Department of Natural Resources
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

REPORT OF INVESTIGATIONS NO. 46

EVALUATION OF THE WATER-SUPPLY POTENTIAL OF AQUIFERS IN THE POTOMAC GROUP OF ANNE ARUNDEL COUNTY, MARYLAND

by

Frederick K. Mack
and
Grufron Achmad

Prepared in cooperation with the
United States Department of the Interior
Geological Survey
and
Anne Arundel County
Office of Planning and Zoning

1986

CONVERSION FACTORS

For use of readers who prefer to use the International System (SI) of metric units, conversion factors for terms used in this report are listed below:

Multiply Inch-Pound Unit	By	To obtain SI Unit
inch (in.)	2.54	centimeter (cm)
inch per year (in./yr)	2.54	centimeter per year (cm/yr)
foot (ft)	0.3048	meter (m)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per second (ft/s)	30.48	centimeter per second (cm/s)
foot squared per day (ft^2/d)	0.0929	meter squared per day (m^2/d)
gallon (gal)	3.785	liter (L)
gallon per day (gal/d)	3.785	liter per day (L/d)
million gallon (Mgal)	3785	cubic meter (m^3)
million gallons per day (Mgal/d)	3785	cubic meter per day (m^3/d)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.589	square kilometer (km^2)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

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

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EVALUATION OF THE WATER-SUPPLY POTENTIAL OF AQUIFERS IN THE POTOMAC GROUP OF ANNE ARUNDEL COUNTY, MARYLAND

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ABSTRACT

A multi-layer aquifer model was developed to simulate the effects of pumping stresses on aquifers in the Potomac Group in northern Anne Arundel County, Maryland. The model represents a hydrologic system including four Coastal Plain aquifers known locally as the Patuxent, the lower Patapsco, the upper Patapsco, and the overlying Magothy aquifer. These aquifers are layers composed mainly of sands that dip gently to the southeast from band-shaped outcrops in the northwestern part of the modeled area, and are separated from one another in downdip areas by relatively impermeable confining beds.

The model was developed by using measured values for the hydrologic properties of the aquifers and confining beds where they were available and by using estimated values where measured values were not available. The model was calibrated by using monthly pumpage of more than 250 production wells and water levels measured in 39 observation wells over the 12-year period from December 1965 through December 1977. The calibration was accomplished by comparing the computed potentiometric levels with the corresponding water levels measured in the field for both steady-state and transient-state conditions. The maximum difference between the computed and observed water levels of the 39 observation wells was about 30 feet, but the difference was generally less than 10 feet. Trends of 30 of 39 hydrographs compared well; eight were fair, and one was poor.

Pumpage by the Anne Arundel County Department of Utilities, other governmental agencies, and industry is expected to total 118 million gallons per day by the year 2000 in the model area, which includes all of Anne Arundel County and portions of the adjacent counties. The calibrated model was used to predict the effect of that pumpage on water levels in each aquifer. The results indicated that deep cones of depression would be developed in some aquifers, but that the well fields could provide the quantities needed.

INTRODUCTION

The Coastal Plain sediments underlying Anne Arundel County, Md., include several aquifers that supply most of the water for the area. The deepest of these aquifers is in sediments of the Potomac Group of Cretaceous age. These deposits are the sole source of ground water in the northwestern part of the county and an important source for the central part of the county.

The demand for water in Anne Arundel County is increasing as the population increases. As the demand continues to increase, it will become necessary to examine all possible sources. Ground water has been the primary source of supply in the past and will undoubtedly be a major source in the future. Efficient development and management of the county's ground-water resources will become increasingly complex and difficult as the demand for water grows larger. Managerial decisions must be based on the best information obtainable. Such data can be gathered only with difficulty, often requiring the acquisition of new information and the use of indirect methods to interpret existing information.

Management of the aquifers of the Potomac Group ultimately must be based on consideration of factors controlling the amount of water the aquifer will yield and factors such as the potential hazard of aquifer contamination by intrusion of saline water from the Chesapeake Bay. Several aspects of the salt-water hazard have been discussed by Mack (1974).

This is one of a series of projects to study the aquifers of the Coastal Plain of Maryland. Funding for this project was provided by the U.S. Geological Survey, the Maryland Geological Survey, and the Anne Arundel County Office of Planning and Zoning.

This study was made to gain a better understanding of the aquifers underlying Anne Arundel County and to develop a system for estimating the ability of the aquifers to supply the water demands of the future. The digital-modeling technique of analysis was selected because it integrates available quantitative information regarding the complex geologic and hydrologic relationships between the aquifers and the fine-grained sediments confining them. The development of a model of the Potomac Group is an essential step in the eventual development of a multi-layered model of the full thickness of the Coastal Plain sediments in southern Maryland.

Although much of the basic data needed to develop this first generation of the model existed before the project started, and more data were gathered within the course of the project, many deficiencies in the data base became apparent as development progressed. Future versions of the model, made after the data gaps have been filled and longer periods of water-level and pumpage data have been obtained, will merit greater confidence.

PURPOSE AND SCOPE

This report presents the results of a study to evaluate the water-supply potential of aquifers in the Potomac Group and the overlying Magothy aquifer of Anne Arundel County. The report describes the hydrogeology of the study area, the development and use of the model in simulating the aquifer system, and the effect of future increases in the rate of withdrawal on ground-water levels.

LOCATION AND EXTENT OF STUDY AREA

The project area (fig. 1) includes the northern two-thirds of Anne Arundel County, plus parts of Baltimore, Prince Georges, and Howard Counties, and part of Baltimore City. It includes an area of about 500 mi^2, most of which is between Baltimore and Annapolis. The area of the model (inset map on fig. 1) was made considerably larger than the area of the project in order to simulate the lateral extent and distant boundaries of the aquifers. The modeled area, 2,500 mi^2, includes all of Anne Arundel County and parts of Baltimore, Prince Georges, Charles, Calvert, Kent, Queen Annes, and Talbot Counties. It also includes all of Washington, D.C., much of the city of Baltimore, and a small part of the State of Virginia.

PREVIOUS INVESTIGATIONS

The geologic and water-yielding characteristics of aquifers in the Potomac Group have been studied previously by many hydrologists. The development of water supplies from these aquifers in southern Maryland before the turn of the century was described by Darton (1896). Data tabulated by Clark, Mathews, and Berry (1918) describe wells tapping the aquifers. Several studies published as part of the series of bulletins of the Maryland Geological Survey were concerned with water resources of individual counties of the area. Ground-water resources of Anne Arundel County have been described by Brookhart (1949) and by Mack (1962). Lucas (1976) prepared the most recent tabulation of ground-water data for the county. Multi-county studies of the geology and water resources of southern Maryland were made by Darton (1896), Otton (1955), Hansen (1968), Glaser (1969), Weigle, Webb and Gardner (1970), and Weigle and Webb (1970). Experience and data obtained during the preparation of digital and analog models of the Magothy aquifer in the Annapolis area (Mack, 1974) and a digital model of the Magothy aquifer in southern Maryland (Mack and Mandle, 1977) were used as the starting point in the development of this model.

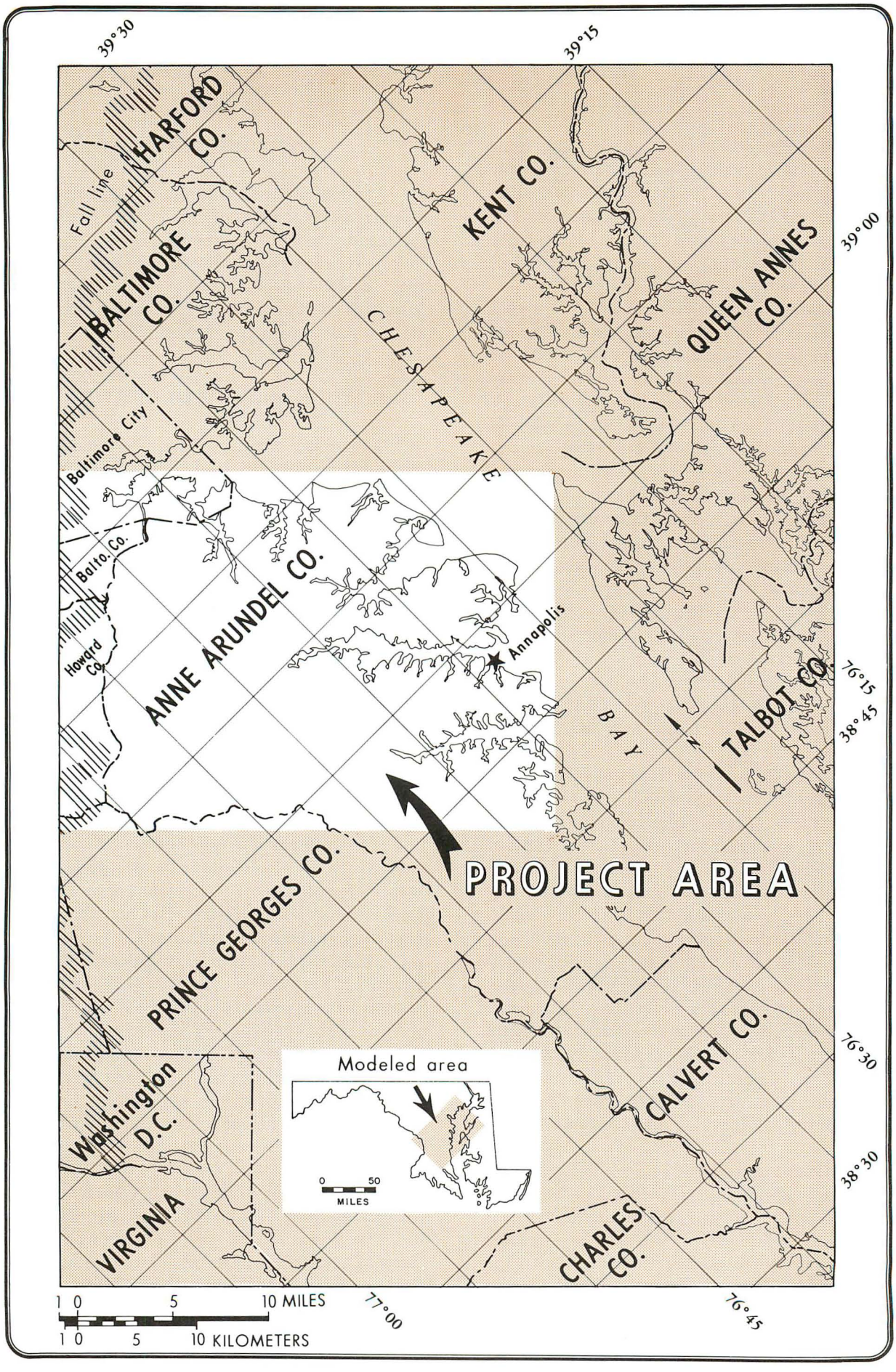


Figure 1. — Project area and geographic limits of the ground-water model.

ACKNOWLEDGMENTS

Assistance with this project was rendered by well drillers, well owners, and Federal, State, county, and city agencies. Personnel of the Maryland Geological Survey and the Maryland Water Resources Administration provided support for much of the field work, which included semi-annual measurements of the observation-well network, pumping tests, geophysical logging, and other test drilling activities. Hydrographs of water-level data gathered and processed over the years by Claire A. Richardson, formerly of the U.S. Geological Survey, played an invaluable part in calibration of the model. Information on water use and assistance with report preparation were received from Judith Wheeler of the U.S. Geological Survey. Harry Hansen, of the Maryland Geological Survey, participated in early planning of the project and provided helpful comments and criticism during its development.

METHOD OF STUDY

The hydrogeology of the Potomac Group and the overlying Magothy Formation was studied by the development and use of a digital model. Project activities progressed through the following phases to produce the model:

1. Acquisition of data for the Potomac Group and adjacent formations. This entailed the gathering of many types of information from many different sources.
2. Development of a conceptual model of the hydrologic system of the Coastal Plain sediments from existing hydrogeologic knowledge, new data obtained by test drilling, and newly developed observation-well networks.
3. Translation of the data from the conceptual model to a mathematical simulation of the real hydrologic units — the digital model.
4. Steady-state calibration of the model by adjusting hydrologic parameters used in the model until the computed potentiometric surfaces matched pre-1965 water levels. The steady-state water levels were used as initial conditions for the transient model.
5. Transient calibration of the model by comparing computed water-level hydrographs with hydrographs of observation wells for the period 1965 to 1977.
6. Trial runs to predict water-level declines due to hypothetical well-field configurations and pumping rates in the future.

HYDROGEOLOGIC SETTING

Geologic conditions in the project area, to a large extent, control the amount of water that can be taken from the Coastal Plain sediments because they affect the rate at which individual wells can be pumped and the depth to which wells must be drilled. Each type of sediment plays a special role in the functioning of the hydrologic system. Thick layers of coarse, well sorted (clean) sand can yield large quantities of water to individual wells and, thus, are important in developing central water systems. Clay layers do not readily yield significant quantities of water to individual wells, but they strongly influence the movement of water by impeding vertical flow between aquifers. Clay layers also serve as sources of recharge by slowly yielding their stored water to aquifers. Their effectiveness in these respects depends on their thickness, hydraulic conductivity, areal extent, and compressibility.

Anne Arundel County and much of the surrounding area is underlain by a wedge-shaped mass of unconsolidated sedimentary deposits, the Coastal Plain sediments, which overlies much older consolidated rocks.

Cores and cuttings of the bedrock underlying Anne Arundel County have been obtained at only a few test sites. The evidence available suggests that the bedrock is similar to the rocks of low hydraulic conductivity found in the Piedmont area of Maryland. This study, therefore, assumed that the bedrock functions as a confining bed. The top of the bedrock surface underlying the Potomac Group, shown in figure 2, dips toward the southeast.

The Potomac Group is comprised of three separate and distinct aquifers in Anne Arundel County. The aquifers are known locally as the Patuxent, lower Patapsco, and upper Patapsco, and are in the Patuxent and Patapsco

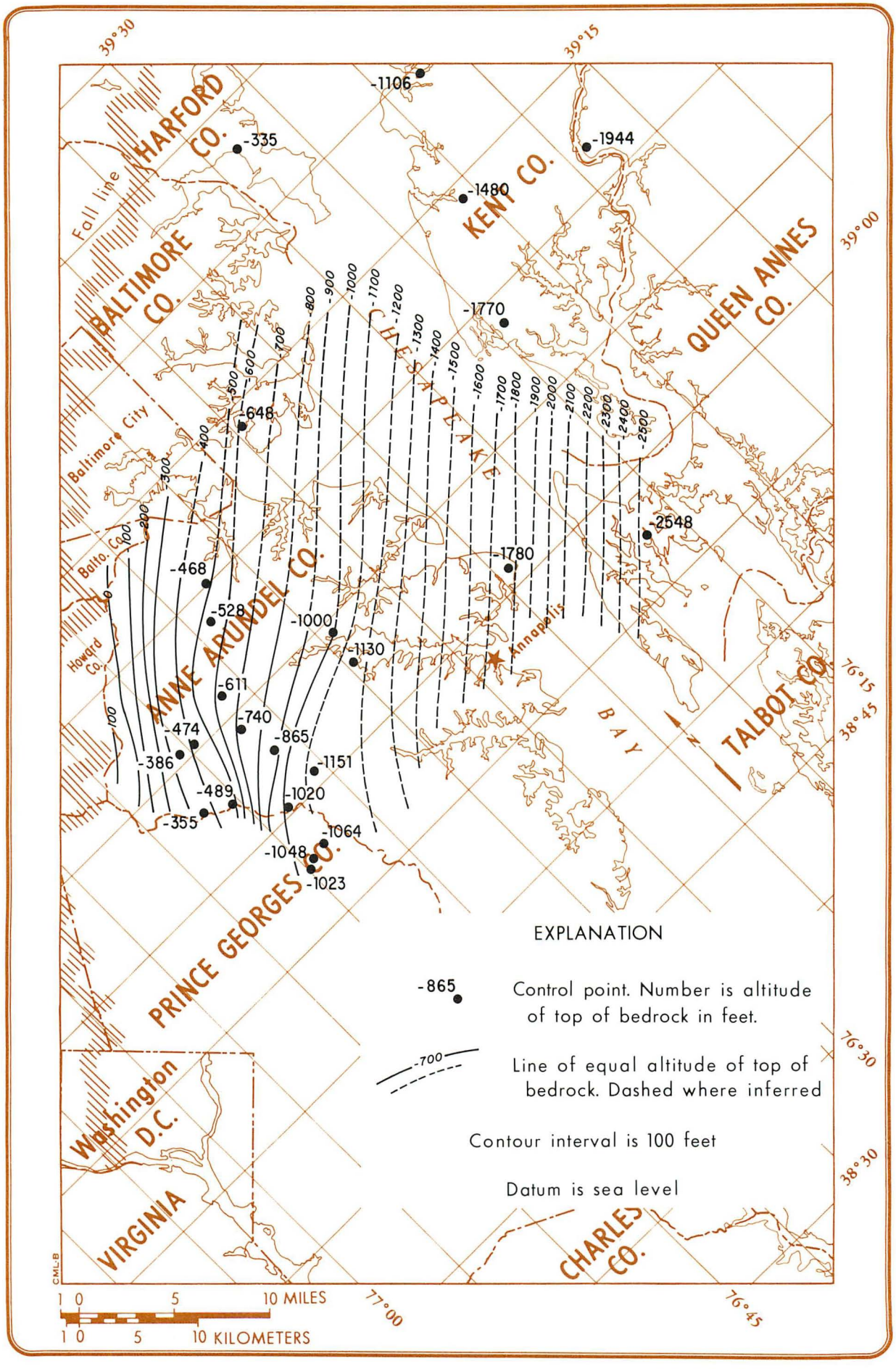


Figure 2. — Approximate altitude of the top of the bedrock.

Formations. They are confined, except in their outcrop areas where water-table conditions exist; confining layers separate the aquifers in most places. Continuous water-level records from clusters of wells that tap the different aquifers indicate that the sands are hydrologically separated from one another. The water-level records show that the pumping of water from one of the aquifers at a specific site commonly has no immediate effect on water levels in the other aquifers at the same site.

DESCRIPTION OF AQUIFERS AND CONFINING LAYERS

The Potomac Group comprises the entire thickness of Coastal Plain sediments in the northern part of the county. It is overlapped by younger deposits ranging in age from Late Cretaceous to Holocene (tab. 1) in the central part of the county. The stratigraphy of the Potomac Group is very complex. Because formations of the group were deposited under fluvial and lacustrine conditions, sand, silt, and clay layers are commonly limited in lateral extent. Sand lenses 25 ft thick at specific points have been found to be much thicker, thinner, or absent 25 to 100 ft away. Figure 3 shows the location of key wells, test holes, and data-collection sites referred to in this report. The geologic sections (figs. 4 to 8) show that the major aquifers and the confining beds are variable in thickness, but generally can be correlated from point to point as they slope gently toward the southeast.

Tops of the aquifers are shown in figures 9 to 12. Control points used to prepare these maps were selected from drillers' logs, geophysical logs, and studies of cores and cuttings from wells and test holes.

Patuxent Aquifer

The Patuxent aquifer in the Patuxent Formation, which crops out along the northwestern boundary of Anne Arundel County, is composed of lenticular, interfingering deposits of sand, silt, and clay. Wells drilled into this aquifer generally encounter sand layers capable of yielding relatively large quantities of water. The Patuxent aquifer directly overlies bedrock. Because the top of the rock (fig. 3) is at the land surface near or close to the Fall Line and dips to the southeast at approximately 80 ft/mi, the aquifer lies at relatively shallow depth, less than 100 ft, along the Howard County line and is over 1,500 ft deep in the eastern part of Anne Arundel County (fig. 9).

The aquifer is relatively thin and even pinches out in the northwestern part of Anne Arundel County. This explains why quantities of ground water available from the Maryland City area are quite limited. In downdip areas, where the aquifer is deeper and thicker, larger quantities of water can be obtained from individual wells. As may be seen in table 2, some of the highest yielding (1 to 2 Mgal/d) well fields tapping these aquifers in Anne Arundel and Prince Georges Counties are at Crofton Meadows, Kings Heights, Bowie, and Glen Burnie. Yields from Sparrows Point and Baltimore City are greater than 2.0 Mgal/d.

Arundel Clay Confining Layer

The Arundel Clay, which directly overlies the Patuxent aquifer, functions as a confining layer because of its relatively low vertical hydraulic conductivity. It crops out in a band-shaped area across the northern part of the county.

Lower Patapsco Aquifer

The lower Patapsco aquifer, which overlies the Arundel Clay, is capable of yielding from 0.5 to 2 Mgal/d from individual wells in most localities where it has been tested. It is the source of water for several of the large wells in the Glen Burnie and Severndale areas. Well AA-De 94, owned by the city of Annapolis, and the only well pumping from this aquifer in the downdip area, yields about 1.5 Mgal/d.

Confining Layer Overlying Lower Patapsco Aquifer

The confining layer separating the lower Patapsco aquifer from the upper Patapsco has not been named. In some areas, such as Severndale, it consists of massive beds of clay of low vertical hydraulic conductivity, but some layers within the confining bed are relatively more permeable. In Severndale (fig. 60), the layer is over 100 ft thick. In Annapolis (fig. 63), it is over 200 ft thick.

Upper Patapsco Aquifer

The upper Patapsco aquifer is one of the best water-bearing formations in Anne Arundel County, but it is much more limited in areal extent than the two deeper aquifers. It crops out in a band-shaped area (fig. 11) that extends from the Patuxent Wildlife Refuge in Prince Georges County across Fort Meade to an area located a few miles south of Glen Burnie. In areas southeast of the outcrop area, the aquifer is under confined conditions and yields large quantities of water. Water supplies for Severndale, Arnold, and the U.S. Naval Academy are obtained from this aquifer.

Confining Layer Overlying Upper Patapsco Aquifer

The thickness and vertical hydraulic conductivity of the confining layer separating the upper Patapsco from the overlying Magothy aquifer are quite variable throughout the project area. The geologic sections in figures 4, 5, 7, and 8 show that the thickness of this confining layer ranges from more than 100 ft in some areas, such as Crofton Meadows (fig. 5), to less than 50 ft in areas such as the Arnold well field (fig. 4).

(Text continued on p. 19.)

Table 1. — Stratigraphy and hydrologic and lithologic characteristics of geologic formations in Anne Arundel County

System	Series	Group	Formation		Average thickness (feet)	Lithologic symbol	Hydrologic character	General lithology
QUATERNARY	HOLOCENE and PLEISTOCENE		Alluvium and terrace deposits		30		Confining bed in most places. Poor aquifer in some places.	Sand, gravel, silt, and clay.
TERTIARY	EOCENE	PAMUNKEY	Nanjemoy Formation		80		Confining bed	Sand, with clayey layers, glauconitic.
			Marlboro Clay		30		Confining bed	Clay, plastic, pale-red to silvery gray.
	PALEOCENE		Aquia Formation		100		Aquifer	Glauconitic, greenish to brown sand with indurated or "rock" layers in middle and basal parts.
			Brightseat Formation		40		Confining bed in most places. Poor aquifer in some places.	Sand, silt, and clay, olive gray to black, glauconitic.
	UPPER		Severn Formation		90		Poor aquifer in places.	Sand, silty to fine, with some glauconite.
			Matawan Formation		30		Confining bed	Silt and fine sand, clayey, dark gray to black, glauconitic.
CRETACEOUS	CRETACEOUS		Magothy Formation		100		Aquifer	Sand, light gray to white, with interbedded thin layers of organic black clay.
	LOWER CRETACEOUS	POTOMAC	Patapsco Formation	Upper part	250		Confining bed	Clay, tough, variegated color.
							Aquifer	Sand, fine to medium, brown color.
				Lower part	250		Confining bed	Clay, tough, variegated color.
							Aquifer	Sand, fine to medium, brown color.
			Arundel Clay		250 (?)		Confining bed	Clay, red, brown, and gray, contains some ironstone nodules and plant remains.
			Patuxent Formation		250 (?)	? ?	Aquifer ? Confining bed Aquifer ?	Sand, gray and yellow, with interbedded clay; kaolinized feldspar and lignite common. Locally clay layers predominate.
LOWER PALEOZOIC (?) TO PRECAMBRIAN(?)			Basement Complex 1/		Unknown		Confining bed	Probably gneiss, granite, gabbro, metagabbro, quartz diorite and granitized schist.

Line encloses the part of the geologic section studied by this project

1/ Consolidated red shaly rocks of Triassic (?) age were drilled at Sandy Point State Park.

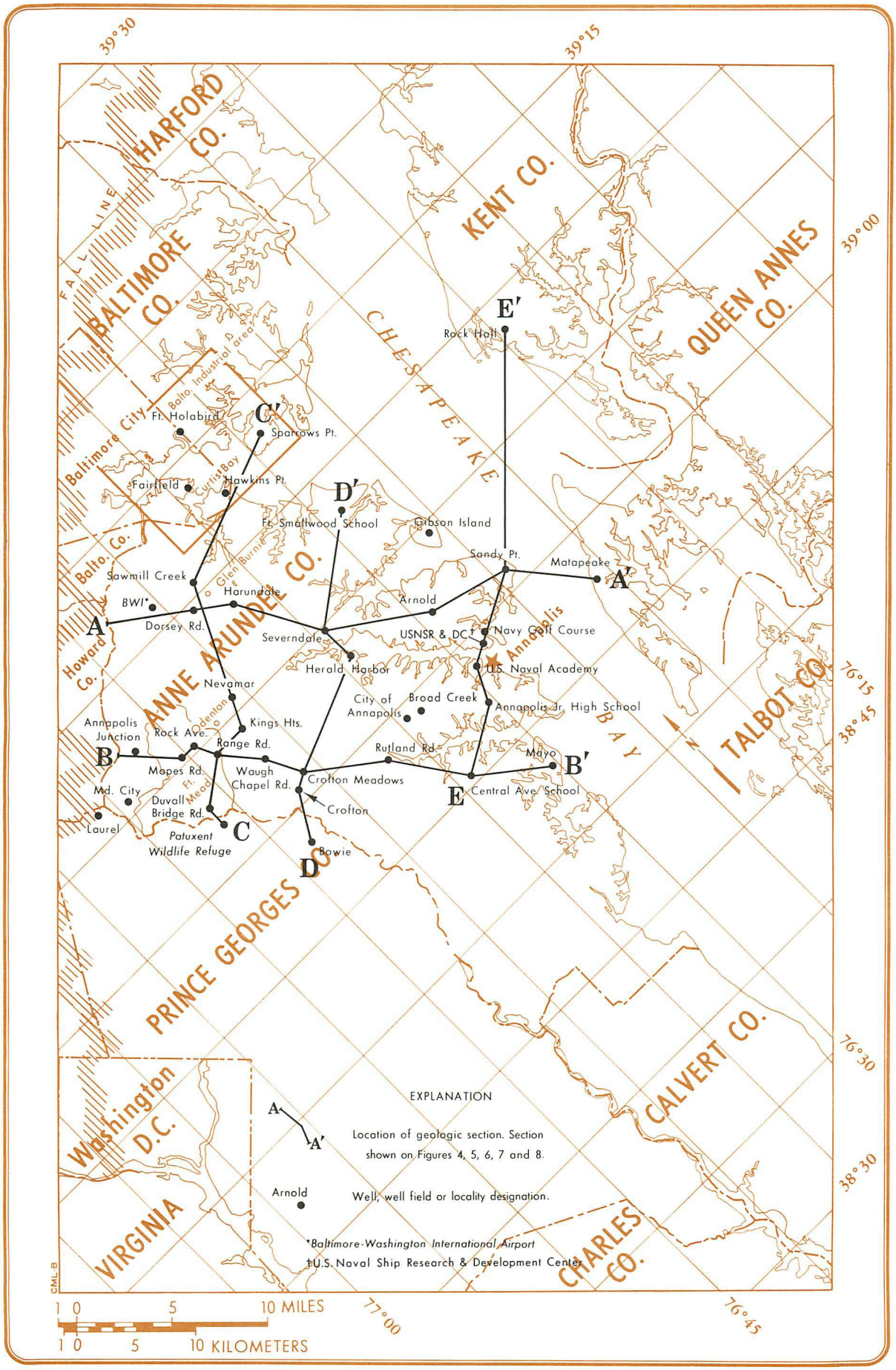


Figure 3. — Locations of geologic sections, key wells, test holes, and data-collection sites referred to in this report.

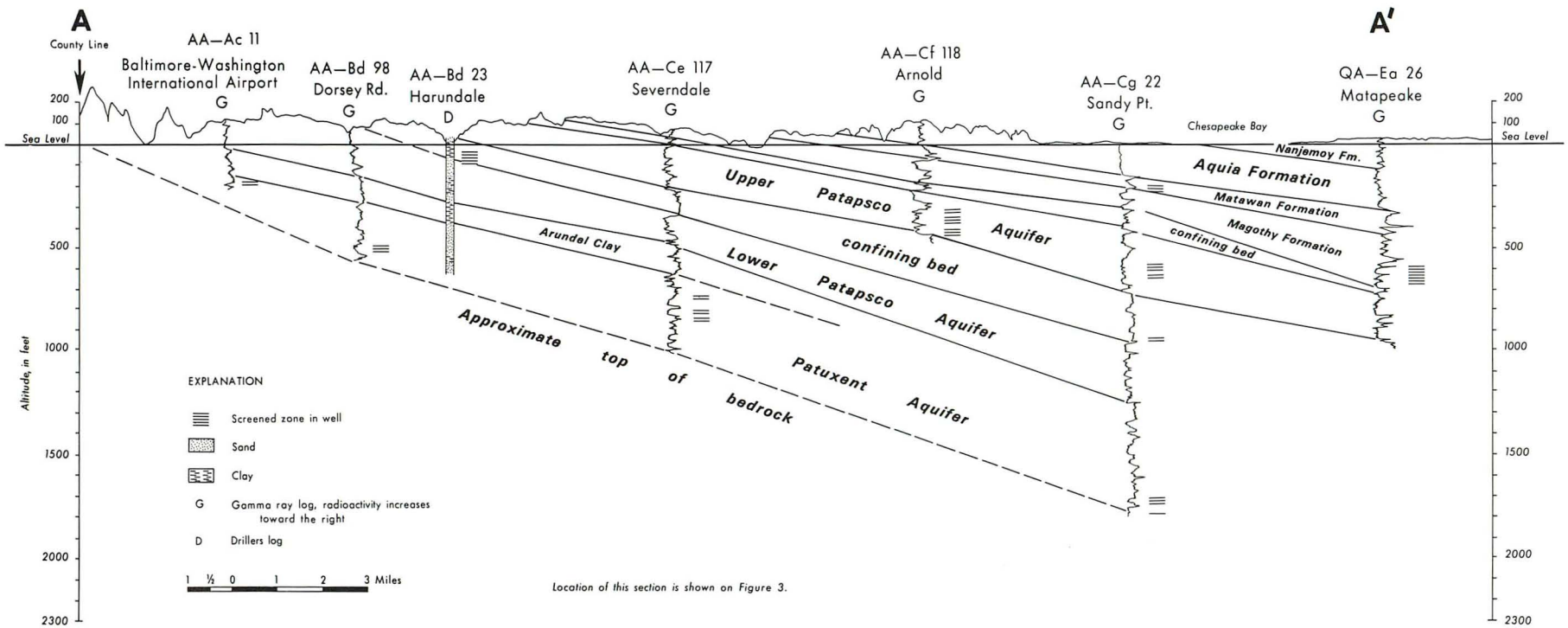


Figure 4. — Hydrogeologic section A-A′, from county boundary line to Matapeake.

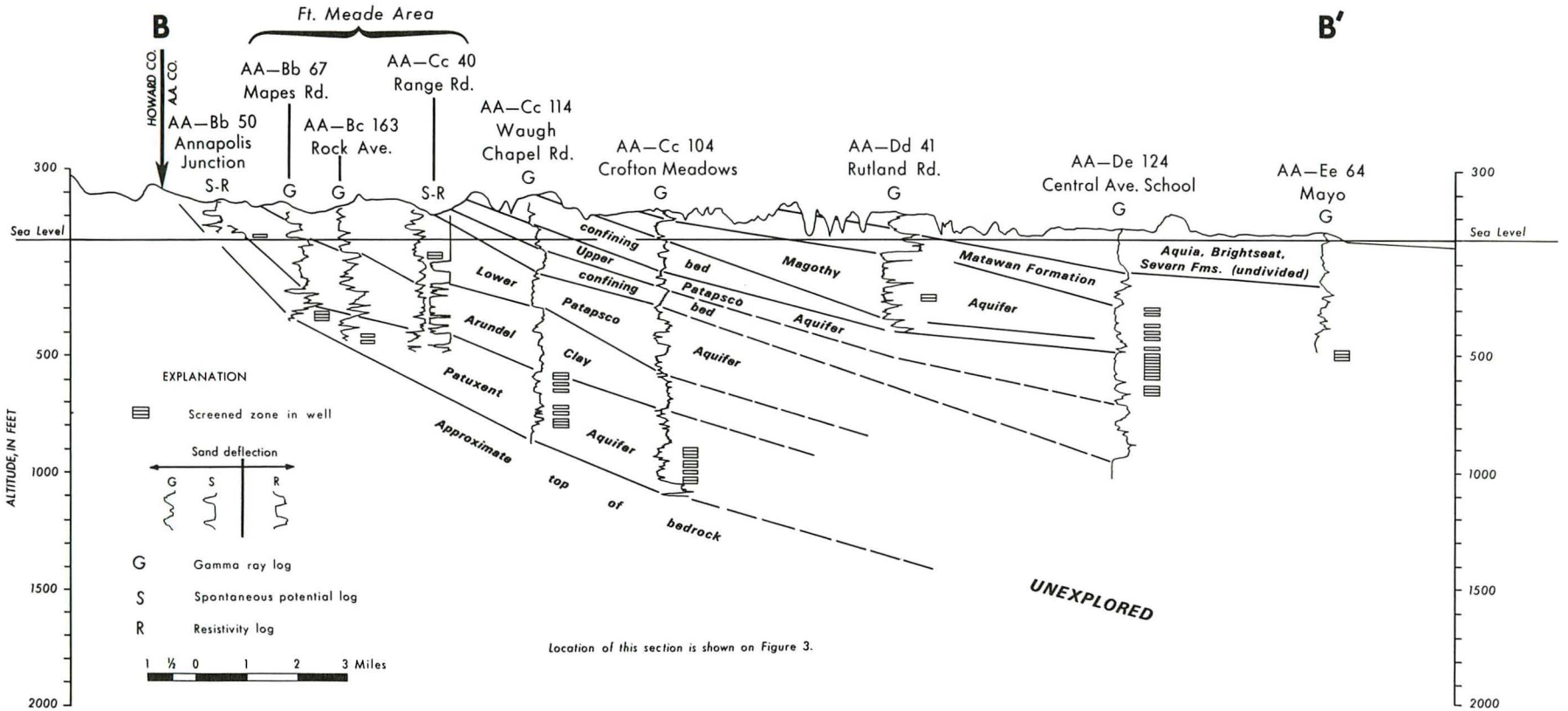


Figure 5. — Hydrogeologic section B-B′, from north of Annapolis Junction to Mayo.

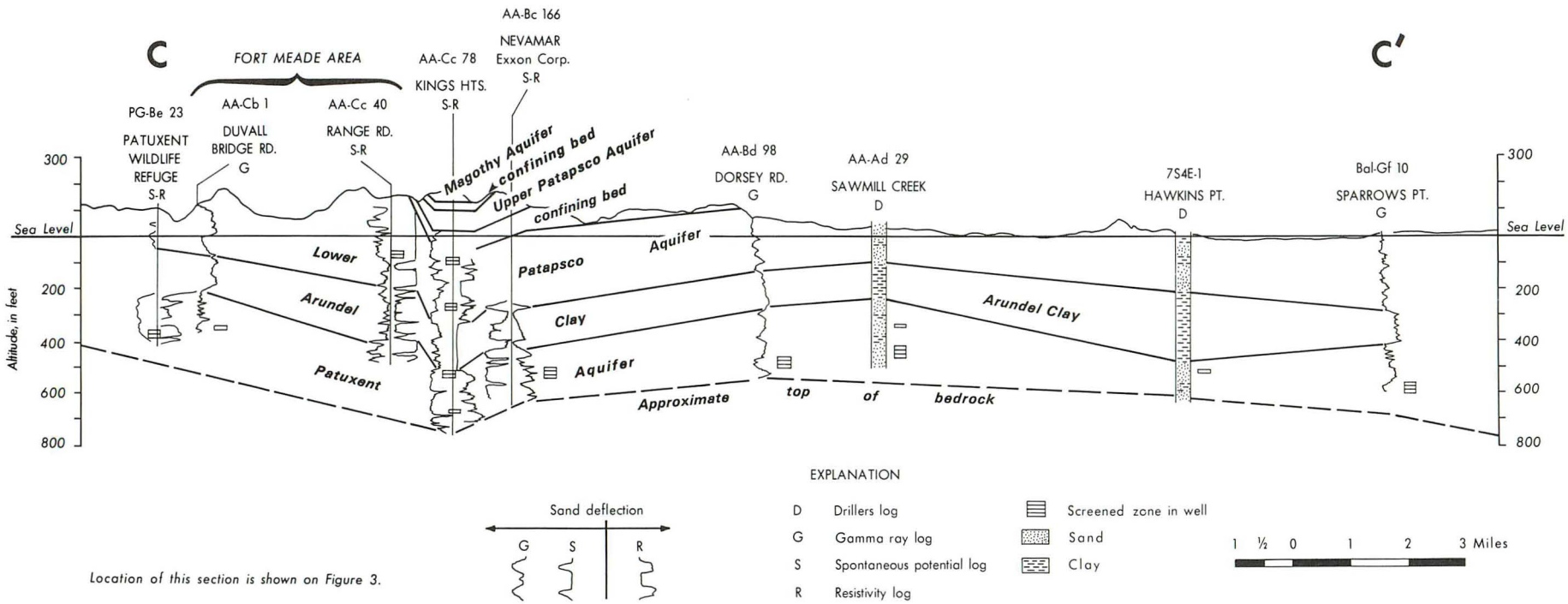
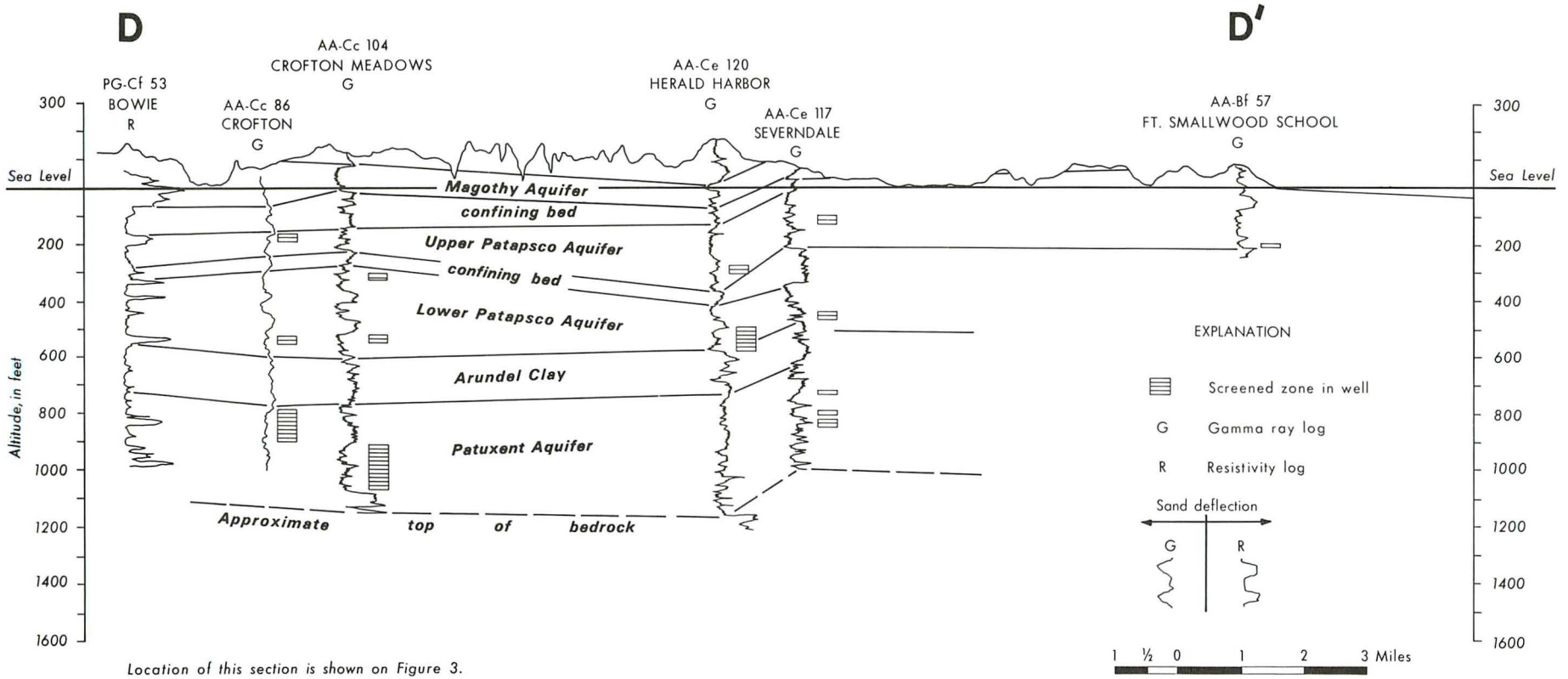


Figure 6. — Hydrogeologic section C-C′, from the Patuxent Wildlife Refuge to Sparrows Point.



Location of this section is shown on Figure 3.

Figure 7. — Hydrogeologic section D-D′, from Bowie to Fort Smallwood School.

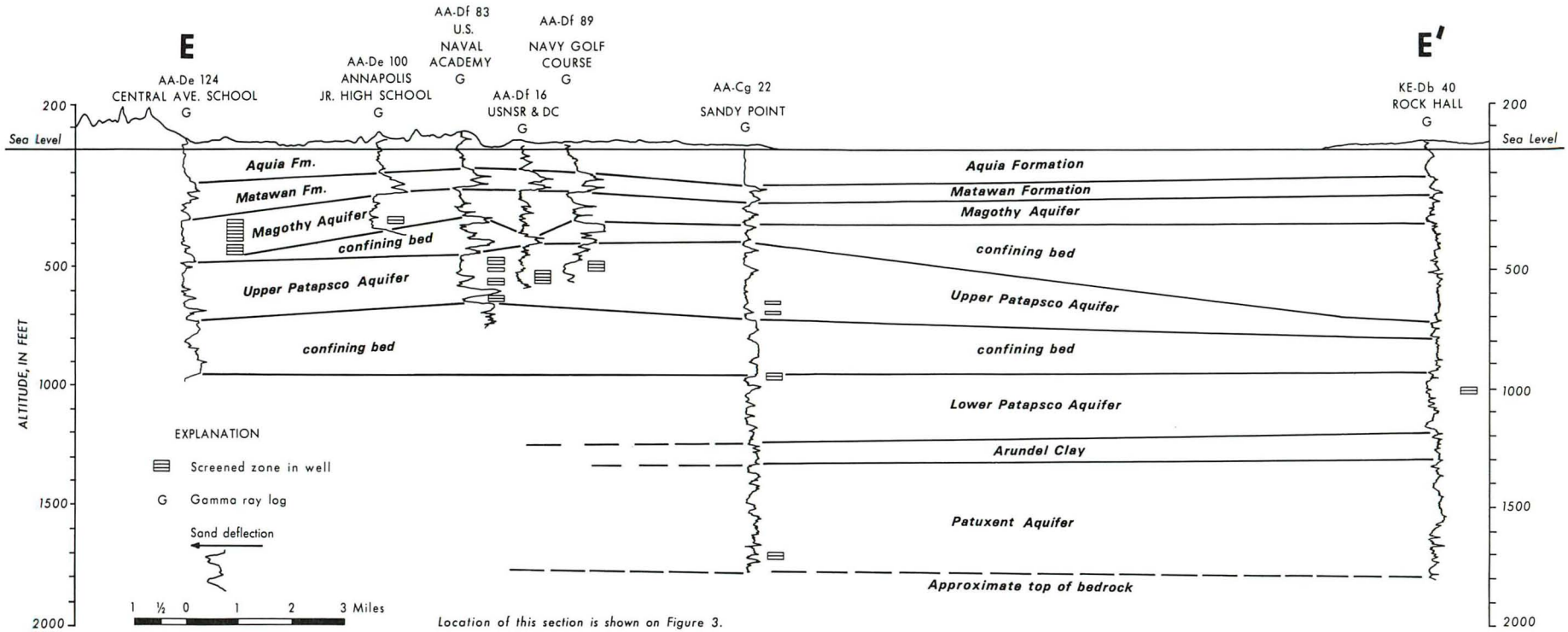


Figure 8. — Hydrogeologic section E-E′, from Central Avenue School to Rock Hall.

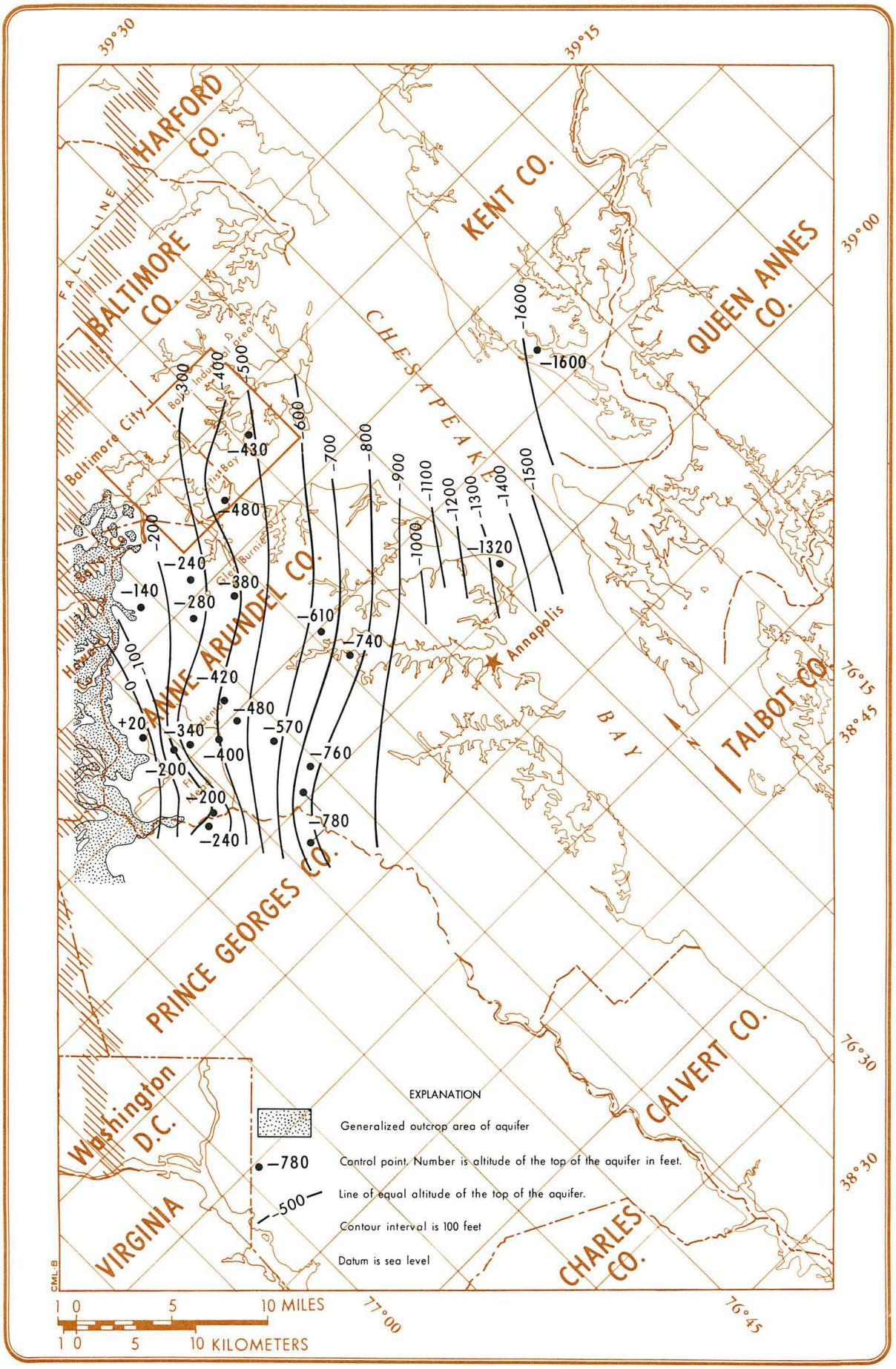


Figure 9. — Outcrop and altitude of top of the Patuxent aquifer.

