during 1994-97. Estimated water withdrawals from the Upper Potomac-Raritan-Magothy aquifer (Magothy aquifer) in Delaware remained at less than 0.5 Mgal/d during 1978-97. The withdrawals were limited to central New Castle County, although the aquifer is used extensively outside the study area in Maryland.

The location of the 250-mg/L chloride line in the Raritan Bay area (fig. 8-3) was mapped by Schaefer (1983). The location of the 250-mg/L chloride line in Salem County was based on water-quality data stored in the U.S. Geological Survey water-quality data base. In Delaware, the 250-mg/L chloride line was mapped by Cushing and others (1973, pl. 3). The location of the 10,000-mg/L chloride line in New Jersey was simulated by Pope and Gordon (1999) based on a saltwater model of the aquifers. The location of the 10,000-mg/L chloride line in Delaware is from Vroblesky and Fleck (1991, p. E-18).

Water Levels

Water-level measurements for 192 wells screened in the Upper Potomac-Raritan-Magothy aquifer are listed in table 8-1 (reverse side of sheet 8). The water-level altitudes in these wells were used to define the 1998 potentiometric surface (fig. 8-3). Maps of simulated water levels by Martin (1998, fig. 48) and Pope and Gordon (1999) were adapted to close the potentiometric-surface contours in the southeastern part of the Coastal Plain.

The potentiometric-surface map shows a regional cone of depression that extends from Raritan Bay to Maryland. The regional cone of depression can be divided into three segments. The northeasternmost segment encompasses much of Monmouth and northern Ocean Counties. Water-level altitudes in the cone of depression typically are -10 to -20 ft. Extensive areas in northeastern Ocean County show water-level altitudes that are about -25 to -30 ft, however. Three single-well cones of depression with minimum water-level altitudes of -20 to -30 ft are located in the Long Branch, Freehold, and Asbury Park quadrangles. A single-well cone of depression with a minimum water-level altitude of -42 ft is in the Lakehurst quadrangle.

During 1993-98, water levels in the center of the northern Coastal Plain cone of depression remained about the same. The -20-ft contour line has been expanded in northern Ocean County, and in one well the water-level altitude has declined to less than -40 ft. The 0-ft contour line has remained in about the same location since 1993.

The central segment of the regional cone of depression encompasses much of Burlington, Camden, Gloucester, and eastern Salem Counties. The central segment has a minimum water-level altitude of -102 ft. One single-well cone of depression with a minimum water-level altitude of -85 ft is in the Moorestown quadrangle.

During 1993-98, water levels in the central segment of the regional cone of depression rose about 20 ft. The -80-ft contour line has contracted significantly during 1993-98. The -20-ft, -40-ft, and -60-ft contour lines are in about the same locations in the northeast to southwest part of the cone, but they have decreased in breadth in the northwest to southeast direction.

The southwestern segment of the regional cone of depression encompasses New Castle and western Salem Counties. Water-level altitudes in this area typically ranged from -25 to -35 ft. The maximum water-level altitude for this aquifer in 1998 was +74 ft (well 23-292) in the Hightstown quadrangle.

A downward hydraulic gradient is present from the Englishtown aquifer system to the Upper Potomac-Raritan-Magothy aquifer in the western part of the aquifer, but in near-shore areas, the hydraulic gradient is upward from the aquifer to the Englishtown aquifer system as shown in section A-A' (fig.1-2). Similarly, the hydraulic gradient between the Upper Potomac-Raritan-Magothy aquifer and the Middle Potomac-Raritan-Magothy aquifer is downward in the updip areas and upward along the Coast. A downward hydraulic gradient is present from the Englishtown aquifer system to the Upper Potomac-Raritan-Magothy aquifer along the whole length of section B-B' (fig.1-3). The hydraulic gradient between the Upper and Middle Potomac-Raritan-Magothy aquifer is nearly neutral in the updip area and upward toward the Upper Potomac-Raritan-Magothy aquifer in the downdip area.

Water-level changes during 1993-98 were calculated for 146 wells. Water levels declined 1 to 11 ft in 48 wells, rose 1 to 51 ft in 80 wells, and remained the same in 18 wells. Water-level changes were calculated for 66 wells in Mercer, Ocean, Monmouth, and Middlesex Counties in the northern Coastal Plain. Water levels rose 1 to 6 ft in 16 wells, and 18 and 28 ft in one well each. The two wells with large water-level increases are in the outcrop area in Middlesex County. Water levels declined 1 to 9 ft in 38 wells and 11 ft and 12 ft in 2 wells. Water levels remained the same in 8 wells. In general, water levels across the northern Coastal Plain remained about the same as 5 years ago, except in northern Ocean County, where water levels declined 5 to 10 ft. Water-withdrawal data (fig. 8-1) show that withdrawal rates were constant during 1993-98. Much of the water supply in this area now is derived from the Swimming River, Glendola, and Manasquan Reservoirs.

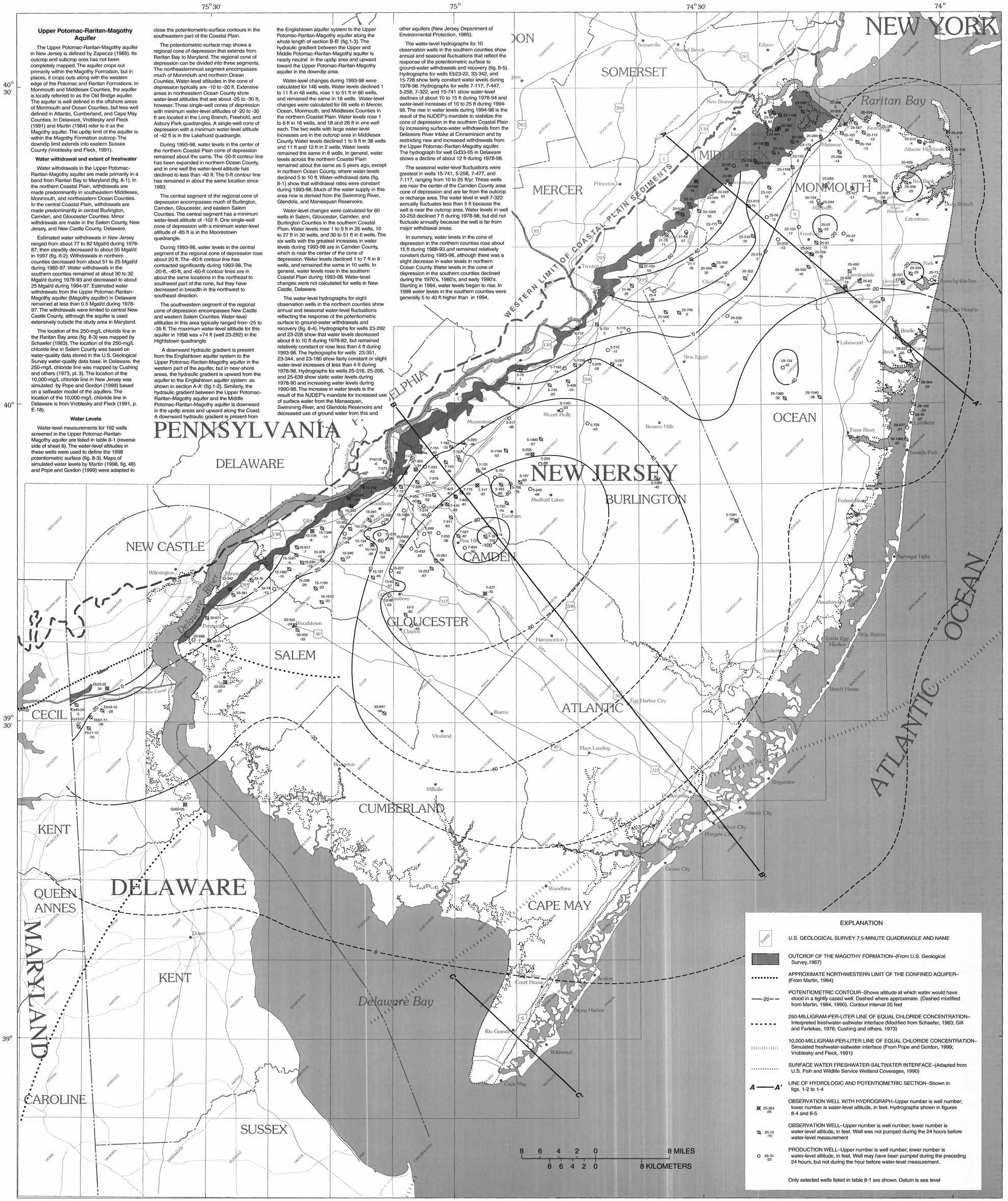
Water-level changes were calculated for 80 wells in Salem, Gloucester, Camden, and Burlington Counties in the southern Coastal Plain. Water levels rose 1 to 9 ft in 26 wells, 10 to 27 ft in 30 wells, and 30 to 51 ft in 6 wells. The six wells with the greatest increases in water levels during 1993-98 are in Camden County, which is near the center of the cone of depression. Water levels declined 1 to 7 ft in 8 wells, and remained the same in 10 wells. In general, water levels rose in the southern Coastal Plain during 1993-98. Water-level changes were not calculated for wells in New Castle, Delaware.

The water-level hydrographs for eight observation wells in the northern counties show annual and seasonal water-level fluctuations reflecting the response of the potentiometric surface to ground-water withdrawals and recovery (fig. 8-4). Hydrographs for wells 23-292 and 23-228 show that water levels decreased about 8 to 10 ft during 1978-82, but remained relatively constant or rose less than 4 ft during 1993-98. The hydrographs for wells 23-351, 23-344, and 23-180 show fairly constant or slight water-level increases of less than 4 ft during 1978-98. Hydrographs for wells 25-316, 25-206, and 25-639 show static water levels during 1978-90 and increasing water levels during 1990-98. The increase in water levels is the result of the NJDEP's mandate for increased use of surface water from the Manasquan, Swimming River, and Glendola Reservoirs and decreased use of ground water from this and other aquifers (New Jersey Department of Environmental Protection, 1985).

The water-level hydrographs for 10 observation wells in the southern counties show annual and seasonal fluctuations that reflect the response of the potentiometric surface to ground-water withdrawals and recovery (fig. 8-5). Hydrographs for wells Eb23-22, 33-342, and 15-728 show fairly constant water levels during 1978-98. Hydrographs for wells 7-117, 7-447, 5-258, 7-322, and 15-741 show water-level declines of about 10 to 15 ft during 1978-94 and water-level increases of 10 to 25 ft during 1994-98. The rise in water levels during 1994-98 is the result of the NJDEP's mandate to stabilize the cone of depression in the southern Coastal Plain by increasing surface-water withdrawals from the Delaware River intake at Cinnaminson and by restricting new and increased withdrawals from the Upper Potomac-Raritan-Magothy aquifer. The hydrograph for well Gd33-05 in Delaware shows a decline of about 12 ft during 1978-98.

The seasonal water-level fluctuations were greatest in wells 15-741, 5-258, 7-477, and 7-117, ranging from 10 to 25 ft/yr. These wells are near the center of the Camden County area cone of depression and are far from the outcrop or recharge area. The water level in well 7-322 annually fluctuates less than 5 ft because the well is near the outcrop area. Water levels in well 33-253 declined 7 ft during 1978-98, but did not fluctuate annually because the well is far from major withdrawal areas.

In summary, water levels in the cone of depression in the northern counties rose about 15 ft during 1988-93 and remained relatively constant during 1993-98, although there was a slight decrease in water levels in northern Ocean County. Water levels in the cone of depression in the southern counties declined during the 1970's, 1980's, and early 1990's. Starting in 1994, water levels began to rise. In 1998 water levels in the southern counties were generally 5 to 40 ft higher than in 1994.



EXPLANATION

- U.S. GEOLOGICAL SURVEY 7.5-MINUTE QUADRANGLE AND NAME
- OUTCROP OF THE MAGOTHY FORMATION–(From U.S. Geological Survey,1967)
- APPROXIMATE NORTHWESTERN LIMIT OF THE CONFINED AQUIFER–(From Martin, 1984)
- -20- POTENTIOMETRIC CONTOUR–Shows altitude at which water would have stood in a tightly cased well. Dashed where approximate. (Dashed modified from Martin, 1984, 1990). Contour interval 20 feet
- 250-MILLIGRAM-PER-LITER LINE OF EQUAL CHLORIDE CONCENTRATION–Interpreted freshwater-saltwater interface (Modified from Schaefer, 1983; Gill and Farlekas, 1976; Cushing and others, 1973)
- 10,000-MILLIGRAM-PER-LITER LINE OF EQUAL CHLORIDE CONCENTRATION–Simulated freshwater-saltwater interface (From Pope and Gordon, 1999; Vroblesky and Fleck, 1991)
- SURFACE WATER FRESHWATER-SALTWATER INTERFACE–(Adapted from U.S. Fish and Wildlife Service Wetland Coverages, 1990)
- A——A' LINE OF HYDROLOGIC AND POTENTIOMETRIC SECTION–Shown in figs. 1-2 to 1-4
- 25-351 -26 OBSERVATION WELL WITH HYDROGRAPH–Upper number is well number; lower number is water-level altitude, in feet. Hydrographs shown in figures 8-4 and 8-5
- 25-13 -15 OBSERVATION WELL–Upper number is well number; lower number is water-level altitude, in feet. Well was not pumped during the 24 hours before water-level measurement
- 29-70 -22 PRODUCTION WELL–Upper number is well number; lower number is water-level altitude, in feet. Well may have been pumped during the preceding 24 hours, but not during the hour before water-level measurement.

Only selected wells listed in table 8-1 are shown. Datum is sea level

Figure 8-3. Potentiometric surface of the Upper Potomac-Raritan-Magothy aquifer, 1998.

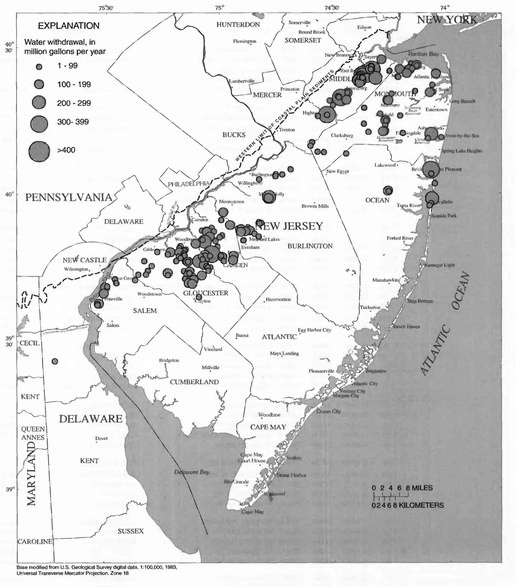


Figure 8-1. Estimated water withdrawals from the Upper Potomac-Raritan-Magothy aquifer, 1997.

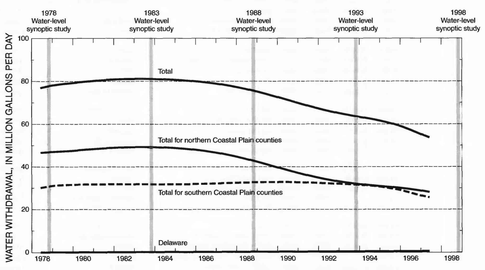


Figure 8-2. Estimated water withdrawals from the Upper Potomac-Raritan-Magothy aquifer, 1978-97.

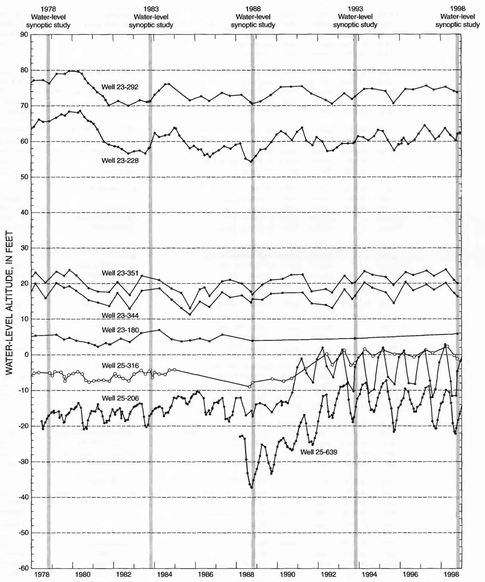


Figure 8-4. Water-level hydrographs for wells screened in the Upper Potomac-Raritan-Magothy aquifer in northern counties of the New Jersey Coastal Plain, 1978-98.

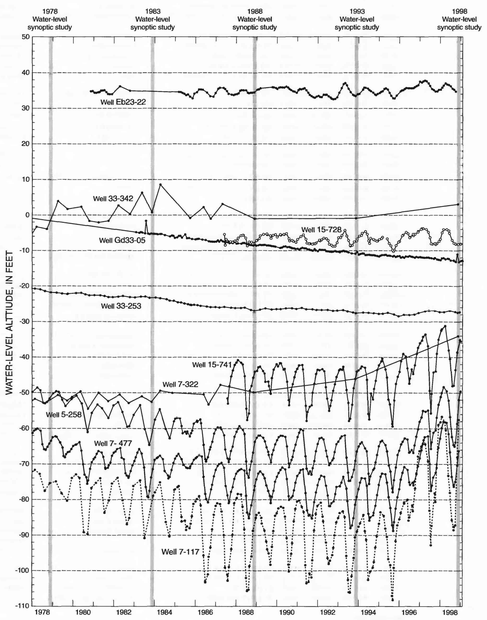


Figure 8-5. Water-level hydrographs for observation wells screened in the Upper Potomac-Raritan-Magothy aquifer in the southern counties of the New Jersey Coastal Plain and in Delaware, 1978-98.

Middle and Undifferentiated Potomac-Raritan-Magothy Aquifer

The Middle Potomac-Raritan-Magothy aquifer in New Jersey is defined by Zapecza (1989). Its outcrop or subcrop area has not been completely mapped; however, it is within the outcrop area of the Potomac, Raritan, and Magothy Formations. In Monmouth and Middlesex Counties, the aquifer is locally referred to as the Farrington aquifer. The aquifer is well defined from the outcrop area to about 20 miles downdip from the outcrop area. Zapecza (1989) refers to the aquifer east of the area as the undifferentiated Potomac-Raritan-Magothy aquifer. In Delaware, Vroblesky and Fleck (1991) refer to it as the Patapsco aquifer. Martin (1984) and Phillips (1967) divide the Potomac Formation into the upper, middle, and lower Potomac aquifers. In this report, the upper and middle Potomac aquifers are combined much as Vroblesky and Fleck (1991) combined them. Martin (1984) shows the updip limit of the aquifer within the outcrop of the Potomac Formation. The downdip limit in Delaware is shown to extend at least into eastern Sussex County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Water withdrawals from the undifferentiated and Middle Potomac-Raritan-Magothy aquifer occur along a broad band from Raritan Bay to Maryland (fig. 9-1). The four major withdrawal centers in this band are in (1) eastern Middlesex and northern Monmouth Counties, (2) northern Ocean County, (3) Burlington, Camden, Gloucester and Salem Counties, and (4) New Castle County, Delaware.

Water withdrawals in New Jersey decreased from about 95 to 70 Mgal/d during 1978-98 (fig. 9-2). During this period, water withdrawals in the northern counties decreased from about 30 to 20 Mgal/d, and withdrawals from the undifferentiated aquifer in Ocean County decreased from about 14 to 9 Mgal/d. Withdrawals in the southern counties decreased from 42 to 31 Mgal/d, and withdrawals in Delaware remained at about 9 Mgal/d during 1978-97.

The extent of freshwater remained about the same as in 1993. The location of the 250-mg/L chloride line in New Jersey (fig. 9-3) is modified from Schaefer (1983), Pucci and others (1994), and Gill and Farlekas (1976). The 250-mg/L chloride line in Delaware is from Cushing and others (1973). The location of the 10,000-mg/L chloride line in New Jersey was simulated by Pope and Gordon (1999) based on a saltwater model of the aquifers. In Delaware, the 10,000-mg/L chloride line is from Vroblesky and Fleck (1991).

Water Levels

Water-level measurements for 182 wells screened in the undifferentiated and Middle Potomac-Raritan-Magothy aquifer are listed in table 9-1 (reverse side of sheet 9). The water levels in these wells were used to define the 1998 potentiometric surface (fig. 9-3). Maps of simulated water levels by Martin (1984 and 1998) and Pope and Gordon (1999) were adapted to close the contours in the southeastern part of the study area. The potentiometric-surface map shows a regional, elongated cone of depression in the Coastal Plain in which water levels are below sea level. The regional cone of depression extends from Raritan Bay in the northeast to Maryland in the southwest. The regional cone of depression can be divided, from north to south, into four subregional cones of depression in (1) northwestern Monmouth County, where the minimum water-level altitude was -35 ft; (2) northern Ocean County, where the minimum water-level altitude was about -40 ft; (3) Burlington County to northern Gloucester Counties, where the minimum water-level altitude was about -65 ft; and (4) Salem and New Castle Counties, where the minimum water-level altitude was -60 ft. The maximum water-level altitude measured during 1998 was +76 ft in well 23-306 northwest of Jamesburg.

The water level in well 11-137 was converted from a measured altitude of -55 ft to a freshwater equivalent altitude of -34 ft. This conversion was done because the chloride concentration in well water was about 11,000 mg/L and, therefore, had a density of 1.011 grams per cubic centimeter. For similar reasons the water level in well 1-1221 was converted from a saltwater head of -50 ft to a freshwater head of -37 ft.

A downward hydraulic gradient is present from the Upper Potomac-Raritan-Magothy aquifer to the Middle Potomac-Raritan-Magothy aquifer in the western part of the aquifer, but in shoreline areas, the hydraulic gradient is upward from the undifferentiated Potomac-Raritan-Magothy aquifer to the Upper Potomac-Raritan-Magothy aquifer as shown in section A-A' (fig. 1-2). A minor downward hydraulic gradient is present near the Delaware River from the Upper Potomac-Raritan-Magothy aquifer to the Middle Potomac-Raritan-Magothy aquifer, and virtually no gradient is present from the Middle Potomac-Raritan-Magothy aquifer to the Lower Potomac-Raritan-Magothy aquifer (section B-B', (fig.1-3). The hydraulic gradient in the downdip area is upward from the Lower Potomac-Raritan-Magothy aquifer to the Middle Potomac-Raritan-Magothy aquifer and upward from the Middle Potomac-Raritan-Magothy aquifer to the Upper Potomac-Raritan-Magothy aquifer.

Water-level changes during 1993-98 were calculated for 130 wells. Water levels declined 1 to 20 ft in 40 wells, rose 1 to 31 ft in 72 wells, and remained the same in 18 wells.

Water levels declined more than 10 ft in two wells in the outcrop areas in Burlington County, in one well each in Middlesex County and Ocean County. Water levels declined 1 to 9 ft in 36 wells. Nineteen of the wells with water-level declines were in Middlesex and Monmouth Counties.

Water levels rose 1 to 9 ft in 32 wells and 10 to 31 ft in 17 wells in Burlington, Camden, Gloucester, and Salem Counties. Water levels rose 1 to 9 ft in 18 wells in the Middlesex, Monmouth, and Ocean Counties and 10 to 12 ft in only 2 wells in Ocean County.

Overall, water levels rose in the Coastal Plain during 1988-98. The rise is the result of NJDEP's mandate to restrict withdrawals from the Potomac-Raritan-Magothy aquifers and substitute with surface-water supplies or other sources of water (New Jersey Department of Environmental Protection, 1985). The substantial water-level rise of about 20 ft in Burlington, Camden, Gloucester, and Salem Counties during 1993-98 is the result of an attempt to stabilize water levels or cause them to rise in this area by encouraging conservation, encouraging water withdrawal from shallower aquifers, and mandating the use of water obtained from the regional water line, which withdraws water from the Delaware River near Cinnaminson. The substantial water-level rise that occurred during 1988-96 in the northern Coastal Plain was followed by a subtle water-level decline during 1996-98. Water levels steadily increased during 1988-96 as a result of the NJDEP plan to cause water levels to rise by encouraging conservation and mandating the use of water obtained from the regional water line, which withdraws water from the Swimming River, Glendola, and Manasquan Reservoirs.

Water-level hydrographs for seven observation wells in the northern counties (Monmouth, Middlesex, and Ocean Counties) show annual and (or) seasonal fluctuations, reflecting the response of the water levels to ground-water withdrawals and recovery (fig. 9-4). Wells 23-291, 23-229, and 23-273 are in or near the outcrop of this aquifer in Middlesex County. The hydrograph for well 23-273 shows constant water levels for the period of record. The hydrographs for wells 23-291 and 23-229 show that water levels declined during 1978-88 and that water levels rose during 1988-98. Hydrographs for wells 23-97, 23-482 and 23-439 show that water levels rose during 1980-84. Water levels in well 23-97 remained constant during 1984-98, whereas water levels in wells 23-482 and 23-439 were unchanged or declined during 1984-88, rose dramatically during 1988-96, then possibly declined during 1996-98. The hydrograph for well 25-272 shows decreasing water levels during 1978-88, increasing water levels during 1989-96, and decreasing water levels during 1996-98. The increase was greatest after mid-1990 when withdrawals from the Manasquan Reservoir began and the public- and industrial- suppliers decreased withdrawals from this and other confined aquifers.

