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GROUND-WATER LEVELS IN DELAWARE
JULY, 1966 - DECEMBER, 1977

BY
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STATE OF DELAWARE
NEWARK, DELAWARE
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GROUND-WATER LEVELS IN DELAWARE

July, 1966 - December, 1977

ABSTRACT

Water-level records from 13 observation wells in Delaware for the period July, 1966 - December, 1977 provide the bases for the analyses of water-level fluctuations.

Water levels in shallow water-table wells generally rise from November to March, when recharge exceeds discharge, and decline during the warm growing season from May through September. Although water-levels in individual wells changed by as much as 11.17 feet during the 11.5 year period studied, the water-table system remained in a state of dynamic equilibrium and exhibited no permanent changes in aquifer storage.

However, the water levels in three artesian observation wells have declined during the same 11.5 year period in response to high demands for ground water while levels in the other two artesian wells have risen slightly due to a reduction in ground-water discharge, or increase in ground-water recharge, or both. Nevertheless during the past several decades, water levels have declined, cones of depression have enlarged, and reductions in aquifer storage have occurred in the Potomac aquifer in central and southeastern New Castle County, and the Piney Point and Cheswold aquifers in the Dover-Dover Air Force Base area. Therefore, future ground-water development in the artesian aquifers must be carefully planned and managed.

INTRODUCTION

Purpose and Scope

The Delaware Geological Survey, in cooperation with the U. S. Geological Survey, maintains a network of permanent observation wells in Delaware to monitor the effects of both natural and induced factors on water levels in water-table and artesian aquifers. This systematic ground-water level data acquisition program is necessary to properly evaluate, plan, and manage ground-water resources throughout Delaware.

The objectives of this report are: (1) explain the relationship between precipitation, runoff, evaporation, and the change in water storage in water-table aquifers; (2) present groundwater-level data for 13 observation wells in graphic and tabular forms for the period July, 1966 - December, 1977; (3) provide a summary of the trends and fluctuations of ground-water levels in these 13 observation wells; (4) show the effect that ground-water development (pumping) has on artesian aquifers; and, (5) assist planners, sanitarians, well drillers, contractors, industry, municipal government, engineers, farmers, and private citizens in evaluating ground-water conditions in both regional and local areas.

The 13 wells discussed in this report are not the only wells being monitored in Delaware. Other wells are monitored on either a temporary or continuous basis as part of water supply studies for municipalities and industry.

English units of measurement are used in this report rather than the International System of Units (metric). For those readers who may prefer to use the International System of Units rather than English units, conversion factors for the terms are presented in Appendix B.

Geologic Setting of Wells Studied

The State of Delaware lies in parts of two physiographic provinces: the Appalachian Piedmont and the Atlantic Coastal Plain (Figure 1). The Piedmont, about 113 square miles of northern New Castle County, is underlain by a complex of hard rocks of igneous and metamorphic origins.

Well Bc43-1, located near Greenville, Delaware is 165 feet deep and completed as an open hole in the Wissahickon Formation. The water in this formation is stored between the grains in

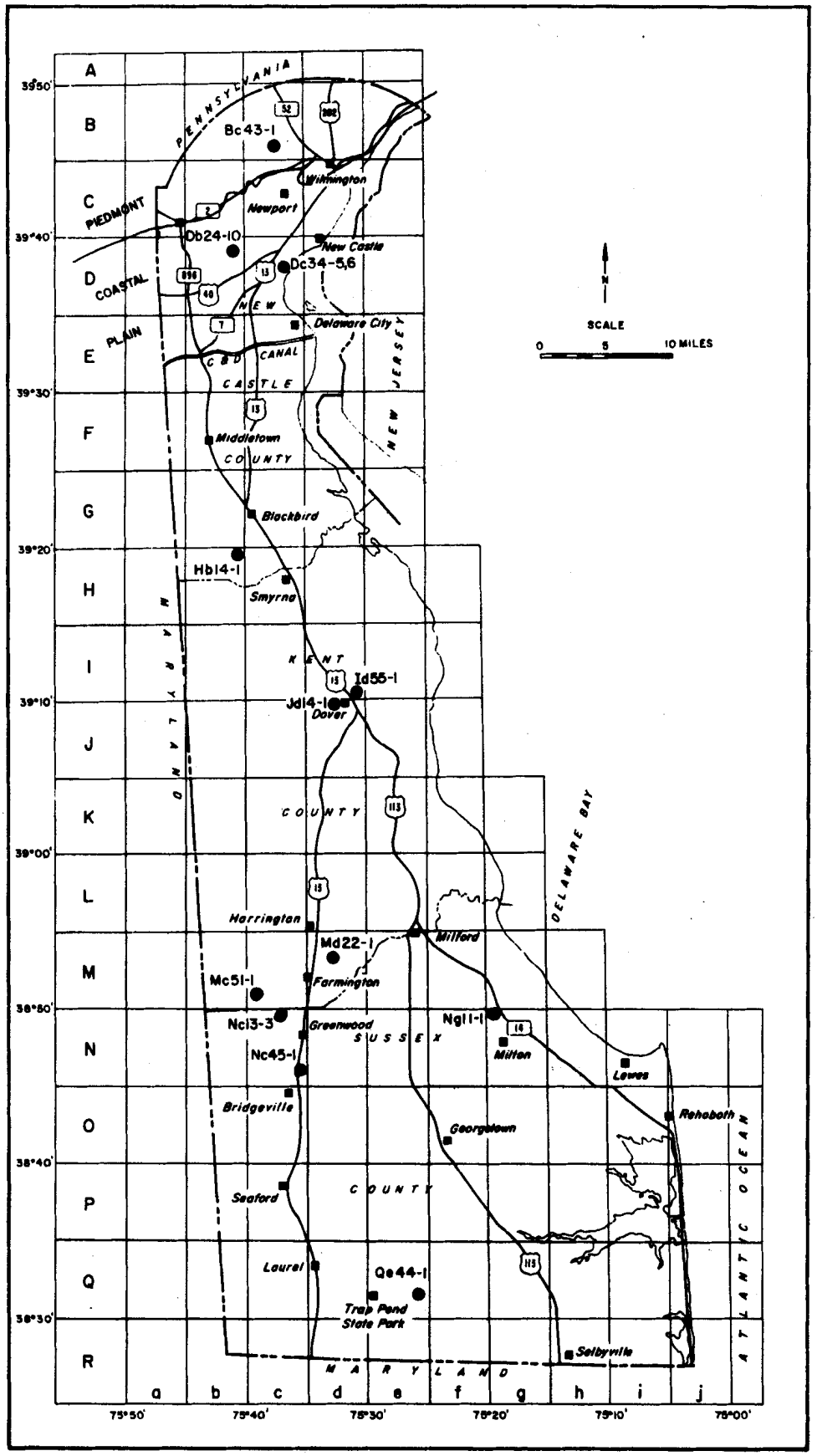

Figure 1. Index map of observation wells.

weathered rock and in fractures, joints, solution channels, and other openings in the hard fresh rock.

The Atlantic Coastal Plain is an area of relatively low relief that consists of a wedge-shaped mass of unconsolidated sands, gravels, silts, and clays that thickens from a "featheredge" at the Fall Line to at least 8,000 feet in southeastern Delaware. Within this mass of sediment are large bodies of sand and gravel containing vast amounts of ground water.

Twelve of the wells discussed in this report are located in the Coastal Plain (Figure 1). Wells Db24-10, Hb14-1, Mc51-1, Md22-1, Nc45-1, Ng11-1, and Qe44-1 are shallow (less than 25 feet deep) water-table wells completed in the surficial sands and gravels of the Columbia deposits of Pleistocene age. These shallow wells are located in areas remote from the effects of ground-water development. The Columbia deposits occur at the surface in much of Delaware and range in thickness from a few feet to as much as 150 feet in deep filled valleys (Jordan, 1964) and form a water-table (unconfined) aquifer of regional extent (Johnston, 1973).

Five wells are relatively deep, ranging in depth from 190 feet to 630 feet, and are completed in artesian (confined) aquifers. Wells Dc34-5 and Dc34-6 are screened in the lower and upper Potomac aquifers, respectively. The Potomac aquifers are used extensively in New Castle County. Wells Id55-1 and Nc13-3 are completed in the Piney Point aquifer. The Piney Point occurs entirely in the subsurface in Delaware and is a major hydrologic unit consisting of an elongate lens of sand trending northeast-southwest across Kent County and into Maryland (Cushing et al., 1973).

Well Jd14-1 is completed in the Cheswold aquifer. The Cheswold aquifer supplies substantial quantities of water to wells throughout Kent County, especially in the Dover-Dover Air Force Base area.

Previous Reports and Sources of Published Data

The systematic investigation of the geology and ground-water resources of Delaware was initiated in 1949 with the installation of a State-wide network of observation wells. The program was begun as a cooperative effort between the U. S. Geological Survey (USGS) and the State of Delaware (Agricultural Extension Service of the University of Delaware and the Delaware State Highway Department). On July 1, 1951,

the Delaware Geological Survey (DGS) became the State cooperating agency.

Water level information for the years 1951-1958 was published by the DGS in a series of water-level reports (Marine, 1954; Boggess and Coskery, 1954; Coskery and Boggess, 1956; Coskery and Rasmussen, 1958; Coskery, 1956; 1961).

Basic water-level data are also contained in several reports that provide information on the geologic formations and their water-bearing characteristics for both regional and local areas. Water levels in many wells in the Newark area are listed in DGS Bulletin No. 2 (Groot and Rasmussen, 1954). Water levels throughout the State are included in a 1955 report by Marine and Rasmussen. A report by Rasmussen, Wilkens, and Beall (1960) contains water levels for many Sussex County wells. Other reports containing water levels in Delaware include DGS Bulletins No. 6 (Rasmussen, Groot, Martin, McCarren, Behn, and others, 1956), No. 11 (Rima, Coskery, and Anderson, 1964), No. 13 (Spoljaric and Woodruff, 1970), and No. 14 (Johnston, 1973), and DGS Report of Investigations No. 8 (Baker, Varrin, Groot, and Jordan, 1966), and No. 9 (Woodruff, 1967).

Woodruff (1967) presents water-level data for 9 observation wells located in areas of little or no pumping for the period January, 1962 through June, 1966. The present report continues and expands the coverage of water levels in that report of investigations.

A series of 33 water-table maps covering the entire Coastal Plain portion of Delaware was published from 1963 through 1965. These maps, prepared by the USGS and DGS in cooperation with the Delaware State Highway Department, show the average depth to the water table, surface drainage, and engineering soil types (Hydrologic Investigation Atlases).

Starting in the drought year 1966, a series of DGS reports titled "Monthly Report on Water Conditions in Delaware" has been issued monthly through September 1971 and bimonthly since that time. These reports contain precipitation, water-level, and streamflow data for specific sites in Delaware.

Rasmussen, Odell, and Beamer (1966) reviewed the general ground-water conditions in Delaware. Another statewide assessment of ground-water resources of Delaware was prepared by the Water Resources Center of the University of Delaware with the DGS (Sundstrom and Pickett, 1968; 1969; 1970; 1971).

Johnston (1976) reports that precipitation and streamflow are related to changes in ground-water levels and the hydraulic characteristics of the water-table or unconfined aquifer. Hydrologic budgets for 4 small basins in the Coastal Plain are presented.

Water levels in several Delaware wells are contained in USGS Water-Data Reports issued yearly.

Well-Numbering System

The State is divided into 5-minute quadrangles of latitude and longitude for the purpose of numbering wells as shown in Figure 1. The quadrangles are lettered north to south with capital letters, and west to east with lower case letters. Each 5-minute quadrangle is further subdivided into 25 one-minute blocks numbered from north to south in series of 10 from 10 to 50 and from west to east in units from 1 to 5. Wells within these one-minute blocks are assigned numbers as they are scheduled. The identity of a well is established by an upper case letter, a lower case letter, and a two-digit number followed by a dash and one or more numbers. For example, well number Db24-10 is the tenth well scheduled in the one-minute block 24 of 5-minute quadrangle Db.

Acknowledgments

Nearly all of the water-level measurements included in this report, except those for well Bc43-1, were made by the USGS in cooperation with the DGS. Water levels in well Bc43-1, owned by Mrs. W. A. Worth, were made under the direction of the Red Clay Valley Association.

Precipitation data at several locations were provided by the USGS. Other precipitation data were obtained from the Environmental Data Service of the National Oceanic and Atmospheric Administration.

P. Patrick Leahy of the USGS supplied ground-water discharge data for the Cheswold and Piney Point aquifers in the Dover area.

The contributions of Robert R. Jordan, Nenad Spoljaric, and Kenneth Woodruff, all members of the DGS, in the form of discussions, constructive criticism, and text review are gratefully acknowledged.

HYDROLOGIC FACTORS IN DELAWARE

Ground-Water Occurrence

Ground water occurs in aquifers under water-table (unconfined) and artesian (confined) conditions. Water-table conditions exist when water in the pores of the rock at the top of the zone of saturation (water table) is in direct contact with the atmosphere and is, therefore, at atmospheric pressure. Ground water is under artesian conditions when the water in the aquifer is beneath a confining bed and is under hydrostatic pressure. When a well is drilled through the confining bed such as a relatively impermeable clay or silt and into an artesian aquifer, the water will rise to some level above the top of the aquifer. This water level represents the artesian or hydrostatic pressure in the aquifer and is commonly referred to as the potentiometric surface.

Precipitation

Precipitation is the source of fresh water in Delaware. The average annual (normal) precipitation in the State is about 44 inches based on a 30-year period of record between 1931 and 1960. For any particular year the precipitation may deviate considerably from this average. For example, examination of Table 1 shows that for the period, July, 1966 - December, 1977, precipitation at New Castle ranged from 7.68 inches above normal to 12.81 inches below normal with a total cumulative deficiency of 25.22 inches. Precipitation at Bridgeville was above average for 5 years and below average for 7 years with a total cumulative deficiency of 18.15 inches. Unlike New Castle and Bridgeville, Dover recorded a surplus of 13.16 inches for the 11.5 year period.

Most of the precipitation falls during the warmer parts of the year and occurs as intense rain often associated with thunderstorms. Such events may be very localized and can result in highly divergent daily and monthly precipitation totals over fairly short distances. During late fall, winter, and early spring, precipitation generally occurs as snow or slow, steady rain.

Water is dispersed in several ways once it reaches the surface. A large portion of the water is returned to the atmosphere by evaporation and transpiration. Some of the water that reaches the land surface becomes direct surface runoff. Other water infiltrates the ground and becomes ground water.

TABLE 1

PRECIPITATION IN DELAWARE, July, 1966 - December, 1977

	New Castle County New Castle, Del.			Kent County Dover, Del.			Sussex County Bridgeville, Del.		
Year	Precipitation	Normal	Departure	Precipitation	Normal	Departure	Precipitation	Normal	Departure
1966 July-Dec.	23.77	23.26	- 0.51	20.47	24.26	- 3.79	17.03	24.06	- 7.03
1967	44.65	44.56*	+ 0.09	52.89	46.14*	+ 6.75	54.89	45.28*	+ 9.61
1968	31.75	44.56	-12.81	32.93e	46.14	-13.21	31.51	45.28	-13.77
1969	40.38	44.56	- 4.18	57.30	46.14	+11.16	45.30	45.28	+ 0.02
1970	38.31	44.56	- 6.25	35.87	46.14	-10.27	43.62	45.28	- 1.66
1971	52.24	44.56	+ 7.68	57.25	46.14	+11.11	48.31	45.28	+ 3.03
1972	48.13	44.56	+ 3.57	55.22	46.14	+ 9.08	54.11	45.28	+ 8.83
1973	47.05	44.56	+ 2.49	47.01e	46.14	+ 0.87	41.32	45.28	- 3.96
1974	39.61	44.56	- 4.95	40.41	46.14	- 5.73	37.18	45.28	- 8.10
1975	49.61	44.56	+ 5.05	61.37	46.14	+15.23	51.49	45.28	+ 6.21
1976	33.59	44.56	-10.97	40.56	46.14	- 5.58	38.80	45.28	- 6.48
1977	40.13	44.56	- 4.43	43.68	46.14	- 2.46	40.43	45.28	- 4.85

* In order to maintain consistency for the entire reporting period in the report (July, 1966 - December, 1977) the precipitation normals used are based on records for the 30-year period 1931-1960, inclusive. A new set of normals based on records for the 30-year period 1941-1970, inclusive have been established. The new normals for New Castle, Dover, and Bridgeville are 40.25 inches, 42.30 inches, and 43.07 inches respectively. The decrease in normals at all three stations reflects, in part, the below normal precipitation recorded during the drought of the early and middle 1960's.

Runoff

Runoff is that portion of precipitation that makes its way into the drainage systems of streams after reaching the land surface. It varies from year to year, seasonally within each year, and daily. Runoff consists of two types: direct runoff and ground-water runoff.

Direct runoff occurs when precipitation flows rapidly over the land surface into stream channels and leaves the area in a relatively short period of time. This type of runoff characterizes streamflow during and shortly after storms and, if substantial, is referred to as flood flow. The equivalent of between 3 and 6 inches, or 7 to 14 percent, of the average annual precipitation of 44 inches occurs in the form of direct runoff (Johnston, 1976; Sundstrom and Pickett, 1971).

Ground-water runoff is that portion of runoff that has infiltrated the ground and is later discharged into streams as base or fair-weather flow. During dry periods streamflow is maintained entirely by continuous ground-water runoff. In Delaware about 11 to 15 inches of ground water (precipitation equivalent) is discharged into bodies of surface water, accounting for approximately 75 percent of annual streamflow. Ground-water runoff continues as long as the water levels in the aquifer are higher than the level at which discharge is occurring.

Evapotranspiration and Ground-Water Recharge

A major portion of precipitation is lost to the atmosphere by evapotranspiration: approximately 26 inches or 59% of annual precipitation (Johnston, 1976; Sundstrom and Pickett, 1971). Some water is evaporated directly from streams, ponds, and other bodies of water. Transpiration, the process by which water absorbed by plants through roots is evaporated into the atmosphere from the plant surface, accounts for a large part of evapotranspiration. Evapotranspiration is maximum during the growing season from June to August when the weather is hot, dry, and windy.

