INTRODUCTION AND MAP 1. SLOPE OF LAND SURFACE

Maryland Geological Survey

Quadrangle Atlas No. 19

HYDROGEOLOGY

By James F. Williams III and others

INTRODUCTION

This atlas describes the hydrogeology of the Finksburg 7 1/2-minute quadrangle in southeastern Carroll and northwestern Baltimore Counties, Maryland, and is intended as an aid to planners, managers, and other users of hydrogeologic information.

The Finksburg quadrangle is drained by the Patapsco River and three of its major tributaries--Morgan, Beaver, and Piney Runs. The topography is hilly to undulating, and the maximum relief is 420 feet. The quadrangle includes several towns and substantial suburban development; but the principal land use is agricultural. The climate is typical of the humid Piedmont region of Maryland, and the average annual precipitation is 43 inches per year (46-year mean at Westminster, Md., which is 8 miles northwest of the quadrangle). Precipitation is almost evenly distributed throughout the year, but is slightly greater in the spring.

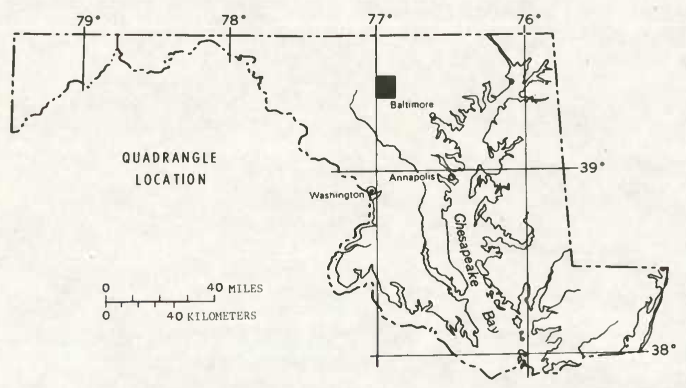

Figure 1. Location of Finksburg Quadrangle in Maryland.

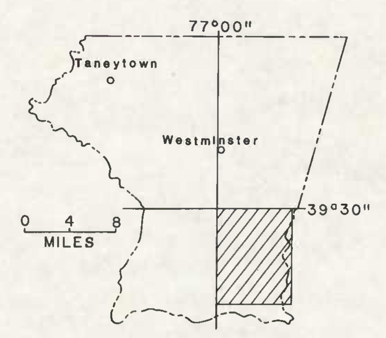

Figure 2. Location of Finksburg Quadrangle in Carroll county.

HYDROLOGY

Part of the local precipitation infiltrates into the ground and recharges the ground-water reservoir. The ground water discharges to streams and sustains the flow during dry periods. The ground-water reservoir consists of the voids and pores in the weathered rock (saprolite) and fractures and joints in the unweathered rock. The water table, which is the top of the zone of saturation, fluctuates in response to changes in ground-water recharge and discharge. All water-bearing rocks in the Finksburg quadrangle can be thought of as belonging to a single water-table aquifer; however, there are some rock units within this aquifer that are more productive than others. The yield of a well depends on the nature and thickness of the weathered zone and the extent and degree of fracturing of the rock.

The ground water is of satisfactory chemical quality for most use. The water is generally soft; hardness averages 34 mg/L as $CaCO_3$ and ranges between 5 and 110 mg/L. Most of the water is mildly acidic; the pH averages 6.4 and ranges from 5.5 to 7.9. Chloride content averages 12.5 mg/L and ranges from 3 to 50 mg/L.

GEOLOGY

The Finksburg quadrangle lies within the Piedmont physiographic province. It is underlain by metamorphosed sedimentary and igneous rocks of probable lower Paleozoic age. Rock types are mainly gneiss, schist, and phyllite. The geology was mapped in detail for the Maryland Geological Survey by W. P. Crowley (unpublished map; written commun., 1978).

The rocks of the quadrangle are overlain by soil and weathered rock (saprolite) that vary in thickness, depending on the topographic position and the type of rock (Otton and others, 1975). In some places the saprolite is thin or absent, and in other places it is more than 100 feet thick; it tends to be thin beneath steep slopes and thick beneath many broad upland areas.

MAPS INCLUDED IN ATLAS

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

Map 2. Depth to the Water Table, by James F. Williams III and John T. Hilleary.

Map 3. Availability of Ground Water, by James F. Williams III.

Map 4. Geohydrologic Conditions Pertaining to Domestic Underground Liquid-Waste Disposal, by James F. Williams III, and Edmond G. Otton.

Map 5. Location of Wells, Springs, and Test Holes, by John T. Hilleary and James F. Williams III.

SLOPE OF LAND SURFACE

Prepared by

Photo Science, Inc.

EXPLANATION

Four slope-area categories are shown on this map by three types of shading and by the absence of shading for the terrain category having a slope of 0 to 5 percent. Terrain having the maximum slope (greater than 25 percent) currently (1978) exceeds the maximum land slope permitted for the installation of domestic sewage-disposal systems (septic tanks) by the Carroll County Health Department. Intermediate terrain categories are useful in planning certain construction activities involving local roads and drains.

This map was prepared using topographic contour negatives by a process developed by the U.S. Geological Survey, Topographic Division. The process uses a semiautomated photomechanical process, which translates the distance between adjacent contours into slope data. The slope zones on the map are unedited. Proximity of the same contour or absence of adjacent contours may produce false slope information at small tops and depressions, on cuts and fills, in saddles and drains, along shores of open water, and at the edges of the map.