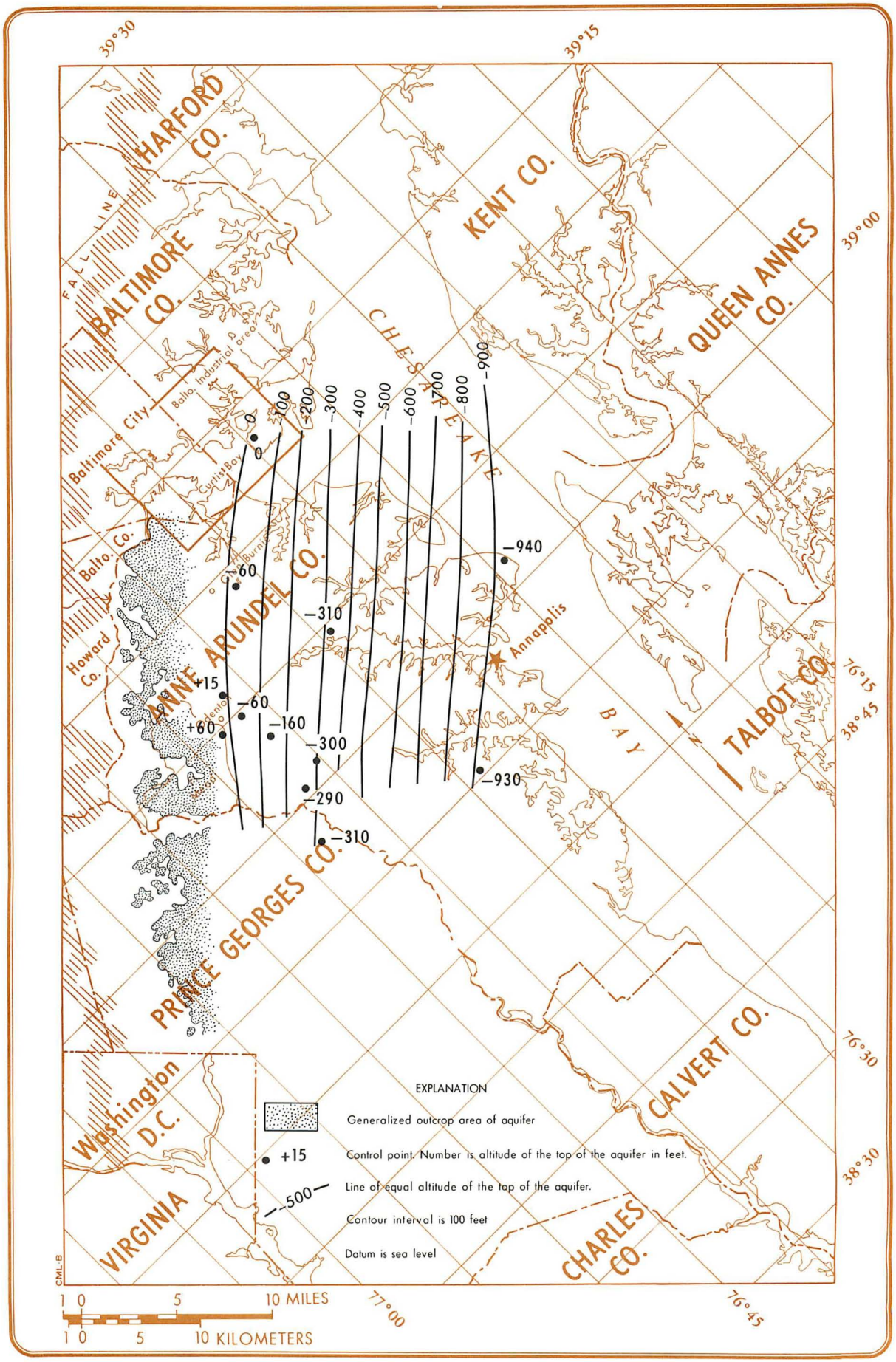


Figure 10. — Outcrop and altitude of top of the lower Patapsco aquifer.

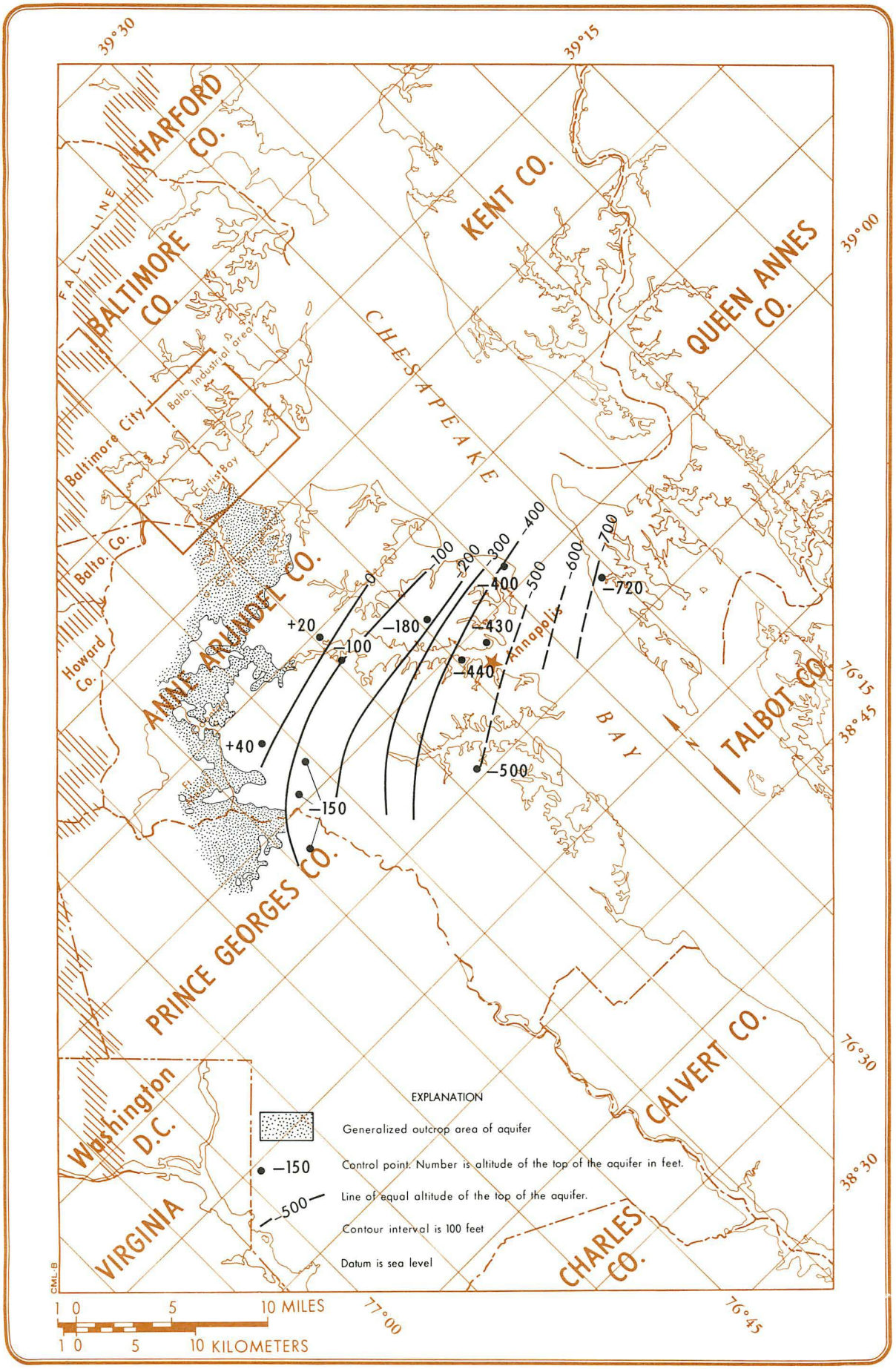


Figure 11. — Outcrop and altitude of top of the upper Patapsco aquifer.

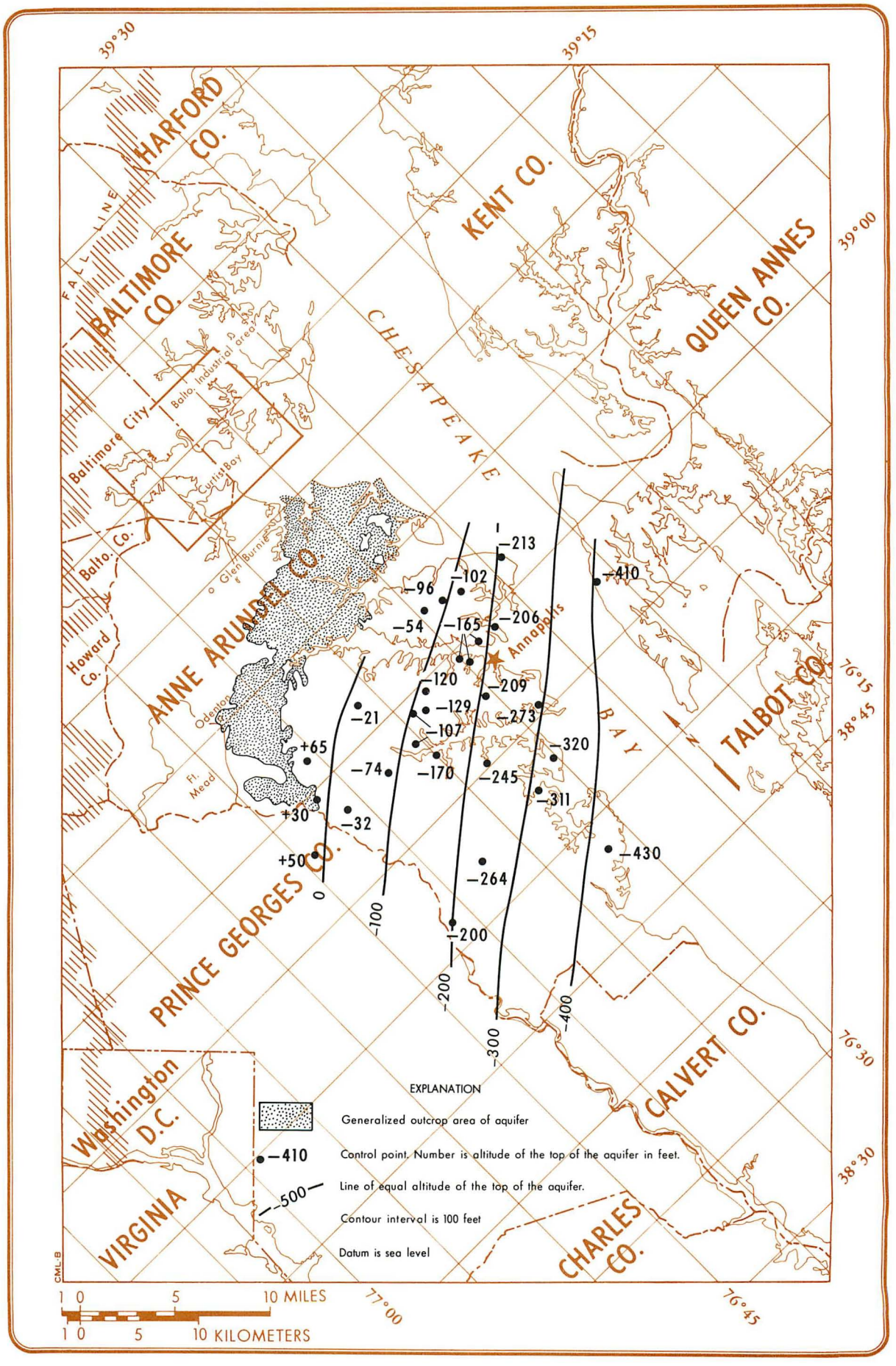


Figure 12. — Outcrop and altitude of top of the Magothy aquifer.

Magothy Aquifer

Although the Magothy aquifer overlies the Potomac Group, it is hydrologically connected in varying degrees from place to place with the underlying Patapsco aquifer. The Magothy aquifer must therefore be considered in determining leakage to and from the upper Patapsco aquifer and is included in the study of aquifers in the Potomac Group. It is well exposed along the Magothy and Severn Rivers, where it consists of 40 to 60 ft of coarse, light-gray sand containing lignite and pyrite. It dips to the southeast at about 30 ft/mi and serves as an excellent aquifer in the Annapolis area.

GROUND-WATER FLOW

That part of the rainfall and snowmelt that does not immediately run off as overland flow and that is not returned to the atmosphere through evapotranspiration, percolates downward to the water table as ground-water recharge. Once water reaches the zone of saturation, it begins to move laterally under the influence of gravity toward points of discharge, such as springs, wells, streams, or the Chesapeake Bay. Lateral movement of water within a typical aquifer is slow and downgradient toward areas of lower head.

The general direction of ground-water flow can be estimated for each aquifer by assuming that the direction of flow is perpendicular to the lines of equal potentiometric head shown on the potentiometric maps (see figs. 22 to 25 and 30 to 37). It will be found that water in most of the aquifers in the project area moves toward the east or southeast.

The vertical interaquifer flow (leakage) through the confining layers is much slower than the lateral flow within the aquifer because vertical hydraulic conductivity of the confining layer is much lower than the horizontal hydraulic conductivity of the aquifer. In recharge areas, the heads in the shallow aquifers are generally higher than the heads in the deeper aquifers. Therefore, the direction of flow is downward. In and around Chesapeake Bay, which is generally a discharge area, the relationship is the reverse; that is, the heads in the deeper aquifers are generally higher causing the direction of flow to be upward.

HISTORICAL STRESSES ON THE AQUIFERS

In the modeled area, total pumpage and the patterns of pumping from aquifers in the Potomac Group and overlying Magothy aquifer have changed considerably since 1940. Early demands were for relatively small quantities of water that could be obtained from shallow wells. As demands for water increased, wells were drilled deeper to get higher yields per well and to avoid interference with other wells. On the other hand, ground-water usage in the Baltimore industrial area (fig. 3) has decreased as industries have switched to city-supplied surface water or treated sewage effluent. Well fields pumping more than 10,000 gal/d are listed in table 2.

Figures 13, 14, 15, and 16 show how pumpage from each of the four aquifers changed from 1965 to 1977. Comparison of these maps shows that in most cases, there was a noticeable increase in the number of well fields during each 5-year interval.

In 1965, ground-water pumpage from the aquifers in the model area totaled 40 Mgal/d. Sixteen Mgal/d were pumped from the Patuxent, 13 Mgal/d from the lower Patapsco, 6 Mgal/d from the upper Patapsco, and 5 Mgal/d from the Magothy. The total pumpage was produced from 265 wells with a minimum of at least 10,000 gal/d per user. Most of the wells are located in Anne Arundel County, some in the Baltimore industrial area, and some in Prince Georges County. The pumping records of these wells show that the total ground-water supply for the 12-year period from 1965 to 1977 remained at 40 Mgal/d although the amount produced by the individual wells and individual aquifers changed from time to time. For example, when the rate of withdrawal of water from wells that tap the lower Patapsco aquifer in the Sparrows Point area was decreased because of increasing salinity, the rate of withdrawal from the deeper Patuxent aquifer was increased.

(Text continued on p. 26.)

Table 2. — Well fields with appropriation permits for more than 10,000 gal/d, and pumpage by aquifer

	Well Field	Average pumpage in Mgal/d		
		1965-69	1970-74	1975-77
LOWER PATAPSCO WELL FIELDS				
48	Sawmill Branch, AA-Ad 23, 40, 41, 67, 68	1.4	1.5	1.3
49	Dorsey Road, Non-Iron, AA-Ad 74, -Bd 55, 56, 64, 92, 95	1.5	1.6	2.0
50	Meade Village, AA-Bc 175, 176	0.0	0.08	0.1
51	Harundale, AA-Bd 36, 37, 61, 63	1.5	1.3	1.2
52	Glendale, AA-Bd 103	0.0	0.4	0.4
53	Phillip Drive/Thelma Ave., AA-Bd 101, 108	0.0	0.8	0.8
54	Crain Highway/Elvaton, AA-Bd 105, 107	0.0	0.7	1.1
55	Quarterfield Road, AA-Bd 109	0.0	0.4	0.1
56	Joseph T. Hock, AA-Ad 60	0.01	0.01	0.01
57	Two Guys Department Store, AA-Ad 69, 71	0.2	0.2	0.2
58	Southern State Coop., AA-Ad 93	0.01	0.01	0.01
59	Nevamar Corp., AA-Bc 171	0.7	0.6	0.5
60	Pioneer City Water, AA-Bc 169, 195	0.0	0.1	0.2
61	Koppers Co., AA-Bc 186	0.0	0.01	0.01
62	Kings Heights, AA-Cc 79, 87, 88	0.05	0.1	0.2
63	Crofton, AA-Cc 89	0.2	0.5	0.1
64	Severndale, AA-Ce 94, 95, 96	0.3	0.6	1.0
65	City of Annapolis, AA-De 94	0.9	1.2	1.5
66	Patuxent Wildlife, PG-Bc 22	0.07	0.07	0.07
67	Sparrows Point, Town Water, BA-Gf 2, 20, 167, 168, 171, 176	0.8	0.0	1.0
68	Fort Foote, PG-Eb 26	0.4	0.2	0.0
69	City of Bowie, PG-Cf 32, 35	0.6	0.6	0.6
70	Sparrows Point, Coke Oven, BA-Gf 13, 139, 202, 203, 204, 205, 206, 207, 208, 209, 218	7.5	0.0	0.0
PATUXENT WELL FIELDS				
71	Beltsville, PG-Bd 15, 16, 19, 21, 27, 28, 29, 30, -Be 6	0.6	0.7	0.7
72	Patuxent Wildlife, PG-Be 22, 23	0.08	0.08	0.08
73	City of Bowie, PG-Cf 64	0.8	1.0	0.2
74	City of Bowie, PG-Cf 66	0.6	0.7	1.0
75	Industrial Parkway, AA-Ac 60, 65	0.0	0.04	0.0
76	Dorsey Road, AA-Ad 76	0.4	0.6	1.5
77	Dorsey Road, AA-Bd 57, 66, 97, 98	1.2	0.6	1.0
78	Matlack, AA-Ad 94	0.01	0.01	0.01
79	U.S.S. Agricultural Chemicals, AA-Ad 96	0.04	0.01	0.01
80	Diamond Shamrock, AA-Ae 36	0.4	0.6	0.8
81	Laurel Race Course, AA-Bb 22, 48, 49	0.07	0.08	0.1
82	Parkway Manor, AA-Bb 37, 71	0.01	0.01	0.01
83	Colony 7 Motor Inn, AA-Bb 50, 54, 70	0.03	0.03	0.03
84	Maryland City, AA-Bb 64, 65, 66, 69	0.4	0.5	0.6
85	Ft. Meade, AA-Bb 68	0.0	0.1	0.5
86	Ft. Meade, AA-Bc 164	0.0	0.4	0.4
87	Holiday Inn, AA-Bb 72, 73	0.0	0.01	0.01
88	Nevamar Corp., AA-Bb 173	0.0	0.05	0.2
89	Holiday Mobile Estates, AA-Bc 177, 178	0.04	0.04	0.05
90	Koppers Co., AA-Bc 185	0.01	0.01	0.01
91	Provinces Water Co., AA-Bc 192, 193	0.0	0.1	0.2
92	Robinhood Trailer Park, AA-Bc 199, 200	0.0	0.02	0.02
93	Kings Heights, AA-Cc 87, 88	0.2	0.5	0.6
94	Crofton, AA-Cc 86, 89	0.1	0.1	0.1
95	Crofton Meadows, AA-Cc 103, 105, 107	0.0	0.0	1.0
96	Hood Vinegar, 1N 3E 7, 8, 10	0.0	0.05	0.05
97	Schluderberg Kurdle, 1S 3E 45, 46	0.2	0.2	0.2
98	Federal Yeast, 3S 5E 35, 39, 41, 42	2.0	2.0	2.0
99	FMC Corporation, 5S 2E 10, 20, 21	2.2	1.9	0.8
100	Eastern Stainless Steel, BA-Fe 41, 59, 61	1.0	1.0	1.0
101	Sparrows Point, Blast Furnace, BA-Gf 139, 211, 212, 214	3.0	2.1	1.5
102	Sparrows Point, Hot Strip, BA-Gf 32, 35, 210	2.0	1.5	1.8
103	Sparrows Point, Wire Mill, BA-Gf 3, 5, 8, 9, 11	2.0	2.0	2.0

Table 2. — Well fields with appropriation permits for more than 10,000 gal/d, and pumpage by aquifer, continued

	Well Field	Average pumpage in Mgal/d		
		1965-69	1970-74	1975-77
MAGOTHY WELL FIELDS				
1	Crofton Center, AA-Cc 62	0.008	0.008	0.008
2	Golden Triangle, AA-Cc 110, 111	0.0	0.005	0.005
3	Crownsville, AA-Cd 11, 43, 50, 72	0.4	0.4	0.2
4	Summerhill, AA-Cd 93, 94	0.005	0.01	0.01
5	Pines on Severn, AA-Ce 69	0.05	0.1	0.05
6	Sherwood Forest, AA-Ce 98	0.06	0.07	0.06
7	Epping Forest, AA-Ce 99, 119	0.002	0.03	0.04
8	Sandy Point, AA-Cg 6, 7, 8	0.007	0.009	0.007
9	City of Annapolis, AA-De 2, 45, 46, 88	2.5	3.0	3.2
10	Sylvan Shores, AA-De 69, 122	0.04	0.04	0.04
11	U.S. Naval R & D Center, AA-Df 64	0.2	0.2	0.2
12	Maryland Manor, AA-Ec 6, 7, 8	0.0	0.04	0.05
13	Lyons Creek/J. Crosby, AA-Fc 23	0.0	0.0	0.01
14	Shores of Calvert/Cavalier Water Co., CA-Ba 7, 8, -Bb 23, 24	0.0	0.0	0.03
15	City of Bowie, PG-Cf 33, 34	0.3	0.4	0.3
16	Marlboro Meadows, PG-Df 34, 36, 39	0.0	0.1	0.2
17	Lonestar/Sauerwein, PG-Ed 51, -Ee 42	0.01	0.01	0.01
18	Safeway/N.E. Marlboro, PG-Ee 3, -Ef 14, 29	0.01	0.01	0.01
19	Boys Village, PG-Fd 5, 55	0.08	0.08	0.08
20	U.S. Navy Cheltenham, PG-Fd 9, 10, 11, 64	0.05	0.05	0.06
21	WSSC, Upper Marlboro, PG-Ef 37	0.04	0.05	0.04
22	Cadillac Motel, PG-Fd 35	0.004	0.004	0.008
23	Brandywine Country Club, PG-Fe 54	0.0	0.03	0.03
24	BFW Fabrication, PG-Fe 32	0.01	0.01	0.01
25	Baden Elementary School, PG-Ge 15, 17	0.004	0.007	0.007
26	Chalk Point, PG-Hf 26, 27, 28, 33, 36	0.3	0.5	0.6
UPPER PATAPSCO WELL FIELDS				
27	Nevamar, AA-Bc 1, 20, 40, 47, 157, 165	1.7	1.9	2.0
28	Transit Truckstop, AA-Bd 111	0.02	0.02	0.02
29	Pasadena Water Co., AA-Be 104, 105	0.04	0.04	0.04
30	Kings Heights, AA-Cc 43	0.01	0.04	0.06
31	Severndale, AA-Ce 94, 95, 96	0.2	0.4	0.7
32	Belvedere Heights, AA-Cf 62, 64	0.1	0.1	0.2
33	Gibson Island, AA-Cf 2, 22	0.1	0.1	0.1
34	Whispering Woods, AA-Cf 117, 126, 127	0.0	0.0	0.05
35	Arnold Field, AA-Cf 118, 119, 120	0.0	0.0	0.0
36	Westinghouse Electric, AA-Cg 18, 19	0.03	0.04	0.04
37	Annapolis Concrete, AA-De 93	0.0	0.01	0.01
38	Broad Creek, AA-De 96, 97	0.1	0.1	0.2
39	Naval Academy, AA-Df 12, 13, 80, 83	1.0	1.3	1.4
40	U.S. Naval R & D Center, AA-Df 16, 65	0.4	0.4	0.4
41	Naval Academy Golf Course, AA-Df 89	0.2	0.2	0.2
42	Pines on Severn, AA-Ce 70	0.05	0.2	0.04
43	Fort Foote, PG-Eb 26	0.4	0.2	0.0
44	Chalk Point, PG-Hf 38	0.0	0.0	0.2
45	Roll-Park Trailer Park, AA-Bd 89	0.0	0.0	0.01
46	Severna Park, AA-Ce 65, 66, 67	0.3	0.4	0.6
47	Brodsky's Trailer Park, AA-Bc 88, 187	0.02	0.02	0.02
3a	City of Bowie, PG-Cf 32, 35	0.6	0.6	0.6

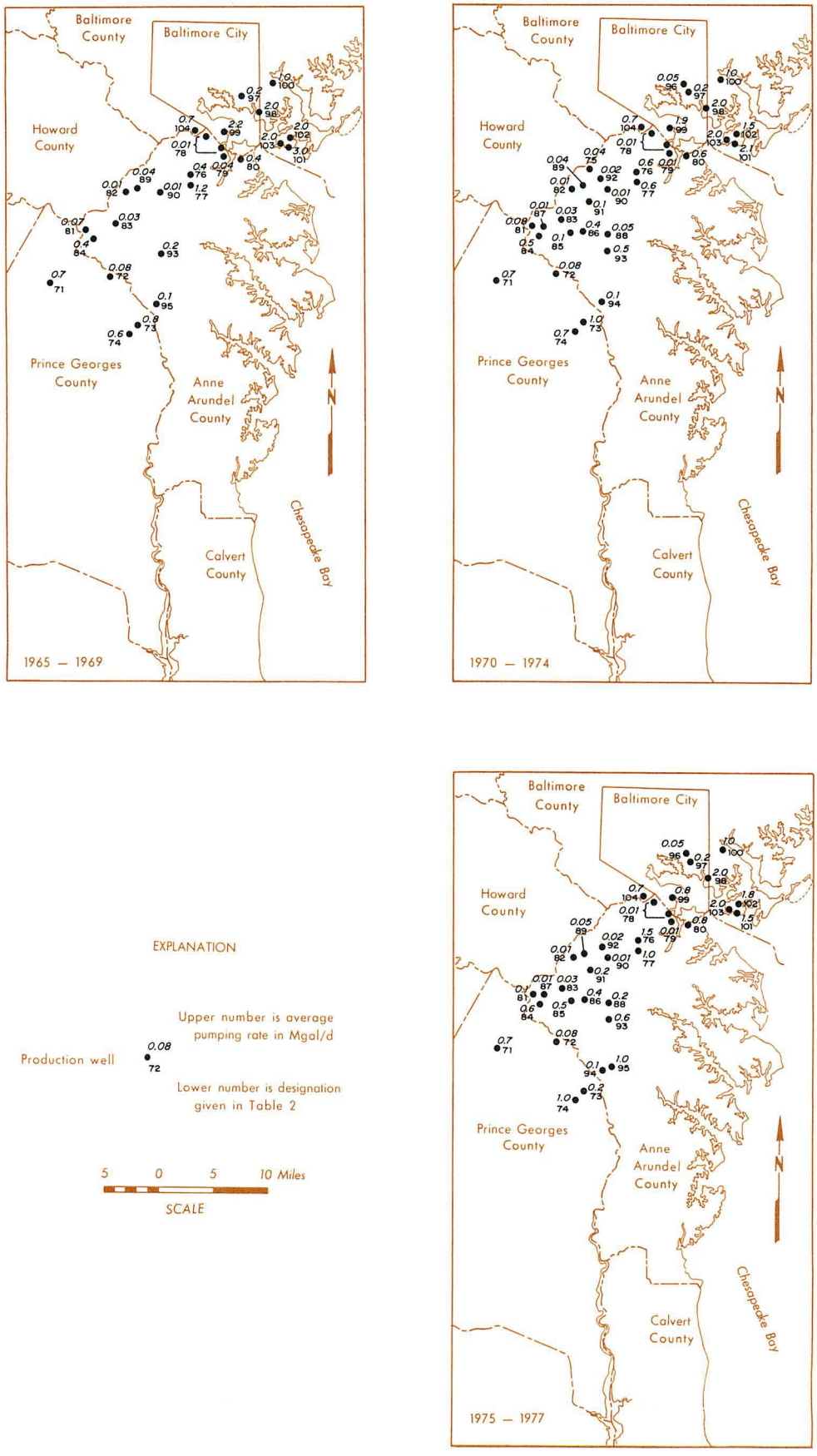


Figure 13. — Locations and pumping rates of well fields withdrawing water from the Patuxent aquifer in 1965-69, 1970-74, and 1975-77.

Figure 14. — Locations and pumping rates of well fields withdrawing water from the lower Patapsco aquifer in 1965-69, 1970-74, and 1975-77.

Figure 15. — Locations and pumping rates of well fields withdrawing water from the upper Patapsco aquifer in 1965-69, 1970-74, and 1975-77.

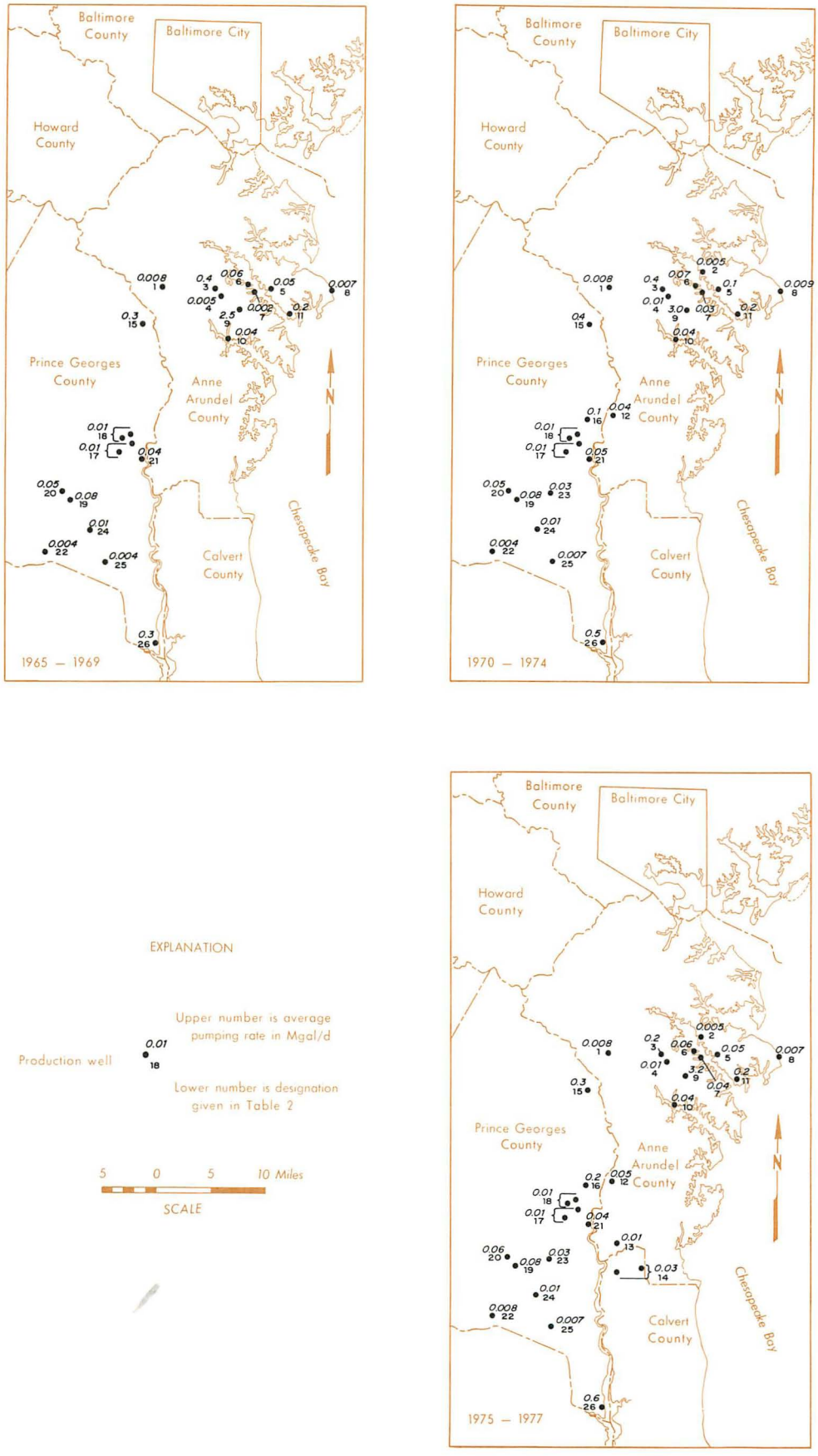


Figure 16. — Locations and pumping rates of well fields withdrawing water from the Magothy aquifer in 1965-69, 1970-74, and 1975-77.

MODEL DEVELOPMENT

The digital-modeling method provides a means of simulating the flow of ground water in a hydrologic system. The quasi-three-dimensional method used in this study solves a set of simultaneous-partial-differential equations that describe the head distribution in a multi-aquifer system. The derivation assumes the nonsteady, two-dimensional flow of a homogeneous fluid in a nonhomogeneous anisotropic aquifer.

The model program was designed for the simulation of a multi-aquifer anisotropic aquifer system with interaquifer leakage. The computer program used for this study is documented in an earlier report (Achmad and Weigle, 1979).

ASSUMPTIONS MADE IN THE MODEL

The model is an approximation of a complex hydrologic system. Simplifying assumptions about the real system had to be made to remain within the constraints of the modeling technique. In developing the model used in this study, assumptions were made regarding the following features of the system:

1. *Flow Direction:* Flow in the aquifers is lateral and flow in the confining bed is vertical. The validity of this assumption has been investigated and demonstrated by Javandel and Witherspoon (1968). It was found that when the permeabilities of the aquifers are two orders of magnitude greater than those of the confining beds, the error introduced by the assumption is less than 5 percent. In the case of aquifers in the Potomac Group, the lateral permeabilities of the aquifers are probably several orders of magnitude greater than the vertical permeabilities of the confining beds.
2. *Boundary Conditions:* The area of the model was arbitrarily made larger than the project area in order to minimize the effect of the boundaries upon the part of the model in the project area. Natural no-flow boundaries occur in the northwestern part of the model where the aquifers have been truncated at their outcrop areas. Artificial boundaries had to be assigned to the other geographical limits of the model, which are at least 25 mi from the project area. These outlying boundaries were modeled as no-flow boundaries after trial runs with flux conditions showed that little water crossed them and their effect on water levels in the project area was negligible.

   The bedrock beneath the Patuxent aquifer was modeled as a no-flow boundary. The uppermost boundary of the aquifer system was treated as a recharge boundary (fig. 17).

   Those parts of the outcrop areas of aquifers in which the levels of larger streams, the Bay, and the water table are known to remain constant, are represented in the model by nodes assigned high storage coefficients in order to keep the potentiometric surface constant. In steady-state simulation, these constant-head boundary nodes retain their high storage coefficient values, while the rest of the nodes are assigned zero storage coefficient.
3. *Initial Water-Level Conditions:* The water levels computed from the steady-state runs, which were calibrated against water levels prior to 1965 (figs. 22 to 25), were used as initial water levels when preparing the model for transient simulation. (See section on Steady-State Calibration.) The water-level data used for the steady-state calibration were selected from the earliest water levels measured for conditions closest to unstressed conditions. The water levels were, therefore, recorded at times when there was little or no pumpage. It was understood that hydraulic pressures in the aquifer system prior to 1965 were not completely stabilized. That is generally true in areas where there is pumpage, although a steady state could exist under pumping conditions. The unstressed areas, however, were assumed to be under steady-state conditions.
4. *Recharge-Discharge:* Recharge from precipitation was modeled as generalized in figure 17. A uniform amount of water was assumed to be available for recharge on the entire surface of the outcrop area of the model. In the model, a part of the precipitation percolates into the aquifers and another part discharges into rivers and the Bay.

DATA PREPARATION FOR THE MODEL

Aquifers in the Potomac Group were simulated by subdividing them into rectangular cells, which constitute a finite-difference grid. The grid consists of 46 columns and 34 rows for a total of 1,564 nodes (figs. 18 to 21). The cell size varies from 1 mi by 1 mi in the project area, to as large as 3 mi by 5 mi outside the project area. The total area modeled (model area) is approximately 2,500 mi^2, and the area of concern (project area), the northern part of Anne Arundel County, is about 500 mi^2.

The finite-difference method of solution assumes that hydrologic properties within each cell do not vary. Average values for aquifer parameters are represented by a node at the center of each cell.

The values for hydraulic properties assigned to each node were obtained by laying the grid over the appropriate map (for example, a transmissivity map) and determining

(Text continued on p. 32.)

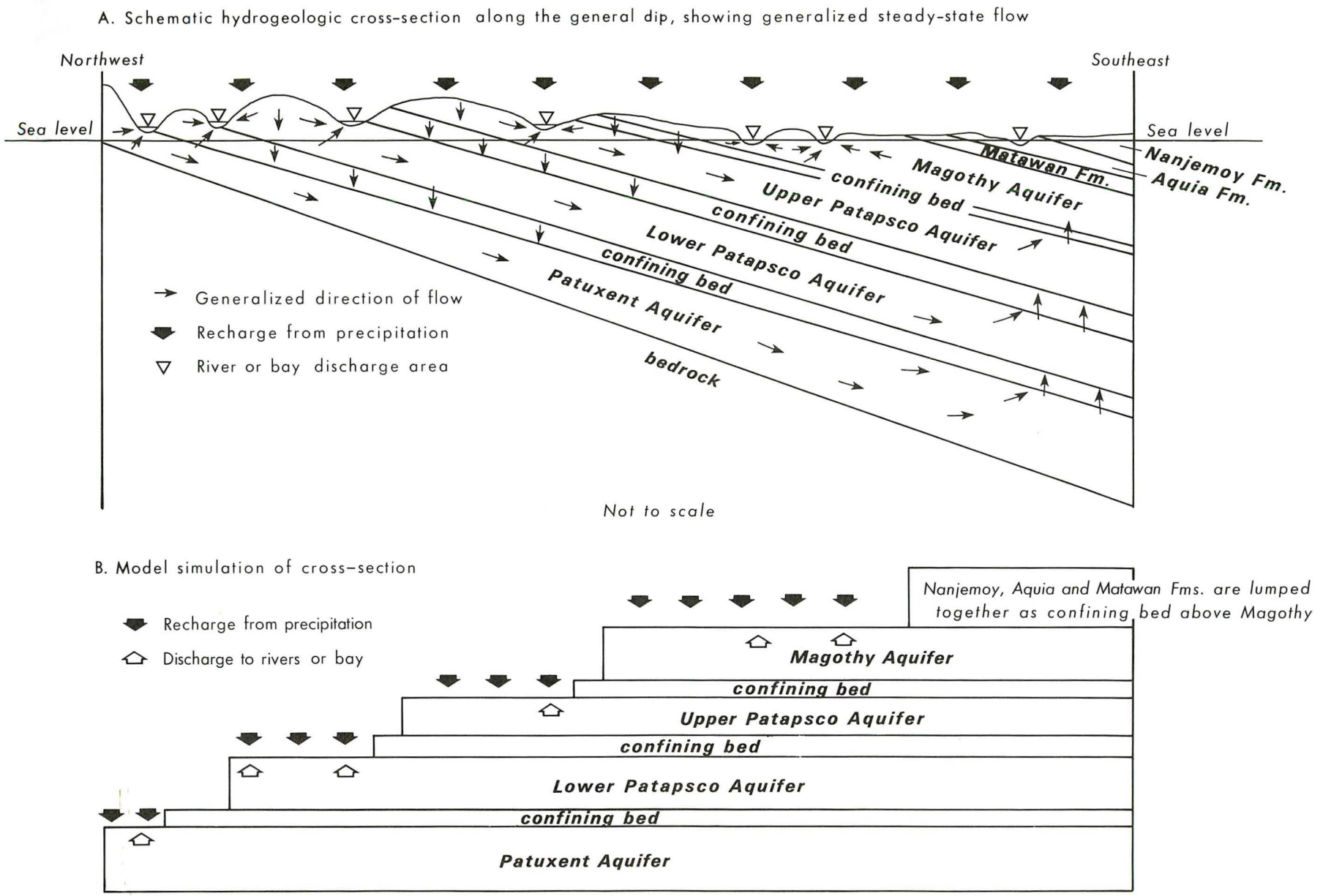


Figure 17. — Schematic cross-sections of the geohydrologic system as simulated in the model.

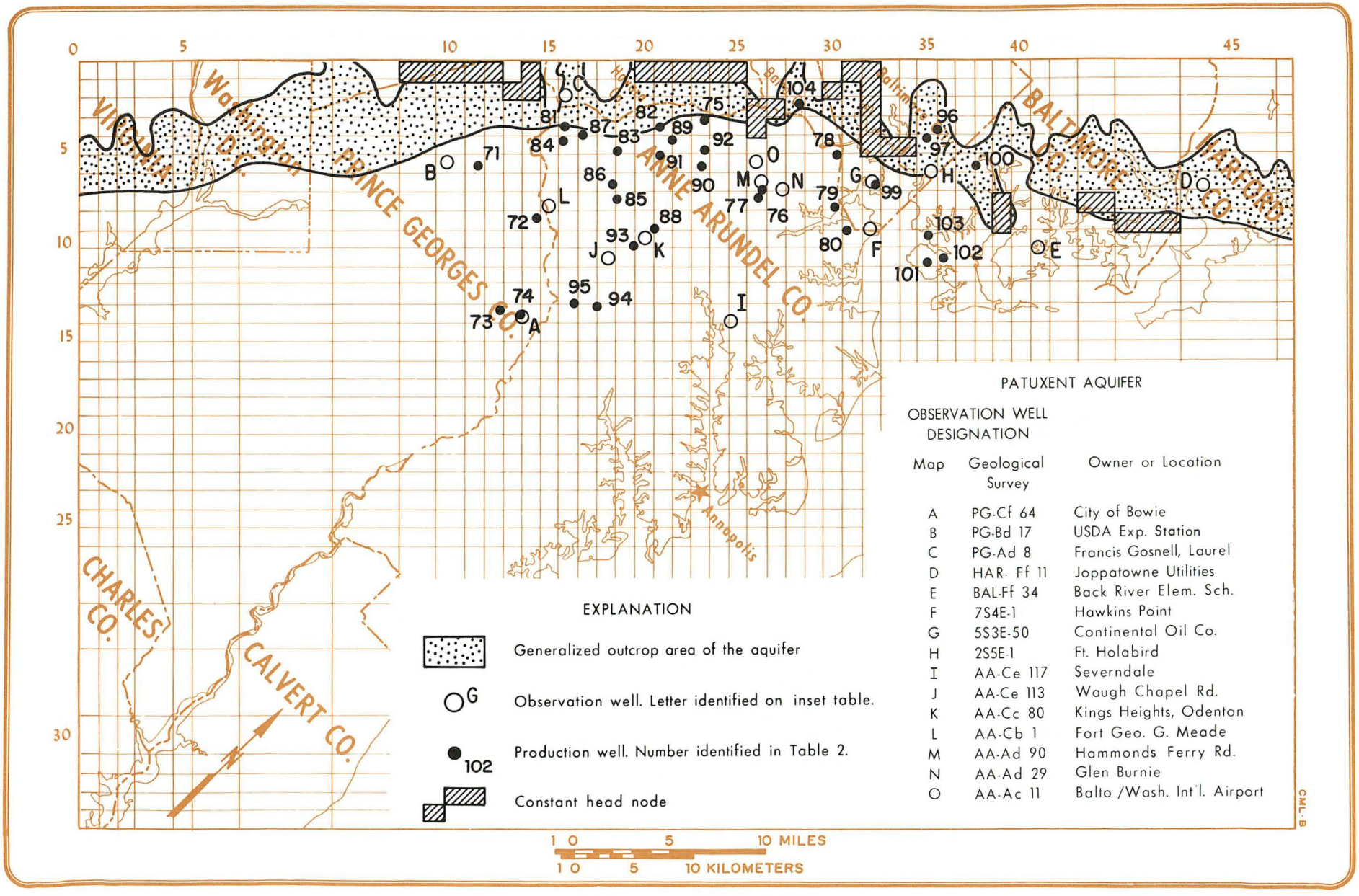


Figure 18. — Model area showing the grid system, outcrop areas, constant-head nodes, and locations of observation and pumping wells for the Patuxent aquifer.

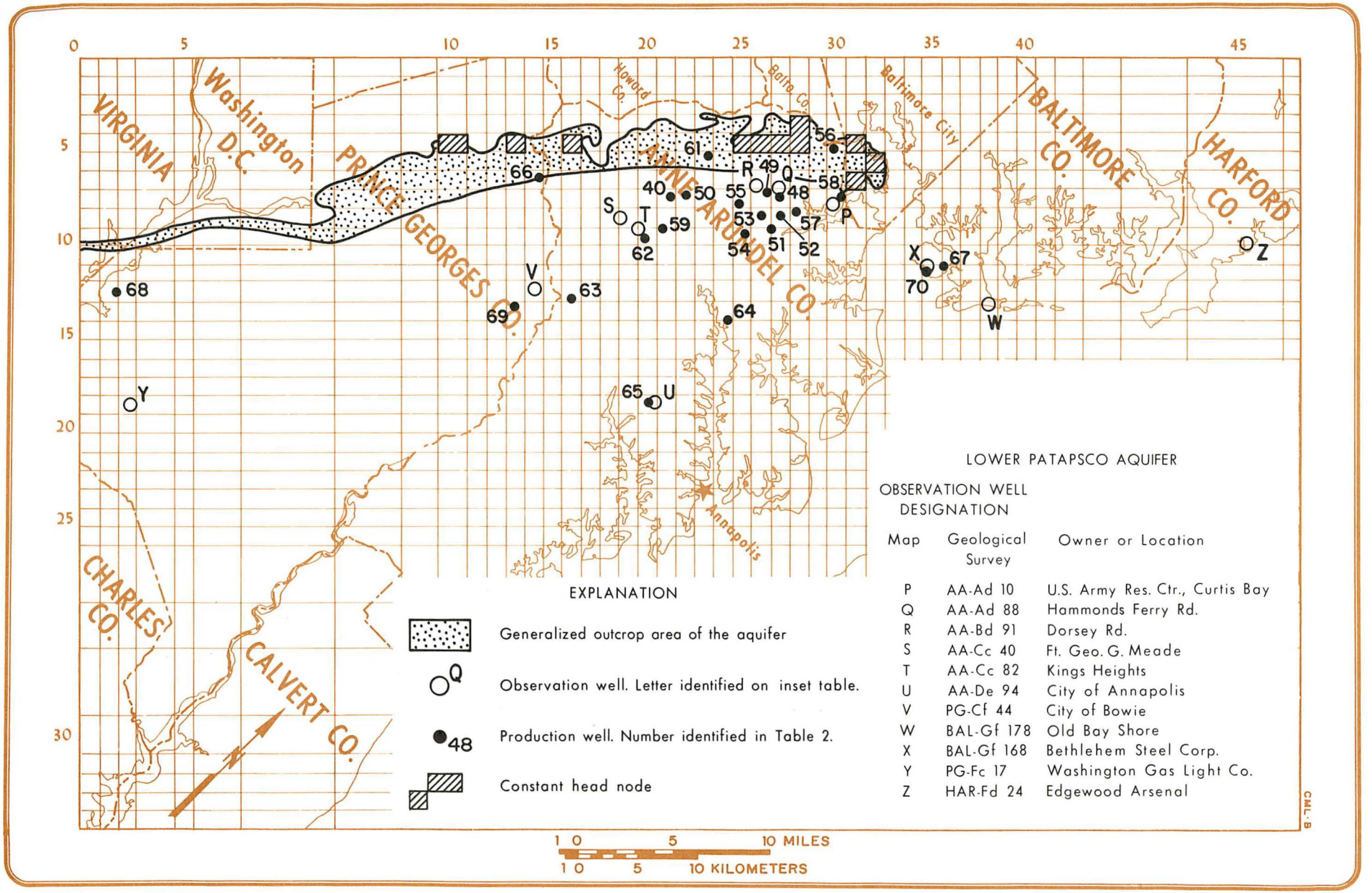


Figure 19. — Model area showing the grid system, outcrop areas, constant-head nodes, and locations of observation and pumping wells for the lower Patapsco aquifer.