In Delaware approximately 13 to 16 inches of precipitation infiltrates the ground annually as ground-water recharge. This recharge is intermittent and varies from day to day, season to season, and year to year. Generally, most ground-water recharge occurs during late fall, winter, and early spring (November to March). Precipitation during this

period is generally light and steady and has good potential for infiltration.

For a more detailed analyses of hydrologic budgets and the relations of ground water to surface water in the shallow water-table aquifer in Delaware, the reader is referred to DGS Report of Investigations No. 24 by R. H. Johnston (1976).

Water-Level Fluctuations

Water levels are not stationary. They fluctuate continuously in response to both natural and artificial factors.

In shallow water-table wells the largest and most prominent fluctuations result from the effects of ground-water recharge, natural ground-water discharge, and pumping from wells. In Delaware, water levels in shallow water-table wells generally begin to decline in April or May as the growing season commences, and begin to rise in response to recharge during October and November.

A very important cause of water-level fluctuations is that induced by man: removal of water from aquifers by pumping. When pumping in a well is started, the water level declines rapidly at first and drawdown extends outward for some distance from the well. The drawdown is greatest near the well and gradually decreases with distance from the well. The shape of the lowered water surface resembles an inverted cone and is referred to as the cone of depression. The size and shape of this cone will vary according to the pumping rate, length of pumping period, aquifer characteristics, and the rate of recharge within the cone of depression.

Minor fluctuations in water levels in artesian aquifers can result from changes in barometric pressure, land-surface loading, earthquakes, and earth and ocean tides. However, these fluctuations are generally small (less than 0.2 feet), cyclic, and cause insignificant changes in ground-water storage over relatively short time periods.

WATER LEVEL MEASUREMENTS

Water levels in shallow water-table wells Db24-10, Hb14-1, Mc51-1, Md22-1, Nc45-1, Ng11-1, and Qe44-1, and in artesian well Dc34-5 were made by periodic (generally monthly) tape measurements.

The levels in wells Bc43-1, Dc34-6, and Id55-1 were recorded on continuous water-level recorders with a time chart of one month. Water levels were extracted from the charts at five-day intervals and at the end of the month. The levels in wells Jd14-1 and Nc13-3 were also measured by these recorders until May, 1976. At that time wells Jd14-1 and Nc13-3 were equipped with analog-to-digital recorders that record water levels hourly in punched tape format.

Well descriptions and water-level data are presented for each well in Appendix A.

All water-level measurements are reported from ground-surface datum. Water levels can be converted to sea-level datum for any particular well by subtracting the recorded water level from the ground-surface elevation. If the resulting number is positive then the level is above sea level; if the number is negative, the level is below sea level.

ANALYSES OF MEASUREMENTS

Water-Table Wells

Examination of ground-water hydrographs shown in Figures 2 through 9 suggests that no long-term trends in water-level rise or decline have occurred. Thus, although levels have fluctuated widely on a seasonal and yearly basis in response to natural climatic factors, no significant changes in ground-water storage have occurred.

During the reporting period the yearly average ground-water levels in individual wells (Table 2) have ranged between a minimum of 2.68 feet (well Ng11-1) and a maximum of 8.34 feet (well Db24-10). The highest yearly average levels were recorded during 1972 and 1975 for six of the eight wells. These high levels correspond directly with above normal precipitation received during 1971-1972 and 1975 (Table 1; Figures 2-9). The lowest average yearly levels occurred during either late 1966 or from late 1976 through 1977. The low levels recorded in 1966 resulted from drought conditions during the early and middle 1960's (Woodruff, 1967). During the period January, 1961 through December, 1966 the cumulative precipitation deficiency for New Castle County, and Kent and Sussex counties was 58.26 inches and 45.77 inches, respectively. An important fact is that although water levels remained abnormally low during the drought, the levels in all

TABLE 2

Yearly average ground-water levels in feet below land surface datum for eight water-table wells.

Well	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Bc43-1	29.06	25.40	28.97	29.33	27.00	25.36	26.56	27.87	28.10	25.65	29.26	29.75
Db24-10	16.28	10.82	10.23	14.31	10.91	10.53	7.94	8.09	10.37	8.85	11.02	14.14
Hb14-1	11.50	8.80	8.03	9.01	6.53	6.63	4.58	5.13	6.81	5.26	7.08	9.34
Mc51-1	13.12	9.82	11.43	12.41	11.16	11.13	10.18	10.63	10.62	9.62	13.11	14.44
Md22-1	8.72	4.23	6.54	5.99	4.76	4.25	3.54	4.78	5.50	3.56	5.75	7.03
Nc45-1	12.03	10.75	11.48	11.58	11.53	12.56	12.85	13.27	13.59	12.75	13.06	13.41
Ng11-1	13.36	11.82	12.44	12.39	11.42	11.04	10.72	11.22	12.26	10.68	11.36	12.66
Qe44-4	9.77	7.66	8.63	8.35	7.79	6.60	6.34	7.35	7.22	6.24	8.50	8.67
Average of 7 wells excluding Bc43-1	12.11	9.13	9.83	10.58	9.16	8.96	8.02	8.64	9.48	8.14	9.98	11.38

but one well, Nc45-1, recovered rather quickly in 1967 in response to above normal precipitation.

Well Nc45-1 near Greenwood, has the longest period of record for wells in this report, 26 years. The yearly average levels for that period are presented in Table 3. The average levels fluctuated very little from 1952 through 1960. However, between 1960 and 1962 they dropped approximately four feet, primarily in response to drought conditions. The levels in this well, unlike those in other water-table wells, have not recovered to pre-drought conditions. Thus, a permanent decrease in ground-water storage occurred between 1960 and 1962.

This permanent decrease in water-level of about two feet coincided with below normal precipitation. However, the decline also occurred at about the same time the main channel of the Nanticoke River was deepened and widened to improve drainage. Because the Nanticoke River flows within about 1,000 feet of well Nc45-1 it is probable that ditching lowered the local water table and established a new gradient toward the river (Johnston, 1976, p. 37).

Figures 2 through 9 compare water-level fluctuations to precipitation over the reporting period. The normal seasonal fluctuations are apparent. During years with average

TABLE 3

Yearly average ground-water levels in feet below land surface datum for well Nc45-1, Greenwood, Delaware.

Year	Average Level	Year	Average Level	Year	Average Level
1952	8.50	1961	-	1970	11.53
1953	8.70	1962	12.44	1971	12.56
1954	9.09	1963	12.56	1972	12.85
1955	8.89	1964	11.08	1973	13.27
1956	8.88	1965	11.71	1974	13.59
1957	8.91	1966	12.03	1975	12.75
1958	8.11	1967	10.75	1976	13.06
1959	8.81	1968	11.48	1977	13.41
1960	8.32	1969	11.58		

precipitation water levels generally rose between November and March and were the highest in early spring when soil moisture was excessive, evapotranspiration was small, and frequent pulses of recharge took place. Johnston (1973) has shown that in many portions of Delaware recharge to the Columbia deposits is rapid with water levels rising within a few hours after the start of heavy rainfall. Levels generally declined from May to September and were usually lowest in the fall following a summer period when soil moisture was deficient, evapotranspiration high, and recharge infrequent.

The declining trend in water levels that began in February, 1976 and continued through November, 1977 is evident in Figure 3. This trend resulted from a combination of below normal precipitation and sustained freezing temperatures during the winter of 1976-1977. The freezing temperatures resulted in frozen ground conditions to depths of three feet, preventing seasonal recharge. However, in response to above

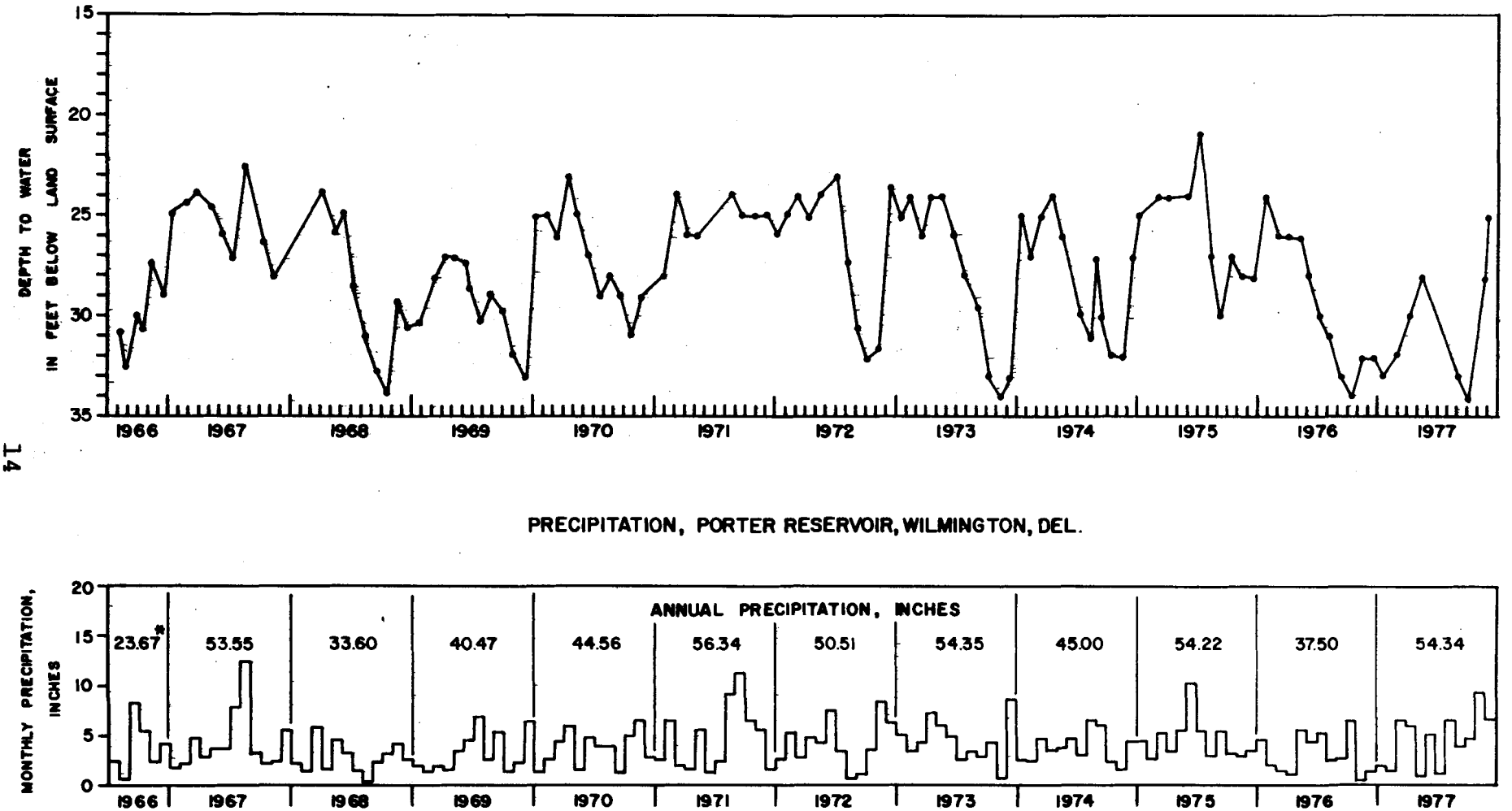

Figure 2. Graphs of water levels in well Bc43-1 and precipitation at Porter Reservoir, Wilmington, Delaware. *Six-month total, July - Dec.

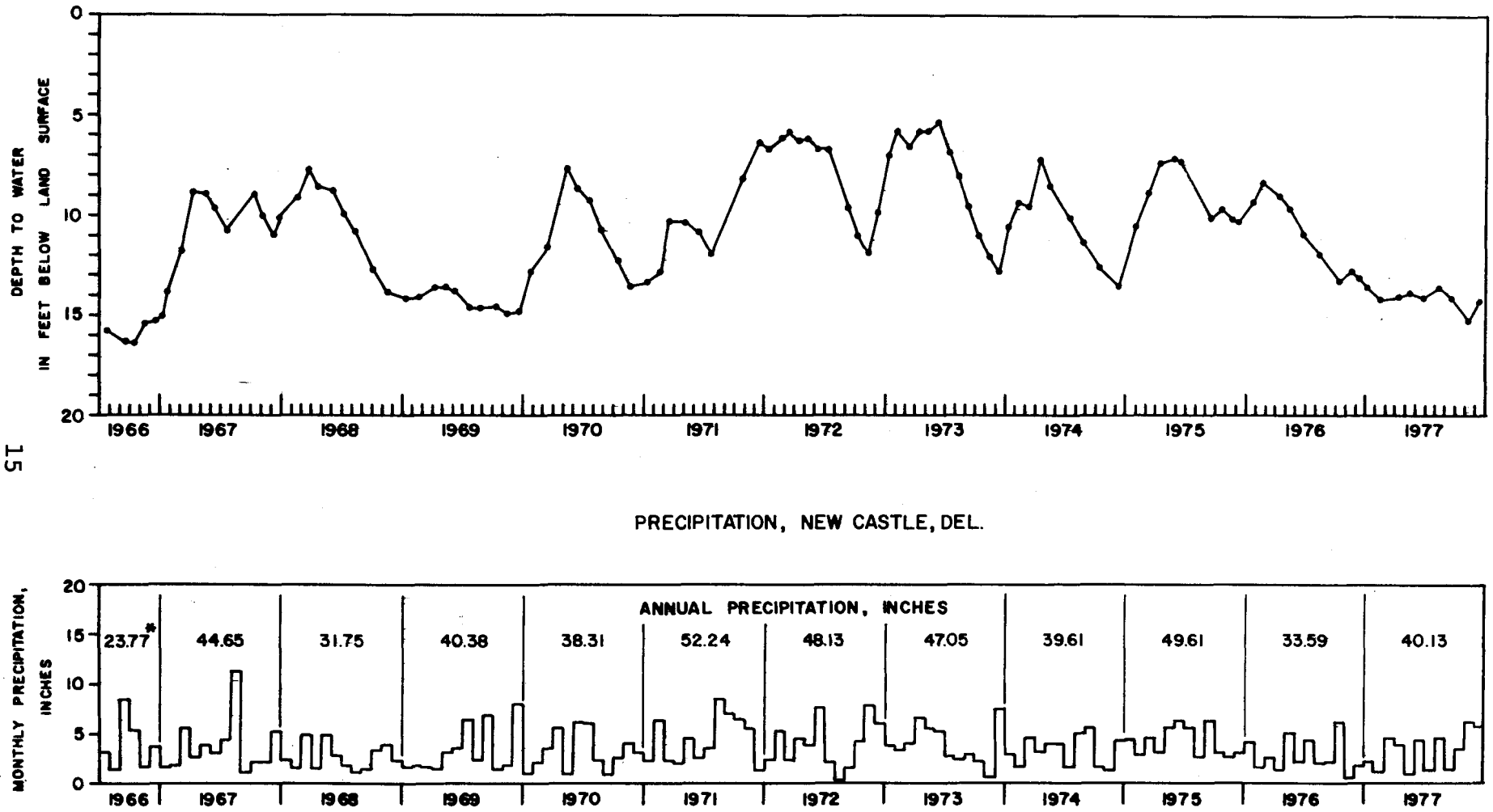

Figure 3. Graphs of water levels in well Db24-10 and precipitation at New Castle, Delaware. *Six-month total, July - Dec.

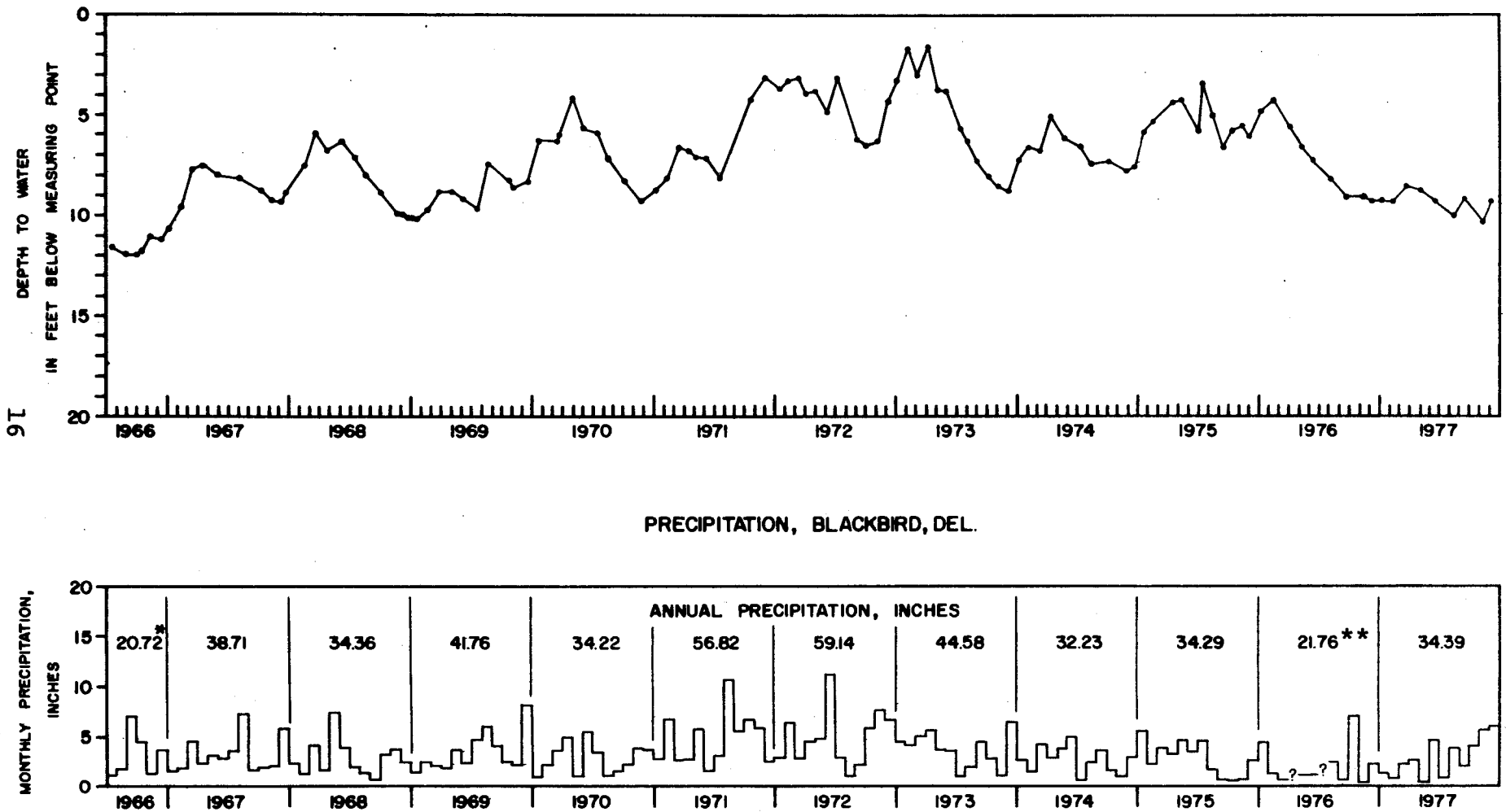

Figure 4. Graphs of water levels in well Hb14-1 and precipitation at Blackbird, Delaware. *Six-month total, July - Dec. **No precipitation data for April and July.