LIMITATIONS OF MAPS

All the maps of this Atlas represent some degree of judgment and interpretation of available data. The boundaries depicted on maps are not to be construed as being final, nor is the information shown intended to supplant a detailed site evaluation by a specialist in these fields.

CONVERSION FACTORS

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

U.S. Inch-pound Unit	Symbol	Multiply by	For Metric Unit	Symbol
inch	(in.)	25.4	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
yard	(yd)	0.9144	meter	(m)
mile	(mi)	1.609	kilometer	(km)
square mile	(mi^2)	2.590	square kilometer	(km^2)
U.S. gallon	(gal)	3.785	liter	(L)
U.S. gallon per minute	(gal/min)	0.06309	liter per second	(L/s)
U.S. gallon per minute per foot	[(gal/min)/ft]	0.207	liter per second per meter	[(L/s)/m]

SELECTED REFERENCES

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic map of Maryland: Maryland Geological Survey, scale 1:250,000.

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Stose, A. J., and Stose, G. W., 1944, Geology of the Hanover-York district Pennsylvania: U.S. Geological Survey Professional Paper 204, 84 p.

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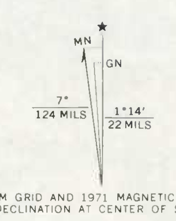
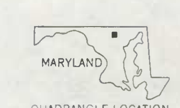


SCALE 1:24000

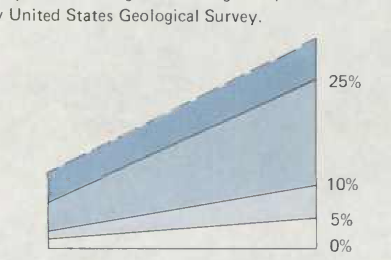
1 MILE — 7000 FEET — 1 KILOMETER

Contour interval 100 feet

1981



Prepared by Photo Science, Inc., Gaithersburg Maryland. Utilizing contour negatives, furnished by United States Geological Survey.



DEPTH TO WATER TABLE

By James F. Williams III and John T. Hilleary

EXPLANATION

This map shows the approximate depth to the top of the zone of saturation (water table). Control for the areas underlain by a shallow water table (0 to 10 feet) is based largely on an analysis of the drainage network on the topographic quadrangle. Control for areas having deeper depths to the water table is based largely on well records (see map 5) and on an analysis of topographic features. In some places, temporary perched zones of saturation may occur above the levels indicated on the map. Areas delineated on the map are not static, but will change from season to season and from year to year.

The water table fluctuates both seasonally and over longer periods in response to changes in frequency and amounts of infiltrating precipitation. Ground-water levels also fluctuate in response to withdrawal from wells, but in the Finksburg quadrangle the effect of pumping from domestic wells is not widespread, such effects normally being confined to a few tens of feet from each well. The greatest fluctuation in the water table occurs beneath hills and uplands and the smallest in valleys and swales.

In general, ground-water levels are lowest in the fall and early winter and highest in the spring; but in some years the lows and highs may deviate from this pattern. Average seasonal fluctuations of the water table are shown in figure 1 by an analysis of the 24-year water-level record of well CL-DD 2, in Winfield about 2 miles west of the Finksburg quadrangle. This well is located in an upland area; it is 310 feet deep and ends in schistose rocks. Water levels generally rise from December to May, a period when ground-water recharge exceeds discharge, and decline from June to November, an interval when ground-water discharge is dominant. The range in water level during any one month over the period of 24 years was substantial. For example, the October range in level amounted to 12.4 feet during the period of record. During the entire period of record, the measured water level fluctuated over a range of 15 feet.

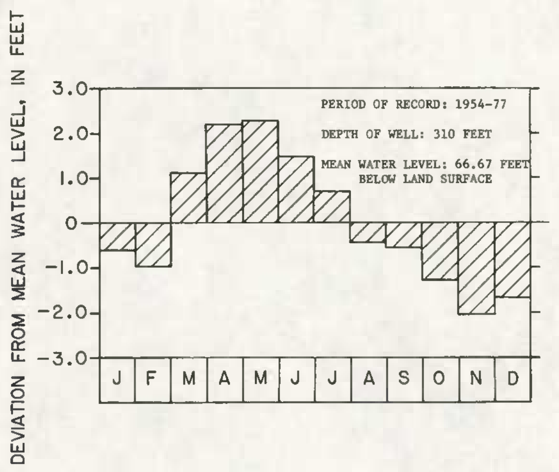


Figure 1. Average monthly deviation from mean water level in well CL-DD 2.

Figure 2 indicates the magnitude of water-level fluctuation in well CL-DD 2 and two other observation wells. The magnitude is often related to the topographic position of a well. Lowland or valley wells, such as BA-EC 43, generally have a lower magnitude of fluctuation than upland wells, such as CL-DD 2 and HO-BD 1. Well BA-EC 43 is located along a stream valley in Pikesville 8 miles southeast of the Finksburg quadrangle, and well HO-BD 1 is located in an upland area at Slacks Corner 2 miles south of the Finksburg quadrangle.

