WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

GROUND WATER IN VIRGINIA: USE DURING 1990, AVAILABILITY, AND RESOURCE INFORMATION NEEDS

Ground water is an important water resource in Virginia. During 1990, an estimated 1,500 Mgal/d (million gallons per day) of freshwater was used in Virginia, in addition to 3,210 Mgal/d for hydroelectric power. An estimated 443 Mgal/d, or 30 percent of the total freshwater used, was withdrawn from ground-water sources. Approximately 1,060 Mgal/d was withdrawn from surface-water sources such as streams and lakes. The U.S. Geological Survey cooperates with State and local government agencies in Virginia, to describe hydrogeologic conditions that control the availability of ground water, and to define the potential for ground-water development.

GROUND-WATER USE DURING 1990

Ground-water users who withdraw 300,000 gallons per month (10,000 gallons per day) or more are required by the Virginia Department of Environmental Quality to report amounts of ground water that are withdrawn and the locations and uses of withdrawals. In addition, restrictions on ground-water pumpage are imposed on parts of southeastern Virginia because of water shortages. During 1990, a Statewide ground-water withdrawal rate of 197 Mgal/d was reported. The water was used primarily for public-water supplies and industrial and commercial purposes. Ground-water withdrawals reported during 1990 are summarized by county in figure 1. The maximum withdrawal rate of 33 Mgal/d was reported in Isle of Wight County, primarily for manufacturing. The minimum withdrawal rate of 0.001 Mgal/d (1,000 gallons per day) was reported in Buckingham County. A large range of withdrawal rates (from less than 0.1 to more than 30 Mgal/d) was reported in counties in the Valley and Ridge, Appalachian Plateaus, and Coastal Plain Physiographic Provinces. By contrast, small withdrawal rates (generally less than 1 Mgal/d) were reported in most of the counties in the Piedmont and Blue Ridge Physiographic Provinces. The largest withdrawal rates in the Piedmont Physiographic Province (up to 10 Mgal/d) were reported for public-water supplies in the counties in northern Virginia and near Richmond, and for manufacturing in Henry County. However, per capita use was similar among all counties in the Piedmont Physiographic Province (less than 100 gallons per day).

Self-supplied domestic and agricultural users and small industrial users who withdraw less than 300,000 gallons per month are not required to report withdrawal amounts, but had an estimated withdrawal rate of 246 Mgal/d during 1990. The actual amounts and geographic distribution of these withdrawals are not documented. Many withdrawals were probably for domestic or agricultural use.

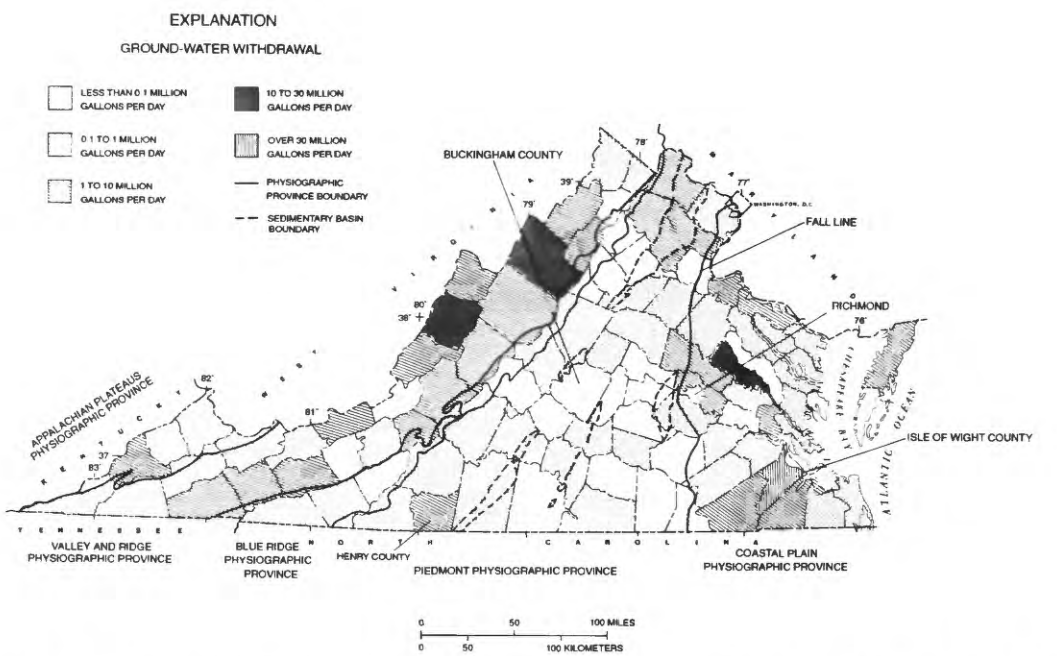

Figure 1. Physiographic provinces and reported ground-water withdrawal by county in Virginia during 1990.

