LINEBORO QUADRANGLE: HYDROGEOLOGY

SLOPE OF LAND SURFACE

Prepared by

Photo Science, Inc.

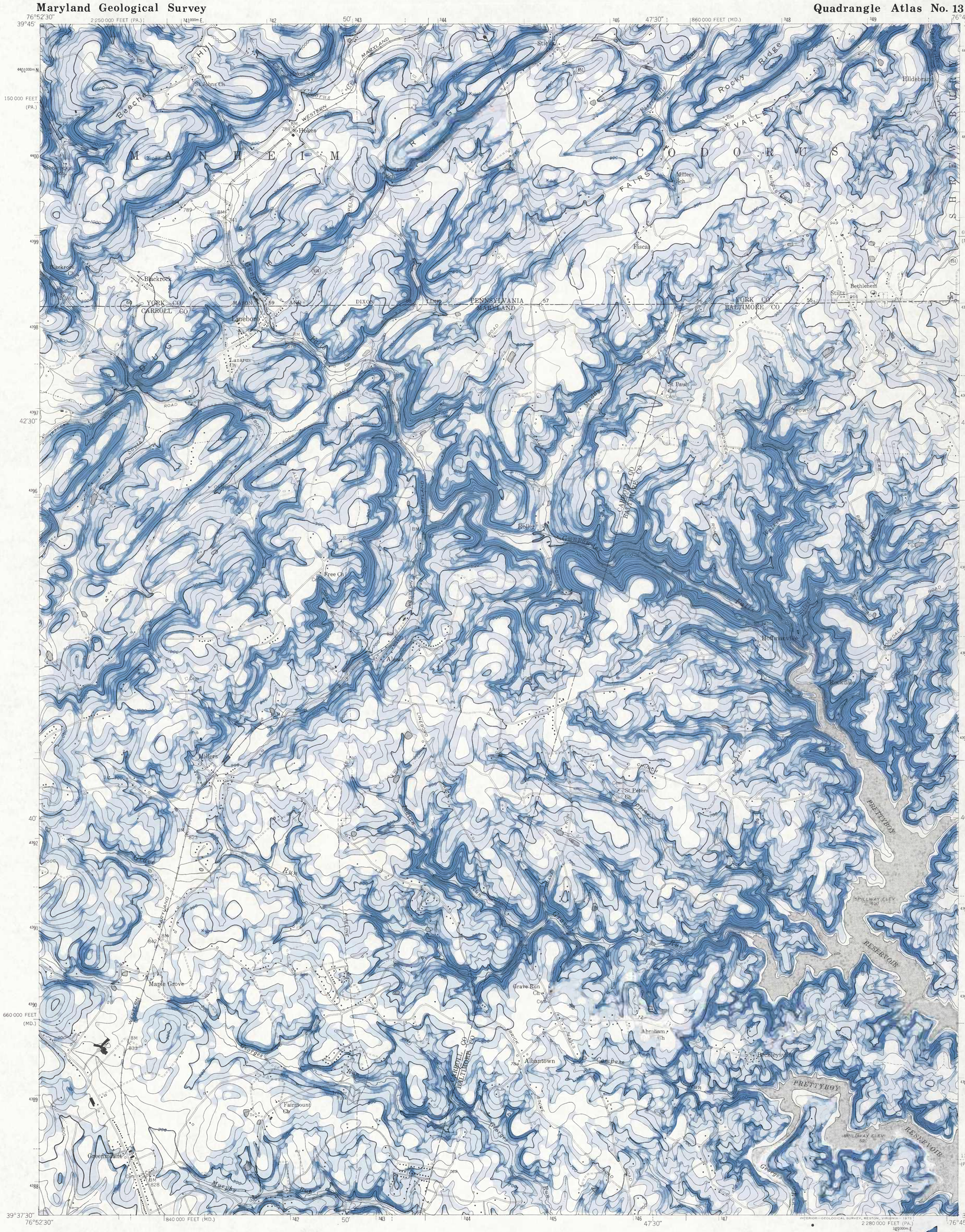
EXPLANATION

This map shows the slope of the land surface in the Lineboro quadrangle, with the slope values grouped into categories. The map was prepared from a 1:24,000-scale topographic contour plate using a semi-automatic photomechanical process. In this process, a device measures the distance between adjacent lines and, for the contour interval provided, calculates the slope between the lines. Narrow summits or depressions and similar features may be falsely mapped due to the bending of a line upon itself. Likewise, equal but adjacent contours produce overestimated slopes. Widely separated contour lines may result in an averaging of the intervening slopes. These limitations are only of small extent. The slope categories, which relate to those in the Baltimore County Soil Survey, were selected for their relevance to current and contemplated Baltimore County planning regulations.

MAP 1. SLOPE OF THE LAND SURFACE

Maryland Geological Survey

Quadrangle Atlas No. 13



MN
GN
8½° 151 MILS
1°09' 20 MILS
UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

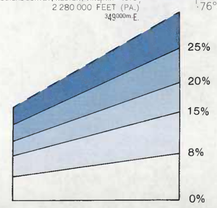
1 5 0 1 KILOMETRE

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981

QUADRANGLE LOCATION



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975

LINEBORO QUADRANGLE MARYLAND: HYDROGEOLOGY LOCATION OF WELLS, SPRINGS, AND TEST HOLES

By

Mark T. Duigon and John T. Hilleary

EXPLANATION

Wells in this quadrangle were described by Meyer (Meyer and Beall, 1958) and Laughlin (1966). Additional wells field-checked in Baltimore County are tabulated herein. Supplemental information for the Carroll County wells is on file with the USGS, Towson, Md.

Information for most of the wells was obtained from the records of well drillers. The supplemental well data have been entered in the National Water Data Storage and Retrieval System (WATSTORE) of the U.S. Geological Survey. Since 1945, a permit from the State of Maryland has been required to drill a water well. The numbers corresponding to the permits are included in the well-data tabulations. Since 1973, these numbers have appeared on a tag affixed to the well casing. The well driller must provide certain information when applying for this permit, and additional information upon completion of the well. Well drillers obtain discharge data by various methods, such as using a totaling meter, filling a bucket, or by estimation.

Wells are identified in accordance with a State-wide numbering system. Each county is set up with a grid system based on every fifth minute of latitude and longitude. Each square of the grid is lettered by row and column. Thus, quadrangle BC is the second row from the north and third column from the west. Wells and springs are given alpha-numeric designations, which identify the county, the 5-minute quadrangle, and the well. For example, well BA-AB 123 is in Baltimore County, in the 5-minute quadrangle AB and is the 123rd well inventoried in that quadrangle.

○ 9
WATER WELL AND NUMBER

○ 4
SPRING AND NUMBER

⦶ 184
U.S. GEOLOGICAL SURVEY TEST WELL AND NUMBER

SELECTED REFERENCES

Laughlin, C. P., 1966, Records of wells and springs in Baltimore County, Maryland: Maryland Geological Survey Water Resources Basic Data Report No. 1, 406 p.

Meyer, Gerald, and Beall, R. M., 1958, The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources 1/ Bulletin, v. 22, 355 p.

