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# AVAILABILITY OF GROUND WATER IN PRINCE GEORGES COUNTY, MARYLAND

By

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## INTRODUCTION

One of Prince Georges County's most valuable natural resources is its ground water. Although there are rivers on both the west and the east sides of the county and there are many small streams throughout the area, these bodies of water are not generally suitable as sources of supply. The sources of public water supply furnished to much of metropolitan Prince Georges County by the Washington Suburban Sanitary Commission are the nontidal parts of the Potomac River (northwest of the District of Columbia) and the Patuxent River (northwest of Laurel). Much of the water in the Potomac and Patuxent Rivers adjacent to the county is brackish or is undrinkable without extensive and costly treatment. Despite hilly terrain in places, the county, in general, is relatively flat and lacks extensive steep-walled valleys for large-capacity surface-water reservoirs. Furthermore, many of the unconsolidated surficial sediments that cover the county cannot form watertight seals at dam sites. Thus, underground water resources assume an important role in this area.

## OCCURENCE OF GROUND WATER

The sources of ground water in Prince Georges County are: (1) Rain and snow that fall either on the county itself or on areas immediately outside the county boundaries and percolate downward into underlying strata; and (2) water in the streams that can be induced to enter the water-bearing formations (aquifers). As the county has generous rainfall in normal years, the aquifers are generally full to overflowing and discharge their surplus water to streams.

Under the influence of gravity, precipitation on the land surface works its way down through the soil and into underlying materials. The water then moves laterally to points of discharge in stream valleys. Water in a stratum that is overlain by permeable material is unconfined and occurs under water-table conditions. The water level in a water-table well fluctuates in response to precipitation, use by vegetation, and to pumping. Water in a fully saturated, permeable stratum that is overlain by impermeable material is under artesian conditions. Artesian water levels fluctuate in response to various natural causes, such as changes in barometric pressure and tidal loading and to pumping from wells. They do not generally respond to precipitation, except on a long-term basis.

The availability of ground water in a particular area is controlled largely by the geology. The text accompanying the geologic map (Hack, 1975) describes in some detail the formations or strata that are found in Prince Georges County. That information will not be repeated here: the reader will recall that, for the most part, these strata form a layered wedge-shaped mass of clay, silt, sand, and gravel lying on top of a hard, crystalline-rock floor. The rock floor dips to the southeast and the overlying wedge of sediments thickens in the same direction. The crystalline rock that appears at the surface in a few stream valleys in the northwestern part of the county lies almost 2,500 feet below the surface in the southeastern part.

Not all of the sediments underlying the county are capable of yielding water to wells. Clay and silt consist of such fine particles that even where they are saturated, their low permeability precludes the easy movement of water that is necessary for good aquifers. Thus, the most productive water-bearing formations in the Coastal Plain are composed of sand and gravel.

Although there is some water available from nearly all the sand beds in the Coastal Plain wedge, only a few are capable of yielding large quantities of water. The most productive aquifers in Prince Georges County are, from oldest (lowest) to youngest (highest): the sands of the Potomac Group, the Magothy Formation, and the Aquia Formation. As discussed in a later section, two aquifer zones, the Patuxent and the Patapsco, are recognized within the Potomac Group. Thus, there are four principal aquifers underlying the county. The geologic map and sections of the county (Hack, 1975) show the distribution of each of these units. In general, each aquifer becomes more productive as it thickens to the southeast. However, as there are local areal variations in the character of the formations themselves, there are variations in the productivity of the aquifers. Furthermore, in some areas the water may be undesirable because of its chemical character.

## WATER QUALITY

Water in the four principal aquifers contains less than 250 mg/l (milligrams per litre) of dissolved mineral matter, reported as dissolved solids. The water is suitable for domestic, public supply, and most industrial uses but may require treatment for the removal of iron and hardness. Areas where these constituents are likely to occur in objectionable concentrations are shown on the aquifer maps.

Iron in concentrations greater than 0.3 mg/l causes staining of fabrics and plumbing fixtures. Such concentrations of dissolved iron are likely to occur throughout all four aquifers. Only those areas where the iron content is likely to exceed 1.0 mg/l are delineated on the water-quality maps.

Hardness is caused by the presence of calcium and magnesium and is recognized by its soap-consuming tendency and the formation of scale. The Geological Survey defines water with up to 60 mg/l hardness as "soft", 61-120 mg/l as "moderately hard", 121-180 mg/l as "hard", and more than 180 mg/l as "very hard". The occurrence of hardness is shown on the water-quality maps. Very hard and, possibly, hard water would probably interfere with household use, although the extent to which hardness is tolerated varies from person to person and usually depends on what the individual has become accustomed to.

## AVAILABILITY OF GROUND WATER

The map of each of the four aquifers shows the location of most of the more productive wells in the county. For each well, the following data are shown: (1) Well number, to facilitate obtaining additional data concerning the well; (2) well yield, in gallons per minute; (3) diameter of the well casing, in inches; (4) depth to the bottom of the well, in feet, below land surface (this represents the deepest point at which water can enter the well); and (5) length of the screen, in feet (this represents the part of the well that is open to the aquifer and through which water may move into the well).

In addition to permeability, which varies throughout an aquifer, the construction features shown on the maps (diameter, depth, and length of screen) largely control the optimum well yield. A larger diameter and a longer screen facilitate the flow of water into the well and make it more efficient. Because pumping rate is proportional to water-level decline, the greater water-level drawdown that is generally possible in a deeper well permits higher yield. Note that the well-yield figures shown on the maps depend not only on the quantity of water available from the aquifers and on the factors mentioned above, but also on the demand at the particular site. For example, a small school will obviously not need as much water as a large housing development. Thus, the school well may never have been tested at, or designed to yield the maximum amount available from a particular aquifer.