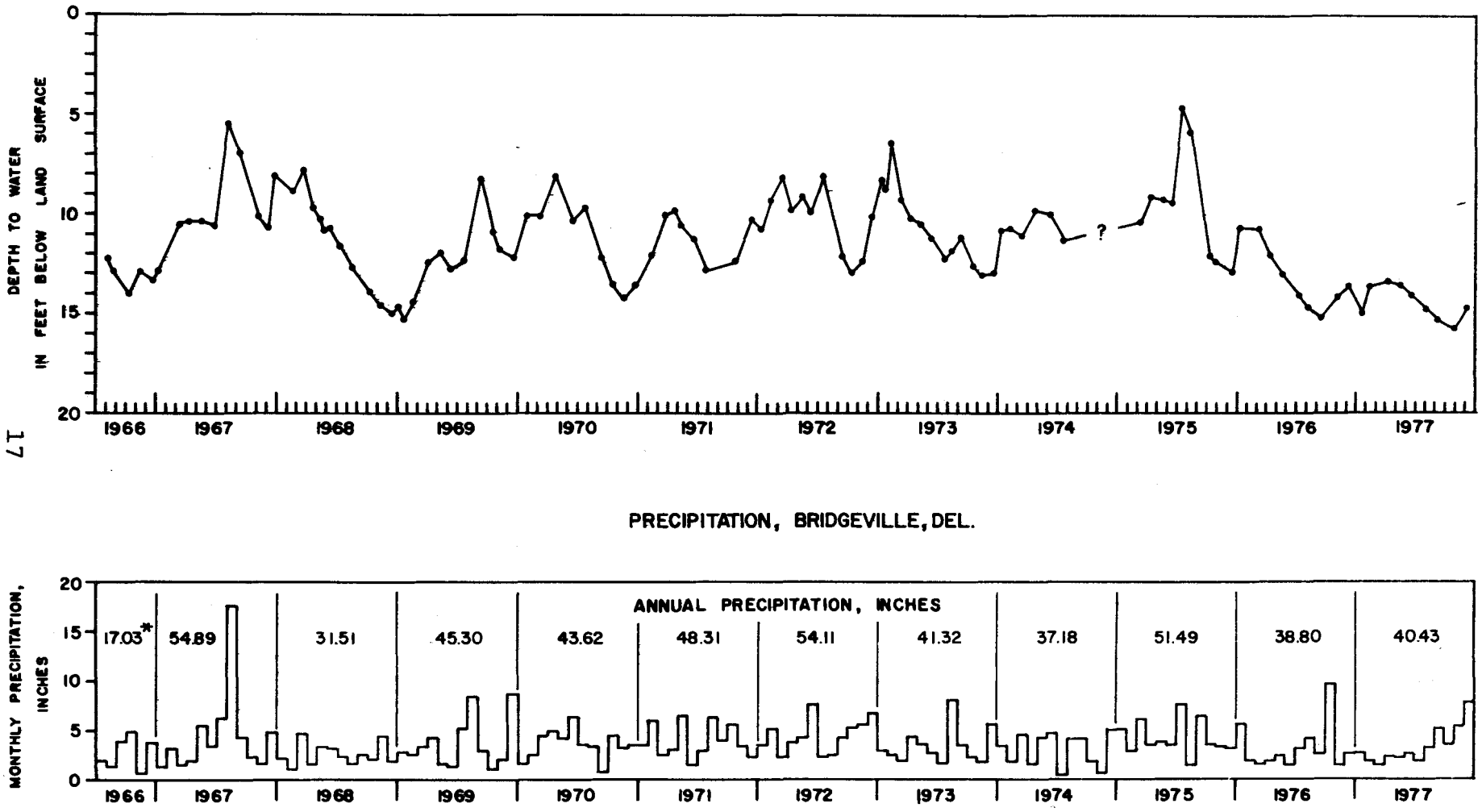

Figure 5. Graphs of water levels in well Mc51-1 and precipitation at Bridgeville, Delaware. *Six-month total, July - Dec.

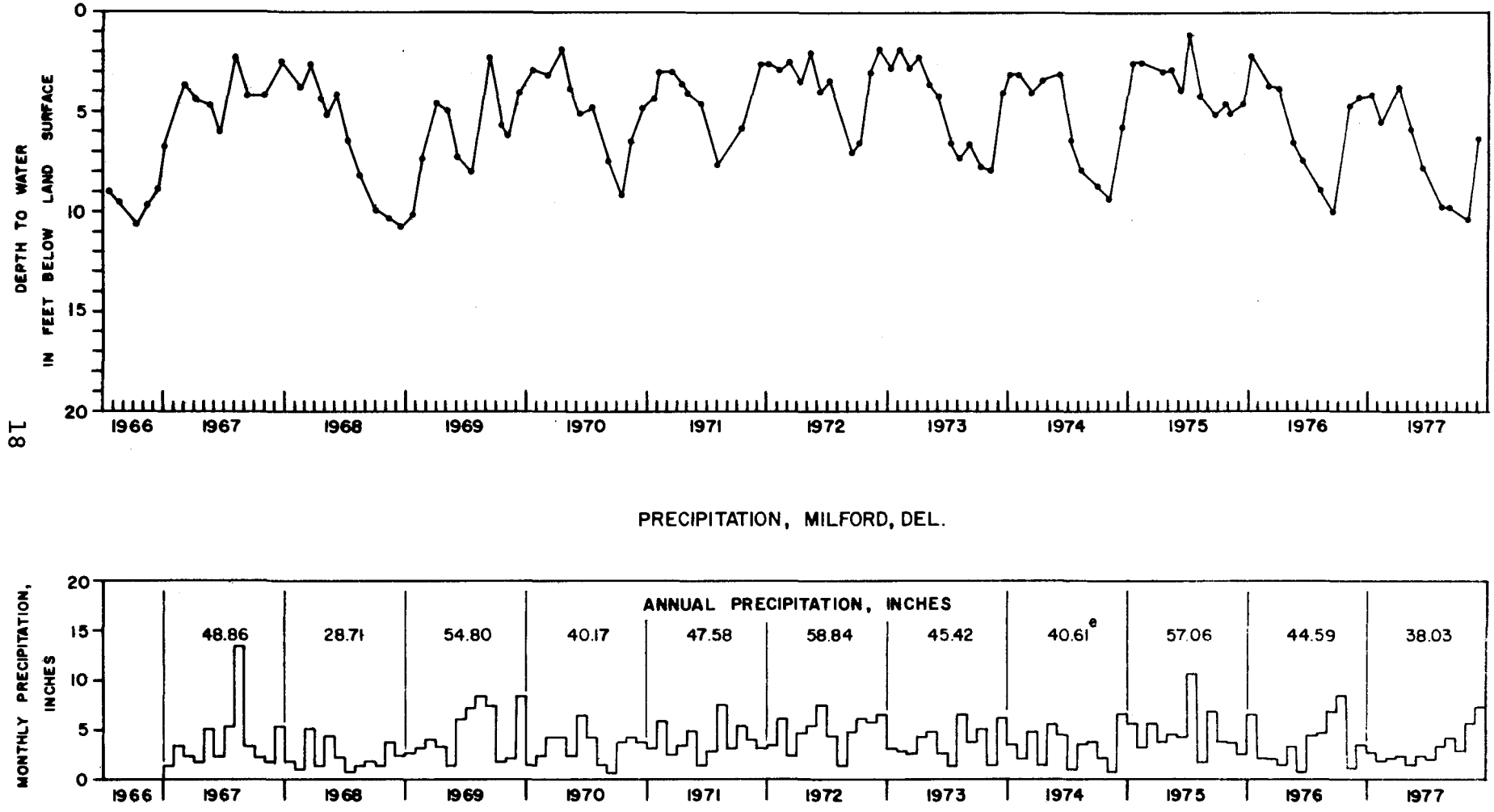

Figure 6. Graphs of water levels in well Md22-1 and precipitation at Milford, Delaware.
e - estimated.

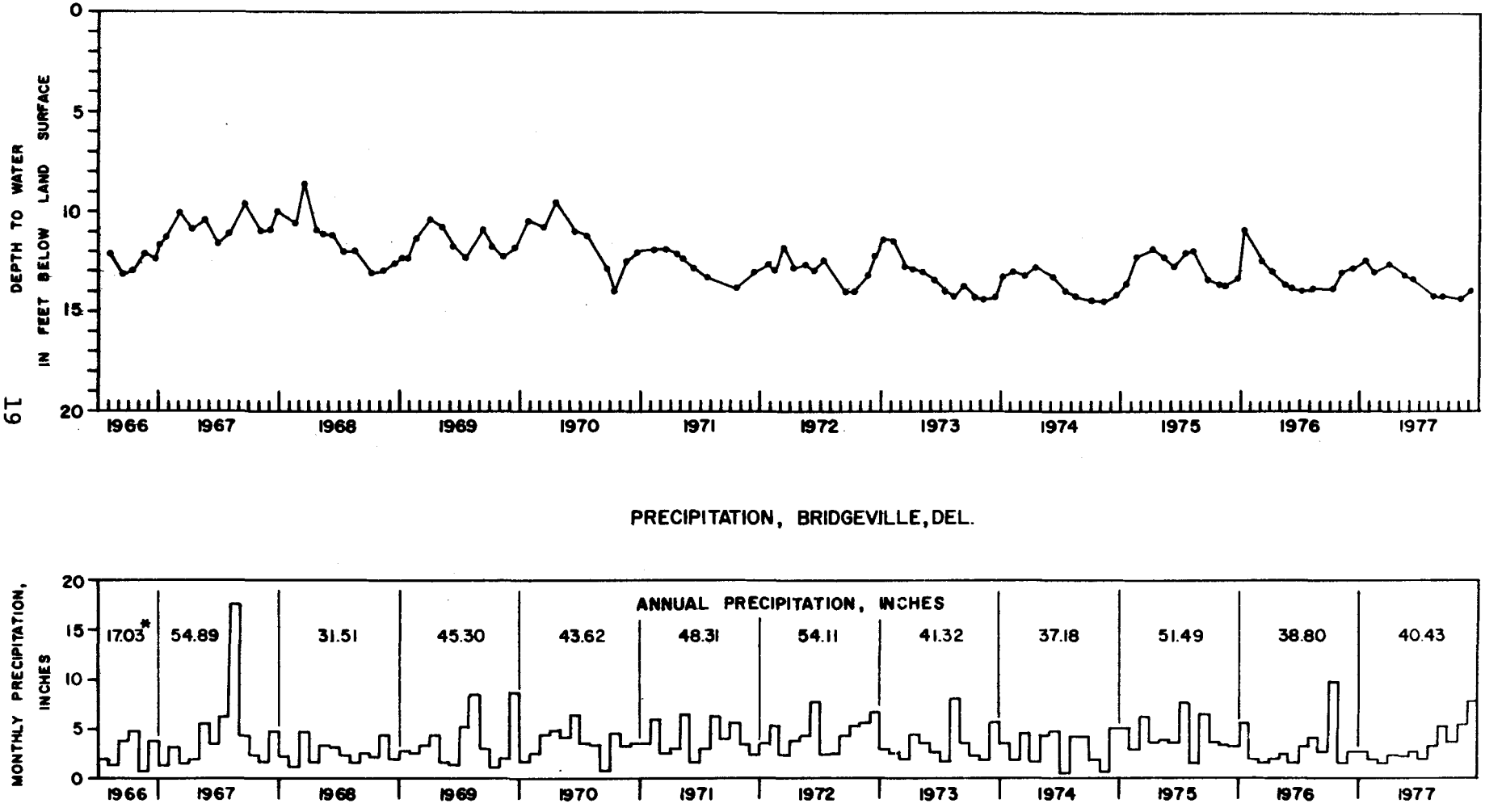

Figure 7. Graphs of water levels in well Nc45-1 and precipitation at Bridgeville, Delaware. *Six-month total, July - Dec.

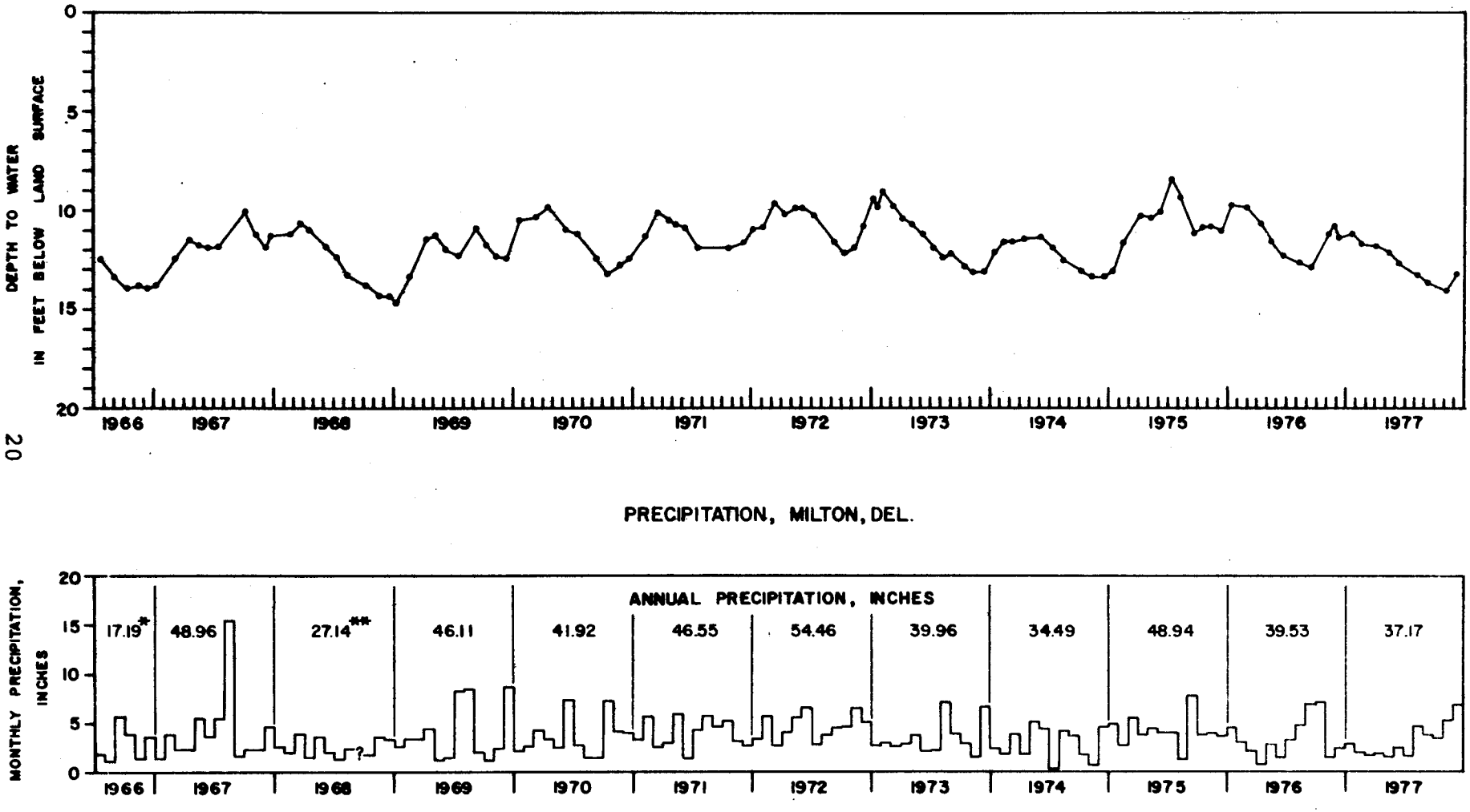

Figure 8. Graphs of water levels in well Ng11-1 and precipitation at Milton, Delaware. *Six-month total, July - Dec. **No precipitation data for September.