SUPPLEMENTAL RECORD OF WELLS IN THE LINEBORO QUADRANGLE

LOCAL NUMBER	STATE PERMIT NUMBER	OWNER	CONTRACTOR	DATE COMPLETED	ALTITUDE OF LAND SURFACE (FEET)	DEPTH OF WELL (FEET)	FINISH	DEPTH CASED (FEET)	CASING DIAMETER (INCHES)	PRINCIPAL AQUIFER	WATER LEVEL (FEET)	DRAW-DOWN (FEET)	DISCHARGE (GALLONS PER MINUTE)	DATE DISCHARGE MEASURED	PUMPING PERIOD (HOURS)	SPECIFIC CAPACITY (GPM/FT)	USE OF WATER	USE OF SITE	TYPE OF LIFT
BA AB 24	BA-73-3070	MYERS, DENNIS	--	06/14/1976	865	140.00	X	23	6	300PRTB	46.00	--	2	08/17/1976	--	--	H	W	S
BA AB 25	BA-73-2592	FISCHER, JOHN	A C REIDER	02/04/1976	890	157.00	X	59	6	300PRTB	39.00	--	2	02/04/1976	6.0	--	H	W	S
BA AB 26	BA-73-2437	DEAN, ELWOOD J	WM C JAMES	10/02/1975	830	150.00	X	55	6	300PRTB	66.00	84	5	10/02/1975	6.0	0.1	H	W	S
BA AB 27	BA-73-0905	SHEPHEND, JACK	G EDGAR HARR	09/20/1973	840	175.00	X	33	6	300PRTB	34.00	--	10	09/20/1973	2.0	--	H	W	A
BA AB 28	BA-73-2964	HARREL, CARL	A C REIDER	06/16/1976	860	320.00	X	23	6	300PRTB	64.00	166	29	06/18/1976	6.0	0.2	H	W	S
BA AB 29	BA-73-3515	SHANER, RALPH	A C REIDER	10/19/1976	730	100.00	X	36	6	300PRTB	40.00	17	2	10/19/1976	6.0	0.1	H	W	S
BA AB 30	BA-73-3559	MERCER, JEROME E	WM C JAMES	10/16/1976	880	135.00	X	61	6	300PRTB	45.00	9	10	10/16/1976	6.0	1.1	H	W	S
BA AB 31	BA-73-0563	HOSHALL, ROBERT	A C REIDER	03/26/1973	720	170.00	X	35	6	300PRTB	32.00	136	3	03/26/1973	1.0	0.0	H	W	A
BA AB 32	BA-73-1015	SMITH, DAVID P	WM C JAMES	10/22/1973	880	125.00	X	20	6	300PRTB	65.00	15	6	10/22/1973	6.0	0.4	H	W	S
BA AB 33	BA-73-1062	MCCARTHY, RICHARD	WM C JAMES	10/24/1973	860	155.00	X	23	6	300PRTB	60.00	75	3	10/24/1973	6.0	0.0	H	W	S
BA AB 34	BA-73-1880	ELLIGSON, PAUL	G EDGAR HARR	02/11/1975	820	200.00	X	46	6	300PRTB	75.00	25	2	02/11/1975	6.0	0.1	H	W	S
BA AB 35	BA-73-2570	GROFT, GENE	H J DILLON	06/15/1976	810	200.00	X	40	6	300PRTB	40.00	135	3	06/15/1976	6.0	0.0	H	W	S
BA AB 36	BA-73-3049	MORELL, JOHN S	WM C JAMES	06/01/1976	830	105.00	X	19	6	300PRTB	40.00	15	5	06/01/1976	6.0	0.3	H	W	S
BA AB 37	BA-73-3507	TALLEY, THEODORE	A C REIDER	09/25/1976	890	215.00	X	18	6	300PRTB	43.00	39	2	09/25/1976	6.0	0.1	H	W	S
BA AB 38	BA-73-2365	LUSBY, GARY	A C REIDER	11/25/1975	900	200.00	X	28	6	300PRTB	51.00	46	2	11/25/1975	6.0	0.0	H	W	S
BA AB 39	BA-73-4438	SALLA, RICHARD	G EDGAR HARR	05/23/1977	865	200.00	X	54	6	300PRTB	30.00	--	5	05/23/1977	6.0	--	H	W	S
BA AB 40	BA-73-0567	MARTENET, HOWARD L	A C REIDER	03/23/1973	725	155.00	X	20	6	300PRTB	40.00	113	5	03/23/1973	1.0	0.0	H	W	S
BA AB 41	BA-73-2457	ASPER, GEORGE E	WM C JAMES	11/06/1975	950	100.00	X	27	6	300PRTB	50.00	50	10	11/06/1975	1.0	0.2	H	W	S
BA AB 42	BA-73-4249	SHECKELLS, THOMAS E	DANA KYKER	04/23/1977	850	235.00	X	42	6	300PRTB	54.00	175	7	04/23/1977	6.0	0.0	H	W	S
BA AB 43	BA-73-2543	HORST, JOSEPH	WM C JAMES	10/13/1975	770	100.00	X	61	6	300PRTB	25.00	75	75	10/13/1975	1.0	1.0	H	W	J
BA AB 44	BA-73-3259	ELLIGSON, JOHN L	A C REIDER	07/20/1976	838	140.00	X	47	6	300PRTB	40.00	25	2	07/20/1976	6.0	0.1	H	W	S
BA AB 45	BA-73-4635	HARGET, CHARLES R	W W REICHART	08/29/1977	910	425.00	X	23	6	300PRTB	70.00	200	3	08/29/1977	6.0	0.0	H	W	S
BA AB 46	BA-73-3325	MANOR LAND ASSOC	WM C JAMES	08/16/1976	890	200.00	X	49	6	300PRTB	40.00	30	2	08/16/1976	6.0	0.1	H	W	S
BA AB 47	BA-73-4535	KAMPES, GARY R	DANA KYKER	07/01/1977	905	252.00	X	41	6	300PRTB	71.00	145	5	07/01/1977	6.0	0.0	H	W	S
BA AB 48	BA-73-1771	STUMP, ARTHUR	GURVIS JONES	10/30/1974	850	225.00	X	56	6	300PRTB	40.00	120	5	10/30/1974	6.0	0.0	H	W	S
BA AB 49	BA-73-3325	MANOR LAND ASSOC	WM C JAMES	08/16/1976	890	200.00	--	--	--	300PRTB		--	0.5	08/16/1976	--	--	--	Z	--
BA BB 79	BA-73-3783	HANN, RONALD	C E CAMPBELL	02/04/1977	760	145.00	X	43	6	300PRTB	25.00	20	4	02/04/1977	6.0	0.2	H	W	S
BA BB 81	BA-73-2110	HAIN, EDGAR	DANA KYKER	05/14/1975	750	205.00	X	21	6	300PRTB	45.00	81	5	05/14/1975	6.0	0.1	H	W	S
BA BB 82	BA-73-1089	WHITE, ROBERT	DANA KYKER	11/07/1973	750	143.00	X	71	6	300PRTB	70.00	45	20	11/07/1973	8.0	0.4	H	W	S
BA BB 83	BA-73-2914	WISNOM, RAYMOND	DANA KYKER	05/03/1976	750	220.00	X	135	6	300PRTB	34.00	147	5	05/03/1976	6.0	0.0	H	W	S
BA BB 84	BA-73-2530	CROUSE, RICHARD	G EDGAR HARR	11/19/1975	700	200.00	X	31	6	300PRTB	32.00	9	2	11/19/1975	6.0	0.2	H	W	S
BA BB 85	BA-73-2593	LAWSON, DAVID	A C REIDER	02/24/1976	750	163.00	X	39	6	300PRTB	53.00	67	2	02/24/1976	6.0	0.0	H	W	S
BA BB 86	BA-73-2395	LAWSON, DAVID	A C REIDER	09/16/1975	720	100.00	X	38	6	300PRTB	38.00	--	2	09/16/1975	6.0	--	H	W	S
BA BB 87	BA-73-4081	SWIFT, RAYMOND K	WM C JAMES	03/10/1977	640	145.00	X	40	6	300PRTB	55.00	8	4	03/10/1977	6.0	0.5	H	W	S
BA BB 88	BA-73-1090	RUHL CORP	A C REIDER	11/19/1973	650	172.00	X	34	6	300PRTB	45.00	125	2	11/19/1973	6.0	0.0	H	W	S
BA BB 89	BA-73-3637	BOSLEY, JAMES	A C REIDER	11/24/1976	670	100.00	X	34	6	300PRTB	99.00	1	2	11/24/1976	6.0	2.0	H	W	S
BA BB 90	BA-73-3271	BRETHAUER, JAMES	WATER INC	08/09/1976	760	142.00	X	20	6	300PRTB	35.00	3	6	08/09/1976	6.0	2.0	H	W	S
BA BB 108	BA-73-3609	BEALL, DOUGLAS	A C REIDER	11/23/1976	630	125.00	X	30	6	300PRTB	34.00	21	2	11/23/1976	6.0	0.1	H	W	S
BA BB 109	BA-73-4149	FREE STATE HOME	DANA KYKER	04/06/1977	635	250.00	X	62	6	300PRTB	73.00	158	12	04/06/1977	6.0	0.1	H	W	S
BA BB 111	BA-73-3904	OLIVER, JAMES	W W REICHART	01/28/1977	720	250.00	X	126	6	300PRTB	50.00	200	8	01/28/1977	6.0	0.0	H	W	A
BA BB 112	BA-73-4542	E LANGREHR CO	G EDGAR HARR	06/24/1977	750	150.00	X	45	6	300PRTB	40.00	--	7	06/24/1977	6.0	--	H	W	S
BA BB 113	BA-73-4533	MILLER, ROLAND A	WM C JAMES	07/07/1977	790	120.00	X	80	6	300PRTB	40.00	--	4	07/07/1977	6.0	--	H	W	S
BA BB 114	BA-73-0604	SNYDER, KENNETH W	WM C JAMES	04/23/1973	735	110.00	X	24	6	300PRTB	30.00	25	10	04/23/1973	6.0	0.4	H	W	S
BA BB 117	BA-73-1530	HOFFMAN, THOMAS	G EDGAR HARR	07/19/1974	710	125.00	X	30	6	300PRTB	40.00	8	25	07/19/1974	0.6	3.1	H	W	S
BA BB 121	BA-73-1875	WARD, WILLIAM F	G EDGAR HARR	04/01/1975	720	200.00	X	93	6	300PRTB	41.00	19	10	04/01/1975	6.0	0.5	H	W	S
BA BB 122	BA-73-2317	MOSES, CHARLES H	WM C JAMES	07/28/1975	765	135.00	X	64	6	300PRTB	35.00	35	5	07/28/1975	6.0	0.1	H	W	S
BA BB 123	BA-73-0300	KELLEY, DALE M	E EDGAR HARR	02/27/1973	620	100.00	X	47	6	300PRTB	20.00	70	10	02/27/1973	6.0	0.1	H	W	S
BA BB 124	BA-73-2263	BUTTNER, CHARLES	G EDGAR HARR	06/25/1975	800	130.00	X	77	6	300PRTB	40.00	80	10	06/25/1975	6.0	0.1	H	W	S
BA BB 125	BA-73-2660	DAVIDSON, TERRY	W W REICHART	12/23/1975	685	400.00	X	21	6	300PRTB	30.00	--	1	12/23/1975	1.0	--	H	W	S
BA BB 127	BA-73-1462	MALONE, C M	JOHN GREENE	05/28/1974	665	125.00	X	19	6	300PRTB	60.00	30	2	05/28/1974	6.0	0.1	H	W	S
BA BB 128	BA-73-4543	E LANGREHR CO	G EDGAR HARR	06/27/1977	770	125.00	X	43	6	300PRTB	32.00	--	7	06/27/1977	6.0	--	H	W	S
BA BB 131	BA-73-3219	SMITH, RAY	C C CAMPBELL	07/13/1976	745	145.00	X	38	6	300PRTB	30.00	10	3	07/13/1976	6.0	0.3	H	W	S