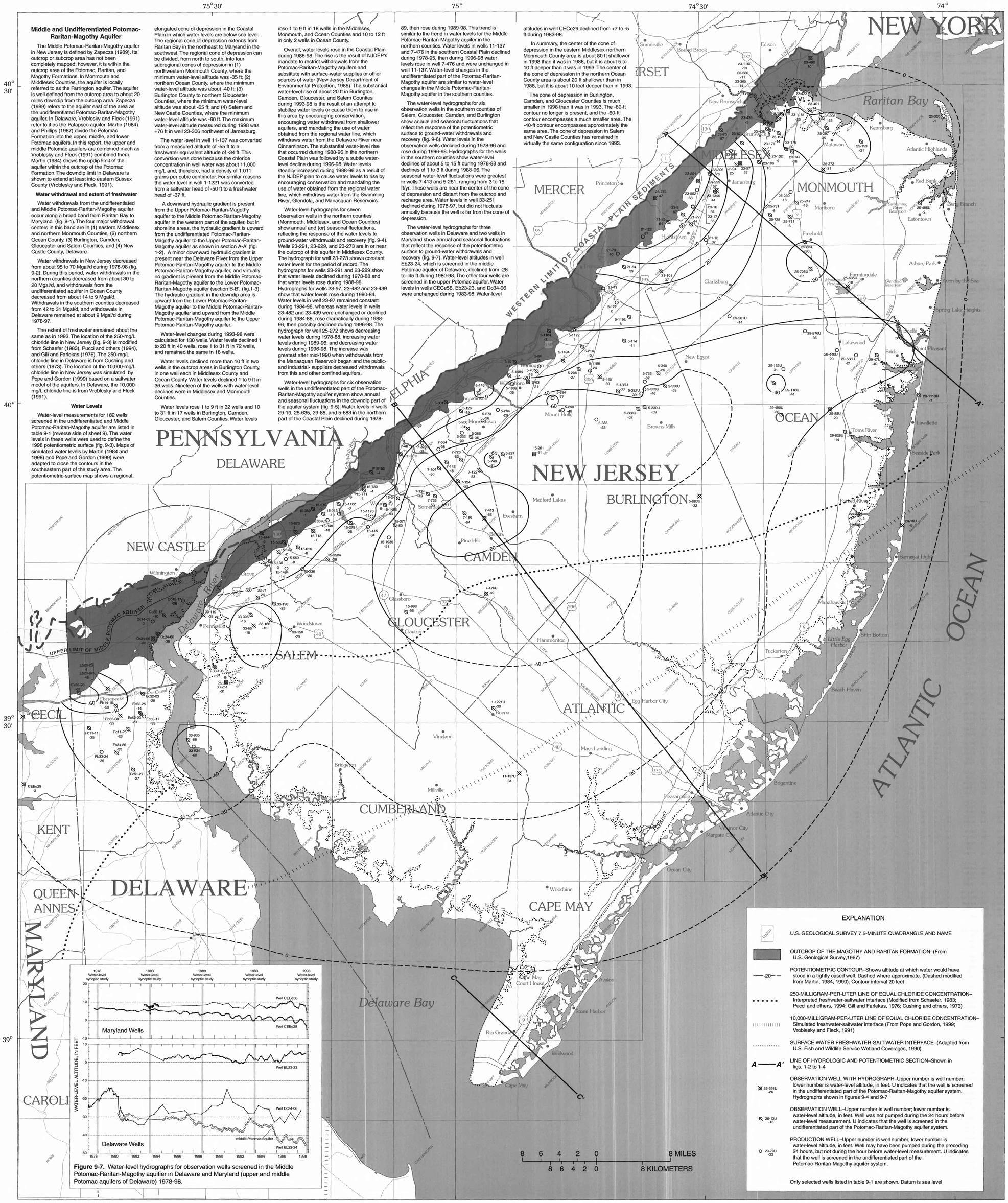
Water-level hydrographs for six observation wells in the undifferentiated part of the Potomac-Raritan-Magothy aquifer system show annual and seasonal fluctuations in the downdip part of the aquifer system (fig. 9-5). Water levels in wells 29-19, 25-635, 29-85, and 5-683 in the northern part of the Coastal Plain declined during 1978-89, then rose during 1989-98. This trend is similar to the trend in water levels for the Middle Potomac-Raritan-Magothy aquifer in the northern counties. Water levels in wells 11-137 and 7-476 in the southern Coastal Plain declined during 1978-95, then during 1996-98 water levels rose in well 7-476 and were unchanged in well 11-137. Water-level changes in the undifferentiated part of the Potomac-Raritan-Magothy aquifer are similar to water-level changes in the Middle Potomac-Raritan-Magothy aquifer in the southern counties.

The water-level hydrographs for six observation wells in the southern counties of Salem, Gloucester, Camden, and Burlington show annual and seasonal fluctuations that reflect the response of the potentiometric surface to ground-water withdrawals and recovery (fig. 9-6). Water levels in the observation wells declined during 1978-96 and rose during 1996-98. Hydrographs for the wells in the southern counties show water-level declines of about 5 to 15 ft during 1978-88 and declines of 1 to 3 ft during 1988-96. The seasonal water-level fluctuations were greatest in wells 7-413 and 5-261, ranging from 3 to 15 ft/yr. These wells are near the center of the cone of depression and distant from the outcrop and recharge area. Water levels in well 33-251 declined during 1978-97, but did not fluctuate annually because the well is far from the cone of depression.

The water-level hydrographs for three observation wells in Delaware and two wells in Maryland show annual and seasonal fluctuations that reflect the response of the potentiometric surface to ground-water withdrawals and recovery (fig. 9-7). Water-level altitudes in well Eb23-24, which is screened in the middle Potomac aquifer of Delaware, declined from -28 to -45 ft during 1980-98. The other four wells are screened in the upper Potomac aquifer. Water levels in wells CECe56, Eb23-23, and Dc34-06 were unchanged during 1983-98. Water-level altitudes in well CECe29 declined from +7 to -5 ft during 1983-98.

In summary, the center of the cone of depression in the eastern Middlesex-northern Monmouth County area is about 80 ft shallower in 1998 than it was in 1988, but it is about 5 to 10 ft deeper than it was in 1993. The center of the cone of depression in the northern Ocean County area is about 20 ft shallower than in 1988, but it is about 10 feet deeper than in 1993.

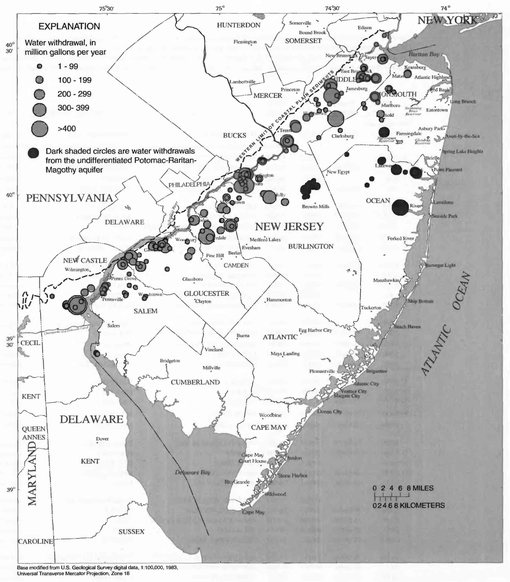
The cone of depression in Burlington, Camden, and Gloucester Counties is much smaller in 1998 than it was in 1993. The -80-ft contour no longer is present, and the -60-ft contour encompasses a much smaller area. The -40-ft contour encompasses approximately the same area. The cone of depression in Salem and New Castle Counties has remained in virtually the same configuration since 1993.



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983,
Universal Transverse Mercator Projection, Zone 18

Figure 9-3. Potentiometric surface of the undifferentiated and Middle Potomac-Raritan-Magothy aquifer, 1998.

Figure 9-7. Water-level hydrographs for observation wells screened in the Middle Potomac-Raritan-Magothy aquifier in Delaware and Maryland (upper and middle Potomac aquifers of Delaware) 1978-98.



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983,
Universal Transverse Mercator Projection, Zone 18

Figure 9-1. Estimated water withdrawals from the undifferentiated and Middle Potomac-Raritan-Magothy aquifer, 1997.

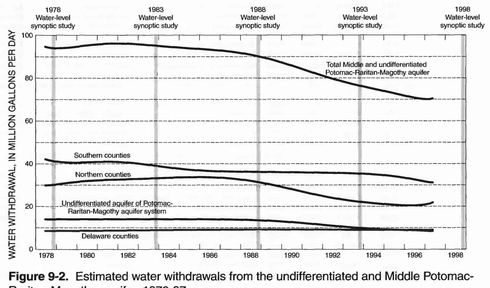


Figure 9-2. Estimated water withdrawals from the undifferentiated and Middle Potomac-Raritan-Magothy-aquifer, 1978-97.

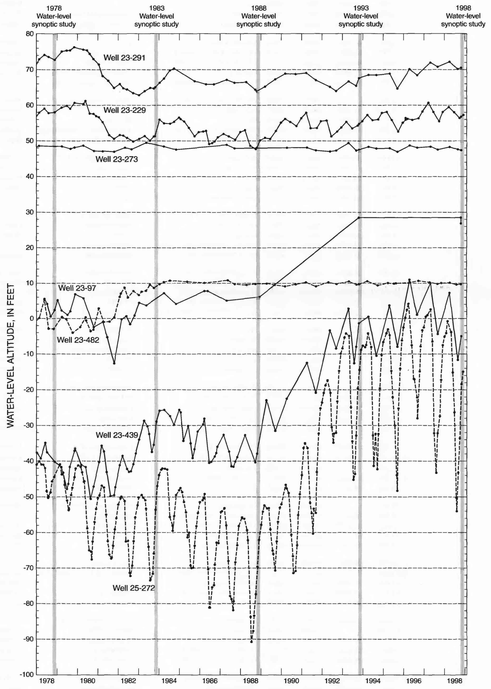


Figure 9-4. Water-level hydrographs for observation wells screened in the Middle Potomac-Raritan-Magothy aquifer in northern counties of the New Jersey Coastal Plain, 1978-98.

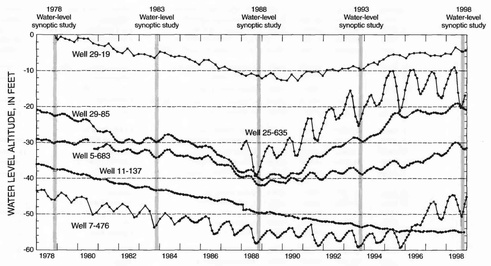


Figure 9-5. Water-level hydrographs for observation wells screened in the undifferentiated Potomac-Raritan-Magothy aquifer system in the New Jersey Coastal Plain, 1978-98.

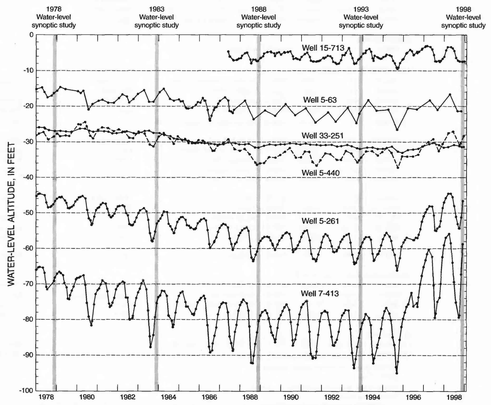


Figure 9-6. Water-level hydrographs for observation wells screened in the Middle Potomac-Raritan-Magothy aquifer in southern counties of the New Jersey Coastal Plain, 1978-98.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

WATER-RESOURCES INVESTIGATIONS REPORT 00-4143
Lower Potomac-Raritan-Mahothy Aquifer - SHEET 10 OF 10
Lacombe, P.J., and Rosman, Robert, 2001
Water levels in, extent of freshwater in, and water withdrawals from ten confined aquifers, New Jersey and Delaware Coastal Plain, 1998

Lower Potomac-Raritan-Magothy Aquifer

The Lower Potomac-Raritan-Magothy aquifer in New Jersey was defined by Zapecza (1990) and is limited to the southwestern counties of the Coastal Plain. Martin (1984) refers to this aquifer in Delaware as the lower Potomac aquifer, whereas Vroblesky and Fleck (1991) refer to it as the Patuxent aquifer. In Martin (1998) the updip limit of the aquifer in New Jersey is within the outcrop area of the Potomac and Magothy Formations; the updip limit of the aquifer in Delaware lies between the western edge of the Coastal Plain sediments and the updip limit of the middle Potomac aquifer, which is within the Potomac Formation. The downdip extent of the aquifer is mapped by Zapecza (1989) as far as southeastern Camden and Gloucester Counties. The downdip limit in Delaware is in northern Kent County (Vroblesky and Fleck, 1991).

Water withdrawal and extent of freshwater

Water withdrawals from the Lower Potomac-Raritan-Magothy aquifer in New Jersey were predominantly from areas adjacent to the Delaware River; however, most withdrawals were in the greater Camden County area (fig. 10-1). Water withdrawals from the aquifer in New Jersey decreased from about 62 Mgal/d in 1978 to about 42 Mgal/d in 1997 (fig. 10-2). Water withdrawals from the lower Potomac aquifer in Delaware totaled about 5 to 6 Mgal/d during 1978-97.

The location of the 250-mg/L chloride line in New Jersey (fig. 10-3) was determined from water-quality data stored in the USGS water-quality data base. The location of the 250-mg/L chloride line in 1998 is similar to that shown by Gill and Farlekas (1976) for the Potomac-Raritan-Magothy aquifer system in 1975. The location of the 250-mg/L chloride line in Delaware is based on maps and figures from Meisler (1989) and Vroblesky and Fleck (1991). The location of the 10,000-mg/L chloride line in New Jersey (fig. 10-3) is from Pope and Gordon, (1999). The location of the 10,000-mg/L line in Delaware is from Vroblesky and Fleck (1991).

Water Levels

Water levels for the Lower Potomac-Raritan-Magothy aquifer were measured in 67 wells in New Jersey, 4 wells in Pennsylvania, 12 wells in Delaware, and 2 wells in Maryland (table 10-1, reverse side of sheet 10). Water levels in these wells were used to define the 1998 potentiometric surface (fig. 10-3). Simulated water levels shown on maps by Martin (1984, 1998) and Pope and Gordon (1999) were adapted to close the contours at the eastern part of the study area. The potentiometric-surface map shows a major cone of depression in the greater Camden County area of New Jersey and a major cone of depression in New Castle County, Delaware, that extends into Salem County, New Jersey. The minimum measured water-level altitude at the center of the Camden County area cone of depression was -62 ft. The cone of depression in New Castle County area had a minimum measured water-level altitude of -179 ft. The maximum water-level altitude measured in 1998 in New Jersey was -2 ft in well 15-398 in the Bridgeport quadrangle, and in Delaware, +16 ft in well Da43-02.

A minor downward hydraulic gradient from the Middle to the Lower Potomac-Raritan-Magothy aquifer near the Delaware River and an upward hydraulic gradient from the Lower to the Middle Potomac-Raritan Magothy aquifer in the central part of Camden County are shown in section B-B' (fig.1-3) .

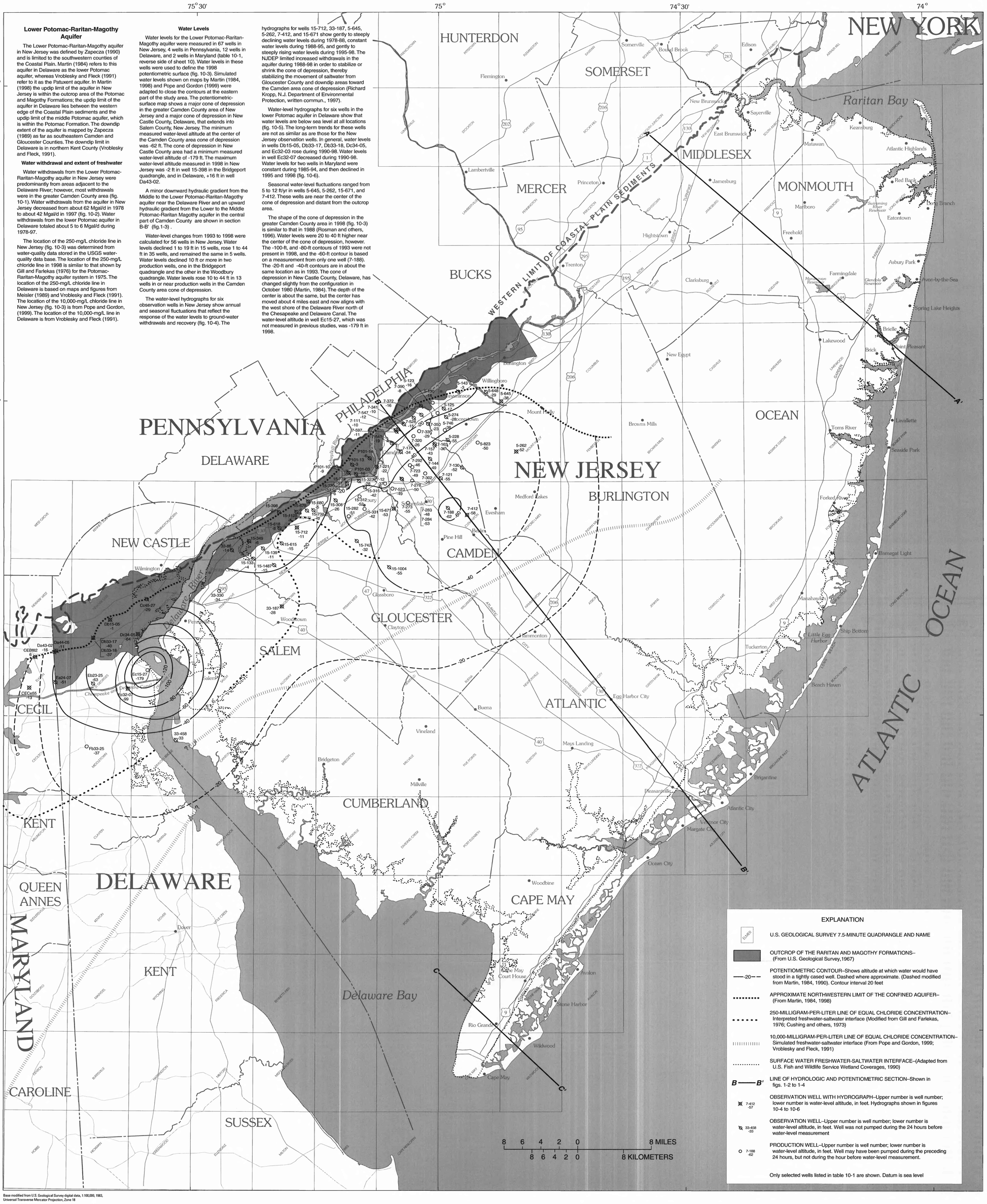
Water-level changes from 1993 to 1998 were calculated for 56 wells in New Jersey. Water levels declined 1 to 19 ft in 15 wells, rose 1 to 44 ft in 35 wells, and remained the same in 5 wells. Water levels declined 10 ft or more in two production wells, one in the Bridgeport quadrangle and the other in the Woodbury quadrangle. Water levels rose 10 to 44 ft in 13 wells in or near production wells in the Camden County area cone of depression.

The water-level hydrographs for six observation wells in New Jersey show annual and seasonal fluctuations that reflect the response of the water levels to ground-water withdrawals and recovery (fig. 10-4). The hydrographs for wells 15-712, 33-187, 5-645, 5-262, 7-412, and 15-671 show gently to steeply declining water levels during 1978-88, constant water levels during 1988-95, and gently to steeply rising water levels during 1995-98. The NJDEP limited increased withdrawals in the aquifer during 1988-98 in order to stabilize or shrink the cone of depression, thereby stabilizing the movement of saltwater from Gloucester County and downdip areas toward the Camden area cone of depression (Richard Kropp, N.J. Department of Environmental Protection, written commun., 1997).

Water-level hydrographs for six wells in the lower Potomac aquifer in Delaware show that water levels are below sea level at all locations (fig. 10-5). The long-term trends for these wells are not as similar as are those for the New Jersey observation wells. In general, water levels in wells Db15-05, Db33-17, Db33-18, Dc34-05, and Ec32-03 rose during 1990-98. Water levels in well Ec32-07 decreased during 1990-98. Water levels for two wells in Maryland were constant during 1985-94, and then declined in 1995 and 1998 (fig. 10-6).

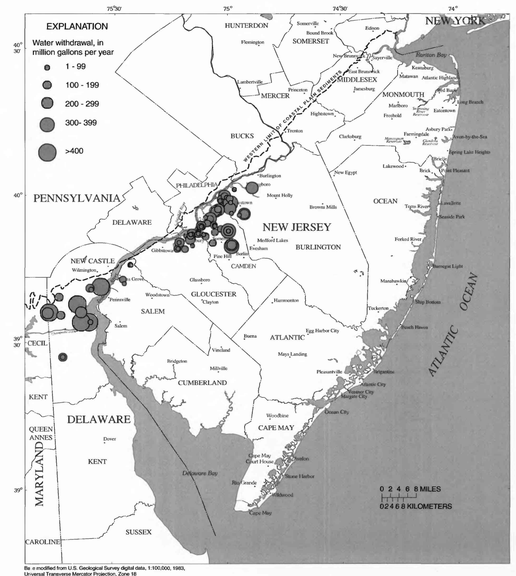
Seasonal water-level fluctuations ranged from 5 to 12 ft/yr in wells 5-645, 5-262, 15-671, and 7-412. These wells are near the center of the cone of depression and distant from the outcrop area.

The shape of the cone of depression in the greater Camden County area in 1998 (fig. 10-3) is similar to that in 1988 (Rosman and others, 1996). Water levels were 20 to 40 ft higher near the center of the cone of depression, however. The -100-ft, and -80-ft contours of 1993 were not present in 1998, and the -60-ft contour is based on a measurement from only one well (7-188). The -20-ft and -40-ft contours are in about the same location as in 1993. The cone of depression in New Castle County, Delaware, has changed slightly from the configuration in October 1980 (Martin, 1984). The depth of the center is about the same, but the center has moved about 4 miles east and now aligns with the west shore of the Delaware River north of the Chesapeake and Delaware Canal. The water-level altitude in well Ec15-27, which was not measured in previous studies, was -179 ft in 1998.



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983, Universal Transverse Mercator Projection, Zone 18

Figure 10-3. Potentiometric surface of the Lower Potomac-Raritan-Magothy aquifer, 1998.



Base modified from U.S. Geological Survey digital data, 1:100,000, 1983, Universal Transverse Mercator Projection, Zone 18

Figure 10-1. Estimated water withdrawals from the Lower Potomac-Raritan-Magothy aquifer, 1997.

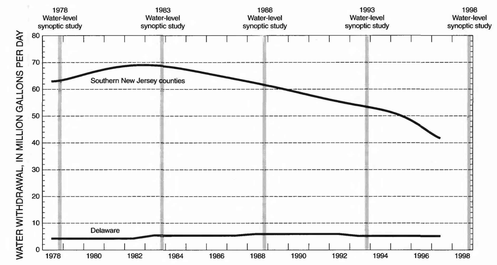


Figure 10-2. Estimated water withdrawals from the Lower Potomac-Raritan-Magothy aquifer, 1978-97.

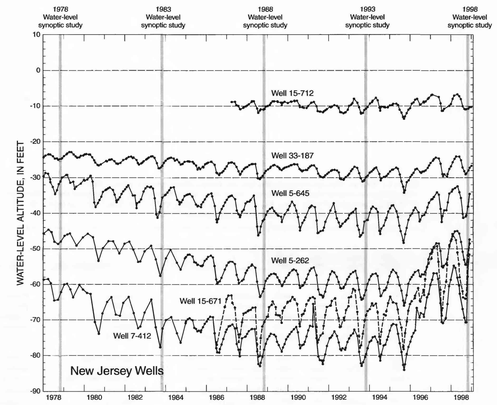


Figure 10-4. Water-level hydrographs for observation wells screened in the Lower Potomac-Raritan-Magothy aquifer, 1978-98.

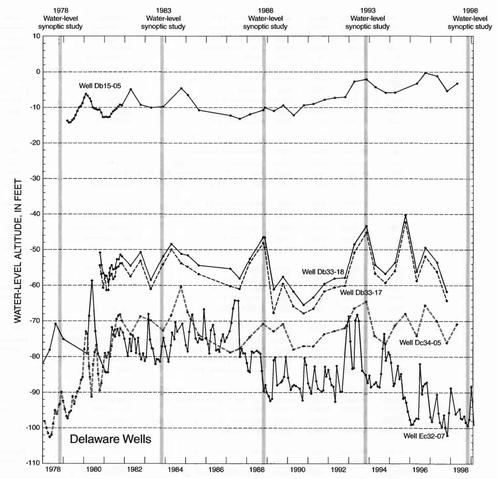


Figure 10-5. Water-level hydrographs for observation wells screened in the lower Potomac aquifer, Delaware, 1978-98.

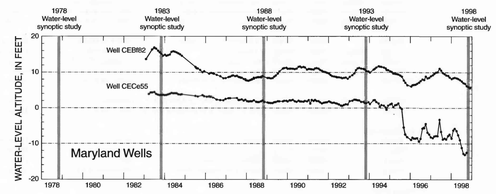


Figure 10-6. Water-level hydrographs for observation wells screened in the lower Potomac aquifer, Maryland, 1978-98.

WATER LEVELS IN, EXTENT OF FRESHWATER IN, AND WATER WITHDRAWALS FROM TEN CONFINED AQUIFERS, NEW JERSEY AND DELAWARE COASTAL PLAIN, 1998

by
Pierre J. Lacombe and Robert Rosman

2001

Table 2-1. Water-level data for wells screened in the Cohansey aquifer, Cape May County, 1978-98