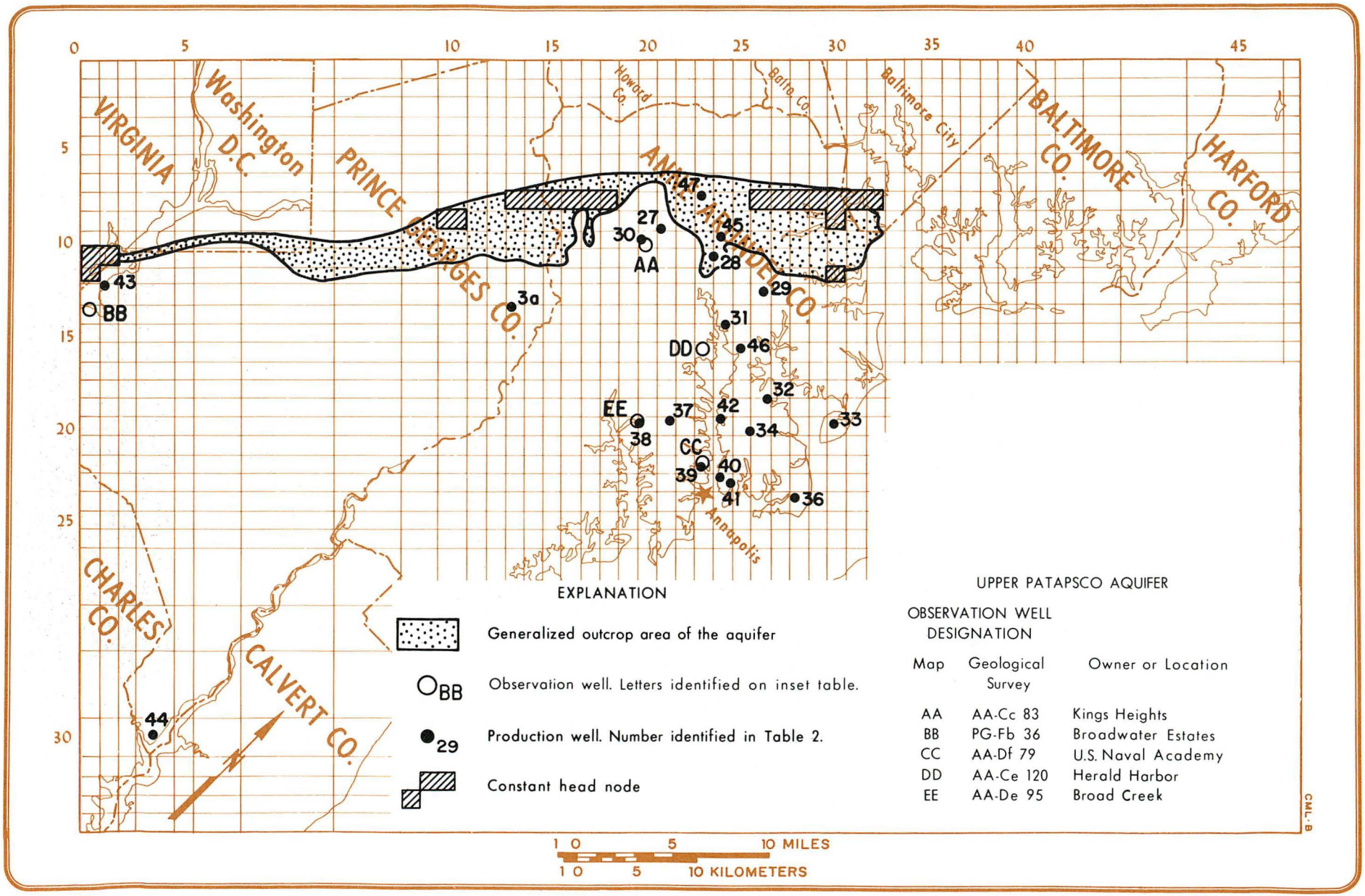


Figure 20. — Model area showing the grid system, outcrop areas, constant-head nodes, and locations of observation and pumping wells for the upper Patapsco aquifer.

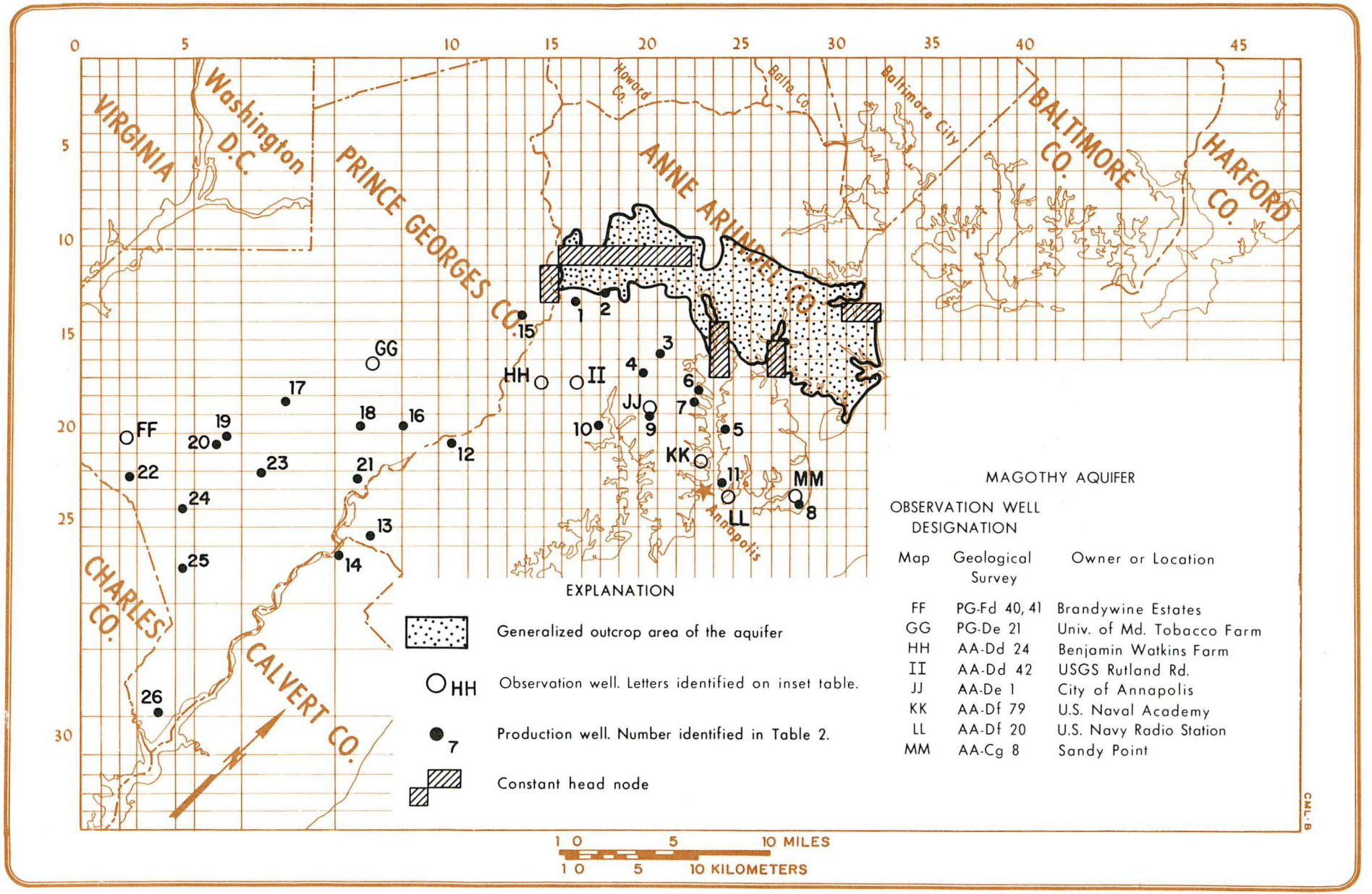


Figure 21. — Model area showing the grid system, outcrop areas, constant-head nodes, and locations of observation and pumping wells for the Magothy aquifer.

an average value of that property for each node. The following data were supplied to the model for each node: (1) initial water-level conditions, (2) transmissivities of aquifers, (3) storage coefficients of aquifers, (4) vertical hydraulic conductivity of confining beds, and (5) specific storage of confining beds. In addition, pumpage was specified for each node where pumping wells are located.

The initial water levels used for the start of transient simulation were obtained from steady-state calibration, in which the computed water levels were calibrated against the earliest water levels measured prior to 1965. Water-level data used in the calibration were obtained from previous reports by Otton (1955), Mack (1962, 1966, 1974, and 1976), and Mack and Mandle (1977).

The first estimates of transmissivity values used for the steady-state model were obtained from published pumping test data (Otton, 1955; Mack, 1962, 1966, 1974, and 1976; and Mack and Mandle, 1977). The transmissivities vary from aquifer to aquifer and in each aquifer the transmissivity varies from place to place. Highest transmissivity values generally are found in areas of greatest use of the aquifer.

The values assigned for the aquifer storage coefficients were obtained from earlier reports by Otton (1955) and Mack (1962). Because it was assumed that all the aquifers are homogeneous, a single storage coefficient was assigned to each aquifer. The values assigned to the confined parts of the aquifers were on the order of 10^{-4}. The values assigned to the water-table parts of the aquifers were on the order of 10^{-1}.

The thickness, vertical hydraulic conductivity, and specific storage of the confining beds, plus the head drop across the confining bed, are the factors used in the flow equation to determine interaquifer leakage. Values for the thickness of the confining beds were obtained from the logs of 22 wells (figs. 4 to 8). Thicknesses ranged from 2 to 300 ft. The values of the vertical hydraulic conductivity of some of the confining beds were obtained from laboratory measurements and have been published in the report on the Magothy aquifer in southern Maryland (Mack and Mandle, 1977). The confining beds are assumed to be homogeneous, and each of the beds is given one hydraulic conductivity value. The initial values for hydraulic conductivities used for steady-state calibration range from 10^{-7} to 10^{-6} ft/d. The vertical leakance, which is the hydraulic conductivity divided by the thickness, varies from node to node depending on the thickness of the confining bed at each node.

The initial value used for the specific storage of each of the confining beds was assumed to be uniform and was estimated based on values used by Lohman (1972), Witherspoon and others (1971), and Wolff (1970).

CALIBRATION OF THE MODEL

A main concern in model development is the accuracy of input data (Konikow, 1978). The necessity for extrapolation of site-specific well test data to cover larger areas is one serious potential source of error. To prepare the model for predictive use, the input data were adjusted until the model reproduced the past hydrologic history of the aquifers.

The calibration of the model involved adjusting the values used for hydraulic properties of the aquifers and confining beds so that water levels simulated by the model agreed with water levels measured in the field. These trial-and-error methods were continued until a reasonable match was obtained under both steady-state and transient conditions.

Steady-State Calibration

The equation governing ground-water flow requires equilibrium conditions at the start of simulation. Otherwise, the results at the end of the simulation will include the effect of presimulation stresses as well as those stresses imposed during the simulation. Ideally, the starting time for the simulation would be the time before the aquifer was stressed. However, because data are weak for this case, the steady-state calibration was performed using water levels measured under conditions of least stress prior to 1965 (see Assumptions Made in the Model).

Under steady-state conditions, recharge to the model equals discharge, and water levels do not change with time. Water-level measurements were available for several locations for each aquifer to permit a reasonable calibration (figs. 22 to 25). The steady-state calibration allowed the refinement of the distribution of the vertical hydraulic conductivities of the confining beds, the recharge rate, and the transmissivities of the aquifers.

Initial Water Levels, Prior to 1965

Using transmissivity values and other hydrologic properties discussed earlier, the model was run with zero as the value for the storage coefficient, except for the constant-head nodes, in an attempt to reproduce the head distributions measured in the aquifers prior to 1965. The values used for aquifer and confining-bed characteristics were adjusted until a satisfactory match was achieved between the computed and earliest measured water levels. The difference between the computed water levels and the observed water levels ranged up to 30 ft, but generally were from 5 to 10 ft.

The initial water levels of each of the four aquifers obtained from steady-state calibration are shown in figures 22 to 25. The values shown at the control points were obtained from measurements of water levels in observation wells. Few points were available for some of the aquifers for the period prior to 1965 because the observation-well networks had not yet been developed.

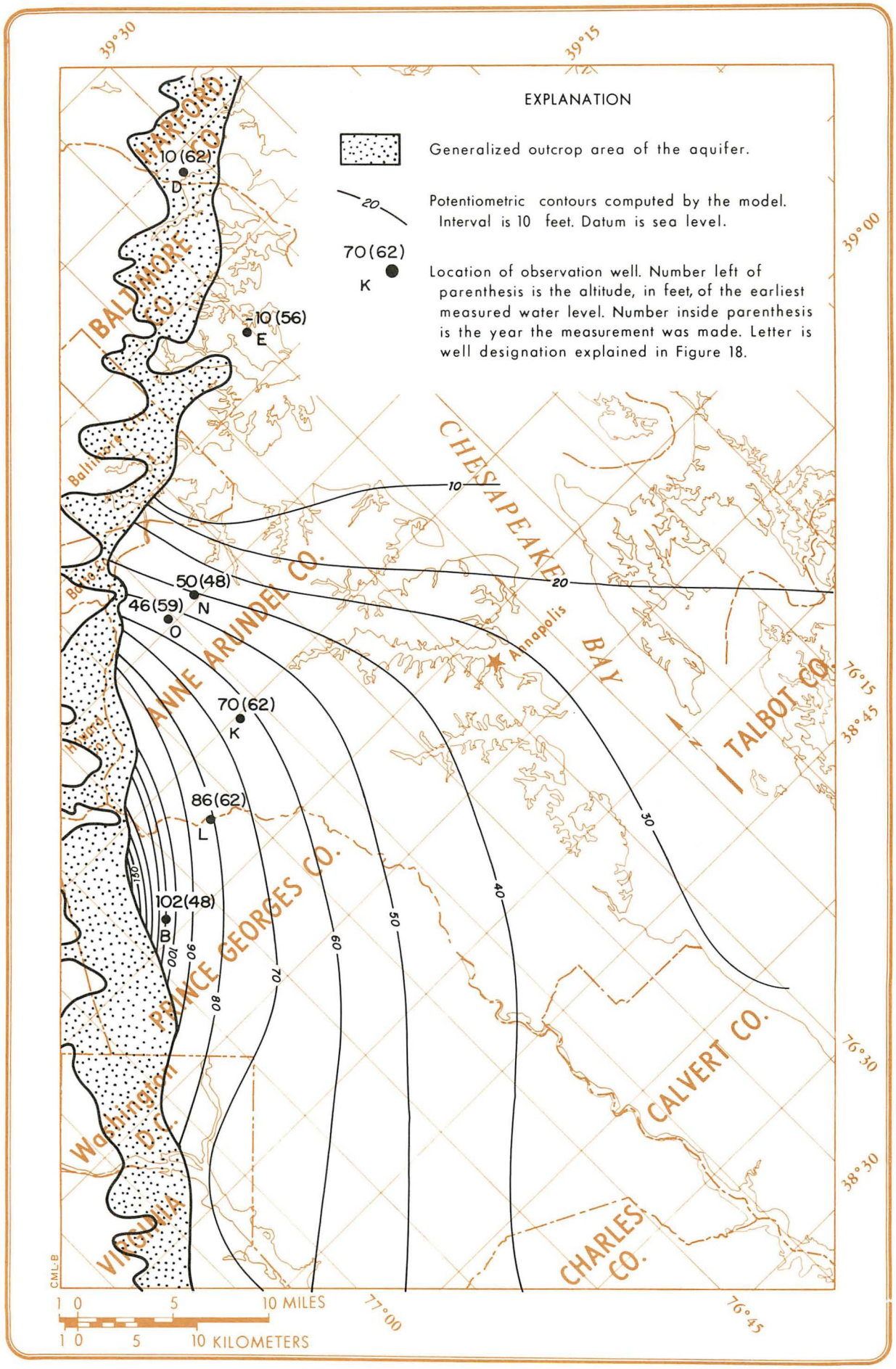


Figure 22. — Computed initial potentiometric surface of the Patuxent aquifer compared with earliest measured water levels.

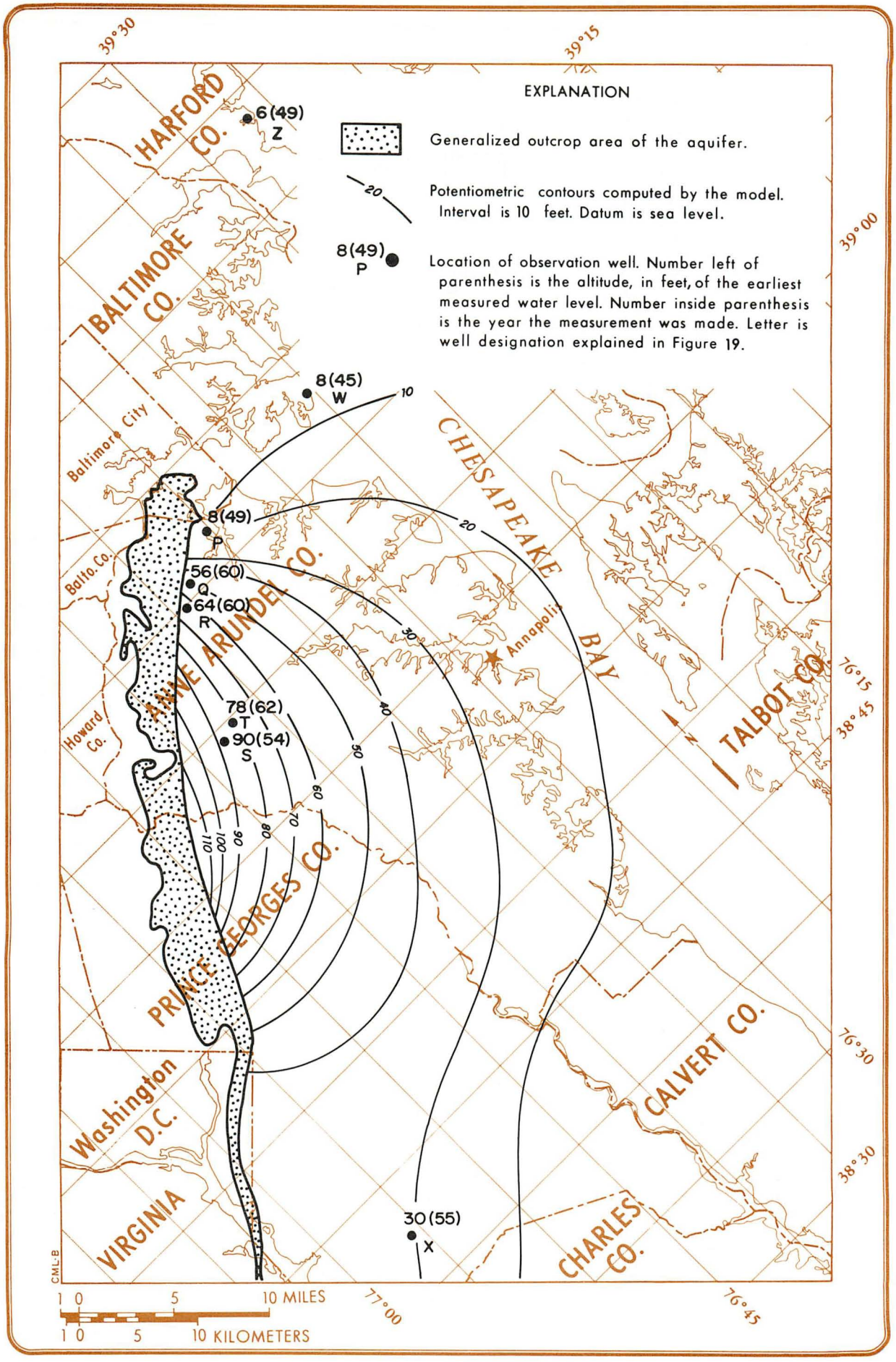


Figure 23. — Computed initial potentiometric surface of the lower Patapsco aquifer compared with earliest measured water levels.

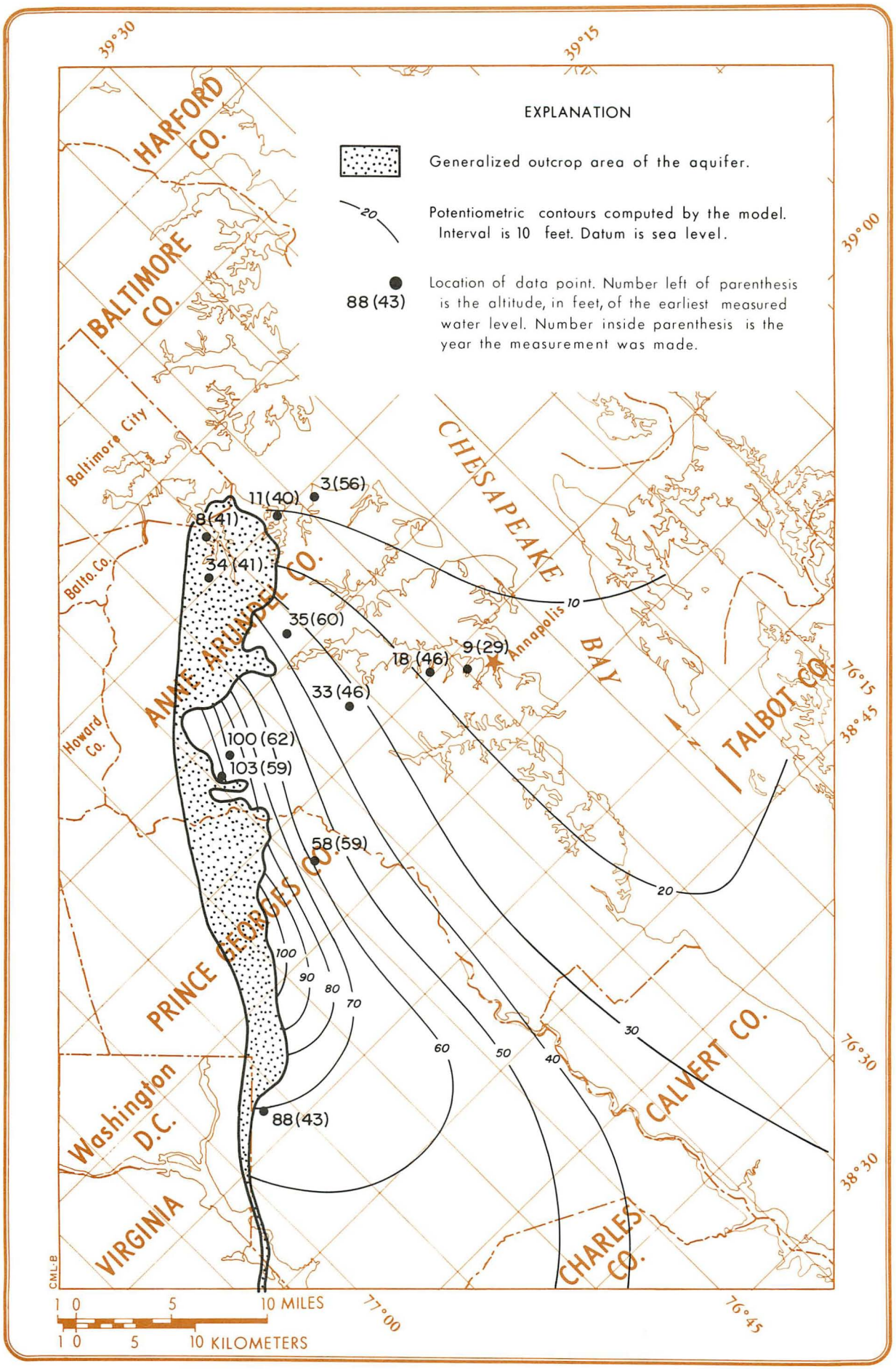


Figure 24. — Computed initial potentiometric surface of the upper Patapsco aquifer compared with earliest measured water levels.

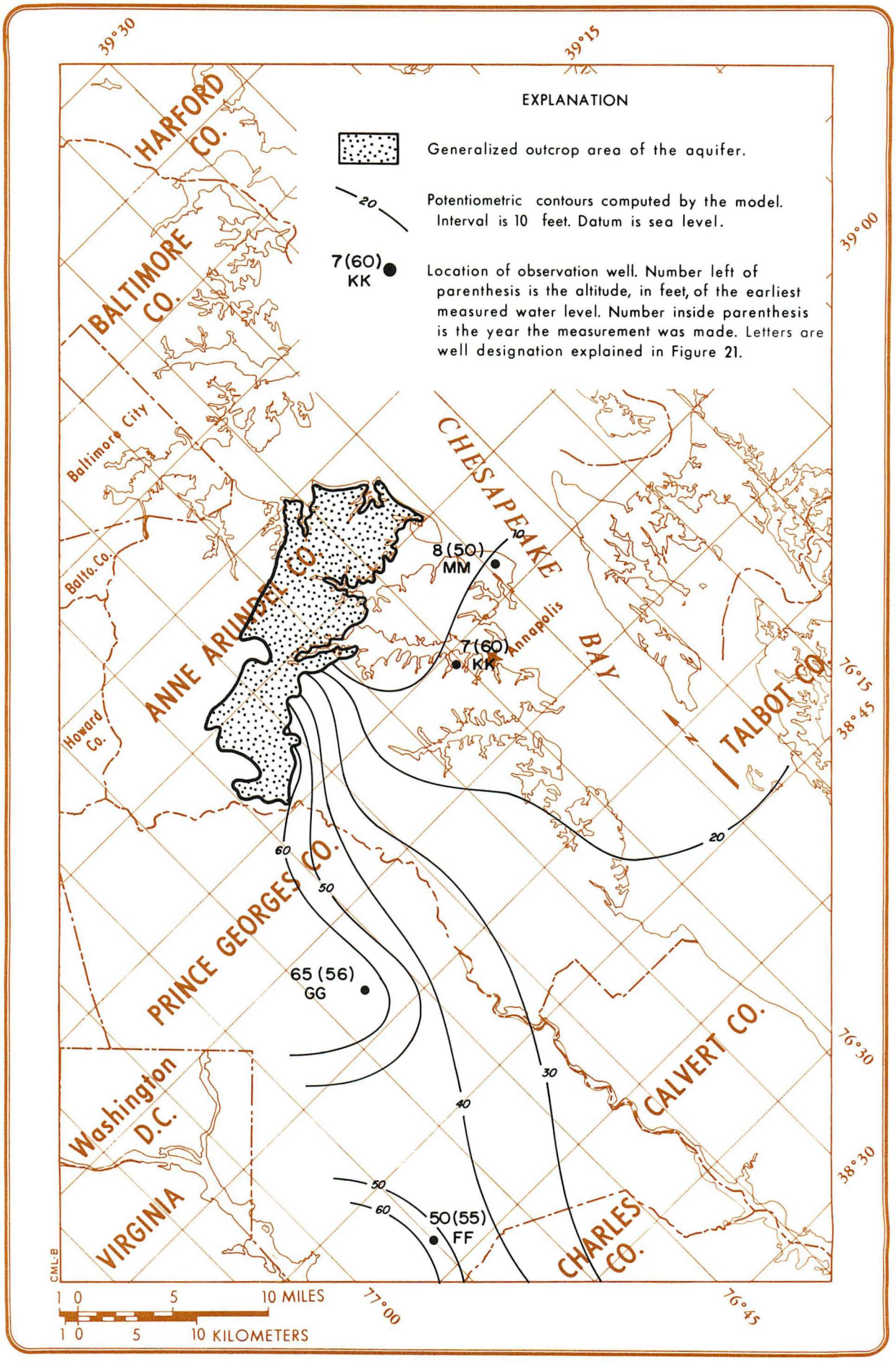


Figure 25. — Computed initial potentiometric surface of the Magothy aquifer compared with earliest measured water levels.

Vertical Hydraulic Conductivity of Confining Beds

The following vertical hydraulic conductivity values (K_v') for the confining beds overlying the aquifers were obtained from steady-state calibration:

K_v' bed overlying Magothy = 1.4×10^{-4} ft/d;
K_v' bed overlying upper Patapsco = 7.2×10^{-6} ft/d;
K_v' bed overlying lower Patapsco = 1.0×10^{-5} ft/d;
K_v' bed overlying Patuxent = 5.9×10^{-7} ft/d.

Ground-Water Recharge

Recharge from precipitation on the outcrop areas occurs at rates limited by the extent of the outcrop areas, rate of precipitation, degree of soil saturation, and the hydraulic conductivity of the aquifer. A greater part of the recharge in the 424-mi^2 outcrop area discharges locally to nearby rivers and Chesapeake Bay. The remaining portion of the recharge percolates into deeper parts of the aquifer system and constitutes the source of water for the aquifers modeled. Recharge to the deeper aquifer system was adjusted during calibration. Best results were obtained using a rate of 1.3 in/year. This value gave a good fit in matching the computed to the measured initial potentiometric surfaces.

Transmissivity

The transmissivity distributions of the aquifers determined by model calibration are shown in figures 26 to 29. Values at control points were obtained from pumping tests. Only minor adjustments were made to the transmissivity values while calibrating the model because the original values assigned were considered the most reliable of the input parameters.

The transmissivity values used in the model for the Patuxent aquifer ranged from 500 to 8,000 ft^2/d. Figure 26 shows that more than 40 percent of the model has transmissivity values of less than 1,000 ft^2/d. Areas with high transmissivity values are concentrated in two locations: north-central Anne Arundel County and the Baltimore City industrial areas — locations that coincide with the heavy users of the Patuxent aquifer.

The transmissivity values used in the model for the lower Patapsco aquifer are shown in figure 27. The transmissivity of the aquifer in the central part of northern Anne Arundel County, about 10 percent of the model area, is shown to be greater than 5,000 ft^2/d.

The transmissivity of the upper Patapsco aquifer used in the model is shown in figure 28. Data for the 35 control points were obtained from pumping tests. The transmissivity values range from 1,000 to 10,000 ft^2/d, and are higher than 3,000 ft^2/d for 30 percent of the model area. The highest transmissivity value was obtained from aquifer testing at Central Avenue School.

The transmissivity of the Magothy aquifer used in the model is shown by contours in figure 29. Data for the control points, 15 of which are located in Anne Arundel County, were obtained from pumping tests. The transmissivity values range from 1,000 to 11,000 ft^2/d.

Transient Calibration

To insure that the model would simulate the effect of predicted future stresses in the aquifer with reasonable accuracy, it was necessary to calibrate the model to approximate observed conditions and as much hydrologic history as practical.

Calibration for 12 years of transient conditions was performed starting with the head distribution obtained in the steady-state simulation. The model was stressed with actual pumpage from all 104 pumping centers in the area modeled (tab. 2, figs. 28 to 31) during the period 1965-77.

Monthly pumpage was simulated in the model in order to better compare computed hydrographs with the observed hydrographs. This study found that use of pumpage data that have been averaged over periods greater than 1 month results in less realistic hydrographs. The only exception would be those cases with constant rates of withdrawal. Hydrographs computed from average yearly pumpage would not be expected to match the observed hydrographs. The transient calibration was done by matching computed hydrographs with the hydrographs of 39 observation wells, and by matching head distributions in each aquifer for 1965 and 1975.

Most of the pumpage data were reported in terms of one well pumping from one aquifer. Some data were reported in terms of total pumpage from a group of wells pumping from one aquifer, and, in a few cases, the pumpage values available were the total values for water pumped from more than one aquifer. In the latter cases, total pumpage was divided proportionally to individual aquifers according to the capacities of the wells tapping them.

In matching the hydrographs, adjustments were made to the hydraulic properties of the aquifer system. The storage coefficients of the aquifers, the hydraulic conductivity, and the specific storage of the confining beds were adjusted in these runs.

Aquifer Storage Coefficients

The storage coefficients used for the confined parts of the aquifers are on the order of 10^{-4}, and it was found that the best results were obtained by using the following values:

Aquifer	Storage coefficient
Magothy	0.0003
Upper Patapsco	.0002
Lower Patapsco	.0002
Patuxent	.00015

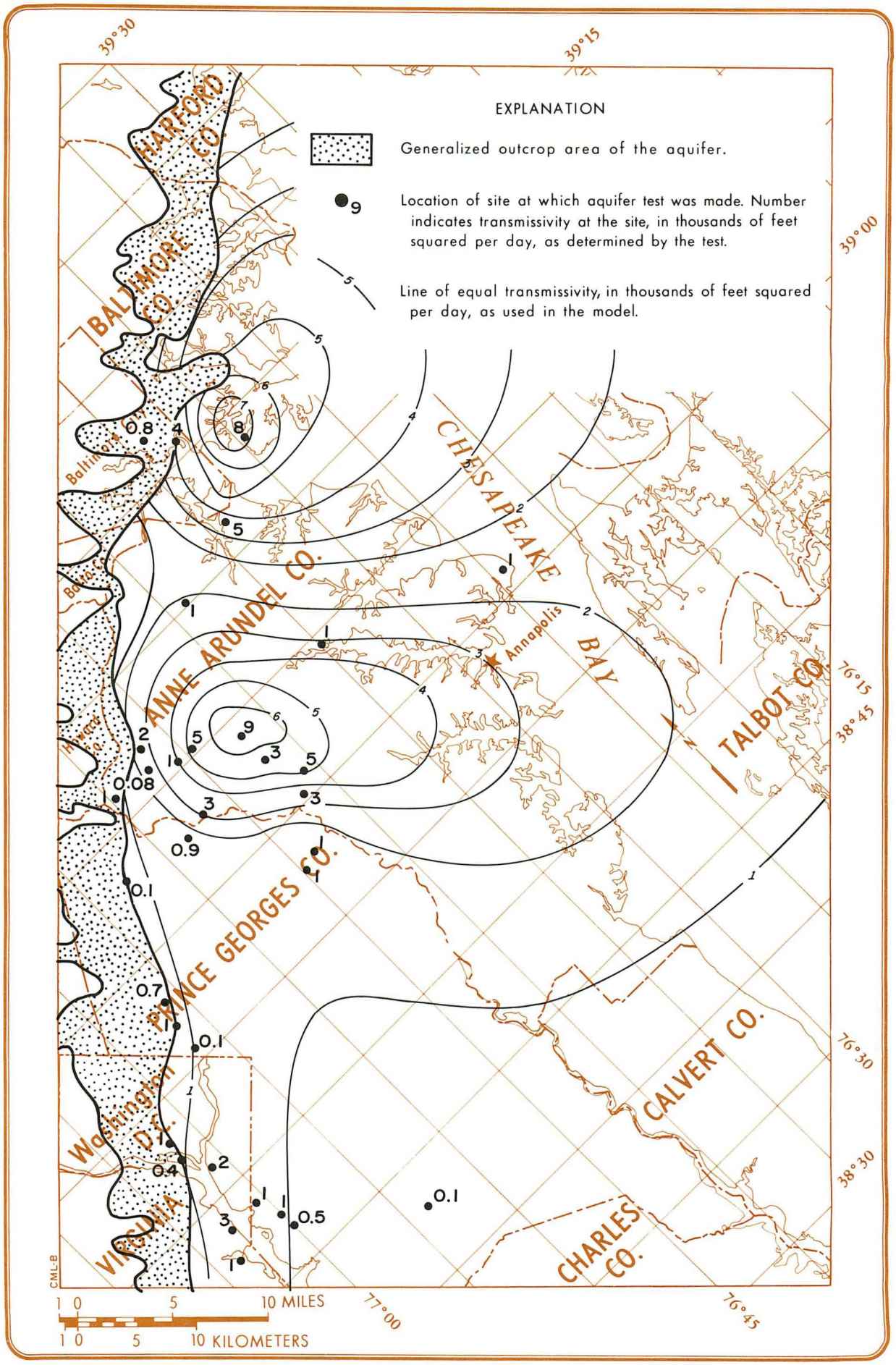


Figure 26. — Transmissivity values of the Patuxent aquifer used in the model compared with transmissivity values obtained from pumping tests.

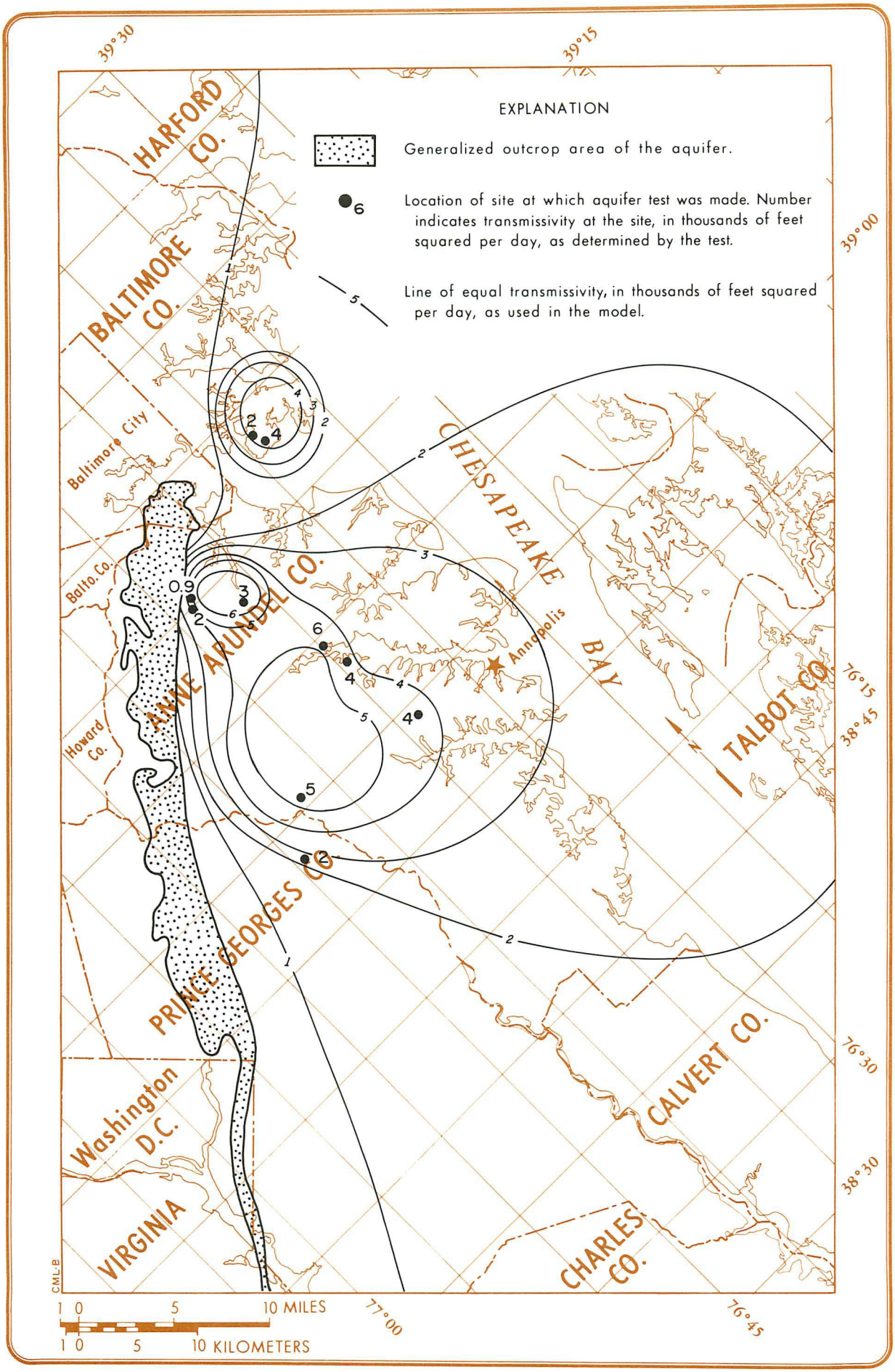


Figure 27. — Transmissivity values of the lower Patapsco aquifer used in the model compared with transmissivity values obtained from pumping tests.

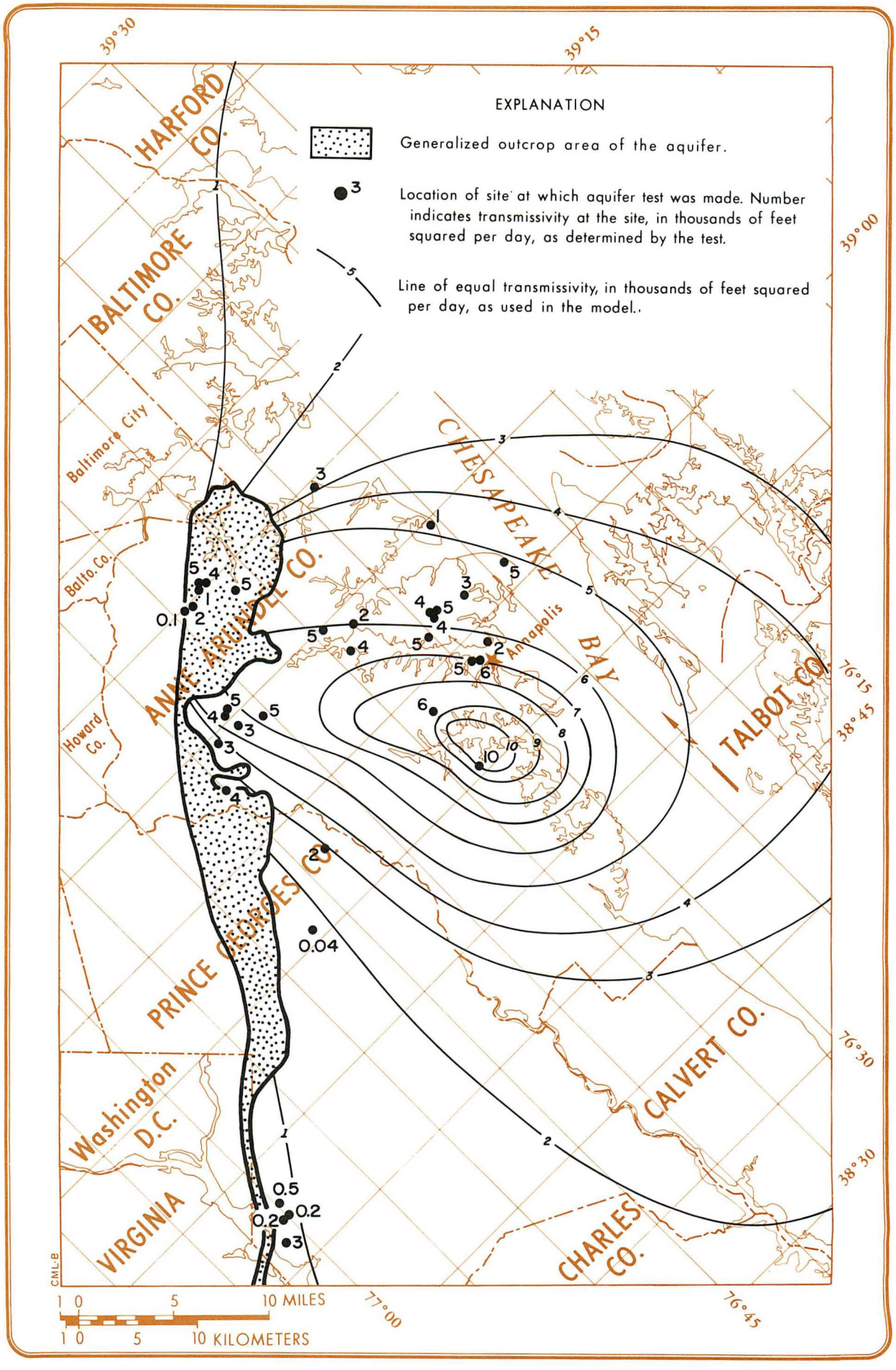


Figure 28. — Transmissivity values of the upper Patapsco aquifer used in the model compared with transmissivity values obtained from pumping tests.

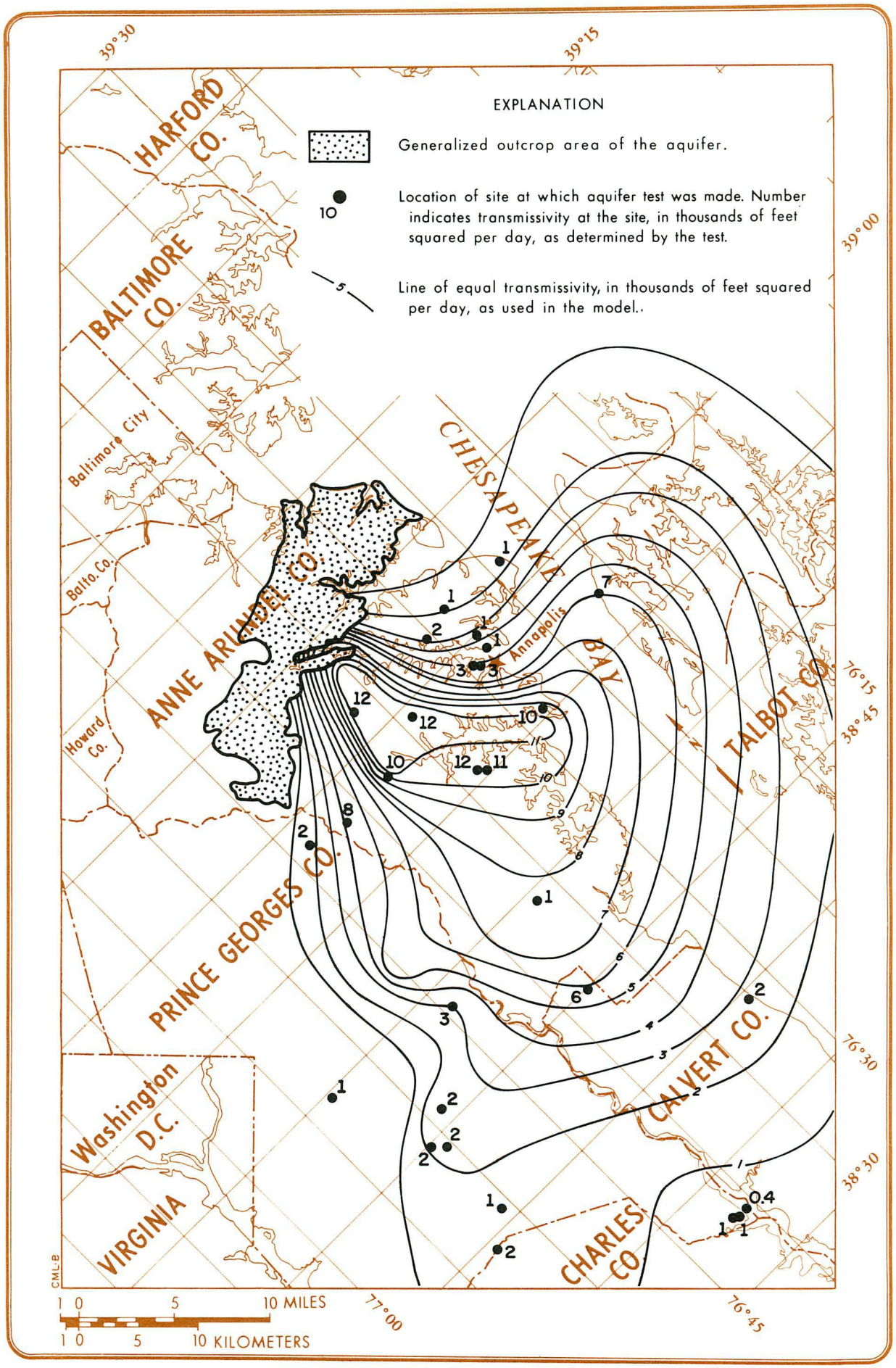


Figure 29. — Transmissivity values of the Magothy aquifer used in the model compared with transmissivity values obtained from pumping tests.

A specific yield of 0.15 was used for the unconfined parts of all the aquifers.

Confining-Bed Specific Storage

The significance of the specific storage of the confining beds was reflected in the leakage calculations. Values assigned to specific storage affect the early time drawdowns simulated by the model, but have less effect as equilibrium is approached. Transient calibration showed that a value of 5×10^{-5} for the specific storage for each of the confining beds gave good results, and a large change (one order of magnitude) in value of the specific storage caused only a small change (no more than 0.1 ft) in water levels of the aquifer simulated.

Potentiometric Surface Maps of 1965 and 1975

The water levels of December 1965 and 1975 computed by the calibrated model follow reasonably well water levels measured in the field. The average difference between the computed and measured water levels was between 5 to 10 ft. The contours of the computed water levels for the Patuxent, lower Patapsco, upper Patapsco, and Magothy aquifers are shown in figures 30 to 37, along with the water levels measured in the observation wells.

Comparison of Hydrographs of Computed and Observed Water Levels

The hydrographs of computed and observed water levels of 39 observation wells are presented in figures 38 to 51[1]. The locations of the pumping and observation wells used in the model are shown in figures 18 to 21. Data for hydrographs used to compare computed and observed water levels are summarized in tables 3 to 6.