FINISH CODES
X OPEN HOLE

PRINCIPAL AQUIFER CODES
300PRTB PRETTYBOY SCHIST

WATER USE CODES
H DOMESTIC

SITE USE CODES
W WITHDRAWAL
Z DESTROYED

LIFT TYPE CODES
S SUBMERSIBLE
A AIR
J JET

MAP 2. LOCATION OF WELLS, SPRINGS, AND TEST HOLES

Maryland Geological Survey Quadrangle Atlas No. 13

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943
Culture revision by the Geological Survey 1953

PHOTOREVISED 1974

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MARYLAND
QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey, the Baltimore County Office of Planning and Zoning and the Commissioners of Carroll County.

1981

MAP 3. DEPTH TO THE WATER TABLE

Maryland Geological Survey Quadrangle Atlas No. 13

LINEBORO QUADRANGLE MARYLAND: HYDROGEOLOGY
DEPTH TO THE WATER TABLE

By

Mark T. Duigon and Edmond G. Otton

EXPLANATION

This map shows the distance from the land surface to the water table (top of the zone of saturation). The major source of data is the records kept by water-well drillers, who note the static level (depth to water when not pumping) in wells they drill. Additional data were obtained from soils maps and field observations of springs and swamps. The map shows that the water table is generally shallowest adjacent to streams, and deepest under summits of hills and ridges.

The water table is part of a dynamic system and, as such, fluctuates in response to various stresses (mainly precipitation and evapotranspiration), usually being highest in the spring and lowest in late summer or fall. Springs are areas where the water table is at the land surface. During extended dry periods some springs cease to flow, indicating that the water table has declined to some distance below the land surface. Because of this fluctuation, a generalized map is presented in order to give an estimate of the average depth to the water table at a given location.

Figure 1 shows a 1-year record of water levels in a well near Woodbine, approximately 30 miles southwest of Lineboro. The loss of moisture by evapotranspiration during the summer growing season is clearly indicated. Figure 2 illustrates what percentage of time the water level in a well in Hampstead (located about 2 miles southeast of Greenmount) is above a given stage. Data for figures 1 and 2 were taken from measurements collected by the U.S. Geological Survey, which monitors water levels nationwide.

Pumping of wells produces a temporary lowering of the water table (drawdown), but, in this region, the effect is generally restricted to the immediate vicinity of the well. The magnitude of this drawdown varies considerably and is an important consideration in planning the construction of a new ground-water supply.

Rainwater that seeps into the ground occasionally finds its downward progress impeded by an impervious layer of clay or other material, and may form a zone of saturation above the actual water table. The top of this zone is known as a perched water table. Such zones are usually temporary and of small extent in this area. They are not shown on this map.