Water levels also fluctuate from year to year depending mostly on differences in precipitation. Figure 3 shows the yearly deviation from the mean water level for 1947-77 for well HO-BD 1.

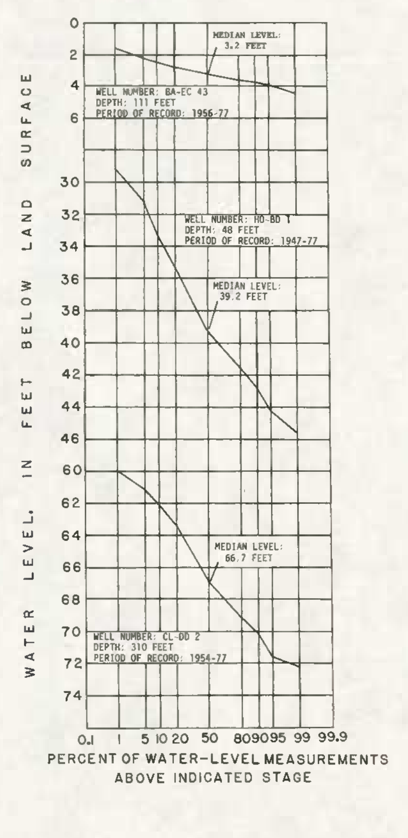


Figure 2. Stage-duration graph of water levels in observation wells.

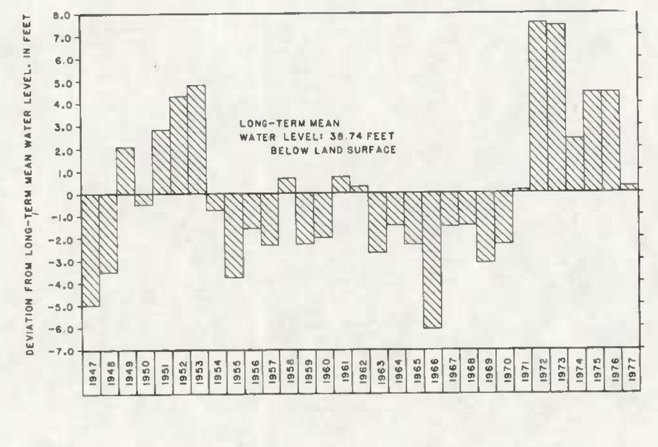


Figure 3. Deviation of annual mean water level from the long--term (1947-77) mean water level in well HO-BD 1.

APPROXIMATE DEPTH TO WATER IN FEET BELOW LAND SURFACE

0 - 10 Feet

10 - 35 Feet

Greater than 35 Feet

MAP 2. DEPTH TO WATER TABLE

Maryland Geological Survey

Quadrangle Atlas No. 19

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943. Field check 1944. Culture revised by the Geological Survey 1953

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

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.

AVAILABILITY OF GROUND WATER

By James F. Williams III

INTRODUCTION

Cround water in Carroll and Baltimore Counties occurs in fractures and other voids in crystalline rocks and in saprolite (decomposed rock), which forms a mantle of variable thickness over most of the bedrock. The source of all the water in the rocks is infiltration of local precipitation. Downward-moving water fills voids and fractures in the rocks and saprolite, forming a zone of saturation at variable depths beneath the land surface. The upper surface of the zone of saturation is the water table, or potentiometric surface. This irregular surface fluctuates with time in response to changes in the rate of replenishment of the saturated zone and to changes in the rate of removal of water from the zone. Water is removed from the saturated zone by gravity flow to nearby streams, by pumping from wells, and by transpiration where the root zone of vegetation is sufficiently close to the saturated zone.

Rocks capable of yielding water to wells and springs are termed aquifers. All water-bearing rocks in the quadrangle can be considered a single water-table aquifer. Figure 1 is a generalized sketch showing ground-water occurrence and movement in the Piedmont region. The yields of individual wells tapping the aquifer vary widely and depend on factors such as topographic position of the well, nature and thickness of the saprolite, and extent and degree of fracturing of the rocks at the well site.

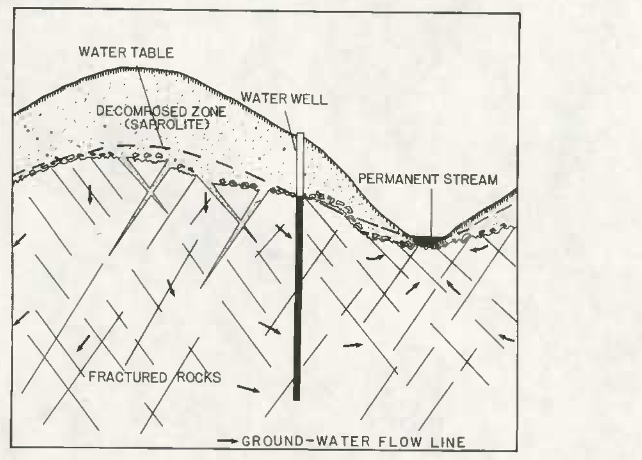


Figure 1. Occurrence and movement of ground water in Piedmont terrain.