[--, data are not available; ft, feet; USGS, U.S. Geological Survey; WD, Water Department; TWP, Township; MUA, Mulnicipal Utillities Authority; CO, Company; WC, Water Company; INC, Incorporated; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Lati-tude[1]	Longi-tude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shut-down period
9-11	57-04898	385612	745457	CAPE MAY CITY WD	CMCWD 1 OBS	CAPE MAY	1940	7	281-321	-18	-20	-14	-17	-15	2	11/19	D
9-17	--	385651	745310	US COAST GUARD	USCG 1	CAPE MAY	1943	[8]11	292-322	-14	-15	-10	[-15]-13	-10	3	12/2	D
9-27	37-00013	385643	745533	CAPE MAY CITY WD	CMCWD 3	CAPE MAY	1950	[5,6,7]10	277-306	[-23]-21	[-30]-27	[-20]-17	-21	-18	3	11/19	D
9-30	--	385650	745310	US GEOLOGICAL SURVEY	USGS TW 6 OBS	CAPE MAY	1957	11	305-325	--	--	--	--	-14	--	12/2	D
9-36	--	385701	745528	CAPE MAY CITY WD	CMCWD 2/CMCWD4(NEW)	CAPE MAY	1966	[8]10	174-282	-26	-33	-20	[-23]-26	-17	9	12/11	D
9-42	37-00268	385723	745240	BORDON CO(SNOW)	SNOW 3	CAPE MAY	1969	5	259-289	--	-18	-12	--	-16	--	12/1	H
9-43	57-00011	385724	745521	CAPE MAY CITY WD	CMCWD 5	CAPE MAY	1966	[6,7]18	246-276	--	[-28]-25	[-16]-13	-21	-16	5	11/19	H
9-48	37-00159	385748	745533	US GEOLOGICAL SURVEY	CANAL 5 OBS	CAPE MAY	1957	[5]17	242-252	[-18]-19	-22	-17	-21	-17	4	11/19	D
9-49	--	385804	745742	US GEOLOGICAL SURVEY	HIGBEE BEACH 3 OBS	CAPE MAY	1957	6	241-250	-16	-15	-13	-14	-13	1	11/19	D
9-52	37-00113	385851	745715	LOWER TWP MUA	LOWER TWP MUA 1	CAPE MAY	1956	18	241-262	--	-15	-16	-22	-19	3	11/19	H
9-54	37-00223	385905	745625	LOWER TWP MUA	LOWER TWP MUA 2	CAPE MAY	1962	14	212-247	--	-18	-16	[-30i]-20	-21	-1	11/19	H
9-57	37-00293	385919	745518	LOWER TWP MUA	LOWER TWP MUA 3	CAPE MAY	1974	20	263-303	--	-13	-13	-17	-12	5	11/19	D
9-58	57-00012	390015	745440	CAPE MAY COUNTY	CMC AIRPORT 1	RIO GRANDE	1942	20	248-275	-18	-15	-14	--	-18	--	11/19	H
G 9-60	--	390056	745426	US GEOLOGICAL SURVEY	AIRPORT 7 OBS	RIO GRANDE	1957	13	242-257	-13	-12	-12	-15	-12	3	11/19	D
9-74	57-00007	390139	745349	WILDWOOD CITY WD	RIO GRANDE 29	RIO GRANDE	1947	9	191-231	--	--	--	-23	-13	10	11/25	H
G 9-80	--	390213	745056	US GEOLOGICAL SURVEY	CAPE MAY 42 OBS	STONE HARBOR	1957	14	242-252	-2	-2	-4	-5	-4	1	11/19	D
9-89	37-00158	390425	745446	US GEOLOGICAL SURVEY	OYSTER LAB 4 OBS	RIO GRANDE	1957	7	195-210	-2	-2	-2	-1	-1	0	11/19	D
9-99	35-00680	390611	744838	US GEOLOGICAL SURVEY	CAPE MAY COUNTY PK 8 OBS	STONE HARBOR	1957	11	214-230	4	5	4	3	4	1	11/16	D
G 9-150	37-00155	385607	745556	US GEOLOGICAL SURVEY	WEST CAPE MAY 1 OBS	CAPE MAY	1957	7	283-293	-18	-19	-13	-17	-13	4	11/19	D
9-159	37-00241	385830	745021	WILDWOOD CITY WD	WWD 35	WILDWOOD	1967	8	249-360	--	-2	-2	-5	-2	3	11/25	H
9-187	--	390218	745609	CAPE MAY COUNTY	CAPE MAY F-35	RIO GRANDE	1965	10	186-190	--	--	-6	-7	-3	4	11/19	D
9-188	--	390215	745440	CAPE MAY COUNTY	CAPE MAY F-36	RIO GRANDE	1965	[7]6	229-233	--	--	[-5]-9	-11	-8	3	12/2	D
9-210	--	385946	745725	CAPE MAY COUNTY	CAPE MAY C-1	CAPE MAY	1965	11	216-221	--	--	-8	-13	-12	1	12/2	D
9-213	--	390128	745639	CAPE MAY COUNTY	CAPE MAY F-41	RIO GRANDE	1965	12	203-208	--	--	--	-8	-7	1	11/19	D
9-219	35-03380	390601	745245	BAYSHORE ASSOCIATES	1982-200 HAND & RT 47	RIO GRANDE	1982	19	150-200	--	--	--	[1i]2	3	1	11/22	D
9-281	37-00254	390710	745134	SOIL CONSERVATION SERVICE	BD-21CH	STONE HARBOR	1967	11	176-181	--	--	5	5	4	-1	11/21	D
9-292	37-03035	390337	744623	US GEOLOGICAL SURVEY	WETLANDS 1 OBS	STONE HARBOR	1988	5	251-261	--	--	--	2	1	-1	11/24	D
9-301	37-00831	385732	745124	WILDWOOD CITY WD	WILDWOOD 44-RECHARGE 4	WILDWOOD	1983	2	190-245	--	--	--	--	-11	--	11/25	H
9-310	37-01781	390018	744748	WILDWOOD CITY WD	RIO GRANDE 39NEW-RECHRG4	STONE HARBOR	1986	[7,8]7	279-357	--	--	[-1]1	[2]0	2	2	11/25	H
9-314	37-00640	385930	744852	WILDWOOD CITY WD	RECHARGE 3	WILDWOOD	1982	10	212-325	--	--	--	2	3	1	11/25	H
9-338	37-01811	390124	744801	HEREFORD INLET MARINA	HEREFD/BISHOP 2-1986 PVC	STONE HARBOR	1986	[8]7	276-296	--	--	--	[2]4	2	-2	11/18	H
9-350	36-16171	391218	744545	US GEOLOGICAL SURVEY	GRT CEDAR SWAMP 1-D OBS	WOODBINE	1992	16	227-237	--	--	--	14	13	-1	11/20	D
9-353	37-04871	385855	745737	US GEOLOGICAL SURVEY	ROSLYN AVE DEEP OBS	CAPE MAY	1992	[8]20	262-272	--	--	--	[-21]-12	-12	0	11/19	D
9-354	37-04873	390147	744855	US GEOLOGICAL SURVEY	GRASSY SOUND 1-D OBS	STONE HARBOR	1992	5	230-240	--	--	--	2	2	0	11/18	D
9-358	37-02274	390356	744955	NJ/AMERICAN WC	SHELL BAY MHP	STONE HARBOR	1987	15	240-270	--	--	--	--	0	--	11/24	H
9-366	37-01039	385940	744954	POST CREEK SEAFOOD INC	1984 788 W MONTGOMERY AV	WILDWOOD	1983	5	270-290	--	--	--	--	-3	--	12/2	H
9-385	37-00861	390154	745332	WILDWOOD CITY WD	RIO GRANDE 43	RIO GRANDE	1983	15	156-274	--	--	--	--	-14	--	11/25	H
9-394	37-00327	385729	745201	OTTEN'S HARBOR CLAM CO	2 MILE BOAT DOCK	WILDWOOD	1979	5	250-275	--	--	--	--	-9	--	12/2	H
9-395	37-04368	385909	745359	CAPE MAY NATIONAL GOLF CLUB	CMNGC CART BLDG 1991	CAPE MAY	1991	15	255-275	--	--	--	-17	-15	2	12/1	H

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

Table 2-2. Water-level data for wells screened in the Rio Grande water-bearing zone, 1978-98

[--data are not available; ft, feet; USGS, U.S. Geological Survey; ASSOC, Association; WC, Water Company; WD, Water Department; TWP, Township; MUA, Municipal Utilities Authority; CO, Company; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Lati-tude[1]	Longi-tude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shut-down period
1-219	--	392647	744042	HAMILTON TWP MUA	HAMILTON MUA TEST 2-73	MAYS LANDING	1973	50	378	--	--	--	--	33	--	11/24	D
9-33	--	385650	745535	CAPE MAY CITY WD	BROADWAY 2	CAPE MAY	1902	12	587-600	--	--	--	--	-13	--	11/19	D
9-67	37-00271	390135	745352	WILDWOOD CITY WD	RIO GRANDE 38	RIO GRANDE	1970	10	461-590	--	--	--	--	-46	--	11/25	H
G 9-71	--	390138	745348	WILDWOOD CITY WD	RIO GRANDE 23 OBS	RIO GRANDE	1926	8	473-523	--	-12	-12	--	-33	--	11/25	D
9-149	37-00005	391814	744954	MORRIS APRIL BROTHERS	MORRIS	TUCKAHOE	1948	[5,6]20	250-290	--	[12]20	[12]20	--	18	--	11/20	D
G 9-304	37-03763	390002	745410	US GEOLOGICAL SURVEY	AIRPORT RIO GRANDE OBS	RIO GRANDE	1989	25	495-505	--	--	--	--	-21	--	12/2	D
9-305	37-00214	390401	744706	SCOTCH BONNET WATER ASSOC	SCOTCH BONNET MARINA	STONE HARBOR	1960	5	--	--	--	--	--	-20	--	12/1	D
9-411	35-12745	391318	745307	STATE OF NJ	E CR MILL POND 1992 DOM	HEISLERVILLE	1992	15	260-300	--	--	--	--	3	--	11/30	D
9-415	35-01233	391450	745130	STATE OF NJ	1973 PICNIC AREA WELL 1	WOODBINE	1974	29	306	--	--	--	--	6	--	11/30	D
11-737	35-03449	391237	745713	LABAR, LELAND	LABAR DOM 1982	HEISLERVILLE	1982	10	307-317	--	--	--	--	2	--	11/23	D
29-455	33-01051	393206	741548	LONG BEACH TWP WC	LBTWD 2	TUCKERTON	1963	5	426-451	--	--	--	--	-19	--	12/4	H
29-775	32-08715	393339	742301	LITTLE EGG HARBOR TWP MUA	LEHMUA 5	NEW GRETNA	1983	5	293-318	--	-8	-6	--	-2	--	11/19	D
29-813	32-11971	393504	742051	LITTLE EGG HARBOR TWP MUA	HOLLY LAKE 6	TUCKERTON	1986	20	307-337	--	--	--	--	1	--	11/19	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

Table 3-1. Water-level data for wells screened in the Atlantic City 800-foot sand, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; Co, Company; CONV, Convalescent; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

	Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
G	1-37	56-00071	392151	742459	ATLANTIC CITY MUA	GALEN HALL OBS	ATLANTIC CITY	1904	10	782-837	-65	-70	-80	-83	-88	-5	11/17	D
	1-39	56-00012	392329	742348	BRIGANTINE CITY WD	NEW 4	OCEANVILLE	1966	10	733-788	-60	-65	-74	-68	-78	-10	11/25	D
	1-117	32-00477	393213	743832	EGG HARBOR WATER WORKS	OW41 5	EGG HARBOR CITY	1964	[5]40	350-432	[28]23	21	19	20	17	-3	11/19	H
G	1-180	36-00294	392754	742701	US GEOLOGICAL SURVEY	OCEANVILLE 1 OBS	OCEANVILLE	1959	27	560-570	-28	-32	-39	-41	-47	-6	11/17	D
	1-367	56-00038	391859	743122	LONGPORT WD	LONGPORT 2	OCEAN CITY	1947	10	750-800	-66	-68	-75	-80	-86	-6	11/24	H
G	1-578	36-00295	391826	743709	US GEOLOGICAL SURVEY	JOBS POINT OBS	OCEAN CITY	1959	10	670-680	-45	-51	-55	-59	-66	-7	11/17	D
	1-600	56-00016	392045	742840	VENTNOR CITY WD	VCWD 8	ATLANTIC CITY	1931	8	750-810	-69	-73	-79	-83	-93	-10	11/23	D
	1-650	--	392651	744254	HAMILTON TWP WD	HAMILTON WD TEST 2-73	MAYS LANDING	1973	20	380	--	18	14	17	14	-3	11/24	D
	1-683	36-02091	392410	742227	BRIGANTINE CITY WD	NEW 5	BRIGANTINE INL	1980	8	725-775	--	--	-64	-70	-71	-1	11/25	D
G	1-702	--	392032	743008	US GEOLOGICAL SURVEY	BURKE AVE TW OBS	OCEAN CITY	1985	5	740-750	--	--	-87	-92	-103	-11	11/17	D
	1-703	36-05092	392639	743232	US GEOLOGICAL SURVEY	FAA POMONA OBS	PLEASANTVILLE	1985	38	560-570	--	--	-45	-46	-58	-12	11/17	D
	1-704	--	392343	743733	US GEOLOGICAL SURVEY	EGG HARBOR HS	MAYS LANDING	1985	51	596-606	--	--	[-37i]-38	-37	-49	-12	11/24	D
	1-706	36-04982	392933	743130	US GEOLOGICAL SURVEY	STKTN ST COLL	PLEASANTVILLE	1985	40	520-530	--	--	-25	-25	-35	-10	11/25	D
	1-711	--	391955	742507	US GEOLOGICAL SURVEY	ACOW 1 OBS	ATLANTIC CITY	1985	0	820-850	--	--	-77	--	-91	--	10/9/97	D
	1-889	36-11871	392007	743033	MARGATE CITY WD	MCWD 8	OCEAN CITY	1989	8	735-795	--	--	--	-86	-94	-8	11/24	H
	1-967	36-13010	392456	742121	BRIGANTINE CITY WD	WELL 6/2R 14TH ST NORTH	BRIGANTINE INL	1990	5	702-776	--	--	--	-62	-64	-2	11/25	H
	1-990	36-16110	392240	743500	NJ/AMERICAN WC	SPRUCE 18	PLEASANTVILLE	1992	23	496-652	--	--	--	--	-62	--	11/24	D
	1-991	36-16204	392524	743425	NJ/AMERICAN WC	TLTN RD TW19	PLEASANTVILLE	1992	63	492-642	--	--	--	--	-55	--	12/1	H
	1-1218	36-17655	392620	743740	HAMILTON TWP MUA	HTMUA CATES RD 1	MAYS LANDING	1994	60	520-610	--	--	--	--	-55	--	11/24	D
	1-1220	36-17339	392647	743700	HAMILTON TWP MUA	HTMUA LOWELL AVE 1	PLEASANTVILLE	1994	65	552-603	--	--	--	--	-51	--	11/24	D
	1-1253	36-16750	392801	743309	NJ/AMERICAN WC	CHRIS GAUPP SO DIV 20	PLEASANTVILLE	1993	55	344-598	--	--	--	--	-43	--	12/1	H
	9-2	37-00280	390420	744435	AVALON CITY WD	AVALON WD 2R-71/NEW 7	AVALON	1971	5	821-861	-36	-40	-46	-44	-49	-5	12/1	H
	9-4	37-00265	390528	744338	AVALON CITY WD	AVALON WD 6	AVALON	1968	10	880-920	-40	-42	-40	-43	-51	-8	12/1	H
	9-79	--	390210	744730	HALLER, LEE	NUMMY IS 2 OBS	STONE HARBOR	1968	2	833-876	--	--	--	-36	-46	-10	11/18	D
	9-92	37-00240	390525	744851	NJ/AMERICAN WC	NEPTUNUS 7	STONE HARBOR	1967	[5]17	681-791	[-30]-32	-31	-34	-38	-41	-3	11/24	H
	9-106	56-00006	391343	743755	NJ/AMERICAN WC	SHORE DIV 7	SEA ISLE CITY	1924	8	760-810	-46	-46	-51	-54	-62	-8	11/24	D
	9-108	36-00412	391500	743645	NJ/AMERICAN WC	NJAWC SHORE DIV 14-1970	SEA ISLE CITY	1970	7	774-840	--	-57	[-55i]-58	--	-70	--	11/24	H
	9-109	56-00008	391535	743611	NJ/AMERICAN WC	SHORE DIV 9	OCEAN CITY	1946	8	749-809	-49	[-55i]-56	-57	--	-69	--	11/24	H
	9-116	56-00007	391638	743451	NJ/AMERICAN WC	SHORE DIV 8	OCEAN CITY	1937	7	760-810	--	-62	-64	-74	-75	-1	11/24	H
	9-125	36-00314	391726	743352	NJ/AMERICAN WC	SHORE DIV 11	OCEAN CITY	1962	10	800	--	--	-66	-76	-87	-11	11/24	H
	9-127	37-00064	390847	744200	SEA ISLE CITY WD	SICWD 4	SEA ISLE CITY	1954	7	742-830	-38	-44	-44	-45	-54	-9	11/30	H
	9-135	37-00009	390323	744525	STONE HARBOR WD	STONE HARBOR WD 3	STONE HARBOR	1949	9	838-878	--	-34	[-33i]-31	[-39i]-38	-43	-5	11/18	D
	9-136	56-00147	391152	743927	NJ/AMERICAN WC	CIWC 1	SEA ISLE CITY	1904	7	802-834	--	-45	-45	-47	-54	-7	11/24	D
	9-144	36-00451	391703	743756	ATLANTIC CITY ELECTRIC CO	ATL CTY ELEC 5	MARMORA	1975	9	650-690	-47	-54	-50	-60	-70	-10	12/1	H
	9-161	--	390704	744750	EASTERN SHORE CONV CENTER	ESCC 1	STONE HARBOR	1983	16	639-654	--	-26	-32	-35	-38	-3	12/1	H
	9-185	37-01340	391621	744355	US GEOLOGICAL SURVEY	MACNAMARA W A	MAMORA	1985	15	640-650	--	--	-35	-37	-41	-4	11/24	D
	9-291	36-09846	390627	744254	AVALON CITY WD	AVALON WD 9 [9](9-8)	AVALON	1988	7	764-941	--	#-38	#-41	-47	-49	-2	12/1	H
	9-296	35-06073	390500	744946	NJ/AMERICAN WC	HAND AVE 8	STONE HARBOR	1986	20	682-812	--	--	-27	-33	-35	-2	11/24	D
G	9-302	37-03628	385709	745128	US GEOLOGICAL SURVEY	COAST GUARD 800 OBS	WILDWOOD	1989	5	883-893	--	--	--	-14	-18	-4	11/19	D
G	9-306	35-09239	390422	745447	US GEOLOGICAL SURVEY	OYSTER 800 OBS	RIO GRANDE	1989	6	656-666	--	--	--	-17	-19	-2	11/19	D
	9-311	36-10378	390750	744242	SEA ISLE CITY WD	SICWD 6-1989 [9](9-126)	SEA ISLE CITY	1989	8	732-896	--	#-44	#-46	-46	-50	-4	11/30	H
G	9-337	37-04660	390012	744720	US GEOLOGICAL SURVEY	M-1 N WILDWOOD 800 OBS	STONE HARBOR	1992	10	910-960	--	--	--	-20	-24	-4	11/19	D
	9-359	36-07286	390657	744500	MIDDLE TWP WATER DISTRICT	MIDDLE TWP WD 2	AVALON	1986	[8]5	708-773	--	--	--	[-42]-46	-52	-6	12/1	D
	9-423	37-05244	390134	745240	ATLANTIC ELECTRIC CO	RIO GRANDE MW 1	RIO GRANDE	1993	20	825-875	--	--	--	-19	-21	-2	12/1	D
	9-459	36-00377	391712	743725	HARBOR RD IMPROVEMENT ASSOC	HRIA 1966	OCEAN CITY	1966	7	620	--	--	--	--	-67	--	11/24	H
	9-461	36-15182	391728	743810	ATLANTIC CITY ELECTRIC CO	ACEC 6 DEEP	MAMORA	1991	8	639-710	--	--	--	-58	-67	-9	12/1	H
	9-479	37-06313	385636	745529	CAPE MAY CITY WD	CMCWD 800FT OBS	CAPE MAY	1998	7	655-825	--	--	--	--	-17	--	11/20	D
	9-480	37-06314	385644	745533	CAPE MAY CITY WD	CMCWD 6 DESAL	CAPE MAY	1997	14	621-820	--	--	--	--	-17	--	11/19	D
	29-9	53-00031	393346	741430	BEACH HAVEN WD	BHWD 8	BEACH HAVEN	1957	5	572-656	--	-30	-31	-32	-34	-2	11/20	H
	29-111	33-01180	394134	740832	HARVEY CEDARS WD	HCWD 4	SHIP BOTTOM	1968	[5]9	465-500	[-26]-22	--	-23	-27	-30	-3	10/30	H
	29-112	33-00674	394218	740808	HARVEY CEDARS WD	HCWD 3	SHIP BOTTOM	1956	5	451-493	-20	-36	-24	-27	-29	-2	10/30	D
	29-464	32-00447	393428	742202	LITTLE EGG HARBOR TWP MUA	MYSTIC 2	TUCKERTON	1963	[5]25	485-542	-10	-11	[-23]-17	-23	-26	-3	11/19	D
	29-544	33-00219	393839	741052	SHIP BOTTOM BORO WD	SHIP BOTTOM WD 4	SHIP BOTTOM	1953	5	536-578	-31	-33	-29	-34	-35	-1	11/20	D
	29-557	33-01132	394042	741411	STAFFORD TWP MUA	STAFFORD 3	SHIP BOTTOM	1965	8	385-428	22	16	16	14	13	-1	11/24	H
	29-561	33-01268	393948	740954	SURF CITY WD	SURF CITY WD 5	SHIP BOTTOM	1970	10	520-562	-25	-28	-24	-20	-30	-10	11/20	H
	29-565	32-00479	393610	742031	TUCKERTON MUA	TMUA 4(OW1)	TUCKERTON	1964	10	463-497	-4	-7	-8	-16	-17	-1	11/19	D
	29-598	33-00967	394201	741212	AT&T TECHNOLOGIES	TEST 1960	SHIP BOTTOM	1960	[7]2	-	--	--	[-18]-21	-25	-26	-1	11/20	H
	29-814	32-12329	393253	742308	LITTLE EGG HARBOR TWP MUA	MYSTIC 7	NEW GRETNA	1986	10	512-552	--	--	--	-24	-26	-2	11/19	D
	29-936	33-24693	393724	741151	LONG BEACH TWP WC	BRANT BEACH 4	BEACH HAVEN	1988	9	528-594	--	--	-25	-25	-26	-1	12/4	H
	29-939	33-22369	393507	741332	LONG BEACH TWP WC	TERRACE 4	BEACH HAVEN	1987	8	533-593	--	--	-27	--	-31	--	12/4	H
	29-1063	32-15207	393511	742158	LITTLE EGG HARBOR TWP MUA	CENTER STREET WELL 8	TUCKERTON	1988	25	475-521	--	--	--	-33	-35	-2	11/19	H
	29-1078	33-26875	394138	741453	STAFFORD TWP MUA	SMUA 5 WATER TREAT PLANT	SHIP BOTTOM	1990	24	366-429	--	--	--	--	26	--	11/24	H

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

[9] Well in which the water-level altitude was measured during a previous synoptic study.
This well and the well used in the current study are at the same site in the same aquifer.

Water-level altitude measured in a previous study, but in a different well.

Table 4-1. Water-level data for wells screened in the Piney Point aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; BORO, Borough; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; DEL, Delaware; DEP, Department of Environmental Protection; CO, Company; ASSOC, Association; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
New Jersey wells																	
1-270	31-03648	393712	744720	AMERICAN HOME PRODUCTS	AMER HOME PRODS 1958	NEWTONVILLE	1958	90	390-410	--	30	30	^{27i}28	19	-9	11/25	D
1-700	35-04274	392933	744604	US GEOLOGICAL SURVEY	ACGS 4	DOROTHY	1984	40	479-539	--	--	17	12	18	6	11/20	D
1-713	35-04656	392902	745051	US GEOLOGICAL SURVEY	MIZPAH DEEP	DOROTHY	1985	100	525-535	--	--	-2	-4	-6	-2	11/20	D
1-834	--	392017	743002	US GEOLOGICAL SURVEY	MARGATE FIREHOUSE 1 OBS	OCEAN CITY	1988	5	970-991	--	--	-28	-30	-32	-2	11/17	D
1-836	35-04559	393148	745617	BUENA BORO MUA	BBMUA 2	BUENA	1985	118	405-455	--	--	-8	-20	-40	-20	11/19	H
1-1219	36-16546	392640	743724	HAMILTON TWP MUA	HTMUA 9 OBS	PLEASANTVILLE	1993	68	722-742	--	--	--	-14	-16	-2	11/17	D
1-1238	55-00008	393159	745559	FIBERTECH GROUP	SCOTT PAPER 1	BUENA	1942	108	463	--	--	--	--	-31	--	12/16	H
G 5-407	--	394422	744309	US GEOLOGICAL SURVEY	ATSION 1 OBS	ATSION	1963	47	240-260	52	51	51	51	50	-1	10/30	D
5-488	32-00913	393838	743855	STATE OF NJ	BATSTO 2	ATSION	1972	35	419-449	49	48	48	52	46	-6	12/12	D
G 5-676	--	394914	742546	US GEOLOGICAL SURVEY	COYLE AIRPORT OBS	WOODMANSIE	1961	199	530-540	121	119	118	119	120	1	10/26	D
5-800	32-04454	394732	744526	SHAMONG TWP	SHAMONG TWP DOM	MEDFORD LAKES	1978	85	200-210	--	73	72	73	72	-1	11/17	D
5-1162	32-05879	394635	744409	GARDENER, HOBART	TRAILER PARK 1980	INDIAN MILLS	1980	60	215-235	--	--	--	55	51	-4	11/5	H
7-572	31-14078	394100	745035	WINSLOW TWP UTILITY	ELMTOWN VIL 1/WINSLOW 10	HAMMONTON	1979	110	304-314	--	62	57	55	52	-3	12/6	H
G 11-44	35-01197	392732	750929	CUMBERLAND COUNTY	VOCATIONAL SCHOOL 3 OBS	BRIDGETON	1972	82	361-376	17	12	7	0	-5	-5	11/9	D
11-92	--	391746	751510	BAY POINT ROD AND GUN	BAY POINT 2	BEN DAVIS POINT	1970	5	397-417	--	-28	-37	-44	-44	0	11/17	D
G 11-96	34-00852	391829	751208	CUMBERLAND COUNTY	JONES ISLAND 2 OBS	CEDARVILLE	1971	10	365-375	-15	-20	-28	-34	-34	0	11/9	D
G 11-163	35-01196	392526	750643	CUMBERLAND COUNTY	FAIR GROUNDS 3 OBS	MILLVILLE	1972	80	463-473	22	13	8	2	-4	-6	11/9	D
11-341	34-00991	391938	751923	SOBUSIAK, WALTER	SOBUSIAK DOM-2	BEN DAVIS POINT	1974	4	300-357	--	-35	-44	-49	-50	-1	11/17	D
11-349	34-01463	391652	751430	VANDVELT, THOMAS	BEACH FRONT DOM	CEDARVILLE	1979	5	380-410	--	-28	-35	-42	-42	0	11/16	H
11-1151	34-01814	391550	751232	STEWART, WILLIAM	DYER COVE DOM	CEDARVILLE	1981	5	466-476	--	--	--	--	-40	--	11/18	D
G 29-18	--	394829	740535	US GEOLOGICAL SURVEY	ISLAND BEACH 2 OBS	BARNEGAT LIGHT	1962	9	468-474	1	0	0	-2	-2	0	10/23	D
29-23	33-01494	395423	740458	SHORE WC	SHORE WC 2	SEASIDE PARK	1973	7	490-527	--	-42	-60	-57	-58	-1	10/28	H
G 29-116	53-00020	395641	740853	ISLAND HEIGHTS BORO WD	IHWD 7R	TOMS RIVER	1948	3	267-293	--	^{0i}-1	^{0i}-1	^{0i}-2	-22	-20	10/28	D
29-425	--	395322	742252	US GEOLOGICAL SURVEY	WEBBS MILLS 2 OBS	WHITING	1962	128	348	121	121	118	119	119	0	10/26	D
29-537	53-00001	395636	740439	SEASIDE HEIGHTS BORO WD	SHWD 2	SEASIDE PARK	1941	4	400-430	--	-35	-30	-35	-58	-23	10/28	H
29-541	53-00022	395451	740455	SEASIDE PARK BORO WD	SPWD 2/SPWD 3 (NEW)	SEASIDE PARK	1932	55	525	--	$^{-30}$-38	$^{-56}$-61	-57	-59	-2	12/4	D
G 29-585	--	395028	741044	STATE OF NJ	DOE-FORKED RIVER OBS	FORKED RIVER	1978	15	412-422	--	15	15	12	14	2	10/21	D
29-607	33-07876	394454	740655	BARNEGAT LIGHT BORO WD	BLWD 4	LONG BEACH NE	1980	5	597-662	--	-41	-34	-38	-44	-6	11/20	D
29-739	33-01247	400044	740957	OCEAN COUNTY COLLEGE	REC FIELD 1	LAKEWOOD	1970	20	200-220	--	13	11	13	8	-5	10/23	H
29-808	33-06595	395606	740445	SEASIDE PARK BORO WD	SPWD 7	SEASIDE PARK	1979	5	395-475	--	-58	$^{-30i}$-29	-46	-76	-30	10/26	D
29-809	33-14067	395527	740826	OCEAN GATE BORO WD	OGBWD 4	TOMS RIVER	1984	10	330-370	--	--	6	-2	-17	-15	10/26	D
29-935	33-22528	395450	740455	SEASIDE PARK BORO WD	EAST-REP (8)	SEASIDE PARK	1987	10	474-514	--	--	--	--	-48	--	10/26	D
29-1039	33-26307	395943	741214	TOMS RIVER WC	TRWC PARKWAY 39	TOMS RIVER	1989	75	248-288	--	--	--	9	14	5	11/2	D
29-1096	33-29653	395358	740937	BERKELEY TWP MUA	BTMUA 1	TOMS RIVER	1992	25	345-440	--	--	--	--	-8	--	11/2	H
29-1210	36-20855	393115	741910	STATE OF NJ	GREAT BAY BLVD 1 OBS	TUCKERTON	1997	5	860-880	--	--	--	--	-14	--	10/26	D
29-1215	33-31998	395801	741023	TOMS RIVER WC	TRWC BROOKSIDE 43	TOMS RIVER	1994	25	196-258	--	--	--	--	-26	--	11/2	H
Delaware wells																	
G Id55-01	10225	391026	753049	CITY OF DOVER WD	WHITE OAK RD	DOVER	1965	20	329-349	--	--	-132	-128	-127	1	11/4	D
Jd14-15	10211	390917	753109	CITY OF DOVER WD	DOVER 12	DOVER	1970	21	370-450	--	--	--	--	-155	--	11/23	D
Jd23-01	10213	390813	753225	CITY OF DOVER WD	DOVER 11	DOVER	1965	35	331-443	--	--	--	--	-144	--	11/24	D
Jd25-03	10212	390845	753031	CITY OF DOVER WD	DOVER 10	DOVER	1965	20	327-484	--	--	--	--	-130	--	11/24	D
Jd34-18	10208	390729	753157	CITY OF DOVER WD	DOVER 6	DOVER	1969	20	330-453	--	--	--	--	-177	--	11/24	D
Je12-03	31640	390920	752859	CITY OF DOVER WD	DOVER 2	LITTLE CREEK	1973	22	340-502	--	--	--	--	-123	--	11/24	D
G Kc31-01	33610	390224	753916	US GEOLOGICAL SURVEY	--	MARYDEL	1975	55	370-380	--	--	--	--	-56	--	4/29	D
G Nc13-03	10233	384935	753659	UNIVERSITY OF DELAWARE	GRNWOD	GREENWOOD	1970	63	620-630	--	--	--	--	-26	--	11/5	D
Maryland wells																	
GCO Bd53	CO73-0541	390227	754702	US GEOLOGICAL SURVEY	--	GOLDSBORO	1976	60	300-312	30	30	26	22	20	-2	10/15	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