APPROXIMATE DEPTH TO WATER TABLE BELOW LAND SURFACE

Less than 10 feet | 10 - 35 feet | Greater than 35 feet

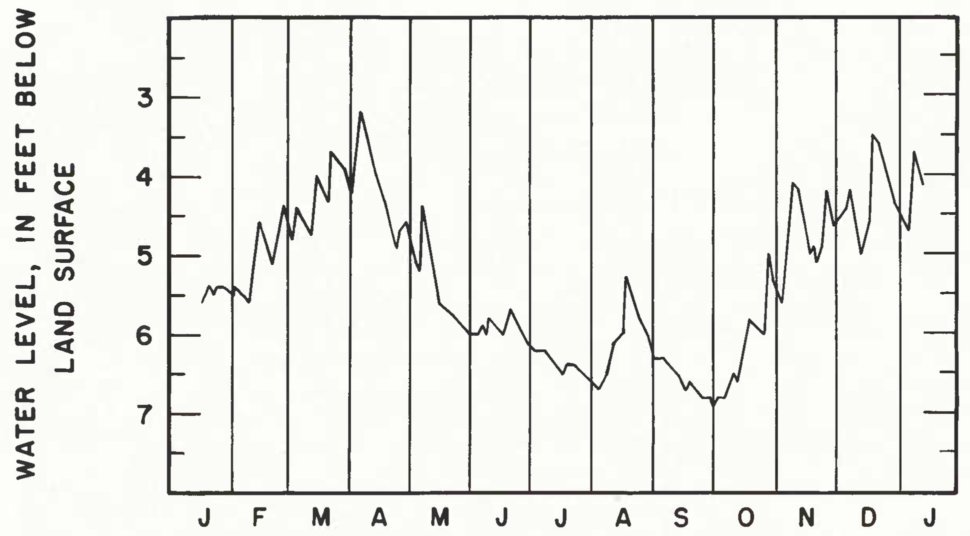


Figure 1. Hydrograph of well CL-EC 75, near Woodbine, for the period January 17, 1977 to January 12, 1978.

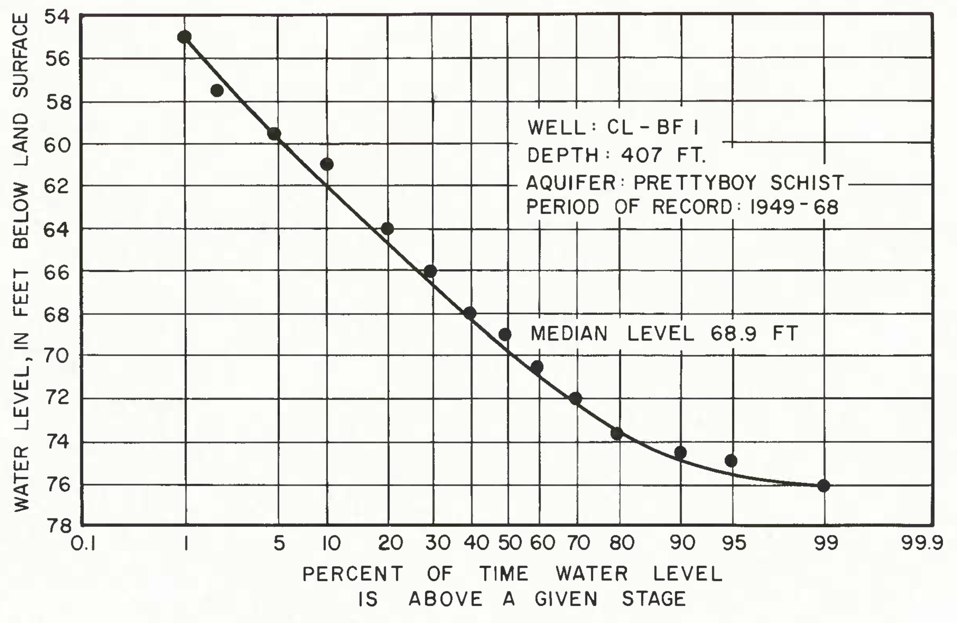
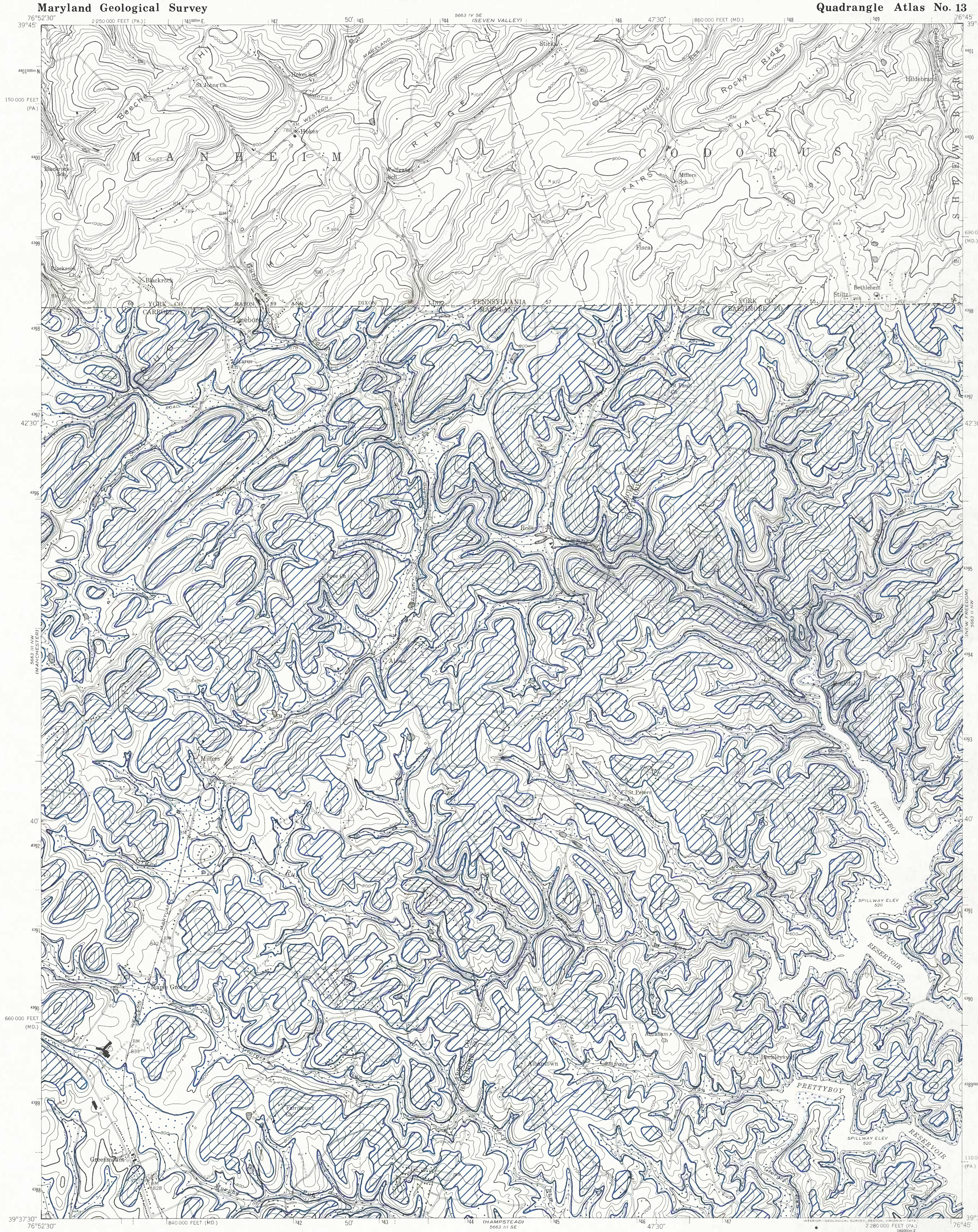


Figure 2. Water-level duration curve for observation well CL-BF 1, in Hampstead (from Nutter and Otton, 1969).