GROUND-WATER AVAILABILITY

Ground water originates from precipitation that infiltrates the land surface. The average annual precipitation in Virginia is approximately 42 inches, of which about 8 to 10 inches recharges ground water. The availability of ground water in Virginia is controlled largely by different hydrogeologic conditions in the five physiographic provinces within the State (fig. 1).

In the Valley and Ridge and Appalachian Plateaus Physiographic Provinces, ground water is available largely from fractures in sedimentary rock, particularly in carbonate rock where fractures are enlarged by solution weathering. Some formations also can provide water from pore spaces between sediment grains.

In the Piedmont and Blue Ridge Physiographic Provinces, ground water is available in igneous and metamorphic rock almost entirely from fractures, because the rock is otherwise nearly impermeable. Ground water also is stored in pore spaces in weathered sediment (regolith) that overlies the rock. Within the Piedmont Physiographic Province, several sedimentary basins can provide ground water from permeable sandstone formations.

In the Coastal Plain Physiographic Province, ground water is available in the pore spaces of unconsolidated sediments. A seaward thickening wedge of eastward-dipping strata overlies Piedmont rock (fig. 2) and forms a vertical sequence of aquifers and confining units. Permeable formations that provide water are termed aquifers and less permeable formations which restrict flow are termed confining units. The thickest and deepest aquifers include the lower Potomac, middle Potomac, and upper Potomac-Brightseat aquifers. Shallower and thinner aquifers include the Aquia, Chickahominy-Piney Point, Yorktown-Eastover, and Columbia aquifers.

Location information is unavailable for estimated ground-water withdrawals. Therefore, only reported ground-water withdrawals that include location information were used to compare withdrawals among different areas of the State. The distribution of reported ground-water withdrawals among the different physiographic provinces is related to differences in ground-water availability. The largest reported withdrawal rates were from unconsolidated sediments in the Coastal Plain Physiographic Province (88.60 Mgal/d, or 45 percent of the Statewide reported withdrawal) and from sedimentary rock in the Valley and Ridge and Appalachian Plateaus Physiographic Provinces (88.43 Mgal/d, or 45 percent). These geologic materials store and transmit ground water more efficiently than materials in the other physiographic provinces. Within the Coastal Plain Physiographic Province 78.99 Mgal/d, or 40 percent of the Statewide reported total was withdrawn from the Potomac aquifers. By contrast, reported withdrawal rates are small (15.87 Mgal/d, or 8 percent) from the predominantly igneous and metamorphic rock in the Piedmont and Blue Ridge Physiographic Provinces.

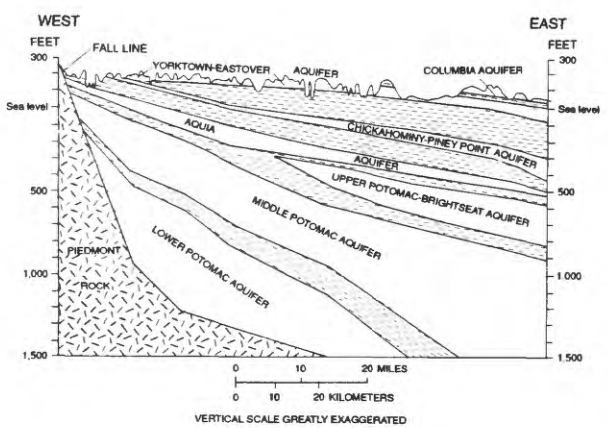

Figure 2. Generalized hydrogeologic section of the Coastal Plain Physiographic Province of Virginia.

GROUND-WATER RESOURCE INFORMATION NEEDS

Economic growth in Virginia depends, in part, on the future development of water resources. The potential for ground-water development in Virginia is generally not well known because of incomplete information on ground-water withdrawals and hydrogeology. Although studies have been conducted to address specific needs, a comprehensive Statewide approach has not been taken. Throughout the State, unreported ground-water withdrawals, and the effects of withdrawal on surface water and shallow ground water generally are unknown. Additional information is needed on factors that affect the availability of ground water. In the Coastal Plain Physiographic Province, the hydrogeology and withdrawal of deep ground water have been studied more than in the other physiographic provinces. However, effects of withdrawal along the boundaries of the flow system, such as water-level drawdown along the Fall Line and saltwater intrusion along the coast, are less well known. In the other physiographic provinces, successful ground-water development involves siting wells in productive fractures in bedrock. Because of the spatial complexity of fractures, detailed analysis at the county scale or finer is needed to identify specific areas of potentially large supplies, and to determine the effects of their development. In addition, controls on ground-water availability in fractured bedrock that result from regional-scale features, such as major faults and differences in lithologic and structural characteristics of major rock units, need to be determined.

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