Patuxent Aquifer.—There are four localities for which pumpage and water-level data are available: Glen Burnie-Dorsey Road; Fort Meade-Kings Heights; city of Bowie; and Baltimore industrial area. Hydrographs of water levels computed by the model compare favorably with hydrographs of observed water levels for the Patuxent aquifer (figs. 38 to 42). Further refinement was possible, but probably not justified given the range of uncertainties inherent in the data. Table 3 summarizes the results of calibration.

Lower Patapsco Aquifer.—The five major well fields withdrawing ground water from the lower Patapsco aquifer are: Odenton, Glen Burnie, Bowie-Crofton, city of Annapolis, and Sparrows Point. In the Glen Burnie area, the lower Patapsco aquifer is tapped by the following 22 pumping wells located in three specific well fields and several individual well sites. (Locations and more detailed information for these wells can be found in Lucas, 1976.) Table 4 summarizes the results of the lower Patapsco aquifer calibration by comparing the hydrographs of the computed and observed water levels (figs. 43 to 46).

Dorsey Road well field	*Sawmill Branch well field*	*Harundale well field*
AA-Ad 74	AA-Ad 23	AA-Bd 36
AA-Bd 55	AA-Ad 40	AA-Bd 37
AA-Bd 64	AA-Ad 41	AA-Bd 61
AA-Bd 92	AA-Ad 67	AA-Bd 67
AA-Bd 95	AA-Ad 68	

Individual well sites	
Quarterfield Road well	AA-Bd 109
Phillips Drive well	AA-Bd 101
Thelma Avenue well	AA-Bd 108
Glendale well	AA-Bd 103
Elvaton well	AA-Bd 107
Crain Highway well	AA-Bd 105
Two Guys Dept. Store wells	AA-Ad 69, AA-Ad 71

Upper Patapsco Aquifer.—Three of the four well fields tapping the upper Patapsco are located in Anne Arundel County. They are the Severndale-Herald Harbor area, the Annapolis area and the Odenton area. The fourth area, Fort Foote, is located in Prince Georges County. Table 5 summarizes the calibration of the upper Patapsco aquifer by comparing the hydrographs of the computed water levels with the hydrographs of the observed water levels (figs. 47 and 48).

Magothy Aquifer.—In general, the computed water levels of observation wells screened in the Magothy aquifer agree reasonably well with the observed levels. (See tab. 6.) The city of Annapolis wells are the largest tapping the Magothy aquifer in Anne Arundel County. The comparison of water-level hydrographs (figs. 49 to 51) is summarized in table 6.

(Text continued on p. 55.)

[1]Figures 38 through 51 are contained in the section "Data for selected wells and test sites" at the end of this report.

Table 3. — Summary of the calibration of the Patuxent aquifer by comparison of hydrographs of computed and observed water levels, 1965-77

Name of locality studied	Wells observed		Nearest pumping well		Evaluation of comparison		Remarks
	Well designation	See figure no.	Well designation	Pumping rate (Mgal/d)	Hydrograph trends	Approximate maximum difference in head (feet)	
Glen Burnie - Dorsey Road	AA-Ac 11 AA-Ad 90 AA-Ad 29	38 38 38	AA-Ad 76 AA-Bd 57 66 97 98	0.3 2.0	Very good Good Good	2 5	One mile from nearest pumping well.
Severndale	AA-Ce 117	39	Dorsey Rd Crofton Meadows Kings Heights Exxon Chemical	2.0 1.4 0.6 0.2	Good	7	Located at least 6 miles from nearest pumping well.
Fort Meade	AA-Cb 1	39	AA-Bb 68 AA-Bc 164 PG-Be 22 PG-Be 23	2.25 0.08	Good	5	Located 1.2 miles from nearest pumping well.
Kings Heights	AA-Cc 80	39	AA-Cc 88	0.6	Fair	10	Located <100 ft from nearest pumping well. Pumping values estimated from a report of total pumpage.
Waugh Chapel Road	AA-Cc 113	40	AA-Cc 87 Cc 88	0.5	Very good	10	Observed data available for only 1977.
City of Bowie	PG-Cf 64	40	PG-Cf 64 66 AA-Cc 86 103 105 107	1.5 to 2.0 1.4	Fair	6	Only two observed values.
Baltimore Industrial Area - Fairfield	5S3E-50	41	AA-Ad 20 94 96 5S2E 20 21 5S3E 10	0.01 0.05 2.0 to 0.2	Very good	20	Reduction in pumpage from 2 to 0.2 Mgal/d caused the water level recovery.
Hawkins Point	7S4E-1	41	AA-Ae 36 Sparrows Pt.	0.8 5 to 6	Good	20	Sparrows Point pumpage caused the water level to remain at 45 ft below sea level.
Ft. Holabird	2S5E-1	42	1S3E-4 5 46 1N3E-7 8 10 BA-Fe 41 59 61 3S5E-35 39 41 42 43	0.5 0.08 1.0 2.5	Good	25	The 4-Mgal/d pumpage caused the water level to remain at 10 ft below sea level.
Back River School	BA-Ff 34	40	-	-	Very good	2	Located 4½ miles east of Sparrows Point.
Joppatown	HA-Ec 11	42	-	-	Very good	2	Located in outcrop area.
Beltsville	PG-Bd 17	42	-	-	Very good	2	Located very close to outcrop area.
Laurel	PG-Ad 8	42	-	-	Very good	2	Located in outcrop area.

Table 4. — Summary of the calibration of the lower Patapsco aquifer by comparison of hydrographs of computed and observed water levels, 1965-77

Name of locality studied	Wells observed		Nearest pumping well		Evaluation of comparison		Remarks
	Well designation	See figure no.	Well designation	Pumping rate (Mgal/d)	Hydrograph trends	Approximate maximum difference in head (feet)	
Odenton area	AA-Cc 40 AA-Cc 82	44 44	AA-Cc 79 Bc 171	0.7	Very good Fair	2 15	Located 2½ mi from pumping center. Within 100 ft of pumpwell.
Glen Burnie							
Dorsey Road	AA-Bd 91	43	Listed on page 20	4.5 (in 1965)	Good	30	Observed only from 1965 to 1971.
Sawmill Branch	AA-Ad 88	43		7 (1971-77)	Fair	1	Only one calibration point.
Harundale							
Others							Each pumping node represents two or more pumping wells.
Curtis Bay area	AA-Ad 10	43	AA-Ad 93	0.01	Very good	2	Nearest well pumped 0.01 Mgal/d.
Bowie-Crofton area	PG-Cf 44	44	PG-Cf 32 35 AA-Cc 89	1.5 0.5	Good	20	Located 1.8 mi from pumping center at Bowie. Located 1.5 mi from pumping center at Crofton.
City of Annapolis well field	AA-De 94	45	AA-De 94	1.2	Fair	8	Water level measured in the pumped well.
Sparrows Point	BA-Gf 168 BA-Gf 178	46 46	Coke Oven Wells Town Water Wells	10 (in 1965) 0.8 to 1	Good	15	Water levels recovered.
Piscataway observation well	PG-Fc 17	45	-	-	Very good	2	Located close to boundary.
Edgewood observation well	HA-Ed 24	45	-	-	Fair	25	Located close to boundary.

Table 5. — Summary of the calibration of the upper Patapsco aquifer by comparison of hydrographs of computed and observed water levels, 1965-77

Name of locality studied	Wells observed		Nearest pumping well		Evaluation of comparison		Remarks
	Well designation	See figure no.	Well designation	Pumping rate (Mgal/d)	Hydrograph trends	Approximate maximum difference in head (feet)	
Odenton area	AA-Cc 83	47	AA-Bc 1 20 40 47 157 165 AA-Cc 43	2.5 0.1			No data available.
Annapolis area	AA-De 95	48	AA-Ce 70 Cf 118 119 120 De 93 96 97	2.6 to 1.6	Good	5	
	AA-Df 79	48	Df 12 13 16 65 80 83 89		Fair	10	Hydrographs measured in pumping well.
Severndale - Herald Harbor	AA-Ce 120	47	AA-Ce 65 66 67 94 95 96	1.35	Fair	4	Observed data available for 1976-77.
Fort Foote	PG-Fb 36	47	PG-Eb 26	0.25	Good	8	Correct trend, computed hydrograph 8 ft too high.

Table 6. — Summary of the calibration of the Magothy aquifer by comparison of hydrographs of computed and observed water levels, 1965-77

Name of locality studied	Wells observed		Nearest pumping well		Evaluation of comparison		Remarks
	Well designation	See figure no.	Well designation	Pumping rate (Mgal/d)	Hydrograph trends	Approximate maximum difference in head (feet)	
Annapolis area	AA-De 1	49	AA-De 2 45 88	2.5 to 4	Very good	4	
	AA-Df 20	49			Very good	2	
	AA-Df 79	49			Very good	2	
	AA-Cg 8	50	AA-Df 64	0.1	Very good	2	
	AA-Dd 24	50	AA-Cg 6 7 8	0.1	Good	4	
	AA Dd 42	50			Good	4	
Upper Marlboro	PG-De 21	51	-	-	Very good	2	
Brandywine Estates	PG-Fd 40, 41	51	-	-	Poor	20	Hydrograph showed pumpage nearby, which is not simulated.

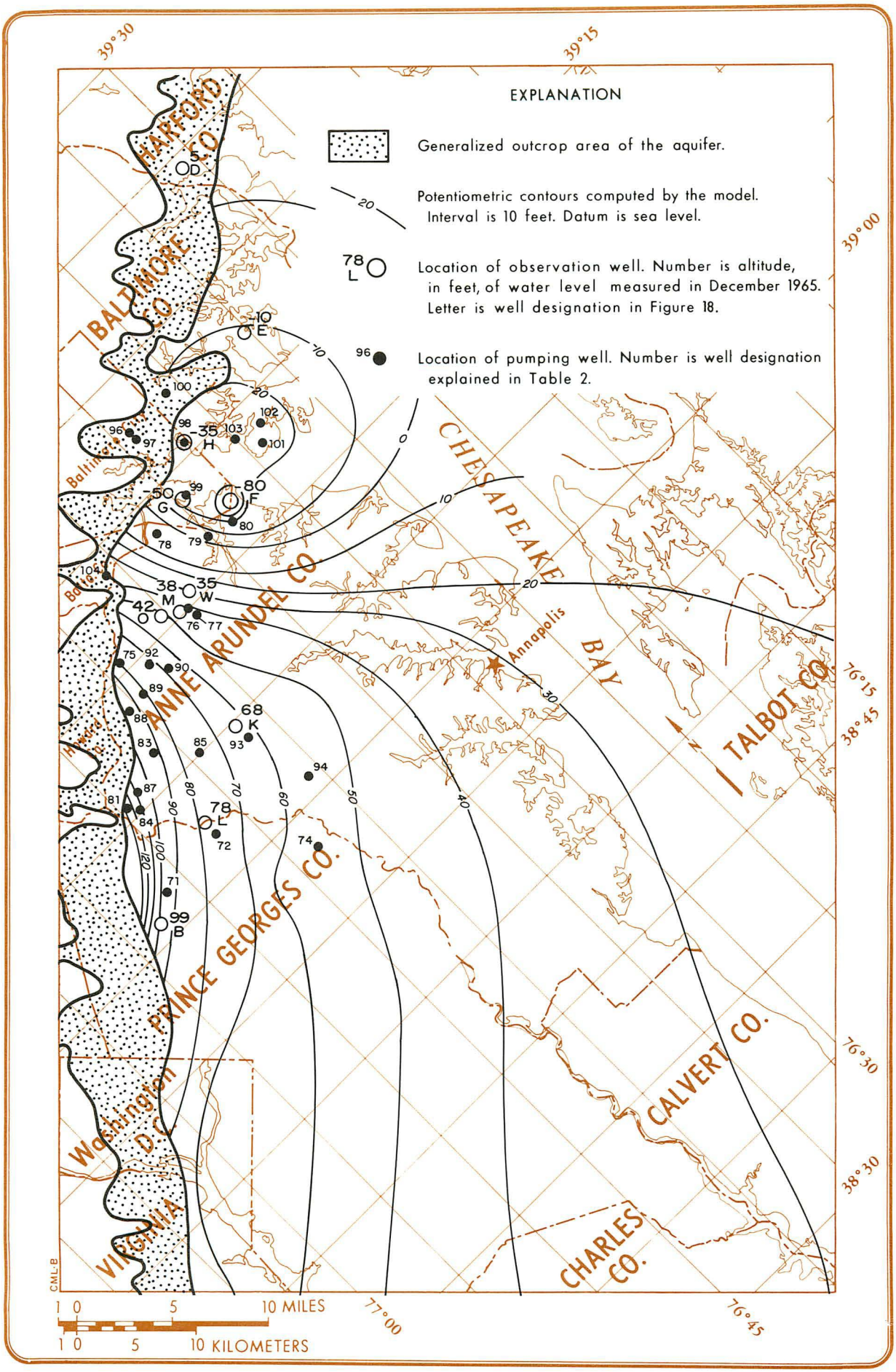


Figure 30. — Computed potentiometric surface of the Patuxent aquifer in December 1965 compared with measured water levels from observation wells.

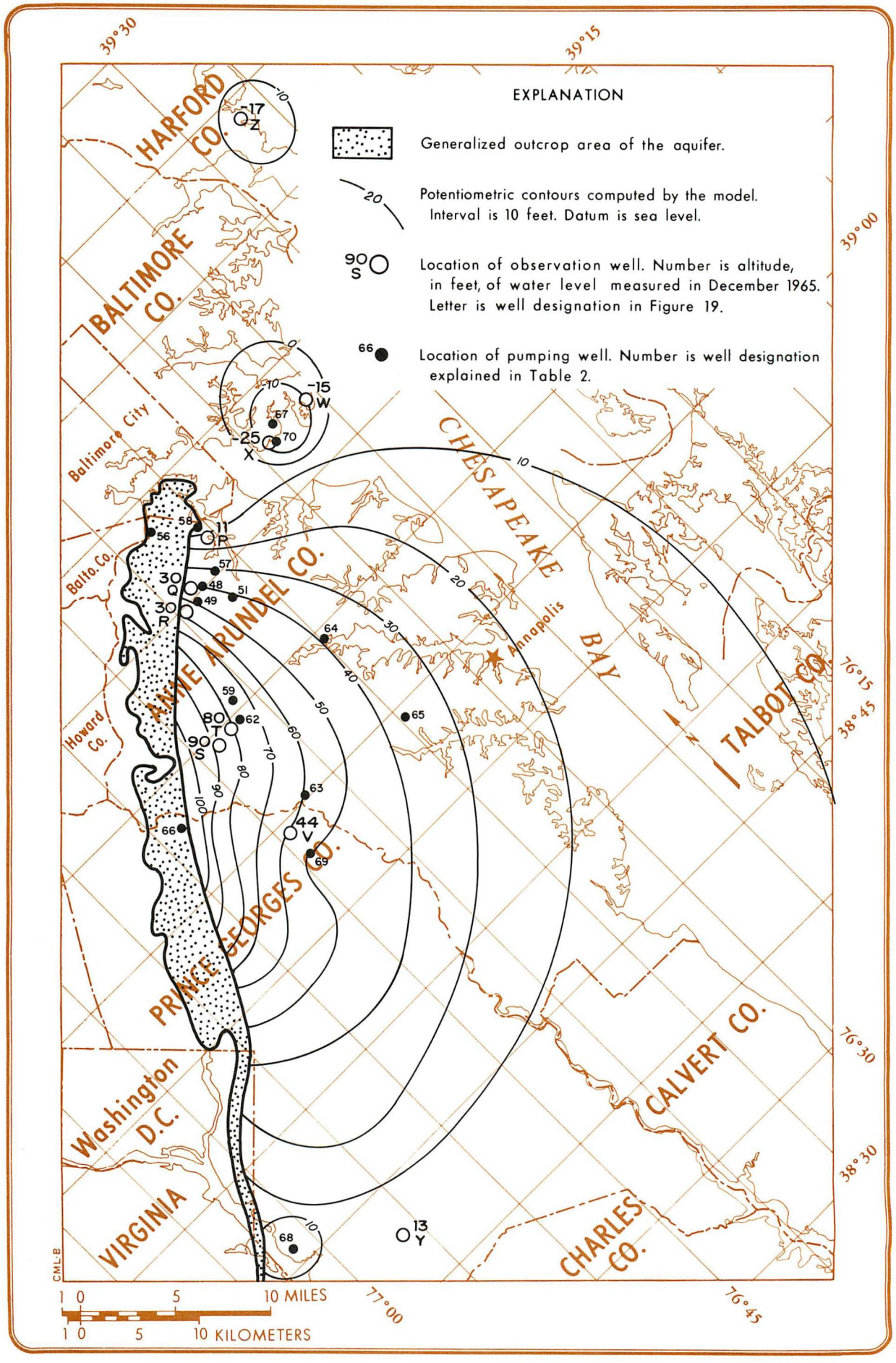


Figure 31. — Computed potentiometric surface of the lower Patapsco aquifer in December 1965 compared with measured water levels from observation wells.

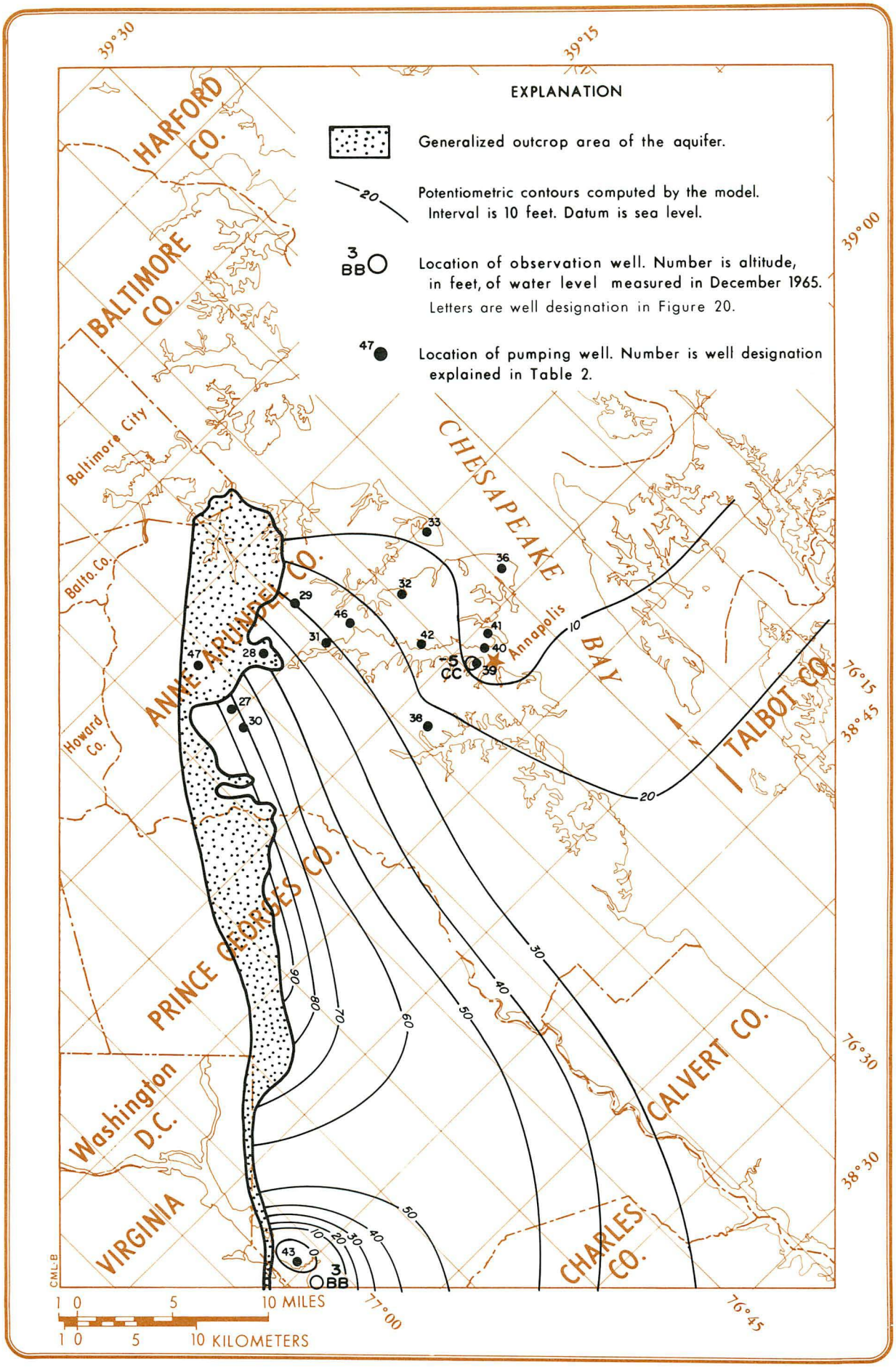


Figure 32. — Computed potentiometric surface of the upper Patapsco aquifer in December 1965 compared with measured water levels from observation wells.

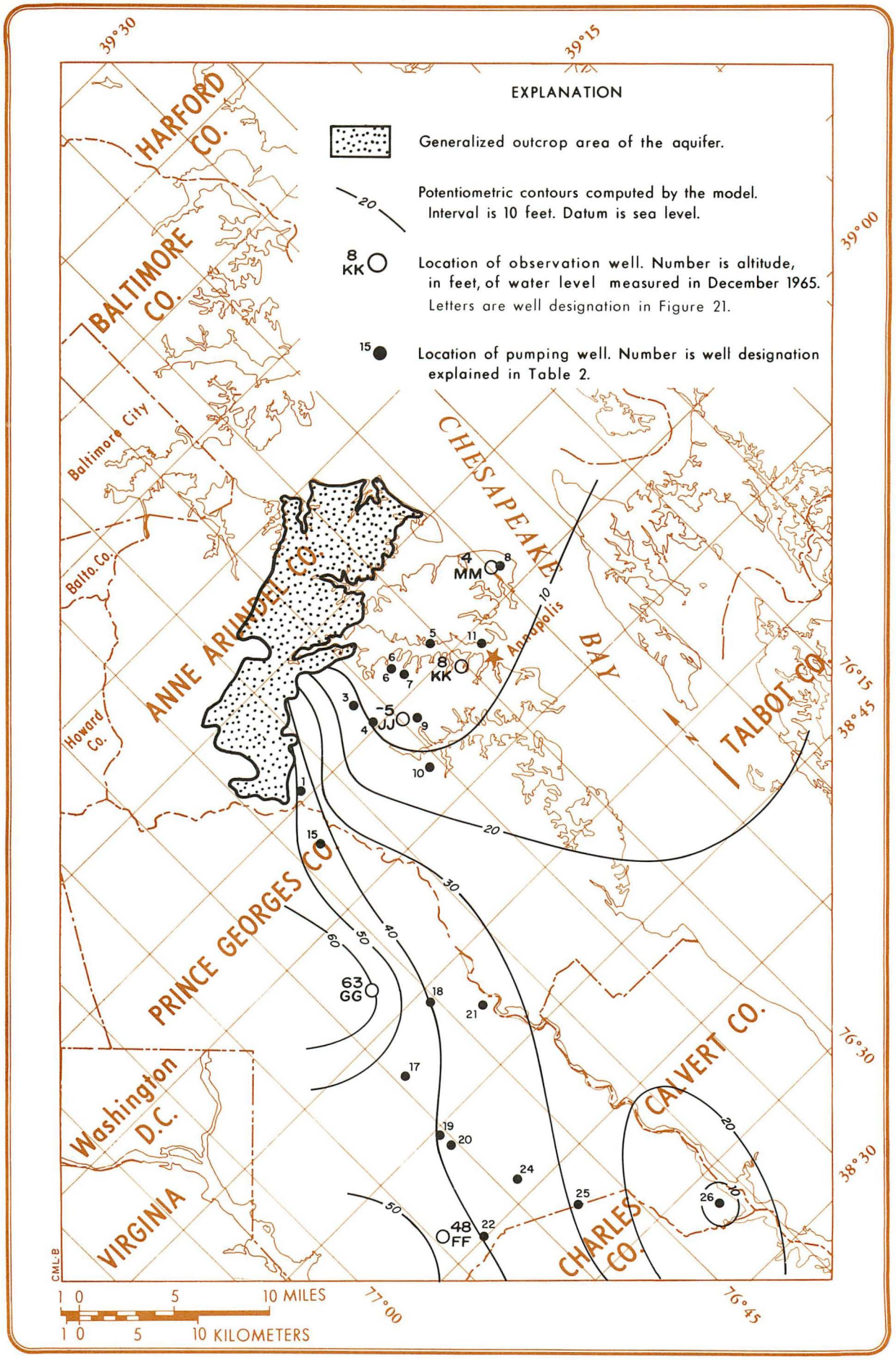


Figure 33. — Computed potentiometric surface of the Magothy aquifer in December 1965 compared with measured water levels from observation wells.

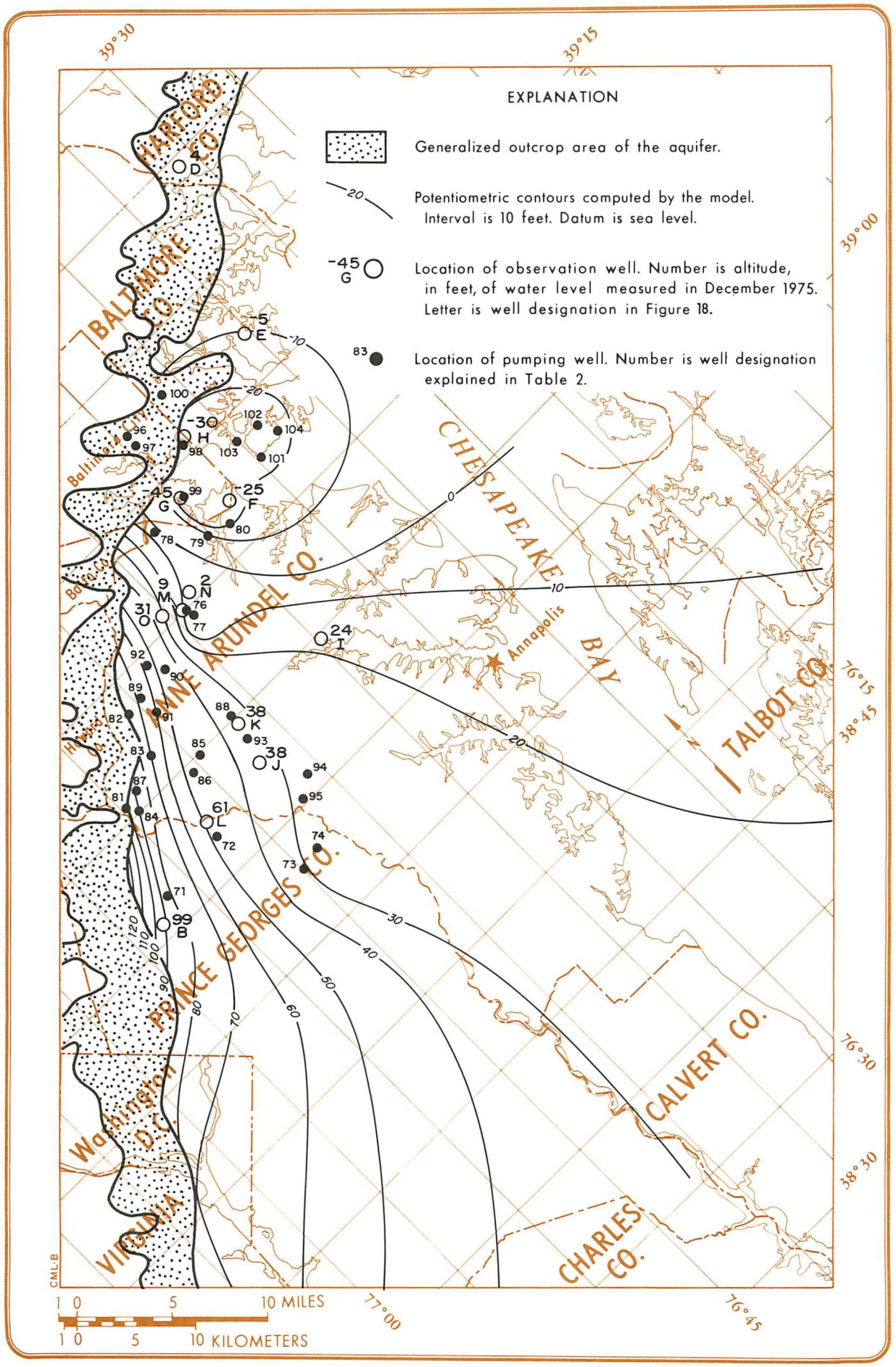


Figure 34. — Computed potentiometric surface of the Patuxent aquifer in December 1975 compared with measured water levels from observation wells.

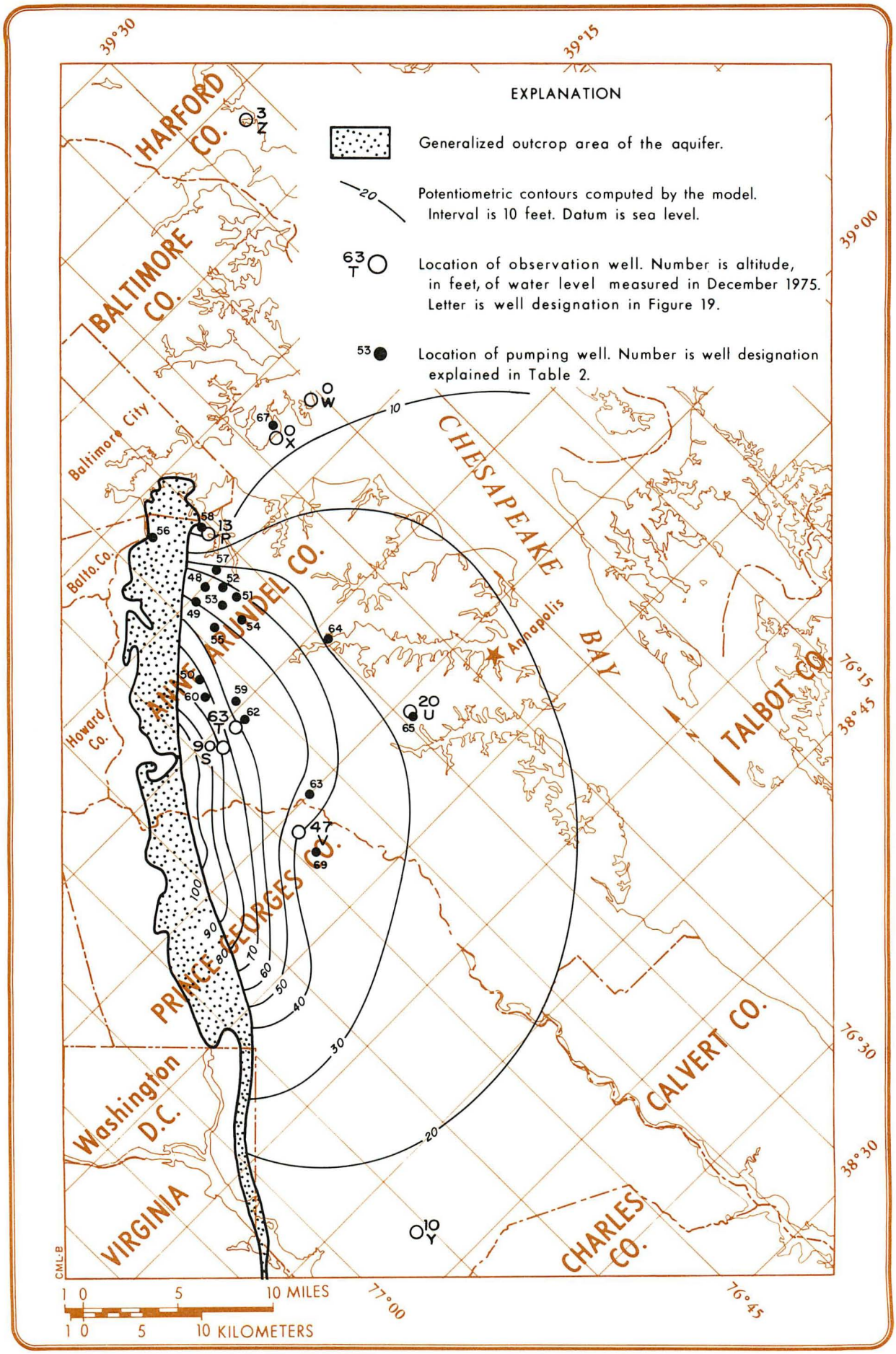


Figure 35. — Computed potentiometric surface of the lower Patapsco aquifer in December 1975 compared with measured water levels from observation wells.

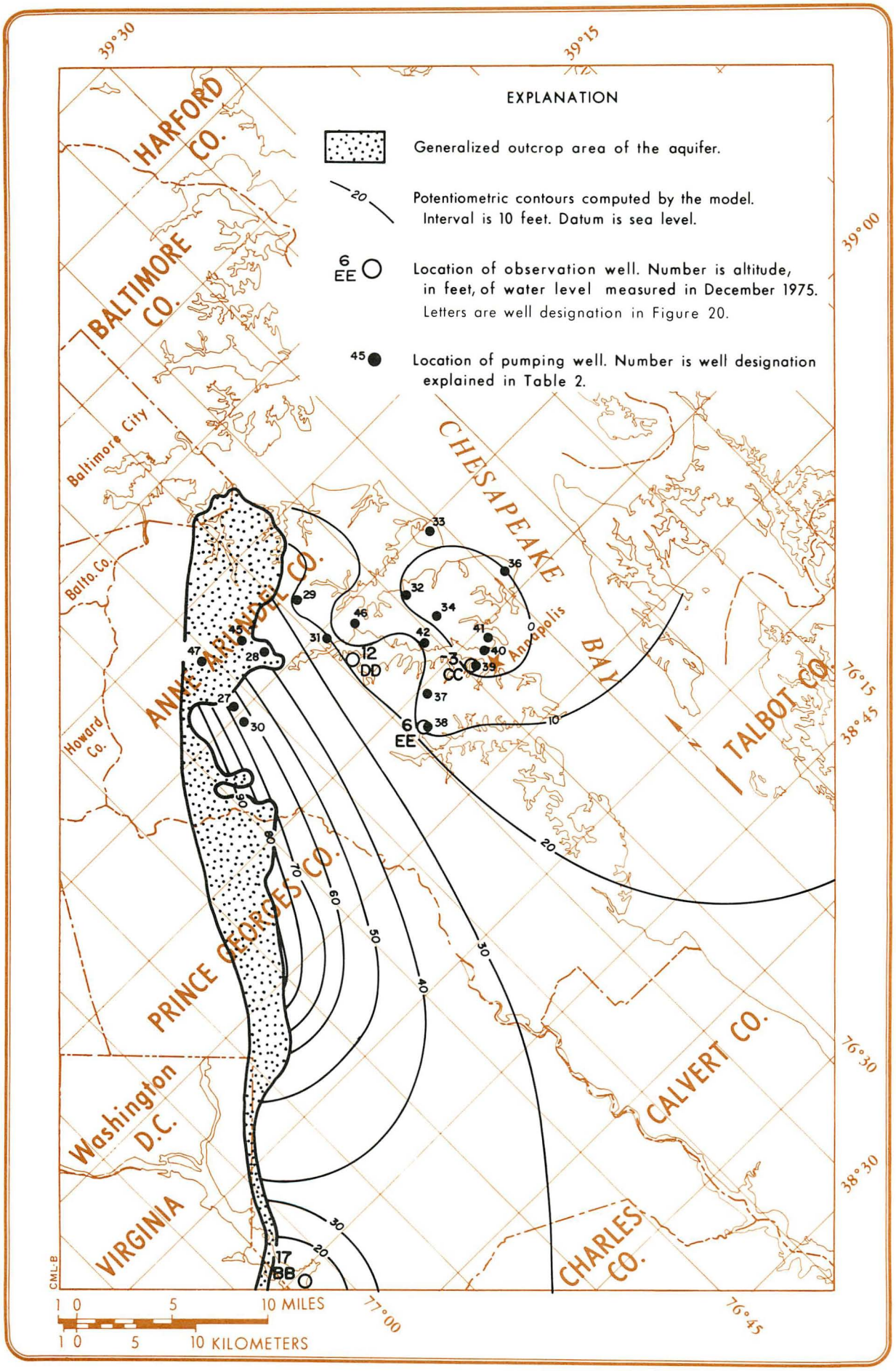


Figure 36. — Computed potentiometric surface of the upper Patapsco aquifer in December 1975 compared with measured water levels from observation wells.

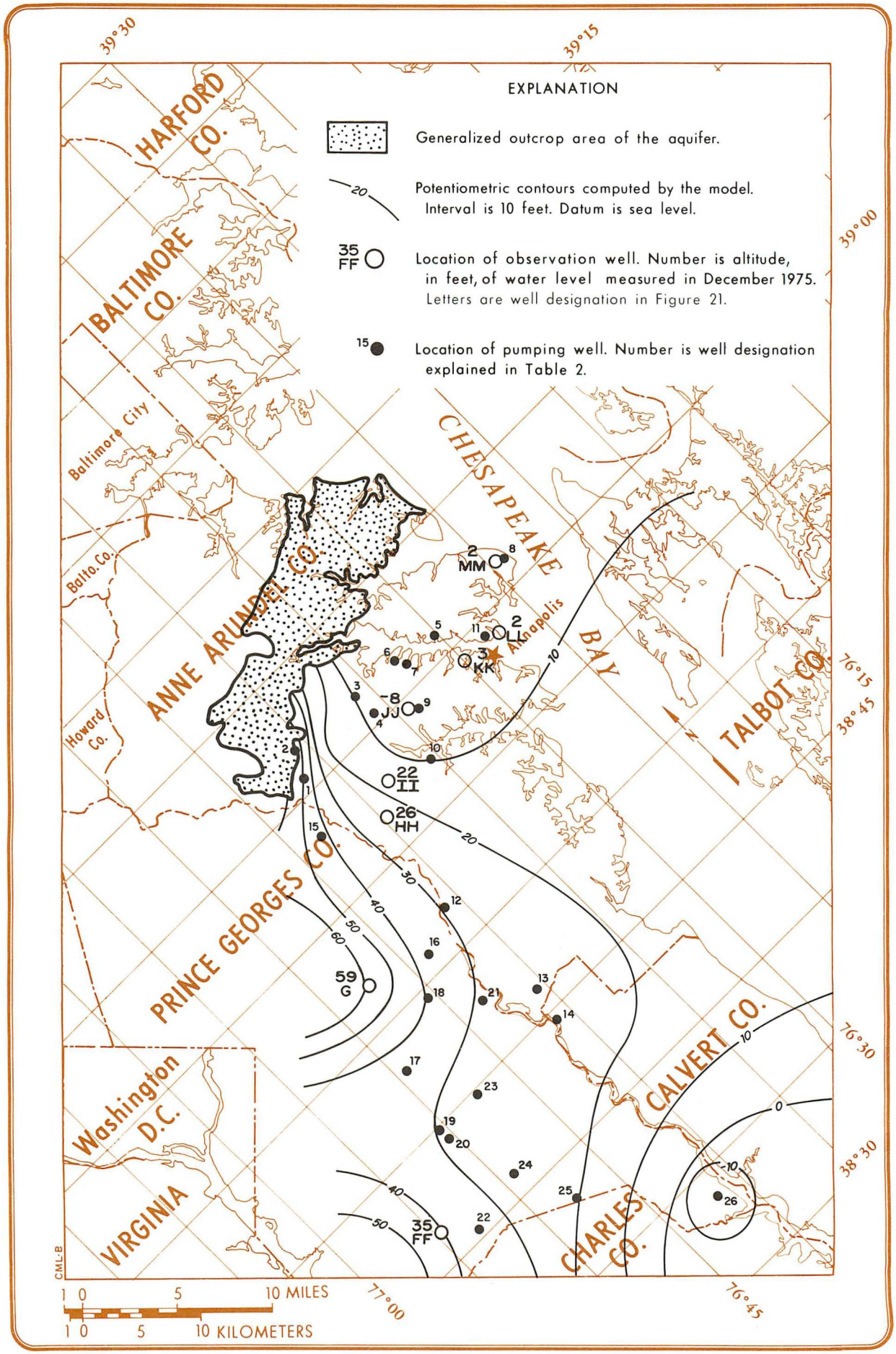


Figure 37. — Computed potentiometric surface of the Magothy aquifer in December 1975 compared with measured water levels from observation wells.

MODEL PREDICTIONS

One of several benefits resulting from the development of models of ground-water flow is their value as tools for estimating the availability of ground water. A calibrated model simulates aquifer responses to applied stresses. It can be stressed at any location in the project area, at any desired pumping rate. Planners can use the model to estimate the effects that hypothetical new wells or increased production from existing wells will have on water levels. Using a variety of well-field configurations and pumping rates, it is possible to estimate the availability of water over a long period of time.

FACTORS IN THE SELECTION OF LOCATIONS OF FUTURE WELL FIELDS

Experience has shown that large quantities of fresh water can be obtained from relatively few wells tapping aquifers that (1) contain water under enough hydrostatic pressure to provide a large amount of available drawdown, (2) have high transmissivity values, and (3) are protected by distance or an overlying clay layer from salt-water sources of contamination.

All four aquifers have water under high hydrostatic pressure in their downdip areas, as may be seen by comparing their potentiometric surfaces (figs. 34 to 37) with the altitudes of their tops (figs. 9 to 12). Transmissivity values of each of the aquifers are variable, but generally high throughout the project area, as may be seen in figures 26 to 29. Therefore, all the aquifers have the potential for development of large quantities of water based on the first two factors.

The presence of salt-water bodies along the eastern margins of Anne Arundel County, in some cases overlying the outcrop areas of the aquifers, must be recognized as a limiting factor in locating sites for future well fields. Salt-water intrusion has severely deterred the development of the ground-water resources of the Baltimore industrial area (Bennett and Meyer, 1952). The potential for salt water intrusion in the Magothy aquifer was described in some detail in an earlier report (Mack, 1974). The reader is referred to those reports for discussions of the mechanism by which the direction of water movement from land areas to salt-water bodies under nonpumping conditions can be reversed as a result of heavy pumping to cause salt water to move into the fresh-water aquifers.

The potential for salt-water intrusion was considered in two ways in the selection of sites of hypothetical well fields for predictive runs:

1. Near-shore areas were avoided as locations for shallow wells. Figures 52 to 55 show the guideline drawn on the map for each aquifer to separate areas most sensitive to salt-water intrusion from those that are less sensitive.
2. Care was taken to be sure the hypothetical wells did not lower the water level below sea level on the landward side of the shorelines of salt-water bodies in their outcrop areas. The assumption was made that deeper aquifers are relatively well protected from salt-water contamination where they are overlain by substantially thick, younger aquifers and confining beds, particularly where the pressure head on the shallower aquifers is above sea level.

PREDICTION OF CAPACITY OF AQUIFERS IN THE POTOMAC GROUP FOR WATER SUPPLY

By using the information on the amount of drawdown available, the areas of highest transmissivity, the areas of greatest demand, and the areas most susceptible to salt-water intrusion, it is possible to simulate pumpage from hypothetical well fields and, thereby, estimate the ability of the aquifers to supply future needs. The ground-water development scheme simulated by the model was designed to estimate the ability of aquifers in the Potomac Group and the Magothy aquifer to meet the water needs of the county. Projected water use for the year 2000 was estimated by combining projected requirements of other users with that of the Anne Arundel County Department of Utilities. Table 7 shows the pumping rates used to stress each aquifer in the model for the year 2000.

The predictive runs were made by simulating pumpage from both (1) wells existing in 1977, and (2) hypothetical wells to increase the supply to meet the demands of the year 2000. The hypothetical wells were located in areas believed to have the most favorable hydrologic conditions and to have the least potential for salt-water contamination. Combined pumping from these wells totaled 118 Mgal/d, more than enough to supply predicted demands of the year 2000.

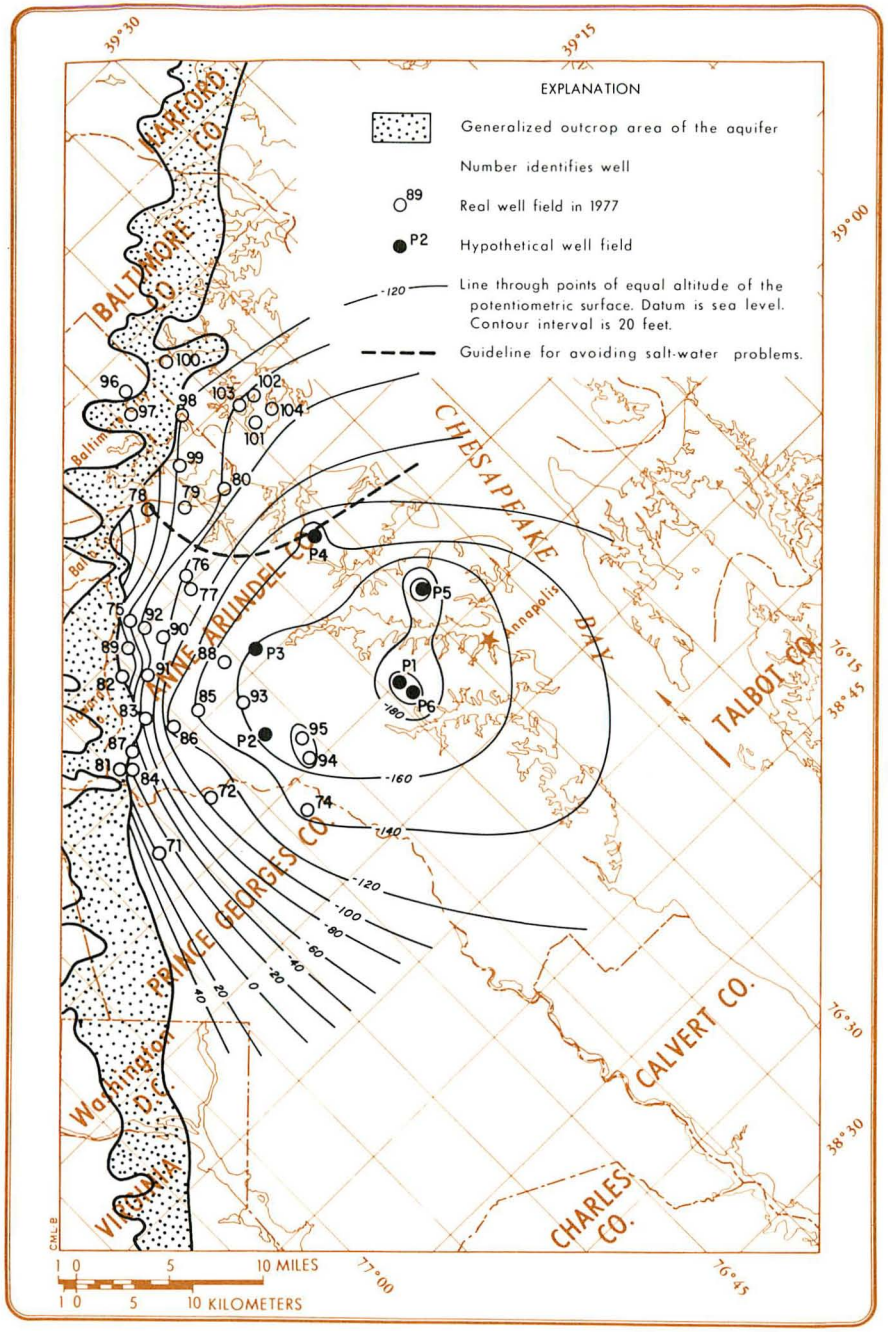
Results of the runs shown in figures 52 to 55 indicate that as much as 200 ft of drawdown should be expected in parts of the lower Patapsco aquifer, 240 ft of drawdown should be expected in parts of the Patuxent aquifer and drawdowns in downdip areas of these aquifers will not lower the water levels below the tops of the aquifers.

(Text continued on p. 61.)

Table 7. — Pumping rates used to simulate the stressing of the aquifers in the year 2000, in million gallons per day

User or supplier	Aquifer				
	Patuxent	Lower Patapsco	Upper Patapsco	Magothy	Total
I. Anne Arundel County					
A. Department of Utilities[1/]	26.3	35	12.8	9.0	83.1
B. Other users in Anne Arundel County	7.5	3.4	4.8	4.0	19.7
II. Counties other than Anne Arundel County	12.1	1.3	.8	1.4	15.6
Total	45.9	39.7	18.4	14.4	118.4

[1/] Includes the hypothetical wells shown in figures 52 through 55.