In general, fracture openings and voids in the rocks decrease with increasing depth. An analysis of the depth of water-yielding fractures, as reported by drillers in 211 wells in the Finksburg quadrangle, indicates that most wells tap fractures in the uppermost 50-100 feet. Figure 2 shows the distribution of water-yielding fractures in depth intervals down to 400 feet, although few wells in the sample were drilled as deep as 400 feet. Most wells tap water-yielding fractures above 250 feet and the odds of encountering additional water-bearing fractures decrease with depth below 250 feet. Therefore, if a well has not obtained the desired yield at 250 feet or so, it might be more prudent to drill another well on a different site rather than to continue drilling below 250 feet.

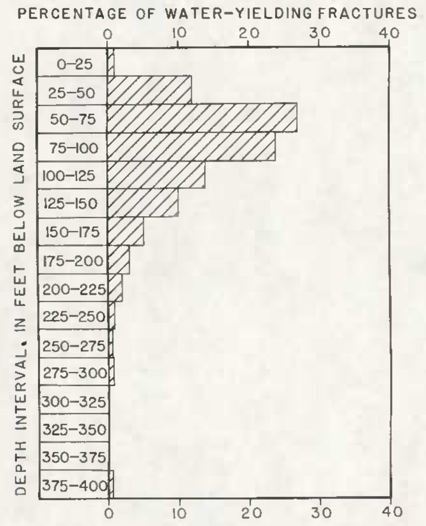


Figure 2. Frequency of water-yielding fractures in 211 wells in the Finksburg quadrangle.

The distribution of fractures is a major factor governing the availability of water in crystalline rocks. An analysis of aerial photographs and the 1:24,000 scale topographic map of the Finksburg quadrangle shows linear features that may identify zones of rock fracturing. The major linear features visible on the photographs are shown by straight-line segments on the accompanying map. The linear orientation of many valleys, streams, and draws within the Finksburg quadrangle appears to be controlled by zones of rock fracturing. Wells drilled in such zones may be expected to have above-average yields. Four wells in the quadrangle (CL-DE 105, -DE 270, -DF 57, and -EE 77) that are situated on linear features have an average specific capacity 1/ of 0.54 (gal/min)/ft, which is approximately 60 percent higher than the average specific capacity of the 231 wells analyzed.

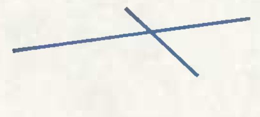
EXPLANATION

Rocks in the quadrangle are predominantly schist, gneiss, and phyllite, and all geologic formations present have similar water-yielding characteristics. Ceologic names and lithologic descriptions used in this report are from an unpublished map prepared for the Maryland Geological Survey by W. P. Crowley (written commun., 1978) and names do not necessarily follow the usage of the U.S. Ceological Survey.

Well-yield and specific-capacity data were evaluated according to geologic formation, and statistical tests of the data showed that, although similar, the formations could be grouped into two geohydrologic units, which are designated 3 and 3A on the map. Statistically, wells in unit 3A are slightly more productive than wells in unit 3. The statistical tests used were the Kruskal-Wallis and Wilcoxon methods (Sokal and Rohlf, 1969, p. 387-402).

Data available on well yield and specific capacity have an inherent sampling bias because a large proportion of the wells are used for domestic purposes, which do not require high yields. Domestic wells are commonly located on uplands, hillsides, and hilltops where conditions are less favorable for highly productive wells than in valleys and lowlands. An earlier study of ground-water conditions in Carroll County (Meyer, 1958, p. 44) indicated that the average yield of valley wells was more than twice as great as that of hilltop and hillside wells. Furthermore, not all domestic wells are tested for their maximum capacity as public supply and industrial wells commonly are.

The rocks of the Finksburg quadrangle are divided into two geohydrologic units according to their water-yielding characteristics, as shown by differences in the median specific capacities of wells in mapped geologic units. Ceohydrologic Unit 1, not present in the Finksburg quadrangle, is used to designate Coastal Plain aquifers present east of the Fall Line, about 15 miles east of the quadrangle. Geohydrologic Unit 2 is used to designate areas underlain chiefly by marble and associated rocks in quadrangles east and north of the Finksburg quadrangle. Rocks of this type are not present in the area of this map.



Linear features which maybe related to zones of rock fracturing.

3 CEOHYDROLOCIC UNIT 3: Area underlain by the Ijamsville Phyllite, Pleasant Grove Schist, Prettyboy Schist, and Sykesville Formation consisting mainly of schist, phyllite, and gneiss of early Paleozoic age. The schist is generally layered, well foliated, and very fine grained, and is commonly garnetiferous, muscovitic, and chloritic, with variable amounts of quartz. The phyllite contains variable amounts of chlorite, muscovite, quartz, and some paragonite. Limonitized pyrite cubes are present in places. The gneiss is mainly associated with the Sykesville Formation and is moderately well foliated to massive, unlayered, and composed of fine- to medium-grained biotite-plagioclase-quartz, locally containing garnet and muscovite. Thickness of the weathered zone is variable, ranging from 0 to more than 100 feet.

WELL YIELDS AND DEPTHS: The reported yields 2/ of 240 wells in the Finksburg quadrangle range from 0 to 36 gal/min. Figure 3 shows that about 4 percent of these wells are inadequate for most uses (yield less than 2 gal/min).3/ The mean yield is 8.7 gal/min; and the median is 7.1 gal/min. The well having the highest yield is CL-DE 98, which is 2 miles east of Gist.

The depths of 286 wells range from 50 to 505 feet; the mean and median depths of these wells are 135 feet and 120 feet, respectively.