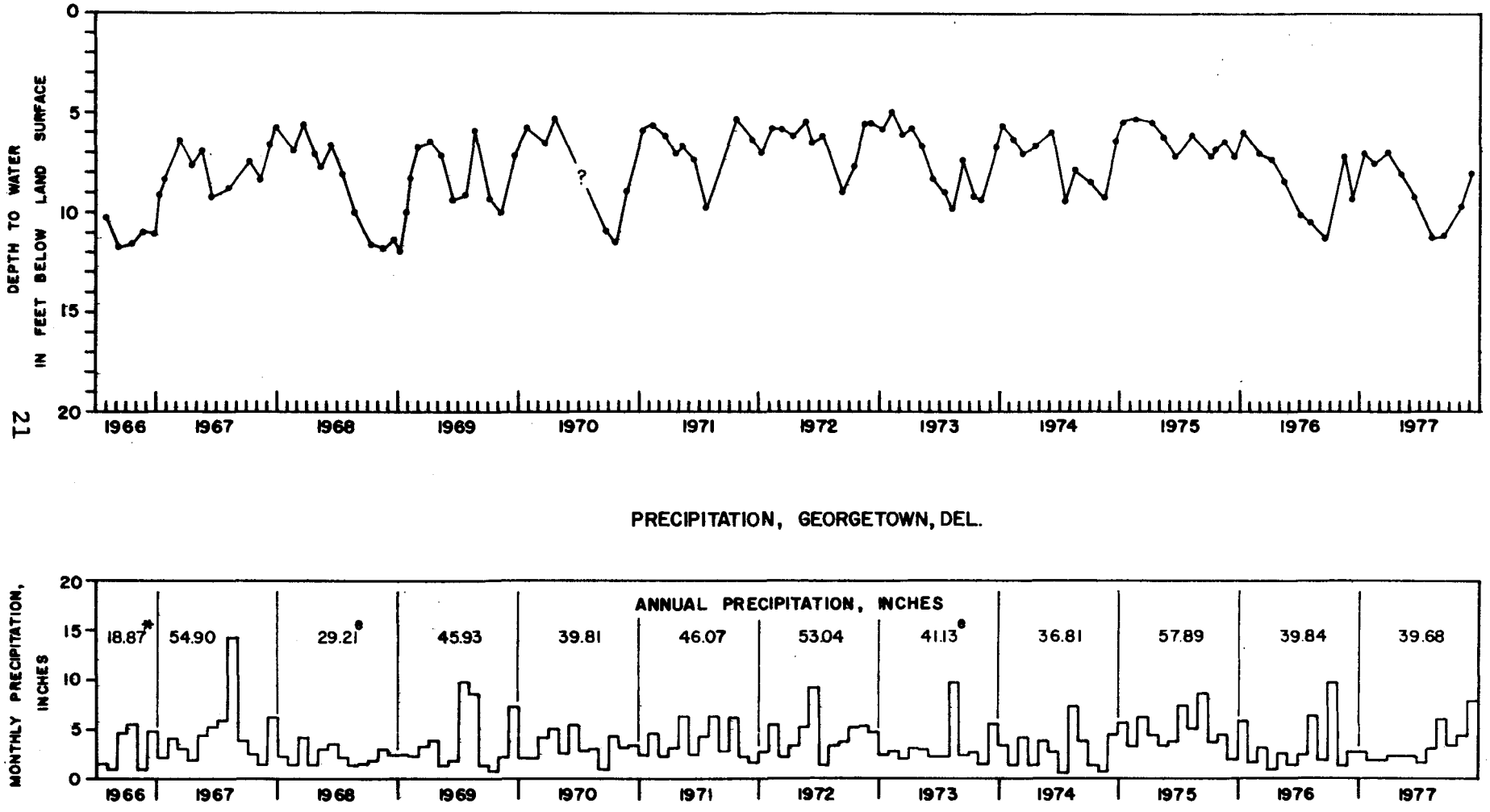

Figure 9. Graphs of water levels in well Qe44-1 and precipitation at Georgetown, Delaware. *Six-month total, July - Dec. e - estimated.

normal precipitation during the winter and spring of 1978, water levels have risen and were within the normal range as of June, 1978.

Table 4 shows the maximum fluctuation of the water table in seven shallow wells during July, 1966 - December, 1977. The largest range during the period was 11.17 feet in well Mc51-1; well Nc45-1 had the smallest range, 5.96 feet.

TABLE 4

Maximum range of water levels in feet for seven shallow water-table wells, July, 1966 - December, 1977.

Well	Maximum Level	Minimum Level	Maximum Range
Db24-10	15.21	5.40	9.81
Hb14-1	11.95	1.54	10.41
Mc51-1	15.69	4.52	11.17
Md22-1	10.70	1.07	9.63
Nc45-1	14.48	8.52	5.96
Ng11-1	14.56	8.43	6.13
Qe44-1	11.89	4.92	6.97

Artesian Wells

Four of the five artesian observation wells (Dc34-5, Dc34-6, Id55-1, Jd14-1) are located in areas where the aquifer systems are heavily pumped. The fifth well, Nc13-3, is located approximately 23 miles from areas of heavy pumping. Nevertheless, the water levels in well Nc13-3 are also affected by pumping in the heavy use areas.

The water level surfaces in these artesian wells change almost constantly in response to changes in discharge, recharge, and readjustment of the hydrostatic pressure in the aquifer system.

Observation Well Dc34-5

The water-level surface in well Dc34-5 has shown a net rise of 11.27 feet during the period of record (Figure 10). This short period of record, 26 months, does not permit the determination of long term trends.

Initial water levels (1915) in the vicinity of Dc34-5 prior to extensive ground-water development were within 4 to 10 feet of land surface (Marine and Rasmussen, 1955). However, the levels have decreased approximately 110 feet since as a result of heavy pumpage by industry.

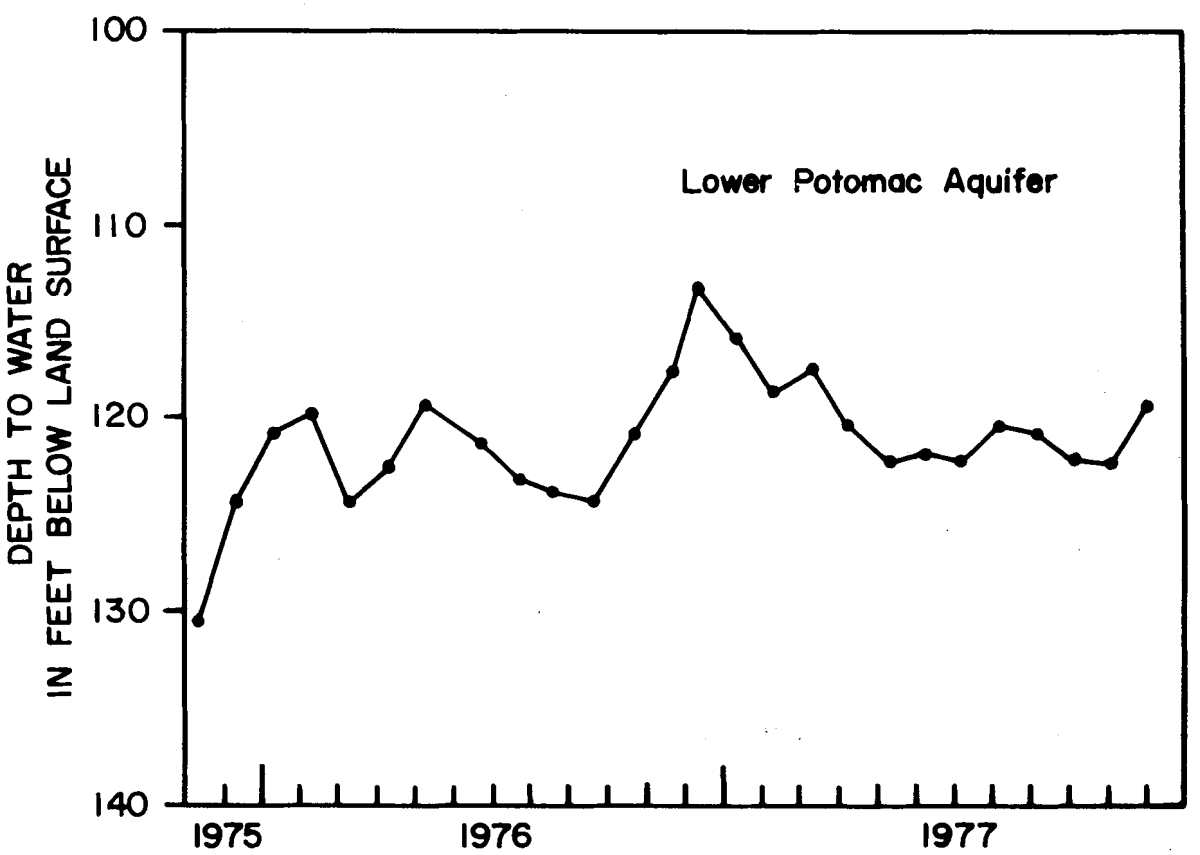

Figure 10. Hydrograph showing water-level fluctuations in well Dc34-5, lower Potomac aquifer, November, 1975-1977.

Observation Well Dc34-6

The hydrograph of well Dc34-6 (Figure 11) shows a general declining water-level trend with a net decline of 9.3 feet during the 26-month period of record. This well, which is screened in the upper Potomac aquifer from 183-188 feet below land surface, is situated in an area influenced by heavy pumpage from industrial, county, and public water-supply wells. The level will probably continue to decline if the present pumpage from well fields in the vicinity of Dc34-6 is maintained or increased.

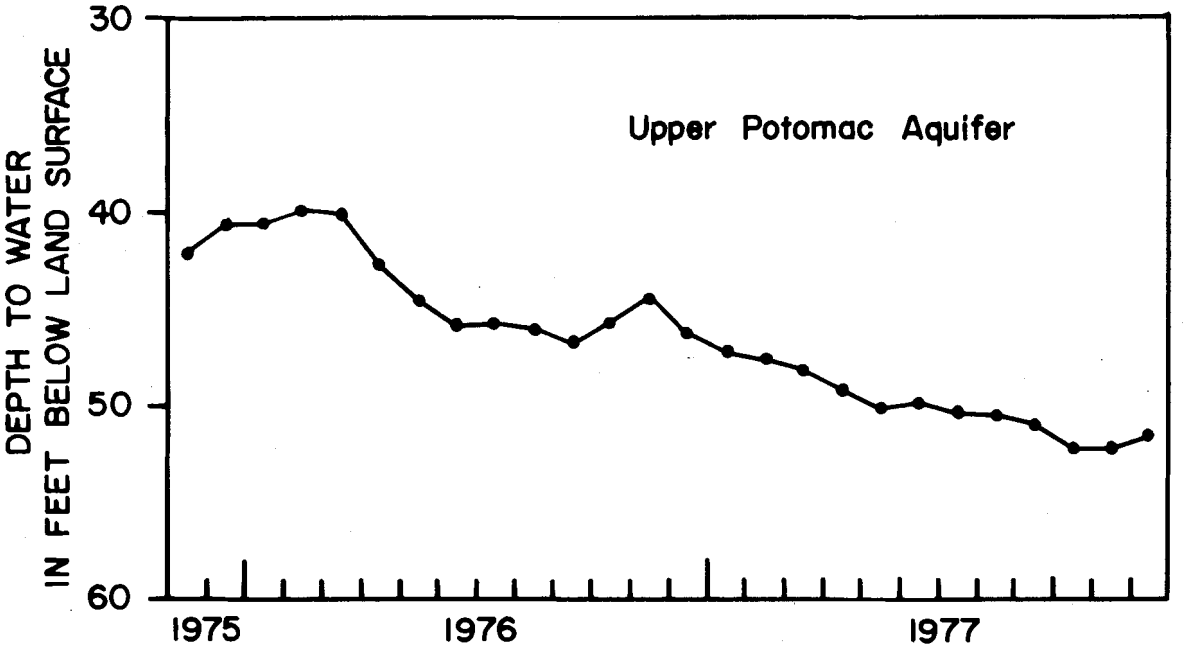

Figure 11. Hydrograph showing water-level fluctuations in well Dc34-6, upper Potomac aquifer, November, 1975-1977.

Observation Well Id55-1

The hydrograph of observation well Id55-1 (Figure 12) shows a general downward trend of the water-level surface during 1969-1977. Figure 12 shows that during the course of a year the water-level surface generally undergoes one cycle of rise and decline. The surface is generally highest during March and April when the aquifer recovers during periods of decreased ground-water withdrawal. This upward trend is reversed during the late spring months and continues through

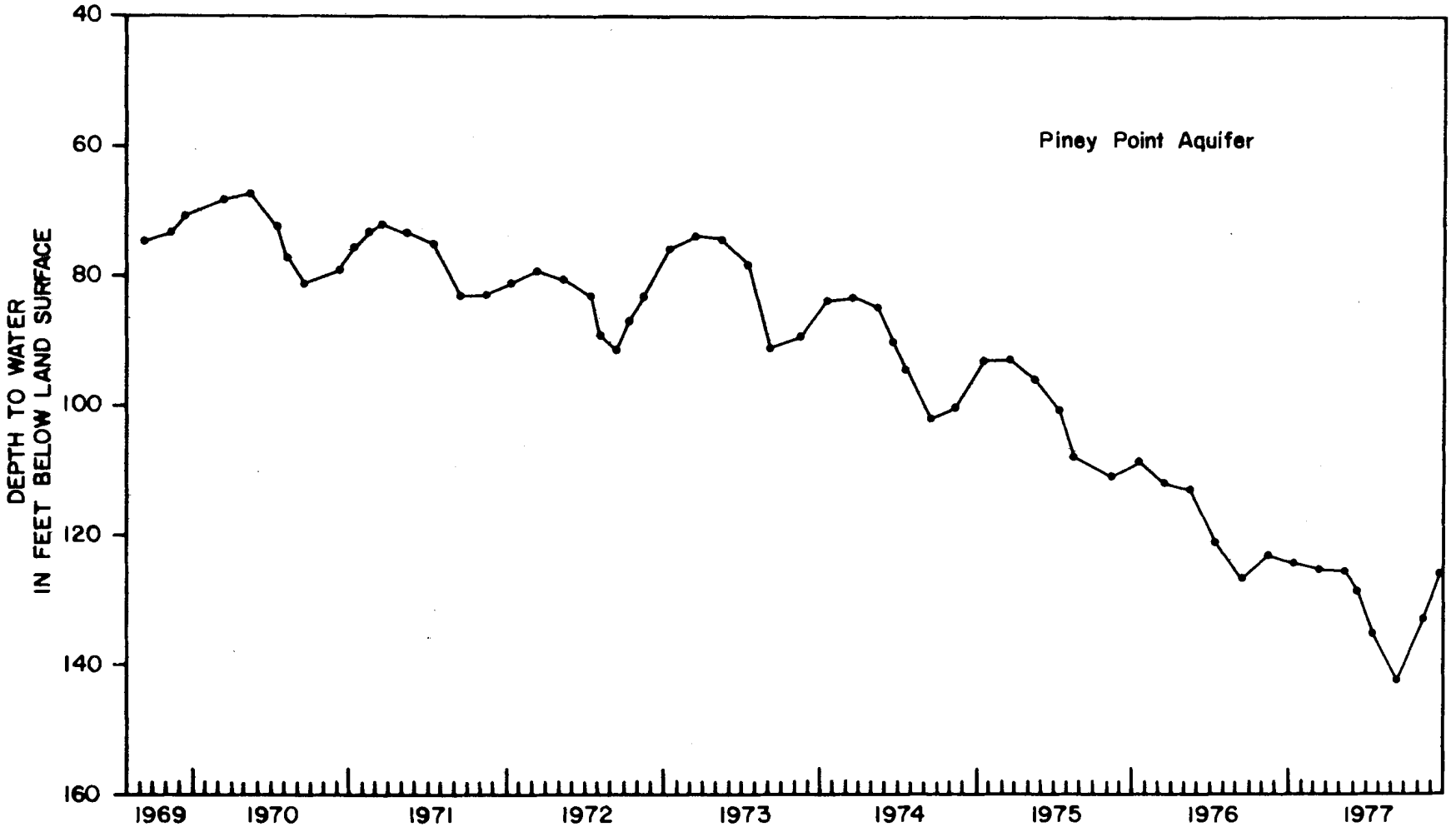

Figure 12. Hydrograph showing water-level fluctuations in well Id55-1, Piney Point aquifer, August, 1969-1977.

the summer as ground-water pumpage increases in response to seasonal demands for water. The total decline during the period of record was 52.09 feet for an average decline of 6.1 feet per year.

The effect of ground-water withdrawal on water levels in the Piney Point aquifer can be clearly seen in Figures 13 and 14. The data indicate that in the period from 1970 to 1972, water levels in well Id55-1 declined gradually in response to nearly equal yearly ground-water withdrawals. However, the sharp decline in water level beginning in 1973 (Figure 13) is due to increased pumping from the aquifer during this period. As annual pumpage increased from 621 million gallons in 1973 to 1,252 million gallons in 1976 in the Dover area, the water declined from 80.74 feet to 117.7 feet. The annual rate of water-level decline increased from 1.84 feet per year in the period from 1970 to 1974 to 12.63 feet per year in the period from 1974 to 1977.

The original water levels in the Piney Point aquifer were reported to be approximately 20 feet above sea level when measured in a well at the mouth of the Mahon River in 1944 (Marine and Rasmussen, 1955). In 1962, the water level was approximately at sea level (20 feet below land surface) at Dover Air Force Base. Since 1962, the Piney Point aquifer has been used extensively in the Dover-Dover Air Force Base area. Pumpage has increased from 116 million gallons per year in 1962 to about 1,329 million gallons per year in 1977 (P. Leahy, personal communication). During this time the water level has declined about 125 feet for an average decline of 7.8 feet per year. It is anticipated that levels will continue to decline in response to continuous and increased demand for water in the Dover area.

In response to heavy pumpage, which has resulted in continual decline in water levels in wells and a continual growth of large cones of depression in the Dover area in both the Piney Point and Cheswold aquifers, a program was initiated in 1974 to develop a computer digital model of both aquifers. The purpose of designing such a model is to develop a capability to forecast future water-level declines under various pumping conditions. Such a tool can be used to plan and manage ground-water development of the Piney Point and Cheswold aquifers in the coming years.