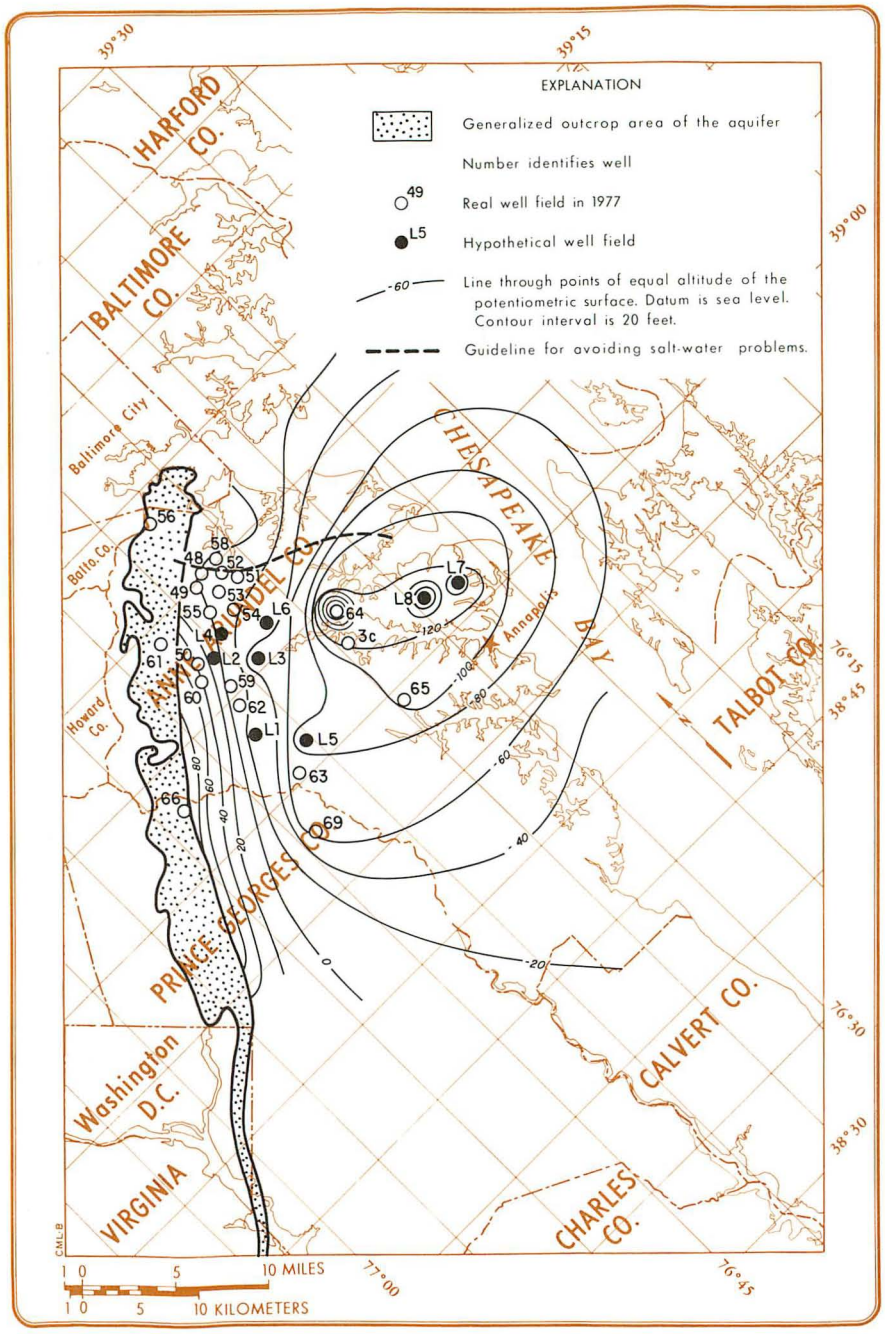


Patuxent Well Fields

Number/Location (See table 2)		Average pumpage (Mgal/d) 1982-2000	Average altitude of water level at node (ft) year 2000	Altitude of top of aquifer (ft)
71	Beltsville	0.70	-2	1/
72	Patuxent Wildlife	0.08	-106	-240
74	City of Bowie	1.00	-145	-780
76	Dorsey Road	1.50	-98	-280
77	Dorsey Road	1.00	-82	-240
78	Matlack	0.01	-10	-200
79	USS Agri. Chem.	0.01	-53	-300
80	Diamond Shamrock	0.80	-83	-420
81	Laurel Race Course	0.10	27	1/
82	Parkway Manor	0.01	-9	30
83	Colony 7 Motor Inn	0.03	-61	-20
84	Maryland City	1.00	-51	1/
85	Ft. Meade	3.00	-136	-340
86	Ft. Meade	3.00	-151	-200
87	Holiday Inn	0.01	21	45
88	Nevamar Corp.	0.20	-146	-420
89	Holiday Mobile Est.	0.05	-10	0
90	Koppers Co.	0.01	-78	-160
91	Provinces Water Co.	0.20	-63	-110
92	Robinhood Trailer Pk.	0.02	-49	-37
93	Kings Heights	3.00	-167	-500
94	Crofton	2.00	-186	-790
95	Crofton Meadows	2.00	-187	-900
96	Hood Vinegar	0.05	1	-5
97	Schluderberg Kurdle	0.20	-3	-100
98	Federal Yeast	2.00	-47	-180
99	F.M.C.	0.80	-48	-460
100	Eastern Stainless	1.00	-12	-100
101	Beth. Steel Blast F.	1.50	-79	-430
102	Beth. Steel Hot Strip	1.80	-74	-500
103	Beth. Steel Wire Mill	2.00	-68	-460
104	Beth. Steel Twn. Wtr.	1.00	-81	-675
P1	Hypothetical Well	2.30	-201	-950
P2	Hypothetical Well	2.00	-164	-570
P3	Hypothetical Well	2.00	-168	-500
P4	Hypothetical Well	3.00	-152	-620
P5	Hypothetical Well	3.50	-212	-950
P6	Hypothetical Well	3.00	-204	-970

1/ Patuxent Formation is the outcropping geologic unit.

Figure 52. — Simulated potentiometric surface of the Patuxent aquifer showing the effects of pumpage required to supply the water demands of year 2000.

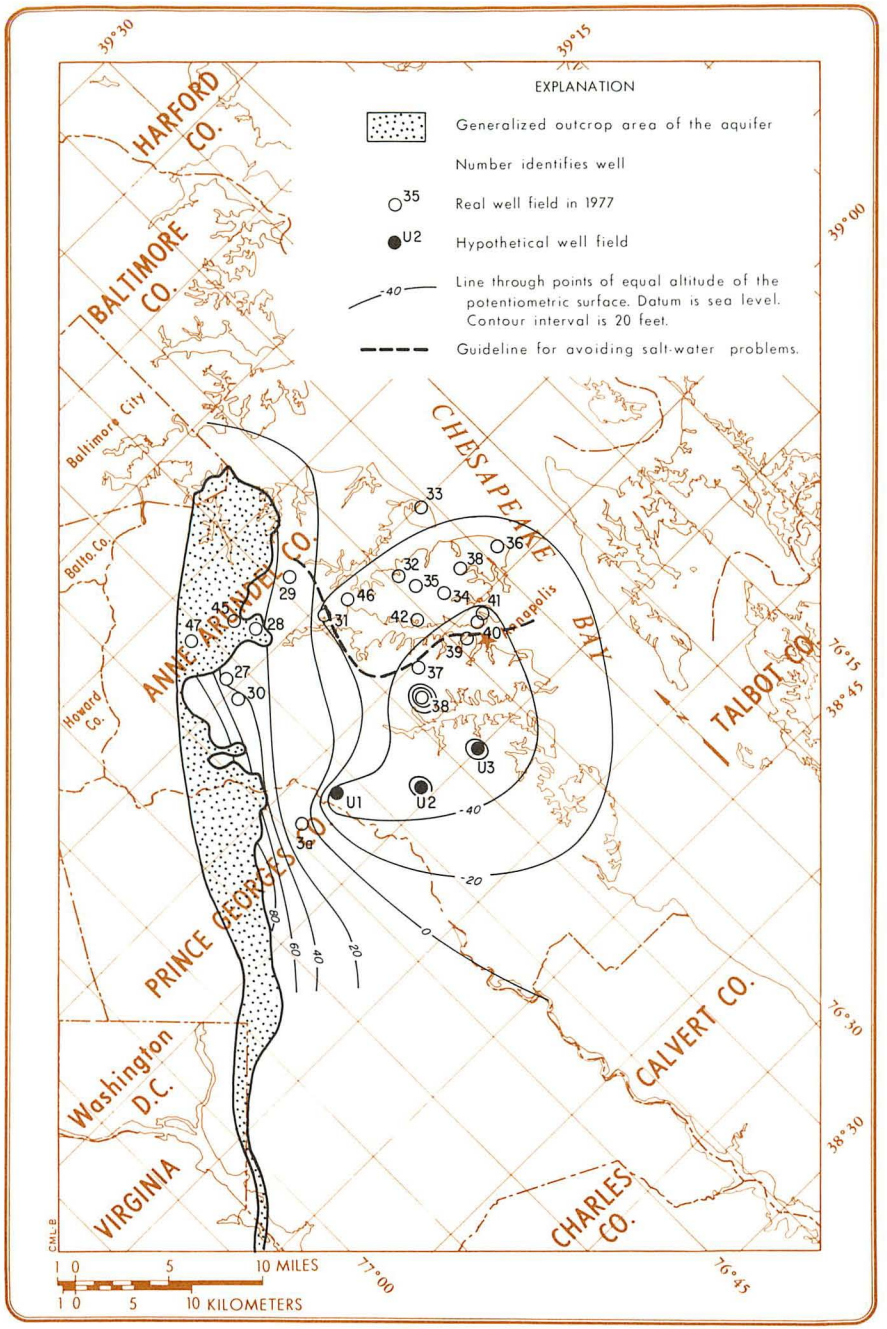


Lower Patapsco Well Fields

Number/Location (See table 2)		Average pumpage (Mgal/d) 1982-2000	Average altitude of water level at node (ft) year 2000	Altitude of top of aquifer (ft)
48	Sawmill Branch	2.30	-7	1/
49	Dorsey Rd. (Non-Iron)	2.30	-3	1/
50	Meade Village	0.10	40	-30
51	Harundale	2.10	-17	-130
52	Glendale	0.80	-10	-90
53	Phillip Dr. & Thelma	1.30	-12	-115
54	Crain & Elvaton	1.55	-25	-160
55	Quarterfield Rd.	0.70	-5	-70
56	Joseph Hock Co.	0.01	23	33
57	Two Guys Dept. Store	0.20	-2	-40
58	Southern States Coop.	0.01	8	30
59	Nevamar Corp.	0.50	-21	0
60	Pioneer City Water	0.20	42	-90
61	Koppers Co.	0.01	98	20
62	Kings Heights	1.00	-16	-60
63	Crofton	1.50	-71	-280
64	Severndale	8.00	-194	-330
65	City of Annapolis	2.40	-118	-750
66	Patuxent Wildlife	0.70	119	1/
69	City of Bowie	1.20	-78	-310
3c	Herald Harbor	0.10	-129	-410
L1	Hypothetical Well	1.50	-34	-200
L2	Hypothetical Well	1.00	2	-150
L3	Hypothetical Well	2.00	-52	-220
L4	Hypothetical Well	1.00	-3	-250
L5	Hypothetical Well	2.00	-87	-300
L6	Hypothetical Well	1.00	-38	-540
L7	Hypothetical Well	1.60	-140	-800
L8	Hypothetical Well	3.00	-166	-600

1/ Lower Patapsco aquifer is the outcropping unit.

Figure 53. — Simulated potentiometric surface of the lower Patapsco aquifer showing the effects of pumpage required to supply the water demands of year 2000.

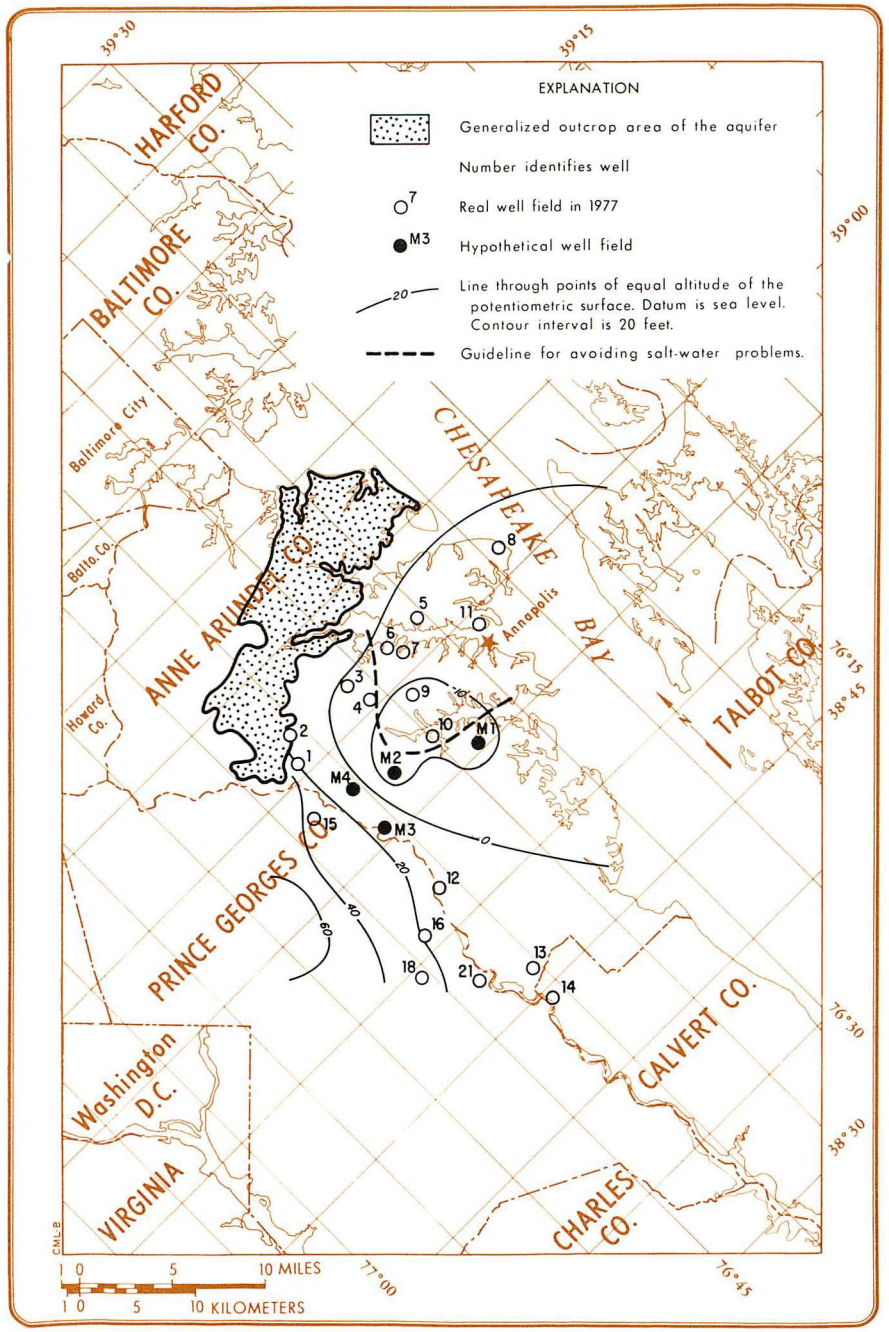


Upper Patapsco Well Fields

Number/Location (See table 2)		Average pumpage (Mgal/d) 1982-2000	Average altitude of water level at node (ft) year 2000	Altitude of top of aquifer (ft)
27	Nevamar Corp.	2.3	30	1/
28	Transit Truck Stop	0.02	21	1/
29	Pasadena Water Co.	0.04	1	40
30	Kings Heights	0.06	55	100
31	Severndale	0.70	-22	-5
36	Westinghouse Elec.	0.02	-28	-360
37	Annapolis Concrete	0.01	-59	-410
38	Broad Creek	4.00	-90	-300
39	Naval Academy	1.80	-62	-440
40	U.S. Navy R & D	0.40	-49	-430
41	U.S. Navy Golf Course	0.20	-42	-430
44	Chalk Point	0.20	-10	-800
45	Rol-Park Trailer Park	0.01	49	100
46	Severna Park	1.00	-30	-100
47	Brodsky's Trailer Park	0.02	75	100
3a	Bowie	0.60	-4	-300
3b	Amberly	0.04	-29	-300
U1	Hypothetical Well	2.00	-55	-450
U2	Hypothetical Well	2.00	-66	-400
U3	Hypothetical Well	3.00	-71	-400

1/ Upper Patapsco aquifer is the outcropping unit.

Figure 54. — Simulated potentiometric surface of the upper Patapsco aquifer showing the effects of pumpage required to supply the water demands of year 2000.



Magothy Well Fields

Number/Location (See table 2)		Average pumpage (Mgal/d) 1982-2000	Average altitude of water level at node (ft) year 2000	Altitude of top of aquifer (ft)
1	Crofton Center	0.08	28	60
2	Golden Triangle	0.05	30	60
3	Crownsville Hospital	0.20	-6	-32
4	Summerhill Trailer Pk.	0.01	-14	-50
6	Sherwood Forest	0.06	-8	-80
7	Epping Forest	0.04	-12	-100
8	Sandy Point State Pk.	0.01	-4	-220
9	City of Annapolis	3.20	-28	-105
10	Sylvan Shores	0.04	-25	-160
11	U.S. Navy R & D	0.20	-14	-210
12	Maryland Manor	0.05	12	-200
13	Lyons Creek & Crosby	0.01	9	-350
14	Shores of Calvert	0.03	6	-400
15	City of Bowie	0.30	36	70
16	Marlboro Meadows	0.20	16	-180
17	Lonestar & Saurwein	0.01	29	0
18	Safeway Store	0.01	29	-200
19	Boys Village	0.08	20	-200
20	U.S. Navy Cheltenham	0.06	21	-170
21	WSSC	0.04	14	-260
22	Cadillac Motel	0.01	26	-220
23	Brandywine Club	0.03	16	-250
24	BFW Fabrication	0.01	18	-300
25	Baden Elementary School	0.01	16	-400
26	Chalk Point	0.60	3	-550
M1	Hypothetical Well	3.00	-33	-200
M2	Hypothetical Well	2.00	-25	-160
M3	Hypothetical Well	2.00	-7	-100
M4	Hypothetical Well	2.00	-1	-40

Figure 55. — Simulated potentiometric surface of the Magothy aquifer showing the effects of pumpage required to supply the water demands of year 2000.

SUMMARY AND CONCLUSIONS

The model of the aquifers of the Potomac Group and the Magothy aquifer in northern Anne Arundel County was developed to (1) study ground-water flow within the project area, and (2) estimate the ability of the aquifers to supply the county's water demands of the future.

Geologic sections based on drillers' logs, cores, and geophysical logs show three major aquifers in the Potomac Group in Anne Arundel County. They are the Patuxent, the lower Patapsco, and the upper Patapsco. The Potomac Group is overlain by the Magothy aquifer, which is also a major source of water supply in the central and southern parts of Anne Arundel County.

The model simulates these aquifers and the movement of water through and between them. It was developed using geologic and hydrologic data gathered over a period of many years. Development and use of the model showed that data were unevenly distributed across the project area. Areas where additional data are needed were thereby identified.

The model was calibrated under both steady-state and transient conditions. Values for parameters used in the model were adjusted until water levels computed by the model compared favorably with water levels measured in the field. The maximum difference between the computed and observed water levels in 39 observation wells was about 30 ft, but the difference was generally less than 10 ft. Trends of 30 of 39 hydrographs compared well, 8 were fair, and 1 was poor.

Predictions were made of the effect pumpage in the year 2000 will have on the potentiometric surface of each aquifer. The individual well fields, those existing in 1977 and those planned for the period 1977-2000, were stressed at rates in accordance with projected needs of the Anne Arundel County Department of Utilities and other users. Aquifers to be developed in the new well fields were selected by considering both quantitative and qualitative factors affecting the availability of ground water. For instance, experience has shown that large quantities of water can be obtained from aquifers that contain water under high pressure and have high transmissivity values. The proximity of salt water in the Chesapeake Bay and its estuaries presents concern that overpumping could result in contamination of parts of such aquifers along the eastern margin of the county. Locations of the new wells were therefore selected where conditions are least susceptible to salt-water intrusion.

The density of the control points on the data maps suggests the level of confidence justified in the model for specific areas. The pumped areas are better defined than the undeveloped areas. Therefore, predictions for pumped areas are likely to be more accurate than those for undeveloped areas. This important factor must be considered when designing future well fields to supply future water requirements of the area. The accuracy of the model predictions of future water-level changes will be dependent on the accuracy of the data.

Model simulations show that the water requirements of the year 2000 can probably be met from aquifers within the county's boundaries. Trial runs indicate that pumping from the total model area at 118 Mgal/d will cause water-level declines of up to 200 ft in parts of the lower Patapsco aquifer and 240 ft in parts of the Patuxent aquifer.

Because of the field studies initiated during the project, future versions of the model will have access to more reliable data. They will have the advantage of (1) more reliable pumpage data obtained by the recently implemented Maryland Water Use Data Program, (2) longer periods of record from better distributed observation wells, and (3) better correlation of aquifers between large well fields. Future generations of the model will permit the computation of more precise answers to questions regarding the effects that changes in pumping will have on water levels.

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DATA FOR SELECTED WELLS AND TEST SITES

Table 8. — Records for selected wells tapping the Patuxent aquifer

Use of Water Codes: C = Commercial H = Domestic N = Industrial P = Public Supply S = School U = Unused

Water-Bearing Formation Codes: Px = Patuxent

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches) CASING	DIAMETER OF WELL (inches) SCREEN	DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA: WATER LEVEL (feet below land surface) STATIC	PUMPING TEST DATA: WATER LEVEL PUMPING	PUMPING TEST DATA: WATER LEVEL DATE	PUMPING TEST DATA: YIELD (gal/min)	PUMPING TEST DATA: HOURS PUMPED	PUMPING TEST DATA: SPECIFIC CAPACITY (gal/min/ft)	USE OF WATER	REMARKS	WELL NUMBER
AA-Ac 11	2445	Balto.-Wash. Int'l Airport	Washington Pump & Well Co.	1948	138	320	6	6?	312	8	Px	90 91	175	4/48 6/59	60	12	0.7	U	Observation well.	AA-Ac 11
AA-Ac 60	66-0326	A.A. Co. Dept. Public Works (Parkway Industrial)	Layne-Atlantic Co.	1965	165	150	8	8	135	15	Px	88	124	10/65	72	12	2.0	P	Drilled to 155 ft.	AA-Ac 60
AA-Ac 65	66-0327	A.A. Co. Dept. Public Works (Parkway Industrial)	do.	1965	170	165	8	6	145	15	Px	93	138	11/65	100	12	2.2	P	Test well drilled in same hole. Drilled to 176 ft.	AA-Ac 65
AA-Ad 20	-	Kavanaugh Products, Inc.	Washington Pump & Well Co.	1944	40	392	8	?	-	-	Px	76	90	8/44	130	-	-	N		AA-Ad 20
AA-Ad 29	-	A.A. Co. Dept. Public Works (Sawmill Creek Field)	Layne-Atlantic Co.	1947	37	500	3	2	395	45	Px	11	-	6/48	12	-	-	U	Drilled to 530 ft. Screened 395-400 ft; 460-500 ft. Observation well.	AA-Ad 29
AA-Ad 76	29134	A.A. Co. Dept Public Works (Dorsey Rd. #5)	do.	1957	69	474	12	10	449	25	Px	35	169	11/57	450	8	3.4	P		AA-Ad 76
AA-Ad 90	40298	A.A. Co. Dept. Public Works (Hammonds Ferry Rd.)	do.	1960	79	453	6	6	443	10	Px	35	117	10/60	315	8	4.0	U	Drilled to 483 ft. Observation well.	AA-Ad 90
AA-Ad 94	26010	Matlack, Inc.	Sam Shannahan Well. Co.	1957	38	213	6	4	198	15	Px	34	65	5/57	75	10	2.4	C		AA-Ad 94
AA-Ad 96	66-1279	U.S.S. Agricultural Chemicals	Frank's Well Drilling Co.	1967	15	370	6	4	355	15	Px	20	45	6/67	400	25	16.0	N		AA-Ad 96
AA-Ae 36	46091	Chemetals Corporation	Shannahan Artesian Well Co.	1962	30	555	16	8	450	73	Px	36	76	4/62	740	24	18.5	N	Screened 450-500 ft; 532-555 ft.	AA-Ae 36
AA-Bb 22	1432	Laurel Race Course	Layne-Atlantic Co.	1947	144	60	6	6	50	10	Px	1 3	12	5/47 6/60	60	8	5.4	C		AA-Bb 22
AA-Bb 38	25503	Parkway Manor Motel	H. H. Bunker & Sons, Inc.	1956	290	276	6	2	266	10	Px	115	190	12/56	15	24	0.2	C		AA-Bb 38
AA-Bb 48	15746	Laurel Race Course	Layne-Atlantic Co.	1954	143	62	6	6	52	10	Px	0 5	50	7/54 6/60	100	3	2.0	C		AA-Bb 48
AA-Bb 49	1432	Laurel Race Course (Well #1)	do.	1947	147	61	6	6	52	10	Px	6 5	15 16	5/47 6/60	60 100	10	6.7 11.1	C		AA-Bb 49
AA-Bb 50	38337	Colony 7 Motor Inn	do.	1960	170	161	6	6	151	10	Px	31	125	6/60	200	136	2.1	U? C	Test hole. Drilled to 162 ft.	AA-Bb 50
AA-Bb 54	41034	do.	do.	1960	170	223	6	6	218	5	Px	60	140	11/60	330	-	4.1	C		AA-Bb 54
AA-Bb 64	47686	A.A. Co. Dept. Public Works (Maryland City #1)	do.	1962	165	140	8	8	104	20	Px	51 57	99	7/62 6/62	300	24	6.3	P		AA-Bb 64

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Bb 65	47687	A.A. Co. Dept. Public Works (Maryland City #2)	Layne-Atlantic Co.	1968	210	184	8	8	146	20	Px	96 93	148	7/62 6/62	270	24	5.2	P		AA-Bb 65
AA-Bb 66	66-0811	A.A. Co. Dept. Public Works (Maryland City #3)	do.	1965	160	126	10	8	78	30	Px	47	72	12/65	250	24	10.0	P		AA-Bb 66
AA-Bb 67	68-0666	U.S. Army - Ft. Meade	Shannahan Artesian Well Co.	1968	130	481	4	2	461	20	Px	62	102	2/68	60	4	1.5	U	Drilled to 516 ft. Test hole for AA-Bb 68.	AA-Bb 67
AA-Bb 68	68-0753	U.S. Army - Ft. Meade #1	do.	1968	130	497	16	8	454	43	Px	65	225	4/68	700	4	4.4	P	Drilled to 515 ft.	AA-Bb 68
AA-Bb 69	71-0757	A.A. Co. Dept. Public Works (Maryland City #4)	Layne Atlantic Co.	1971	205	145	8	8	100	45	Px	68	99	5/71	300	24	9.7	P		AA-Bb 69
AA-Bb 70	50529	Colony 7 Motor Inn	do.	1963	170	219	6	6	214	5	Px	44	119	4/63	190	8	2.5	C		AA-Bb 70
AA-Bb 71	53130	Parkway Manor Motel	H. H. Bunker & Sons, Inc.	1963	290	310	6	2	285	25	Px	200	208	10/63	12	5	1.5	C		AA-Bb 71
AA-Bb 72	69-0553	Holiday Inn	H. H. Bunker & Sons, Inc.	1969	225	200	6	2	190	20	Px	98	180	10/69	35	24	0.4	C		AA-Bb 72
AA-Bb 73	70-0323	do.	do.	1969	225	192	6	6?	182	10	Px	94	180	10/69	50	16	0.6	C		AA-Bb 73
AA-Bc 163	68-0667	U.S. Army - Ft. Meade	Shannahan Artesian Well Co.	1968	130	604	4	2	542	20	Px	70	107	2/68	58	4	1.6	U	Test hole for AA-Bc 164.	AA-Bc 163
AA-Bc 164	68-0754	U.S. Army - Ft. Meade #2	do.	1968	130	594	16	8	493	101	Px	70	153	3/68	884	24	10.7	P	Drilled to 598 ft; screened 495-518 ft, 518-531 ft, 531-574 ft, 574-594 ft.	AA-Bc 164
AA-Bc 166	69-0520	Exxon Chemical Co.	do.	1969	125	669	4	3	638	31	Px	75	87	2/69	40	4	3.3	U	Drilled to 735 ft. Test hole for AA-Bc 173.	AA-Bc 166
AA-Bc 173	70-0799	Nevamar Corporation #8	do.	1970	120	680	16	8?	628	52	Px	85	157	11/70	800	8	11.1	N		AA-Bc 173
AA-Bc 175	71-0122	A.A. Co. Dept. Public Works (Meade Village #1)	Layne-Atlantic Co.	1970	190	243	8	8?	223	20	Px	110	148	10/70	250	12	6.6	P		AA-Bc 175
AA-Bc 177	51459	Holiday Mobile Estates	H. H. Bunker & Sons, Inc.	1963	220	257	6	6	247	10	Px	118	120	5/63	175	24	87.5	P		AA-Bc 177
AA-Bc 178	71-0790	do.	Frank's Well Drilling Co.	1971	240	273	6	6	263	10	Px	150	200	5/71	155	24	3.1	P		AA-Bc 178
AA-Bc 185	67-0305	Koppers Co., Inc.	Layne-Atlantic Co.	1967	125	359	8	6	334	20	Px	43	135	5/67	200	-	2.2	N	Screened 334-344 ft; 349-359 ft.	AA-Bc 185
AA-Bc 192	71-1090	The Provinces Water Co.	Shannahan Artesian Well Co.	1971	260	556	10	5	500	56	Px	205	232	9/71	401	24	14.8	P		AA-Bc 192
AA-Bc 193	71-1103	do.	do.	1971	255	526	10	5	481	45	Px	197	254	11/71	362	24	6.4	P		AA-Bc 193
AA-Bc 199	55723	Robinhood Dell Mobile Homes	Gulfstan Corporation	1963	180	188	6	?	-	-	Px	121	170	9/63	100	48	2.0	P		AA-Bc 199

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Bc 200	69-0283	Robinwood Dell Mobile Homes	H. H. Bunker & Sons, Inc.	1968	190	247	6	2	237	10	Px	123	180	10/68	25	30	0.4	P		AA-Bc 200
AA-Bd 23	2803	A.A. Co. Dept. Public Works (Harundale)	Layne-Atlantic Co.	1948	30	617	None	None	-	None	Px	-	-	-	16	8	-	U	Test hole for AA-Bd 36.	AA-Bd 23
AA-Bd 57	21549	A.A. Co. Dept. Public Works (Dorsey Rd. #2)	do.	1956	68	510	10	10	485	25	Px	12	127	1/56	475	4	4.1	P		AA-Bd 57
AA-Bd 66	28416	A.A. Co. Dept. Public Works (Dorsey Rd. #13)	do.	1957	87	517	12	10	497	20	Px	31	214	10/57	375	8	2.0	P		AA-Bd 66
AA-Bd 97	49554	A.A. Co. Dept. Public Works (Dorsey Rd. #7)	do.	1962	75	534	10	10	504	30	Px	26	146	11/62	500	40	4.1	P		AA-Bd 97
AA-Bd 98	57226	A.A. Co. Dept. Public Works (Dorsey Rd. #17)	Gulfstan Corporation	1964	75	591	10	10	552	39	Px	58	205	8/64	907	8	6.2	P	Drilled to 625 ft.	AA-Bd 98
AA-Cb 1	35695	U.S. Army - Ft. Meade	Layne-Atlantic Co.	1959	129	505	6	6	485	20	Px	44	188	9/59	276	24	1.9	U	Drilled to 515 ft. Observation well.	AA-Cb 1
AA-Cc 80	46965	A.A. Co. Dept. Public Works (Kings Heights)	do.	1962	178	873	1	1	870	3	Px	106	-	10/62	-	-	-	U	Observation well.	AA-Cc 80
AA-Cc 86	56079	A.A. Co. Dept. Public Works (Crofton #1)	Gulfstan Corporation	1964	60	960	20	10	850	110	Px	12	63	7/64	825	24	1.1	P		AA-Cc 86
AA-Cc 87	66-0299	A.A. Co. Dept. Public Works (Kings Heights #4)	do.	1966	178	758	20	10	684	64	Px	110	299	2/66	566	24	2.5	P		AA-Cc 87
AA-Cc 88	66-0300	A.A. Co. Dept. Public Works (Kings Heights)	do.	1966	178	885	20	10	775	65	Px	119	182	8/66	1241	24	19.7	P	Screened 775-785 ft, 812-857 ft, 865-875 ft.	AA-Cc 88
AA-Cc 103	73-0086	A.A. Co. Dept. Public Works (Crofton Meadows #1)	Layne-Atlantic Co.	1973	125	1150	10	10	1030	100	Px	83	182	7/73	609	24	6.2	P	Screened 1030-1100 ft, 1115-1145 ft.	AA-Cc 103
AA-Cc 104	73-0087	A.A. Co. Dept. Public Works (Crofton Meadows)	do.	1973	135	1262	-	-	-	-	Px	-	-	-	-	-	-	U	Test boring. Abandoned and filled.	AA-Cc 104
AA-Cc 105	73-0087	A.A. Co. Dept. Public Works (Crofton Meadows #2)	do.	1973	130	1195	10	10	1040	110	Px	103	239	8/73	726	24	5.3	P	Drilled to 1242 ft; screened 1040-1090 ft, 1110-1115 ft, 1170-1190 ft.	AA-Cc 105
AA-Cc 107	73-2802	A.A. Co. Dept. Public Works (Crofton Meadows #3)	do.	1974	120	1000	-	-	-	-	Px	-	-	-	-	-	-	P	Drilled to 1230 ft.	AA-Cc 107

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Cc 113	73-5838	A.A. Co. Dept. Public Works (Waugh Chapel Rd.)	Sydnor Hydrodynamics	1976	152	980	6	4	748	40	Px	118	155	10/76	200	4	5.4	U	Screened 748-758 ft, 798-808 ft, 910-920 ft, 960-970 ft.	AA-Cc 113
AA-Cc 114	73-5837	A.A. Co. Dept. Public Works (Waugh Chapel Rd.)	do.	1976	149	975	6	6	730	115	Px	114	160	10/76	250	24	5.4	P	Drilled to 1,025 ft. Screened 730-755 ft, 770-780 ft, 790-810 ft, 880-890 ft, 908-918 ft, 935-975 ft.	AA-Cc 114
AA-Ce 117	73-0172	A.A. Co. Dept. Public Works (Severndale)	Delmarva Drilling Co., Inc.	1972	80	922	6	6?	836	50	Px	62	180	8/72	500	24	4.2	U	Screened 836-851 ft, 870-890 ft, 907-922 ft.	AA-Ce 117
AA-Cg 22	73-8606	U.S. Geological Survey (Sandy Pt. State Pk.)	Sydnor Hydrodynamics	1978	13	1760	4	4	1735	20	Px	7	33	9/78	30	24	1.2	U	Drilled to 1,785 ft. Observation well. Reached basement.	AA-Cg 22
1N-3E- 7	20712	Hood Vinegar Co.	G. Edgar Harr Sons.	1955	100	302	6	4?	145.5	-	Px	125	270	10/55	40	13	0.3	N		1N-3E- 7
1N-3E- 8	21213	do.	do.	1955	100	400	6	4?	171	-	Px	75	240	11/55	15	9	0.1	N		1N-3E- 8
1N-3E-10	71-0001	do.	Frank's Well Drilling Co.	1971	100?	100	6	4	90	10	Px	75	90	5/71	60	2	4.0	N		1N-3E-10
1S-3E- 4	-	Schluderberg & Kurdle Co.	Layne-Atlantic Co.	1943	60	195	8	8	146	20	Px	110.5	170	4/43	125	-	2.0	N	Screened 146-156 ft, 170-180 ft.	1S-3E- 4
1S-3E- 5	-	Monarch Rubber Co.	G. Edgar Harr	1937	38	104	8	6	90?	10	Px	45-55	-	4/43	35	-	-	N		1S-3E- 5
1S-3E-46	71-0003	Schluderberg & Kurdle Co.	Shannahan Artesian Well Co.	1971	70	198	10	10?	159	28	Px	105	153	3/71	182	8	3.8	N		1S-3E-46
2S-5E- 1	-	Ft. Holabird Industrial Park	Va. Machinery & Well Co.	1930	32	290	12	?	-	-	Px	60	100	2/34	260	2	12.4	U		2S-5E- 1
5S-2E-20	-	F.M.C. Corp.	Shannahan Artesian Well Co.	1946	5	262	10	?	222	40	Px	94	126	1946	310	-	9.7	N	Drilled to 300 ft.	5S-2E-20
5S-2E-21	-	do.	do.	1946	5	257	-	-	212	45	Px	-	-	-	425	-	-	N		5S-2E-21
5S-3E-10	-	U.S. Industrial Chemical Co.	Not recorded	-	15	-	-	-	-	-	Px	-	173	8/43	-	-	-	N		5S-3E-10
5S-3E-50	16145	Continental Oil Co.	Shannahan Artesian Well Co.	1955	20	297	16-10-8	8	252	45	Px	79	218	5/55	610	48	4.4	U	Drilled to 360 ft.	5S-3E-50
7S-4E- 1	17129	S.C.M. Pigments Corp.	do.	1954	40	575	2	2	165	35	Px	100 88	-	10/54 9/57	8	4	-	U	Drilled to 638 ft. Screened 165-175 ft, 210-220 ft, 230-235 ft, 565-575 ft.	7S-4E- 1
3S-5E-35	69-0003	Federal Yeast Co.	do.	1969	15	370	12-8	8	270	50	Px	61	67	5/69	106	12	17.7	N	Drilled to 387 ft. Screened 270-300 ft, 350-370 ft.	3S-5E-35
3S-5E-39	68-0002	do.	do.	1968	15	391	12	8	281	55	Px	62	155	6/68	650	32	0.7	N	Screened 281-303 ft, 313-332 ft, 367-391 ft.	3S-5E-39

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
3S-5E-41	71-0002	Federal Yeast Co.	Shannahan Artesian Well Co.	1971	15	396	12	8	267	77	Px	62	93	7/71	620	24	20.0	N	Screened 267-303 ft, 355-396 ft.	3S-5E-41
3S-5E-42	73-0004	Federal Yeast Co. (Well #11)	do.	1975	15	400	12	8	284	63	Px	65	135	5/75	750	8	10.7	N	Drilled to 409 ft. Screened 284-314 ft, 367-375 ft, 375-400 ft.	3S-5E-42
3S-5E-43	73-0012	do.	do.	1976	15	389	12	8	290	58	Px	60	110	4/76	350	8	7.0	N	Drilled to 400 ft. Screened 290-316 ft, 347-362 ft, 372-389 ft.	3S-5E-43
BA-Fe 41	23135	Eastern Stainless Steel Co.	Layne-Atlantic Co.	1956	45	304	12-10	8	210	25	Px	80	183	8/56	400	5	3.9	N	Screened 210-215 ft, 257-262 ft, 289-304 ft.	BA-Fe 41
BA-Fe 59	67-0369	do.	Shannahan Artesian Well Co.	1967	45	320	10	8	292	29	Px	80	250	4/67	300	24	1.7	N	Drilled to 338 ft.	BA-Fe 59
BA-Fe 61	53370	do.	do.	1963	45	188	10	8	166	22	Px	95	159	9/63	160	16	2.7	N	Drilled to 221 ft.	BA-Fe 61
BA-Ff 34	-	Baltimore County (Back River School)	Not recorded	1943	20	341	8	6	331	10	Px	42 24	-	1/46 3/82	25	-	-	U		BA-Ff 34
BA-Gc 1	-	Calvert Distilling Co.	Ranney Water Collector Co.	1942	10	33	-	-	-	-	Px	-	24	10/43	1000	-	-	N		BA-Gc 1
BA-Gf 3	-	Bethlehem Steel Co. (Wire Mill #5)	Shannahan Artesian Well Co.	1926	10	622	12	5	597	25	Px	100	157	1/43	460	-	8.1	N		BA-Gf 3
BA-Gf 5	-	Bethlehem Steel Co. (Wire Mill #7)	do.	1925	10	610	12	5	581	29	Px	110	172	1/43	550	-	8.9	N		BA-Gf 5
BA-Gf 8	-	Bethlehem Steel Co. (Wire Mill #10)	do.	1937	10	618	12	7	587	31	Px	92	140	1/43	620	-	12.9	N		BA-Gf 8
BA-Gf 9	-	Bethlehem Steel Co. (Wire Mill #11)	do.	1938	10	454	12	5	441	13	Px	110	183	1939	510	-	7.0	N		BA-Gf 9
BA-Gf 11	-	Bethlehem Steel Co. (Wire Mill #12A)	do.	1941	10	633	14	?	422	-	Px	80	176	5/43	690	-	7.2	U		BA-Gf 11
BA-Gf 32	-	Bethlehem Steel Co. (Hot Strip #3)	do.	1937	10	668	12	7	526	67	Px	86	129	10/45	620	-	14.4	N	Screened 526-536 ft, 571-578 ft, 638-688 ft.	BA-Gf 32
BA-Gf 35	-	Bethlehem Steel Co. (Hot Strip #6)	do.	1937	10	675	12	6	530	90	Px	-	125M	10/45	690	-	-	N	Screened 530-590 ft, 566-577 ft, 645-675 ft.	BA-Gf 35
BA-Gf 139	-	Bethlehem Steel Co. (Coke Oven #31)	do.	1939	10	615	16	7	520	60	Px	109	166	1939	550		9.7	N	Screened 520-530 ft, 555-575 ft, 585-615 ft.	BA-Gf 139
BA-Gf 210	23182	Bethlehem Steel Co. (Hot Strip #10)	do.	1957	10	692	12	11.5	546	47	Px	107	196	11/57	650	24	7.4	N	Screened 546-553 ft, 570-584 ft, 654-659 ft, 667-674 ft, 678-692 ft.	BA-Gf 210
BA-Gf 211	23183	Bethlehem Steel Co. (Blast Furnace #2)	do.	1957	10	696	12	11.5	586	50	Px	100	126	12/57	650	24	25.0	N	Screened 586-594 ft, 647-661 ft, 668-696 ft.	BA-Gf 211

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
BA-Gf 212	34726	Bethlehem Steel Co. (Blast Furnace #3)	Shannahan Artesian Well Co.	1960	10	685	12	8	500	53	Px	103	131	5/60	695	24	24.8	N	Screened 500-510 ft, 545-557 ft, 569-573 ft, 658-685 ft.	BA-Gf 212
BA-Gf 214	48602	Bethlehem Steel Co. (40-inch Mill)	do.	1962	10	687	12	8	637	50	Px	75	125	11/62	700	24	14.0	N		BA-Gf 214
HA-Ec 11	47211	Joppatowne Utilities	Layne Atlantic Co.	1952	10	68	6	2	63	5	Px	1	-	5/52	40	3	-	U		HA-Ec 11
PG-Ad 8	-	Francis Gosnell	-	Pre-1850	179	35	48	-	-	-	Px	11.59	-	2/48	-	-	-	U		PG-Ad 8
PG-Bd 15	-	Beltsville Agricultural Research Center (Well B)	Columbia Well Drilling Co.	1934	116	167	8	8	167	20	Px	16	130	1934	110	-	0.9	H, N	Drilled to 250 ft.	PG-Bd 15
PG-Bd 16	-	Beltsville Agricultural Research Center (Well C)	Va. Machinery & Well Co., Inc.	1925	125	185	8	8?	165	20	Px	15	22	11/25	60	-	8.6	H, N	Drilled to 600 ft.	PG-Bd 16
PG-Bd 17	-	Beltsville Agricultural Research Center (Well D)	William Strothoff Co., Inc.	1931	124	92	8	8	72	20	Px	24 22.45	55	12/48 11/51 6/31	20	-	-	U	Drilled to 251 ft.	PG-Bd 17
PG-Bd 19	-	Beltsville Agricultural Research Center (Well L)	Washington Pump & Well Co.	1937	125	197	6	6?	-	-	Px	35	170	1937	100	-	0.7	H, N		PG-Bd 19
PG-Bd 21	-	Beltsville Agricultural Research Center (Well G)	do.	1934	153	265	6	6?	160 235	60	Px	55	145	1934	100	-	1.1	H, N	Drilled to 425 ft.	PG-Bd 21
PG-Bd 27	-	Beltsville Agricultural Research Center (Well O)	do.	1939	145	252	6	6?	230	22	Px	55	164	1939	120	-	1.1	H, N	Drilled to 255 ft.	PG-Bd 27
PG-Bd 28	-	Beltsville Agricultural Research Center (Well P)	do.	1939	162	167	6	6?	124	43	Px	52 49	105	1939 11/51	165	-	3.0	H, N		PG-Bd 28
PG-Bd 29	-	Beltsville Agricultural Research Center (Well Q)	Sydnor Hydrodynamics, Inc.	1939	120	220	8	6	204	16	Px	20	-	1939	-	-	-	H, N	Drilled to 232 ft.	PG-Bd 29
PG-Bd 30	-	Beltsville Agricultural Research Center (Well R)	Washington Pump & Well Co.	1937	155	310	8	8?	-	-	Px	56 67	-	12/48 11/51	125	-	-	U		PG-Bd 30
PG-Be 6	-	Beltsville Agricultural Research Center (Well K)	do.	1934	177	430	8	6	430	-	Px	93 95	215	1934 12/51	90	-	0.7	H, N		PG-Be 6

Table 8. — Records for selected wells tapping the Patuxent aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
PG-Be 23	67-0003	Patuxent Wildlife Refuge (Endangered Species #7)	Layne-Atlantic Co.	1966	120	520	14	6	480	40	Px	50	206	11/66	390	28	2.5	S	Drilled to 606 ft. Screen diameter 6 in.	PG-Be 23
PG-Cf 64	65-0030	City of Bowie (Water Treatment Plt. #4)	Sydnor Hydrodynamics, Inc.	1965	114	1169	24	10	924	146	Px	56	227	2/65	1104	72	6.4	P	Drilled to 1,173 ft. Screen diameter 10 in. Multiple screens.	PG-Cf 64
PG-Cf 66	65-0085	City of Bowie (Fox Hill Rec. Ctr. #5)	C. W. Lauman & Co., Inc.	1965	142	980	24	12	905	75	Px	88	224	11/65	1040	72	7.6	P	Drilled to 1,127 ft.	PG-Cf 66

Table 9. — Records for selected wells tapping the lower Patapsco aquifer

Use of Water Codes: A = Air Conditioning C = Commercial F = Fire Protection N = Industrial P = Public Supply U = Unused

Water-Bearing Formation Codes: lPs = Lower Patapsco

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Ad 10	-	U.S. Army Reserve Center	-	1918	45	109	8	?	-	-	lPs	37	-	8/44	50	-	-	U		AA-Ad 10
AA-Ad 23	-	A.A. Co. Dept. Public Works (Sawmill Creek #3)	Layne-Atlantic Co.	1945	42	78	18	8	63	10	lPs	-	-	-	150	-	-	P		AA-Ad 23
AA-Ad 40	1629	A.A. Co. Dept. Public Works (Sawmill Creek #4)	do.	1947	57	102	20	10	80	22	lPs	28	62	4/47	292	-	8.6	P		AA-Ad 40
AA-Ad 41	1630	A.A. Co. Dept. Public Works (Sawmill Creek #5)	do.	1947	39	146	18	8	126	20	lPs	10	68	6/47	250	-	4.3	P		AA-Ad 41
AA-Ad 60	19426	Joseph J. Hock, Inc.	Maryland Drilling Co.	1955	15	52	4	4	48	4	lPs	19	40	9/55	25	-	1.2	C	Drilled to 68 ft.	AA-Ad 60
AA-Ad 67	13957	A.A. Co. Dept. Public Works (Sawmill Creek #6)	Layne-Atlantic Co.	1953	43	151	10	8	131	20	lPs	12	120	11/53	487	-	4.5	P		AA-Ad 67
AA-Ad 68	13958	A.A. Co. Dept. Public Works (Sawmill Creek #7)	do.	1953	56	160	10	10	140	20	lPs	16	128	12/53	400	-	3.5	P		AA-Ad 68
AA-Ad 69	27725	Two Guys Dept. Store	H. H. Bunker & Sons, Inc.	1957	60	119	8	8	97	22	lPs	32	62	7/57	270	8	9.0	A		AA-Ad 69
AA-Ad 71	27724	do.	do.	1957	60	120	8	6	108	12	lPs	32	72	8/57	150	8	3.7	A		AA-Ad 71
AA-Ad 74	28580	A.A. Co. Dept. Public Works (Dorsey Rd. #4)	Layne-Atlantic Co.	1957	90	186	12	10	171	15	lPs	33 37	157	10/57 9/59	375	8	3.0	P		AA-Ad 74
AA-Ad 88	39818	A.A. Co. Dept. Public Works (Dorsey Rd.)	do.	1960	70	164	6	2.5	159	5	lPs	17	-	10/60	-	-	-	U	Observation well.	AA-Ad 88
AA-Ad 93	66-1456	Coop Fertilizer Co.	Frank's Well Drilling Co.	1966	17	260	6	4	-	10	lPs	30	60	6/66	70	6	2.3	N		AA-Ad 93
AA-Bc 169	70-0369	Pioneer City Realty Co.	Layne-Atlantic Co.	1970	145	265	8	8?	240	25	lPs	72	120	3/70	440	8	9.2	P		AA-Bc 169
AA-Bc 171	65-1220	Nevamar Corporation #6	do.	1965	125	404	12	10	272	131	lPs	58	220	7/65	600	8	3.7	N	Drilled to 421 ft.	AA-Bc 171
AA-Bc 175	71-0122	A.A. Co. Dept. Public Works (Meade Village #1)	do.	1970	190	243	8	8?	223	20	lPs	110	148	10/70	250	12	6.6	P		AA-Bc 175
AA-Bc 176	71-0123	A.A. Co. Dept. Public Works (Meade Village #2)	do.	1970	190	280	8	8?	260	20	lPs	105	139	11/70	300	12	8.8	P	Drilled to 283 ft.	AA-Bc 176