WELL SPECIFIC CAPACITIES: Reported specific capacities 2/ of 194 wells range from 0.0 to 1.6 (gal/min)/ft of drawdown. The mean and median specific capacities of these wells are 0.25 and 0.17, respectively. The highest specific capacity 1.6 (gal/min)/ft was for well CL-DE 240, half a mile northeast of Clee Mill.

Figure 4 shows a histogram of the specific capacities of the 194 wells. Notice that the specific capacities of wells in unit 3 tend to be slightly lower than those for unit 3A shown in figure 6.

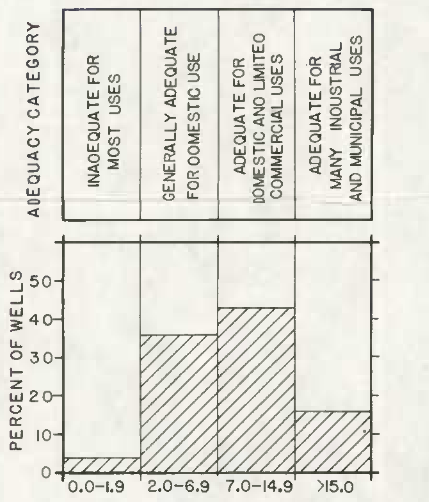


Figure 3. Yield class graph for Ceohydrologic Unit 3.

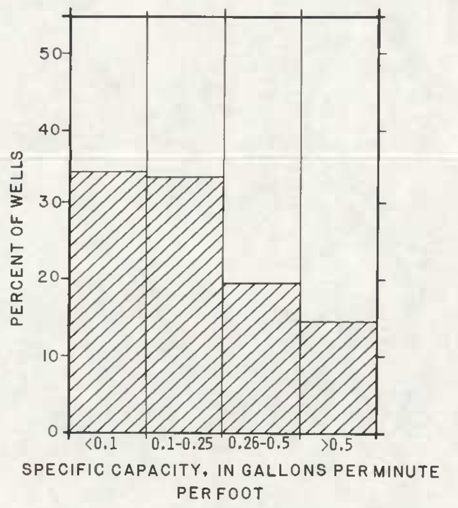


Figure 4. Specific capacity graph for Ceohydrologic Unit 3.

3A CEOHYDROLOGIC UNIT 3A: Area underlain by the Piney Run and Morgan Run Formations, consisting of fine- to medium-grained chlorite (or biotite)-plagioclase-muscovite-quartz schist, interlayered with 20-50 percent fine-grained quartzite. Locally, this unit contains up to 50 percent interlayered mafic and ultramafic rock. The mafic and ultramafic rock occurs as conformable layers generally a few feet to a few tens of feet thick. Thickness of the weathered zone is variable, ranging from 0 to more than 100 feet.

WELL YIELDS AND DEPTHS: All wells inventoried were capable of furnishing domestic water supplies (fig. 5). The reported yields 2/ of 37 wells in this unit in the quadrangle range from 2 to 30 gal/min; the mean is 9.7 gal/min, and the median is 8.0 gal/min. The well having the highest yield is CL-EE 143, which is 1.5 miles west of the Sykesville State Hospital.

The depths of 51 wells in this unit range from 45 to 377 feet; the mean and median depths of these wells are 108 feet and 100 feet, respectively.

WELL SPECIFIC CAPACITIES: Reported specific capacities 1/ of 37 wells range from 0.01 to 1.6 (gal/min)/ft of drawdown. The mean and median specific capacities of these wells are 0.41 and 0.31, respectively. The highest specific capacity 1.6 (gal/min)/ft was for well CL-DE 271, three-quarters of a mile northeast of Johnsville.

Figure 6 shows a histogram of the specific capacities for the 37 wells. Notice that the specific capacities tend to be slightly higher than those for unit 3 shown in figure 4.

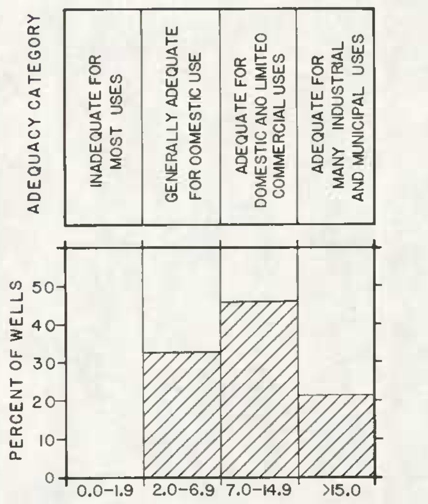


Figure 5. Yield class graph for Ceohydrologic Unit 3A.

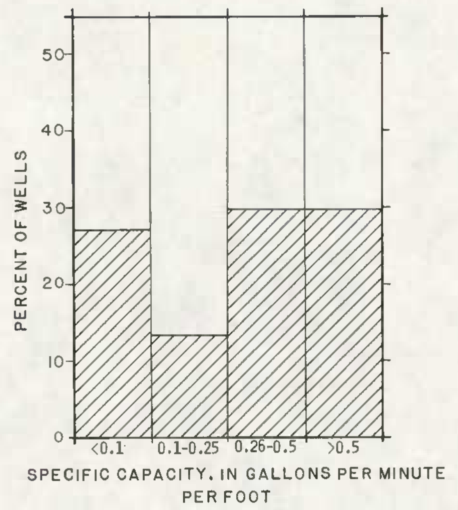


Figure 6. Specific capacity graph for Geohydrologic Unit 3A.

