



# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN WEST VIRGINIA

### GROUND-WATER ISSUES

Ground water is used throughout West Virginia for public, domestic, and industrial supplies. The water supply for about 53 percent of the State's population is derived from ground-water sources—wells, springs, coal mines, and limestone mines. Although most of the urban areas obtain water for public supplies from streams, 90 percent of the rural population depends on ground-water sources for domestic use. During 1985, estimated average withdrawal of ground water was 58.1 million gallons per day (Mgal/d) for public and self-supplied domestic use, 33.5 Mgal/d for industrial use, and 16.2 Mgal/d for agricultural use. More than one-half of all ground water used for public supply requires treatment to meet the national drinking-water standards established by the U.S. Environmental Protection Agency. The major issues in West Virginia related to ground water are:

- Ground-water contamination from landfills, hazardous-waste sites, urban-industrial areas, oil and gas fields, and agricultural areas,
- Effects of coal mining, and
- Availability.

### U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate scientific information on the Nation's water resources. The Water Resources Division of the USGS has three major activities in West Virginia: (1) Collection and dissemination of data, (2) water resource interpretive studies, and (3) research. These activities are conducted by scientists, technicians, and support staff in Charleston and Morgantown. Hydrologic-data collection and interpretive studies primarily are conducted in cooperation with local, State, and other Federal agencies, who share in the planning and financial support of the program.

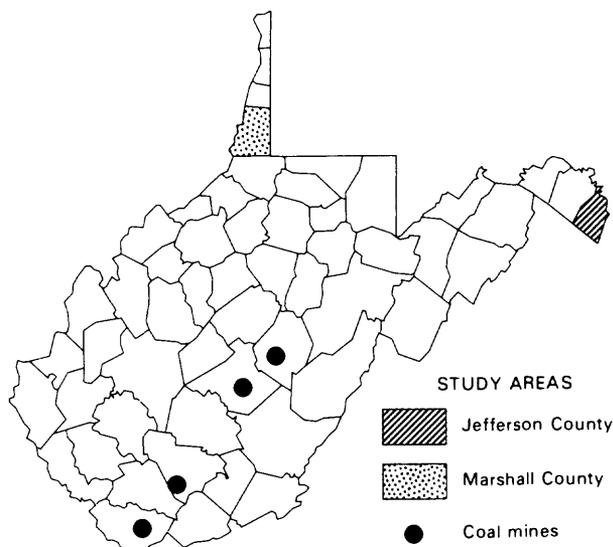
The USGS maintains four hydrologic networks to monitor streamflow and stage, ground-water levels, water quality, and sediment throughout the State. Hydrologic data are stored in the USGS National Water Data Storage and Retrieval System data base. The data are used by water planners and others involved in decisions that affect West Virginia's water resources.

During 1987, a statewide network of 33 observation wells was maintained by the USGS to measure fluctuations in ground-water levels. These measurements are used to monitor changes in ground-water storage. Water from selected wells in the network is sampled periodically and analyzed for major chemical constituents and physical properties.

The USGS has conducted more than 100 hydrologic studies in West Virginia. During fiscal year 1987, the USGS entered into agreements with 13 local, State, and other Federal agencies involving 23 hydrologic studies in West Virginia; 10 of these studies were concerned with ground-water quantity and quality. These studies provide information to answer hydrologic questions that are specific to the State's major ground-water issues and may provide information on multistate and national hydrologic problems. Three examples of ground-water studies by the USGS that address specific ground-water issues in West Virginia are discussed in the following sections.

### Ground-Water Flow in Limestone Areas, Jefferson County

Jefferson County, about 50 miles northwest of Washington, D.C., has experienced rapid population growth, about 42 percent from 1970 to 1980. Associated with this growth in population is an increased need for dependable water supplies. State and local officials are concerned about the availability of adequate supplies of potable ground water that will be required to meet this need. Most of the county is underlain by limestone that is susceptible to ground-water contamination. Recharge in limestone areas is rapid, and typically occurs through sinkholes and from caves and surface streams. These conditions make the safe disposal of wastes, such as sewage, difficult. Sinkholes, which are recharge points for underlying aquifers, commonly have been used for the disposal of domestic and agricultural wastes. Disposal of pesticides, spills of petroleum products, and leachate



from landfills and impoundments also are sources of contamination that could move rapidly through solution channels in the limestone to affect public-supply wells, springs, and streams. The USGS, in cooperation with the West Virginia Department of Natural Resources, Division of Water Resources, and with the Jefferson County Commission, is studying the ground water in limestone areas. The major objectives of the study are to delineate ground-water flow systems and describe the hydrogeologic characteristics of the aquifers, to assess the ground-water quality of major aquifers and identify areas where changes in water quality have occurred, and to develop hydrologic, geologic, and geographic data bases that are compatible with present geographic information systems. Information from this study will enable State and local regulatory agencies and planners to develop management strategies for the protection and future development of the ground-water resources of Jefferson County.