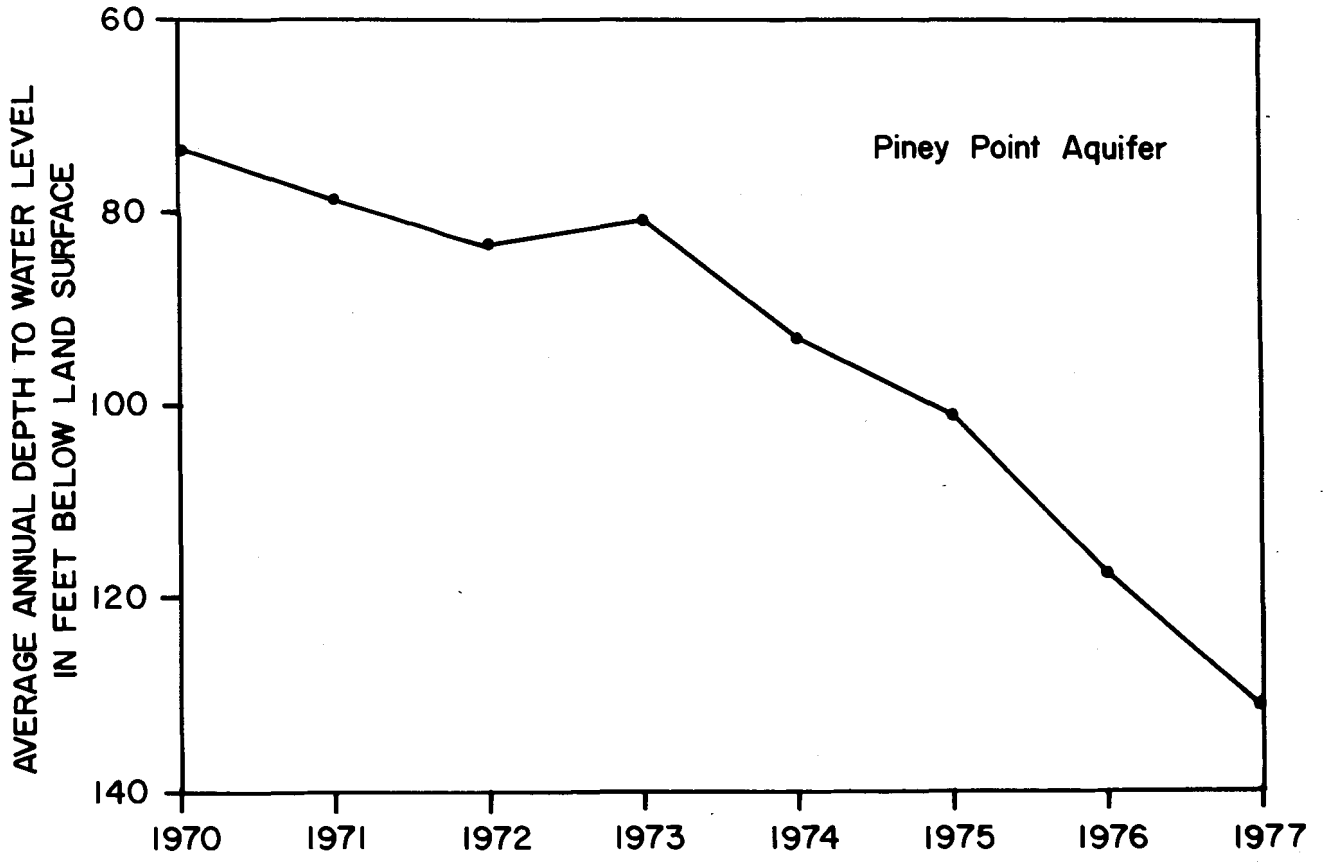

Figure 13. Hydrograph showing average annual water levels in well Id55-1, Piney Point aquifer, 1970-1977.

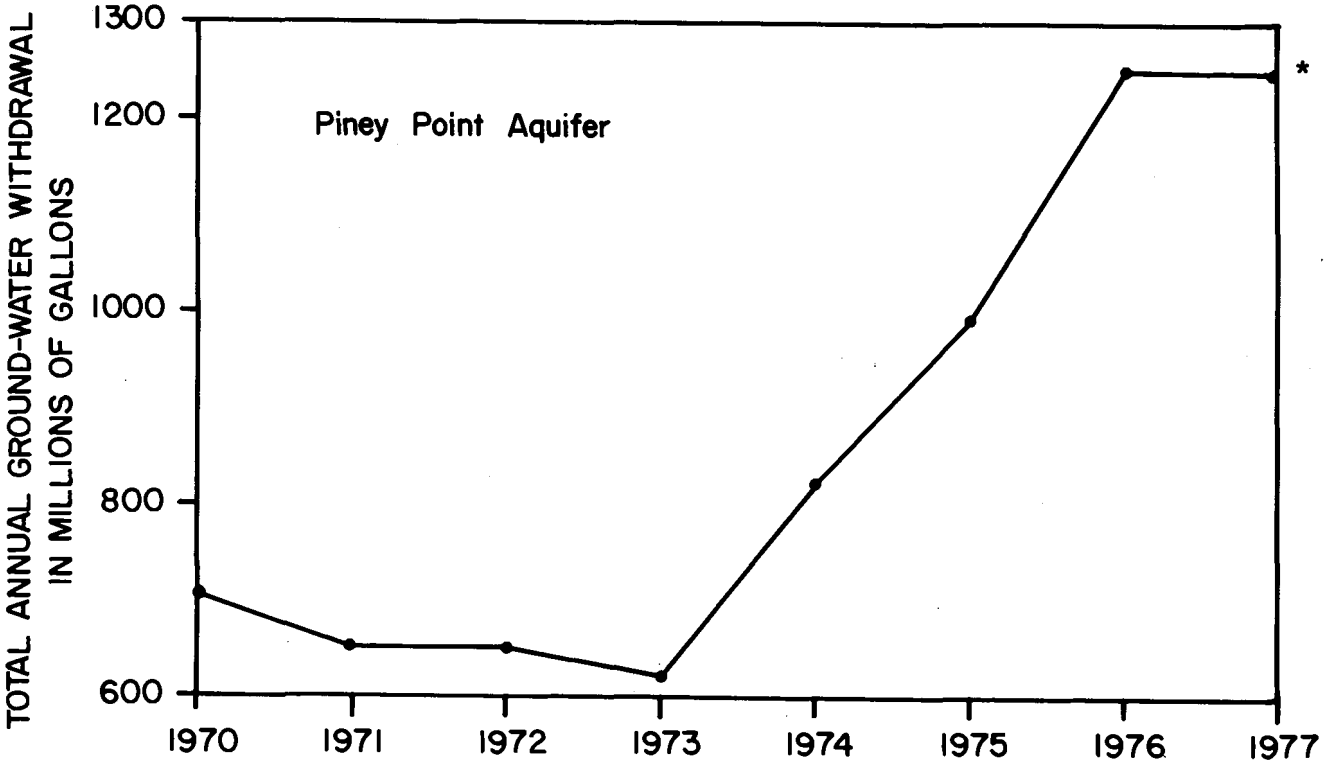

Figure 14. Graph showing total annual ground-water withdrawal from the Piney Point aquifer in the Dover area, 1970-1977. * Projected pumpage based on data from Jan. through May, 1977.

Observation Well Ncl3-3

The hydrograph of observation well Ncl3-3 (Figure 15) indicates a general downward trend of the water-level surface from 1971 through 1977. Unlike the levels in well Id55-1, the levels in Ncl3-3 are affected very slightly by seasonal variations in ground-water pumpage. The total decline in water level for the period 1971 to 1977 was 8.2 feet, an average decline of 1.17 feet per year.

The hydrograph can be separated into three segments: (1) a relatively steep decline in the water-level surface from 1971 to 1972; (2) a slight decline from 1972 to 1974; and, (3) a relatively steep decline from 1974 to 1977. These trends correlate with changes in pumpage from the aquifer. For instance, annual pumpage increased from 5.22 million gallons in 1966 to 766 million gallons in 1970 resulting in a steeping of the slope of water-level decline. From 1970 to 1973 the annual rate of pumpage decreased from 766 million gallons to 683 million gallons. However, the annual rate increased from 683 million gallons in 1973 to an estimated 1,329 million gallons in 1977 resulting in a steeping of the water-level surface during the corresponding period. It is anticipated that the level in Ncl3-3 will continue to decline if additional stresses are placed on the Piney Point aquifer.

Observation Well Jdl4-1

The hydrograph of well Jdl4-1 (Figure 16) indicates that the water-level surface rose 22.1 feet during the 5-year, 5-month period of record, an average rise of 4.08 feet per year. This trend is directly related to ground-water withdrawals from the aquifer. Examination of Figures 17 and 18 shows that as total annual pumpage decreased from 2,022 million gallons in 1973 to 1,640 million gallons in 1976, average annual depths to water-level rose about 17 feet. In 1977, annual pumpage increased by about 70 million gallons over 1976. Associated with this increase was a decrease in the average annual water level.

A history of ground-water development of the Cheswold aquifer in the Dover-Dover Air Force Base area is presented by Marine and Rasmussen (1955) and Sundstrom and Pickett (1968).

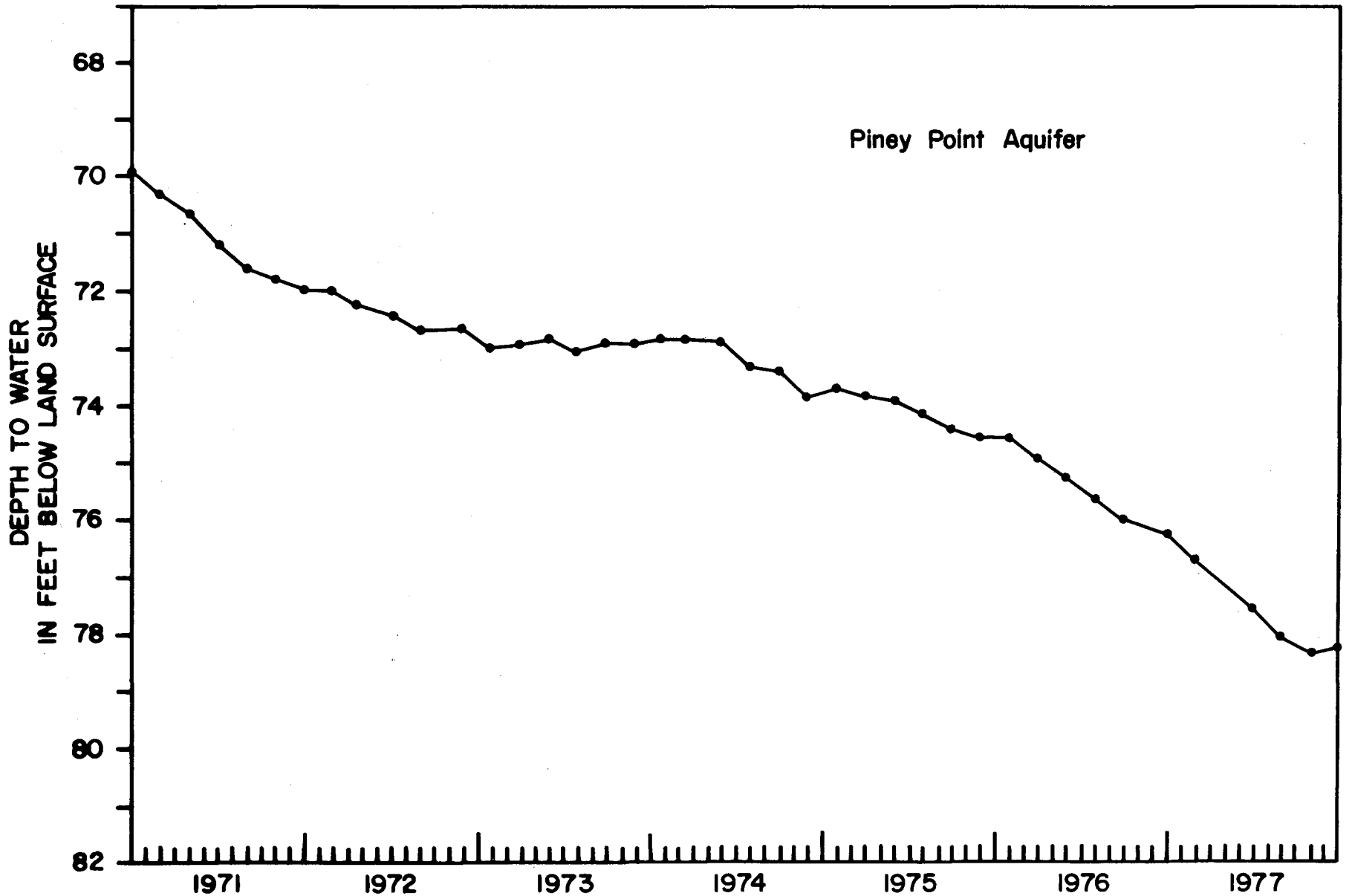

Figure 15. Hydrograph showing water-level fluctuations in well Ncl3-3, Piney Point aquifer, 1971-1977.

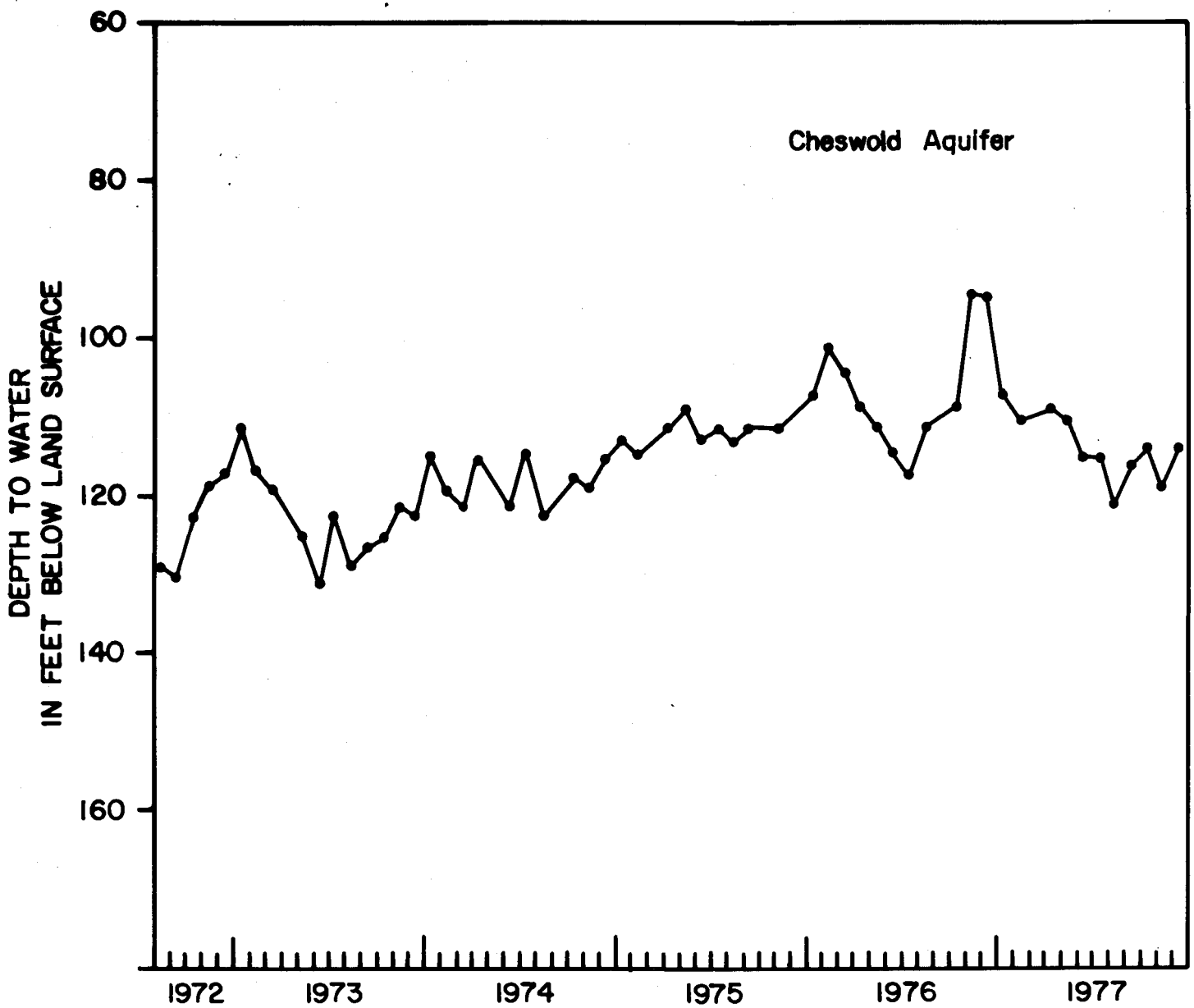

Figure 16. Hydrograph showing water-level fluctuations in well Jdl4-1, Cheswold aquifer, August, 1972-1977.

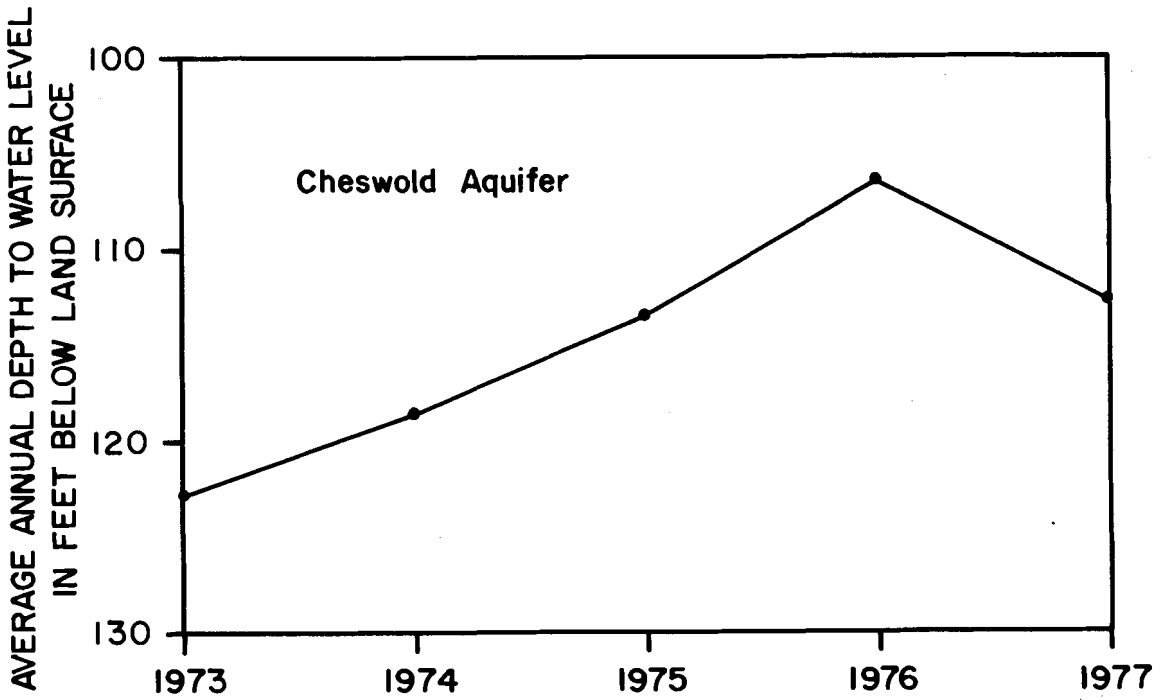

Figure 17. Hydrograph showing average annual water levels in well Jd14-1, Cheswold aquifer, 1973-1977.