Table 9. — Records for selected wells tapping the lower Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Bc 186	67-0306	Koppers Co., Inc.	Layne-Atlantic Co.	1966	125	167	8	8?	120	25	1Ps	32	121	10/66	200	8	2.2	F	Drilled to 179 ft.	AA-Bc 186
AA-Bc 195	70-0370	Pioneer City Realty Co.	do.	1970	150	220	8	8?	182	30	1Ps	72	122	2/70	450	8	9.0	P	Drilled to 311 ft. Screened 182-197 ft, 205-220 ft.	AA-Bc 195
AA-Bd 36	2803	A.A. Co. Dept. Public Works (Harundale #1)	do.	1948	31	123	20	10	98	25	1Ps	3	70	7/51 6/48	439	-	-	P	Test well AA-Bd 23 drilled to 617 ft. Same permit no. as AA-Bd 23.	AA-Bd 36
AA-Bd 37	-	A.A. Co. Dept. Public Works (Harundale #2)	do.	1949	38	115	20	10	90	25	1Ps	7	67	1/49	450	48	7.5	P		AA-Bd 37
AA-Bd 55	21548	A.A. Co. Dept. Public Works (Dorsey Rd. #1)	do.	1955	70	131	10	10	111	20	1Ps	11	52	12/55	450	8	11.0	P		AA-Bd 55
AA-Bd 56	21550	A.A. Co. Dept. Public Works (Dorsey Rd. #3)	do.	1956	62	153	10	10	133	20	1Ps	7	118	2/56	350	4	3.1	P		AA-Bd 56
AA-Bd 61	19874	A.A. Co. Dept. Public Works (Harundale #4)	do.	1955	42	206	10	8	186	20	1Ps	13	45	8/55	500	5	15.6	P		AA-Bd 61
AA-Bd 63	20138	A.A. Co. Dept. Public Works (Harundale #3)	do.	1955	28	180	10	8	160	20	1Ps	0	110	9/55	500	5	4.5	P		AA-Bd 63
AA-Bd 64	28059	A.A. Co. Dept. Public Works (Dorsey Rd. #11)	do.	1957	73	181	12	10	161	20	1Ps	13	170	9/57	375	8	2.3	P		AA-Bd 64
AA-Bd 91	42029	A.A. Co. Dept. Public Works (Dorsey Rd. #12)	do.	1961	79	160	6	2	155	5	1Ps	15	-	3/61	-	-	-	U		AA-Bd 91
AA-Bd 92	42472	A.A. Co. Dept. Public Works (Dorsey Rd. #14)	do.	1961	85	157	10	10	132	25	1Ps	22	120	5/61	200	24	2.0	P		AA-Bd 92
AA-Bd 95	50489	A.A. Co. Dept. Public Works (Dorsey Rd. #15)	do.	1963	70	178	10	10	150	20	1Ps	19	142	2/63	350	24	2.8	P		AA-Bd 95
AA-Bd 101	69-0871	A.A. Co. Dept. Public Works (Philip Dr.)	do.	1969	55	212	10	10	172	40	1Ps	20	83	4/69	608	24	9.7	P	Drilled to 265 ft.	AA-Bd 101

Table 9. — Records for selected wells tapping the lower Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Bd 103	69-0954	A.A. Co. Dept. Public Works (Glendale)	Layne-Atlantic Co.	1969	80	221	10	10	176	35	1Ps	67	152	5/69	554	24	6.5	P	Drilled to 275 ft. Screened 176-196 ft, 206-222 ft.	AA-Bd 103
AA-Bd 105	69-1128	A.A. Co. Dept. Public Works (Crain Highway)	do.	1969	90	237	10	10	197	40	1Ps	32	70	6/69	554	24	14.6	P	Drilled to 265 ft.	AA-Bd 105
AA-Bd 107	69-1195	A.A. Co. Dept. Public Works (Elvaton Rd.)	do.	1969	20	240	10	10	185	35	1Ps	20	70	7/69	650	24	10.2	P	Drilled to 288 ft. Screened 185-200 ft, 220-240 ft.	AA-Bd 107
AA-Bd 108	71-0554	A.A. Co. Dept. Public Works (Thelma Avenue)	do.	1971	70	205	10	10	175	30	1Ps	30	158	5/71	325	24	2.5	P	Drilled to 242 ft.	AA-Bd 108
AA-Bd 109	71-0553	A.A. Co. Dept. Public Works (Quarterfield Rd.)	do.	1971	190	300	10	10	260	40	1Ps	125	164	7/71	326	24	8.4	P	Drilled to 334 ft.	AA-Bd 109
AA-Bf 57	73-6882	A.A. Co. Bd. of Education (Ft. Smallwood)	C. Z. Enterprises	1977	60	290	12	6	270	20	1Ps	81	102	4/77	108	24	5.1	U	Drilled to 329 ft.	AA-Bf 57
AA-Cc 40	35693	U.S. Army - Ft. Meade (Range Rd.)	Layne-Atlantic Co.	1959	138	238	6	6	208	30	1Ps	46	130	8/59	350	24	4.2	U	Observation well.	AA-Cc 40
AA-Cc 79	46508	A.A. Co. Dept. Public Works (Kings Heights #3)	do.	1962	178	462	10	10	442	20	1Ps	105	160	4/62	500	24	9.1	P		AA-Cc 79
AA-Cc 82	46965	A.A. Co. Dept. Public Works (Kings Heights)	do.	1962	178	458	1	1	455	3	1Ps	110	-	10/62	-	-	-	U	Observation well.	AA-Cc 82
AA-Cc 83	46965	A.A. Co. Dept. Public Works (Kings Heights)	do.	1962	178	285	1	1	282	3	1Ps	74	-	10/62	-	-	-	U		AA-Cc 83
AA-Cc 87	66-0299	A.A. Co. Dept. Public Works (Kings Heights #4)	Gulfstan Corporation	1966	178	749	20	10	684	65	1Ps	110	229	2/66	556	24	4.7	P	Drilled to 759 ft.	AA-Cc 87
AA-Cc 88	66-0300	A.A. Co. Dept. Public Works (Kings Heights #5)	do.	1966	178	875	20	10	775	65	1Ps	119	182	8/66	1241	24	19.6	P	Drilled to 885 ft. Screened 775-785 ft, 812-857 ft, 865-875 ft.	AA-Cc 88
AA-Cc 89	65-0672	A.A. Co. Dept. Public Works (Crofton #2)	do.	1965	60	605	10	8	575	30	1Ps	70	185	10/65	618	240	5.5	P	Drilled to 610 ft.	AA-Cc 89

Table 9. — Records for selected wells tapping the lower Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Ce 94	43201	A.A. Co. Dept. Public Works (Severndale #1)	Layne-Atlantic Co.	1961	90	550	10	10	530	20	1Ps	61	116	9/61	500	24	9.1	P	Drilled to 560 ft.	AA-Ce 94
AA-Ce 95	43202	A.A. Co. Dept. Public Works (Severndale #2)	do.	1961	89	508	10	10	432	10	1Ps	59	101	8/61	500	24	11.9	P	Drilled to 515 ft. Screened 432-442 ft, 498-508 ft.	AA-Ce 95
AA-Ce 123	73-6871	A.A. Co. Dept. Public Works (Herald Harbor)	A.C. Schultes & Sons, Inc.	1977	160	726	18	10	653	40	1Ps	149	283	4/77	400	24	3.5	P	Screened 653-659 ft, 678-697 ft, 711-726 ft.	AA-Ce 123
AA-Ce 124	73-6872	do.	do.	1977	160	716	18	10	658	42	1Ps	150	218	6/77	405	24	6.0	P	Screened 658-664 ft, 680-716 ft.	AA-Ce 124
AA-Cg 23	73-8959	U.S. Geological Survey (Sandy Pt. State Pk.)	Sydnor Hydrodynamics	1978	16	986	4	4	968	10	1Ps	10	88	9/78	35	24	.5	N	Drilled to 1,000 ft. Observation well.	AA-Cg 23
AA-De 94	65-0822	City of Annapolis (Well #8)	Layne-Atlantic Co.	1965	130	1040	12	10	906	80	1Ps	97	162	8/65	1100	48	16.9	P	Screened 906-916 ft, 980-1,040 ft.	AA-De 94
BA-Gf 2	-	Bethlehem Steel Co. (Wire Mill #4)	Shannahan Artesian Well Co.	1925	10	248	-	-	-	-	1Ps	-	-	-	-	-	-	N	Plugged.	BA-Gf 2
BA-Gf 13	-	Bethlehem Steel Co. (Tin Mill #11)	do.	1916	10	160	6	4	125	22	1Ps	-	-	-	-	-	-	N	Abandoned. Screened 125-136 ft,	BA-Gf 13
BA-Gf 20	-	Bethlehem Steel Co. (Tin Mill #5)	do.	1926	10	314	-	-	-	-	1Ps	-	-	-	-	-	-	N	Plugged.	BA-Gf 20
BA-Gf 167	-	Bethlehem Steel Co. (Town Water #2)	do.	1919	10	297	10	6	277	20	1Ps	10 56	-	3/82 10/44	87	-	-	N	Drilled to 301 ft.	BA-Gf 167
BA-Gf 168	-	Bethlehem Steel Co. (Town. Water #3)	do.	1919	10	304	10	6	283	21	1Ps	10 56	-	3/82 10/44	103	-	-	N	Drilled to 308 ft.	BA-Gf 168
BA-Gf 171	-	Bethlehem Steel Co. (Town Water #6)	do.	1919	10	290	10	6	274	20	1Ps	57	-	10/44	103	-	-	N		BA-Gf 171
BA-Gf 176	-	Bethlehem Steel Co. (Town Water #11)	do.	1940	10	332	14	10	290	42	1Ps	108	169	2/40	752	-	12.3	N		BA-Gf 176
BA-Gf 178	-	Bethlehem Steel Co. (Bayshore Park)	do.	1905	6	339	8	8	-	-	1Ps	-	-	-	66	-	-	N		BA-Gf 178
BA-Gf 202	186	Bethlehem Steel Co. (Coke Oven #34)	do.	1946	10	192	16	12	161	31	1PS	53	81	10/46	680	24	24.2	N	Drilled to 194 ft.	BA-Gf 202
BA-Gf 203	187	Bethlehem Steel Co. (Coke Oven #35)	do.	1946	10	187	16	12	156	31	1Ps	75	99	10/46	670	24	27.9	N	Drilled to 196 ft.	BA-Gf 203
BA-Gf 204	7461	Bethlehem Steel Co. (Coke Oven #37)	do.	1951	10	293	16	12	250	43	1Ps	45	114	6/51	650	24	9.4	N		BA-Gf 204
BA-Gf 205	7460	Bethlehem Steel Co. (Coke Oven #38)	do.	1951	10	183	16	12	158	25	1Ps	78	136	7/51	850	24	14.7	N		BA-Gf 205

Table 9. — Records for selected wells tapping the lower Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
BA-Gf 206	12426	Bethlehem Steel Co. (Coke Oven #39)	Shannahan Artesian Well Co.	1954	10	234	18	12	193	40	1Ps	89	95	6/54	90	8	15.0	N		BA-Gf 206
BA-Gf 207	12428	Bethlehem Steel Co. (Coke Oven #40)	do.	1954	10	199	18	12	165	30	1Ps	57	97	2/54	600	9	15.0	N	Drilled to 199 ft.	BA-Gf 207
BA-Gf 208	12427	Bethlehem Steel Co. (Coke Oven #41)	do.	1954	10	318?	18	12	274	40	1Ps	101	138	4/54	600	8	16.2	N		BA-Gf 208
BA-Gf 209	23184	Bethlehem Steel Co. (Coke Oven #42)	do.	1957	10	312	18	10	277	35	1Ps	165	200	6/57	545	8	15.6	N		BA-Gf 209
BA-Gf 218	-	Bethlehem Steel Co. (Coke Oven #36)	do.	1949	10	211	16	12	190	21	1Ps	32	92	1949	670	-	11.3	N		BA-Gf 218
HA-Ed 24	-	U.S. Army - Edgewood Arsenal	Layne-Atlantic Co.	1941	13	135	18	?	120	15	1Ps	8	-	4/44	-	-	-	U	Observation well.	HA-Ed 24
KE-Db 40	73-0805	U.S. Geological Survey (Rock Hall)	A. C. Schultes & Sons, Inc.	1978	15	1030	4	4	1018	11	1Ps	12	24	12/78	54	24	4.5	U	Drilled to 1,832 ft. Observation well.	KE-Db 40
PG-Be 22	52827	Patuxent Wildlife Refuge (Coburn Lab #5)	Layne-Atlantic Co.	1963	130	290	6	6	270	10	1Ps	35	58	8/63	60	8	3.0	U		PG-Be 22
PG-Cf 32	34998	City of Bowie (Briardale La. #2)	C. W. Lauman & Co., Inc.	1959	113	700	24	12	457	75	1Ps	65	173	8/59	1230	24	11.4	P	Observation well from 7/64. Screened 457-472 ft, 498-513 ft, 655-700 ft.	PG-Cf 32
PG-Cf 35	43623	City of Bowie (Briardale La. #3)	do.	1961	147	733	24	12	503	98	1Ps	96	326	11/61	850	24	3.7	P	Drilled to 762?. Observation well from 12/61. Screened 503-538 ft, 590-616 ft, 648-656 ft, 706-733 ft.	PG-Cf 35
PG-Cf 44	43720	City of Bowie (Sewage Treatment Plant)	H. H. Bunker & Sons, Inc.	1961	47	333	4	2	328	5	1Ps	0	15	8/61	15	3	1.0	C	Observation well from 1963.	PG-Cf 44
PG-Eb 26	25967	Washington Suburban San. Comm. (Fort Foote)	Layne-Atlantic Co.	1957	151	578	12	12	239	75	1Ps	143	256	4/57	697	12	6.2	P	Drilled to 858? ft. Observation well from 1964. Screened 239-259 ft, 347-372 ft, 548-578 ft.	PG-Eb 26
PG-Fc 17	PG-12	Washington Gas Light Co. (Thorne #2)	Eakle and Holder	1955	59	716	6	-	712	4	1Ps	29	-	10/55	-	-	-	U	Drilled to 1728 ft. Observation well from 10/55. Gun-perforated from 712 ft to 716 ft with 32 shots.	PG-Fc 17
QA-Ea 26	-	U.S. Army Corps of Engineers (Chesapeake Bay Model)	U.S. Army	1972	20	1090	-	-	-	-	1Ps	-	-	-	-	-	-	U	Well abandoned after casing collapsed.	QA-Ea 26

Table 10. — Records for selected wells tapping the upper Patapsco aquifer

Use of Water Codes: C = Commercial N = Industrial P = Public Supply U = Unused

Water-Bearing Formation Codes: uPs = Upper Patapsco

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Bc 1	-	Nevamar Corp. (Well #1)	Shannahan Artesian Well Co.	1944	130	166	10	8	146	20	uPs	41	88	-	250	--	5.3	N	Drilled to 175 ft. Plugged with cement 3/79.	AA-Bc 1
AA-Bc 20	-	Nevamar Corp. (Well #2)	do.	1945	131	180	8	8	148	20	uPs	42	94	6/45	307	--	5.9	N	Drilled to 180 ft.	AA-Bc 20
AA-Bc 40	1710	Nevamar Corp. (Well #3)	do.	1947	130	168	12	?	146	22	uPs	37	105	12/47	615	24	9.0	N		AA-Bc 40
AA-Bc 47	5895	Nevamar Corp. (Well #4)	do.	1950	137	185	18	12	153	32	uPs	51	74	10/51	281	8	12.2	N		AA-Bc 47
AA-Bc 88	21457	Bradsky's Modern Trailer Park	Layne-Atlantic Co.	1955	175	136	6	6	131	5	uPs	65	90	11/55	310	4	12.4	P		AA-Bc 88
AA-Bc 157	13484	Nevamar Corp. (Well #5)	Shannahan Artesian Well Co.	1953	125	155	18	12	125	30	uPs	41	109	12/54	600	24	8.8	N		AA-Bc 157
AA-Bc 165	68-0455	Nevamar Corp. (Well #7)	do.	1968	125	161	12	12	136	25	uPs	54	123	2/68	500	8	7.2	N	Drilled to 164 ft.	AA-Bc 165
AA-Bc 187	67-1347	Brodsky's Modern Trailer Park	Layne-Atlantic Co.	1967	175	127	6	6?	122	5	uPs	72	90	6/67	50	8	2.8	P		AA-Bc 187
AA-Bd 89	33024	Rol-Park Trailer Village	H. H. Bunker & Sons, Inc.	1958	80	67	6	4	57	10	uPs	24	-	2/61	20	1	-	P		AA-Bd 89
AA-Bd 111	49529	Transit Truck Stop, Inc.	H. H. Bunker & Sons, Inc.	1962	95	126	6	6	116	10	uPs	57	90	10/62	240	10	7.3	C		AA-Bd 111
AA-Be 104	50096	Pasadena Water Co.	do.	1962	55	95	8	8?	84	11	uPs	13	70	12/62	200	50	3.5	P		AA-Be 104
AA-Be 105	66-0135	do.	do.	1965	45	272	8	8?	260	12	uPs	29	130	8/65	150	8	1.5	P		AA-Be 105
AA-Cc 43	17069	A.A. Co. Dept. Public Works (Kings Heights #2)	Layne-Atlantic Co.	1955	180	167	10	8	142	25	uPs	51	141	1/55	350	4	3.9	P	Drilled originally to 185 ft. Screened 149-164 ft.	AA-Cc 43
AA-Ce 65	35523	A.A. Co. Dept. Public Works (Severna Park #3)	do.	1959	10	150	10	8	130	20	uPs	10	50	7/59	350	8	8.7	P		AA-Cc 65
AA-Ce 66	4035	A.A. Co. Dept. Public Works (Severna Park #1)	do.	1950	10	119	8	8	109	10	uPs	Flowing	-	1950	50	3	-	P		AA-Ce 66
AA-Ce 67	15241	A.A. Co. Dept. Public Works (Severna Park #2)	do.	1954	10	185	10	6	175	10	uPs	1	60	8/54	174	5	2.9	P		AA-Ce 67
AA-Ce 70	36388	A.A. Co. Dept. Public Works (Pines-On-Severn #2)	do.	1959	15	416	10	10	396	20	uPs	10	61	11/59	450	8	8.8	P		AA-Ce 70

Table 10. — Records for selected wells tapping the upper Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Ce 94	43201	A.A. Co. Dept. Public Works (Severndale #1)	Layne-Atlantic Co.	1961	90	550	10	10	530	20	uPs	61	116	9/61	500	24	9.1	P	Drilled to 560 ft.	AA-Ce 94
AA-Ce 96	43203	A.A. Co. Dept. Public Works (Severndale #3)	do.	1961	89	198	10	10	183	15	uPs	63	125	10/61	400	24	6.5	P	Drilled to 303 ft.	AA-Ce 96
AA-Ce 120	73-5414	A.A. Co. Dept. Public Works (Herald Harbor)	Sydnor Hydrodynamics	1976	161	471	6	4	445	20	uPs	148	-	3/76	100	2	-	U	Drilled to 1,340 ft.	AA-Ce 120
AA-Cf 2	-	A.A. Co. Dept. Public Works (Gibson Island #1)	Shannahan Artesian Well Co.	1929	25	323	10	6	298	25	uPs	13	-	9/59	100	-	-	P	Drilled to 324 ft.	AA-Cf 2
AA-Cf 22	6923	A.A. Co. Dept. Public Works (Gibson Island #2)	Layne-Atlantic Co.	1950	25	319	10	8	304	15	uPs	19	- 90	1/51 1950	300	36	4.2	P		AA-Cf 22
AA-Cf 62	14758	A.A. Co. Dept. Public Works (Belvedere Heights #1)	do.	1954	58	325	12	6	310	15	uPs	63	76	4/54	150	4	11.5	P		AA-Cf 62
AA-Cf 64	24455	A.A. Co. Dept. Public Works (Belvedere Heights #2)	do.	1956	65	332	8	8	312	20	uPs	54	100	10/56	465	8	10.1	P		AA-Cf 64
AA-Cf 117	73-4309	Utility Service Corp. (Whispering Woods #1)	Frank's Well Drilling, Inc.	1975	100	500	6	4	490	10	uPs	116	131	5/75	200	18	13.3	P		AA-Cf 117
AA-Cf 118	73-5564	A.A. Co. Dept. Public Works (Arnold #2)	Sydnor Hydrodynamics	1976	120	551	18	12	387	113	uPs	119	192	5/76	754	24	10.3	P	Drilled to 610 ft. Screened 387-390 ft, 404-424 ft, 428-443 ft, 450-455 ft, 470-495 ft, 502-522 ft, 526-541 ft.	AA-Cf 118
AA-Cf 119	73-5562	A.A. Co. Dept. Public Works (Arnold #1)	do.	1976	125	565	18	12	429	107	uPs	130	187	8/76	754	24	13.2	P	Drilled to 600 ft. Screened 429-432 ft, 436-468 ft, 474-508 ft, 516-554 ft.	AA-Cf 119
AA-Cf 120	73-5563	A.A. Co. Dept. Public Works (Arnold #3)	do.	1976	120	560	18	12	423	85	uPs	124	186	10/76	754	24	12.2	P	Drilled to 600 ft. Screened 423-426 ft, 450-498, 514-548 ft.	AA-Cf 120
AA-Cf 126	73-5689	Utility Service Corp. (Whispering Woods #2)	Frank's Well Drilling, Inc.	1976	100?	480	6	4	465	15	uPs	109	157	4/76	180	5	3.8	P		AA-Cf 126
AA-Cf 127	73-5854	Utility Service Corp. (Whispering Woods #3)	do.	1976	100?	466	6	4	456	10	uPs	94	134	5/76	230	12	5.8	P	Drilled to 475 ft.	AA-Cf 127
AA-Cg 18	66-1439	Westinghouse Electric Co. (Well #2)	Layne-Atlantic Co.	1966	8	530	14	6	510	20	uPs	8	25	6/66	100	24	5.9	N	Drilled to 545 ft.	AA-Cg 18

Table 10. — Records for selected wells tapping the upper Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
AA-Cg 19	67-0122	Westinghouse Electric Co. (Well #1)	Layne-Atlantic Co.	1966	8	518	14	6	498	20	uPs	6	41	11/66	349	24	10.0	N	Drilled to 538 ft.	AA-Cg 19
AA-Cg 24	73-8960	U.S. Geological Survey (Sandy Pt. State Pk.)	Sydnor Hydrodynamics	1978	16	664	6 & 4	4	605	20	uPs	15	44	9/78	150	24	5.2	N	Drilled to 670 ft. Observation well.	AA-Cg 24
AA-De 93	66-1494	Annapolis Concrete Co.	Chas. Trifiltis	1966	85	440	6	3	420	20	uPs	76	110	6/66	120	1	3.5	N	Drilled to 471 ft.	AA-De 93
AA-De 95	68-0175	A.A. Co. Dept. Public Works (Truman Parkway)	Layne-Atlantic Co.	1967	72	480	6	6	465	15	uPs	68	91	8/67	267	8	11.5	U	Drilled to 612 ft. Observation well with recorder.	AA-De 95
AA-De 96	68-0188	A.A. Co. Dept. Public Works (Truman Parkway)	do.	1967	65	492	12	10	447	45	uPs	65	122	9/67	1001	30	17.6	P		AA-De 96
AA-De 97	68-0189	A.A. Co. Dept. Public Works (Truman Parkway)	do.	1967	90	495	12	10	445	50	uPs	84	150	10/67	1001	30	15.2	P	Drilled to 563 ft.	AA-De 97
AA-Df 12	-	U.S. Naval Academy (Well #11)	do.	1939	10	593	18	8?	526	67	uPs	2	107	1/39	1510	-	14.4	U		AA-Df 12
AA-Df 13	-	U.S. Naval Academy (Well #12)	do.	1944	14	588	18	8	518	70	uPs	-	107?	-	1280	-	-	U	Drilled to 606 ft.	AA-Df 13
AA-Df 16	-	U.S. Naval Ship R & D Center (Well #2)	do.	1944	8	583	12	6	513	70	uPs	Flowing	50	9/44	620	-	<12	-	Drilled to 597 ft.	AA-Df 16
AA-Df 65	10550	U.S. Naval Ship R & D Center (Well #4)	do.	1952	52	590	18	8	535	50	uPs	65 61M	120 181M	11/52 4/69	650	24	11.8	-	Drilled to 612 ft. Screened 535-575 ft, 580-590 ft.	AA-Df 65
AA-Df 79	37867	U.S. Naval Academy (Observation well)	do.	1960	5	695	6	6	572	40	uPs	Flowing 7	60	3/60 6/69	300	-	5.0	U	Drilled to 705 ft. Screened from 300-320 ft, 572-592 ft, 675-695 ft. Packer is between the upper and middle screens.	AA-Df 79
AA-Df 80	40906	U.S. Naval Academy (Well #13)	do.	1960	5	696	20-12	12	568	55	uPs	7	152	12/60	1548	12	10.7	U	Drilled to 698 ft. Screened 568-598 ft, 671-696 ft.	AA-Df 80
AA-Df 83	69-0494	U.S. Naval Academy (Well #14)	do.	1969	65	705	20-12	12	532	85	uPs	73	135	3/69	1200	24	19.4	P	Drilled to 808 ft. Screened 532-557 ft, 564-589 ft, 620-640 ft, 685-700 ft.	AA-Df 83
AA-Df 89	70-0806	U.S. Naval Academy Golf Assoc.	do.	1970	20	535	16	8?	505	30	uPs	20	85	6/70	305	12	4.7	N	Drilled to 566 ft.	AA-Df 89
PG-Eb 26	25967	Washington Suburban San. Comm. (Fort Foote)	do.	1957	151	578	12	12	239	75	uPs	143	256	4/57	697	12	6.2	P	Drilled to 828 ft. Observation well from 1964. Screened 239-259 ft, 347-372 ft, 548-578 ft.	PG-Eb 26
PG-Fb 36	24834	Broadwater Estates, Inc.	Washington Pump & Well Co.	1957	78	284	8	8	268	13	uPs	62 84	180	5/57 7/61	80	12	0.7	U	Observation well from 7/61.	PG-Fb 36

Table 10. — Records for selected wells tapping the upper Patapsco aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
PG-Hf 38	73-0172	Potomac Electric Power Co. (Chalk Point #6B)	Shannahan Artesian Well Co.	1974	12	1066	12	6	964	67	uPs	7	98	3/74	513	24	5.6	N	Observation well from 7/75. Screened 964-974 ft, 1,009-1,066 ft.	PG-Hf 38

Table 11. — Records for selected wells tapping the Magothy aquifer

Use of Water Codes: C = Commercial H = Domestic N = Industrial P = Public Supply U = Unused

Water-Bearing Formation Codes: Mg = Magothy

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches) CASING	DIAMETER OF WELL (inches) SCREEN	DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA: WATER LEVEL (feet below land surface) STATIC	PUMPING	DATE	YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)	USE OF WATER	REMARKS	WELL NUMBER
AA-Cc 62	23114	Lo-Mar-Ro Trailer Park	Layne-Atlantic Co.	1956	97	88	6	6	83	5	Mg	36	80	5/56	178	4	4.0	P		AA-Cc 62
AA-Cc 98	70-0540	Emory E. Hamilton	H. J. Greer Drilling Co.	1970	110	87	4	2	82	5	Mg	60	65	4/70	12	1	2.4	H		AA-Cc 98
AA-Cd 11	-	Crownsville State Hospital (Owner #1)	Shannahan Artesian Well Co.	1930	105	226	10	10	206	20	Mg	79 73	106	1930 4/51	308	-	11.4	U	Drilled to 232 ft.	AA-Cd 11
AA-Cd 43	12737	Crownsville State Hospital (Owner #3)	do.	1953	130	285	10	8	255	30	Mg	103	151	9/53	365	12	7.6	U	Drilled to 394 ft.	AA-Cd 43
AA-Cd 50	25525	Crownsville State Hospital (Owner #4)	do.	1957	131	276	10	8	249	27	Mg	110	170	1/57	415	24	6.9	U	Drilled to 299 ft.	AA-Cd 50
AA-Cd 72	42495	Crownsville State Hospital (Owner #5)	do.	1961	130	269	10	8	244	25	Mg	110	214	5/61	404	24	3.9	U	Drilled to 300 ft.	AA-Cd 72
AA-Cd 93	54254	Summer Hill Trailer Park	R. M. Leatherbury	1964	135	201	4	2	185	16	Mg	120	127	1/64	20	6	2.9	P		AA-Cd 93
AA-Cd 94	73-2448	do.	H. H. Bunker & Sons, Inc.	1973	145	207	4	2	197	10	Mg	123	160	8/73	30	24	0.8	P		AA-Cd 94
AA-Ce 69	36387	A.A. Co. Dept. Public Works (Pines-On-Severn #1)	Layne-Atlantic Co.	1959	15	203	10	10	183	20	Mg	15 12	88	10/59 1/60	440	24	6.0	P	Drilled to 207 ft.	AA-Ce 69
AA-Ce 99	66-0871	Epping Forest Water Co. (Well #2)	Columbia Pump & Well Co.	1966	10	94	6	6	76	18	Mg	0	65	3/66	70	8	1.1	P		AA-Ce 99
AA-Ce 110	70-0419	David H. Mooney, Jr.	C. C. Purner Well Drilling Co.	1969	76	125	4	2?	105	20	Mg	73 79	85	12/69 2/70	10	2	0.8	H		AA-Ce 110
AA-Ce 111	68-0624	Thomas R. Buttion	H.H. Bunker & Sons, Inc.	1968	25	132	4	2	127	5	Mg	21	50	1/68	80	3	2.8	H		AA-Ce 111
AA-Ce 119	73-1300	Epping Forest Water Co.	East Coast Well & Pump, Inc.	1973	10	105	8	6	88	17	Mg	3	56	8/73	90	8	1.7	P		AA-Ce 119
AA-Cg 6	4686	Maryland Park Service (Sandy Point State Park #1)	Layne-Atlantic Co.	1949	19	268	6	4	258	10	Mg	8 14	80	9/49 4/72	220 200	8	3.0	P	Drilled to 278 ft.	AA-Cg 6
AA-Cg 7	5228	Maryland Park Service (Sandy Point State Park #3)	do.	1950	17	275	10	8	260	15	Mg	24 11	115	2/50 3/50	210	-	2.3	P		AA-Cg 7
AA-Cg 8	5228	Maryland Park Service (Sandy Point State Park #2)	do.	1950	18	272	10	8	257	15	Mg	21 10	63	2/50 3/66	250	-	6.0	P		AA-Cg 8
AA-Dd 24	20365	Benjamin Watkins, 3rd.	Cyphers	1955	164	235	4	-	230	-	Mg	130 130	165	8/55 10/60	3	-	0.1	H		AA-Dd 24

Table 11. — Records for selected wells tapping the Magothy aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches) CASING	DIAMETER OF WELL (inches) SCREEN	DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA: WATER LEVEL (feet below land surface) STATIC	PUMPING	DATE	YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)	USE OF WATER	REMARKS	WELL NUMBER
AA-Dd 41	71-0231	U.S. Geological Survey (Rutland Rd.)	East Coast Well & Pump, Inc.	1970	105	372	2	2?	360	12	Mg	81	-	4/71	8	-	-	U	Observation well.	AA-Dd 41
AA-Dd 42	71-0231	U.S. Geological Survey (Rutland Rd.)	do.	1970	105	275	4	2	190	30	Mg	82	114	10/70	65	8	2.1	U	Screened 190-200 ft, 225-235 ft, 265-275 ft. Observation well.	AA-Dd 42
AA-De 1	-	City of Annapolis (Well #1)	Layne-Atlantic Co.	1939	14	237	10	6	-	30	Mg	Flowing	181?	2/43	400	-	5.3	U		AA-De 1
AA-De 2	-	City of Annapolis (Well #2)	do.	1939	14	258	18	8	-	45	Mg	Flowing	181?	2/43	700	-	10.0	P		AA-De 2
AA-De 45	1627	City of Annapolis (Well #6)	do.	1947	28	242	20	10	192	52	Mg	8	110	8/47	1000	48	9.8	P		AA-De 45
AA-De 46	1628	City of Annapolis (Well #5)	do.	1947	24	248	20	10	199	49	Mg	12	110	7/47	1000	24	10.2	P	Drilled to 300 ft.	AA-De 46
AA-De 69	22000	Sylvan Shores Service Co.	H. H. Bunker & Sons, Inc.	1956	65	325	6	6	313	12	Mg	42	110	4/56	240	24	3.5	P		AA-De 69
AA-De 88	17076	City of Annapolis (Well #7)	Shannahan Artesian Well Co.	1955	120	345	20	10	287	58	Mg	120	145	3/55	600	24	24.0	P	Drilled to 347 ft.	AA-De 88
AA-De 100	-	U.S. Geological Survey (Annapolis Jr. H.S.)	Ideal Well Drillers, Inc.	1968	41	350	2	2?	340	10	Mg	-	-	-	-	-	-	U	Observation well.	AA-De 100
AA-De 122	73-1868	Sylvan Shores Service Co.	H. H. Bunker & Sons, Inc.	1973	60	324	6	6	314	10	Mg	47	130	10/73	70	20	0.8	P		AA-De 122
AA-De 124	73-5055	A.A. Co. Dept. Public Works (Central Ave.)	Delmarva Drilling Co.	1975	28	480	2	2	350	30	Mg	15	25	11/75	2	14	0.2	U	Drilled to 1,100 ft.	AA-De 124
AA-Df 20	-	U.S. Navy (Radio Transmitter Station #4)	Washington Pump & Well Co.	1933	22	255	10	8	233	20	Mg	8 20	180	1933 5/69	28	-	0.2	U	Drilled to 680 ft. Screened 229-255 ft, 233-253 ft, 374-394 ft. Observation well.	AA-Df 20
AA-Df 64	2313	U.S. Naval Ship R & D Center (Well #3)	American Drilling Co.	1948	32	402	12	6	350	52	Mg	32	70	1969	500	-	13.2	P		AA-Df 64
AA-Df 79	37867	U.S. Naval Academy	Layne-Atlantic Co.	1960	5	320	6	6	300	20	Mg	Flowing	76	3/60	318	-	3.6	U	Drilled to 705 ft. Observation well.	AA-Df 79
AA-Df 82	54277	A.A. Co. Dept. Public Works (Providence)	do.	1964	88	371	8	8	346	20	Mg	95	160	1/64	200	12	3.1	U	Drilled to 664? ft.	AA-Df 82
AA-Ec 6	70-0726	Maryland Manor Homes (Well #1)	R. M. Leatherbury	1970	50	295	4	?	275	20	Mg	140	155	6/70	55	5	3.7	P		AA-Ec 6
AA-Ec 7	70-0727	Maryland Manor Homes (Well #2)	do.	1970	55	300	4	?	280	20	Mg	140	150	6/70	65	4	6.5	P		AA-Ec 7

Table 11. — Records for selected wells tapping the Magothy aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches) CASING	DIAMETER OF WELL (inches) SCREEN	DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA: WATER LEVEL (feet below land surface) STATIC	PUMPING	DATE	YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)	USE OF WATER	REMARKS	WELL NUMBER
AA-Ec 8	70-0728	Maryland Manor Homes (Well #3)	R. M. Leatherbury	1970	55	305	4	?	285	20	Mg	120	140	6/70	60	5	3.0	P		AA-Ec 8
AA-Ee 64	73-5693	Chesapeake Bay Village	C. Z. Enterprises	1976	20	538	6	6	508	30	Mg	9	174	7/76	80	48	0.5	U	Drilled to 572 ft. Observation well.	AA-Ee 64
CA-Ba 7	73-0094	Calvert Co. Div. Water & Sewerage (Shores of Calvert #2)	East Coast Well & Pump Co.	1973	51	473	6	6	448	25	Mg	42	98	8/73	150	24	2.7	P	Drilled to 475 ft.	CA-Ba 7
CA-Ba 8	73-0095	Calvert Co. Div. Water & Sewerage (Shores of Calvert #1)	do.	1973	51	473	6	6	448	21	Mg	42	196	6/73	300	24	1.9	P	Drilled to 475 ft.	CA-Ba 8
CA-Bb 23	71-0013	Calvert Co. Div. Water & Sewerage (Cavalier Country #1)	do.	1970	148	552	6	6	526	19	Mg	135	145	8/70	150	12	15.0	P	Drilled to 562 ft.	CA-Bb 23
CA-Bb 24	71-0012	Calvert Co. Div. Water & Sewerage (Cavalier Country #2)	do.	1970	137	542	6	6	522	20	Mg	120*	156*	8/70	150	12	4.2	P	*Measured from T.O.C.-not L.S.D.	CA-Bb 24
PG-Cf 33	34997	City of Bowie (Briardale La. #1)	C. W. Lauman & Co., Inc.	1959	113	192	20	12	110	82	Mg	65	103	9/59	500	8	13.2	P	Observation well from 7/61.	PG-Cf 33
PG-Cf 34	40717	City of Bowie (Sussex La.)	do.	1960	112	114	6	6	98	16	Mg	27	47	9/60	94	2	4.7	P		PG-Cf 34
PG-De 21	22875	Univ. of Maryland Tobacco Research Farm	Layne-Atlantic Co.	1956	105	155	6	6	150	5	Mg	40	49	4/56	30	5	3.4	U	Drilled to 167? ft. Observation well from 5/58.	PG-De 21
PG-Df 34	65-0098	Marlboro Meadows (Well #1)	Sydnor Hydrodynamics	1965	80	540	24	8	242	82	Mg	45	94	7/65	1016	12	20.7	P	Screened 242-262 ft, 270-281 ft, 322-338 ft, 369-379 ft, 384-394 ft, 409-424 ft.	PG-Df 34
PG-Df 36	68-0043	Marlboro Meadows (Well #2)	do.	1968	100	427	24	10	222	83	Mg	29	-	5/68	1200	72	-	P	Drilled to 500 ft. Screened 222-225 ft, 236-444 ft, 398-422 ft. Observation well from 1982.	PG-Df 36
PG-Df 39	69-0046	Marlboro Meadows (Sewage Treatment Plt. #3)	Layne-Atlantic Co.	1969	40	444	6	4	350	74	Mg	Flowing	50	5/69	250	24	1.0	P	Drilled to 474 ft. Screened 350-370 ft, 370-424 ft.	PG-Df 39
PG-Ee 3	2025	Northeast Marlboro Water System	Washington Pump & Well Co.	1948	150	321	6	6?	309	12	Mg	130	160	1/48	60	12	2.0	P		PG-Ee 3
PG-Ee 42	13029	Willie G. Sauerwein	do.	1953	220	325	6	6	315	10	Mg	175	244	12/53	65	24	1.0	U P?		PG-Ee 42
PG-Ef 14	18956	Safeway Stores, Inc.	do.	1955	20	232	8	8	204	26	Mg	+8	120	6/55	300*	24	2.4	C	Drilled to 264 ft. *At 85 ft below LSD pump tested 110 gpm At 90 ft below LSD pump tested 150 gpm At 120 ft below LSD pump tested 300 gpm	PG-Ef 14

Table 11. — Records for selected wells tapping the Magothy aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
PG-Ef 29	45504	Southern Maryland Tobacco Co.	Shannahan Artesian Well Co.	1962	50	272	6	5	256	15	Mg	11 9	41	3/62 4/62	60	4	2.0	N	Drilled to 274 ft.	PG-Ef 29
PG-Ef 37	70-0009	Washington Suburban San. Comm. (Western Br. Sew. Tr. Plt.)	Layne-Atlantic Co.	1969	20	341	26	8	281	60	Mg	Flowing	75	12/69	412	12	<5.6	N	Drilled to 464 ft.	PG-Ef 37
PG-Fd 5	3344	State of Maryland (Cheltenham Center)	Columbia Pump & Well Co.	1949	237	438	8	8	417	21	Mg	190 189	311	1/49 5/49	165	12	1.4	U		PG-Fd 5
PG-Fd 9	-	U.S. Navy (Communication Station)	----	1937	190	365	10	?	-	-	Mg	146	-	5/49	33	-	-	U		PG-Fd 9
PG-Fd 10	-	U.S. Navy (Communication Station)	Shannahan Artesian Well Co.	1944	190	366	8	8	-	-	Mg	137M 144	- -	3/63 7/49	40	-	-	U		PG-Fd 10
PG-Fd 11	3724	U.S. Navy (Communication Station)	do.	1949	230	438	8	8	396	46	Mg	78 184	245	5/49 7/49	239	12	3.9	U	Drilled to 444 ft.	PF-Fd 11
PG-Fd 35	9773	Cadillac Motel	Washington Pump & Well Co.	1952	200	436	6	5.5	430	6	Mg	145 148	208	5/52 6/52	70	50	0.3	C	Drilled to 442 ft.	PG-Fd 35
PG-Fd 40	19074	Brandywood Estates, Inc.	Layne-Atlantic Co.	1955	198	374	8	8?	344	30	Mg	149 150	221	6/55 7/61	225	49	3.3	U	Drilled to 394 ft. Observation well from 11/56-4/68.	PG-Fd 40
PG-Fd 41	18058	do.	do.	1955	198	362	4	2.5	352	10	Mg	146	166	3/55	38	4	1.9	U	Drilled to 388 ft. Observation well from 5/67.	PG-Fd 41
PG-Fd 55	24111	State of Maryland (Cheltenham Center)	Shannahan Artesian Well Co.	1956	215	439	16	8	388	39	Mg	173	210	7/56	303	24	8.1	U	Drilled to 456 ft. Screened 388-399 ft, 411-439 ft.	PG-Fd 55
PG-Fd 64	-	U.S. Navy (Communications Station White City)	Washington Pump & Well Co.	1951	220	--	-	-	-	-	Mg	-	-	-	250	11	-	U		PG-Fd 64
PG-Fe 32	65-0063	BFW Fabrication Co.	G & L Drilling, Inc.	1965	225	557	8	6	537	20	Mg	210	250	4/65	100	24	2.5	N		PG-Fe 32
PG-Fe 34	71-0018	The Larwin Group, Inc. (Brandywine Country Club)	Sydnor Hydrodynamics	1970	165	520	10	8	404	48	Mg	130	260	10/70	554	8	4.3	U	Drilled to 610 ft. Screened 404-414 ft, 426-440 ft, 490-502 ft, 508-520 ft.	PG-Fe 34
PG-Ge 15	70-0007	P.G. Co. Board of Education (Baden Elementary School #2)	Layne-Atlantic Co.	1969	211	692	12	8	672	20	Mg	187	207	10/69	150	12	7.5	U?	Drilled to 738 ft. Observation well from 2/74.	PG-Ge 15
PG-Ge 17	68-0011	Cedarville Trailer Park, Inc.	Shannahan Artesian Well Co.	1967	210	627	6	4	596	25	Mg	172	185	11/67	50	14	3.8	P	Screened 596-621 ft, 621-627 ft.	PG-Ge 17

Table 11. — Records for selected wells tapping the Magothy aquifer, continued

WELL NUMBER	STATE PERMIT NUMBER	OWNER OR NAME	CONTRACTOR	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (feet)	DEPTH OF WELL (feet)	DIAMETER OF WELL (inches)		DEPTH OF BOTTOM OF CASING OR TOP OF SCREEN (feet below land surface)	TOTAL SCREEN LENGTH (feet)	WATER-BEARING FORMATION	PUMPING TEST DATA						USE OF WATER	REMARKS	WELL NUMBER
												WATER LEVEL (feet below land surface)			YIELD (gal/min)	HOURS PUMPED	SPECIFIC CAPACITY (gal/min/ft)			
							CASING	SCREEN				STATIC	PUMPING	DATE						
PG-Hf 26	49920	Potomac Electric Power Co. (Chalk Point #2)	Shannahan Artesian Well Co.	1963	14	635	10	6	605	30	Mg	+1.6 Flowing	229	2/63 2/63	385	25	1.6	N	Drilled to 638 ft.	PG-Hf 26
PG-Hf 27	49921	Potomac Electric Power Co. (Chalk Point #3)	do.	1963	16	633	10	6	597	36	Mg	Flowing +9.7	182	4/63 6/63	400	26	2.1	N	Drilled to 650 ft. Screened 597-605 ft, 611-633 ft.	PG-Hf 27
PG-Hf 28	51271	Potomac Electric Power Co. (Chalk Point #1)	do.	1963	7	623	10	6	593	30	Mg	Flowing	224	5/63	400	26	<1.7	N	Drilled to 640 ft.	PG-Hf 28
PG-Hf 33	73-0065	Potomac Electric Power Co. (Chalk Point #5)	do.	1973	9	639	12	10	596	43	Mg	35	206	9/73	511	24	3.0	N	Observation well from 7/75.	PG-Hf 33
PG-Hf 36	73-0140	Potomac Electric Power Co. (Chalk Point #6A)	do.	1973	12	634	12	10	605	29	Mg	32	201	11/73	506	24	3.0	U?	Observation well from 7/75.	PG-Hf 36

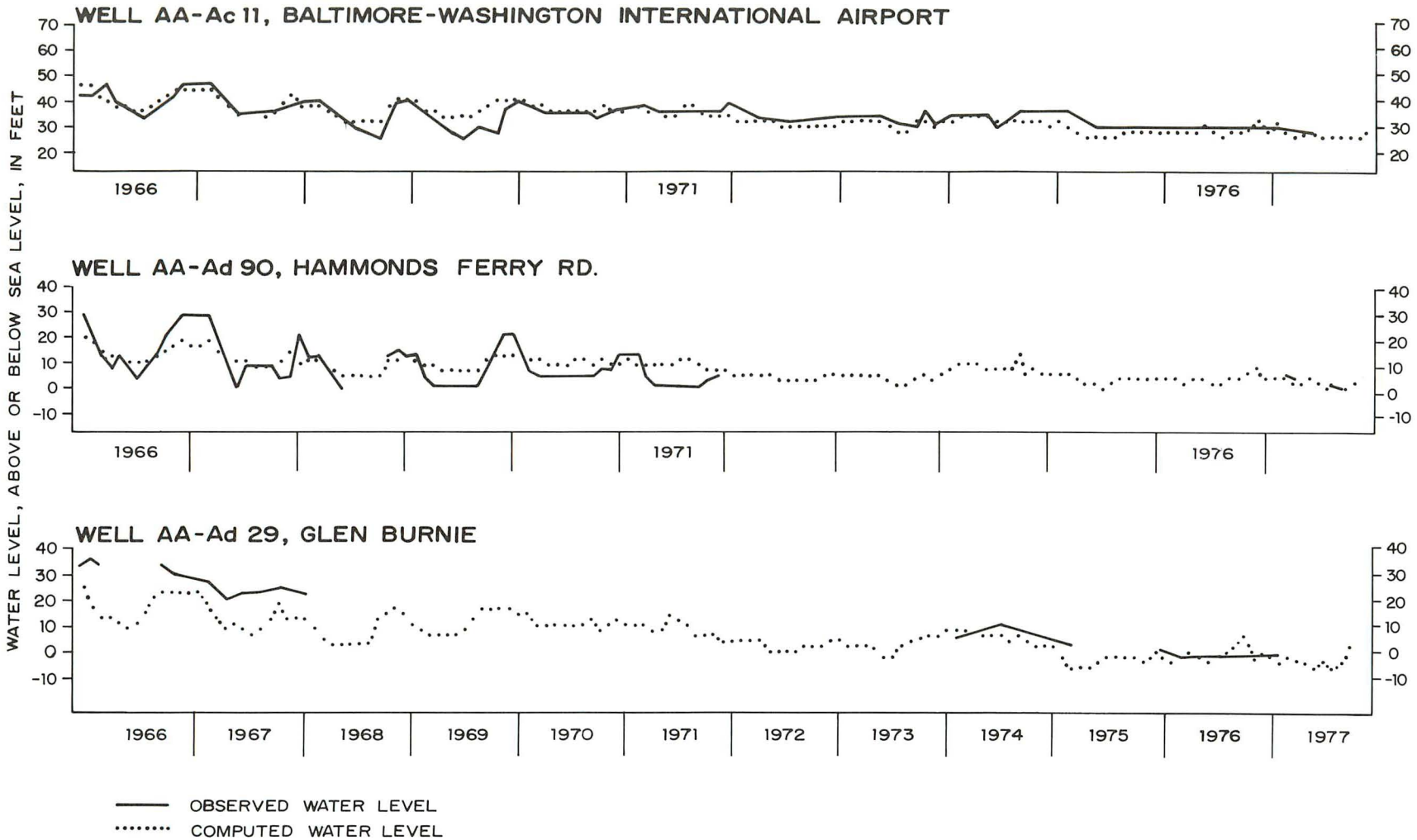


Figure 38. — Computed and observed hydrographs for wells in the Patuxent aquifer: AA-Ac 11, AA-Ad 90, and AA-Ad 29.