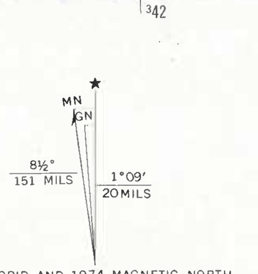
REFERENCE

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 p.



Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943
Culture revision by the Geological Survey 1953

PHOTOREVISED 1974

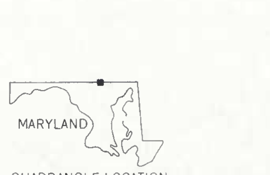


UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981



QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey, the Baltimore County Office of Planning and Zoning and the Commissioners of Carroll County.

LINEBORO QUADRANGLE MARYLAND: HYDROGEOLOGY
AVAILABILITY OF GROUND WATER

By
Mark T. Duigon and Edmond G. Otton

MAP 4. AVAILABILITY OF GROUND WATER

Maryland Geological Survey
Quadrangle Atlas No. 13

EXPLANATION

The ground-water availability classes presented on this map are based on statistical evaluation of specific capacities (discharge, in gal/min, divided by drawdown, in ft) of wells grouped by geologic unit. The geologic units correspond to the mapping units of Crowley (1976). Because specific capacity decreases as pumping continues, only wells that have been pump-tested for a 3-hour-minimum duration were included in the analyses. The groups were tested for significant (95-percent confidence level) differences by the Kruskal-Wallis and Wilcoxon nonparametric tests (Sokol and Rohlf, 1969, Rohlf and Sokol, 1969). The results suggest the presence of three units in the Lineboro quadrangle. These units are numbered from most to least productive.

○ WELL WITH YIELD LESS THAN 2 GAL/MIN

● WELL WITH YIELD GREATER THAN 15 GAL/MIN

GEOHYDROLOGIC UNIT 1, not present in this quadrangle, is made up of Coastal Plain sediments found elsewhere in Baltimore County.

2 — GEOHYDROLOGIC UNIT 2: This unit is underlain principally by the Bachman Valley Formation, a phyllite that may be calcareous. It includes a few areas of Prettyboy Schist where that rock is very calcareous and occupies a similar topographic setting. In the Lineboro quadrangle, Unit 2 occurs in northeast-southwest trending valleys.

Well yields of 26 wells from the Lineboro and nearby quadrangles range from 2 gal/min to 100 gal/min; the median yield is 13 gal/min. Figure 1 shows distribution of well yields calculated from specific capacities. Specific capacities range from 0.01 (gal/min)/ft to 2.0 (gal/min)/ft; the median is 0.37 (gal/min)/ft. Well depths range from 60 to 340 ft; median depth is 128 ft.

Wells in Unit 2 will generally be adequate for domestic use, and, with proper construction and design, may serve for municipal and commercial or industrial supply. Flooding is a possible hazard because this unit occupies valleys. Flood waters can damage equipment if suitable precautions are not taken, and contamination by surface waters can occur if the well casing is not properly driven into unweathered rock and grouted.

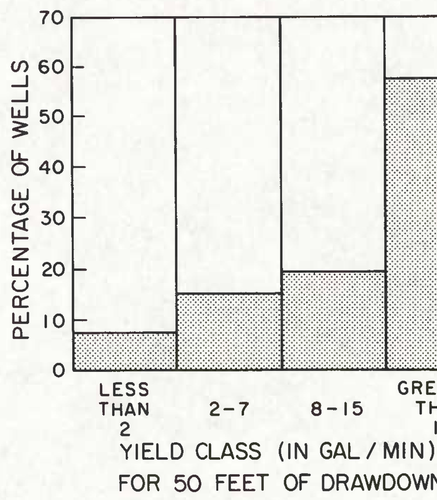


Figure 1. Well-yield distribution, Geohydrologic Unit 2 (26 wells).

3 — GEOHYDROLOGIC UNIT 3: This, the most widespread unit in the Lineboro quadrangle, is highly variable. The area is underlain chiefly by the Prettyboy Schist, a part of the Wissahickon Group. The unit covers a typical Piedmont rolling topography.

Yields of 84 wells range from 0 gal/min to 40 gal/min, the median is 5 gal/min. Figure 2 shows distribution of well yields calculated from specific capacities. The range of specific capacities is from 0.00 (gal/min)/ft to 3.5 (gal/min)/ft. The median is 0.11 (gal/min)/ft. Although a large proportion of wells have low yields (6 percent yield less than 2 gal/min), some wells have rather high yields. Improved techniques of construction and stimulation may result in increased production, but these methods are usually not economical for domestic wells. Wells range from 76 ft to 505 ft in depth. Median well depth is 159 ft.

Ground water is generally soft (less than 60 mg/L as $CaCO_3$) and slightly acidic, and in most cases does not require any special treatment for domestic use.

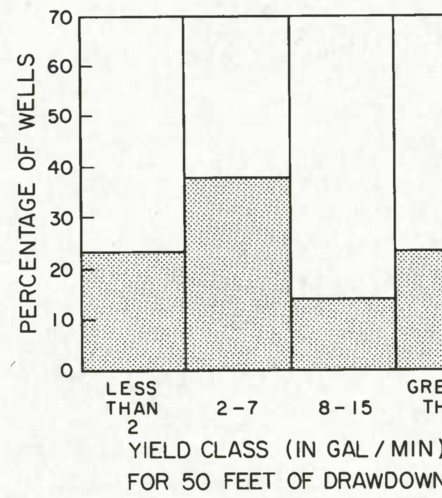


Figure 2. Well-yield distribution, Geohydrologic Unit 3 (84 wells).

4 — GEOHYDROLOGIC UNIT 4: This unit includes only a small area in the northwestern corner of the mapped area. Data were obtained from nearby areas in other quadrangles. Unit 4 is underlain by the Marburg Formation, a phyllite, in the Lineboro quadrangle. It is the least productive unit with yields of 29 wells ranging from 1 gal/min to 30 gal/min. Median yield is 4 gal/min. Figure 3 shows distribution of well yields calculated from specific capacities. Specific capacities range from 0.01 (gal/min)/ft to 1.1 (gal/min)/ft and have a median value of 0.03 (gal/min)/ft. Depths range from 100 ft to 351 ft, and the median depth is 175 ft. Wells are generally adequate for domestic use, but only a small percentage of wells (7 percent) can meet higher demands.

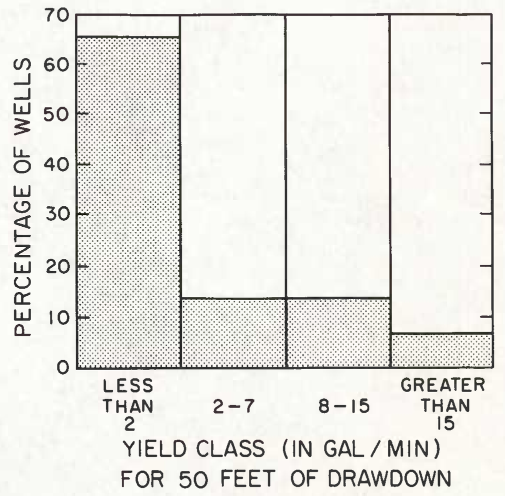


Figure 3. Well-yield distribution, Geohydrologic Unit 4 (29 wells).