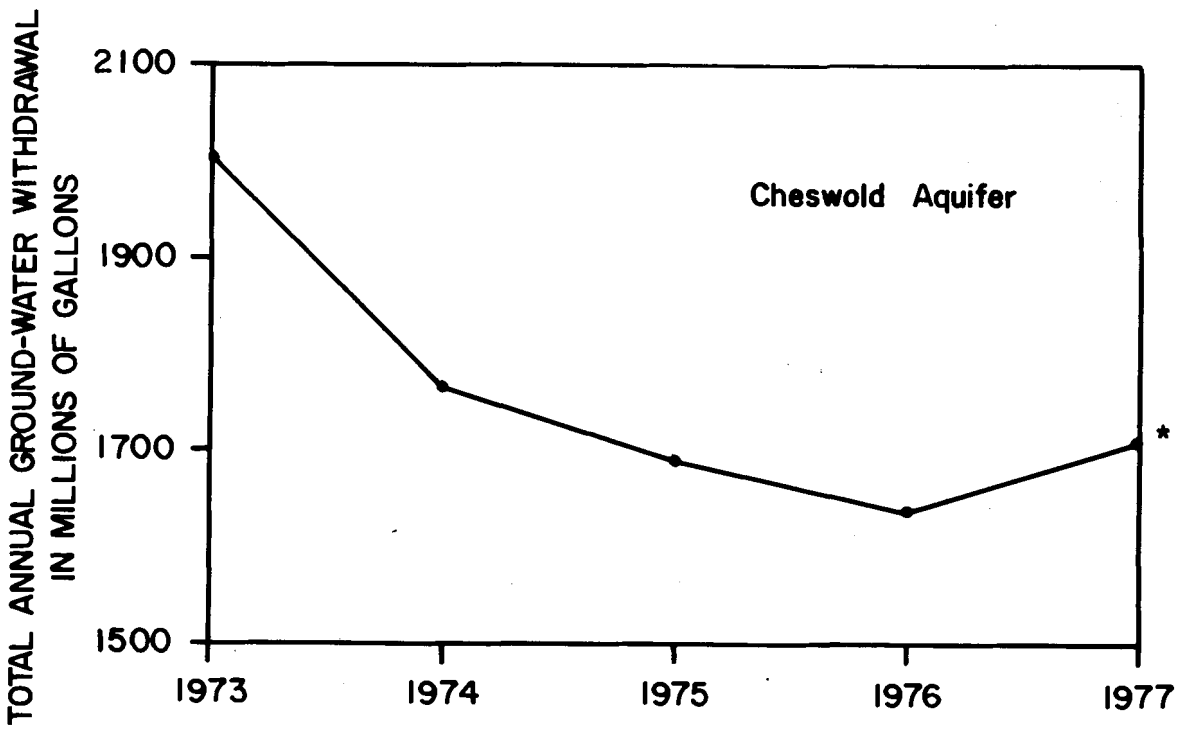

Figure 18. Graph showing total annual ground-water withdrawal from the Cheswold aquifer in the Dover area, 1973-1977. * Projected pumpage based on data from Jan. through May, 1977.

CONCLUSIONS

There appears to have been no significant changes in ground-water storage in the shallow water-table aquifer in areas remote from ground-water development during the 11.5 year reporting period.

The relationship between natural climatic factors and water-level rise and decline in the water-table aquifer is evident. The hydrographs show that levels generally rise from November through March, when recharge exceeds discharge, and decline from May through September during the warm growing season when soil moisture is deficient, evapotranspiration is high, and recharge is infrequent. Although levels in several wells exhibited overall declines up to 21 months duration as a result of below normal precipitation, the levels recovered rather quickly in response to normal and above normal precipitation following extended dry periods.

The maximum range of water-level fluctuations during the reporting period in water-table wells was 11.17 feet in well Mc51-1. A minimum range of 5.96 feet was recorded in well Nc45-1. The maximum range during any one calendar year was 8.38 feet in well Mc51-1 (1975) while the minimum range was 1.35 feet in well Db24-10 (1969). This indicates that some owners of shallow wells can expect to experience water supply difficulties during certain periods. Shallow wells constructed during periods of high water levels are especially susceptible to supply difficulties during extended dry periods.

Ditching operations along the Nanticoke River resulted in a permanent lowering of the water table in well Nc45-1 of approximately two feet during 1960-61.

Development of ground-water supplies in heavy use areas of the Potomac, Piney Point and Cheswold aquifers during the past several decades has resulted in the development of cones of depression with areas of several square miles, and reductions in aquifer storage. The long-term declines in water levels have occurred in response to man-induced stresses placed on the aquifers by pumpage.

Wells Id55-1, Nc13-3, and Dc34-6 showed declines in water levels during the respective reporting periods while the levels in wells Dc34-5 and Jd14-1 rose in response to decreases in ground-water discharge, increases in ground-water recharge, or a combination thereof.

The projected increase in water demands and, therefore, ground-water withdrawal from the Potomac, Piney Point, and Cheswold aquifers will result in continuing declines of the potentiometric surfaces in these aquifers. Thus, it is imperative that future development of these aquifers be carefully planned and managed by utilizing all available geologic and hydrologic data applied to ground-water models.

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APPENDIX A

Well Descriptions and Water-Level Data

The well number is given first followed by the owner's name. The location is defined by latitude and longitude and sometimes more generally by reference to a nearby geographic feature. The aquifer screened, well construction data, highest and lowest water levels, period of record, and other pertinent information are also presented. Abbreviations used are listed below:

lat. - latitude

long. - longitude

lsd - land surface datum

msl - mean sea level

mp - measuring point

Bc43-1. Mrs. W. A. Worth. Lat. 39°46'52", long. 75°37'30". Near Hoopes Reservoir. Drilled unused well in Wissahickon Formation. Diameter 6", depth 165.35 feet. Lsd about 330 feet above msl. MP recorder platform 0.96 feet above lsd. Highest water level 20.98 feet below lsd, July 14, 1975; lowest, 34.35 feet below lsd, Nov. 25, 1964. Records available: Aug. 1950, Jan. 1956 to Sept. 1960, April 1961 to 1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
Aug. 2	30.85	June 7	27.44	Apr. 14	25.03	Jan. 5	24.99
Aug. 29	32.52	June 27	28.64	May 17	23.99	Mar. 5	24.01
Sept. 22	29.96	July 28	30.24	July 2	23.03	Apr. 4	24.04
Oct. 14	30.69	Aug. 29	28.94	Aug. 4	27.29	May 9	24.03
Nov. 4	27.42	Sept. 30	29.74	Sept. 6	30.54	June 10	24.03
Nov. 26	29.50	Nov. 1	31.98	Oct. 9	32.14	July 14	20.98
Dec. 19	28.99	Dec. 3	33.03	Nov. 10	31.64	Aug. 15	27.01
1967		1970		Dec. 15	23.54	Sept. 15	29.99
Jan. 7	24.89	Jan. 5	25.02	1973		Oct. 19	27.00
Feb. 24	24.38	Feb. 9	25.01	Jan. 16	25.03	Nov. 21	28.00
Mar. 28	23.78	Mar. 13	26.04	Feb. 17	24.02	Dec. 30	28.04
May 2	24.62	Apr. 15	23.03	Mar. 23	25.97	1976	
June 8	25.93	May 18	24.97	Apr. 24	24.04	Jan. 30	24.02
July 10	27.18	June 20	26.99	May 28	24.01	Mar. 2	25.96
Aug. 14	22.63	July 23	28.97	June 29	25.97	Apr. 5	25.96
Oct. 9	27.23	Aug. 24	28.03	July 31	27.98	May 7	26.04
Nov. 10	28.01	Sept. 24	28.98	Sept. 4	29.59	June 9	27.99
1968		Oct. 26	30.97	Oct. 9	32.96	July 13	29.95
Apr. 1	23.76	Nov. 28	29.02	Nov. 12	34.00	Aug. 16	30.96
May 4	25.78	1971		Dec. 14	33.01	Sept. 17	32.99
June 5	24.91	Feb. 1	28.04	1974		Oct. 19	33.96
July 9	28.61	Mar. 4	23.97	Jan. 16	25.01	Nov. 23	32.01
Aug. 13	31.09	Apr. 5	25.95	Feb. 18	27.02	Dec. 27	32.02
Sept. 17	32.76	May 6	26.00	Mar. 23	25.04	1977	
Oct. 19	33.81	Aug. 28	23.96	Apr. 23	24.01	Jan. 28	32.99
Nov. 20	29.37	Sept. 29	24.97	May 27	26.01	Mar. 1	31.95
Dec. 23	30.61	Nov. 1	25.04	July 13	29.95	Apr. 15	24.99
1969		Dec. 4	24.97	Aug. 14	31.03	May 24	28.04
Jan. 23	30.32	1972		Sept. 16	30.01	Sept. 5	32.97
Mar. 4	28.04	Jan. 4	25.95	Oct. 18	31.95	Oct. 11	34.03
Apr. 4	27.14	Feb. 7	24.98	Nov. 20	32.01	Nov. 30	28.02
May 6	27.14	Mar. 13	24.03	Dec. 27	27.03	Dec. 2	25.02

Db24-10. Department of Highways and Transportation. Lat. 39°38'56", long. 75°41'56". Near Newark. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 24.0 feet. Well point 21.0 - 24.0 feet. Lsd about 77 feet above msl. MP top of casing at lsd. Highest water level 4.88 feet below lsd, May 12, 1958; lowest 17.43 feet below lsd, Feb. 10, 1966. Records available 1957 - 1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
July 21	15.66	June 6	13.93	June 6	6.69	Apr. 7	7.29
Sept. 19	16.37	July 22	14.58	July 11	6.70	May 20	7.05
Oct. 12	16.35	Aug. 23	14.70	Sept. 7	9.70	June 5	7.33
Nov. 16	15.38	Oct. 17	14.56	Oct. 9	11.01	June 25	7.05
Dec. 20	15.24	Nov. 7	14.96	Nov. 9	12.00	Sept. 15	10.03
1967		Dec. 22	14.85	Dec. 5	9.99	Oct. 28	9.77
Jan. 3	15.10	1970		1973		Nov. 13	10.21
Jan. 24	13.80	Jan. 26	12.86	Jan. 11	7.01	Dec. 8	10.30
Mar. 2	11.69	Mar. 13	11.58	Feb. 6	5.85	1976	
Apr. 12	8.79	Mar. 24	11.34	Mar. 8	6.60	Jan. 22	9.35
May 16	9.00	May 6	7.62	Apr. 3	5.76	Feb. 26	8.40
June 18	9.68	June 2	8.73	May 8	5.77	Apr. 12	9.06
July 25	10.75	July 15	9.42	June 7	5.40	May 17	9.73
Oct. 10	8.97	Aug. 20	10.68	July 17	6.93	June 29	11.00
Nov. 4	10.02	Oct. 5	12.32	Aug. 7	8.10	Aug. 12	12.01
Dec. 5	11.01	Nov. 19	13.62	Sept. 6	9.64	Oct. 4	13.41
Dec. 27	10.22	1971		Oct. 8	11.05	Nov. 11	12.94
1968		Jan. 13	13.42	Nov. 8	12.11	Dec. 9	13.32
Feb. 23	9.15	Feb. 23	12.76	Dec. 11	12.86	1977	
Mar. 26	7.71	Mar. 23	10.34	1974		Jan. 13	13.80
Apr. 29	8.56	Apr. 26	10.30	Jan. 8	10.62	Feb. 16	14.23
June 5	8.89	May 5	10.45	Feb. 12	9.44	Apr. 4	14.09
July 16	9.97	June 16	10.92	Mar. 12	9.61	May 5	13.94
Aug. 15	10.91	July 26	12.00	Apr. 16	7.29	June 28	14.17
Oct. 2	12.72	Oct. 28	8.17	May 8	8.54	Aug. 8	13.65
Nov. 21	13.93	Dec. 16	6.38	July 16	10.20	Aug. 11	13.70
1969		1972		Aug. 19	11.42	Sept. 15	14.20
Jan. 3	14.11	Jan. 13	6.72	Oct. 7	12.66	Nov. 2	15.21
Jan. 22	14.30	Feb. 21	6.22	Dec. 5	13.55	Dec. 12	14.41
Feb. 25	14.18	Mar. 10	5.92	1975			
Apr. 2	13.61	Apr. 4	6.26	Jan. 31	10.52		
May 9	13.63	May 8	6.12	Mar. 5	8.97		

Mc51-1. Department of Highways and Transportation. Lat. 38°50'42", long. 75°39'57". Near Framington. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 18.1 feet. Well point 16.1-18.1 feet. Lsd about 55' above msl. MP top of casing at lsd. Highest water level 4.52 feet below lsd, July 16, 1975; lowest 15.69 feet below lsd, Nov. 1, 1977. Records available 1958-1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
Aug. 8	12.24	Feb. 26	14.38	Mar. 13	8.06	Mar. 10	10.57
Aug. 26	12.90	Apr. 1	12.43	Apr. 6	9.73	Apr. 14	9.14
Oct. 14	14.00	May 6	11.90	May 5	9.06	May 28	9.23
Nov. 16	12.82	June 12	12.74	June 7	9.79	June 17	9.40
Dec. 21	13.30	July 25	12.32	July 11	8.02	July 16	4.52
1967		Sept. 11	8.16	Sept. 14	12.02	Aug. 4	5.79
Jan. 3	12.84	Oct. 15	10.78	Oct. 13	12.93	Oct. 7	12.07
Jan. 24	12.25	Nov. 6	11.73	Nov. 14	12.30	Oct. 31	12.38
Mar. 8	10.50	Dec. 19	12.10	Dec. 11	10.08	Dec. 23	12.90
Apr. 12	10.40	1970		1973		1976	
May 19	10.40	Jan. 30	10.02	Jan. 10	8.21	Jan. 13	10.62
June 28	10.60	Mar. 12	10.05	Jan. 29	8.64	Mar. 4	10.74
Aug. 6	5.47	Mar. 23	10.57	Feb. 8	6.47	Apr. 14	12.06
Sept. 12	6.88	Apr. 23	8.04	Mar. 7	9.24	May 21	12.98
Nov. 5	10.04	June 16	10.34	Apr. 6	10.18	July 8	14.05
Dec. 4	10.57	July 28	9.65	May 10	10.47	Aug. 11	14.65
Dec. 28	8.06	Sept. 9	12.20	June 6	11.17	Sept. 24	15.18
1968		Oct. 16	13.50	July 19	12.33	Nov. 2	14.14
Feb. 20	8.82	Nov. 23	13.71	Aug. 13	11.79	Dec. 8	13.58
Mar. 27	7.74	Dec. 29	13.54	Sept. 4	11.11	1977	
Apr. 26	9.69	1971		Oct. 19	12.56	Jan. 20	14.97
May 9	10.22	Feb. 9	12.09	Nov. 12	13.03	Feb. 15	13.59
May 23	10.80	Mar. 26	10.05	Dec. 21	12.97	Apr. 8	13.39
June 6	10.73	Apr. 23	9.84	1974		May 18	13.55
July 13	11.60	May 4	10.54	Jan. 11	10.80	June 16	14.02
Aug. 19	12.68	June 17	11.24	Feb. 7	10.64	Aug. 2	14.78
Oct. 4	13.90	July 29	12.76	Mar. 15	11.14	Sept. 6	15.29
Nov. 13	14.57	Oct. 26	12.36	Apr. 22	9.83	Nov. 1	15.69
Dec. 18	14.95	Dec. 13	10.17	June 7	10.01	Dec. 7	14.70
1969		1972		July 19	11.27		
Jan. 2	14.74	Jan. 6	10.66	1975			
Jan. 24	15.24	Feb. 8	9.34	Mar. 4	10.28		

Hb14-1. Department of Highways and Transportation. Lat. 39°19'49", long. 75°41'08". Near Blackbird. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 18.6 feet. Well point 15.6-18.6 feet. Lsd about 72' above msl. MP top of casing at lsd. Highest water level 1.49 feet below lsd, April 7, 1958; lowest 11.95 feet below lsd, Aug. 31, 1966. Records available: 1957-1977. Well is inclined to vertical and therefore levels reflect relative changes and not true distance from lsd.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
July 21	11.63	Mar. 31	8.90	Apr. 7	3.94	Jan. 22	5.85
Aug. 31	11.95	May 12	8.84	May 3	3.80	Feb. 21	5.28
Sept. 29	11.94	June 9	9.12	June 9	4.97	Apr. 19	4.37
Oct. 10	11.85	July 22	9.68	July 11	3.20	May 21	4.25
Nov. 11	11.03	Aug. 23	7.44	Sept. 8	6.30	July 3	5.83
Dec. 12	11.15	Oct. 22	8.24	Oct. 12	7.00	July 14	3.44
1967		Nov. 7	8.54	Nov. 13	6.78	Aug. 13	5.03
Jan. 4	10.69	Dec. 19	8.29	Dec. 7	4.24	Sept. 17	6.55
Feb. 13	9.56	1970		1973		Oct. 21	5.69
Mar. 14	7.66	Jan. 26	6.18	Jan. 9	3.22	Nov. 21	5.54
Apr. 28	7.51	Mar. 18	6.23	Feb. 8	1.69	Dec. 8	6.08
June 1	7.98	Mar. 24	5.99	Mar. 6	3.00	1976	
Aug. 7	8.16	May 1	4.09	Apr. 5	1.54	Jan. 15	4.75
Oct. 10	8.90	June 4	5.67	May 7	3.72	Feb. 24	4.19
Nov. 4	9.26	July 16	5.89	June 5	3.84	Apr. 12	5.63
Dec. 5	9.42	Aug. 18	7.09	July 19	5.61	May 17	6.51
Dec. 27	8.82	Oct. 5	8.37	Aug. 9	6.39	June 21	7.36
1968		Nov. 30	9.25	Sept. 4	7.25	Aug. 11	8.15
Feb. 23	7.53	1971		Oct. 11	8.06	Sept. 30	9.03
Mar. 27	5.81	Jan. 13	8.69	Nov. 7	8.53	Nov. 15	9.02
Apr. 29	6.65	Feb. 18	8.14	Dec. 13	8.72	Dec. 9	9.22
June 5	6.31	Mar. 23	6.53	1974		1977	
July 19	7.11	Apr. 26	6.71	Jan. 10	7.22	Jan. 13	9.28
Aug. 20	7.98	May 12	7.03	Feb. 14	6.64	Feb. 14	9.36
Oct. 3	8.93	June 10	7.16	Mar. 14	6.89	Mar. 29	8.51
Nov. 29	9.87	July 26	8.09	Apr. 18	5.07	May 10	8.71
Dec. 9	9.96	Oct. 28	4.17	May 30	6.10	June 21	9.40
Dec. 30	10.11	Dec. 2	3.15	July 18	6.53	Aug. 19	10.01
1969		1972		Aug. 21	7.49	Sept. 14	9.11
Jan. 3	10.16	Jan. 20	3.71	Oct. 7	7.35	Nov. 8	10.37
Jan. 21	10.26	Feb. 16	3.26	Dec. 4	7.74	Dec. 9	9.39
Feb. 24	9.69	Mar. 15	3.17	Dec. 30	7.08		