In addition to well data, the maps show, by means of contours, the altitude of the top of each aquifer, in feet above or below sea level. This permits the prediction of aquifer depth at specific sites by subtracting aquifer altitude from land-surface altitude.

### Potomac Group

On the geologic map of Prince Georges County (Hack, 1975), the formtions that compose the Potomac Group are undivided and are mapped on the basis of lithology; that is, as sand and gravel, or clay. For purposes of describing the availability of ground water, however, it is desirable to divide the sediments of the Potomac Group into a lower sandy zone, the Patuxent aquifer, and an upper sandy zone, the Patapsco aquifer. These two aquifers are separated, at least in the northeastern part of the county, by a predominantly clayey zone, the Arundel Clay.

In the tidewater Potomac area (south of the District of Columbia and east of the Potomac River), there are few highly productive individual sand beds. Where large quantities of ground water are needed in this area, they can be obtained only by screening two or more sand beds that may occur in more than one aquifer.

### Patuxent Aquifer

The Patuxent aquifer is the principal source of ground water in the northern and northwestern parts of the county. The highest reported well yield is 1,104 gal/min (gallons per minute), and yields of at least 200 gal/min can probably be obtained from properly designed wells in most of the county. In the area adjacent to Montgomery County, the Patuxent is thin and well yields of less than 100 gal/min can be expected. This part of the county is least favorable for the development of ground-water supplies. Southeast of the —800-foot contour line, little is known about the nature of the sediments composing the Patuxent aquifer.

### Patapsco Aquifer

The Patapsco aquifer is an important source of water in a northeast-southwest-trending band across the central part of the county. The maximum reported well yield is 1,230 gal/min, and yields of at least 200 gal/min can probably be obtained throughout the area of occurrence. Although little information is available in much of the southeastern part of the county, the data from test drilling at Chalk Point in the extreme southeast corner of the county indicate that the Patapsco is a continuous aquifer zone and represents a potential source of water in areas where it is not presently tapped.

## Magothy Formation

The Magothy Formation, which overlies the Potomac Group, was once believed to crop out in a discontinuous band trending northeast-southwest across the north-central part of Prince Georges County (Keith, Miller, and Bibbins, 1911). More recent geologic maps have not identified this formation on the land surface and it is believed to be overlapped by younger deposits. Hence, it appears on the county geologic map (Hack, 1975) only in the cross-section.

The Magothy Formation is a major aquifer southeast of a line trending from Bowie-Belair to Upper Marlboro to Brandywine. West of this line, it thins, becomes less well defined, and is not considered to be an aquifer in the northern and western parts of the county. Although the Magothy is basically a sheetlike deposit, a domelike structure in the Brandywine area (Jacobeen, 1972) leads to somewhat erratic depths to the top of the formation within fairly short horizontal distances. Because the nature and extent of the Brandywine structure are only partly known, the contours should be used with some caution in this particular area.

The maximum reported well yield is 1,016 gal/min from a well at Marlboro Meadows, and yields of 100 to 300 gal/min may be obtained in much of the area underlain by the Magothy aquifer. Some wells drilled in recent years for public-supply or commercial purposes indicate that yields of at least 400 gal/min are available at Bowie-Belair, south of Upper Marlboro, and in the Chalk Point area.

## Aquia Formation

The Aquia Formation, the youngest and uppermost of the major aquifers in Prince Georges County, crops out in a large area in the central and eastern part of the county and in stream valleys in the southwestern part. In much of the area where it is present, it is too shallow, too thin, or too clayey to be very productive. Only in the southeastern part of the county is the Aquia capable of yielding more than several tens of gallons per minute to wells. An Aquia well drilled recently in Calvert County across the Patuxent River, about 2 1/2 miles southeast of Chalk Point, yielded 271 gal/min during a pumping test. Thus, larger yields than are presently known in Prince Georges County may be available to properly constructed large-diameter wells, but this remains to be proven by future drilling.

## SUMMARY

Although geologic conditions vary widely from place to place in Prince Georges County, some ground water is available throughout the area. Quantities adequate for public and commercial supplies are available in most areas. However, the development of wells for these purposes, ideally, would be preceded by careful study of data available in the files of the Geological Survey and perhaps by test wells, where detailed information does not now exist.

SELECTED BIBLIOGRAPHY

Hack, J. T., 1975, Geologic map for land-use planning, Prince Georges County, Maryland: U.S. Geol. Survey open-file report 75-208, 15 p., 1 pl.

Hansen, H. J. III, 1968, Geophysical log cross-section network of the Cretaceous sediments of southern Maryland: Maryland Geol. Survey Rept. Inv. 7, 46 p., 8 figs., 17 pls.

Jacobeen, F. H., Jr., 1972, Seismic evidence for high angle reverse faulting in the Coastal Plain of Prince Georges and Charles County, Maryland: Maryland Geol. Survey Inf. Circ. no 13, 21 p., 10 figs., 2 pls.

Keith, Arthur, Miller, B. L., and Bibbins, A., 1911, Map of Prince Georges County and District of Columbia showing the geological formations, Maryland Geol. Survey.

Mack, F. K., 1966, Ground water in Prince Georges County: Maryland Geol. Survey Bull. 29, 101 p., 40 figs., 2 pls.

Meyer, Gerald, 1952, Ground-water resources in Geology and water resources of Prince Georges County: Maryland Dept. of Geology, Mines and Water Resources 1/ Bull. 10, p. 82-257.

Otton, E. G., 1955, Ground-water resources of the southern Maryland Coastal Plain: Maryland Dept. of Geology, Mines and Water Resources 1/ Bull. 15, 347 p., 26 figs., 15 pls.

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