SUMMARY

A total of 139 wells analysed for the Lineboro quadrangle and vicinity were found to have yields ranging from 0 to 100 gal/min and a median yield of 6 gal/min. Values for upper and lower quartiles are 12.0 gal/min and 2.9 gal/min, respectively. Only 4 percent of these wells yield less than the 2 gal/min minimum considered adequate for domestic use. Figure 4 shows distribution of yields of 139 wells. Specific capacities of these wells range from 0.00 (gal/min)/ft to 3.5 (gal/min)/ft; the median is 0.10 (gal/min)/ft. Depths of the wells range from 60 ft to 505 ft below land surface. Median well depth is 158 ft. Because most of the wells analyzed are domestic wells, they may not be indicative of the potentials of the aquifers.

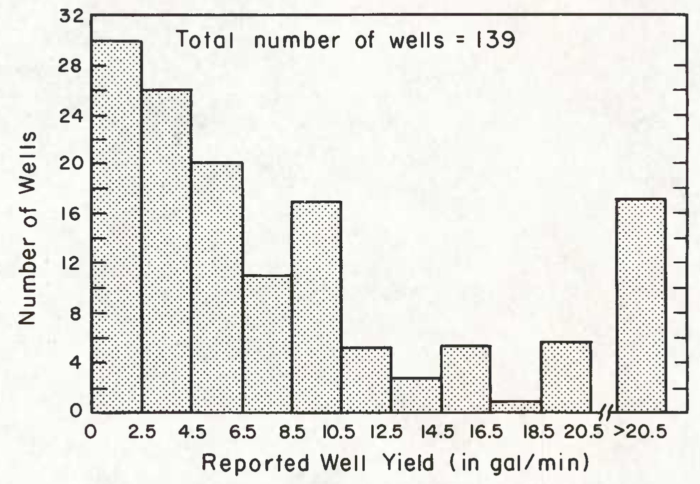


Figure 4. Distribution of reported well yields, wells having pumping tests of three-hour minimum duration.

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Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943
Culture revision by the Geological Survey 1953

PHOTOREVISED 1974

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MARYLAND
QUADRANGLE LOCATION

1981

Prepared in cooperation with the United States Geological Survey, the Baltimore County Office of Planning and Zoning and the Commissioners of Carroll County.

LINEBORO QUADRANGLE MARYLAND: HYDROGEOLOGY
GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

By
Mark T. Duigon

INTRODUCTION

Where centralized sewage systems are not available, wastes from individual homes must be disposed of by other means, usually within home-site boundaries. These wastes are composed of many different substances including urine, fecal material, laundry soaps and cleaning compounds, and food scraps--all transported out of the house as a slurry by mixing with large quantities of water. Some of these are toxic, while others may support bacteria and viruses. These substances must be reduced in quantity or deactivated to prevent contamination or pollution of the environment.

The usual disposal method is to feed the slurry into a septic tank (which separates the liquid from solids and greases), which releases a partly purified effluent into a seepage pit or tile field for infiltration through the soil. It is in the soil (or saprolite in most places in the Piedmont) where most of the renovation should occur as the effluent percolates toward the saturated zone.

Careful construction and maintenance of disposal systems are essential. Negligent construction of tile fields is as common a cause of failure as incorrect soil evaluation or system design (Coulter and others, 1961, p. 17). Lack of periodic maintenance is the primary reason for failure of over 15 percent of approximately 30,000 individual disposal systems in Baltimore County (Marvin Cook, oral commun., 1978). Systems that operate according to different principles may be more effective, but if not maintained, they lose their effectiveness and fail more readily than seepage pits or tile fields combined with a septic tank.

This map indicates the relative degree to which the geohydrologic environment affects the operation of septic-tank systems based on the constraint factors described below.

The following diagram shows the relative degree of constraint between the three units:

CONSTRAINT FACTORS

1. Flood hazard: Disposal systems do not drain properly when flooded and may be physically damaged. Contamination of surface water is possible when flood waters mix with effluent, and can spread to ground-water supplies.

2. Shallow water table: If effluent enters the ground-water system before it has passed through enough soil for adequate renovation, it will contaminate the ground-water system. Baltimore County requires 4 feet from the base of the seepage system to the water table, and the base is usually at least 6 feet below the land surface. The Carroll County requirement is 5 feet.

3. Depth to bedrock: Fractures in bedrock act as ground-water conduits, and renovation of effluent is not effective. Therefore, the thickness of unconsolidated material between the base of the seepage system and the bedrock surface needs to be sufficient.

4. Slope: Excessive slopes generally have thinner soil covers and are likely to allow effluent to emerge at the surface. Baltimore and Carroll Counties allow a maximum slope of 25 percent. Sternberg (written commun., 1974) concluded that, where the slope exceeds 20 percent, effluent will come to the surface downslope from a drainfield regardless of soil type or depth of trenches. Measured slopes for this map were obtained from Map 1.

5. Infiltration rate: This factor affects the design of the disposal system. If infiltration is too slow, plumbing will operate sluggishly and may back up. If too fast, renovation will be inadequate. In Maryland, the infiltration rate is evaluated at the site by a percolation test [1/].

Most of these factors are individually evaluated on a broad scale by the U.S. Department of Agriculture, Soil Conservation Service (Matthews, 1969; Reybold and Matthews, 1976) and are presented in tabular form corresponding to mapped soil units. The map presented here integrates and maps those evaluations in addition to field observations by the author, other data in this atlas, and consideration of percolation tests by county officials. This map cannot substitute for onsite evaluations, as discussed in the section, Limitations of Maps.

1/ The percolation test in Baltimore County consists of digging at least two holes to bedrock or as deep as the backhoe will dig (about 16 ft). This is to determine if the water table or bedrock surface is high. A lateral extension of the first hole is dug to an approximate depth of 5 ft (initially), and, at the bottom, a 1x1x1-ft hole is hand-dug. This small hole is filled with water to a level of 7 in. above the base of the hole. The level is allowed to drop 1 in. and then is timed as it drops a second inch. The test is considered successful if the level takes from 2 to 30 minutes to drop the second inch. If the test fails, it is repeated at a greater depth or at another location. A proposed building lot must have a successful percolation test before a building permit will be issued, if sewage is to be disposed onsite. The testing health official also notes any other factors that may affect operation of the disposal system, such as impermeable layers. The Carroll County percolation test is similar.

MAP UNITS

UNIT I: Disposal facilities constructed in this unit are likely to fail. The unit generally occurs adjacent to streams and lakes. It is characterized by one or more of the following critical factors: Subject to flooding; water table less than 10 ft from land surface; bedrock at depths less than 10 ft; land slopes exceeding 25 percent; the presence of soils having low permeability (less than 0.63 in/hr, equivalent to greater than 95 min/in). Unit I includes soils that have developed on alluvium and are subject to flooding, such as the Melvin silt loam and Baile silt loam. It also includes residual soils, such as the Mt. Airy channery loam, which is characterized by bedrock depths of less than 3 ft.

UNIT II: Conditions in this unit are not as severe as in Unit I, but several factors may combine to affect disposal systems adversely. Onsite evaluation is of particular importance because of variability and, in places, marginality. Unit II occurs mainly in patches adjacent to Unit I, but a little upslope from stream channels. It generally corresponds with areas mapped as Manor or Glenelg soils, with moderate (15 to 25 percent) slopes. Depths to water table and bedrock vary; for example, depth to bedrock beneath Montalto soils is reported to be 5 to 12 ft. Unit II includes areas of scattered outcrops, stony areas, and areas where the land has been modified and is, therefore, variable in several properties.