Md22-1. Department of Highways and Transportation. Lat. 38°53'10", long. 75°33'15". Near Harrington. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 17.2 feet. Well point 14.2-17.2 feet. Lsd about 58 feet above msl. MP top of casing at lsd. Highest water level 1.07 feet below lsd, July 14, 1975; lowest 11.14 feet below lsd, Jan. 6, 1966. Records available: 1958-1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
July 26	8.98	July 24	7.98	May 15	1.94	Jan. 22	2.60
Aug. 26	9.50	Sept. 11	2.24	June 9	3.79	Feb. 18	2.53
Oct. 14	10.56	Oct. 23	5.64	July 12	3.47	Apr. 21	2.90
Nov. 16	9.66	Nov. 6	6.06	Sept. 18	6.97	May 16	2.85
Dec. 21	8.84	Dec. 15	3.93	Oct. 10	6.58	June 17	3.88
1967		1970		Nov. 13	2.99	July 14	1.07
Jan. 4	6.71	Jan. 27	2.84	Dec. 11	1.75	Aug. 12	4.20
Mar. 6	3.57	Mar. 6	3.05	1973		Sept. 30	5.06
Apr. 12	4.32	Mar. 10	3.30	Jan. 12	2.66	Oct. 31	4.52
May 31	4.60	Apr. 20	1.73	Feb. 8	1.83	Nov. 10	5.02
June 21	5.98	May 20	3.80	Mar. 7	2.69	Dec. 23	4.56
Aug. 6	2.27	June 19	5.04	Apr. 6	2.24	1976	
Sept. 12	4.08	July 28	4.72	May 7	3.56	Jan. 16	2.21
Nov. 5	4.14	Sept. 11	7.49	June 6	4.20	Mar. 4	3.65
Dec. 28	2.37	Oct. 19	9.13	July 19	6.54	Apr. 9	3.82
1968		Nov. 23	6.42	Aug. 13	7.30	May 28	6.62
Feb. 20	3.72	Dec. 29	4.84	Sept. 6	6.62	June 22	7.39
Mar. 27	2.56	1971		Oct. 19	7.69	Aug. 10	8.95
Apr. 26	4.33	Jan. 29	4.29	Nov. 12	7.97	Sept. 24	10.04
May 9	5.08	Feb. 9	2.97	Dec. 26	4.10	Nov. 15	4.71
June 6	4.07	Mar. 25	2.94	1974		Dec. 8	4.33
July 13	6.44	Apr. 23	3.58	Jan. 7	3.16	1977	
Aug. 19	8.12	May 4	4.03	Feb. 6	3.16	Jan. 18	4.03
Oct. 4	9.91	June 17	4.52	Mar. 15	4.02	Feb. 15	5.50
Nov. 13	10.43	Aug. 2	7.62	Apr. 22	3.45	Apr. 8	3.72
Dec. 18	10.70	Oct. 26	5.73	June 10	3.08	May 13	5.85
1969		Dec. 13	2.61	July 16	6.38	June 22	7.78
Jan. 24	10.06	1972		Aug. 27	7.93	Aug. 17	9.79
Feb. 26	7.34	Jan. 6	2.66	Oct. 5	8.70	Sept. 12	9.76
Apr. 4	4.49	Feb. 8	2.84	Nov. 8	9.36	Nov. 2	10.42
May 5	4.94	Mar. 16	2.53	Dec. 26	5.75	Dec. 6	6.42
June 12	7.21	Apr. 12	3.41				

Nc45-1. Department of Highways and Transportation. Lat. 38°46'40", long. 75°35'29". Near Greenwood. Driven observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 15.45 feet. Well point 12.95-15.45 feet. Lsd about 43 feet above msl. MP 1.05 feet above lsd. Highest water level 6.67 feet below lsd, Jan. 30, 1952; lowest 14.48 feet below lsd, Nov. 18, 1974. Records available 1950-1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
Aug. 3	12.10	Apr. 1	10.43	May 15	12.61	Jan. 16	13.54
Sept. 12	13.12	May 6	10.67	June 9	12.90	Feb. 18	12.24
Oct. 14	12.91	June 11	11.65	July 11	12.42	Apr. 11	11.73
Nov. 18	12.08	July 28	12.34	Sept. 18	13.97	May 16	12.28
Dec. 22	12.34	Sept. 11	10.76	Oct. 10	14.00	June 11	12.68
1967		Oct. 6	11.73	Nov. 20	13.07	July 17	11.95
Jan. 4	11.63	Nov. 6	12.22	Dec. 12	12.17	Aug. 4	11.91
Jan. 24	11.28	Dec. 16	11.69	1973		Sept. 29	13.39
Mar. 1	10.01	1970		Jan. 5	11.31	Oct. 31	13.58
Apr. 10	10.83	Jan. 28	10.42	Feb. 9	11.40	Nov. 11	13.64
May 19	10.47	Mar. 10	10.67	Mar. 13	12.63	Dec. 22	13.28
June 30	11.57	Apr. 22	9.47	Apr. 3	12.89	1976	
Aug. 1	11.09	June 15	10.90	May 10	12.96	Jan. 13	10.79
Sept. 12	9.54	July 20	11.18	June 12	13.44	Mar. 4	12.44
Nov. 5	10.94	Sept. 22	12.79	July 19	13.96	Apr. 2	12.94
Dec. 4	10.95	Oct. 16	13.93	Aug. 13	14.20	May 20	13.54
Dec. 28	9.97	Nov. 23	12.48	Sept. 7	13.70	June 3	13.70
1968		Dec. 29	11.97	Oct. 19	14.23	July 8	13.97
Feb. 20	10.53	1971		Nov. 12	14.30	Aug. 10	13.78
Mar. 27	8.52	Feb. 9	11.80	Dec. 18	14.17	Oct. 15	13.77
Apr. 26	10.91	Mar. 25	11.67	1974		Nov. 3	12.92
May 8	11.13	Apr. 23	12.04	Jan. 7	13.16	Dec. 10	12.75
June 6	11.20	May 4	12.30	Feb. 6	12.87	1977	
July 13	11.99	June 18	12.84	Mar. 15	13.17	Jan. 21	12.30
Aug. 19	11.95	July 29	13.23	Apr. 22	12.72	Feb. 18	12.92
Oct. 4	13.09	Oct. 26	13.72	June 10	13.21	Mar. 31	12.54
Nov. 13	12.90	Dec. 10	12.95	July 19	13.80	May 18	13.01
Dec. 19	12.60	1972		Aug. 19	14.12	June 15	13.30
1969		Jan. 19	12.62	Oct. 2	14.35	Aug. 17	14.22
Jan. 2	12.30	Feb. 8	12.89	Nov. 18	14.48	Sept. 14	14.20
Jan. 23	12.34	Mar. 13	11.84	Dec. 18	14.05	Nov. 3	14.42
Feb. 25	11.26	Apr. 11	12.82			Dec. 6	13.81

Ng11-1. Department of Highways and Transportation. Lat. 38°49'55", long. 75°19'29". Near Milton. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 19.1 feet. Well point 16.1-19.1 feet. Lsd about 24 feet above msl. MP top of casing at lsd. Highest water level 8.43 feet below lsd, July 17, 1975; lowest 14.64 feet below lsd, Jan. 7, 1966. Records available: 1959-1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
July 27	12.41	May 7	11.20	May 11	9.94	Jan. 14	13.07
Sept. 1	13.28	June 11	11.90	June 5	9.95	Feb. 19	11.60
Oct. 17	13.86	July 23	12.21	July 12	10.26	Apr. 8	10.33
Nov. 21	13.65	Sept. 11	10.92	Sept. 12	11.60	May 13	10.45
Dec. 19	13.83	Oct. 6	11.64	Oct. 11	12.16	June 16	10.16
1967		Nov. 6	12.32	Nov. 16	11.78	July 17	8.43
Jan. 4	13.70	Dec. 15	12.39	Dec. 5	10.77	Aug. 5	9.35
Jan. 26	13.19	1970		1973		Sept. 19	11.26
Mar. 3	12.31	Jan. 27	10.46	Jan. 9	9.38	Oct. 20	10.96
Apr. 23	11.37	Mar. 10	10.32	Jan. 29	9.92	Nov. 14	10.81
May 16	11.68	Mar. 23	10.68	Feb. 6	9.03	Dec. 22	11.01
June 19	11.85	Apr. 20	9.84	Mar. 5	9.80	1976	
July 28	11.78	June 9	10.97	Apr. 4	10.46	Jan. 13	9.75
Oct. 2	10.00	July 20	11.12	May 8	10.65	Mar. 1	9.96
Nov. 5	11.15	Sept. 14	12.47	June 11	11.24	Apr. 9	10.72
Dec. 4	11.81	Oct. 19	13.20	July 17	11.96	May 18	11.56
Dec. 28	11.19	Nov. 27	12.70	Aug. 8	12.37	June 29	12.41
1968		Dec. 28	12.46	Sept. 4	12.18	Aug. 10	12.66
Feb. 27	11.07	1971		Oct. 16	12.81	Sept. 28	12.89
Mar. 27	10.51	Feb. 8	11.21	Nov. 7	13.06	Nov. 4	11.28
Apr. 26	10.97	Mar. 22	10.01	Dec. 19	13.04	Nov. 26	10.86
June 6	11.70	Apr. 27	10.47	1974		Dec. 8	11.47
July 13	12.27	May 5	10.62	Jan. 8	12.04	1977	
Aug. 19	13.22	June 14	10.79	Feb. 13	11.61	Jan. 20	11.21
Oct. 4	13.73	July 26	11.80	Mar. 12	11.60	Feb. 14	11.72
Nov. 18	14.24	Oct. 26	11.90	Apr. 19	11.48	Apr. 1	11.81
Dec. 20	14.29	Dec. 6	11.51	June 4	11.49	May 13	12.13
1969		1972		July 17	11.91	June 22	12.67
Jan. 2	14.56	Jan. 3	10.96	Aug. 20	12.51	Aug. 3	13.34
Jan. 20	14.34	Feb. 7	10.83	Oct. 3	13.02	Sept. 12	13.69
Feb. 26	13.35	Mar. 13	9.57	Nov. 14	13.48	Nov. 2	14.02
Apr. 4	11.47	Apr. 11	10.15	Dec. 26	13.48	Dec. 5	13.33

Qe44-1. Department of Highways and Transportation. Lat. 38°31'39", long. 75°26'02". Near Trap Pond. Bored observation water-table well in sand of Pleistocene age. Diameter 1 inch, depth 25.0 feet. Well point 22-25 feet. Lsd about 50 feet above msl. MP top of casing at lsd. Highest water level 4.92 feet below lsd, Feb. 6, 1973; lowest, 12.18 feet below lsd, Oct. 16, 1962 and on Sept. 8, 1964. Records available: 1959-1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1966		1969		1972		1975	
Aug. 1	10.24	Feb. 14	7.72	Apr. 11	6.04	Jan. 14	5.43
Sept. 2	11.68	Feb. 28	6.67	May 17	5.36	Feb. 19	5.20
Oct. 17	11.52	Apr. 4	6.46	June 5	6.43	Apr. 8	5.39
Nov. 18	10.97	May 7	7.10	July 12	6.16	May 13	6.18
Dec. 22	11.04	June 11	9.39	Sept. 12	8.83	June 18	7.05
1967		July 23	9.09	Oct. 11	7.61	Aug. 10	6.05
Jan. 4	9.02	Aug. 24	5.80	Nov. 20	5.49	Oct. 3	7.07
Jan. 24	8.30	Oct. 6	9.26	Dec. 5	5.50	Oct. 20	6.72
Mar. 4	6.43	Nov. 6	9.95	1973		Nov. 21	6.34
Apr. 13	7.54	Dec. 16	7.05	Jan. 9	5.70	Dec. 22	7.01
May 17	6.76	1970		Feb. 6	4.92	1976	
June 28	9.22	Jan. 28	5.66	Mar. 5	6.02	Jan. 13	5.87
Aug. 4	8.74	Mar. 20	6.49	Apr. 4	5.69	Mar. 1	6.90
Oct. 3	7.28	Mar. 23	6.09	May 8	6.60	Apr. 9	7.25
Nov. 5	8.30	Apr. 21	5.24	June 11	8.26	May 20	8.40
Dec. 4	7.01	Sept. 22	10.82	July 17	8.94	July 2	10.03
Dec. 28	5.68	Oct. 19	11.38	Aug. 8	9.76	Aug. 10	10.47
1968		Nov. 24	8.86	Sept. 4	7.34	Sept. 27	11.22
Feb. 20	6.78	1971		Oct. 16	9.06	Nov. 15	7.12
Mar. 27	5.54	Jan. 11	5.82	Nov. 7	9.30	Dec. 9	9.26
Apr. 26	7.09	Feb. 11	5.52	Dec. 19	6.55	1977	
May 7	7.67	Mar. 22	6.05	1974		Jan. 18	6.92
June 6	6.56	Apr. 27	6.96	Jan. 8	5.52	Feb. 17	7.41
July 13	8.09	May 5	6.53	Feb. 13	6.22	Mar. 31	6.93
Aug. 19	9.91	June 14	7.30	Mar. 12	6.99	May 10	7.97
Oct. 4	11.59	July 26	9.67	Apr. 23	6.55	June 20	9.16
Nov. 15	11.75	Oct. 26	5.28	June 4	5.91	Aug. 15	11.16
Dec. 20	11.36	Dec. 6	6.28	July 17	9.29	Sept. 19	11.06
1969		1972		Aug. 20	7.74	Nov. 8	9.54
Jan. 2	11.89	Jan. 3	6.86	Oct. 3	8.44	Dec. 12	7.87
Jan. 22	9.87	Feb. 7	5.72	Nov. 18	9.14		
Feb. 3	8.25	Mar. 13	5.74	Dec. 27	6.42		

Dc34-5. State of Delaware, Delaware National Guard Rifle Range, near New Castle. Lat. 39°37'55", long. 75°36'48". Drilled artesian observation well in the Lower Potomac Aquifer. Diameter 2 inches to 579 feet, depth 579 feet. Screened 574-579 feet. Lsd 28 feet above msl. MP top of 2 inch coupling 2.1 feet above lsd. Highest water level 113.02 feet below lsd, Dec. 13, 1976; lowest 130.42 feet below lsd, Nov. 11, 1975. Records available Nov. 1975 - Dec. 1977.

Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level
1975		1977					
Nov. 11	130.42	Jan. 14	115.92				
Dec. 3	125.55	Feb. 10	118.68				
Dec. 9	124.25	Mar. 11	117.63				
		Apr. 11	120.24				
1976		May 11	122.11				
		June 8	121.86				
Jan. 9	120.88	July 7	122.16				
Feb. 9	119.77	Aug. 5	120.22				
Mar 8	124.34	Sept. 6	120.88				
Apr. 9	122.58	Oct. 3	122.05				
May 7	119.33	Nov. 4	122.25				
June 17	121.15	Dec. 1	119.15				
July 19	123.04						
Aug. 16	123.82						
Sept. 17	124.34						
Oct. 18	120.94						
Nov. 18	117.65						
Dec. 13	113.02						

Dc34-6. State of Delaware, Delaware National Guard Rifle Range, near New Castle. Lat 39°37'55", long. 75°36'48". Drilled artesian observation well in Upper Potomac Aquifer. Diameter 6 inches to 43 feet; 2 inches to 190 feet, depth 190 feet. Screened 183-188 feet. Lsd 28 feet above msl. MP top of casing 2.0 feet above lsd. Highest water level 39.94 feet below lsd, Feb. 15, 1976; lowest 52.45 feet below lsd, Sept. 20, 1977. Records available Nov. 1975 - Dec. 1977. (Noon water level on 5th, 10th, 15th, 20th, 25th, and end of each month below land surface datum.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1975						
5												41.65
10											42.59	40.88
15											42.12	40.75
20											41.85	40.64
25											41.60	40.83
eom											41.26	40.42
						1976						
5	41.10	40.47	40.52	40.85	45.15	44.69	45.72	46.52	46.05	46.57	44.23	47.42
10	41.15	40.20	40.37	42.66	44.77	45.21	45.61	46.07	45.93	46.71	44.45	48.10
15	40.71	39.94	40.10	42.86	44.45	45.90	45.75	46.00	46.82	45.68	44.40	46.30
20	40.48	40.50	40.05	43.80	44.78	45.58	46.25	46.75	46.64	44.46	44.60	44.65
25	40.35	40.22	42.10	43.67	44.93	45.45	46.50	46.18	46.15	44.10	46.18	46.08
eom	40.05	40.04	40.49	44.08	44.64	45.05	46.27	46.98	46.20	44.50	47.50	47.42
						1977						
5	47.00	47.70	47.40	47.97	49.35	50.66	50.80	49.95	50.82	52.14	51.75	50.89
10	46.70	48.40	49.40	49.60	50.40	50.55	50.55	49.85	50.65	51.50	51.10	51.97
15	47.10	47.60	49.05	49.30	50.08	49.95	50.45	50.54	51.00	52.09	52.02	51.67
20	47.45	48.27	48.63	49.25	50.48	48.90	49.30	50.20	52.45	51.78	51.56	51.42
25	47.57	48.00	49.70	48.95	50.72	50.45	49.96	50.38	51.32	51.57	51.05	51.20
eom	47.93	48.15	48.10	49.30	50.23	50.10	49.50	50.60	52.30	51.84	51.92	51.89

Id55-1. City of Dover. Lat. 39°10'26", long. 75°30'49". Drilled artesian observation well in the Piney Point Aquifer. Diameter 2.5 inches, depth 349 feet. Screened 329-349 feet. Lsd about 20 feet above msl. MP top of casing at lsd. Highest water level 67.34 feet below lsd, May 4, 6, and 8, 1970; lowest 143.0 feet below lsd, Sept. 5, 1977. Records available 1969-1977. Water levels are influenced by pumping in the Dover area. (Noon water level on 5th, 10th, 15th, 20th, 25th, and end of each month below land-surface datum from recorder graph). e = estimate.