SELECTED REFERENCES

Meyer, Gerald, 1958, The ground-water resources, in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 22, p. 1-228.

Sokal, R. R., and Rohlf, J. F., 1969, Biometry: San Francisco, W. H. Freeman & Company, 776 p.

1/ Specific capacity of a well is the yield per foot of drawdown of the water level in the well. No time period is specified for the measurement of this variable, which is commonly expressed in gallons per minute per foot of drawdown (gal/min)/ft . For many domestic wells, the period of measurement ranges from 2 to 6 hours. Analyses include only wells tested for 2 hours or longer.

2/ Only wells for which the driller reported a yield test of 2 hours duration, or longer, were used in this analysis.

3/ The Maryland Water Resources Administration defines an adequate domestic well as one that will yield 2 gal/min or more during a 2-hour period. The well water-supply systems shall be capable of producing this quantity three times during any one 24-hour period.

MAP 3. AVAILABILITY OF GROUND WATER

Maryland Geological Survey Quadrangle Atlas No. 19

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943. Field check 1944 Culture revised by the Ceological Survey 1953

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

1981

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.

MAP 4. CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEMS

Maryland Geological Survey

Quadrangle Atlas No. 19

CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEM

By James F. Williams III and Edmond G. Otton

SELECTION OF UNITS

Septic tanks have been used for sewage-disposal systems for several decades in rural and suburban communities. Their number in the Finksburg quadrangle has greatly increased in recent years because of rapid suburban expansion.

Properly designed and located septic-tank systems can be efficient and effective in using the soil and subsoil to renovate and diapose of domestic wastewater. It is critical to construct a septic-tank system on a site that will insure that a high percentage of harmful aubstances are removed before the wastewater mixes with the underlying ground water.

Factors that can contribute to incomplete wastewater renovation are: (1) Lack of a satisfactory thickness of a suitable soil or subsoil over bedrock, (2) high water table, (3) steep land slopes, and (4) inadequate subsoil percolation rates.

The three areas, or units, shown on this map differ in their degree of limitations or constraints for domeatic wastewater-disposal systems because of differences in soil and subsoil characteristics, land slope, and depth to the water table.

MAXIMUM CONSTRAINTS	MARGINAL TO VARIABLE CONSTRAINTS	MODERATE CONSTRAINTS
I	II	IV
	III	IVA

FACTORS CONSIDERED, AND THEIR SOURCE OF EVALUATION

1. Bedrock--Because of its minimal absorption capacity, bedrock in the Finksburg quadrangle is essentially a non-renovating material. (A renovating material will remove many of the elements and compounds present in the wastewater.) An underground disposal system is not practicable where bedrock occurs at or near the land aurface. The Carroll County Health Department requires at least 5 feet of aoil or subsoil between the wastewater-discharge surface and bedrock.

2. Depth to Water Table--The ahallower the water table the thinner the unsaturated soil available for renovation. Also, areas underlain by a shallow water table are more susceptible to flooding during heavy precipitation or snowmelt. The Carroll County Health Department requires that (1) the water table be at least 5 feet below the bottom of the tile field or seepage pit, (2) the top of the tile field be 3 feet below the land surface, and (3) an additional 2 feet be added to compensate for ground-water fluctuations. This amounts to a minimum 10-foot depth from the ground surface to the water table.

3. Land Slopes--Steep land slopes are considered to be a major contributing cause of failure of underground-disposal systems (U.S. Public Health Service, 1961, p. 18). Slopes greater than 15 percent are considered hazardous for septic-tank installation by the U.S. Soil Conservation Service (U.S. Dept. of Agriculture, Soil Conservation Service, 1971, p. 8). The Carroll County Health Department does not permit the installation of underground domestic sewage-disposal systems where the slope is more than 25 percent.

4. Percolation Rates--Percolation rates are important in the design of septic-tank disposal systems. A slow percolation rate will contribute to a buildup of wastewater that eventually may seep to the land surface. A fast percolation rate will not allow for adequate renovation and, consequently, contaminated wastewater may reach the water table. The Carroll County Health Department requires a percolation test [1/] for each septic-tank disposal system.

MAP UNITS

I UNIT I. Includes low-lying valley-bottom areas, where the depth to the water table ranges from 0-10 feet; areas where the slope of the land surface exceeds 25 percent; and areas where the bedrock is less than 10 feet below land surface.

A large part of the terrain in unit I is characterized by steep-sided valley slopes, commonly rocky, and by flat, poorly drained valley bottoms, subject to periodic flooding. Some upland areas where the bedrock is near the land surface, such as the northwestern part of the quadrangle, are also included in this unit.

The valley bottoms are underlain mainly by Hatboro, Codorus, and Baile soils, consisting chiefly of silt loam and some gravelly loam. The steep hillsides are underlain by Mt. Airy and Glenelg soils and, in places, by bare rocky ground.

Few percolation tests have been run in unit I because it is seldom considered for building aites. The results of 30 tests show a range of from 10 to 800 min/in.