UNIT III: This is the most favorable unit for disposal systems, but inclusion in this unit does not guarantee the suitability of a particular site for sewage disposal. Unit III is generally found in well-drained interfluvial areas and is dominated by Chester, Glenelg, and Manor soils of gentle (less than 15 percent) slopes developed over schist and phyllite. Permeability varies (0.63 to 6.3 in./hr or 95 to 9.5 min/in.), but is generally adequate. The water table and bedrock are at depths greater than 10 ft.

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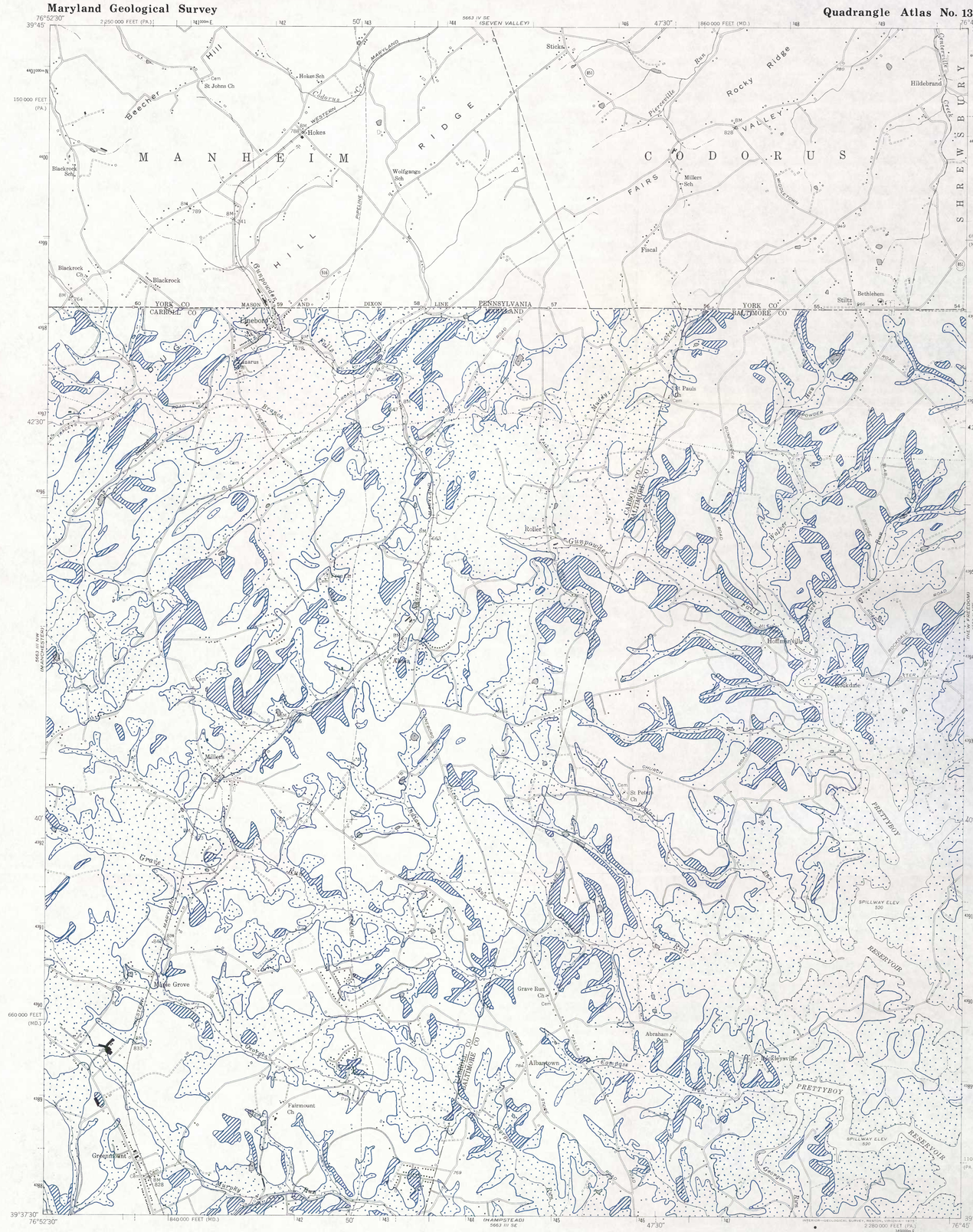
MAP 5. GEOHYDROLOGIC CONSTRAINTS ON SEPTIC SYSTEMS

Maryland Geological Survey **Quadrangle Atlas No. 13**



Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943
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PHOTOREVISED 1974

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1981

QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey, the Baltimore County Office of Planning and Zoning and the Commissioners of Carroll County.

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
Kenneth N. Weaver, Director

QUADRANGLE ATLAS NO. 13

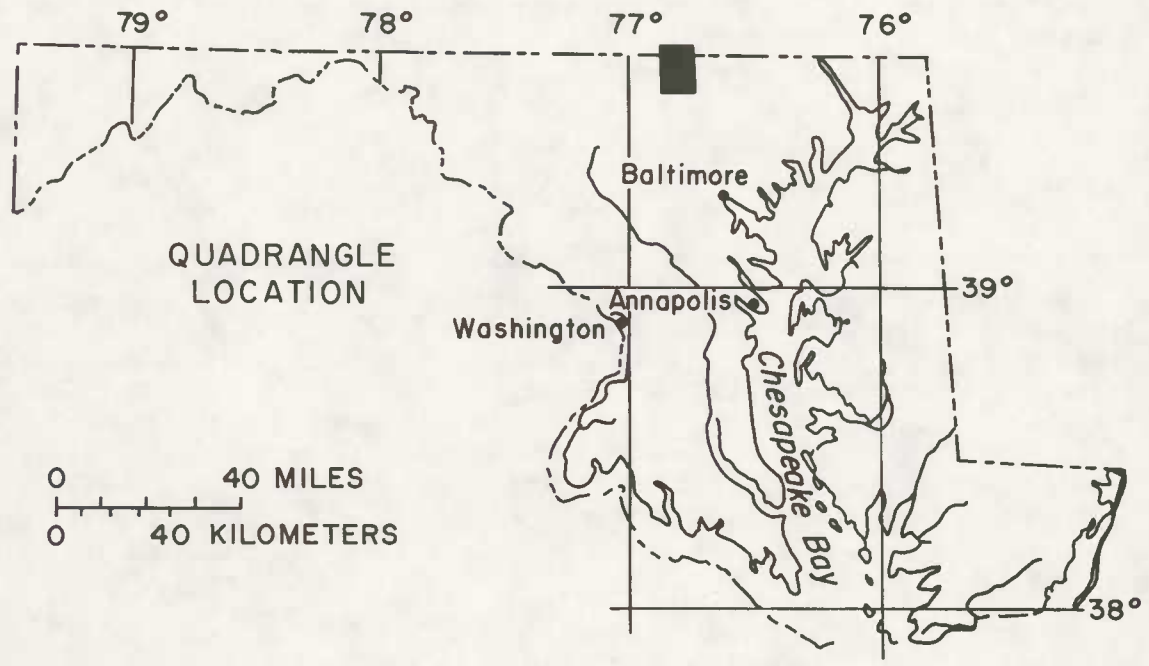
LINEBORO QUADRANGLE: HYDROGEOLOGY

By
Mark T. Duigon, Edmond G. Otton and John T. Hilleary

INTRODUCTION

This atlas describes the hydrogeology of the Lineboro 7 1/2-minute quadrangle in northwest Baltimore County and northeast Carroll County, Maryland. The northern quarter of the quadrangle extends into York County, Pennsylvania. The York County portion has not been included in this study.