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1969						
5	-	-	-	-	-	-	-	-	73.79	74.24	72.51	71.47
10	-	-	-	-	-	-	-	-	73.95	73.89	72.75e	70.90
15	-	-	-	-	-	-	-	-	74.35	73.42	72.90	70.80
20	-	-	-	-	-	-	-	-	74.59	73.05	72.63	70.87
25	-	-	-	-	-	-	-	-	74.05	73.10	72.34	70.61
eom	-	-	-	-	-	-	-	73.82	74.27	72.87	71.70	69.74
						1970						
5	69.37	69.00	68.80	68.38	67.40	69.40	72.30	74.75	79.65	-	81.42	80.09
10	69.13	68.95	68.83	68.58	67.45	69.59	72.76	75.72	80.57	-	81.50	80.08
15	69.12	69.44	68.54	68.45	67.51	70.31	72.73	77.25	81.30	-	81.08	79.26
20	69.12	69.20	68.37	67.85	67.70	71.38	73.01	78.30	82.22	-	80.83	78.42
25	69.05	68.85	68.12	67.53	67.92	71.76	73.5 e	78.74	84.65	-	80.81	77.57
eom	69.05	69.52	68.18	67.54	68.98	72.08	74.10	78.79	84.97	82.09	80.23	76.95
						1971						
5	76.27	73.90	72.30	72.30	72.96	74.71	80.98	83.30	83.74	83.91	82.20	81.86
10	76.05	73.48	72.15	72.05	73.32	75.66	81.35	83.27	83.98	83.35e	82.30	81.75
15	75.58	73.23	72.00	71.98	73.83	75.64	81.25	83.63	83.90	83.30	82.40	81.74
20	75.17	72.98	71.75	72.14	73.95	76.26	82.0 e	83.60	84.45	83.07	82.25	82.17
25	74.78	72.55	71.95	72.33	74.35	77.60	81.72	84.11	84.45	82.75	82.30	82.37
eom	74.34	72.65	72.16	72.64	74.72	78.92	83.13	83.58	84.27	82.54	81.45	81.69
						1972						
5	81.08	80.46	79.23	78.53	78.95	83.34	84.37	88.72	93.37	89.08	85.08	80.93
10	81.45	80.37	79.63	78.37	79.14	83.60	83.97	89.61	93.25	88.24	84.34	80.25
15	81.63	79.76	79.23	78.27	80.38	84.27	83.68	89.80	91.83	87.38	83.45	79.55
20	81.29	79.54	79.19	78.23	81.02	84.90	83.78	90.47	91.11	86.85	82.81	79.07
25	81.25	79.42	78.87	78.35	82.60	84.94	85.05	91.40	89.87	86.29	82.18	78.50
eom	80.81	79.36	78.77	78.50	83.15	84.85	87.61	93.50	89.70	85.43	81.67	77.30

Well Id55-1 continued -

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1973						
5	77.20	74.87	74.90	74.15	74.48	75.70	78.90	82.35	-	91.02	89.92	87.32
10	76.87	74.68	74.68	73.87	74.33	76.52	78.60	82.75	91.83	90.20	89.80	86.82
15	76.28	74.43	74.50	74.13	74.49	78.30	78.43	85.50	-	90.30	89.52	86.58
20	75.82	74.36	74.55	74.80	74.87	78.61	78.34	86.98	93.00	90.51	90.00	86.12
25	75.53	75.11	74.45	74.70	74.88	78.86	78.62	-	93.00	90.30	88.83	85.95
eom	75.16	74.90	74.42	74.50	74.60	79.65	79.68	-	92.06	89.90	87.90	85.40
						1974						
5	85.00	-	83.90	-	84.38	88.65	93.2	-	102.27	102.39	100.08	97.4
10	84.93	83.51	83.71	84.38	84.9	88.65	93.2	99.28	101.25	102.72	100.78	97.1
15	83.95	83.71	83.50	83.20	84.90	90.53	94.2	99.22	102.01	102.00	100.30	97.0
20	-	83.69	-	83.00	86.18	91.7	95.29	100.5	102.25	101.64	99.11	96.7
25	-	83.98	-	83.1	88.00	93.7	-	101.5	102.61	100.75	99.09	96.1
eom	-	84.22	-	83.85	88.8	93.7	-	102.04	102.42	100.47	98.2	94.6
						1975						
5	93.7	93.3	94.6	92.5	96.7	99.1	101.3	102.6	109.5	111.6	110.5	109.1
10	93.3	93.3	94.2	92.8	97.1	99.2	101.3		109.5	111.6	111.3	108.1
15	93.2	93.6	93.3	92.1	96.3	99.6	101.3	108.0	110.3e	110.0	111.2	108.7
20	93.2	93.5	92.4	92.9	96.7	99.7	101.5	108.7	110.7e	109.9	111.0	109.2
25	93.2	93.6	92.4	93.9	98.0	101.4	102.0	109.4	110.9	109.9	110.0	109.8
eom	93.7	94.0	92.3	95.7	98.6	101.9	101.8	109.5	111.1	110.8	109.5	107.9
						1976						
5	106.9	110.5	111.8	111.2	112.4	114.9	122.0	121.2	126.9e	126.2	123.2	-
10	108.1	110.6	111.7	111.1	112.7	115.1	121.8	122.5	126.8e	126.6	122.8	-
15	108.5	112.0	111.7	110.5	113.5	117.5	121.0e	123.1	126.5e	125.6	122.6	124.8
20	109.6	110.9	111.0	110.4	114.4	119.5	120.2	123.4	126.6e	125.1	-	125.6
25	110.8	111.8	110.7	112.0	114.5	120.9	121.5	124.6	125.7	124.4	-	125.6
eom	111.2	112.0	110.0	112.6	114.9	120.9	120.0	127.0	-	123.6	122.1	123.6
						1977						
5	123.0e	127.5e	125.7	124.7	125.2	128.5	132.0	138.6	143.0	139.1	132.9	128.45
10	123.4	127.8	126.2	124.0	125.6	128.6	134.0	139.8	142.8	137.8	132.6	-
15	124.2	126.8	125.3	123.8	125.8	128.2	135.1	141.2	142.2	137.0	132.5	-
20	124.5	127.1	125.4	124.1	126.6	129.0	137.7	141.5	141.7	135.6	131.7	-
25	125.2	126.0	126.0	124.7	128.2	130.5	139.7	141.5	141.9	134.4	130.1	-
eom	126.9e	125.8	125.6	125.2e	-	131.8	138.4	142.2	141.3	133.5	129.1	125.91

- no data

Ncl3-3. University of Delaware, College of Agricultural Sciences. Lat. 38° 49' 30", long. 75° 37' 02". Near Greenwood. Drilled artesian observation well in the Piney Point Aquifer. Diameter 6 inches, depth 630 feet. Screened 620-630 feet. Lsd 62.5 feet above msl. MP top of casing 3.0 feet above lsd. Highest water level 69.70 feet below lsd, Jan. 1, 1971; lowest 78.36 feet below lsd, Dec. 10, 1977. Records available 1970-1977. (Noon water level on 5th, 10th, 15th, 20th, 25th, and end of each month below land-surface datum. From recorder graph Dec., 1970 - June, 1976; from digital record June, 1976 - Dec., 1977).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1971						
5	69.90	-	70.35	70.80	70.70	-	71.23	71.50	71.62	71.70	71.85	72.08
10	70.01	-	70.43	70.75	70.82	-	71.29	71.45	71.58	71.40	71.70	71.79
15	70.02	70.22	70.30	70.75	-	-	71.27	71.52	71.55	71.70	71.82	71.79
20	70.17	70.14	70.25	70.65	-	-	71.36	71.56	71.65	71.93	71.63	71.80
25	70.15	70.29	70.68	70.71	-	-	71.41	71.67	71.77	71.56	71.73	72.03
eom	70.10	70.31	70.61	70.67	-	71.20	71.48	71.57	71.70	71.75	71.65	71.96
						1972						
5	71.82	72.17	71.97	72.27	72.32	72.32	72.37	72.59	72.70	72.93	72.85	72.80
10	71.83	72.22	72.25	72.27	72.32	72.35	72.50	72.69	72.90	73.10	72.75	72.66
15	72.05	71.83	72.08	72.15	72.15	72.43	72.39	72.70	72.80	-	72.67	72.65
20	72.00	71.99	72.29	72.08	72.16	72.36	72.50	72.72	72.95	73.05	72.62	72.69
25	72.05	72.04	72.10	72.20	72.34	72.24	72.42	72.75	72.93	-	72.70	72.75
eom	72.07	72.00	72.13	72.41	72.24	72.15	72.58	72.86	72.65	-	72.65	72.77
						1973						
5	72.73	72.86	72.94	72.66	72.83	72.91	72.81	72.95	72.89	72.88	72.92	72.85
10	72.87	72.85	72.96	72.60	72.77	72.90	72.92	72.90	72.90	72.95	73.06	72.88
15	72.76	72.65	72.73	73.06	72.87	72.99	72.96	72.82	72.82	72.82	72.83	72.93
20	72.69	72.87	72.82	72.99	72.75	72.96	73.03	72.87	72.92	72.91	73.10	72.79
25	72.86	73.05	72.83	72.85	72.76	72.92	73.10	72.90	73.08	72.97	72.75	72.79
eom	73.00	73.00	72.94	72.95	72.85	72.88	73.10	72.92	72.98	72.79	72.97	72.86
						1974						
5	72.90	72.85	72.72	72.67	72.95	72.98	73.10	73.35	73.47	73.69	73.49	73.78
10	72.82	72.75	72.88	72.86	72.85	72.81	73.03	73.24	73.37	73.58	73.67	73.63
15	72.78	72.90	72.97	72.68	72.85	72.99	73.10	73.35	73.44	73.58	73.68	73.70
20	72.85	72.75	72.85	73.05	73.05	73.01	73.25	73.37	73.47	73.58	73.36	73.58
25	72.85	72.74	73.05	72.95	72.90	72.92	73.31	73.39	73.45	73.54	73.63	73.40
eom	72.61	72.82	72.52	72.85	72.92	73.02	73.35	73.38	73.44	73.67	73.88	73.75

Nc13-3 continued -

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1975						
5	73.72	73.5	73.85	73.75	73.76	73.88	74.13	74.14	74.49	74.56	74.53	74.65
10	73.65	73.75	73.85	73.85	73.93	74.15	74.09	74.25	74.56	74.49	74.50	74.39
15	73.60	73.79	73.87	73.81	73.90	73.98	74.06	74.28	74.66	74.42	74.48	74.47
20	73.44	73.68	73.48	73.85	73.95	74.10	73.95	74.41	74.45	74.32	74.48	74.61
25	73.20	73.53	73.60	73.88	74.03	74.18	74.00	74.36	74.35	74.39	74.47	74.78
eom	73.75	73.72	73.82	73.95	73.90	74.20	74.20	74.48	74.45	74.65	74.60	74.52
						1976						
5	74.73	74.80	74.80	74.92	75.20	75.53	75.59	75.91	75.99	76.10	-	76.48
10	74.74	74.73	74.80	75.03	75.20	75.44	75.66	75.88	75.99	76.02	-	76.35
15	74.67	74.90	74.87	75.08	75.20	75.48	75.54	75.82	76.19	76.02	76.14	76.30
20	74.70	74.82	74.85	74.99	75.46	75.46	75.77	76.02	76.07	-	76.09	76.11
25	74.78	74.86	74.90	74.88	75.28	75.47	75.78	76.07	76.24	-	76.29	76.33
eom	74.63	74.81	74.97	75.15	75.27	75.48	75.70	76.09	76.03	-	76.37	76.25
						1977						
5	76.42	76.31	76.74	76.56	-	77.28	77.61	77.86	78.03	78.23	78.28	77.97
10	76.00	76.69	76.91	77.08	-	-	77.70	77.89	77.89	78.12	78.02	78.36
15	76.29	76.66	76.78	-	-	77.47	77.76	77.93	78.14	78.03	78.20	78.10
20	76.36	76.53	76.80	-	-	77.37	77.68	77.90	77.91	78.09	78.35	78.11
25	76.30	76.51	76.87	-	-	77.46	77.81	78.01	78.02	78.33	78.03	77.91
eom	76.46	76.73	76.81	-	-	77.57	77.78	78.06	78.10	78.32	78.21	78.20

- no data

Jd14-1. City of Dover. Lat. 39°09'35", long. 75°32'00". Drilled former public supply artesian well in the Cheswold Aquifer. Diameter 12 inches, depth 227 feet. Screened 195-227 feet. Lsd about 35 feet above msl. MP top of casing at lsd. Highest water level 91.07 feet below lsd, Nov. 30, 1976; lowest, 131.4 feet below lsd, Sept. 2, 1972. Records available 1972-1977. Water levels are influenced by pumping in the Dover area. (Noon water level on 5th, 10th, 15th, 20th, 25th, and end of each month below land surface datum. From recorder graph 1972 - May, 1976; from digital record May, 1976 - Dec., 1977).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1972						
5	-	-	-	-	-	-	-	-	126.6	127.5	117.9	115.7
10	-	-	-	-	-	-	-	129.0	128.3	123.7	120.2	114.6
15	-	-	-	-	-	-	-	-	130.1	122.5	118.5	117.4
20	-	-	-	-	-	-	-	124.5	130.6	123.0	115.8	116.4
25	-	-	-	-	-	-	-	129.5	127.8	121.4	113.3	111.8
eom	-	-	-	-	-	-	-	130.4	129.4	116.5	114.6	110.6
						1973						
5	112.8	113.9	118.0	-	124.9	127.3	125.2	126.0	126.5	130.0	121.4	121.5
10	113.4	117.4	120.2	-	126.5	127.2	123.9	128.8	125.1	128.9	122.5	120.3
15	111.0	116.6	119.1	-	125.2	131.0	122.3	128.6	126.3	122.8	121.5	122.5
20	116.0	114.4	-	123.1	122.6	130.1	125.4	125.5	127.4	126.7	-	123.2
25	116.5	114.2	-	122.7	126.2	128.4	125.8	125.2	127.0	125.8	115.8	114.9
eom	115.3	120.7	-	122.1	124.4	127.1	128.0	128.9	127.1	125.0	122.2	114.5
						1974						
5	117.4	118.7	119.5	123.9	118.5	120.8	117.9	122.0	118.4	119.4	117.2	115.0
10	119.8	117.1	118.2	120.9	122.2	119.5	116.2	123.3	-	119.5	116.1	114.5
15	114.6	119.5	121.3	115.5	121.6	121.6	114.3	122.2	-	117.9	118.8	115.2
20	114.0	120.2	120.8	120.5	116.7	122.8	118.2	120.1	-	118.0	117.8	117.6
25	119.9	116.0	119.0	121.0	116.8	120.4	119.6	118.2	-	119.2	115.6	110.0
eom	119.7	119.3	117.6	119.6	119.3	118.4	123.0	120.1	118.5	116.7	113.6	109.0
						1975						
5	109.9	113.7	112.3	110.8	106.0	112.0	111.4	112.9	113.5	111.7	109.9	111.5
10	112.8	113.4	109.9	112.4	108.2	111.8	112.4	112.4	113.4	111.7	109.8	109.7
15	112.8	114.5	110.9	111.5	108.8	112.7	111.8	113.3	111.9	111.2	111.6	107.9
20	110.8	114.4	111.8	111.0	109.1	113.5	111.2	113.5	112.3	110.7	112.0	106.1
25	114.0	112.0	111.0	111.7	108.8	113.0	112.4	113.0	112.1	110.8	111.8	105.6
eom	115.1	113.9	108.1	108.5	109.7	112.2	113.6	113.1	112.2	110.6	110.1	104.8

Jd14-1 continued -

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1976						
5	103.8	-	102.8	105.5	109.7	111.21	115.63	111.92	110.57	107.80	97.89	91.07
10	106.8	-	103.5	108.6	110.0	112.92	118.15	109.76	112.09	106.80	96.98	93.65
15	107.9	101.8	104.5	108.7	111.6	114.24	117.72	111.63	111.67	108.62	94.01	94.54
20	-	100.8	107.7	109.3	113.0	112.86	115.77	111.58	107.83	102.12	94.80	93.31
25	-	101.5	107.3	107.7	112.4	112.14	112.84	111.70	110.39	97.70	91.94	92.82
eom	-	100.9	107.4	110.1	107.84	115.94	114.36	111.85	109.60	96.01	91.07	96.12
						1977						
5	102.51	108.79	108.47	108.55	111.14	114.27	114.84	118.95	119.31	110.95	118.00	113.94
10	105.23	110.06	108.73	107.30	109.82	115.12	114.88	121.85	117.31	107.80	118.76	115.57
15	107.80	110.36	108.68	108.97	110.19	115.26	115.73	124.52	116.06	113.99	118.93	113.86
20	109.09	108.08	107.33	109.35	113.02	113.43	117.34	-	114.92	115.93	115.55	110.21
25	107.40	109.42	109.51	109.80	113.88	114.41	118.10	-	113.64	117.04	111.95	108.08
eom	108.63	108.21	109.93	109.79	114.51	115.67	117.23	117.56	112.24	117.15	113.83	106.95

- no data

APPENDIX B

For use of those readers who may prefer to use the International System of Units (SI) rather than English units, the conversion factors for the terms used in this report are listed below.

Multiply English units	By	To obtain SI units
	Length	
inches (in)	25.4	millimeters (mm)
inches (in)	2.540	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)
	Area	
square miles (mi^2)	2.59	square kilometers (km^2)
	Flow	
gallons	0.0038	cubic meters (m^3)