II UNIT II. Includes areas underlain by maroon to reddish-brown shale, siltstone and sandstone, comprising the New Oxford Formation. This unit has relatively thin soil and subaoil having low percolation rate, especially where shale and siltstone are the underlying rocka. Unit II is not present in the Finksburg quadrangle, but is present in the New Windsor quadrangle to the northwest.

III UNIT III. Includes areas underlain by marble and by bluish-gray phyllite and greenstone. In places, bands of steeply-dipping white to reddish, impure marble occur within wider bands of phyllite. Depths of weathering in these rocks range widely from a few to nearly 100 ft. Results of percolation tests show great variability in percolation rates. Unit III is not present in the Finksburg quadrangle, but is present in adjacent quadrangles to the north and west.

IV UNIT IV. Includes many of the upland interstream areas of the quadrangle where the depth to the water table ia greater than 10 ft, and, beneath many hilltops, is more than 35 ft. Underlain by a complex series of schist and interlayered quartz and quartzite, in places garnetiferous and muscovitic. Soils in unit IV are in the Mt. Airy, Glenelg, Linganore,and Chester series.

Based on 377 tests, percolation rates range from <1 to 50 min/in. The mean rate is 8 min/in. About 18 percent of the tests failed (68 tests), chiefly because the rates were too slow to meet the minimum passing requirements of 30 min/in.

As many of the sewage disposal systems in the quadrangle are seepage pits 6 to 12 ft deep in partly decomposed, fractured and creviced rock, the opportunity for suitable renovation of the liquid effluent is minimal. Under such circumstances, ground water in nearby downslope wells can become contaminated.

IVA UNIT IVA. Comprised of an upland, interstream area along a northeast trending band of interlayered achist and quartzite, including in places mafic and ultramafic rocks. W. P. Crowley (written commun., 1978), based on geologic mapping in 1977, has designated these rocks as the Piney Run and Morgan Run Formations. These names do not necessarily follow the usage of the U.S. Geological Survey.

The depth to the top of the water table commonly ranges from 10 to >35 ft. Soils in the unit are chiefly in the Mt. Airy, Glenelg and Chester series.

The results of 118 percolation testa show that percolation rates range from <1 to 20 min/in., and average about 5 min/in. Failing test results occurred in only 5 percent of the tests. The high percolation rates suggest that effluent will quickly pass into the underlying fractured rocks, and, as was true in unit IV, pose some degree of pollution hazard to ground-water supplies.

SELECTED REFERENCES

Healy, K. A., and Laak, R., 1973, Factors affecting the percolation test: Journal Water Pollution Control Federation, v. 45, no. 7, p. 1508-1516.

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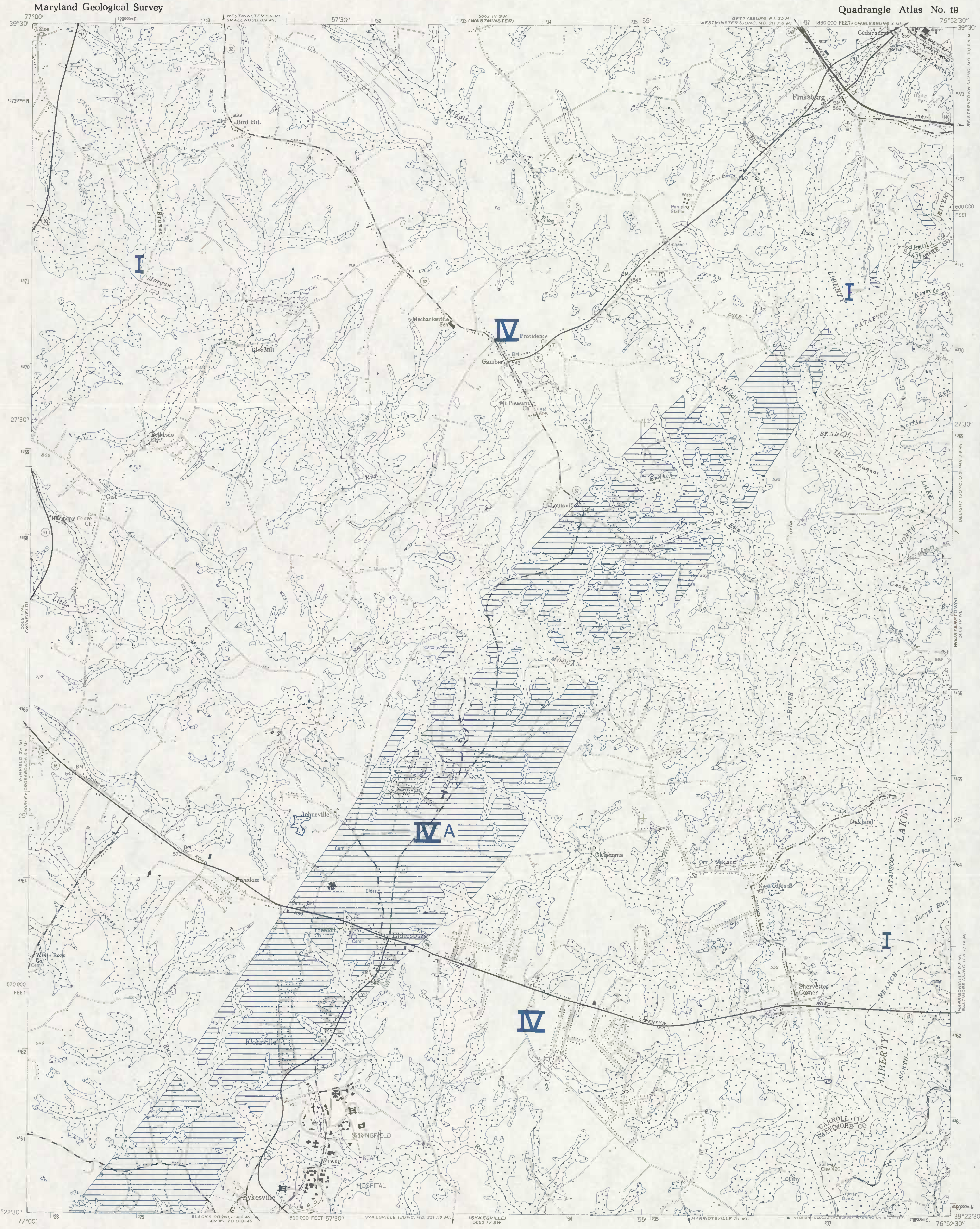
U.S. Department of Agriculture, Soil Conservation Service, 1969, Soil survey, Carroll County, Maryland: Washington, U.S. Government Printing Office, Soil Survey Series, 92 pages, 55 photomaps, 1 index.