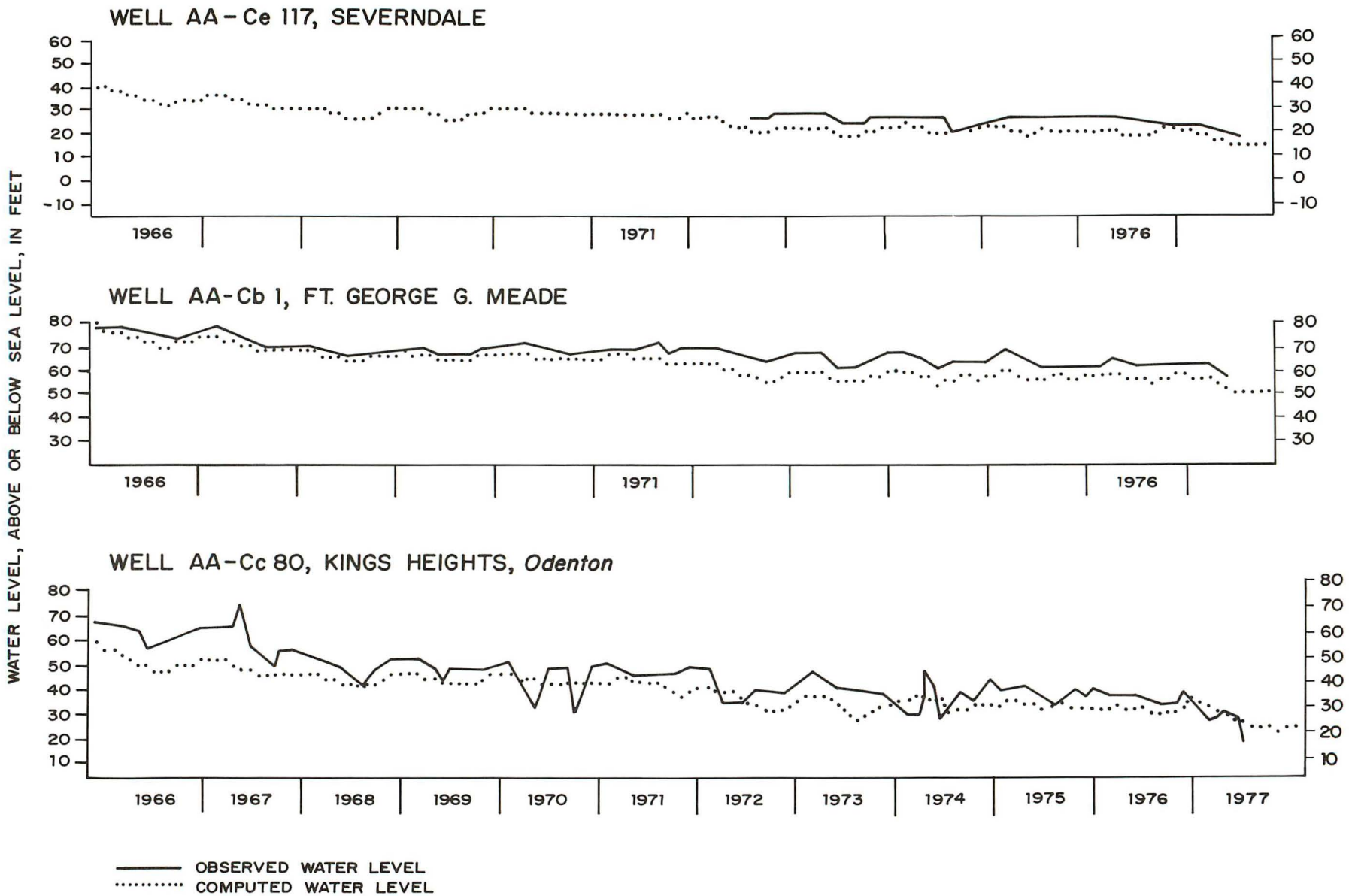


Figure 39. — Computed and observed hydrographs for wells in the Patuxent aquifer: AA-Ce 117, AA-Cb 1, and AA-Cc 80.

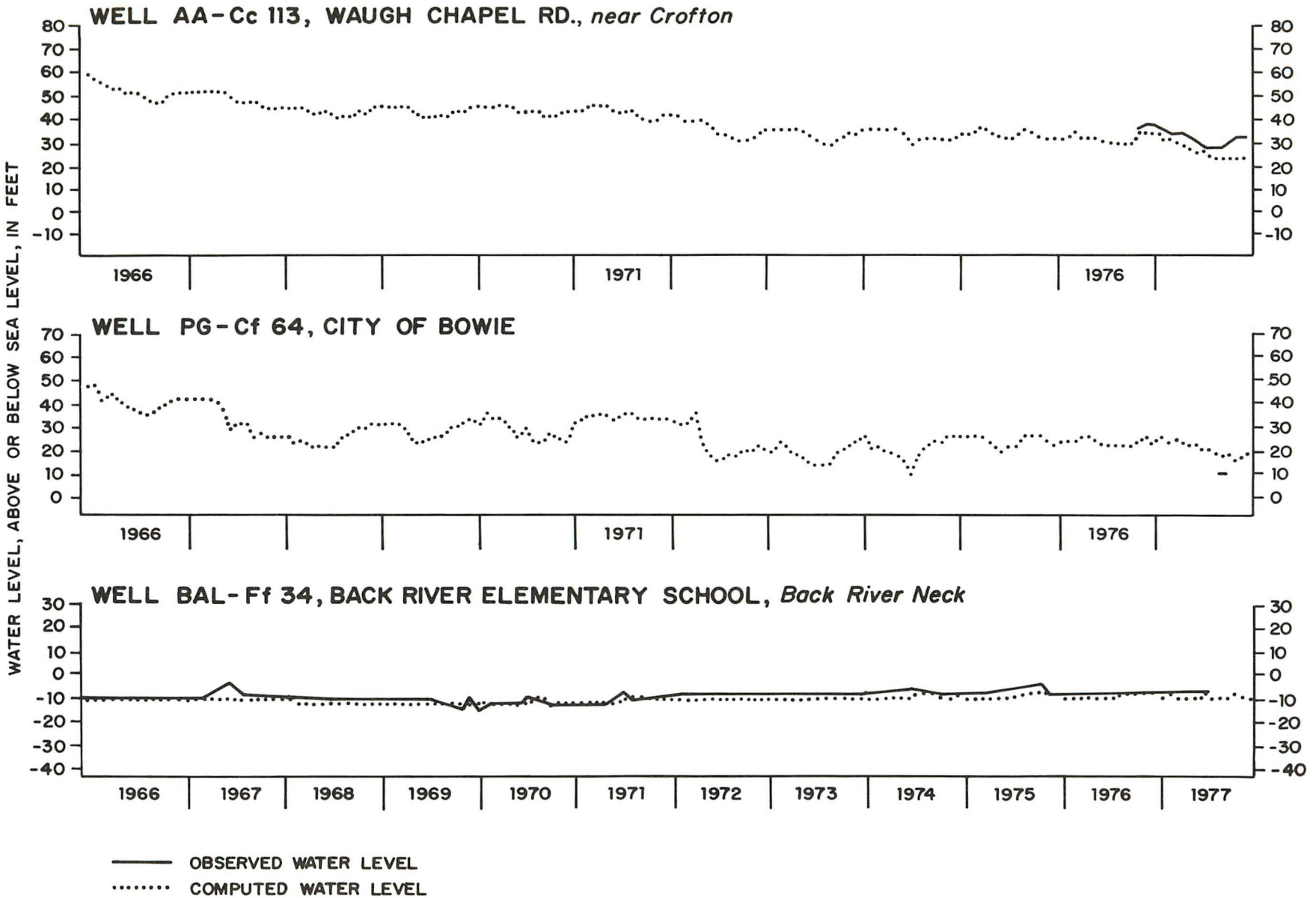


Figure 40. — Computed and observed hydrographs for wells in the Patuxent aquifer: AA-Cc 113, PG-Cf 64, and BA-Ff 34.

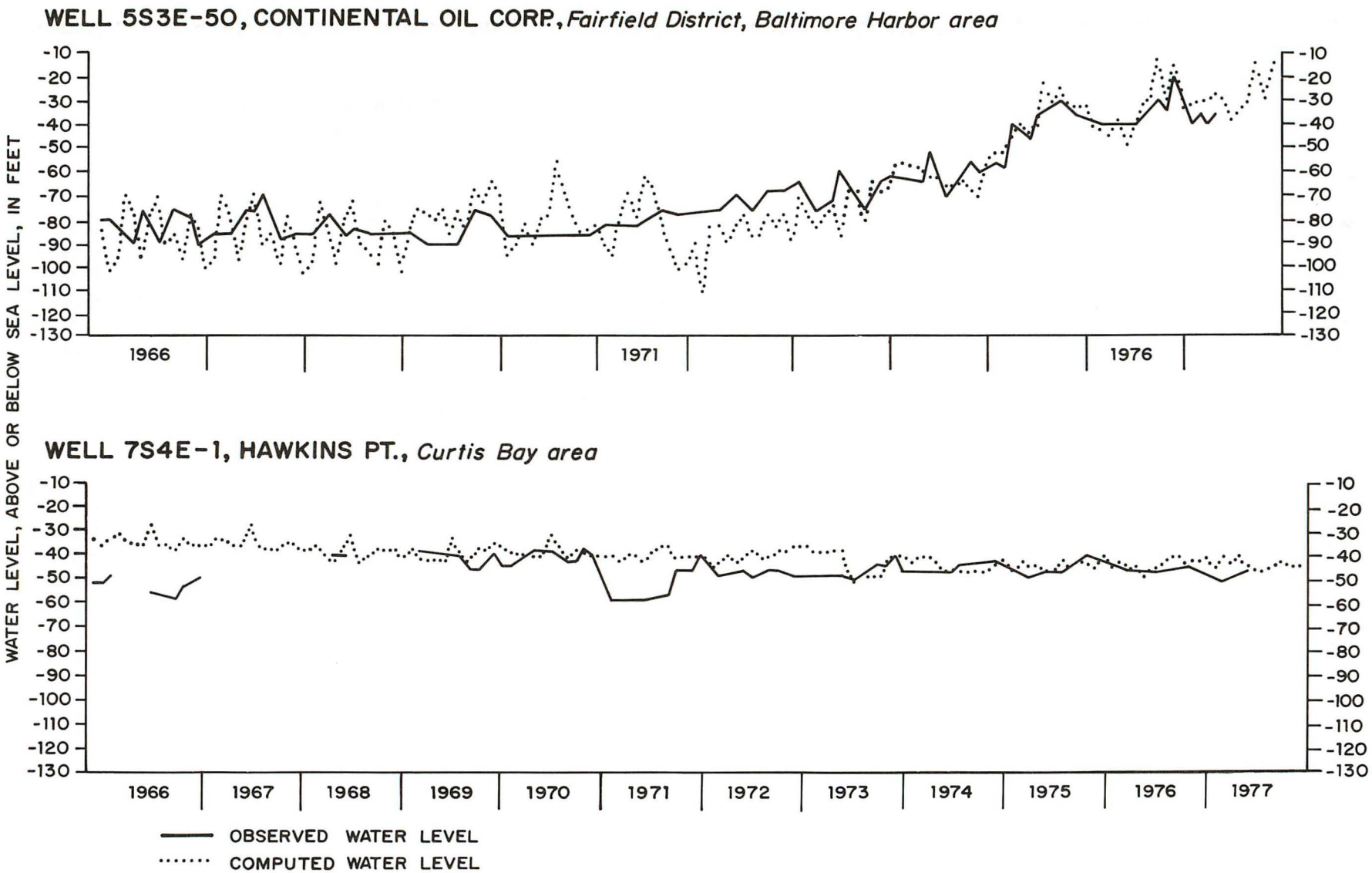


Figure 41. — Computed and observed hydrographs for wells in the Patuxent aquifer: 5S3E-50 and 7S4E-1.

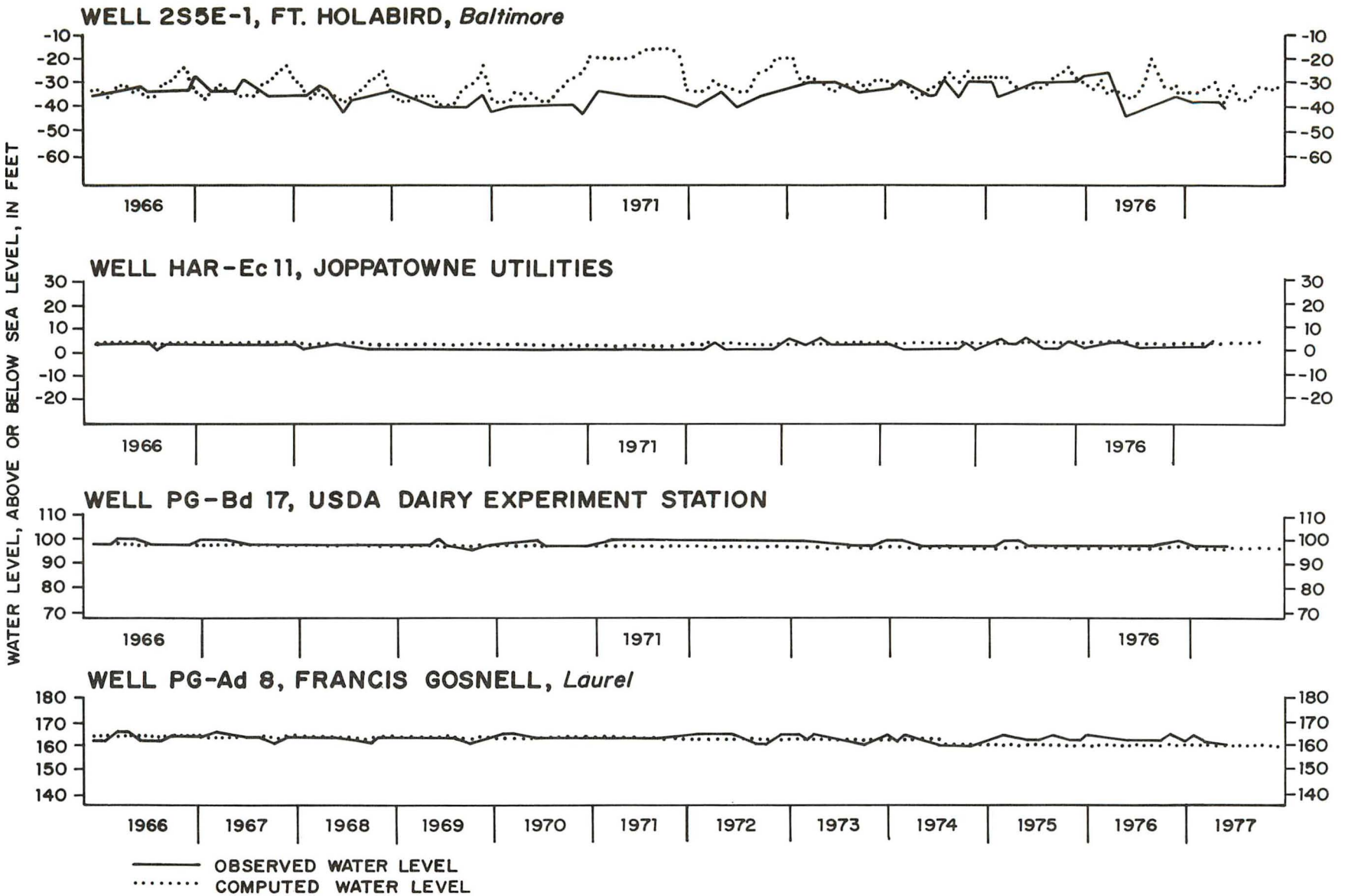


Figure 42. — Computed and observed hydrographs for wells in the Patuxent aquifer: 2S5E-1, HA-Ec 11, PG-Bd 17, and PG-Ad 8.

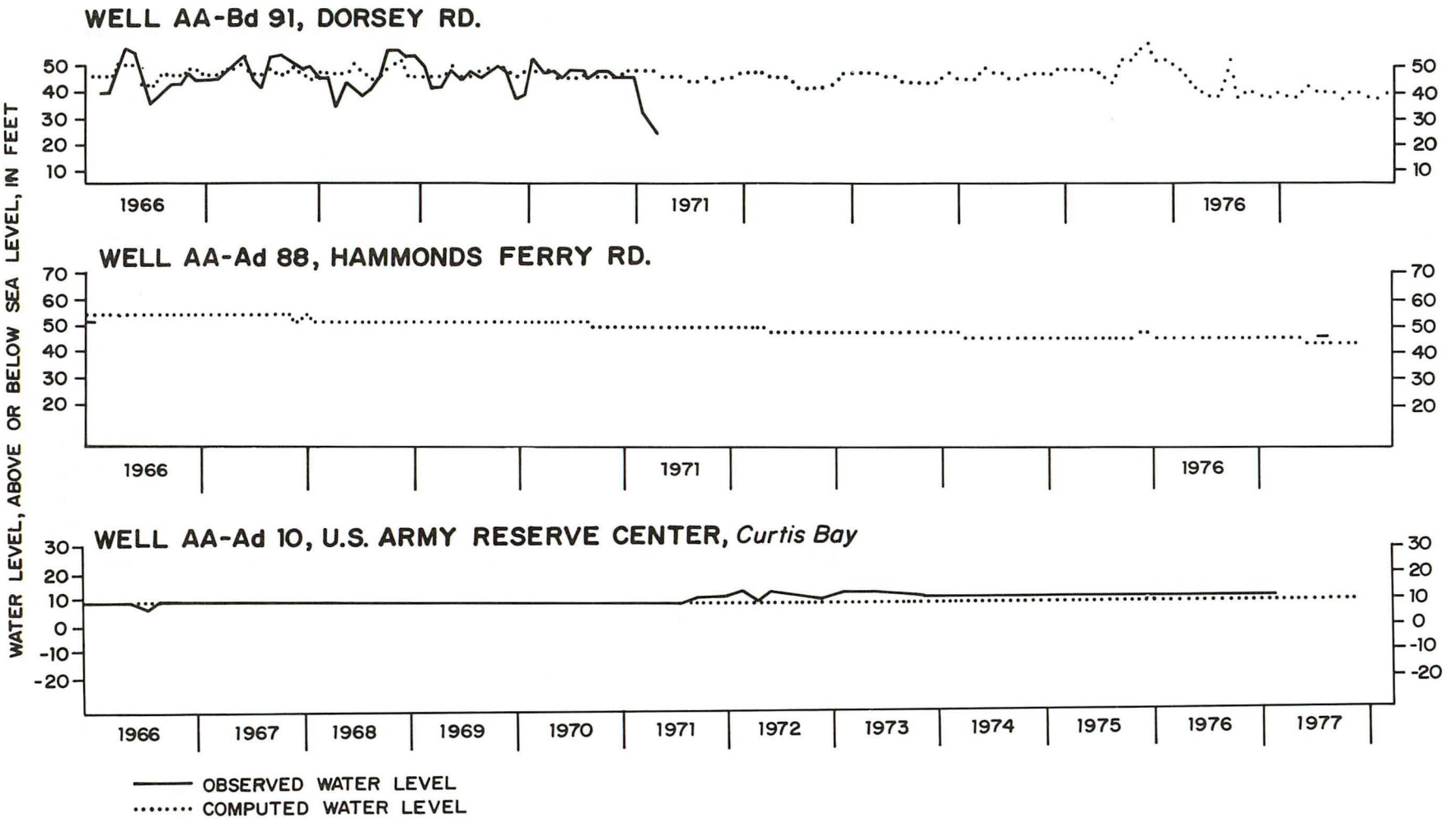


Figure 43. — Computed and observed hydrographs for wells in the lower Patapsco aquifer: AA-Bd 91, AA-Ad 88, and AA-Ad 10.

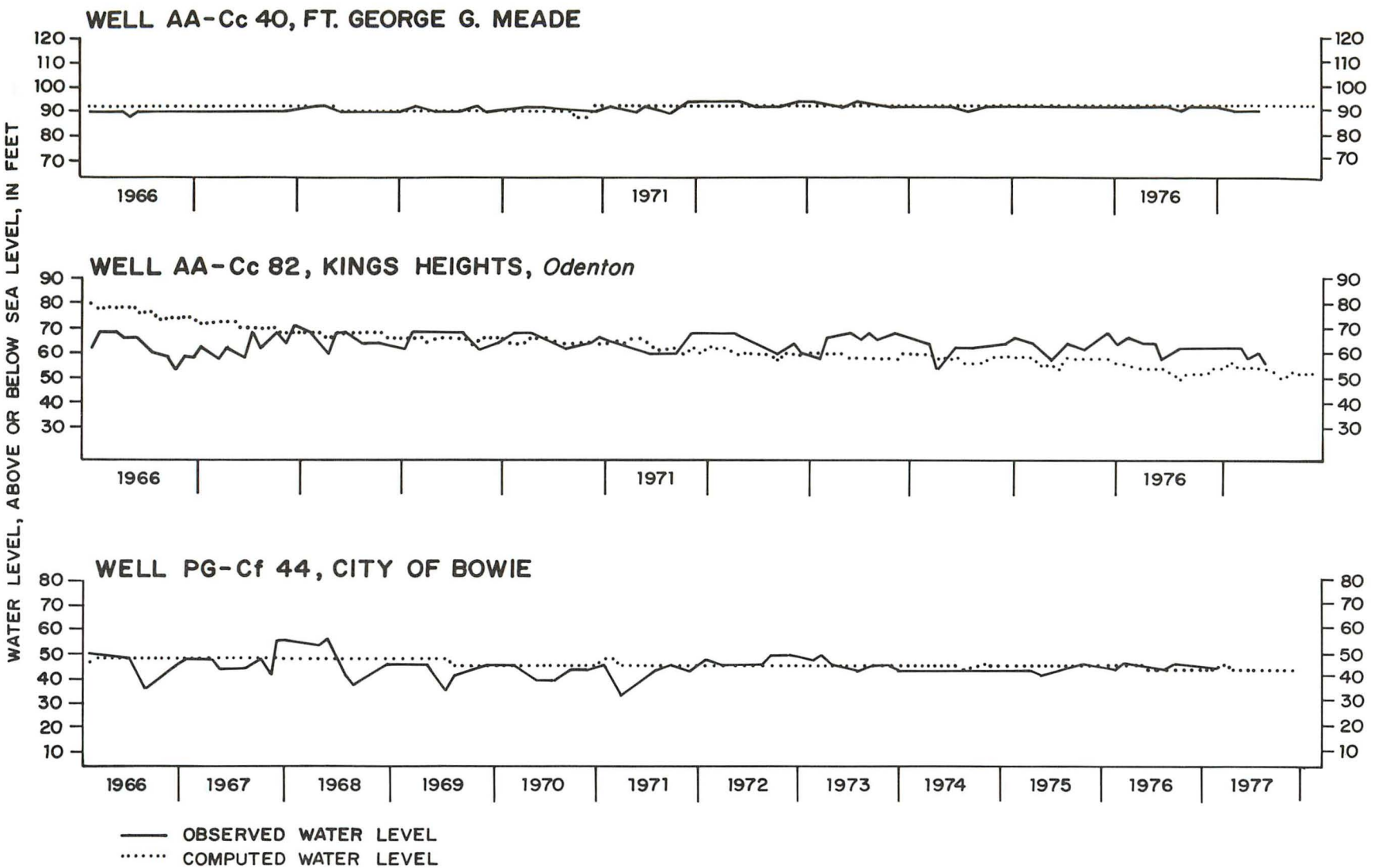


Figure 44. — Computed and observed hydrographs for wells in the lower Patapsco aquifer: AA-Cc 40, AA-Cc 82, and PG-Cf 44.

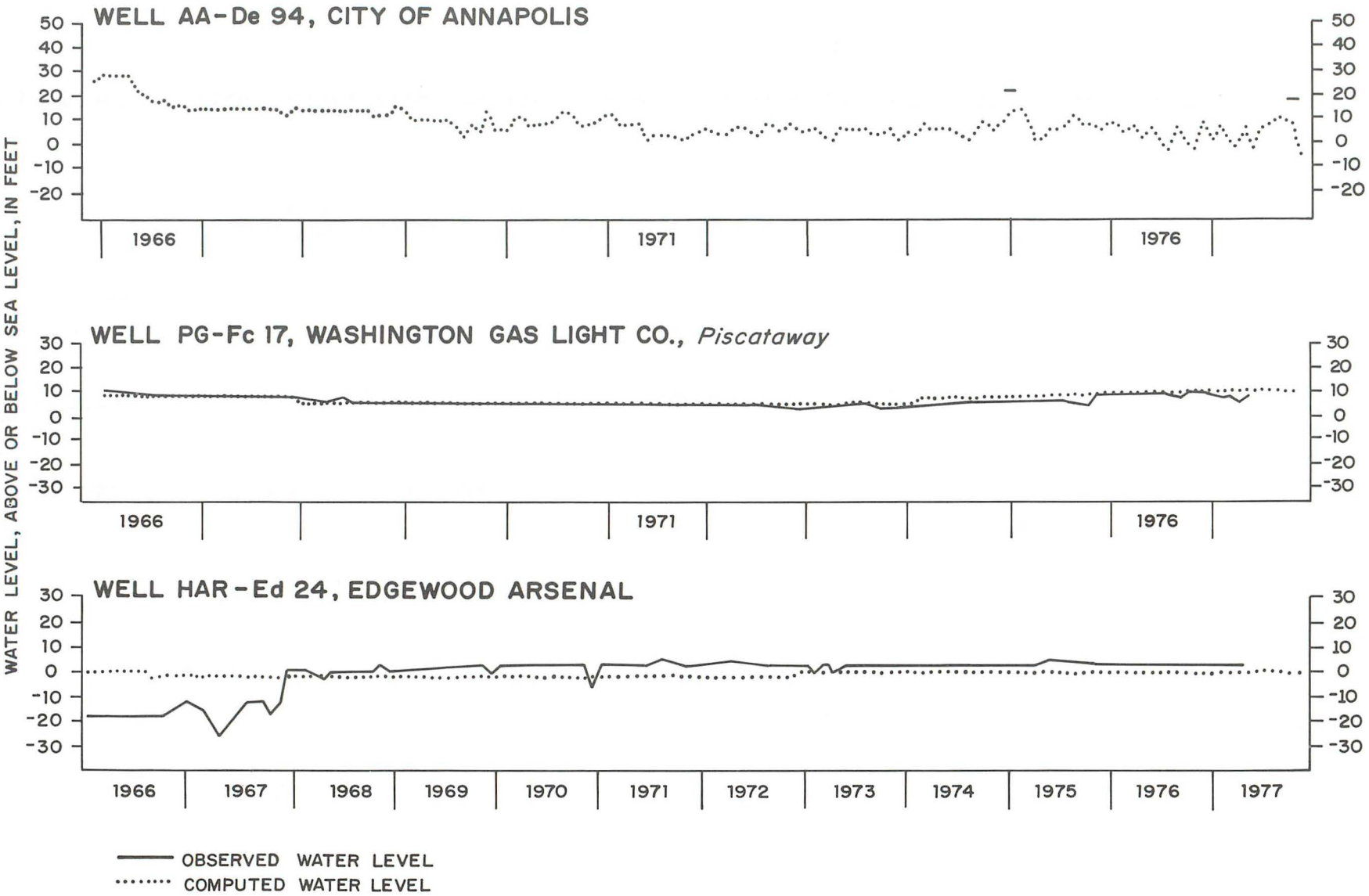


Figure 45. — Computed and observed hydrographs for wells in the lower Patapsco aquifer: AA-De 94, PG-Fc 17, and HA-Ed 24.

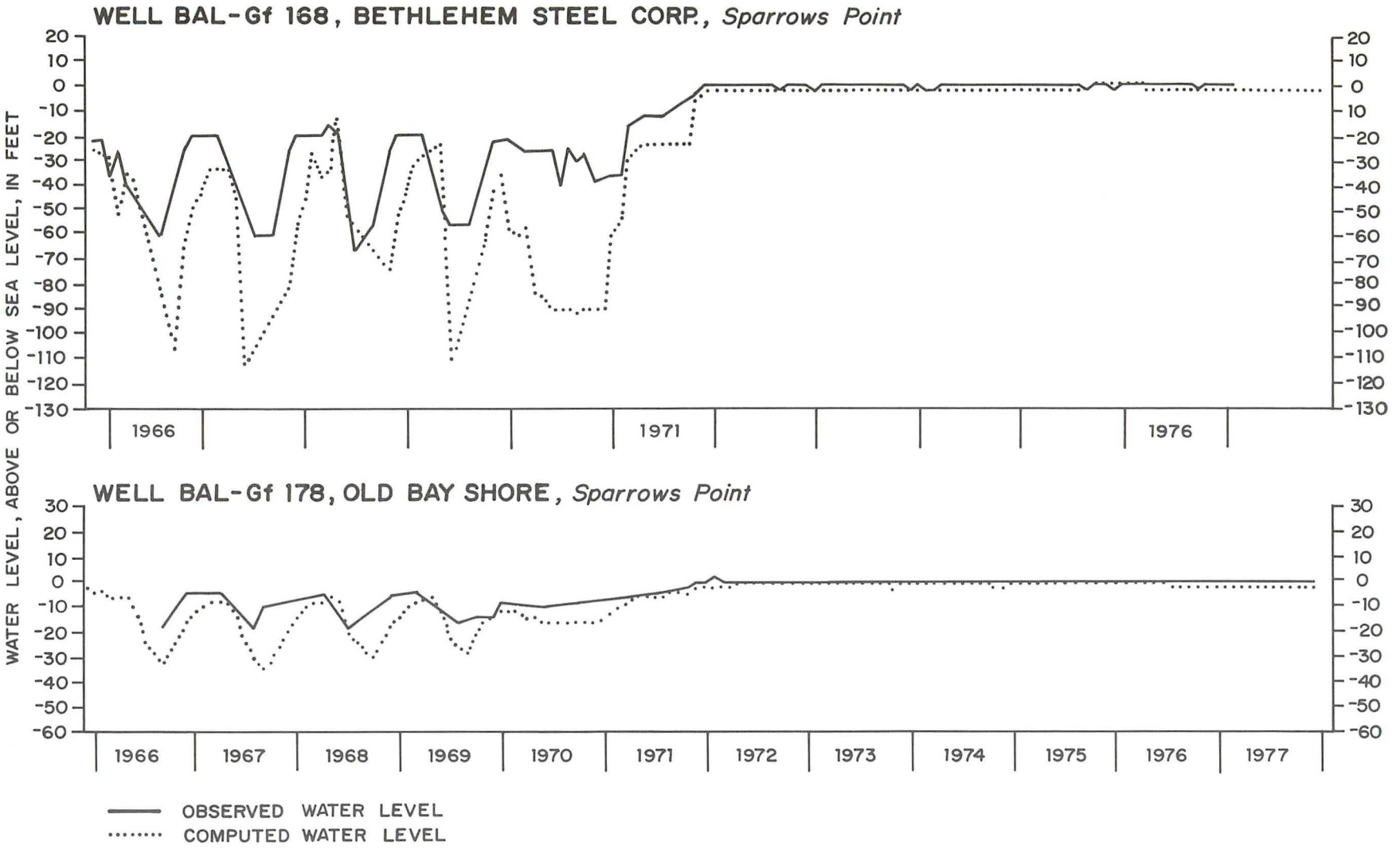


Figure 46. — Computed and observed hydrographs for wells in the lower Patapsco aquifer: BA-Gf 168 and BA-Gf 178.

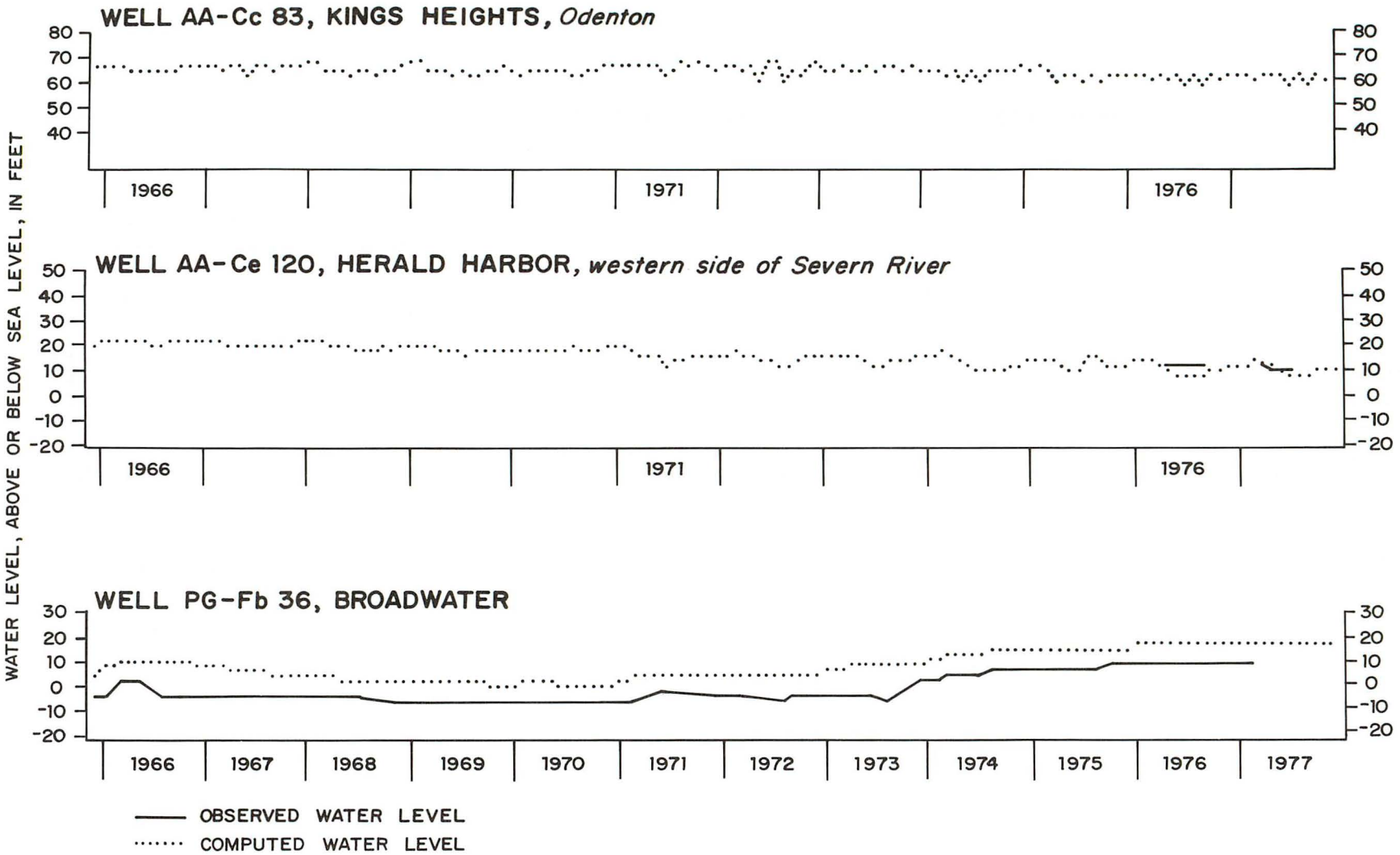


Figure 47. — Computed and observed hydrographs for wells in the upper Patapsco aquifer: AA-Cc 83, AA-Ce 120, and PG-Fb 36.

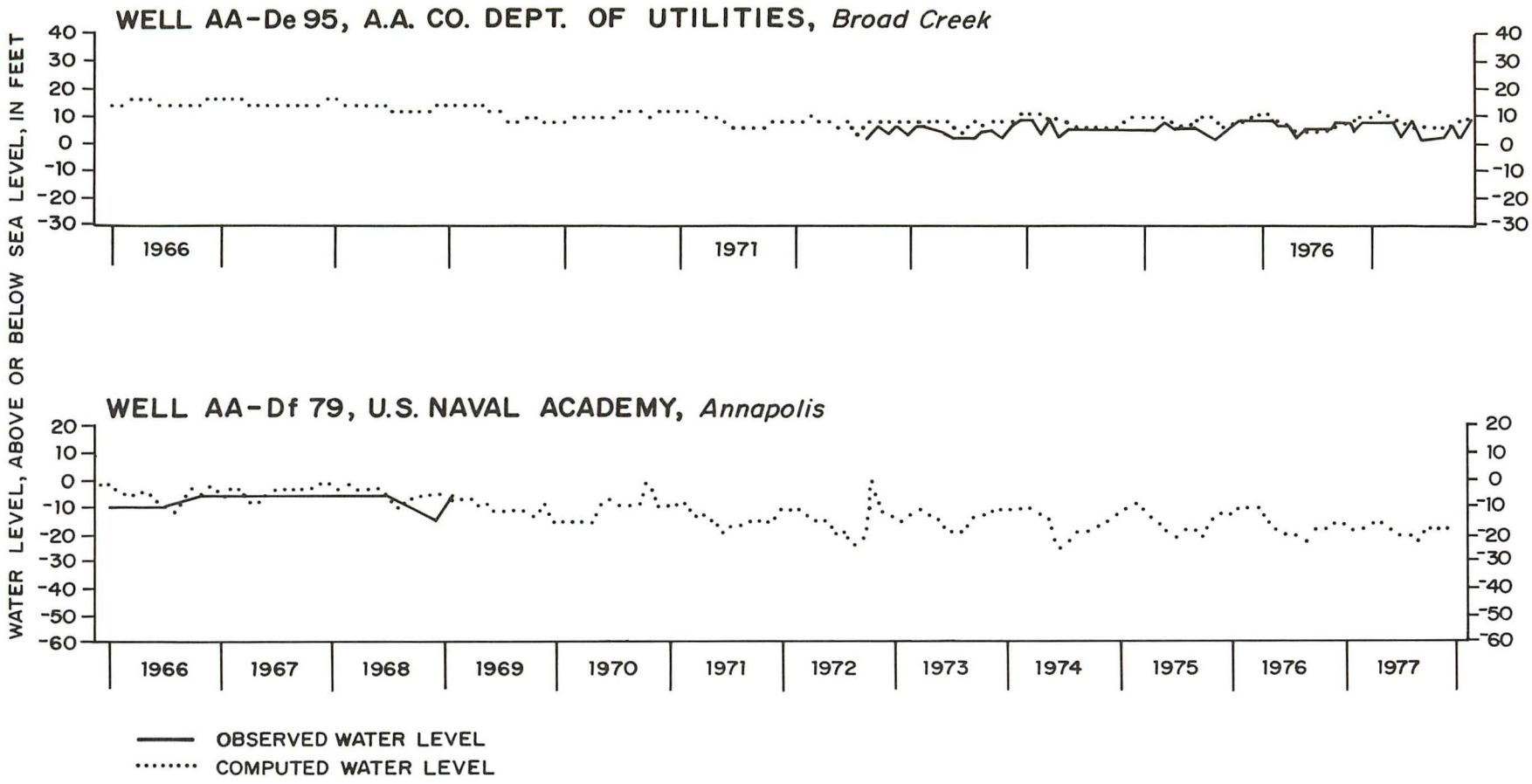


Figure 48. — Computed and observed hydrographs for wells in the upper Patapsco aquifer: AA-De 95 and AA-Df 79.

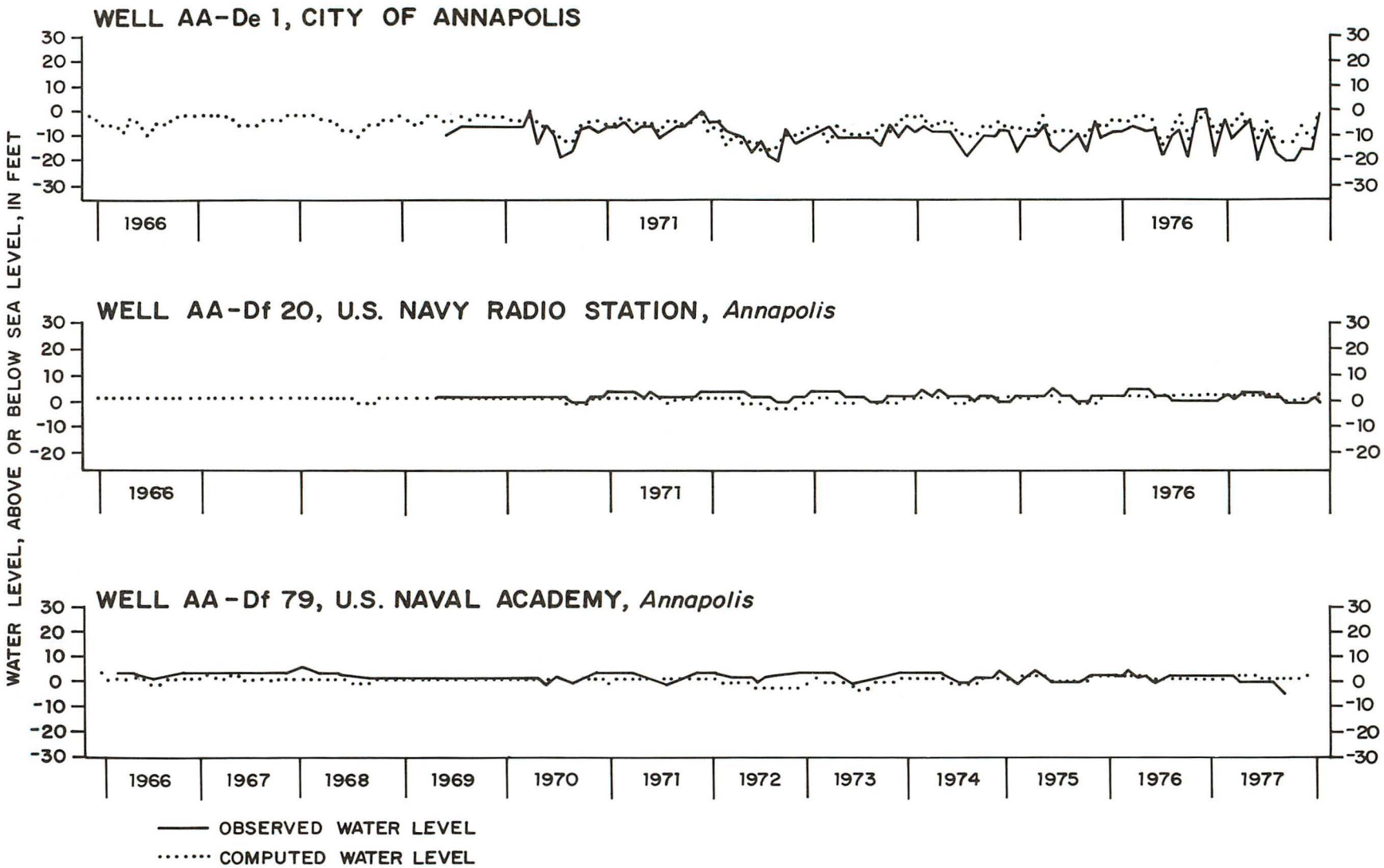


Figure 49. — Computed and observed hydrographs for wells in the Magothy aquifer: AA-De 1, AA-Df 20, and AA-Df 79.

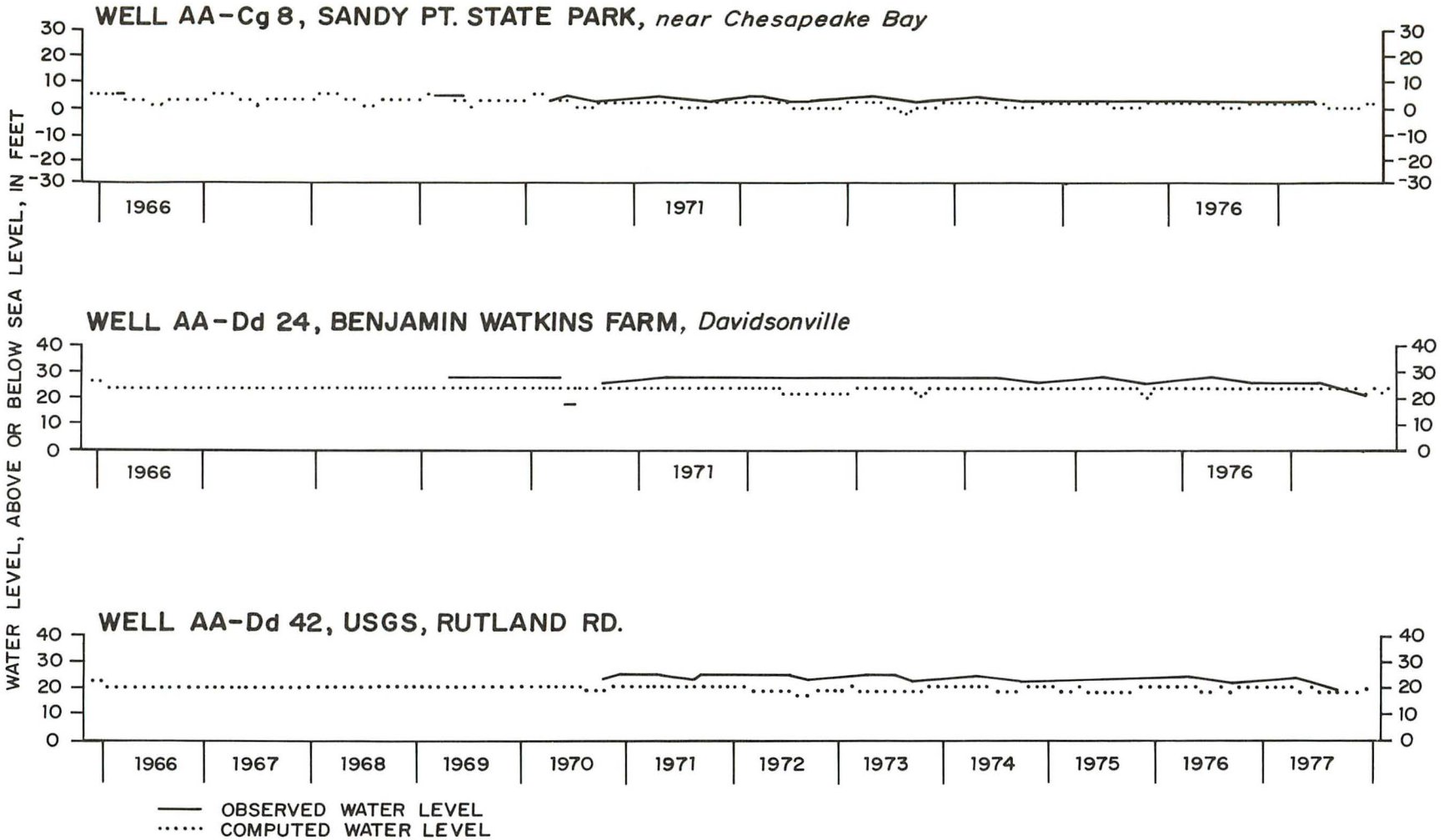


Figure 50. — Computed and observed hydrographs for wells in the Magothy aquifer: AA-Cg 8, AA-Dd 24, and AA-Dd 42.