Table 5-1. Water-level data for wells screened in the Vincentown aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; BORO, Borough; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; DEL, Delaware; DEP, Department of Environmental Protection; INC, Incorporated; ASSOC, Association; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 2 hours; D, 24 hours or more]

Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
G 5-1250	28-20189	400148	743520	US AIR FORCE -MCGUIRE BASE	MCGUIRE 08-MW-52 OBS	NEW EGYPT	1988	112	45-55	--	--	--	--	102	--	10/26	D
15-123	31-00216	394252	750937	REUTER, GEORGE	REUTER 1	PITMAN WEST	1951	140	121-150	--	--	--	--	75	--	11/3	H
15-1005	30-03319	394040	751324	OLSEN, ROBERT	OLSEN DOM	PITMAN WEST	1984	148	140-156	--	--	--	--	62	--	11/4	D
15-1360	31-42096	394346	750804	PITMAN BORO	PITMAN MW-3	PITMAN WEST	1993	117	166-191	--	--	--	--	75	--	11/3	D
25-448	29-04725	401134	740722	THECKER, DUNCAN	WALL TWP PLANT	ASBURY PARK	1965	125	219-235	--	--	--	--	70	--	10/29	D
25-451	29-10756	400903	741518	NJ/AMERICAN WC	ALDRICH WC 5	ADELPHIA	1980	95	114-174	--	--	--	--	67	--	10/29	H
G 25-636	29-18404	401105	741202	US GEOLOGICAL SURVEY	HOWELL TWP 2 OBS	FARMINGDALE	1987	112	85-95	--	--	59	--	73	14	10/21	D
25-688	29-15300	401326	740834	CARY CHEMICALS INC	CARY CHEM 1	FARMINGDALE	1985	110	11-23	--	--	96	--	102	6	10/29	D
25-691	29-15843	401104	741109	MONMOUTH COUNTY PARK	HOWELL PK GLF COURSE 1	FARMINGDALE	1986	50	5-25	--	--	43	--	45	2	10/26	D
25-702	29-09528	401333	740427	MT CALVARY CEMETERY	CEMETERY 2	ASBURY PARK	1978	45	129-140	--	--	--	--	44	--	10/20	D
25-703	29-11712	401314	740652	MONMOUTH MEMORIAL PARK	MMPA DOM	ASBURY PARK	1982	80	167-187	--	--	--	--	70	--	10/18	D
25-717	29-28188	401046	742002	US GEOLOGICAL SURVEY	TURKEY SWAMP 1 OBS	ADELPHIA	1992	150	38-43	--	--	--	--	131	--	10/30	D
25-788	29-36417	401507	740118	HOLLYWOOD GOLF CLUB	HOLLYWOOD GLF 2	LONG BRANCH	1997	50	120-166	--	--	--	--	29	--	10/21	D
G 29-139	28-04784	400414	742702	US GEOLOGICAL SURVEY	COLLIERS MILLS 2 OBS	CASSVILLE	1964	136	161-171	--	129	129	--	130	1	10/21	D
29-230	28-05038	400724	742342	ST VLADIMIR CEMETERY	CEMETERY 1	CASSVILLE	1964	150	85-100	--	--	--	--	132	--	10/23	D
29-658	29-08966	400700	741846	JACKSON BAPTIST CHURCH	JACKSON BAPT CH DOM	LAKEHURST	1977	115	202-215	--	--	96	--	94	-2	10/29	D
29-660	28-07193	400851	742214	OAK TREE TRAILER PARK	OAK TREE TRPK DOM	ADELPHIA	1971	155	132-138	--	--	--	--	141	--	10/29	D
29-698	28-11275	400616	742334	INDIAN ROCK TRAILER PARK	INDIAN ROCK TRPK DOM	CASSVILLE	1979	130	120-132	--	--	119	--	115	-4	10/23	D
29-744	28-00935	400207	743030	US ARMY FORT DIX	BRINDLE LAKE	NEW EGYPT	1953	80	94-145	--	--	--	--	80	--	11/12	D
29-916	29-13024	400850	741646	HOLBROOK LITTLE LEAGUE	HOLBROOK LITTLE LEAGUE	ADELPHIA	1983	125	139-155	--	--	--	--	111	--	12/3	D
29-917	29-16962	400850	741516	JACKSON TWP MUA	JACKSON MUA 11	ADELPHIA	1986	75	126-186	--	--	75	--	63	-12	10/26	H
33-240	--	393253	752425	SALEM CITY WD	SCWD 3	SALEM	1900	7	140	--	--	1	--	1	0	11/13	D
33-368	--	393253	752425	SALEM CITY WD	QUINTON 5	SALEM	1908	7	133	--	--	--	--	2	--	11/13	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

Table 6-1. Water-level data for wells screened in the Wenonah-Mount Laurel aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; DEL, Delaware, CO, Company; CTR, Center; ED, Education; ELEM, Elementary; EPA, Environmental Protection Agency; SR, Senior; SCH, School; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
New Jersey wells																	
5-245	31-00163	395112	745123	MEDFORD TWP WD	MTWD 4-5 / MTWD 5 (NEW)	MEDFORD LAKES	1950	57	230-252	--	30	19	14	-14	-28	12/15	H
5-247	31-00110	395145	745111	MEDFORD TWP WD	MTWD 2	MEDFORD LAKES	1950	52	180-200	36	--	24	27[7]26	5	-22	12/15	H
5-257	51-00156	395516	745103	JOHNSON,W E JR	JOHNSON NEW	MOUNT HOLLY	1965	80	90	27	25	27	[16]54	50	-4	10/30	D
5-354	32-00103	395813	743950	NJ/AMERICAN WC	SVWC 1	PEMBERTON	1953	[5]62	178-198	[43]40	39	36	40	36	-4	11/23	H
5-355	52-00004	395826	744109	PEMBERTON TWP WD	PBWD 1	PEMBERTON	1939	81	155-185	39	38	38	41	39	-2	11/4	H
5-359	32-00539	395727	744118	LAKE VALLEY WC	LVWC 1	PEMBERTON	1967	70	181-242	36	35	37	34	37	3	12/15	D
5-365	32-00386	395752	743452	PEMBERTON TWP WD	PTWD 4	BROWNS MILLS	1960	93	290-330	16	-5	-13	-14	-2	12	10/26	H
5-366	32-00775	395755	743239	PEMBERTON TWP WD	PTWD 4 INCH	BROWNS MILLS	1972	90	301-323	-42	-48	-61	-50	-36	14	10/27	D
5-427	32-00749	395330	744205	HAMPTON LAKE WC	HLWC 2	PEMBERTON	1971	70	260-348	11	-8	-13	-5	-5	0	11/6	H
5-695	32-01240	395328	743720	SUNNY PINES CONTRACTING CO	TEST HOLE 1-74	BROWNS MILLS	1974	111	428-496	33	27	24	18	16	-2	10/27	D
5-718	32-00361	395736	743036	WHITES BOG ENVIR	PEMBERTON	BROWNS MILLS	1959	105	376-388	--	--	--	--	2	--	11/2	D
5-720	31-11574	395112	744535	ALLENWOOD MOBILE ESTATE	ALLEN 2	MEDFORD LAKES	1978	[5,6]125	410	[30]20	[17]22	-8	0	-15	-15	12/15	H
5-724	32-03118	395413	744231	HAMPTON LAKE WC	HLWC 3	PEMBERTON	1977	43	199-275	18	15	6	6	-6	-12	11/6	D
5-725	48-00021	400212	743708	WRIGHTSTOWN MUA	WMUA 2	NEW EGYPT	1971	[5,6]145	142-162	[118]128	[116]126	125	126	125	-1	11/6	H
5-744	32-00520	395639	742953	WHITE J J CO	DOMEST 66	WHITING	1966	100	456	9	-13	-21	-21	-9	12	10/26	D
5-1004	32-08631	395801	744344	LAKE VALLEY WC	LVWC 2	PEMBERTON	1982	65	209-254	--	--	10	17	17	0	11/16	H
5-1082	31-19052	395941	744720	TIDSWELL III, BROOKE	TIDSWELL DOM	MOUNT HOLLY	1982	35	82-92	--	--	9	910	5	-5	11/4	D
5-1086	32-10112	395753	743706	THOMPSON, STEPHAN	THOMPSON DOM	BROWNS MILLS	1985	55	242-247	--	--	6	--	8	--	10/27	D
5-1087	32-09937	395333	744441	RED LION FAITH CHAPEL	RED LION DOM	PEMBERTON	1984	55	227-232	--	--	11	9	-2	-11	11/5	D
5-1155	31-39849	395315	744946	MEDFORD TWP	MEDFORD TWP MW-1 OBS	MOUNT HOLLY	1992	46	120-180	--	--	--	31	23	-8	11/17	D
5-1165	32-00490	395855	743513	HILLTOP TRAILER PARK	HILLTOP PK 1	BROWNS MILLS	1965	120	275-307	--	--	--	6	14	8	10/27	H
5-1166	28-17342	400430	743354	DEBROSKI, SKIP	RD 2 DOM	NEW EGYPT	1986	135	119-129	--	--	--	100	97	-3	11/3	D
5-1178	32-13264	395541	744415	MOUNT HOLLY WC	RETREAT RD 2 [9](5-430)	PEMBERTON	1987	40	140-180	#30	#27	#25	30	19	-11	11/20	H
5-1186	32-15968	395915	743308	PEMBERTON TWP WD	PTWD 8A	BROWNS MILLS	1989	90	267-358	--	--	--	-27	-6	21	10/26	D
5-1245	52-00082	395450	744510	BLUE GRASS LAWN FARMS	BLUE GRASS LAWN FARMS 2	MOUNT HOLLY	--	39	-	--	--	--	--	10	--	10/30	D
5-1253	31-46953	394940	744807	MEDFORD TWP	MTWP TW-15	MEDFORD LAKES	1995	118	357-417	--	--	--	--	-47	--	11/9	D
5-1387	31-40373	394800	745246	EVESHAM TWP MUA	EVESHAM 4 OBS	CLEMENTON	1992	119	335-355	--	--	--	--	2	--	10/18	D
5-1475	32-18506	395834	743513	PEMBERTON TWP SCHOOLS	TRENTON RD OW 3	BROWNS MILLS	1992	110	276-326	--	--	--	--	7	--	10/27	D
5-1491	28-10497	400545	743446	HOFFMAN-LAROCHE	HOF-LAR 1	NEW EGYPT	1978	136	206-222	--	--	--	--	105	--	11/4	H
5-1495	32-06317	395606	742848	WHITE J J CO	MARC DOM	WHITING	1980	117	512-522	--	--	--	--	-1	--	10/26	D
7-22	31-00513	394738	745614	BERLIN BORO WD	BERLIN WD 8	CLEMENTON	1952	147	310-360	34	31	11	-7	4	11	11/3	D
G 7-118	31-04898	395229	745712	NJ/AMERICAN WC	HUTTON HILL 2 OBS	CLEMENTON	1965	158	137-147	69	69	68	68	68	0	11/4	D
7-308	51-00014	394928	750021	NJ/AMERICAN WC	RUNNEMEDE	RUNNEMEDE	1923	77	126	57	58	56	55	49	-6	11/10	D
7-391	31-05628	394639	745750	LOWER CAMDEN CO REGIONAL SCHOOL	OVERBROOK HS 1	CLEMENTON	1971	160	315-335	28	29	8	-6	-22	-16	11/2	D
7-401	31-02371	394722	745810	PINE VALLEY GOLF CLUB	PINE VALLEY GOLF CLUB 1955	CLEMENTON	1955	85	267	36	43	23	9	-6	-15	10/28	D
7-414	51-00010	394922	745633	NJ/AMERICAN WC	ELM TREE 26	CLEMENTON	1960	150	237-275	60	[5]152	36	51	58	7	11/17	D
7-421	--	395109	745715	DIALECTRIC COMMUNICATIONS ASSOC.	RCA/DCA INDOOR WELL	CLEMENTON	1955	175	220-234	91	91	89	89	87	-2	11/4	D
7-449	31-04749	394618	745413	WINSLOW TWP WC	WINSLOW TWP 5	CLEMENTON	1965	159	420-460	20	19	-4	-22	-10	12	11/10	D
G 7-478	--	394215	745617	US GEOLOGICAL SURVEY	NEW BROOKLYN PARK 3 OBS	WILLIAMSTOWN	1961	111	520-530	36	40	21	3	-25	-28	10/4	D
7-513	31-07766	394532	745623	JOHNS-MANVILLE CO	JOHNS-MANVILLE 3	CLEMENTON	1974	[7]166	410-460	--	--	-1-5	-19	-31	-12	11/5	H
7-526	31-06193	394932	745847	LINDENWALD BORO MUA	SEWAGE PL2	CLEMENTON	1972	78	138-158	63	66	61	62	59	-3	10/28	H
7-685	31-22273	394513	745915	CONSUMERS NJ WC	GSWC 10 ERIAL	WILLIAMSTOWN	1985	[8]144	322-427	--	--	--	[4]-20	-62	-42	11/3	H
7-847	31-36246	394359	750118	CONSUMERS NJ WC	CNJ TW-17	PITMAN EAST	1991	150	329-380	--	--	--	--	-81	--	11/3	H
15-367	30-00649	394234	751307	GANGEMI, VICENT	GANGEMI IRR	PITMAN WEST	--	73	500	--	68	66	68	66	-2	11/3	D
15-542	31-16873	394147	750654	RON SON MUSHROOM CO	RON SON MSHRM 1	PITMAN EAST	1980	150	265-295	--	--	73	51	25	-26	11/6	D
15-687	--	394638	751201	US EPA	KRAMER LF X-6S	WOODBURY	1984	28	6-24	--	--	21	22	22	0	11/3	D
15-910	30-02454	394155	751401	WOLFSON, BENJAMIN	WOLFSON DOM 1981	PITMAN WEST	1981	84	140-160	--	--	58	57	54	-3	11/3	D
15-953	31-06570	394718	750604	UNITED ENGINEERING SERVICES	KINSLEY 1 DW-2	RUNNEMEDE	1972	81	86-100	--	--	56	55	54	-1	11/5	D
15-1009	31-22018	394426	750633	FLAHERTY, JOSEPH	FLAHERTY DOM	PITMAN EAST	1984	100	149-178	--	--	65	62	58	-4	12/16	D
15-1040	30-05046	394257	751825	STRING, DONALD	SPRINGFIELD FARMS 2	WOODSTOWN	1988	120	77-87	--	--	77	79	78	-1	11/10	D
15-1060	31-30571	394100	750553	GLASSBORO BORO WD	GWD6	PITMAN EAST	1989	136	335-386	--	--	--	20	-47	-67	11/3	H
15-1104	30-02422	394350	751916	GRASSO, JOSEPH S	GRASSO FOODS MW 3	WOODSTOWN	1981	102	40	--	--	--	81	79	-2	11/6	D
15-1119	31-44252	394347	750939	MANTUA TWP MUA	MTMUA 8	PITMAN WEST	1992	141	159-199	--	--	--	--	68	--	11/9	H
15-1126	31-34033	394119	750627	GLASSBORO BORO	GLASSBORO ML-1 OBS	PITMAN EAST	1990	146	328-338	--	--	--	--	-22	--	11/5	D
15-1203	31-34604	394234	750454	WASHINGTON TWP MUA	WTMUA MW-9	PITMAN EAST	1990	147	298-308	--	--	--	--	-31	--	11/4	H
25-14	49-00017	401138	740125	AVON BY THE SEA BORO WD	AWD 1	ASBURY PARK	1925	28	424-504	-145	-162	-202	-83	-77	6	10/20	D
25-88	29-05886	401444	741700	CENTRAL JERSEY BANK	CNTRL JRSY BK IRR	ADELPHIA	1969	150	143-163	--	--	114	112	113	1	12/1	D
25-95	29-04709	401618	741644	STEGERS, KURT	STEGERS DOM	FREEHOLD	1965	162	128-140	--	--	--	133	134	1	10/19	D
25-166	29-04381	400952	741405	NJ/AMERICAN WC	ALDRICH WC 3/HTMUA 3	FARMINGDALE	1964	114	336-396	--	--	--	--	12	--	10/29	D
25-168	29-03105	400957	741305	NJ/AMERICAN WC	ALDRICH WC 2	FARMINGDALE	1960	[5,6,7]160	354-440	[56]-46	[54]-44	[66]-56	--	-2	--	10/29	H
25-173	--	401248	741136	NJ CONCRETE PIPE	WELL 1 (well 2)	FARMINGDALE	--	90	-	23	23	19	39	[6]43	4	12/1	H
25-185	29-02607	401438	741025	NAD EARLE	TRANS DEPOT S7	FARMINGDALE	1958	119	229-250	59	60	56	65	66	1	10/23	D
25-243	--	401854	741325	MARLBORO CONSTRUCTION INC	IENTILE IRR	MARLBORO	1963	120	80	88	87	86	88	85	-3	10/22	H
25-335	--	401215	740409	WELSH FARMS	WARDELL 1	ASBURY PARK	1941	[5,6,7]90	465-480	[118]-110	[128]-118	[146]-136	-56	-59	-3	10/26	H
G 25-353	--	401542	740530	US ARMY	FORT MONMOUTH 1-NCO OBS	LONG BRANCH	1972	140	321-327	-7	-21	-15	10	15	5	10/16	D
25-391	29-07506	400928	740211	SPRING LAKE HEIGHTS WD	SPRING LK HGT4	ASBURY PARK	1974	[5,6]25	485-561	[195]-190	[166]-161	-213	-104	-83	21	10/26	H
25-396	28-06896	400658	743135	RUTGERS UNIVERSITY	RUTGERS UNIV IRR	NEW EGYPT	1970	122	92-102	85	85	83	86	83	-3	11/2	H
25-405	--	401005	742913	PERRETTI FARMS	PUNK BROS IRR 3	ROOSEVELT	1964	158	124	127	128	126	127	145	18	11/30	D
25-412	28-05835	401045	742821	FIORDLAND, WILLIAM	ERB IRR	ROOSEVELT	1966	190	100-140	149	[145]148	147	148	146	-2	11/4	D
G 25-486	--	400711	740202	STATE OF NJ	DOE-SEA GIRT OBS	POINT PLEASANT	1978	10	604-614	--	-171	-185	-102	-74	28	10/23	D
25-521	29-09867	401020	741937	AMARESCU, DONALD	AMARESCU DOM	ADELPHIA	1979	150	222-228	--	--	99	102	103	1	11/2	D
25-533	29-05113	400816	741334	MOON MOTEL	MOON MOTEL 1	FARMINGDALE	1966	120	349-365	--	-61	-74	-21	-16	5	10/26	H
25-542	--	400953	740726	BRISBANE CHILD TREATMENT CNTR	BRISBANE 2	ASBURY PARK	--	[6,7]60	430-450	--	[97]-107	[113]-123	-59	-42	17	10/20	H
25-546	29-12717	400713	741016	DUTTON, ANTHONY	DUTTOM DOM	LAKEWOOD	1983	[7]60	420-445	--	--	[143]-123	-76	-49	27	10/23	D
G 25-637	29-18400	401105	741202	US GEOLOGICAL SURVEY	HOWELL TWP 3 OBS	FARMINGDALE	1987	112	307-317	--	--	-28	7	16	9	10/21	D
25-687	29-15008	401756	740258	EATONTOWN SR CITIZENS HOUSING	EATONTOWN SR HOUSING	LONG BRANCH	1985	[8]40	177-187	--	--	[21]20	[18]28	31	3	10/22	D
25-720	29-16821	401053	741558	NJ/AMERICAN WC	AWC T-2/4-B	ADELPHIA	1986	120	235-255	--	--	--	51	72	21	10/29	D
29-31	29-04663	400234	740814	BRICK TWP BRD ED	EMMA YOUNG 1	LAKEWOOD	1965	[5,6,7]13	605-625	[113]-117	[120]-124	[129]-133	-120	-73	47	10/22	D
29-36	29-06021	400410	740917	BRICK TWP BRD ED	HIGH SCHOOL	LAKEWOOD	1970	[6,7]30	518-548	--	[136]-131	[151]-146	-115	-75	40	10/22	D
29-37	29-04283	400429	740652	SAINT DOMINICS CHURCH	ST DOMINICS CH DOM	POINT PLEASANT	1964	[8]20	576-591	-136	-141	-155	[124]-129	-90	39	10/22	D
29-49	29-06022	400505	740649	BRICK TWP BRD ED	VET MEMORIAL SCH	POINT PLEASANT	1970	[6,7]29	556-586	--	[144]-135	[158]-149	-122	-82	40	10/22	H
G 29-140	28-04785	400414	742702	US GEOLOGICAL SURVEY	COLLIERS MILLS 3 OBS	CASSVILLE	1964	135	257-267	115	114	112	112	112	0	10/21	D
29-227	29-05007	400604	741915	MEADOWBROOK VILLAGE	HOLMANSVILLE 1	LAKEHURST	1966	110	358	42	38	48	[37]47	46	-1	10/27	H
29-234	28-08255	400809	742532	GREAT ADVENTURE	GA 2	ROOSEVELT	1974	[6]140	180-200	123	[160]130	[131]122	121	121	0	11/16	H
29-699	28-07966	400915	742336	JACKSON TWP BOARD OF ED	GETZ SCHOOL	ROOSEVELT	1973	160	214-226	--	124	121	123	122	-1	11/3	H
29-713	28-10063	400636	742102	JACKSON TWP	LIBRARY	LAKEHURST	1978	130	318-324	--	83	82	84	84	0	10/29	D
29-740	29-08522	400352	742145	OCEAN COUNTY VOCATIONAL SCH	OCEAN CO VO-TECH 2	LAKEHURST	1976	105	340-380	--	41	39	41[4]2	52	10	12/2	D
29-781	29-09069	400622	741957	IVINE, WILLARD	IVINE DOM	LAKEHURST	1977	110	302-325	--	--	40	36	42	6	10/21	D
29-783	29-09681	400745	741817	FOUNTAIN HEAD PARK	FOUNTAIN HEAD PK DOM	ADELPHIA	1979	[6,7]120	310-325	--	[62]57	[42]47	47	56	9	11/30	H
29-784	29-10449	400550	741808	EMMUS, ROLAND	EMMUS DOM	LAKEHURST	1980	90	341-347	--	--	2	4	8	4	10/23	D
29-786	29-08581	400630	741730	JACKSON TWP	HULSE RD 1	LAKEHURST	1977	110	364-379	--	0	-3	4	13	9	11/17	D
29-926	28-18902	400610	742728	TIMBERLAND LAKE CAMPGROUND	JELLYSTONE 3	CASSVILLE	1987	105	127-160	--	--	109	110	110	0	12/4	D
29-1138	28-23392	400616	743011	JENSENS DEEP RUN INC	RTE 537 OW1	NEW EGYPT	1989	95	100-120	--	--	--	--	96	--	12/5	H
33-2	--	393202	751630	CUMBERLAND COUNTY	BOSTWICK NO 3	ALLOWAY	1972	85	462-472	23	22	20	19	14	-5	11/13	
33-8	30-00030	393330	751817	STRANG, ARNOLD	STRANG 1	ALLOWAY	1949	70	322-345	--	--	20	18	15	-3	11/13	D
G 33-20	--	393534	751752	HORNER, EPHRAIM	HORNER OBS	ALLOWAY	1929	77	283	33	32	30	28	25	-3	11/12	D
33-22	31-04612	393533	751018	ELMER WC	ELMER WC 6	ELMER	1963	105	460-500	28	30	27	20	6	-14	11/13	H
33-50	--	393538	752640	SALEM MEMORIAL HOSPITAL	HOSP 1-1950	S ALEM	1950	20	73-97	5	6	4	5	6	1	11/12	D
33-56	--	393606	752524	MANNINGTON TWP ELEMENTARY SCH	MTES 1	SALEM	1959	25	93	7	[8]7	[6]7	7	7	0	12/17	H
33-241	--	393253	752422	SALEM CITY WD	QUINTON	SALEM	--	10	248	6	4	6	5	4	-1	11/13	D
G 33-252	--	393348	752755	US GEOLOGICAL SURVEY	SALEM 2 OBS	SALEM	1965	3	91-96	1	0	0	0	-1	-1	11/9	D
33-381	30-01505	393453	752709	MANNINGTON MILLS	MILLS 6	SALEM	1977	10	85-125	--	0	1	1	0	-1	11/12	D
33-384	30-01356	393137	752500	WILD OAK COUNTRY CLUB	1-IRR-73	SALEM	1973	20	320	--	6	6	5	4	-1	11/13	D
33-407	34-01600	393009	752604	LOWER ALLOWAY CREEK TWP	SEN CIT 2	CANTON	1980	5	250-300	--	--	--	--	-7	--	11/17	H
33-456	31-19206	393507	751045	ELMER WC	EWC 8	ELMER	1982	125	443-503	--	28	27	22	8	-14	11/13	D
33-670	30-04467	393355	751915	HOERST, JANET	LICCIARDELLO DOM	ALLOWAY	1987	64	310-320	--	--	18	17	14	-3	11/12	D
33-902	30-09510	393847	751910	WOODSTOWN BORO	WB-4	WOODSTOWN	1993	48	100-143	--	--	--	--	36	--	11/9	D
33-931	30-12288	393426	751724	BOY SCOUTS OF AMERICA	BSA MAINTENANCE 1	ALLOWAY	1997	92	343-353	--	--	--	--	20	--	11/13	D
33-932	30-05631	393604	752529	MANNINGTON TWP	MANNINGTON TOWN HALL 1	SALEM	1989	30	70-80	--	--	--	--	9	--	12/17	H
33-938	34-00970	392743	753147	PUBLIC SERVICE ELECTRIC & GAS	PSE&G TEST 1	TAYLORS BRIDGE	1974	18	270-290	--	--	--	--	2	--	11/17	D
Delaware wells																	
Ec51-20	82243	393035	753910	TIDEWATER	RT 13	ST GEORGES	1992	56	115-135	--	--	--	--	29	--	12/2	D
Fb14-14	110686	392929	754118	ARTESIAN WC	PW2	MIDDLETOWN	1997	50	122-142	--	--	--	--	13	--	11/12	D
Fb24-06	84852	392848	754103	TIDEWATER	1	MIDDLETOWN	1990	60	106-198	--	--	--	--	17	--	12/2	D
Fb34-25	157826	392706	754109	ARTESIAN WC	2 OBS	MIDDLETOWN	1998	65	157-232	--	--	--	--	12	--	11/12	D
Fb42-03	10455	392656	754304	MIDDLETOWN	5	MIDDLETOWN	1960	65	133-206	--	--	--	--	32	--	12/3	D
Fc12-23	96300	392914	753818	TIDEWATER	MISTY VALE DR	MIDDLETOWN	1993	50	140-170	--	--	--	--	8	--	12/2	D
Fc42-13	97960	392640	753847	TIDEWATER	RT 299	MIDDLETOWN	1993	35	200-220	--	--	--	--	6	--	12/2	D
Fc43-05	157829	392641	753748	ARTESIAN WC	1 OBS	MIDDLETOWN	1998	52	200-270	--	--	--	--	3	--	11/12	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

[9] Well in which the water-level altitude was measured during a previous synoptic study.
Both wells are at the same site in the same aquifer.