### **Effects of Longwall Coal Mining, Marshall County**

Longwall mining is a technique that is becoming more common in West Virginia and in other States in the Eastern Coal Province. In 1986, 43 mines in the State used this technique. Longwall mining removes more than 80 percent of the coal in a panel that is typically about 500 feet wide and several thousand feet long. Upon removal of the coal, the hydraulic roof supports are removed and the mine roof is permitted to collapse, which in turn, causes subsidence of the overburden. In Marshall County, many residents report declines in water levels in their wells and decreases in well yields near areas mined by the longwall technique. Additional information is needed about the ground-water resources of Marshall County and the effects of overburden collapse on the hydrology for the optimum development of ground-water resources and for maximum development of the State's coal resources. The USGS, in cooperation with the Marshall County Commission, conducted a 3½-year study to determine the ground-water conditions in mined and unmined areas, in subsidence areas, and of the effects of longwall-coal mining on ground-water hydrology in selected areas of the county. Available geologic and hydrologic data were compiled, areas mined by the longwall technique and other methods were identified, wells and springs were inventoried, water samples were collected for chemical analysis, an observation well and spring network was established, and numerous aquifer tests were conducted. The study found that longwall-coal mining caused increases in the transmissivity of the overburden, declines in ground-water levels, and decreases in spring discharge at two sites. Information gained from this study will be used by the mining industry and water managers to evaluate the probable effects of increased longwall mining in the State.

### **Availability and Quality of Water, Selected Underground Coal Mines**

Many small communities in the coal regions of West Virginia have limited water supplies. In some areas, water from active and abandoned underground coal mines is used for community, industrial, and individual water supplies. About 70 public water systems withdraw more than 7 Mgal/d of water from coal mines to supply an estimated 82,000 people, various industries, and commercial establishments with potable water. Information about the hydrologic characteristics of coal mines is needed to determine their potential as dependable sources of water. The USGS, in cooperation with the State Geological and Economic Survey, the Governor's Office of Community and Industrial Development, and the city of Welch in McDowell County, is studying the geologic and hydrologic characteristics of selected coal mines

to determine the recharge, discharge, and storage of underground mines; to determine the chemical quality of water and its spatial and temporal variability within the mines; to determine the response of the mine to pumping and the degree of interconnection with adjacent aquifer systems and mines; and to estimate the sustained yield available from the mines. The USGS is monitoring mine discharge and water levels in selected mines, collecting water samples to determine seasonal water-quality variations, and conducting aquifer tests at selected mines. The study will provide communities and industries with information needed to assess the potential of underground coal mines as dependable sources of potable water.

### **GROUND-WATER MANAGEMENT**

Water law in West Virginia is based on a modification of the riparian doctrine. State policy is to "maintain reasonable standards of purity and quality of the water of the State . . ." The responsibility for protection and management of ground-water resources is shared by the Departments of Natural Resources, Health, Energy, Agriculture, and Highways, and the Water Resources Board. These agencies and the State Geological and Economic Survey implement most of the regulatory, planning, and research programs of the State. The Division of Water Resources, Department of Natural Resources, administers and enforces all laws relating to the conservation, development, protection, and use of the ground-water resources of the State. During fiscal year 1988, the following State and local agencies entered into interagency or cooperative cost-sharing agreements with the USGS to conduct ground-water studies in West Virginia:

City of Welch  
Governor's Office of Community and Industrial Development  
Jefferson County Commission  
Marshall County Commission  
West Virginia Department of Natural Resources  
Division of Water Resources  
West Virginia Geological and Economic Survey

### **SELECTED REFERENCES**

- Meador, Steve, 1986, Regulation of surface subsidence in West Virginia, *in* Proceedings of the second workshop on surface subsidence due to underground mining: Morgantown, West Virginia, June 9-11, 1986, p. 6-8.
- Shultz, R.A., 1988, Ground-water hydrology of Marshall County, West Virginia, with emphasis on the effects of longwall-coal mining: U.S. Geological Survey Water-Resources Investigations Report 88-4006, 147 p.
- U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.
- \_\_\_\_\_, 1985, Water-resources investigations in West Virginia, 1985: U.S. Geological Survey Water Fact Sheet, 2 p.

Information on the technical reports and data related to ground water in West Virginia can be obtained from:

District Chief  
U.S. Geological Survey  
Water Resources Division  
603 Morris Street  
Charleston, West Virginia 25301

Director  
West Virginia Water Resources Research Institute  
P.O. Box 6064  
Morgantown, West Virginia 26506-6064