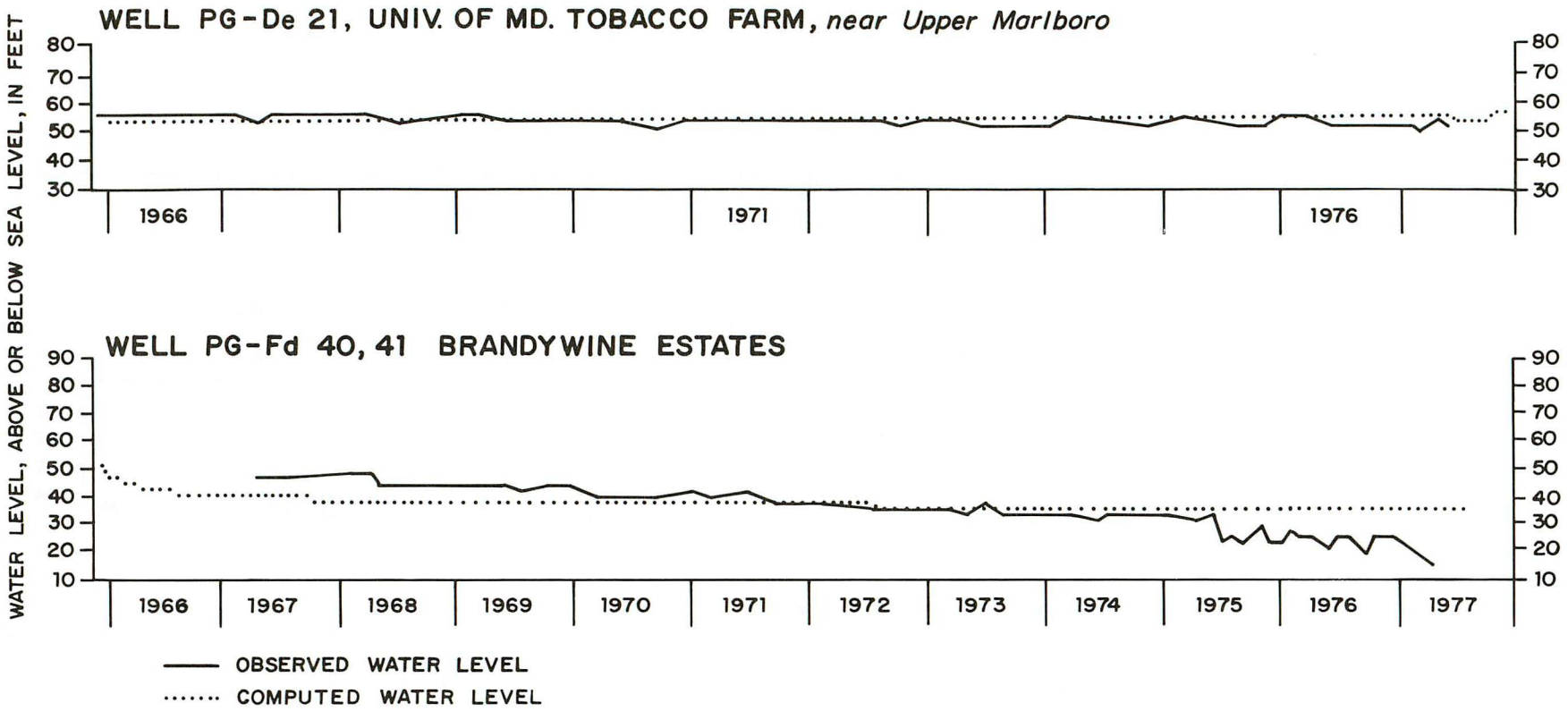
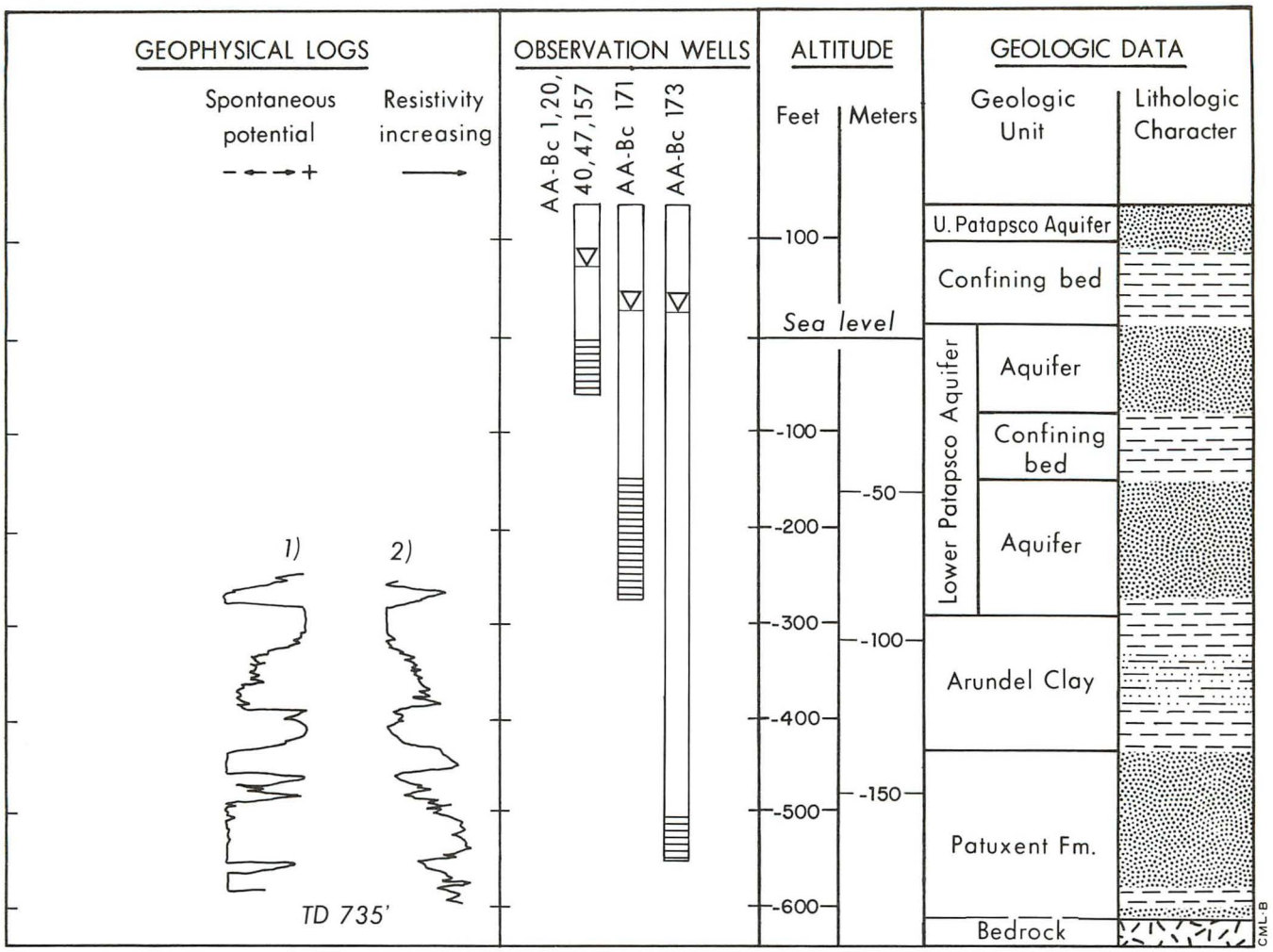


Figure 51. — Computed and observed hydrographs for wells in the Magothy aquifer: PG-De 21, PG-Fd 40 and 41.



1) and 2) Logs are from well AA-Bc 166

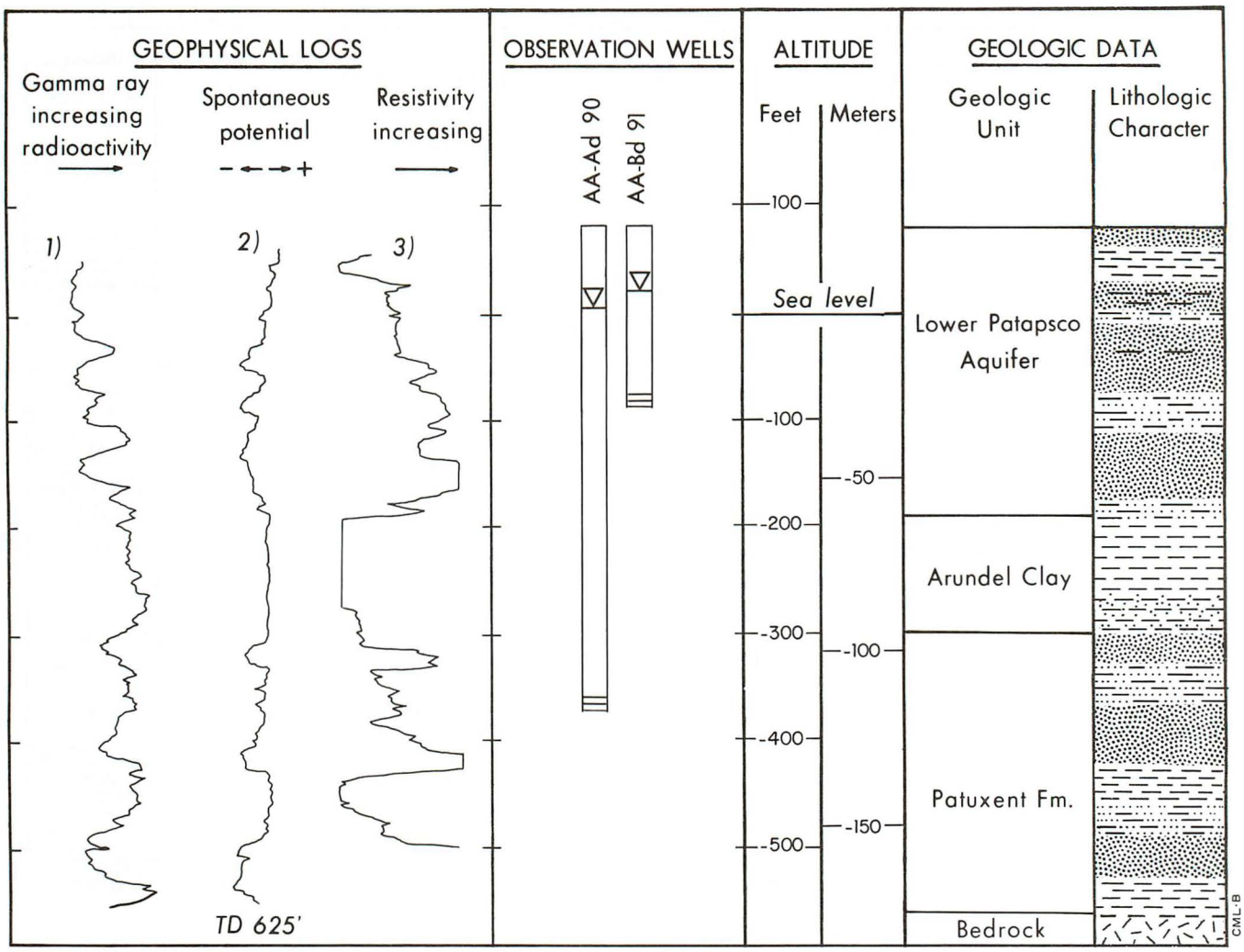
EXPLANATION

Sand — Clay — Sandy clay & clayey sand — Bedrock

Screened zone in well — 130 feet Altitude of land surface — ▽ Water level in 1979

TD Total depth drilled

Figure 56. — Geophysical, geologic, and hydrologic data for Nevamar Corporation at Odenton.



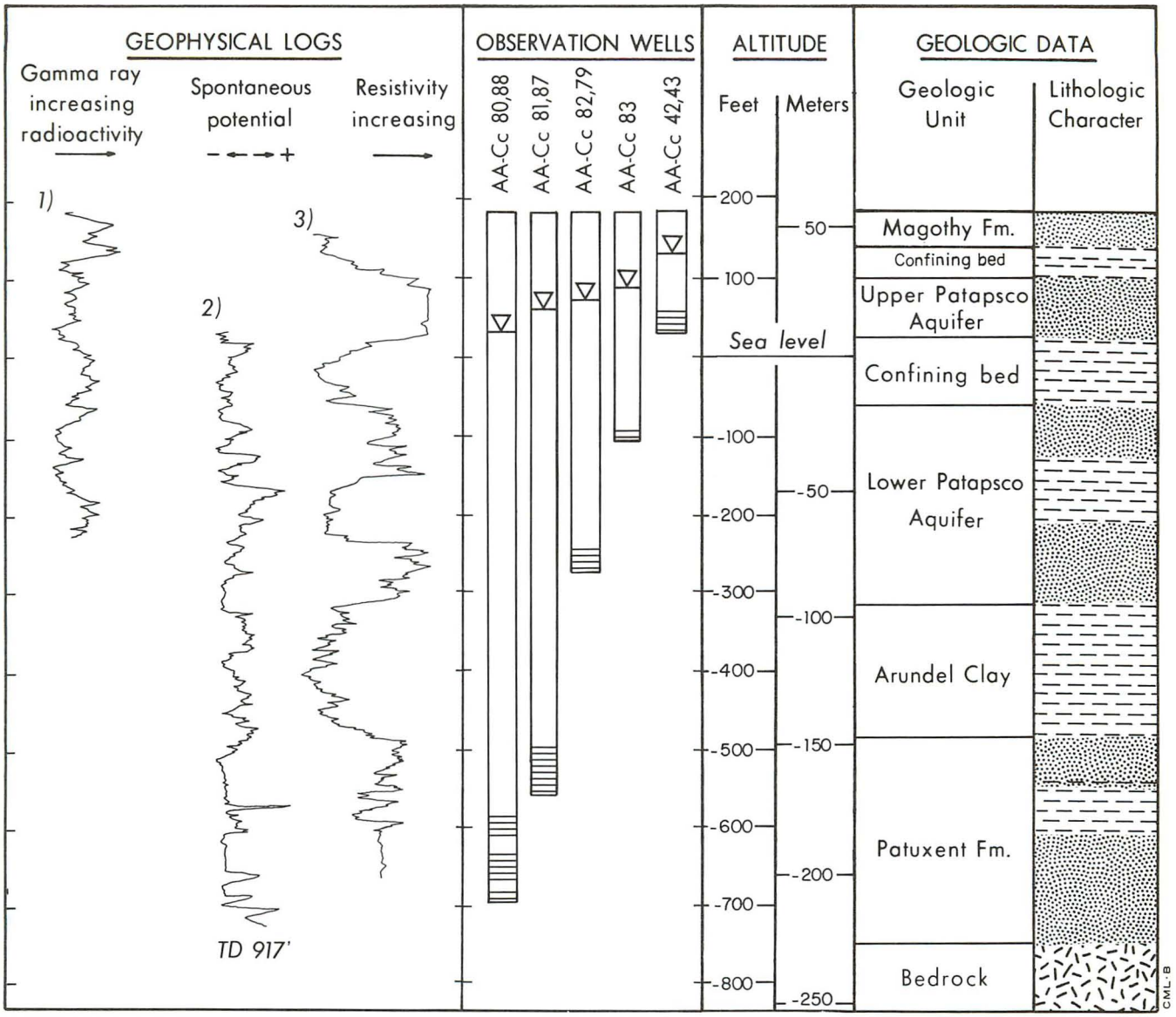
1), 2) and 3) Logs from well AA-Bd 98

EXPLANATION

Sand — Clay — Sandy clay & clayey sand — Bedrock

Screened zone in well — 80 feet Altitude of land surface — ▽ Water level in 1977

Figure 57. — Geophysical, geologic, and hydrologic data for Dorsey Road.



1) Log from well AA-Cc 87 2) Log from well AA-Cc 78 3) Log from well AA-Cc 88

EXPLANATION

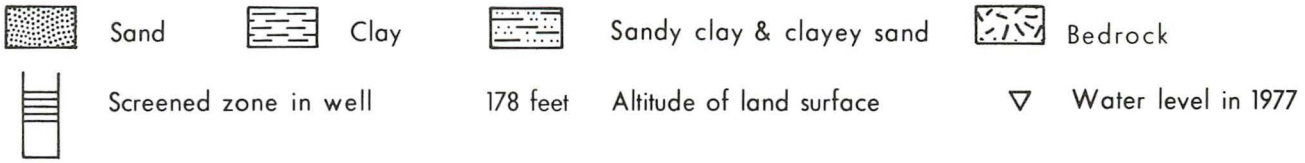
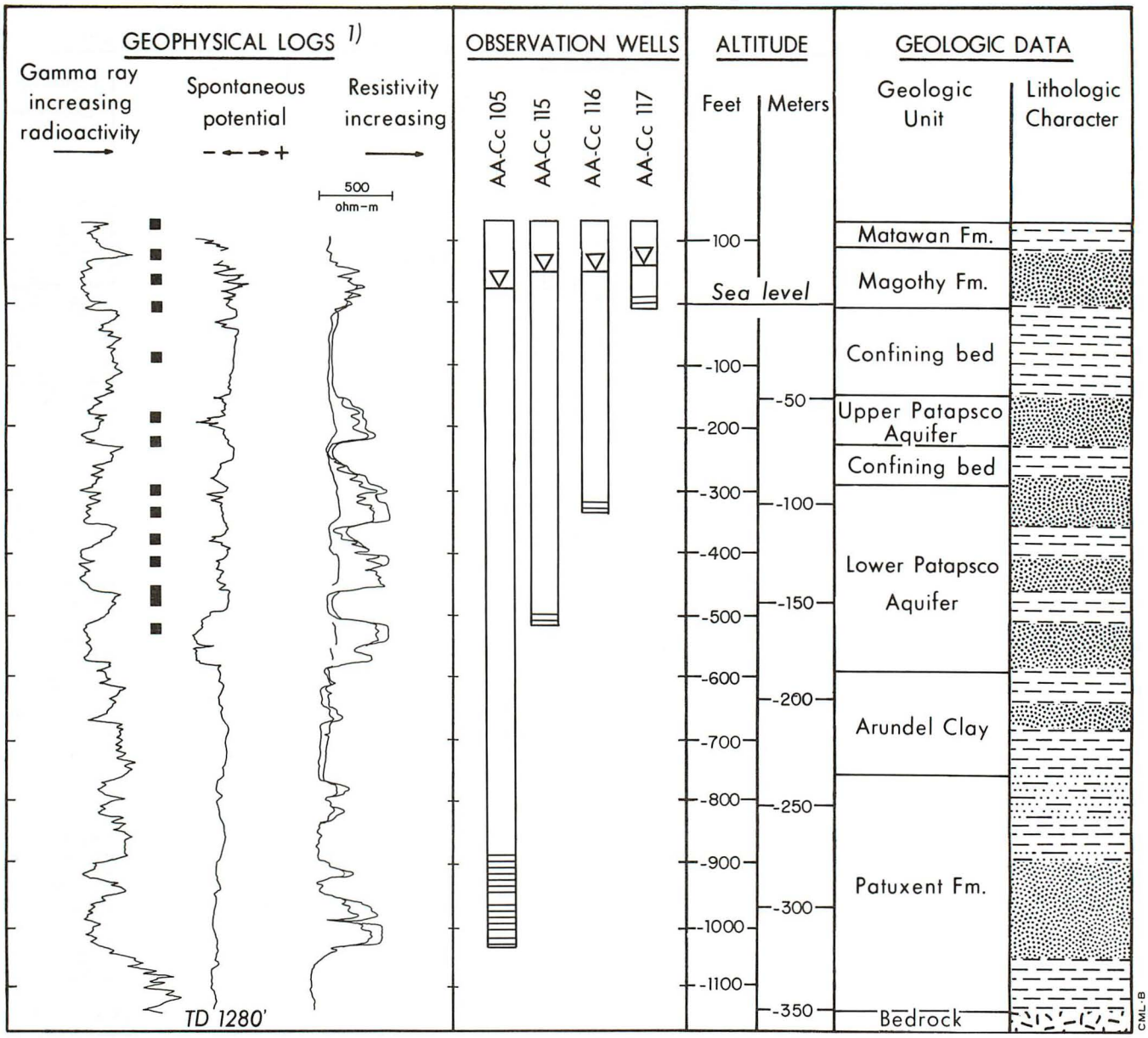


Figure 58. — Geophysical, geologic, and hydrologic data for Kings Heights.



1) The upper sections of these logs (land surface to 600 feet below sea level) are based on data from well AA-Cc 115 and the lower sections are from well AA-Cc 107.

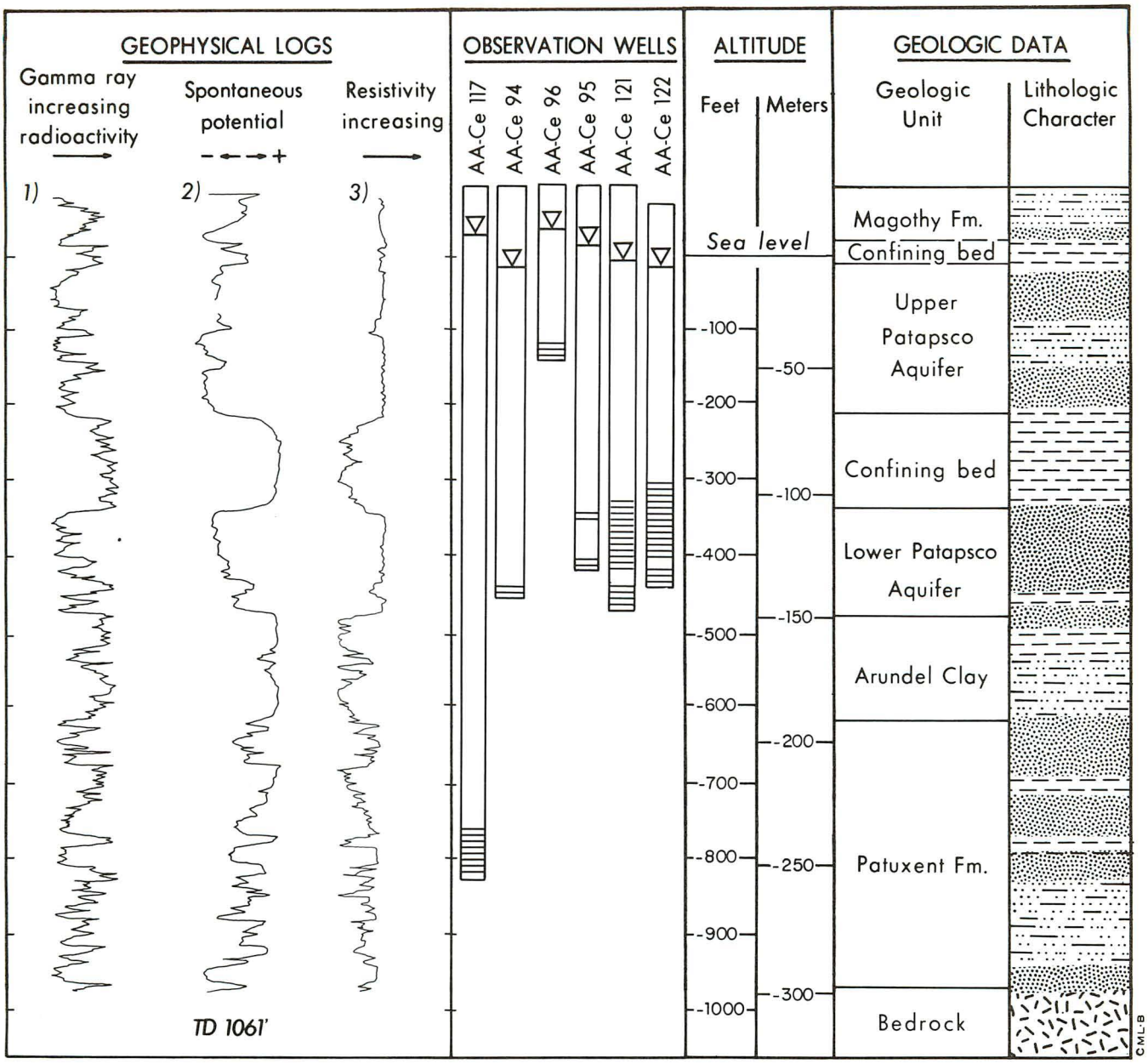
EXPLANATION

Sand — Clay — Sandy clay & clayey sand — Bedrock

Screened zone in well — 130 feet Altitude of land surface — ▽ Water level in 1979

■ Zone sampled by coring

Figure 59. — Geophysical, geologic, and hydrologic data for Crofton Meadows.



1), 2) and 3) Logs from well AA-Ce 117

EXPLANATION

Sand

Clay

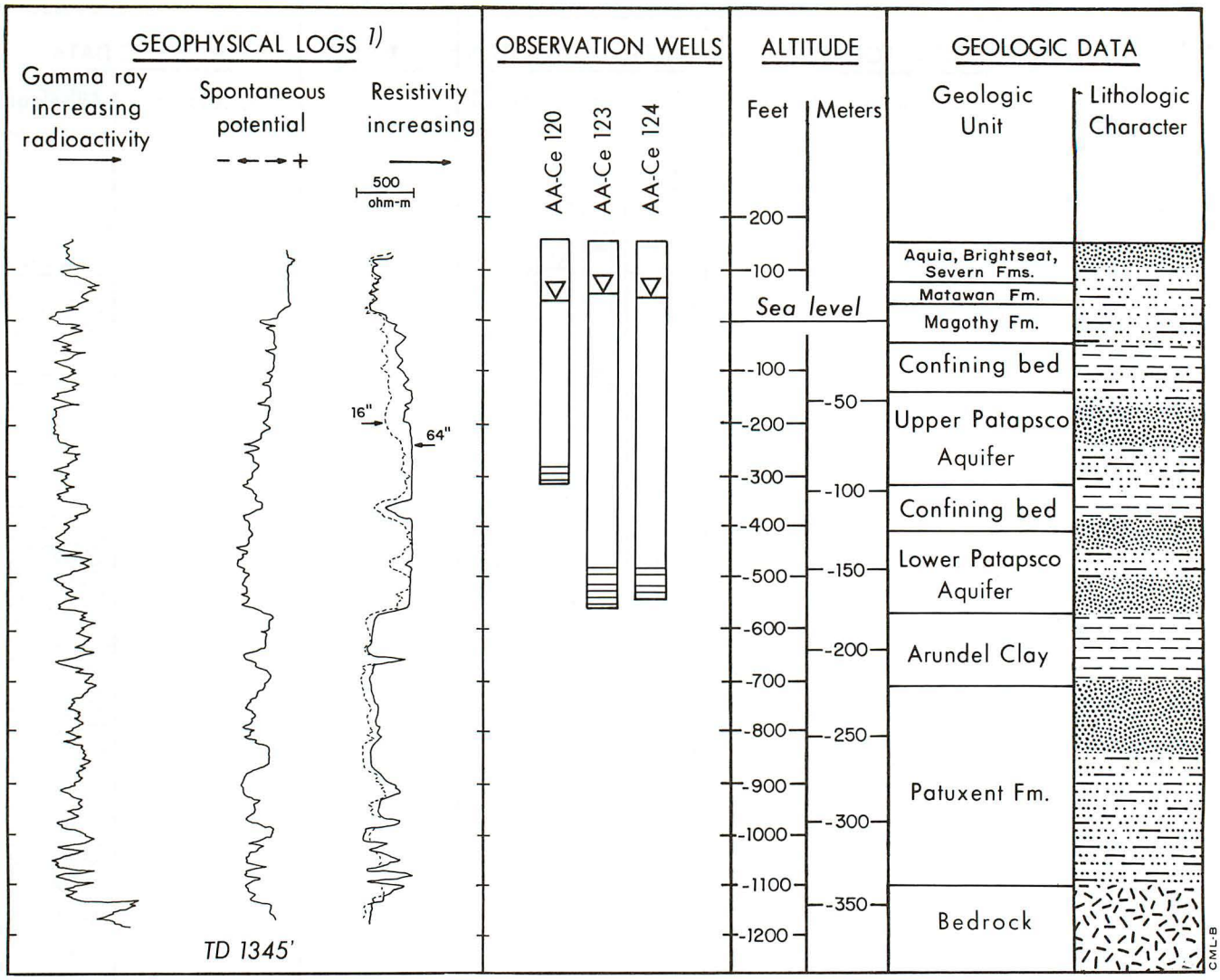
Sandy clay & clayey sand

Bedrock

Screened zone in well

▽ Water level in 1979

Figure 60. — Geophysical, geologic, and hydrologic data for Severndale.



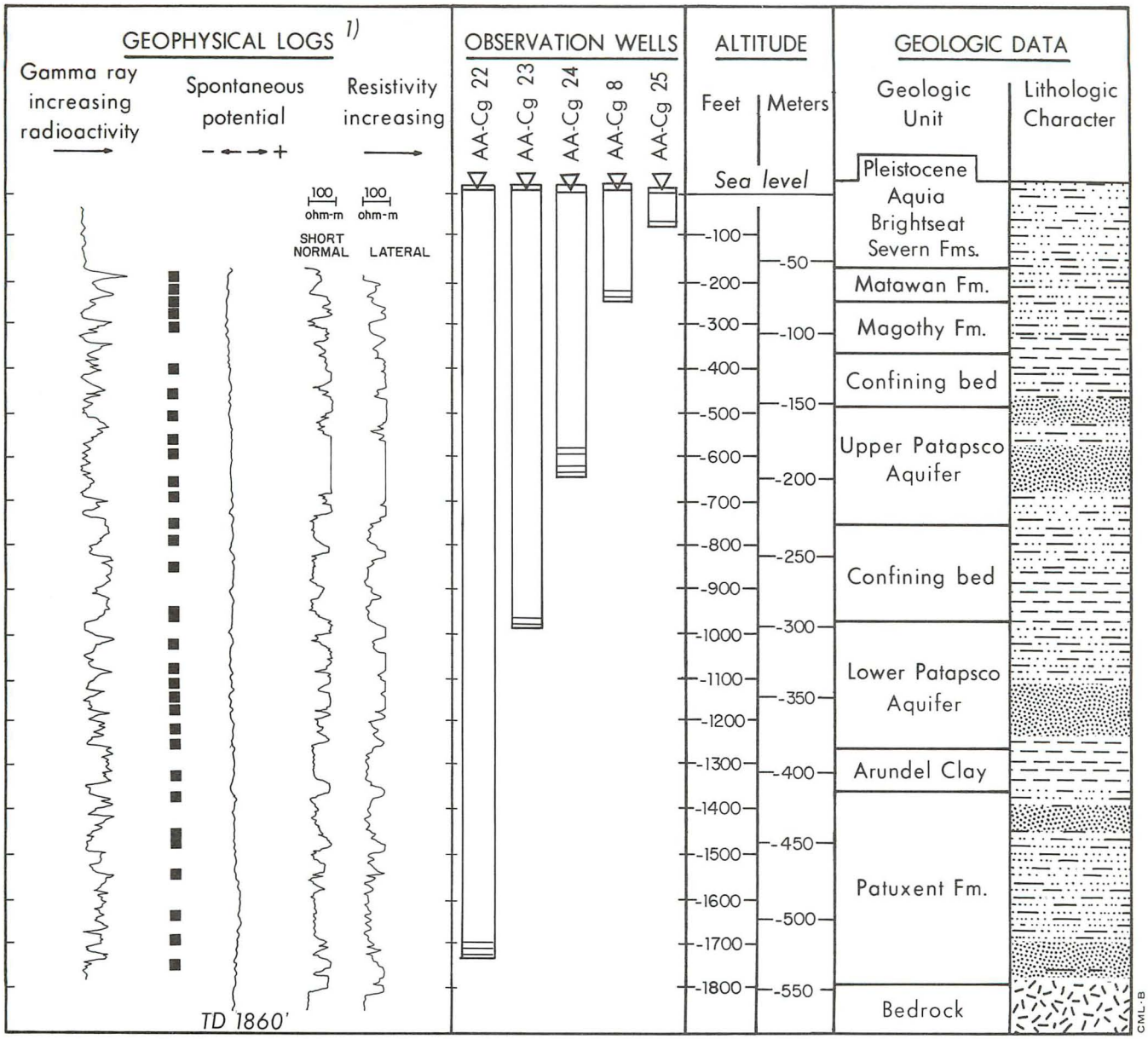
1) Logs are from well AA-Ce 120.

EXPLANATION

Sand — Clay — Sandy clay & clayey sand — Bedrock

Screened zone in well — 162 feet Altitude of land surface — ▽ Water level in 1979

Figure 61. — Geophysical, geologic, and hydrologic data for Herald Harbor.



1) Logs from well AA-Cg 22

EXPLANATION

Sand

Clay

Sandy clay & clayey sand

Bedrock

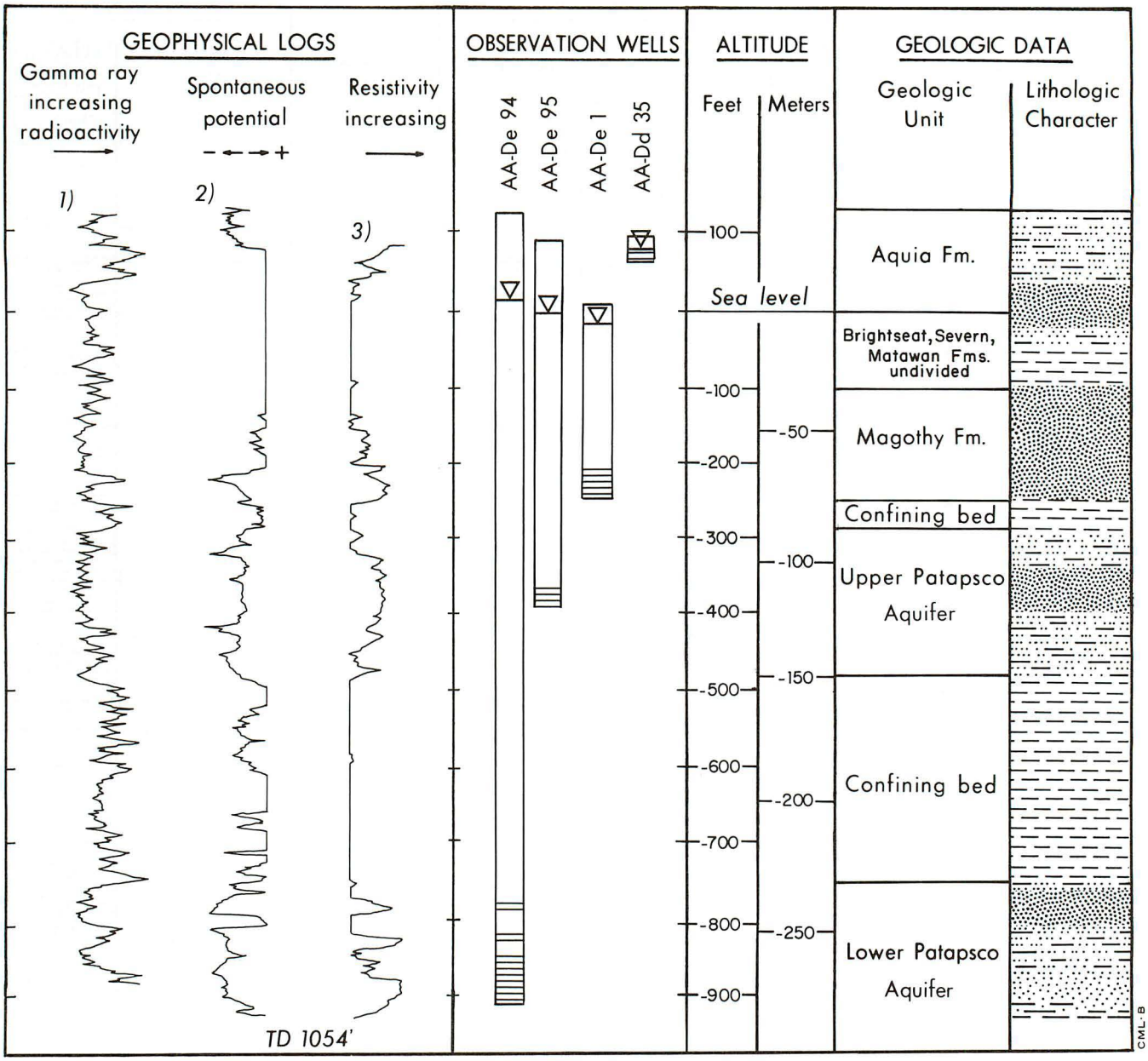
Screened zone in well

12 feet Altitude of land surface

▽ Water level in 1979

■ Zone sampled by coring

Figure 62. — Geophysical, geologic, and hydrologic data for Sandy Point.



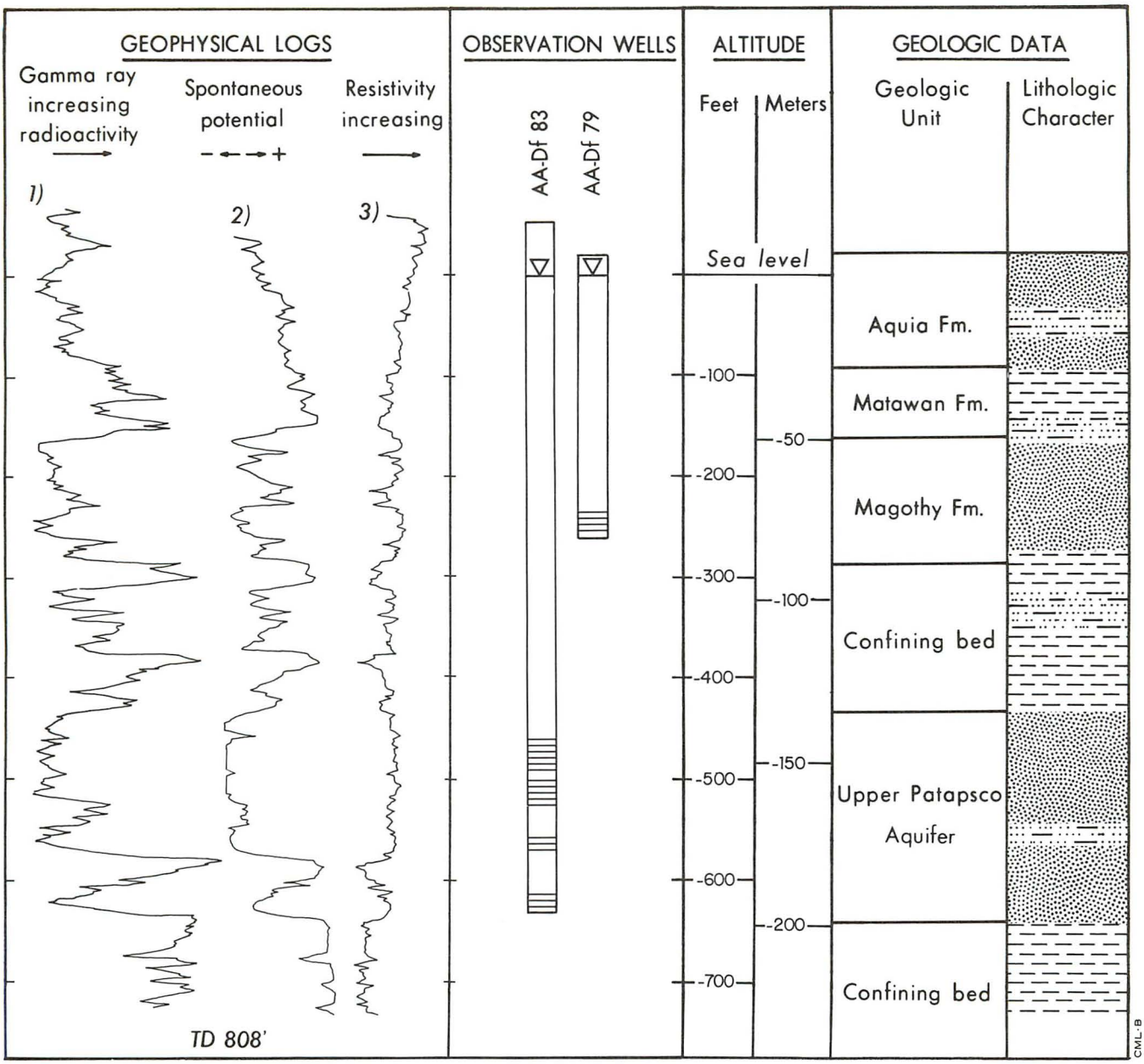
1) Log from well AA-De 94 *2) and 3) Logs from well AA-De 92*

EXPLANATION

Sand — Clay — Sandy clay & clayey sand — ▽ Water level in 1977

Screened zone in well

Figure 63. — Geophysical, geologic, and hydrologic data for city of Annapolis well field.



1), 2) and 3) Logs from well AA-Df 83

EXPLANATION

Sand

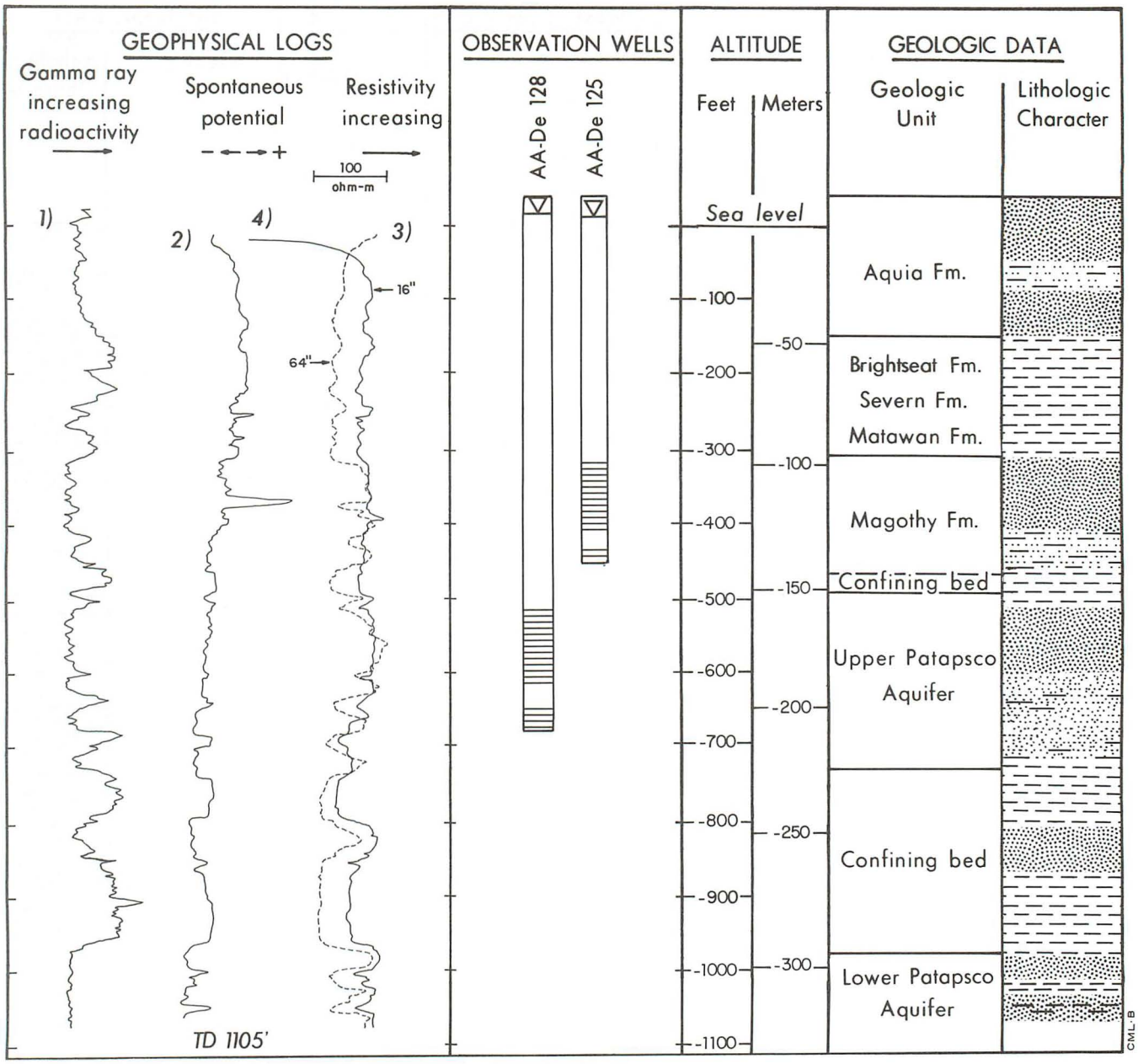
Clay

Sandy clay & clayey sand

Screened zone in well

▽ Water level in 1979

Figure 64. — Geophysical, geologic, and hydrologic data for U.S. Naval Academy.



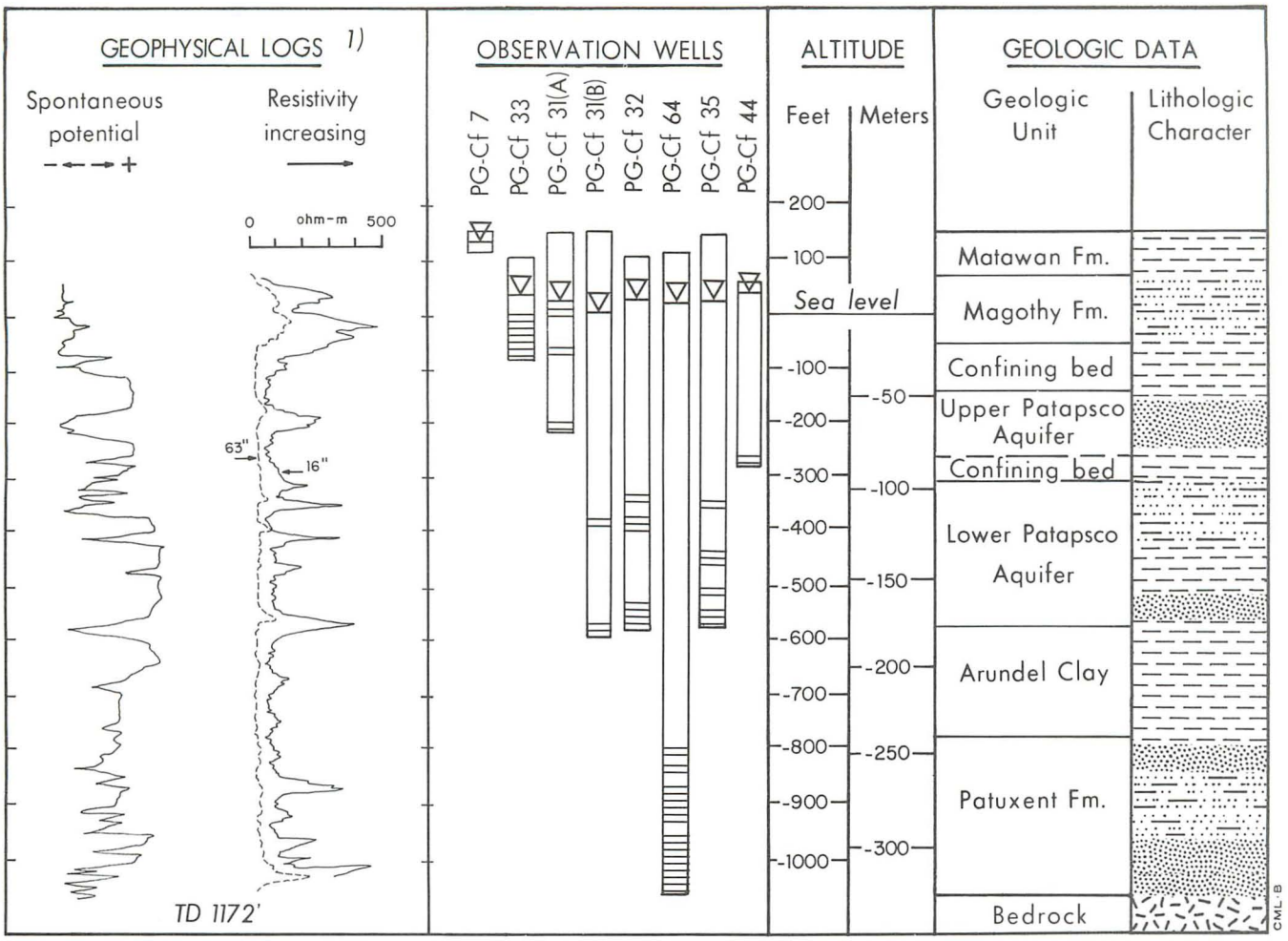
1), 2), 3), and 4) Logs from well AA-De 124

EXPLANATION

Sand — Clay — Sandy clay & clayey sand — ▽ Water level in 1977

Screened zone in well — 30 feet Altitude of land surface

Figure 65. — Geophysical, geologic, and hydrologic data for Central Avenue.



1) Log from well PG-Cf 53

EXPLANATION

Figure 66. — Geophysical, geologic, and hydrologic data for city of Bowie.

MARYLAND GEOLOGICAL SURVEY
2300 St. Paul Street
Baltimore, Maryland 21218

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3. Water resources of the Salisbury area, Maryland, by D.H. Boggess and S.G. Heidel, 1968, 69 p. 3.00
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