Water-level altitude measured in a previous study, but in a different well.

Table 7-1. Water-level data for wells screened in the Englishtown aquifer system, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; USGS, U.S. Geological Survey; ( ), water-level altitude from well in same well field; ft, feet; BORO, Borough; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; CO, Company; EPA, Environmental Protection Agency; SR, Senior; BR, Bridge; L, well screened in the Lower Englishtown aquifer system; G, indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

	Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screen interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
	5-195	31-01164	395833	745042	THOMAS, STEVE	THOMAS D-1	MOUNT HOLLY	1954	60	70-74	25	23	22	26	22	-4	11/4	D
	5-197	31-01191	395653	744921	JONES, LESTER	JONES-LUMBERTON TWP	MOUNT HOLLY	1953	41	148-159	26	25	19	26	24	-2	10/30	D
	5-256	31-01399	395509	745102	JOHNSON, W E JR	JOHNSON W E IRR	MOUNT HOLLY	1950	79	440	--	--	--	--	19	--	10/30	H
G	5-259	--	395524	745025	US GEOLOGICAL SURVEY	MEDFORD 2 OBS	MOUNT HOLLY	1963	73	253-263	25	20	24	24	20	-4	10/30	D
	5-375	32-01276	395807	743837	BURLINGTON COUNTY INSTITUTE	BUR CO INST 3 (9)	PEMBERTON	1956	70	343-378	--	29	25	20	12	-8	11/5	H
	5-387	32-01103	395943	744120	PEMBERTON TWP SCHOOLS	HIGH SCH 2 (3)	PEMBERTON	1973	[5]50	208-228	[4]452	54	49	52	49	-3	11/6	H
	5-437	28-03831	400210	744138	KAUFFMAN, MINTER	KAUFFMAN - SPRINGFIELD	COLUMBUS	1960	74	94-105	62	61	61	66	58	-8	11/9	D
	5-754	--	395941	743250	US ARMY	RANGE HQ 7	BROWNS MILLS	1975	100	419-447	50	46	43	37	32	-5	10/28	H
	5-1191	52-00001	395710	743311	PINE VIEW TERRACE INC	PVTI 1	BROWNS MILLS	--	91	440	--	--	--	--	19	--	10/26	D
	5-1390	32-21804	395309	743521	STATE OF NJ	NEW LISBON 2 OBS	BROWNS MILLS	1997	105	615-635	--	--	--	--	10	--	10/26	D
	5-1492	32-22557	395915	743308	PEMBERTON TWP WD	PTWD 12	BROWNS MILLS	1998	88	411-451	--	--	--	--	23	--	10/26	D
	7-166	31-01202	394807	745806	CLEMENTON BORO WD	CWD 9	CLEMENTON	1954	150	367-457	0	46	11	15	13	-2	11/4	D
	7-529	31-13543	394832	745915	CLEMENTON BORO WD	CWD 11	CLEMENTON	1978	[5,6,7]55	250-283	[6]1	[55]50	[31]26	3	0	-3	11/4	H
	7-672	31-24779	394929	750023	NJ/AMERICAN WC	LAUREL SP TEST2 1EF OBS	RUNNEMEDE	1986	76	195-215	--	--	50	46	28	-18	11/18	D
	7-731	31-29319	395001	745851	NJ/AMERICAN WC	LINDEN AVE OW-57	CLEMENTON	1989	65	216-236	--	--	--	48	42	-6	11/10	D
	15-188	31-02415	394605	751057	WENNER, BARBARA	YAHRLING 1	WOODBURY	1955	80	134-160	--	--	31	31	31	0	12/16	D
	15-344	30-00064	394518	751640	STATE OF NJ TURNPIKE AUTHORITY	NJTA INT 2	BRIDGEPORT	1951	80	69-83	--	--	--	--	67	--	12/1	D
	15-676	--	394638	751201	US EPA	KRAMER LANDFILL X-6D	WOODBURY	1984	28	68-78	--	--	30	[26]30	30	0	11/3	D
G	23-104	--	402143	741849	OLYMPIA & YORK BR DEVELOPMENT	MORRELL1 OBS	FREEHOLD	1923	77	0-11	--	--	--	74	70	-4	10/21	D
	23-211	28-07520	401819	742248	VLCEJ, STEPHEN	VLCEJ DOM	JAMESBURG	1972	105	43-49	90	93	91	--	95	--	10/23	D
	25-9	49-00050	402441	740234	ATLANTIC HIGH WD	AHWD 2	SANDY HOOK	1923	15	200	10	11	5	10	9	-1	10/22	D
	25-16	29-00045	401037	740148	BELMAR BORO WD	BWD 3 ELEC(12)	ASBURY PARK	1949	20	563-594	-188	-196	-202	-91	-68	23	10/19	D
	25-26	49-00024	401102	740045	BELMAR BORO WD	BWD 4 ELEC(11)	ASBURY PARK	1941	15	601-671	-165	-174	-173	-84	-62	22	10/18	H
	25-28	29-05292	400623	740429	BRIELLE WD	BRIELLE WD 3	POINT PLEASANT	1967	90	770-820	-219	-220	-207	-119	-93	26	10/26	H
	25-30	29-00069	400645	740345	BRIELLE WD	BRIELLE WD 2	POINT PLEASANT	1950	33	690-750	-233	-249	-225	-116	-91	25	10/26	H
	25-46	29-04196	401747	741221	CEDAR DRIVE ELEMENTARY SCHOOL	CEDAR DR ELE SCH	MARLBORO	1963	122	212-232	70	68	61	--	58	--	11/10	H
	25-63	29-04386	401143	741018	FARMINGDALE BORO WD	FARMINGDALE 3	FARMINGDALE	1964	[7]75	420-460	--	--	[-84i]-83	[-38i]-39	-27	12	10/29	H
	25-80	29-05417	401415	741501	IVC INDUSTRIES	WORTHINGTON BIO 1-1967	ADELPHIA	1967	120	294-334	75	78	73	73	78	5	11/30	D
	25-96	29-04435	401624	741502	FREEHOLD TWP WD	5-OLD SO.GULF1	FREEHOLD	1964	200	327-356	87	88	81	74	68	-6	10/22	D
	25-105	29-05302	401654	741736	FREEHOLD TWP WD	FREEHOLD TWP 3	FREEHOLD	1967	[5]112	150-212	[104]86	100	69	59	56	-3	10/22	H
	25-107	29-03177	401701	741417	MUELLER, R W DR	DURAND,E. 1960	MARLBORO	1960	163	249-257	81	81	73	70	64	-6	10/22	D
	25-132	29-02079	402202	741002	BELL TELEPHONE CO	BELL LAB TW 2	MARLBORO	1960	120	191-221	64	64	63	63	62	-1	10/22	D
	25-144	49-00031	402158	740956	BELL TELEPHONE CO	BELL LAB 3	MARLBORO	1965	120	154	--	--	75	--	73	--	10/22	D
	25-151	29-03736	402439	740849	LILY TULIP CUP CO	LILY TULIP 1	KEYPORT	1962	60	101-126	--	34	33	--	34	--	10/20	D
	25-162	29-07043	400815	741043	NJ NATURAL GAS CO	1-1973	FARMINGDALE	1973	69	500-560	-114	-120	-125	-66	-48	18	10/22	H
	25-165	29-05346	400844	741324	NJ/AMERICAN WC	ALDRICH W CO 4/HTMUA 4	FARMINGDALE	1967	135	363-550	--	--	-94	-46	-36	10	10/29	H
	25-184	29-04186	401429	741254	DEER RUN FARMS	DIXON DOM-1963	FARMINGDALE	1963	140	360-380	--	69	65	69	69	0	12/3	D
G	25-250	29-04437	401918	741529	GORDONS CORNER WC	VILLAGE 215 OBS	FREEHOLD	1964	139	185-215	100	99	95	92	90	-2	10/19	D
	25-277	29-00030	402239	741434	ENTRON CORP (LAVOIE LAB)	LAVOIE LAB 1	KEYPORT	1948	180	138-152	--	--	--	--	92	--	10/21	D
	25-365	29-04513	402046	740105	RUMSON COUNTRY CLUB	RUMSON C C 2	LONG BRANCH	1965	8	268-333	--	--	--	6	2	-4	10/23	D
	25-374	29-04102	400804	740227	SEA GIRT WD	SGWD 5	ASBURY PARK	1963	20	660-710	-205	-218	-216	-113	-91	22	10/20	H
	25-385	49-00016	400915	740146	SPRING LAKE BORO WD	SLWD 3	ASBURY PARK	1941	20	640-705	-197	-208	-210	-106	-100	6	10/18	D
	25-389	29-00398	400859	740308	SPRING LAKE HEIGHTS WD	SPRING LK HGT2	ASBURY PARK	1953	60	660-711	-203	-232	[-230]-224	-109	-83	26	10/26	H
G	25-429	29-04140	400834	740834	US GEOLOGICAL SURVEY	ALLAIRE STATE PARK C OBS	FARMINGDALE	1963	98	623-633	-143	-149	-149	-78	-58	20	10/23	D
	25-441	29-05289	401028	740638	WALL TWP WD	RT 34 WELL	ASBURY PARK	1968	120	549-649	-162	-163	-170	-74	-65	9	10/20	H
G	25-638	29-18401	401105	741202	US GEOLOGICAL SURVEY	HOWELL TWP 4 OBS	FARMINGDALE	1987	112	483-493	--	--	-53	-14	-3	11	10/21	D
	25-692	29-14852	401813	741818	WEINGARTEN-SIEGEL GROUP	JUSTIN CORP CNTR	FREEHOLD	1985	110	120-150	--	--	90	[86i]85	85	0	11/3	D
	25-697	29-13591	401950	740446	BOWERS, PHILIP J & CO	PJ BOWERS & CO	LONG BRANCH	1984	760	247-277	--	--	[-2]8	11	12	1	10/21	D
	25-704	29-15337	401450	741832	KAPLAN RAIN TREE GOLF COURSE	WEMROCK RD IRR	ADELPHIA	1985	195	290-320	--	--	--	107	107	0	11/9	D
	25-710	29-16728	400606	740911	PARKWAY WC	PARKWAY 1 A	LAKEWOOD	1986	45	594-644	--	--	-164	-96	-70	26	10/23	D
	25-713	29-20565	401656	740803	BAILEY, RICHARD E	NEW WELL 2 DOM	MARLBORO	1988	80	300-320	--	--	19	--	23	--	11/12	D
G	25-715	29-25384	402426	740019	ATLANTIC HIGHLANDS WD	AHWD B OBS	SANDY HOOK	1991	[8]229	350-360	--	--	--	[-4]5	4	-1	10/19	D
	25-733	29-28556	401620	741153	MONMOUTH CO PARK SYSTEM	MCPS 5	MARLBORO	1992	135	316-366	--	--	--	--	47	--	10/20	H
	25-735	29-26191	402113	741340	STATE OF NJ [9](25-256)	MARLBORO PSYCH HOSP 17	MARLBORO	1991	140	140-191	#124	#87	#83	#79	83	4	11/16	H
	25-771	29-36217	402350	735839	NATIONAL PARK SERVICE	SANDY HOOK 2 OBS	SANDY HOOK	1997	7	258-278	--	--	--	--	-2	--	10/19	D
					Chloride concentration of water sample from well 25-771 is 16,000 mg/L. Water density is 1.011 g/cm^3 .						Fresh water equivalent head is				1	--	10/19	D
	25-786	29-30436	401801	740814	MONMOUTH COUNTY PARKS	COMFORT STATION WELL	MARLBORO	1994	87	233-273	--	--	--	--	32	--	10/21	H
	25-787	28-36906	401055	743134	POPE, DARYLL	POPE DEEP DOM	ALLENTOWN	1995	133	90-100	--	--	--	--	113	--	10/30	D
	29-5	49-00002	400405	740242	NJ/AMERICAN WC	BAY HEAD 5	POINT PLEASANT	1947	10	750-834	-226	-219	-202	-153	-104	49	10/28	D
G	29-138	--	400414	742702	US GEOLOGICAL SURVEY	COLLIERS MILLS 1 OBS	CASSVILLE	1964	137	417-427	65	63	60	61	65	4	10/21	D
	29-236	29-03883	400823	741533	JACKSON TWP MUA	JACKSON MUA 2	ADELPHIA	1962	170	541-577	--	-43	-53	-16	-56	-40	10/26	H
	29-237	28-08254	400800	742543	GREAT ADVENTURE	GA 1	ROOSEVELT	1974	140	358-388	--	--	122	100	100	0	11/16	H
	29-433	29-05110	400309	741120	LAKEWOOD TWP MUA	S LAKEWOOD 3	LAKEWOOD	1966	45	673-741	-207	-202	-184	-105	-78	27	10/27	H
	29-434	29-04304	400354	741310	NJ/AMERICAN WC	LAKEWOOD 7	LAKEWOOD	1964	85	697-757	-227	[-197]-198	--	[-130]-131	-106	25	10/28	D
	29-438	29-04834	400443	741352	NJ/AMERICAN WC	LAKEWOOD 8	LAKEWOOD	1965	78	600-758	-152	-170	-161	-112	-79	33	10/28	D
	29-441	29-05068	400505	741114	NJ/AMERICAN WC	LAKEWOOD OBS	LAKEWOOD	1966	30	726-736	-136	-141	-140	-112	-70	42	10/28	D
	29-443	29-02231	400515	741251	NJ/AMERICAN WC	LAKEWOOD 5	LAKEWOOD	1957	[6]36	547-604	--	[-153]-157	-154	-94	-65	29	10/28	D
	29-449	29-05496	400614	741157	NJ/AMERICAN WC	LAKEWOOD 9	LAKEWOOD	1968	55	569-698	-170	--	-189	-161	-118	43	10/28	H
	29-450	29-03324	400622	741349	NJ/AMERICAN WC	LAKEWOOD 6	LAKEWOOD	1960	70	520-582	-135	-153	-133	[-112]-87	-61	26	10/28	H
	29-451	29-02207	400636	741515	LAKEWOOD TWP PINE PARK	ST GABRIELS 1	LAKEHURST	1957	60	510-530	-102	-108	-103	-64	-52	12	10/27	D
L	29-454	53-00002	395808	740421	LAVALLETTE BORO WD	LWD 2	SEASIDE PARK	1931	5	1,009-1,136	-119	-118	-107	-85	-85	0	10/26	D
	29-503	29-01325	400210	740310	NJ/AMERICAN WC	MANTOLOKING 6 OBS	POINT PLEASANT	1955	5	845-906	--	-194	-194	-133	-98	35	10/23	D
	29-518	--	400401	743200	NEW EGYPT WC	2-1903	NEW EGYPT	1903	75	218-238	--	--	61	62	62	0	11/6	D
G	29-530	29-04530	400454	740413	POINT PLEASANT BORO WD	PPWD 6 OBS	POINT PLEASANT	1965	20	730-790	-236	-211	-202	-146	-99	47	10/23	D
L	29-534	33-01117	395609	741240	US GEOLOGICAL SURVEY	TOMS RIVER 2 OBS	TOMS RIVER	1965	18	1,080-1,146	[-78]-79	-86	-86	-85	-66	19	10/23	D
	29-938	28-20499	400404	742137	JACKSON ESTATES	1988 WELL	LAKEHURST	1988	130	487-527	--	--	-8	7	22	15	10/30	D
	29-1336	28-34164	400427	742939	HALLOCK FARMS LTD	HALLOCK 2	CASSVILLE	1991	130	305-355	--	--	--	--	76	--	12/4	D
	33-168	30-00029	393943	752236	HARRIS SALE CO.	HARRIS SALES DOM	PENNS GROVE	1949	40	113-124	--	--	--	--	17	--	11/18	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

[9] Well in which the water-level altitude was measured during a previous synoptic study.
Both wells are at the same site in the same aquifer.

Water-level altitude measured in a previous study, but in a different well.