_______1971, Soils and septic tanks: 12 p.

U.S. Public Health Service, 1967, Manual of septic-tank practice (revised edition): U.S. Public Health Service Publication 526, 92 p.

1/ The percolation test conducted in Carroll County (1979) is performed as follows: A 2- to 3-ft-wide pit is dug to the depth to be tested, and a 1-ft-square hole is hand-dug 1-ft deep in the floor of the pit. The 1-ft hole is filled with water, and the time required for the water level to drop the second inch of a 2-inch decline is measured. For the test to be rated "passing", the time required for the water-level to drop the second inch must be between 2 and 30 minutes.



Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943. Field check 1944. Culture revised by the Geological Survey 1953

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1981

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.

LOCATIONS OF WELLS, SPRINGS AND TEST HOLES

By John T. Hilleary and James F. Williams III

EXPLANATION

Information for wells and springs shown on the map is on file with the U.S. Geological Survey, Towson, Md., and the Maryland Geological Survey, Baltimore, Md. Drillers' logs and well-construction records are available for most wells shown.

Well-numbering system: The wells and springs shown on the map are numbered according to a coordinate system designed in 1942 by the U.S. Geological Survey. In this system, each Maryland county is divided into quadrangles of 5-minutes of latitude and longitude. The first letter of the well number designates a 5-minute segment of latitude; the second letter designates a 5-minute segment of longitude. These letter designations are followed by a number assigned to wells chronologically. This letter-number sequence is the quadrangle designation, which is preceded by an abbreviation of the county name. Thus, well CL-DE 14 is the 14th well inventoried in quadrangle DE of Carroll County, and well BA-EA 1 is the first well inventoried in quadrangle EA of Baltimore County. The numbering system currently in use (1977) differs slightly from that used in earlier published reports, such as Meyer (1958). In the 1958 report, well CL-DE 14 was designated as Car-De 14.

Miscellaneous shallow boreholes or auger test holes are designated by a number followed by a "T". These holes are numbered chronologically within each 7 1/2-minute quadrangle. Geologic and hydrologic records for them were obtained from various local engineering-consulting companies that have performed soil and hydrogeologic studies within the quadrangle.

Water wells drilled in Maryland since 1945 also have a number (not shown on this map) assigned by the Maryland Water Resources Administration. From 1970 through 1972, this number consisted of a two-letter county prefix (for example, CL for Carroll County) followed by a two-digit number indicating the State fiscal year in which the permit was issued (for example, -72 for the 1972 fiscal year). A four-digit chronologic sequence number follows the fiscal year designation. Thus, well CL-72-0010 is the 10th well permit issued for Carroll County during the 1972 fiscal year. In 1973, this system was modified and the first two digits of the number no longer indicate the fiscal year. In that year, permanent metal well tags were manufactured with the numbers ranging from CL-73-0001 to CL-73-9999. These tags are permanently attached to each well and are currently (1978) being used in Carroll County.

Records of wells, springs, and boreholes shown on the map are published in Meyer (1958), or are in the files of the U.S. Geological Survey at Towson, Md.

10 — WELL AND NUMBER

4 — SPRING AND NUMBER

8T — TEST HOLE AND NUMBER

SELECTED REFERENCE

Meyer, Gerald, 1958, The ground-water resources, in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 22, p. 1-228. [The name of this agency was changed to the Maryland Geological Survey in 1964.]

ADDITIONAL NOTE

Records of wells shown on this map are contained in:
Hilleary, J.T. and Weigle, J.M., 1982, Carroll County ground-water information: Well records, spring records and chemical quality data: Maryland Geological Survey, Basic Data Report No. 12, 252 p.

MAP 5. LOCATIONS OF WELLS, SPRINGS AND TEST HOLES

Maryland Geological Survey Quadrangle Atlas No. 19

Topography from aerial photographs by stereophotogrammetric methods. Aerial photographs taken 1943. Field check 1944. Culture revised by the Geological Survey 1953

1981

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