The information contained herein is intended for use by planners, health officials, developers, environmental consultants, and the public, who are concerned with the interaction between ground water and development and land use.



The climate of this area is temperate, with an average annual temperature of 52°F, and an average annual precipitation of 44 inches (Vokes and Edwards, 1974, p. 20, 28).

The Lineboro quadrangle lies within the eastern division of the Piedmont physiographic province. The area exhibits the rolling topography typical of that province. Along major streams, and part way up their tributaries, many valleys are steep-sided. Except for a small area southwest of Maryland Highway 30, drainage is to Gunpowder Falls. Geologic structure (joint systems) controls the drainage pattern to an extent. Magnitudes and frequencies of stream discharges are described by Walker (1971), using U.S. Geological Survey stream-gage data. There are no stream gages in the Lineboro quadrangle; however, Walker presents a method for estimating stream characteristics at ungaged locations based on basin characteristics whose relations to discharge have been determined at sites where long-term records exist. The nearest U.S. Geological Survey stream gage is located one-half mile south on Georges Run at Armacost, in the adjacent Hampstead quadrangle.

Land in the area is used largely for agriculture and woodland; major crops are corn and wheat. In recent years, several housing developments have been built to accommodate the expanding population, which includes migration from urban areas.

The availability of waterpower and clean water from Gunpowder Falls led to the establishment of some of Maryland's first papermills by William Hoffman (Seitz, 1946). In 1893, after 117 years of operation, the papermills closed. Several years later the property was turned over to Baltimore City for the creation of a water-supply reservoir. Prettyboy Dam was completed in 1933 and was named for a tributary of the Gunpowder Falls near the dam site. The Prettyboy Branch received its name from a horse that drowned in the stream (Seitz, 1946, p. 53). The height of the dam crest above the streambed is 130 feet. The reservoir floods 1,500 acres at crest elevation and has a capacity of about 20 billion gallons. Baltimore City owns approximately 7,380 acres of land adjoining the reservoir, and this land is protected as part of the watershed. In addition to serving as a water supply, the reservoir provides recreation in the form of fishing, hiking, and boating.

GEOLOGY

The Lineboro quadrangle is underlain by metamorphosed sedimentary rocks, most of which are schist and phyllite, and, in some areas are calcareous or, locally, pure marble. Most of the rocks in this quadrangle belong to what has been called the Wissahickon Formation; however, stratigraphic nomenclature has been undergoing revision. (See Southwick and Fisher, 1967; and Crowley, 1976.) The stratigraphic nomenclature used in this report is that of Crowley (1976a, 1976b) and does not necessarily follow the usage of the USGS. In the Lineboro quadrangle, the principal formation is the Prettyboy Schist. A small area in the northwest part of the study area is underlain by the Bachman Valley Formation and the Marburg Formation.

Mantling these crystalline rocks is a variable thickness of overburden consisting of weathered rock (saprolite) and alluvium deposited by streams along their flood plains. The nature and thickness of the overburden depend upon such factors as the type of rock from which it was derived and its topographic position. In some places rock that is only slightly weathered is exposed, while in other areas saprolite thickness exceeds 100 feet. Overburden is generally thinner beneath steeper slopes, due to erosion. Because well drillers usually set casing 1 or 2 feet into fresh rock, depth of casing is usually a good indication of overburden thickness (Nutter and Otton, 1969, p. 15).

A variety of soils has developed in response to factors such as climate, biota, topography, parent material, and time. The various soil types have been mapped and studied by the U.S. Department of Agriculture, Soil Conservation Service (Matthews, 1969, Reybold and Matthews, 1976).

HYDROLOGY

In the Piedmont province, ground water occurs chiefly in fractures in crystalline metamorphic rocks. Water moves along these fractures; intersecting fractures provide a larger network for ground-water movement. Fractures tend to become tighter with increased depth (LeGrand, 1954), thereby decreasing the rate at which water can flow. Also, the number of fractures encountered decreases with increased depth. This decrease in fracture frequency and openness usually limits the depth to which water wells can be drilled economically. Davis and Turk (1964) present a method for determining the optimum depths of wells, considering both hydrologic and economic factors.

Most of the ground water is stored in the pore spaces of unconsolidated material that overlies the fractured rock. This overburden is considered too unsatisfactory to be developed as a water supply because of its commonly low permeability and the susceptibility of contamination to wells drilled in this material. Overburden serves as a storage reservoir for the underlying rock aquifer; however, the rate at which water can be pumped from a well depends on the hydrologic properties of the rock itself.

The overburden provides renovation for downward-percolating water. The rock fractures have little renovation capacity. If contaminated water infiltrates the fractures, it can travel significant distances without adequate purification.

The primary criterion for choosing successful well locations is topography. Wells in valleys and draws tend to have greater yields, whereas those on hilltops are generally deeper and less productive. This may be caused by the decrease in number of fractures with depth; the water table is closer to the land surface in valleys and draws and therefore more intersecting fractures are filled with water; however, under hilltops, only the deeper, more widely separated fractures contain water. Another factor is the tendency of stream valleys to follow zones of rock weakness, which may in some cases correspond to zones of multiple fractures. And finally, topography can help concentrate recharge.

Rock type may have an effect on well yields. The strength and mineralogy of a rock unit affect the rock's permeability by influencing the way in which fracturing develops and weathering occurs.

An analysis of linear features aids in selecting optimum well sites. In some places, these features, called lineaments, are related to zones of more intense fracturing. These features are identified by linear segments of stream channels, linear soil or vegetation tonal patterns, and alinement of some geologic features. They can be seen on topographic maps and aerial photographs, but need to be field-checked for verification. Although fractures can occur anywhere, the probability of drilling a well that will intersect at least one water-bearing fracture is increased by choosing a site that is suspected of being in a zone of greater fracture density.

MAPS INCLUDED IN THIS ATLAS

The information in this atlas is presented as five maps, each on a standard topographic quadrangle base:

1. Slope of the Land Surface, by Photo Science, Inc.

2. Location of Wells and Springs, by Mark T. Duigon and John T. Hilleary.

3. Depth to the Water Table, by Mark T. Duigon and Edmond G. Otton.

4. Availability of Ground Water, by Edmond G. Otton and Mark T. Duigon.

5. Geohydrologic Constraints on Septic Systems, by Mark T. Duigon.

LIMITATIONS OF MAPS

These maps are designed for broad planning purposes and are not meant to substitute for detailed onsite investigations where required. The boundaries may not be exact because of the scale of the maps, data quality, geographical distribution, and judgment required for interpolation and extrapolation.

CONVERSION OF MEASUREMENT UNITS

In this atlas, figures for measurements are given in inch-pound units. The following table contains the factors for converting these inch-pound units to metric (System International or SI) units:

Inch-pound unit	Symbol	Multiply by	For metric unit	Symbol
inch	(in.)	25.4	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
mile	(mi)	1.609	kilometer	(km)
gallon	(gal)	3.785	liter	(L)
gallon per minute	(gal/min)	0.0631	liter per second	(L/s)
gallon per day	(gal/d)	0.0438	cubic meter per second	(m^3/s)
gallon per minute per foot	[(gal/min)/ft]	0.2070	liter per second per meter	[(L/s)/m]

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1/ The name of this agency was changed to Maryland Geological Survey in June 1964.

Department of Natural Resources

MARYLAND GEOLOGICAL SURVEY

Kenneth N. Weaver, Director

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