Table 8-1. Water-level data for wells screened in the Upper Potomac-Raritan-Magothy aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; BORO, Borough; MUA, Municipal Utilities Authority; GLOUC CO, Gloucester County; WD, Water Department; TWP, Township; WC, Water Company; NJ, New Jersey; DEL, Delaware; CO, Company; CORP, Corporation; ED, Education; AUTH, Authority; CC, County Club; CTR, Center; Int, International; NAT, Natural; G, indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shut-down period
New Jersey wells																	
5-76	31-01751	400324	745152	HEAL, CHARLES JR	HEAL	BRISTOL	1955	[5,6,7]62	59-80	$^{-3}$9	$^{-4}$8	$^{-6}$6	1	1	0	10/27	D
5-116	28-02847	400708	743836	CHESTERFIELD SCHOOL	CHESTERFIELD SCH 1	COLUMBUS	1957	102	247-253	7	6	3	4	5	1	11/6	H
5-165	31-05458	395233	745418	EVESHAM TWP MUA	EMUA 4	MOORESTOWN	1970	110	464-500	-75	-81	-89	-104	-85	19	11/6	D
5-167	31-07883	395247	745157	EVESHAM TWP MUA	EMUA 5	MOUNT HOLLY	1973	50	478-548	-70	-79	-84	-88	-69	19	11/10	D
5-207	28-03986	400356	744039	VAN MATER, CHAS	CRESANT FARMS	COLUMBUS	--	95	325	-13	-16	-20	-20	-18	2	11/3	D
5-209	28-06599	400412	744323	COLUMBUS WC	CWC 2(OLD 3)	COLUMBUS	1969	73	259-274	--	-18	-22	-32	-28	4	11/20	H
5-212	28-03560	400515	744109	NORTHERN BURLINGTON COUNTY	HIGH SCHOOL 1	COLUMBUS	1959	83	290-310	-13	-15	-18	-18	-17	1	11/12	H
5-218	--	400718	744453	RIVER FRONT MOTEL	RIVER FRT MTL	COLUMBUS	--	[5,6,7]65	100	$^{-2}$3	$^{-4}$1	$^{-4}$1	3	2	-1	11/9	D
5-229	31-08922	395630	745855	MAPLE SHADE WD	MSWD 9	MOORESTOWN	1975	40	160-200	-47	-57	-56	-53	-46	7	11/10	D
5-249	31-05282	395209	745043	MEDFORD TWP WD	MTWD3/MTWD1	MEDFORD LAKES	1968	55	523-541	-65	-75	-84	-86	-68	18	11/9	H
5-254	31-10560	395430	744929	MEDFORD LEASE	2-1977 [9](5-253)	MOUNT HOLLY	1977	32	451-471	[#]-58	[#]-72	[#]-68	-77	-66	11	11/6	H
G 5-258	31-04627	395524	745025	US GEOLOGICAL SURVEY	MEDFORD 1 OBS	MOUNT HOLLY	1963	71	400-410	-52	-65	-66	-69	-59	10	10/30	D
5-317	31-00212	395850	745318	STATE OF NJ - TURNPIKE AUTH	4N-1	MOORESTOWN	1951	45	192-222	--	--	-45	-46	-46	0	12/1	H
5-438	--	400218	744604	SPRINGFIELD GOLF CENTER	GOLF FARM DOM [9](5-1137)	BRISTOL	1957	41	220-230	-22	-23	--	--	-24	--	10/30	D
5-707	31-14627	395315	745503	EVESHAM TWP MUA	EMUA 7	MOORESTOWN	1979	100	405-441	--	-86	-94	--	-71	--	11/6	H
5-728	--	395819	744341	MOBILE ESTATES	FIELD PUMP	PEMBERTON	1972	55	485-500	-31	-31	-37	-42	-43	-1	11/5	H
5-731	--	400739	744228	INTERSTATE WASTE	MONITOR 8	TRENTON EAST	1978	[5,6]93	118-128	^{2i}5	^{2}4	3	3	3	0	11/17	D
5-745	27-05937	400157	744819	BC COUNTY CLUB	CLUB 1R	BRISTOL	1974	102	260-290	-18	-17	-21	-23	-23	0	11/5	D
5-755	31-06840	395049	745338	EVESHAM TWP MUA	EMUA 10 (KGWC 1)	CLEMENTON	1973	90	547-593	--	-79	-91	-91	-74	17	11/6	D
5-795	31-09595	395239	745308	EVESHAM TWP MUA	MLWC 5/EMUA 5A	MOORESTOWN	1976	60	416-463	-79	-96	-97	-97	-76	21	11/6	H
5-1159	28-15286	400350	744510	HOMESTEAD WATER & TREATMENT	WTR TREATMENT PLANT PW 2	BRISTOL	1985	50	165-205	--	--	--	-9	-9	0	11/9	D
5-1181	31-41329	395935	744653	ELIZABETHTOWN WC	GREEN ST 3R	MOUNT HOLLY	1993	19	313-343	--	--	--	-63	-53	10	11/20	H
5-1183	28-28543	400333	744629	INTERSTATE STORAGE & PIPE CO	INTERSTATE NEW 1991	BRISTOL	1991	75	200-220	--	--	--	-16	-14	2	10/27	H
5-1194	31-29146	395546	745343	RUDDEROW, JOHN	RUDDEROW DOM ELBO LN	MOORESTOWN	1989	[8]80	300-310	--	--	--	$^{-74}$-64	-53	11	11/3	D
5-1389	32-22005	395309	743521	STATE OF NJ	NEW LISBON 1 OBS	BROWNS MILLS	1997	105	900-920	--	--	--	--	-42	--	10/26	D
5-1391	32-21805	394904	742536	STATE OF NJ	COYLE 2 OBS (OW 96)	WOODMANSIE	1997	180	1,416-1,436	--	--	--	--	-32	--	10/26	D
5-1490	31-17792	395651	744923	JONES, LESTER	LJONES-DEEP	MOUNT HOLLY	1981	41	364-376	--	--	--	--	-57	--	10/30	D
7-13	51-00032	395221	750636	BELLMAWR BORO WD	BBWD 1	RUNNEMEDE	1942	31	111-160	--	-46	-44	-39	-30	9	11/5	D
7-18	31-02079	394738	745614	BERLIN BORO WD	BERLIN WD 9	CLEMENTON	1955	145	650-713	--	--	-95	-98	-102	-4	11/3	D
7-115	31-00051	395149	745909	WOODCREST COUNTRY CLUB	WOODCREST CC DOM-1	CLEMENTON	1949	70	400-420	--	-84	-101	-95	-62	33	11/5	D
G 7-117	31-04897	395229	745712	NJ/AMERICAN WC	HUTTON HILL 1 OBS	CLEMENTON	1965	[6]158	552-562	-75	$^{-80}$-79	-84	-91	-67	24	11/4	D
7-131	31-05096	395353	745708	NJ/AMERICAN WC	OLD ORCHARD B	MOORESTOWN	1967	71	342	-74	-79	-83	-86	-54	32	11/23	D
7-143	31-03305	395441	750104	NJ/AMERICAN WC	ELLISBURG 16	CAMDEN	1957	40	187-220	-61	-65	-67	-64	-48	16	11/10	D
7-151	51-00094	395514	750213	GARDEN STATE RACE TRACK	RACE TRACK	CAMDEN	1944	30	158	-51	-54	-54	--	-42	--	10/29	H
7-162	31-04274	395608	750025	NJ/AMERICAN WC	COLUMBIA 24	CAMDEN	1961	34	112-167	-46	-50	-52	-51	-35	16	11/9	D
7-249	31-02703	394754	750343	CONSUMERS NJ WC	BLACKWOOD DIV 3	RUNNEMEDE	1956	65	426-447	--	--	-86	-86	-63	23	11/3	H
7-252	31-05581	394759	750158	CONSUMERS NJ WC	BLACKWOOD DIV 6	RUNNEMEDE	1971	75	407-477	-73	-84	-81	$^{-85}$-86	-56	30	11/3	H
7-274	31-05226	395030	750347	NJ/AMERICAN WC	OTTERBROOK 39	RUNNEMEDE	1968	60	269-349	-81	-87	-81	-86	-53	33	11/17	H
7-279	31-04798	395238	750317	NJ/AMERICAN WC	HADDON 30	CAMDEN	1965	65	224-275	-76	-72	-77	--	-47	--	11/18	H
7-285	31-03308	395248	750433	NJ/AMERICAN WC	EGGBERT 18	CAMDEN	1958	24	144-191	-63	-64	-64	-58	-42	16	11/18	D
7-293	31-04986	395416	750336	HADDON TWP BD ED	HADDON TWP HS1	CAMDEN	1966	15	142-162	-56	-57	-57	-55	-43	12	10/27	H
7-311	31-04723	394928	750027	NJ/AMERICAN WC	LAUREL 15	RUNNEMEDE	1964	75	395-473	-80	-86	-91	-88	-63	25	11/10	D
7-316	31-05100	395134	750230	NJ/AMERICAN WC	MAGNOLIA 33	RUNNEMEDE	1967	75	271-348	--	-87	-83	-79	-52	27	11/17	D
G 7-322	31-04283	395359	750445	NJ/AMERICAN WC	OAKLYN TEST	CAMDEN	1961	33	101-112	-52	-53	-50	-46	-34	12	11/18	D
7-404	31-03307	395055	750420	NJ/AMERICAN WC	RUNNEMEDE 19	RUNNEMEDE	1958	67	297-339	-78	-83	-82	-75	-50	25	11/17	D
7-410	31-02360	395041	750056	NJ/AMERICAN WC	SOMERDALE 14	RUNNEMEDE	1956	95	441	-90	-95	-94	-93	-63	30	11/17	D
7-422	31-03306	395124	745952	NJ/AMERICAN WC	ASHLAND 17	CLEMENTON	1957	68	379-421	-87	-91	-107	-112	-61	51	11/17	D
7-423	--	395128	745954	NJ/AMERICAN WC	ASHLAND TER 32	CLEMENTON	1966	70	459	--	--	--	--	-61	--	11/17	D
G 7-477	--	394215	745617	US GEOLOGICAL SURVEY	NEW BROOKLYN PARK 2 OBS	WILLIAMSTOWN	1961	111	829-839	-64	-73	-77	-81	-70	11	11/4	D
7-521	31-12301	394742	745931	CLEMENTON BORO WD	CWD 10	CLEMENTON	1978	180	600-629	--	--	-103	-104	-87	17	11/4	D
7-573	--	395355	750738	US GEOLOGICAL SURVEY	COAST GUARD 2	PHILADELPHIA	1966	[6]11	89	--	$^{-8}$-9	-9	-5	-4	1	10/27	D
7-727	31-31110	395455	745924	NJ/AMERICAN WC	RANOLDO TERR KINGSTON 62	MOORESTOWN	1989	40	175-202	--	--	--	-70	-53	17	11/9	D
7-824	31-37826	394636	745845	PINE HILL MUA	PHMUA 4	CLEMENTON	1992	150	590-665	--	--	--	--	-90	--	11/4	H
15-1	31-02889	393913	750517	CLAYTON BORO WD	CLAYTON P-3	PITMAN EAST	1956	133	746-800	-62	-69	-77	-80	-65	15	11/3	H
15-3	31-06676	394015	750559	CLAYTON BORO WD	4-1973	PITMAN EAST	1973	140	670-740	-63	--	-71	-74	-62	12	11/5	D
15-8	51-00101	394628	750813	WOODBURY CITY WD	SEWELL 2A	WOODBURY	1973	21	244-307	$^{-51}$-50	$^{-54}$-53	-61	--	-52	--	11/5	D
15-28	30-00432	394755	751327	EAST GREENWICH TWP WD	EGWD 2	WOODBURY	1956	70	191-216	-21	-23	-23	-27	-24	3	11/9	H
15-60	31-02358	394206	750758	GLASSBORO BORO WD	GWD 3	PITMAN WEST	1955	150	562-612	-60	-70	-66	-70	-63	7	11/2	H
15-63	31-04176	394308	750702	GLASSBORO BORO WD	GWD 4	PITMAN EAST	1961	[5]150	549-599	$^{-63}$-59	-65	-64	-67	-57	10	11/2	D
15-127	31-03280	394346	750959	LEONARD, WM	LEONARD IRR-5	PITMAN WEST	1958	140	524	-46	-49	-50	--	-45	--	11/3	D
15-194	31-05309	394732	751037	MANTUA TWP MUA	MANTUA TMUA 4	WOODBURY	1969	10	230-265	-48	-53	-51	-52	-41	11	11/9	H
15-227	31-04061	394426	750747	PITMAN BORO WD	PWD P3	PITMAN WEST	1960	99	447-487	-60	-64	-71	-68	-62	6	11/3	H
15-240	30-00973	394510	751838	DEL MONTE CORP	DEL MONTE 9	BRIDGEPORT	1963	[5,6]32	190-231	$^{-22}$-20	$^{-21}$-19	$^{-21}$-20	-21	-19	2	11/13	D
15-253	31-04741	394437	750249	WASHINGTON TWP MUA	6(FRIES MLS 1)	PITMAN EAST	1964	152	584-652	-65	-76	-81	-92	-67	25	11/4	D
15-261	31-03913	394520	750218	WASHINGTON TWP MUA	WTMUA 1	RUNNEMEDE	1959	100	581-612	-72	-81	-85	-91	-68	23	11/4	D
15-275	31-00170	394751	750912	WENONAH WD	WENONAH WD 2	WOODBURY	1951	50	268-310	-51	-53	-62	-63	-66	-3	11/6	H
15-276	31-04567	394821	751026	WEST DEPTFORD TWP WD	WDTWD 4	WOODBURY	1963	60	242-289	-39	-44	-46	-48	-40	8	11/2	H
15-281	31-03021	394912	751026	WEST DEPTFORD TWP WD	WDTWD 3	WOODBURY	1957	61	227-243	-35	-40	-37	-38	-30	8	11/2	D
15-303	--	395030	751236	PENNWALT CORP	PENWALT TEST WELL 1	WOODBURY	1969	10	84-114	-6	-8	-9	-8	-7	1	11/10	D
15-330	31-06356	394858	750845	WOODBURY HEIGHTS BORO	1 HELEN AVE	WOODBURY	1972	40	190-235	-44	-50	-49	-47	-38	9	11/4	H
15-339	30-01161	394350	751910	GRASSO, J S	GRASSO FOODS 1	WOODSTOWN	1969	90	247-267	-19	-19	-20	-21	-20	1	11/10	H
15-346	30-01565	394529	751340	TOMARCHIO, ALFRED S	TOMARACHIO IRR	WOODBURY	1977	80	267-343	--	-24	-29	-35	-27	8	11/3	D
15-355	30-01426	394822	751247	EAST GREENWICH TWP WD	EGWD 3	WOODBURY	1977	42	205-245	-28	-30	-28	-28	-29	-1	11/9	D
15-378	--	394523	751610	STATE OF NJ - TURNPIKE AUTH	MAINT 1	BRIDGEPORT	--	[7]105	98	--	--	$^{-26}$-21	-21	-19	2	12/1	D
15-433	31-17801	394631	750517	WASHINGTON TWP MUA	WTMUA 9	RUNNEMEDE	1981	135	512-552	--	-69	-78	-82	-67	15	11/4	H
15-617	30-03533	394637	751916	US GEOLOGICAL SURVEY	SHIVELER UPPER	BRIDGEPORT	1985	31	60-70	--	--	--	-7	-7	0	11/13	D
G 15-728	30-04549	394808	751724	US GEOLOGICAL SURVEY	STEFKA 4 OBS	BRIDGEPORT	1987	4	46-56	--	--	-7	-7	-8	-1	11/5	D
G 15-741	--	394652	751004	US GEOLOGICAL SURVEY	MANTUA SHALLOW OBS	WOODBURY	1986	[7]82	293-313	--	--	$^{-46}$-44	-46	-38	8	11/5	D
15-779	31-26239	395223	751117	US GEOLOGICAL SURVEY	NATIONAL PK #11- OW-BU	WOODBURY	1987	[7]5	25-35	--	--	$^{-5}$-8	-1	-1	0	12/3	D
15-1000	31-21614	394646	750631	ROSE ANGELINI INC	ANGELINI 1	RUNNEMEDE	1984	75	354-359	--	--	-71	-70	-56	14	11/5	D
15-1031	30-03412	394553	751920	MATLACK TRUCKING	MATLACK TRUCKING MW-18	BRIDGEPORT	1984	47	95-105	--	--	-9	-10	-9	1	11/13	D
15-1089	31-37705	395007	750613	DEPTFORD TWP MUA	BOOSTER STA 8	RUNNEMEDE	1991	45	198-258	--	--	--	--	-45	--	11/6	H
15-1105	30-04335	394244	751659	GLOU COUNTY SOLID WASTE COMPLEX	GCSWC 1	WOODSTOWN	1986	145	357-377	--	--	--	-25	-22	3	11/6	D
15-1106	30-07949	395115	751257	AUSIMONT USA INC	PZ-3I	WOODBURY	1991	5	101-111	--	--	--	-14	-14	0	11/10	D
15-1346	30-03764	394826	751611	EM DIAGNOSTIC SYSTEMS INC	EM IRR-1985	BRIDGEPORT	1985	10	60-90	--	--	--	--	-11	--	11/12	D
15-1482	30-12607	394433	752011	WOOLWICH WC	WOOLWICH WC MW-2	WOODSTOWN	1998	100	192-220	--	--	--	--	-15	--	11/6	D
15-1483	30-12606	394433	752012	WOOLWICH WC	WOOLWICH WC MW-1	WOODSTOWN	1998	102	186-216	--	--	--	--	-17	--	11/6	D
15-1513	30-05444	394126	751614	SOUTH HARRISON TWP	SO HARRISON AMBULANCE BD	WOODSTOWN	1989	78	357-367	--	--	--	--	-33	--	11/13	D
21-1	--	401347	743052	SKEBA	1959	ALLENTOWN	1959	125	285-315	--	--	--	--	36	--	10/30	D
21-19	28-05897	401608	743354	EAST WINDSOR MUA	EWMUA 5	HIGHTSTOWN	1966	90	133-181	71	68	69	70	71	1	10/20	D
21-46	28-02489	401119	743810	SANTOSUSSO, J A	SANTOSUSSO DOM	TRENTON EAST	1957	60	138-141	32	--	-70	--	26	--	11/5	D
21-84	48-00063	401622	743129	HIGHTSTOWN BORO WD	HIGHTSTOWN 2	HIGHTSTOWN	1947	[5]84	181-205	^{77}61	54	51	56	57	1	10/21	H
21-103	28-00801	401309	743702	SUBURBAN PROPANE NAT GAS CO	SUBURBAN NATURAL GAS DOM	ALLENTOWN	1953	110	183-186	61	59	58	60	59	-1	10/25	D
23-15	48-00064	401842	743055	ELIZABETHTOWN WC	CTWD 2	HIGHTSTOWN	1917	95	110	59	65	64	67	69	2	11/5	D
23-96	28-07432	402236	742535	HELMETTA WC	6(4-R)	NEW BRUNSWICK	1972	40	32-42	38	37	36	38	38	0	10/28	H
23-98	28-01426	402051	742604	NJ/AMERICAN WC	JAMESBURG 6	JAMESBURG	1954	50	99-120	47	44	41	45	42	-3	10/28	D
23-101	28-07904	402030	742115	MOLDER FISH	1973	FREEHOLD	1973	50	211-223	17	--	11	19	18	-1	10/19	D
23-108	48-00194	402253	742247	DUHERNAL WC	DUHERNAL 13	NEW BRUNSWICK	1947	27	87-107	--	--	--	-15	13	28	10/21	D
23-109	--	402302	742256	DUHERNAL WC	DUHERNAL 26 OBS	NEW BRUNSWICK	1942	24	101	1	-2	-2	-2	16	18	10/21	D
23-142	--	402346	741832	OLD BRIDGE MUA	BROWNTOWN 1	SOUTH AMBOY	--	90	199-249	8	4	9	8	8	0	9/28	H
23-143	--	402347	742038	DUHERNAL WC	DUHERNAL 2 OBS	SOUTH AMBOY	1938	30	81-91	--	5	5	7	6	-1	10/21	D
23-173	--	402406	741620	OLD BRIDGE BD ED	IRA-71	SOUTH AMBOY	1971	60	173-193	-4	-7	-8	1	0	-1	10/19	D
G 23-180	--	402438	742129	DUHERNAL WC	DUHERNAL 1 OBS	SOUTH AMBOY	1938	19	57-67	4	4	4	5	4	-1	10/21	D
23-182	--	402449	741819	BOWNE, CLYDE	BROWNTOWN	SOUTH AMBOY	1932	31	66-71	17	15	13	16	18	2	10/19	D
23-213	28-06470	401847	742345	BARATTA, CARL	BARATTA DOM	JAMESBURG	1968	100	195-198	--	--	--	--	15	--	11/5	D
G 23-228	28-04251	402015	742757	MONROE TWP MUA	FORSGATE 3 OBS	JAMESBURG	1961	[6]147	128-138	66	^{59}58	55	60	62	2	10/27	D
G 23-292	28-04250	402109	743012	MONROE TWP MUA	FORSGATE 2 OBS	HIGHTSTOWN	1961	[5]107	93-104	^{77}76	71	71	72	74	2	10/27	D
G 23-344	--	402558	742013	SAYREVILLE WD	SWD 2 OBS	SOUTH AMBOY	1957	22	31-37	15	13	14	17	16	-1	10/27	D
G 23-351	--	402605	741959	SAYREVILLE WD	SWD 1 OBS	SOUTH AMBOY	--	[5]35	76-82	^{22}20	17	17	20	20	0	10/27	D
23-508	--	401801	743154	DANSER, FRANK	DOM-73	HIGHTSTOWN	1973	105	90	68	65	63	65	66	1	10/20	D
23-565	28-11720	401958	742819	MONROE TWP MUA	ROSSMORE GC 17	JAMESBURG	1980	130	165-197	--	--	--	--	49	--	10/26	D
23-569	29-11861	402738	741700	SAYREVILLE WD	SWD T	SOUTH AMBOY	1982	90	102-132	--	--	--	--	34	--	10/29	D
23-581	28-08423	402734	742037	PARLIN SUPPLY CO	PARLIN SUP IRR	SOUTH AMBOY	1974	80	24-44	--	--	60	--	63	--	9/20	D
23-775	28-11436	401717	742721	SEPTAK, JOHN J	SEPTAK 1	JAMESBURG	1979	120	182-190	--	--	--	--	41	--	11/10	D
23-1156	29-12379	402225	741820	JOCAMA CONSTRUCTION CO	JOCAMA BLDG 3	FREEHOLD	1982	60	230-238	--	--	-4	4	3	-1	12/3	D
23-1159	29-19607	402720	741950	E I DUPONT	PM-8D	SOUTH AMBOY	1987	86	95-105	--	--	42	43	47	4	10/21	D
23-1200	28-17439	401820	742953	MACK PROPERTY NUMBER 12	FIRESTONE WAREHOUSE	JAMESBURG	1986	95	166-176	--	--	--	--	50	--	10/23	D
25-4	28-08915	401047	743527	ALLENTOWN WD	ALLENTOWN WD 2	ALLENTOWN	1975	77	212-262	--	30	0	--	35	--	10/28	H
25-13	29-07461	401137	740121	AVON WD	AVON BY THE SEA WD 4	ASBURY PARK	1974	29	1,105-1,165	-16	-27	-29	-15	-17	-2	10/20	H
25-37	29-04068	401607	741209	HOMINY HILLS GOLF CLUB	GLF CLB 2-1963	MARLBORO	1963	137	686-706	-30	-35	-30	-14	-18	-4	10/20	H
25-56	28-05400	401744	742135	ENGLISHTOWN BORO WD	ENGLISHTOWN 2	FREEHOLD	1965	70	363-384	9	1	18	16	12	-4	10/23	H
25-62	29-03492	401134	741014	ROKEACH AND SONS CO	ROKEACH & SNS 4-DEEP	FARMINGDALE	1961	[5]80	831-885	$^{-25}$-20	-31	-29	-11	-15	-4	10/21	D
25-91	29-05708	401516	741530	BROCKWAY GLASS	BROCKWAY 2	FREEHOLD	1969	140	632-685	-38	-47	-34	-13	-15	-2	11/16	D
25-97	29-04708	401625	741501	FREEHOLD TWP WD	6-OLD SO.GULF2	FREEHOLD	1966	195	596-656	-42	-47	-38	-19	-23	-4	10/22	D
25-103	29-07494	401646	741737	FREEHOLD TWP WD	7-74	FREEHOLD	1974	[8]107	478-575	-53	-36	-39	$^{-6}$-14	-17	-3	10/22	H
25-112	29-03096	402537	740933	SHORELANDS WC	W KEANSBURG 2	KEYPORT	1960	[6]44	312-352	-40	$^{-36}$-35	-39	-13	-12	1	10/19	D
25-116	29-03509	402400	735912	HIGHLANDS WD	HWD 2 NEW	SANDY HOOK	1961	10	600-660	-15	-18	-16	--	-4	--	10/23	D
25-121	29-03033	402023	741100	PENNWALT CORP	1 (PENNWALT)	MARLBORO	1960	80	560-590	-26	-33	-35	-15	-17	-2	11/2	D
25-154	29-04207	402445	741019	SHORELANDS WC	W KEANSBURG 3	KEYPORT	1964	73	400-430	-39	-35	-38	-12	-13	-1	10/19	D
25-195	29-01297	402621	740743	KEANSBURG MUA	KWD 5A	KEYPORT	1954	[6]15	290-350	--	$^{-40}$-35	-32	-21	-18	3	10/19	H
25-197	29-08379	402535	741214	KEYPORT BORO WD	KEYPORT 7	KEYPORT	1976	35	304-354	-27	-26	-25	-10	-10	0	10/20	D
G 25-206	--	402625	741145	KEYPORT BORO WD	KEYPORT 4 OBS	KEYPORT	1939	[5]14	225-249	$^{-14}$-13	-14	-15	-3	-4	-1	10/19	D
25-214	28-07184	401429	742146	UNITED WATER MANALAPAN	LAMBS RD 1	ADELPHIA	1971	190	585-641	-6	-5	--	--	3	--	11/10	H
25-218	--	401557	742318	BOY SCOUTS OF AMERICA	QUAIL HILL 2	JAMESBURG	1967	250	510-527	20	13	12	--	22	--	10/22	D
25-220	28-06114	401537	742012	BATTLEGROUND COUNTRY CLUB	BATTLEGROUND CC IRR	FREEHOLD	1967	120	539-569	-21	-29	-29	-10	-13	-3	10/20	H
25-244	29-05790	401848	741504	GORDONS CORNER WC	GORDONS 7	FREEHOLD	1969	[5,6,7,8]170	524-594	$^{-35}$-25	$^{-43}$-33	$^{-48}$-38	$^{-20}$-10	-16	-6	10/23	D
25-259	29-00073	402035	741423	MARLBORO STATE HOSPITAL	STATE HOSP 12	MARLBORO	1950	155	508-593	-18	-26	-27	-5	-5	0	11/3	D
25-284	29-01731	402515	741450	MATAWAN BORO WD	MATAWAN BORO 3	KEYPORT	1956	90	231-271	-7	-7	-11	4	4	0	10/19	D
25-288	29-05350	402349	741232	ABERDEEN TWP MUA	MATAWAN MUA 3	KEYPORT	1967	83	345-425	-31	-33	-36	-11	-14	-3	10/23	D
25-303	29-05164	402106	740810	BAMM HOLLOW COUNTRY CLUB	BHCC 1	MARLBORO	1966	70	527-600	--	--	-61	-19	-14	5	10/21	D
G 25-316	29-04299	402536	735905	STATE OF NJ	SANDY HOOK SP1 OBS	SANDY HOOK	1965	11	371-397	-5	-4	-9	-2	-1	1	10/19	D
25-322	28-01842	401157	742418	RESTINE, P J	RESTINE 1	ROOSEVELT	1956	210	667-697	4	-2	-4	7	7	0	12/14	D
25-334	29-00137	401214	740355	NJ/AMERICAN WC	JUMPING BR 4 [9](25-333)	ASBURY PARK	1951	23	1,013-1,065	-21	-37	-37	[#]-17	-29	-12	10/30	D
25-358	29-00079	402047	740420	RED BANK BORO WD	1B-1950/RB 4	LONG BRANCH	1950	40	637-687	-29	-33	-37	$^{-19i}$-22	-25	-3	11/25	D
25-362	28-02219	401312	742802	ROOSEVELT WD	ROOSEVELT 3	ROOSEVELT	1956	198	442-472	28	30	28	39	36	-3	11/16	D
25-436	29-06193	400952	740725	BRISBANE CHILD TREATMENT CTR	1 (OLD 3-1971)	ASBURY PARK	1971	60	990-1,033	-26	-41	-43	-17	-21	-4	10/20	D
25-459	29-09335	402219	740337	NAVESINK, CC	1--78	LONG BRANCH	1978	80	551-612	-23	-24	-25	-15	-19	-4	10/21	H
25-493	29-07784	401231	741127	HOWELL TWP MUA	1-1975/YELLOW BRK WELL	FARMINGDALE	1975	[6]115	860	--	$^{-20}$-35	-38	-17	-19	-2	10/29	D
25-496	29-10478	402441	740233	ATLANTIC HIGHLAND WD	AHWD 4	SANDY HOOK	1980	[6,7]10	510-543	--	$^{-18}$-23	$^{-19}$-24	--	-4	--	10/22	H
25-500	28-12215	400849	743403	COLLINS	COLLINS IRR	ALLENTOWN	1981	88	270-305	--	4	0	--	4	--	10/28	D
25-502	29-11033	401411	741608	FREEHOLD TWP WD	FREEHOLD WD 8	ADELPHIA	1981	125	616-671	--	-51	-43	--	-20	--	10/22	D
25-509	28-12280	401315	742810	ROOSEVELT WD	ROOSEVELT 4	ROOSEVELT	--	170	390-430	--	29	27	36	36	0	10/23	H
25-513	29-11230	402442	740242	ATLANTIC HIGHLAND WD	AHWD 5	SANDY HOOK	1981	[8]15	506-548	--	--	--	-8	-4	4	10/22	D
25-514	29-12732	402641	740911	INT FLAVORS & FRAGRANCE	IFF-2R	KEYPORT	1983	14	266-312	--	-26	-27	-15	-9	6	10/20	D
25-550	29-13610	401258	741629	FREEHOLD TWP WD	FREEHOLD TWP WD 9 OBS	ADELPHIA	1984	105	636-656	--	--	-39	-12	-16	-4	10/22	D
25-567	29-15851	402630	741029	US GEOLOGICAL SURVEY	UB WATER TOWER	KEYPORT	1986	10	250-270	--	--	-23	-9	-7	2	10/19	D
25-568	29-16343	402652	741100	US GEOLOGICAL SURVEY	JCP&L	KEYPORT	1986	10	245-265	--	--	-12	-2	3	5	10/20	D
G 25-639	29-18403	401105	741202	US GEOLOGICAL SURVEY	HOWELL TWP 5 OBS	FARMINGDALE	1988	112	891-901	--	--	-35	-16	-19	-3	10/21	D
25-721	29-15170	401131	740518	NJ/AMERICAN WC	MCWC 1 GONDOLA RSVR	ASBURY PARK	1985	130	999-1,149	--	--	--	--	-17	--	10/23	D
25-724	29-17817	401927	741624	GORDONS CORNER WC	GCWC 9-A RIVER RD	FREEHOLD	1987	[8]130	446-551	--	--	--	$^{-21}$-12	-18	-6	10/23	H
25-726	29-24703	401412	741604	FREEHOLD TWP WD [9](25-81)	KOENIG LANE T PLANT 13	ADELPHIA	1991	130	584-673	--	--	--	[#]-15	-19	-4	10/22	D
25-729	29-21611	401904	740702	NJ/AMERICAN WC	SWIMMING R RES TP 2	LONG BRANCH	--	35	575-655	--	--	--	-17	-18	-1	10/23	D
25-749	48-00045	400844	743225	CREAM RIDGE GOLF COURSE	CRM RDGE GC 1	ALLENTOWN	--	100	350	--	--	--	--	0	--	11/16	D
29-70	33-01159	395905	740359	NJ/AMERICAN WC	MONTEREY 1	SEASIDE PARK	1967	5	1,375-1,495	-21	-28	-26	-22	-27	-5	10/28	H
29-100	33-00360	395956	740344	NJ/AMERICAN WC	NORMANDY 3	SEASIDE PARK	1954	8	1,428-1.479	-18	-27	-24	-21	-23	-2	10/23	D
29-134	29-03570	400330	741945	JACKSON TWP MUA	SCM 1	LAKEHURST	1961	[5,6,7]105	846-962	$^{-24}$-14	$^{-28}$-18	$^{-31}$-21	-33	-42	-9	10/27	H
29-238	28-08229	400824	742630	JACKSON TWP MUA	JACKSON 7	ROOSEVELT	1974	130	584-648	-10	-4	-8	-5	-14	-9	10/27	H
29-504	29-03142	400210	740310	NJ/AMERICAN WC	MANTOLOKING 7	POINT PLEASANT	1960	5	1,263-1,368	-18	-27	-25	-18	-22	-4	10/28	H
29-531	29-03345	400454	740414	POINT PLEASANT BORO WD	PPWD 5	POINT PLEASANT	1960	18	1,256-1,342	-19	-33	-29	-18	-25	-7	10/23	H
29-577	33-05553	395741	740437	LAVALLETTE WD	LAVALLETTE BORO WD 5	SEASIDE PARK	1978	7	1,394-1,498	--	-22	-20	-20	-21	-1	10/26	H
29-1040	29-23401	400041	741519	MANCHESTER TWP MUA	MTMUA 10	LAKEHURST	1989	38	1,013-1,184	--	--	--	-27	-38	-11	10/27	D
29-1365	33-37776	395634	740441	SEASIDE HEIGHTS BORO WD	SEASIDE HGHTS WD-7	SEASIDE PARK	1998	4	1,389-1,580	--	--	--	--	-27	--	10/28	D
29-1380	29-39030	400036	741935	LAKEHURST BORO WC	LAKEHURST BORO 14	LAKEHURST	1998	65	937-1,024	--	--	--	--	-32	--	12/2	D
33-74	30-01151	394241	752201	OLDMANS TWP WD	1 (AUBURN W C)	WOODSTOWN	1968	80	185-206	--	--	-13	-13	-13	0	12/16	H
33-76	30-00661	394328	752446	DAWSON, H W	DAWSON 1	PENNS GROVE	1957	27	118-123	3	0	2	1	1	0	11/16	D
33-111	30-01253	393746	752955	PENNSVILLE TWP WD	HOOK RD OBS	PENNS GROVE	1971	10	190-235	-14	-15	-17	-19	-20	-1	11/18	D
G 33-253	--	393348	752755	US GEOLOGICAL SURVEY	SALEM 3 OBS	SALEM	1965	3	335-340	-22	-23	-27	-28	-27	1	11/9	D
G 33-342	--	394236	752724	STATE OF NJ	PENNS GROVE 24	PENNS GROVE	1941	18	46-51	-5	1	-1	-1	3	4	11/9	D
33-355	--	393914	751930	WOODSTOWN ICE CO	C1	WOODSTOWN	1927	58	360	-29	-22	-24	-17	-24	-7	11/10	D
33-361	30-01815	394205	752700	PENNS GROVE WSC	SCHULTES 4	PENNS GROVE	1978	13	44-54	-9	-8	-9	-6	1	7	11/18	D
33-671	30-05148	393954	753013	PENNSVILLE TWP WD	PTWD 3A	WILMINGTON SO	1988	7	87-102	--	--	--	--	-7	--	11/16	D
33-686	30-08335	393749	753149	PENNSVILLE TWP WD	PTWD 4A RPL	WILMINGTON SO	1992	10	110-130	--	--	--	-10	-7	3	11/18	D
33-841	35-17766	393055	750835	STATE OF NJ	PARVIN SP 1 OBS (OW A)	ELMER	1997	75	1,005-1,025	--	--	--	--	-48	--	11/9	D
33-933	30-12200	393845	751909	WOODSTOWN BORO	WOODSTOWN BORO WD 5	WOODSTOWN	1998	48	535-670	--	--	--	--	-33	--	11/9	D
Pennsylvania wells																	
P10116	--	395443	750832	S A F AMERICA INC	PH 752 - SAFA 13	PHILADELPHIA	1979	9	60-75	--	--	-6	--	-6	--	11/3	D
Delaware wells (Magothy aquifer)																	
Ea45-04	100389	393133	754559	TIDEWATER	--	ELKTON	1994	40	85-105	--	--	--	--	-5	--	12/2	D
G Eb23-22	46613	393316	754216	US GEOLOGICAL SURVEY	8-C-D	ST GEORGES	1980	60	101-105	--	--	--	--	34	--	11/5	D
Eb43-10	68944	393104	754250	TIDEWATER	CR 896	ST GEORGES	1987	72	210-230	--	--	--	--	-28	--	12/2	D
Eb51-11	80899	393025	754415	--	--	ST GEORGES	1990	48	161-177	--	--	--	--	-26	--	12/2	D
Fa15-07	83639	392931	754542	TIDEWATER	WHEAT 2	CECILTON	1999	65	190-210	--	--	--	--	-17	--	12/2	D
Fb11-10	157175	392923	754428	ARTESIAN	1 OBS	MIDDLETOWN	1998	70	200-230	--	--	--	--	-25	--	11/12	D
G Gd33-05	GD33-05	392212	753242	SHELL OIL	VOGEL 2	SMYRMA	1961	18	628-660	--	--	--	--	-11	--	11/4	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.

[9] Well in which the water-level altitude was measured during a previous synoptic study.
Both wells are at the same site in the same aquifer.

[#] Water-level altitude measured in a previous study, but in a different well.

Table 9-1. Water-level data for wells screened in the Middle and undifferentiated Potomac-Raritan-Magothy aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; BORO, Borough; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WD, Water Company; NJ, New Jersey; DEL, Delaware; CO, Company; CORP, Corporation; WMC, Water Commission; DEPT, Department; DEP, Department of Environmental Protection; SERV, Service; U, well in undifferentiated part of the Potomac-Raritan-Magothy aquifer system; G, Indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shut-down period
New Jersey wells																	
U 1-1221	35-14298	393124	745527	BUENA BORO MUA	SEWER PLANT INJ 1	BUENA	1993	100	1,532-1,980	--	--	--	-50	-43	7	11/19	D
				Chloride concentration in water sample from well 1-1221 is 10,000 mg/L. Water density is 1.007 g/cm^3. Fresh water equivalent head is						--	--	--	-37	-30	7	11/19	D
G 5-63	--	400213	745108	WILLINGBORO MUA	WILLINGBORO 1 OBS	BRISTOL	1965	45	284-294	-16	-16	-21	$^{-22i}$-21	-21	0	10/30	D
5-70	27-05259	400313	745004	BURLINGTON TWP WD	BURLINGTON WD TEST 1	BRISTOL	1970	60	140-200	-13	-11	-16	--	-16	--	11/4	D
5-84	--	400342	744948	MASONIC HOME	MASONIC 1	BRISTOL	1921	^{5}60	174-194	^{8}-11	-10	-16	-14	-12	2	10/27	H
5-87	27-03694	400407	745246	TENNECO CHEMICALS	TENNECO 5-OBS	BEVERLY	1961	10	50-60	--	-8	-13	-9	-11	-2	10/29	D
5-114	28-02901	400606	743923	DEMARCO, RALPH	DEMARCO	COLUMBUS	1958	85	388-392	-7	-8	-12	-13	-11	2	11/12	D
U 5-119	28-04082	400821	743845	CARLILE FARM	WILKENS FARM 1	TRENTON EAST	1961	100	305	--	--	--	--	8	--	11/19	D
5-122	28-05042	400941	744017	WAGNER CORRECTIONAL FACILITY	NJSR 5	TRENTON EAST	1964	75	337-367	4	0	-1	-4	0	4	11/9	H
5-126	31-04276	395929	745922	NJ/AMERICAN WC	DVWC 12-POMONA	MOORESTOWN	1961	73	157-196	-8	$^{-17i}$-15	-16	-16	-15	1	11/9	D
5-145	27-02821	400110	745713	HOLY CROSS HIGH SCHOOL	HOLLY CROSS HS	BEVERLY	1958	70	154-174	2	1	-3	2	6	4	10/27	D
5-206	28-03595	400325	744456	CARTY, RONALD	RALPH PARKER	COLUMBUS	1959	62	370-380	-24	-25	-23	-29	-27	2	11/12	D
5-214	--	400531	744430	WALDER, THOMAS	WALDER IRR	COLUMBUS	--	60	319	-10	--	-13	-12	-12	0	12/4	D
5-232	31-06020	395727	745915	MAPLE SHADE WD	MSWD 8	MOORESTOWN	1972	20	210-270	-29	-35	-33	-35	-30	5	11/10	H
G 5-261	--	395525	745025	US GEOLOGICAL SURVEY	MEDFORD 5 OBS	MOUNT HOLLY	1967	73	740-750	-48	-58	-61	-62	-51	11	10/30	D
5-265	31-04727	395702	745808	MOORESTOWN TWP WD	MOORESTOWN WD 6	MOORESTOWN	1963	42	248-288	-38	-47	-47	--	-36	--	10/26	D
5-268	--	395751	745832	MARLAC ELECTRONICS	MARLAC ELEC - LAYNE 1	MOORESTOWN	1960	70	288	-30	-35	-39	-38	-31	7	11/5	D
5-273	31-04770	395835	745643	MOORESTOWN FIELD CLUB	FIELD CLUB 1	MOORESTOWN	1964	70	274-302	-27	-29	-32	-33	-26	7	11/3	H
5-284	31-03806	395936	745452	MOORESTOWN TWP WD	MTWD 4	MOORESTOWN	1959	^{5,6,7}62	298-338	$^{-26}$-23	$^{-32}$-29	$^{-31}$-28	--	-28	--	10/26	H
5-290	31-06674	395936	744655	MOUNT HOLLY WC	MHWC 6	MOUNT HOLLY	1973	15	545-615	-55	-57	-63	-60	-48	12	11/20	H
5-297	31-01610	395525	745416	RUDDEROW, J E	SPRING VALLEY	MOORESTOWN	1954	48	441-457	--	--	-71	-69	-57	12	11/3	D
U 5-330	52-00008	395949	743655	US ARMY	FORT DIX 4	BROWNS MILLS	1943	140	1,056-1,086	-49	-51	-65	-65	-59	6	10/29	D
U 5-332	48-00269	400106	743720	US ARMY	FORT DIX 5	NEW EGYPT	1969	150	1,064-1,104	-39	-42	-52	-51	-39	12	10/29	H
U 5-333	32-07668	400129	743656	US ARMY	FORT DIX 2	NEW EGYPT	1941	131	1,030-1,051	-47	-48	-61	--	-46	--	10/29	D
U 5-336	28-00795	400150	743428	US AIR FORCE	MCGUIRE C	NEW EGYPT	1953	^{7}105	1,036-1,089	--	--	$^{-58}$-55	-63	-53	10	10/29	D
5-340	28-03943	400300	743514	US AIR FORCE	MCGUIRE B	NEW EGYPT	1960	^{5}130	780-835	$^{-32}$-28	-30	-34	-32	-26	6	10/29	D
5-385	32-03778	395839	744249	SYBRON CHEMICAL INC	IONAC CHEM 5	PEMBERTON	1977	30	747-823	--	-52	-61	-70	-52	18	12/15	H
U 5-388	52-00009	395939	743742	US ARMY	FORT DIX 6	PEMBERTON	1970	160	1,090-1,140	-42	-47	-62	-50	-52	-2	11/2	D
U 5-436	--	400118	744010	HELIS, WM G	STOCK FARM 1	COLUMBUS	1928	96	757-800	--	--	-51	-42	-33	9	11/9	D
UG 5-440	28-05128	400242	744223	GOODWIN, FRED	RHODIA 1 OBS	COLUMBUS	1964	72	603-613	-29	-29	-36	-35	-30	5	10/21	D
5-634	47-00001	400041	744809	MOUNT HOLLY WC	MHWC 5	BRISTOL	1965	55	516	-56	-58	-60	-64	-77	-13	11/20	H
5-683	--	395122	743017	US GEOLOGICAL SURVEY	BUTLER PLACE 1 OBS	CHATSWORTH	1964	141	2,102-2,117	-30	-34	-42	-39	-32	7	10/26	D
5-726	28-08443	400213	743653	WRIGHTSTOWN MUA	WMUA 3	NEW EGYPT	1974	140	667-726	--	--	-41	-36	-37	-1	11/6	H
5-749	31-07140	395508	745539	RAMBLEWOOD COUNTRY CLUB	3 TEE	MOORESTOWN	--	75	425	-60	-69	-75	-73	-61	12	10/26	D
5-801	27-06877	400020	750114	TEXACO CO	OW 10	FRANKFORD	1980	20	5-25	--	0	-1	-4	-3	1	10/27	D
5-1089	27-08534	400201	745307	WILLINGBORO MUA	WMUA 10	BEVERLY	1986	19	176-251	--	--	--	-25	-35	-10	11/2	H
5-1158	28-28844	400316	744334	COLUMBUS FARMERS MARKET	COLUMBUS FM 1992 DEEP	COLUMBUS	1992	45	450-460	--	--	--	-28	-24	4	11/3	H
5-1172	28-20985	400713	744527	MERSHON, RANDOLPH	MERSHON COM-1989	BRISTOL	1989	42	270-290	--	--	--	--	1	--	10/29	D
5-1184	27-12174	400701	744833	FLORENCE TWP WD	FTWD 1 OBS	BRISTOL	1992	30	110-120	--	--	--	2	-2	-4	10/29	D
5-1484	27-14624	400250	745320	WILLINGBORO MUA	WMUA 5-1998 ^{9}(5-667)	BEVERLY	1998	39	215-253	#-11	#-16	#-17	#-22	-17	5	11/2	D
5-1494	27-07548	400414	744650	BURLINGTON COUNTY	BURL CO LF 4W	BRISTOL	1983	44	150	--	--	--	--	-6	--	10/27	D
7-48	31-00013	395527	750646	CAMDEN CITY WD	CITY 6N	CAMDEN	1948	14	111-135	-26	-26	-20	-18	-11	7	11/5	D
7-124	31-07020	395252	745943	NJ/AMERICAN WC	BROWNING 45	MOORESTOWN	1973	77	483-626	-77	-84	-92	-85	-55	30	11/17	D
7-132	31-05095	395353	745708	NJ/AMERICAN WC	OLD ORCHARD C	MOORESTOWN	1967	71	500	-82	-81	-81	--	-53	--	11/28	D
7-135	31-05218	395353	745708	NJ/AMERICAN WC	OLD ORCHARD 38	MOORESTOWN	1968	72	443-493	--	--	-73	-81	-50	31	11/23	D
7-142	31-04098	395438	750107	NJ/AMERICAN WC	ELLISBURG 23	CAMDEN	1960	32	321-378	--	--	-66	-64	-48	16	11/10	D
7-186	--	394950	745855	NJ/AMERICAN WC	GIBBSBORO 3 OBS	CLEMENTON	1969	70	680	-77	-84	-88	-89	-64	25	11/10	D
7-304	31-05108	395404	750202	HADDONFIELD BORO WD	LAKE ST WELL	CAMDEN	1967	50	307-372	--	--	-72	-75	-56	19	10/29	D
7-329	31-04836	395628	750406	MERCHANTVILLE PENNSAUKEN WCM	BROWNING 2A/BROWNING 1	CAMDEN	1965	^{5}16	110-140	$^{-32}$-36	-31	-34	-29	-21	8	11/4	H
G 7-413	31-04561	394922	745630	NJ/AMERICAN WC	ELM TREE 3 OBS	CLEMENTON	1963	149	706-717	-69	-78	-82	-85	-66	19	11/4	D
UG 7-476	--	394215	745617	US GEOLOGICAL SURVEY	NEW BROOKLYN PARK 1 OBS	WILLIAMSTOWN	1960	111	1,485-1,495	-46	-53	-57	-58	-49	9	10/4	D
7-534	--	395553	750207	GARDEN STATE RACE TRACK	GARDEN ST RA 2	CAMDEN	--	40	198-219	--	-48	-49	-45	-38	7	10/29	H
7-726	31-31111	395455	745924	NJ/AMERICAN WC	RANOLDO TERR KINGSTON 59	MOORESTOWN	1989	40	276-422	--	--	--	-70	-53	17	11/9	D
7-733	31-40817	395127	750233	NJ/AMERICAN WC	HIGHLAND & WALNUT OW-64	RUNNEMEDE	1993	75	452-535	--	--	--	-82	-53	29	11/17	D
7-734	31-40970	395140	750327	NJ/AMERICAN WC	TRENTON & SECOND OW-63	RUNNEMEDE	1993	60	333-499	--	--	--	--	-49	--	11/18	D
UG 11-137	--	392514	745217	DE ROSA, SAM	RAGOVIN 2100 OBS	DOROTHY	1964	85	2,083-2,093	-37	-43	-49	-53	-55	-2	11/19	D
				Chloride concentration of water sample from well 11-137 is 11,000 mg/L. Water density is 1.011 g/cm^3. Fresh water equivalent head is						-16	-22	-28	-31	-34	-3	11/19	D
15-24	31-05513	395115	750706	DEPTFORD TWP MUA	DTMUA 4	RUNNEMEDE	1971	40	282-345	-48	-50	-46	$^{-39i}$-40	-31	9	11/6	D
15-135	30-01314	394516	752241	SHELL OIL CO	WELL 8A OBS	MARCUS HOOK	1972	^{6}7	130-180	--	^{4}-1	-2	-2	-3	-1	11/12	D
15-140	30-01248	394608	752135	PURELAND INDUSTRIAL COMPLEX	PURELAND TEST WELL 4	BRIDGEPORT	1970	^{5,6}6	132-184	^{0}2	^{1}-1	-2	-11	-2	9	11/12	D
15-213	30-00602	394947	751416	PAULSBORO BORO WD	PWD 5	WOODBURY	1957	10	135-175	-10	-10	-10	-10	-10	0	11/9	H
15-236	30-01177	394434	751843	SWEDESBORO BORO WD	SBWD 3	WOODSTOWN	1969	75	241-312	-21	-20	-22	-12	-20	-8	11/6	H
15-279	30-00916	394857	751250	HUNTSMAN POLYPROPYLENE CORP	SHELL 7 OBS	WOODBURY	1962	17	315-320	-23	-24	-26	-26	-25	1	11/6	D
15-348	30-01776	394910	751541	GREENWICH TWP WD	GTWD 6	BRIDGEPORT	1978	20	105-135	-9	-10	-11	-10	-10	0	11/12	H
15-359	--	395015	751727	E I DUPONT	C POWER 22	BRIDGEPORT	--	5	103	1	2	0	0	-1	-1	10/27	D
15-374	31-13385	394843	750728	DEPTFORD TWP MUA	DTMUA 6	RUNNEMEDE	1979	50	430-486	--	-65	-63	-63	-50	13	11/6	D
15-415	31-14478	394834	751044	WEST DEPTFORD TWP WD	TEST 8-79	WOODBURY	1979	40	287-307	--	-42	-39	-42	-34	8	11/2	H
15-444	30-02032	394756	752344	MONSANTO CHEM	7D	MARCUS HOOK	1979	16	65-70	--	--	--	--	-8	--	11/13	D
15-569	30-02405	394529	752045	NJ/AMERICAN WC	PURLAND WC 3	BRIDGEPORT	1981	32	161-201	--	--	-12	-9	-8	1	11/23	H
15-585	30-02522	394704	752058	SAFETY-KLEEN INC	DP5	BRIDGEPORT	1981	8	79-89	--	--	$^{-1i}$1	1	-1	-2	11/12	D
15-616	30-03532	394637	751916	US GEOLOGICAL SURVEY	SHIVELER MIDDLE	BRIDGEPORT	1985	31	230-240	--	--	-8	-8	-8	0	11/13	D
15-620	30-03677	394804	751933	US GEOLOGICAL SURVEY	GAVENTA MIDDLE 1	BRIDGEPORT	1985	7	131-141	--	--	2	^{5i}2	1	-1	11/12	D
15-679	30-03624	394946	751612	VALERO REFINING CO OF NJ	W-5D	BRIDGEPORT	1985	10	118-128	--	--	-3	-7	-5	2	11/16	D
G 15-713	30-04348	394808	751724	US GEOLOGICAL SURVEY	STEFKA 2 OBS	BRIDGEPORT	1986	6	125-155	--	--	-8	-7	-7	0	11/5	D
15-727	30-04548	394808	751724	US GEOLOGICAL SURVEY	STEFKA 3 OBS	BRIDGEPORT	1987	5	195-205	--	--	-8	-8	-8	0	11/5	D
15-771	31-26243	395202	751115	US GEOLOGICAL SURVEY	NATIONAL PARK 2-PW-M	WOODBURY	1987	10	92-123	--	--	-6	-3	-4	0	11/12	D
15-780	31-26244	395223	751117	US GEOLOGICAL SURVEY	NATIONAL PK 10-OW-BM	WOODBURY	1987	5	75-85	--	--	-2	-5	-4	1	12/3	D
15-998	--	394031	750605	US GEOLOGICAL SURVEY	USGS CLAYTON 1 OBS	PITMAN EAST	1988	141	820-837	--	--	-64	--	-56	--	11/5	D
15-1036	31-22504	394733	750812	DEPTFORD TWP MUA	DTMUA 7	WOODBURY	1985	60	259-319	--	--	--	-63	-51	12	11/6	H
15-1122	30-07015	395042	751419	BP OIL CO	BP R-9-A	WOODBURY	1990	14	45-90	--	--	--	--	-3	--	11/9	D
15-1176	31-43251	394932	751018	WESTWOOD GOLF CLUB	WWOOD GOLF COURSE DEEP 1	WOODBURY	1994	60	174-184	--	--	--	--	-11	--	11/4	H
15-1484	30-12608	394434	752012	WOOLWICH WC	WOOLWICH WC MW-3	WOODSTOWN	1998	104	280-300	--	--	--	--	-14	--	11/6	D
15-1485	31-48720	395036	750842	WOODBURY CITY WD	WCWD 6A/RB-8 ^{9}(15-431)	WOODBURY	1997	30	160-306	--	#-46	--	#-39	-33	6	11/5	H
15-1504	30-12671	394527	751540	SOUTH JERSEY WC	SJWC 3 OBS	BRIDGEPORT	1998	92	458-478	--	--	--	--	-29	--	12/16	D
21-12	28-07034	401536	742920	EAST WINDSOR MUA	6 TWIN RIVERS	JAMESBURG	1971	115	520-560	28	27	23	25	37	12	10/20	H
21-22	28-05440	401702	743106	EAST WINDSOR MUA	EWMUA 3	HIGHTSTOWN	1965	100	337-367	47	42	32	38	44	6	10/20	D
21-25	28-01262	401717	743352	SHISE 100 CORP	KENTILE 1	HIGHTSTOWN	1954	100	205-226	65	64	67	64	64	0	10/21	D
21-43	28-05409	401103	744155	BORDENTOWN CITY WD	WHITE HORSE 2	TRENTON EAST	1965	10	118-138	-4	6	8	8	7	-1	11/10	H
21-54	28-04602	401305	743921	CONSUMERS NJ WC	ROBERT FROST 10	TRENTON EAST	1962	85	194-243	--	--	38	40	39	-1	11/6	D
21-73	28-02927	401419	744007	CONSUMERS NJ WC	PAXSON AVE 9	TRENTON EAST	1958	80	128-144	--	--	42	47	40	-7	11/6	H
21-101	28-06030	401238	743448	PRINCETON MEMORIAL PARK	MEMORIAL PK1	ALLENTOWN	1966	135	366-421	30	36	35	38	37	-1	10/28	D
21-120	28-05368	401555	743704	ELIZABETHTOWN WC	JEFFERSON PK 1	HIGHTSTOWN	1965	80	96-121	77	75	63	--	74	--	11/5	H
21-122	28-06455	401544	743659	ELIZABETHTOWN WC	JEFFERSON PK 2	HIGHTSTOWN	1968	75	75-126	--	--	--	--	67	--	11/5	H
23-9	28-00180	401800	743206	DANSER, FRANK	IRR-1950	HIGHTSTOWN	1950	100	250-280	71	67	64	67	67	0	10/20	D
23-16	28-07800	401842	743055	ELIZABETHTOWN WC	CTWD 1A	HIGHTSTOWN	1972	95	230-260	66	60	58	62	64	2	11/5	H
23-17	28-04589	401843	743055	ELIZABETHTOWN WC	CTWD 3	HIGHTSTOWN	1963	98	268-298	67	61	60	--	65	--	11/5	H
23-57	28-01202	402441	742448	EAST BRUNSWICK TWP WD	COLONIAL OAKS	NEW BRUNSWICK	1954	122	216-241	-28	-21	-20	10	4	-6	10/19	D
23-70	--	402555	742719	WEISS, ABE	FISCHER OBS	NEW BRUNSWICK	1936	73	0-21	57	56	56	57	57	0	10/27	D
23-94	48-00242	402239	742530	HELMETTA WC	5-1962 (OLD#2)	NEW BRUNSWICK	1962	60	183-193	13	27	20	32	25	-7	10/28	D
G 23-97	--	402247	742503	DUHERNAL WC	DUHERNAL 49F OBS	NEW BRUNSWICK	1946	39	236-301	2	2	6	29	27	-2	10/21	D
23-106	--	402251	742248	DUHERNAL WC	DUHERNAL 32 OBS	NEW BRUNSWICK	1944	27	132	--	--	--	4	13	9	10/21	D
23-107	--	402252	742246	DUHERNAL WC	DUHERNAL 54F OBS	NEW BRUNSWICK	1946	28	311-334	--	--	--	--	8	--	10/21	D
23-132	--	402335	742136	DUHERNAL WC	DUHERNAL 56F OBS	SOUTH AMBOY	1947	25	262-267	-44	-38	-36	-3	4	7	10/21	D
23-147	29-04998	402350	741840	OLD BRIDGE MUA	BROWNTOWN 4	SOUTH AMBOY	1966	80	425-475	--	-79	-65	-16	-18	-2	10/20	D
23-171	48-00208	402404	742204	DUHERNAL WC	DUHERNAL BF	SOUTH AMBOY	1946	^{5}20	240-300	$^{-53}$-48	-44	-44	-8	-11	-3	9/22	D
23-176	29-06429	402407	741924	OLD BRIDGE MUA	1-1972 OBS	SOUTH AMBOY	1972	45	321-363	-61	-53	-66	-14	-20	-6	10/18	D
23-194	--	402536	742018	PERTH AMBOY WD	RUNYON 1 OBS	SOUTH AMBOY	1930	18	201-281	-76	-46	-59	-8	-14	-6	10/27	D
23-206	29-00768	402700	741454	OLD BRIDGE MUA	LAWRENCE HAR 9	KEYPORT	1953	60	360-395	-75	-78	-86	-31	-25	6	10/20	D
G 23-229	28-04252	402015	742757	MONROE TWP MUA	FORSGATE 4 OBS	JAMESBURG	1961	^{6}147	319-330	58	^{52}51	48	55	57	2	10/27	D
G 23-273	--	401932	743529	STATE OF NJ	PLAINSBORO POND OBS	HIGHTSTOWN	1970	76	70-75	--	--	--	47	47	0	10/27	D
G 23-291	28-04249	402109	743013	MONROE TWP MUA	FORSGATE 1 OBS	HIGHTSTOWN	1961	107	192-203	73	65	64	67	70	3	10/27	D
23-306	28-06538	402147	742847	PHELPS DODGE CO	PHELPS DODGE 3	JAMESBURG	1968	120	201-207	75	69	69	72	76	4	10/23	D
23-365	--	402633	742120	DUHERNAL WC	DUHERNAL SAY 4 OBS	SOUTH AMBOY	1931	6	148-160	-52	-43	-51	-9	-14	-5	10/27	D
23-380	48-36510	402659	742020	HERCULES POWDER CO	HERCULES 2-1927	SOUTH AMBOY	1927	48	184-237	-56	-43	-37	-5	-11	-6	10/20	D
23-401	29-05352	402744	741628	SAYREVILLE WD	MORGAN P	SOUTH AMBOY	1967	44	254-288	-75	-80	-77	--	-14	--	10/29	D
23-423	--	402943	741808	NL INDUSTRIES	CL TEST 1	SOUTH AMBOY	1956	30	75-84	-47	-46	-47	--	-11	--	10/20	D
23-438	28-09722	402559	742142	SOUTH RIVER WD	SRWD 5	SOUTH AMBOY	1977	20	132-182	-49	-38	-46	-3	-8	-5	10/22	D
G 23-439	28-05987	402633	742200	SOUTH RIVER WD	SRWD 2 OBS	SOUTH AMBOY	1967	21	121-126	-40	-32	-38	-2	-5	-3	10/27	D
G 23-482	--	403242	741617	AMERICAN CYANAMID CO	AMERICAN CYANAMID 1 OBS	PERTH AMBOY	--	11	44-76	-3	9	10	10	10	0	10/19	D
23-506	28-03020	402358	742612	SMITH, LAWRENCE	3-1958	NEW BRUNSWICK	1958	120	213-223	--	--	9	29	23	-6	10/21	D
23-552	28-10991	402018	743021	SOUTH BRUNSWICK MUA	SBMUA 15	HIGHTSTOWN	1979	105	116-166	--	--	59	88	68	-20	10/21	H
23-1160	28-20882	402720	741950	E I DUPONT	FW-2	SOUTH AMBOY	1988	86	210-230	--	--	-54	-13	-13	0	10/21	D
23-1181	29-19615	402742	741906	E I DUPONT	PM-2D PARLIN PLANT	SOUTH AMBOY	1987	70	127-137	--	--	--	-24	-20	4	10/21	D
23-1346	--	402008	742810	MONROE TWP MUA	MONROE TMUA 19	JAMESBURG	1997	130	276-337					44	--	10/26	D
25-153	29-05942	402444	741010	SHORELANDS WC	W KEANSBURG 4	KEYPORT	1970	65	635-690	-47	-70	-116	-20	-21	-1	10/19	D
25-230	29-06353	402004	741853	GORDONS CORNERS WC	GORDONS 5	FREEHOLD	1972	125	580-670	-41	-36	-49	-14	-16	-2	10/23	H
25-247	29-04285	401902	741811	GORDONS CORNERS WC	GORDONS 2	FREEHOLD	1964	146	762-832	-26	-34	-48	-8	-16	-8	10/23	D
G 25-272	29-06527	402208	741452	MARLBORO TWP MUA	MARLBORO 1 OBS	MARLBORO	1972	117	670-680	-44	-55	-73	-17	-21	-4	10/19	D
25-297	29-02052	402603	741422	ABERDEEN TWP WD	MATAWAN TWP 1	KEYPORT	1956	^{5,6,7}65	447-487	$^{-71}$-86	$^{-78}$-93	$^{-98}$-113	-26	-35	-9	10/19	D
25-320	--	402705	735959	NATIONAL PARK SERVICE	FT HANCOCK 5A	SANDY HOOK	1970	14	838-878	-4	$^{-8}$-9	-10	-1	-1	0	10/21	H
UG 25-495	--	401850	740301	DEPARTMENT OF ENERGY	DGE TC-40	LONG BRANCH	--	10	1000	--	--	-11	-3	-2	1	10/21	D
25-634	29-16237	401520	741712	FREEHOLD ASSOCIATES	FREEHOLD RACEWAY 1	FREEHOLD	1985	170	877-914	--	--	--	-22	-20	2	12/14	D
U 25-635	29-18402	401105	741202	US GEOLOGICAL SURVEY	HOWELL TWP 1 OBS	FARMINGDALE	1987	^{7}111	1,226-1,330	--	--	$^{-39}$-38	-23	-18	5	10/21	D
25-711	29-14303	401744	741903	GORDONS CORNERS WC	GORDONS 12	FREEHOLD	1986	90	649-756	--	--	-35	-4	-8	-4	10/23	D
U 25-725	29-24426	401247	741633	FREEHOLD TWP WD	JACKSON MILLS T PLANT 11	ADELPHIA	1990	100	918-997	--		--	--	-27	--	10/22	D
25-728	28-21488	401752	742126	ENGLISHTOWN BORO WD	ENGLISHTOWN 3	FREEHOLD	1988	70	541-621	--	--	--	-1	-3	-2	10/23	D
25-731	28-22008	401840	742159	MATCHAPONIX WATER SUPPLY	MWS INJECTION 1	FREEHOLD	1989	60	541-628	--	--	--	--	-8	--	10/19	H
UG 29-19	--	394829	740535	US GEOLOGICAL SURVEY	ISLAND BEACH 3 OBS	BARNEGAT LIGHT	1962	9	2,736-2,756	0	-6	-11	-10	-5	5	10/23	D
U 29-47	--	400433	740833	BRICK TWP MUA	BRICK MUA 1 OBS	LAKEWOOD	1973	8	1,709-1,749	-36	-41	-65	-45	-40	5	10/22	D
UG 29-85	--	395929	741420	CIBA-GEIGY CORP	TOMS RIVER 84 OBS	TOMS RIVER	1968	^{6}67	1,460-1,480	-23	$^{-30}$-29	-40	-30	-20	10	10/21	D
U 29-118	29-04322	400200	742110	LAKEHURST NAVAL AIR STATION	LAKE NAS32	LAKEHURST	1964	^{5,6}96	1,397-1,583	$^{-23}$-27	$^{-29}$-28	$^{-42i}$-41	-29	-41	-12	10/27	D
U 29-132	29-03726	400319	741957	JACKSON TWP MUA	SCM 3	LAKEHURST	1962	^{5,6,7}105	1,606-1,728	$^{-33}$-23	$^{-37}$-27	$^{-51}$-41	$^{-20i}$-35	-31	4	10/27	H
U 29-440	29-06549	400504	741324	NJ/AMERICAN WC	LAKEWOOD 10	LAKEWOOD	1972	72	1,357-1,602	-20	-31	-44	-29	-20	9	10/28	H
U 29-490	33-01343	395901	742017	AMERICAN SMELTING & REFINING	AM SMELTING 2	KESWICK GROVE	1972	89	1,436-1,636	-41	-29	-44	-29	-30	-1	10/27	D
U 29-576	29-08936	400653	741717	JACKSON TWP MUA	JACKSON 8	LAKEHURST	1977	^{5,8}135	1,276-1,462	$^{-27}$-32	-35	-48	$^{-35}$-40	-36	4	10/26	H
U 29-581	48-00056	400821	742630	JACKSON TWP MUA	JACKSON TWP 10	ROOSEVELT	--	130	876-976	-1	-16	-26	-17	-14	3	10/27	H
U 29-588	29-09259	400435	741105	LAKEWOOD TWP MUA	S LAKEWOOD 7	LAKEWOOD	1978	^{6,7}73	1,410-1,620	--	$^{-27}$-24	$^{-56}$-53	$^{-34i}$-33	-21	12	10/27	H
U 29-626	33-10224	395721	741230	TOMS RIVER WC	TRWC 30	TOMS RIVER	--	9	1,700-1,875	--	-23	$^{-34i}$-33	-23	-14	9	11/2	D
U 29-1113	29-25859	400047	740327	NJ/AMERICAN WC	MANTOLOKING 19	POINT PLEASANT	1991	10	1,852-1,974	--	--	--	--	-7	--	10/28	D
33-65	--	393912	752436	E I DUPONT	COURSE LAND 3B	PENNS GROVE	1966	30	501-512	-14	-15	-18	--	-18	--	11/18	D
33-71	30-00196	394151	752407	STATE OF NJ	1S-2	PENNS GROVE	1953	38	344	-19	-20	--	-24	-24	0	12/1	D
33-106	--	393514	752917	LINSKI, ALEX	LINSKI DOM	SALEM	1962	5	359-365	--	--	-30	-31	-31	0	11/12	D
33-119	30-00018	394009	753043	PENNSVILLE TWP WD	PTWD 2	WILMINGTON SO	1949	7	210-230	-46	-39	-43	-44	-38	6	11/16	D
33-158	30-00763	393848	752010	ACME MARKETS CO	ACME 1	WOODSTOWN	1960	^{8}62	562-575	--	--	-25	$^{-22}$-17	-25	-8	11/9	D
33-166	--	393942	752234	E I DUPONT	COURSE LAND 4B	PENNS GROVE	1967	47	568-578	-14	-15	-18	--	-18	--	11/18	D
33-198	30-01383	394117	752207	DUBOICE, MAURICE	IRR 74	WOODSTOWN	1974	51	337-362	-21	-23	-25	-26	-25	1	11/9	D
33-251	--	393348	752755	US GEOLOGICAL SURVEY	SALEM 1 OBS	SALEM	1965	3	699-709	-27	-28	-32	-32	-31	1	11/9	D
33-305	30-01083	394013	752459	E I DUPONT	COURSE LAND P3	PENNS GROVE	1966	14	381-457	-13	-14	-16	--	-16	--	11/18	D
33-934	34-04055	392743	753148	PUBLIC SERVICE ELECTRIC & GAS	PSE&G J OBS	TAYLORS BRIDGE	1991	16	826-836	--	--	--	--	-60	--	11/17	H
33-935	34-01011	392820	753230	PUBLIC SERVICE ELECTRIC & GAS	PSE&G I OBS	TAYLORS BRIDGE	1974	7	760-790	--	--	--	--	-58	--	11/17	D
Pennsylvania wells																	
P10105	--	395342	751021	U S NAVY	PH 12	PHILADELPHIA	1944	9	101	--	--	-7	-4	-4	0	11/6	D
Upper Potomac aquifer--Delaware wells																	
Cc55-17	137	394008	753529	NCC BD.OF WATER & LIGHT	SCHOOL HOUSE	WILMINGTON SO	1967	^{7}55	88-128	--	--	$^{-7}$8	--	-10	--	11/9	D
Dc14-03	10037	393932	753653	ARTESIAN WC	MIDVALE I	WILMINGTON SO	1950	60	59-75	--	--	--	--	0	--	11/18	H
Dc14-53	10038	393935	753653	ARTESIAN WC	MIDVALE II	WILMINGTON SO	1951	56	57-77	--	--	--	--	4	--	11/18	D
Dc24-60	156750	393821	753616	ARTESIAN WC	MW2	WILMINGTON SO	1998	8	90-180	--	--	--	--	-29	--	11/23	D
G Dc34-06	10231	393755	753648	DELAWARE GEOLOGICAL SURVEY	NG 6	WILMINGTON SO	1975	^{7}25	183-188	--	--	$^{-28}$-31	--	-36	--	10/20	D
Ea35-20	97257	393242	754546	ARTESIAN WC	DENNY EAST	ELKTON	1993	50	143-163	--	--	--	--	-62	--	11/16	D
G Eb23-23	10403	393316	754216	US GEOLOGICAL SURVEY	8-C-D	ST GEORGES	1980	60	288-292	--	--	--	--	4	--	11/5	D
Eb55-08	98124	393037	754043	ARTESIAN WC	1 OBS	ST GEORGES	1993	58	400-420	--	--	--	--	-29	--	11/12	D
Ec32-03	Ec32-03	393241	753802	UNION CARBIDE	TW2	ST GEORGES	1966	11	318-328	--	--	-32	--	-28	--	11/4	D
Ec52-23	99469	393048	753814	ARTESIAN WC	--	ST GEORGES	1994	35	482-532	--	--	--	--	-29	--	11/12	D
Ec52-25	99470	393053	753818	ARTESIAN WC	LESTER OBS	ST GEORGES	1994	40	400-450	--	--	--	--	-14	--	11/12	D
Fb11-11	157176	392923	754428	ARTESIAN WC	OBS 2	MIDDLETOWN	1998	70	257-297	--	--	--	--	-25	--	11/12	D
Fb33-24	39685	392710	754257	MIDDLETOWN	9	MIDDLETOWN	1977	60	420-536	--	--	--	--	-36	--	12/3	H
Fb34-26	157823	392706	754109	ARTESIAN WC	1 OBS	MIDDLETOWN	1998	65	600-626	--	--	--	--	-33	--	11/12	D
Fc11-25	157831	392918	753944	ARTESIAN WC	1 OBS	MIDDLETOWN	1998	40	374-424	--	--	--	--	-26	--	11/12	D
Fc51-27	99806	392531	753906	ARTESIAN WC	CR 441	MIDDLETOWN	1994	50	692-713	--	--	--	--	-27	--	12/2	D
Middle Potomac aquifer--Delaware wells																	
Cd42-17	40146	394132	753312	ARTESIAN WC	COLLINS PARK I	WILMINGTON SO	1984	45	100-125	--	--	--	--	-28	--	11/18	H
Db52-27	35417	393539	754336	ARTESIAN WC	CARAVEL FARMS #1	ST GEORGES	1974	73	65-100	--	--	--	--	59	--	11/16	H
G Eb23-24	10404	393309	754215	US GEOLOGICAL SURVEY	8-C-D	ST GEORGES	1980	60	432-436	--	--	-34	--	-46	--	11/5	D
Ec53-17	157984	393033	753750	ARTESIAN WC	OBS 1	ST GEORGES	1998	50	420-470	--	--	--	--	-33	--	11/12	H
Maryland wells																	
G CECe56	CE-81-0466	393026	755231	US GEOLOGICAL SURVEY	--	ELKTON	--	38	116-121	--	--	--	--	6	--	11/2	D
G CEEe29	CE-73-2266	392403	755218	US GEOLOGICAL SURVEY	--	CECILTON	--	75	515-525	--	--	--	--	-3	--	11/5	D

1 Degree, minute, and second symbols are omitted.

2 Datum is sea level.

3 Datum is land surface. Single numbers are depth of well.

4 Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

5 Land-surface altitude modified from 1978 report.

6 Land-surface altitude modified from 1983 report.

7 Land-surface altitude modified from 1988 report.

8 Land-surface altitude modified from 1993 report.

9 Well in which the water-level altitude was measured during a previous synoptic study.
Both wells are at the same site in the same aquifer.

Water-level altitude measured in a previous study, but in a different well.

Table 10-1. Water-level data for wells screened in the Lower Potomac-Raritan-Magothy aquifer, 1978-98

[Well depth given if screened interval is unknown; --, data are not available; ft, feet; USGS, U.S. Geological Survey; BORO, Borough; MUA, Municipal Utilities Authority; WD, Water Department; TWP, Township; WC, Water Company; WCM, Water Commission; NJ, New Jersey; DEL, Delaware; CO, Company; CORP, Corporation; DEP, Department of Environmental Protection; G, indicates the water-level hydrograph for this well is included in the report; Shutdown period: H, more than 1 hour and less than 24 hours; D, 24 hours or more]

	Well number	Permit number	Latitude[1]	Longitude[1]	Owner	Local well identifier	USGS quadrangle	Year drilled	Land-surface altitude[2] (ft)	Screened interval[3] (ft)	Water-level altitude[4] 1978 (ft)	1983 (ft)	1988 (ft)	1993 (ft)	1998 (ft)	1993-98 water-level change (ft)	Date in 1998	Shutdown period
New Jersey wells																		
	5-123	31-05321	395904	750009	NJ/AMERICAN WC	DVWC 28	CAMDEN	1969	[5]25	226-261	[-5]-10	-12	-16	-16	-16	0	11/18	H
	5-125	31-03835	395929	745922	NJ/AMERICAN WC	DVWC 10	MOORESTOWN	1959	79	239-281	-11	-15	-16	-19	-17	2	11/9	D
	5-130	31-04576	400002	750044	NJ/AMERICAN WC	RIVERTON 13	FRANKFORD	1963	[5]70	167-198	-9-4	-3	-14	-12	-14	-2	11/18	H
	5-143	27-04247	400105	745734	NJ/AMERICAN WC	DVWC 23	BEVERLY	1964	36	176	--	--	-7	6	-3	-9	11/10	D
	5-228	31-08923	395630	745855	MAPLE SHADE WD	MSWD 10	MOORESTOWN	1975	40	440-500	-47	-51	-60	-53	-55	-2	11/10	D
G	5-262	--	395524	745025	US GEOLOGICAL SURVEY	MEDFORD 4 OBS	MOUNT HOLLY	1967	72	1,125-1,145	-48	[-57]-58	-60	-61	-52	9	10/30	D
	5-274	31-03674	395841	745905	DENTON VACUUM INC	CAMPBELL 1 OBS	MOORESTOWN	1958	40	241-262	-20	-26	-29	-31	-28	3	11/4	D
G	5-645	--	400010	745216	WILLINGBORO MUA	WILLINGBORO 2 OBS	BRISTOL	1965	40	431-441	-31	-35	-41	-41	-38	3	10/30	D
	5-648	--	400103	745409	WILLINGBORO MUA	WMUA 3-OBS	BEVERLY	1965	34	306-316	-20	-23	-29	[-27i]-28	-29	-1	11/2	D
	5-746	31-12925	395727	745915	MAPLE SHADE WD	MSWD 11	MOORESTOWN	1978	[5,6,7,8]13	389-450	[-36]-29	[-34]-41	[-36]-43	[-36]-43	-38	5	11/10	H
	5-823	--	395615	745512	MOUNT LAUREL MUA	MLMUA 4	MOORESTOWN	1974	35	590-640	-48	-62	-75	-64	-50	14	10/30	H
	7-12	31-02687	395221	750637	BELLMAWR BORO WD	BELLMAWR WD 3	RUNNEMEDE	1956	35	334-359	-53	-56	-48	-46	-37	9	11/5	H
	7-111	31-03456	395726	750518	NJ/AMERICAN WC	CAMDEN DIV 50	CAMDEN	1958	9	139-170	--	--	-26	--	-10	--	11/9	D
	7-121	--	395252	745943	NJ/AMERICAN WC	BROWING T-1	MOORESTOWN	1973	80	672-729	-85	-94	-103	-99	-55	44	11/17	D
	7-130	31-05077	395353	745708	NJ/AMERICAN WC	OLD ORCHARD A	MOORESTOWN	1967	71	743-748	-67	-75	-80	-79	-52	27	11/23	D
	7-144	31-00684	395442	750103	NJ/AMERICAN WC	ELLISBURG 13	CAMDEN	1953	39	491-527	-60	-64	-67	-65	-49	16	11/10	D
	7-157	31-05033	395600	750031	NJ/AMERICAN WC	COLUMBIA 31	CAMDEN	1967	45	376-427	--	--	-55	--	-43	--	11/9	D
	7-163	31-04051	395609	750028	NJ/AMERICAN WC	COLUMBIA 22	CAMDEN	1960	39	371-453	-46	-51	-53	-45	-36	9	11/9	D
	7-175	31-00079	395521	750439	COLLINGSWOOD WD	CWD 1R	CAMDEN	1949	25	266-306	--	-48	-47	--	-34	--	10/30	D
	7-188	31-05950	395002	745851	NJ/AMERICAN WC	GIBBSBORO 42	CLEMENTON	1972	65	934-986	--	--	-89	-97	-62	35	11/10	D
	7-221	--	395356	750738	US GEOLOGICAL SURVEY	COAST GUARD 1	PHILADELPHIA	1966	[5]11	162-170	[-40]-39	-35	-30	-26	-22	4	10/27	D
	7-273	31-04756	395030	750347	NJ/AMERICAN WC	OTTERBROOK 29	RUNNEMEDE	1965	60	612-712	-72	-71	-77	-76	-55	21	11/17	H
	7-278	31-02434	395238	750316	NJ/AMERICAN WC	HADDON 15	CAMDEN	1956	65	452-594	-72	-76	-82	--	-50	--	11/18	H
	7-283	31-04282	395246	750434	NJ/AMERICAN WC	EGBERT OBS	CAMDEN	1962	[6]24	445-455	-62	[-65]-64	-64	-61	-48	13	11/4	D
	7-284	31-05054	395247	750432	NJ/AMERICAN WC	EGGBERT 35	CAMDEN	1967	22	484	--	--	-74	-69	-53	16	11/18	D
	7-292	31-04855	395406	750332	HADDON TWP WD	HTWD 4	CAMDEN	1965	45	417-448	-63	-64	-67	-64	-46	18	11/2	H
	7-302	31-02130	395319	750140	HADDONFIELD BORO WD	RULON	CAMDEN	1956	25	523-572	-72	-79	-85	-91	-58	33	10/29	H
	7-320	31-04642	395652	750307	MERCHANTVILLE PENNSAUKEN WCM	WOODBINE 1	CAMDEN	1963	[5,6,7,8]69	245-285	[-37]-33	[-40]-36	[-38]-34	[-36]-32	-26	6	11/4	H
	7-335	31-02915	395720	750225	MERCHANTVILLE PENNSAUKEN WCM	MARION 1	CAMDEN	1957	61	243-278	-33	-35	-35	-34	-29	5	11/4	H
	7-341	31-01417	395800	750417	MERCHANTVILLE PENNSAUKEN WCM	DELA GARDEN 2	CAMDEN	1954	[5,6,7]45	115-145	[-28]-22	[-27]-21	[-25]-19	[-27]-21	-10	11	11/4	D
	7-350	51-00064	395802	750118	MERCHANTVILLE PENNSAUKEN WCM	PARK AVE 2	CAMDEN	1943	12	232-257	--	--	--	--	-23	--	11/4	D
	7-372	31-05110	395853	750208	MERCHANTVILLE PENNSAUKEN WCM	NATIONAL HWY 1	CAMDEN	1967	[7,8]68	195-230	--	--	[-51]-23	[-48]-20	-16	4	11/4	D
	7-390	51-00050	395944	750211	CAMDEN CITY WD	CAMDEN WD MORRIS 1	CAMDEN	--	[5,6,7,8]6	107	[-6]-9	[-5]-8	[-8]-11	[-6]-9	-8	1	11/2	D
G	7-412	31-09560	394922	745630	NJ/AMERICAN WC	ELM TREE 2 OBS	CLEMENTON	1963	[6]149	1,082-1,092	-62	[-73]-72	-78	-80	-58	22	11/4	D
	7-523	31-12315	395152	750542	BELLMAWR BORO WD	BELLMAWR BORO	RUNNEMEDE	1977	75	458-557	-62	-64	-67	-64	-49	15	11/5	H
	7-528	31-08526	395836	750304	CAMDEN CITY WD	PUCHACK 6-75/7	CAMDEN	1975	20	140-180	-23	-28	-32	-22	-15	7	11/2	D
	7-541	31-15720	395611	750546	CAMDEN CITY WD	TW-8-79	CAMDEN	1979	20	215-253	--	-34	-31	-26	-19	7	11/5	D
	7-547	31-18944	395731	750458	NJ/AMERICAN WC	54	CAMDEN	1982	35	160-200	--	-33	-32	--	-12	--	11/9	D
	7-597	31-20270	395718	750513	NJ/AMERICAN WC	55	CAMDEN	1983	11	136-176	--	-31	-30	--	-11	--	11/9	D
	7-723	31-28896	395355	750315	HADDON TWP	RHOADES AVE 3A	CAMDEN	1988	64	418-470	--	--	--	--	-49	--	11/2	H
	15-133	30-01222	394510	752244	PURELAND INDUSTRIAL COMPLEX	PURLAND TEST WELL 1	MARCUS HOOK	1970	20	317-367	--	--	-2	-4	-4	0	11/12	D
	15-139	30-01223	394608	752135	PURELAND INDUSTRIAL COMPLEX	PURLAND TEST WELL 3	BRIDGEPORT	1970	[5,6]7	301-345	[-9]-10	[-9]-10	-11	-1	-11	-10	11/12	D
	15-282	31-07056	394913	751105	WEST DEPTFORD TWP WD	5 KINGS HIWAY	WOODBURY	1973	55	388-450	-30	--	-34	-32	-51	-19	11/5	H
	15-308	--	395044	751242	AUSIMONT USA INC	PENNWALT TEST WELL 8	WOODBURY	1969	10	231-271	-14	-15	-19	-41	-26	15	11/10	D
	15-312	51-00063	395107	750946	WEST DEPTFORD TWP WD	6 RED BANK AVE	WOODBURY	1973	20	322-372	-58	-55	-56	-45	-52	-7	11/5	H
	15-316	31-00035	395159	750907	COASTAL EAGLE POINT OIL CO	EAGLE PT 1 OBS	WOODBURY	1948	32	288-298	-67	-54	-58	-42	-42	0	11/9	D
	15-323	31-00037	395235	750950	COASTAL EAGLE POINT OIL CO	EAGLE POINT 3 OBS	PHILADELPHIA	1948	21	255-275	-52	-43	-44	-30	-28	2	11/9	D
	15-331	31-04259	394955	750908	WOODBURY CITY WD	RAILROAD 5	WOODBURY	1960	35	405-457	-44	-47	-53	-49	-42	7	11/5	H
	15-349	--	394650	752316	PURELAND INDUSTRIAL COMPLEX	LANDTECT 2	MARCUS HOOK	1973	[5]6	170-220	[-6]-5	[-6]-5	[-9i]-8	-5	-6	-1	11/12	D
	15-398	30-02016	394935	751938	PETTIT, LOUIS	419	BRIDGEPORT	1979	1	50-60	--	--	-2	-1	-2	-1	11/12	D
	15-615	30-03530	394637	751916	US GEOLOGICAL SURVEY	SHIVELER LOWER	BRIDGEPORT	1985	29	378-388	--	--	-15	-16	-15	1	11/13	D
	15-618	30-03531	394804	751933	US GEOLOGICAL SURVEY	GAVENTA DEEP	BRIDGEPORT	1985	[8]7	230-240	--	--	-7	[-4]-7	-8	-1	11/12	D
G	15-671	--	394957	750530	US GEOLOGICAL SURVEY	DEPTFORD DEEP OBS	RUNNEMEDE	1986	35	650-670	--	--	-69	-69	-53	16	11/5	D
	15-678	30-03625	394946	751612	VALERO REFINING CO OF NJ	W-5C/L	BRIDGEPORT	1985	9	194-204	--	--	-8	-5	-8	-3	11/16	D
	15-680	30-03602	395038	751605	VALERO REFINING CO OF NJ	W-7C/L	BRIDGEPORT	1985	[8]9	186-196	--	--	-5	-7-6	-5	1	11/16	D
G	15-712	30-04347	394808	751724	US GEOLOGICAL SURVEY	STEFKA 1 OBS	BRIDGEPORT	1986	77	275-290	--	--	[-10]-11	-11	-11	0	11/5	D
	15-738	30-03612	394948	751524	VALERO REFINING CO OF NJ	W-4C/L	BRIDGEPORT	1985	5	188-198	--	--	-9	-8	-9	-1	11/16	D
	15-742	31-25266	394652	751004	US GEOLOGICAL SURVEY	MANTUA DEEP OBS	WOODBURY	1986	[7]84	757-777	--	--	[-39]-37	-37	-32	5	11/5	D
	15-770	31-26237	395202	751115	US GEOLOGICAL SURVEY	NATIONAL PARK 1-PW-L	WOODBURY	1987	10	204-224	--	--	-25	-21	-17	4	11/6	D
	15-778	31-26245	395223	751117	US GEOLOGICAL SURVEY	NATIONAL PARK 9-OW-BL	WOODBURY	1987	5	170-190	--	--	--	--	-17	--	12/3	D
	15-1004	--	394421	750604	US GEOLOGICAL SURVEY	CEDAR LAKE DEEP	PITMAN EAST	1988	80	1,038-1,206	--	--	--	-63	-55	8	11/2	D
	15-1125	30-04112	394937	751728	E I DUPONT	REPAUNO M-47	BRIDGEPORT	1986	15	186-196	--	--	--	-3	-4	-1	10/27	D
	15-1487	30-12606	394433	752012	WOOLWICH WC	WOOLWICH WC MW-4	WOODSTOWN	1998	104	495-525	--	--	--	--	-15	--	11/6	D
	33-86	30-01139	394557	752523	GEON CO	4 (PW-3)	MARCUS HOOK	1967	13	169-189	-10	-12	-11	-17	-14	3	11/13	D
G	33-187	--	394037	751914	US GEOLOGICAL SURVEY	POINT AIRY OBS	WOODSTOWN	1958	73	664-672	-25	-26	-28	-29	-28	1	11/12	D
	33-330	50-00098	394205	752657	PENNS GROVE WATER SUPPLY CO	LAYTON 11	PENNS GROVE	1936	16	394	-38	-15	-23	-40	-34	6	11/18	H
	33-458	--	392751	753207	PUBLIC SERVICE ELECTRIC & GAS CO	PSEG 6-OBS	TAYLORS BRIDGE	1980	20	1,112-1,132	--	-24	--	-32	-33	-1	11/17	D
Pennsylvania wells																		
	P101-03	--	395314	751010	US NAVY	PH 19	PHILADELPHIA	1946	9	242-247	--	--	-22	-18	-16	2	11/6	D
	P101-10	--	395323	751108	US NAVY	PH 5 - NAVY 5	PHILADELPHIA	1942	15	148-173	--	--	--	--	-9	--	11/6	D
	P101-13	--	395408	751040	ROOSEVELT PARK	PH 63	PHILADELPHIA	1919	6	--	--	--	-5	-4	-3	1	11/6	D
	P101-14	--	395445	750831	PASHA AUTO WAREHOUSING	PH 750-SAFA TW3	PHILADELPHIA	1979	10	122-167	--	--	-8	-6	-6	0	11/3	D
Delaware wells																		
	Cc45-27	159723	394114	753545	ARTESIAN WC	AIRPORT OBS	WILMINGTON SO	1998	70	295-305	--	--	--	--	-29	--	11/19	D
	Da43-02	42911	393608	754703	ARTESIAN WC	ES 2 OBS	ELKTON	1980	70	228-247	--	--	--	--	-16	--	11/20	D
	Da44-05	42913	393615	754644	ARTESIAN WC	ES 1 OBS	ELKTON	1980	80	172-182	--	--	--	--	-11	--	11/20	D
G	Db15-05	Db15-05	393917	754016	UNITED WD	--	NEWARK EAST	1968	20	215-238	--	--	--	--	-1	--	10/20	D
G	Db33-17	10398	393734	753711	US GEOLOGICAL SURVEY	BECK B	NEWARK EAST	1980	48	185-189	--	--	--	--	-40	--	11/19	D
G	Db33-18	10398	393734	753711	US GEOLOGICAL SURVEY	BECK B	NEWARK EAST	1980	48	139-143	--	--	--	--	-37	--	11/19	D
G	Dc34-05	DC3405	393755	753648	US GEOLOGICAL SURVEY	DEL NAT GUARD 1 OBS	WILMINGTON SO	1975	28	574-579	--	--	-68	-65	-64	1	10/20	D
	Ea24-07	96500	393314	754649	ARTESIAN WC	DENNY WEST	ELKTON	1993	45	332-352	--	--	--	--	-51	--	11/16	D
G	Eb23-25	10405	393309	754215	US GEOLOGICAL SURVEY	LUM D	ST GEORGES	1980	60	600-604	--	--	-49	-52	-63	-11	11/5	D
	Ec15-27	36504	393428	753538	DELAWARE CITY	4	DELAWARE CITY	1976	13	692-722	--	--	--	--	-179	--	11/9	H
G	Ec32-07	Ec32-07	393209	753802	UNION CARBIDE	ST. GEORGES #7	SAINT GEORGES	1966	11	575-585	--	--	-91	-85	-99	-14	11/3	D
	Fb33-25	39676	392708	754257	MIDDLETOWN	8	MIDDLETOWN	1977	60	800-846	--	--	--	--	-37	--	12/3	H
Maryland wells																		
G	CEBf82	CE-81-0470	393537	754920	US GEOLOGICAL SURVEY	HOLLY HALL ELEM SCHOOL	ELKTON	1983	70	120-125	--	--	--	--	6	--	11/5	D
G	CECe55	CE-81-0465	393241	755002	US GEOLOGICAL SURVEY	ELK FOREST ROAD	ELKTON	1983	55	370-375	--	--	--	--	-13	--	11/5	D

[1] Degree, minute, and second symbols are omitted.

[2] Datum is sea level.

[3] Datum is land surface. Single numbers are depth of well.

[4] Datum is sea level.
Superscript in water-level altitude part of table body is a previously published water-level altitude. If superscript includes an i, then previously published value was incorrect.
Base number in water-level altitude part of the table is a recalculated water-level altitude based on the modified land-surface altitude.

[5] Land-surface altitude modified from 1978 report.

[6] Land-surface altitude modified from 1983 report.

[7] Land-surface altitude modified from 1988 report.

[8] Land-surface altitude modified from 1993 report.