

# Virginia's Ground-Water Resources, Monitoring Network, and Studies, 2007

## Ground-Water Resources

Ground water is a valuable resource in Virginia, providing 312 million gallons per day, or 22 percent, of the total freshwater used in the State (excluding thermoelectric use). Contrasting geologic features and landforms of the physiographic provinces of Virginia affect the quantity and quality of ground water throughout the State. Most ground-water withdrawals are in the Coastal Plain in the eastern part of the State, where aquifers are highly productive.

## Ground-Water Monitoring Network

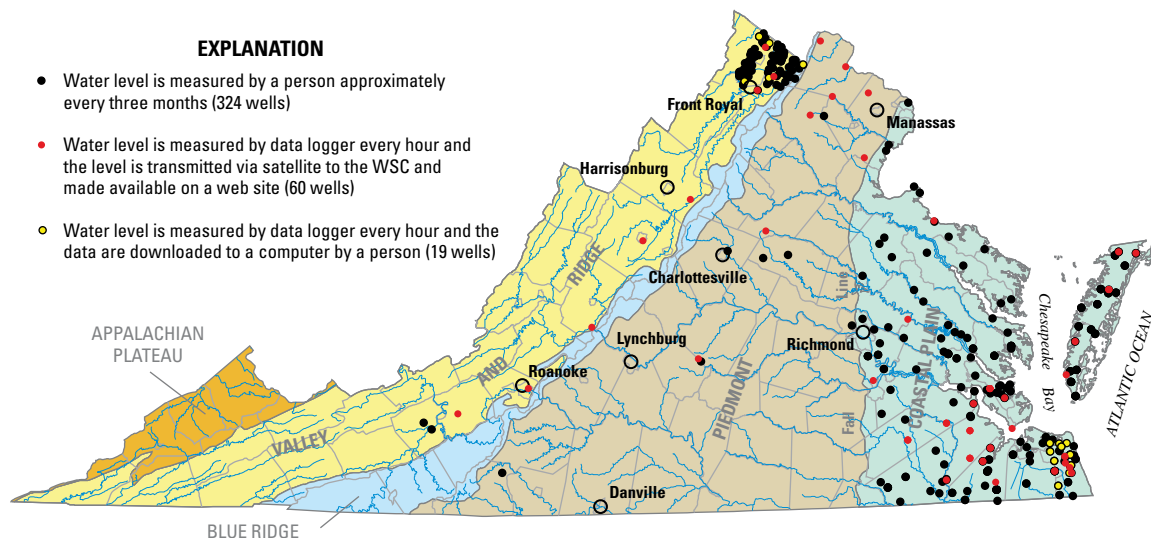
Ground-water-level and ground-water-quality data are essential for water-resource assessment and management. Water-level measurements from observation wells are the principal source of information about hydrologic stresses on aquifers and how these stresses affect ground-water

recharge, storage, and discharge. Long-term, systematic measurements of water levels provide essential data needed to:

- Evaluate changes in the resource over time;
- Develop ground-water models and forecast trends;
- Design, implement, and monitor the effectiveness of ground-water management and protection programs;
- Provide drought warning and tracking; and
- Inform the State's ground-water appropriation permitting process.

The USGS Virginia Water Science Center (WSC), in cooperation with the Virginia Department of Environmental Quality, monitors the water level in 403 wells across the State (fig. 1). Most of the wells are located in the Coastal Plain in the eastern part of the State and in the northern Shenandoah Valley.

*The foundation of any good ground-water analysis is the availability of high-quality data.*



**Figure 1.** Locations of 403 water-level monitoring wells in Virginia. For 2006 ground-water levels at 353 wells, see <http://web10capp.er.usgs.gov/imf/sites/adr06/launch2.jsp>. For current real-time ground-water levels at 61 wells, see [http://waterdata.usgs.gov/va/nwis/current/?type=gw&group\\_key=county\\_cd](http://waterdata.usgs.gov/va/nwis/current/?type=gw&group_key=county_cd)

*Although forecasts of future events that are based on model simulations are imprecise, they nevertheless may represent the best available decision-making information at a given time.*

## Ground-Water Studies

The Virginia WSC conducts ground-water studies in cooperation with State, local, and other Federal agencies. Such studies are conducted on the Coastal Plain, in the Shenandoah Valley, and State wide. Some studies are designed to assess the quantity, others are designed to assess the quality, and still others assess both the quantity and quality of ground water in a particular region.

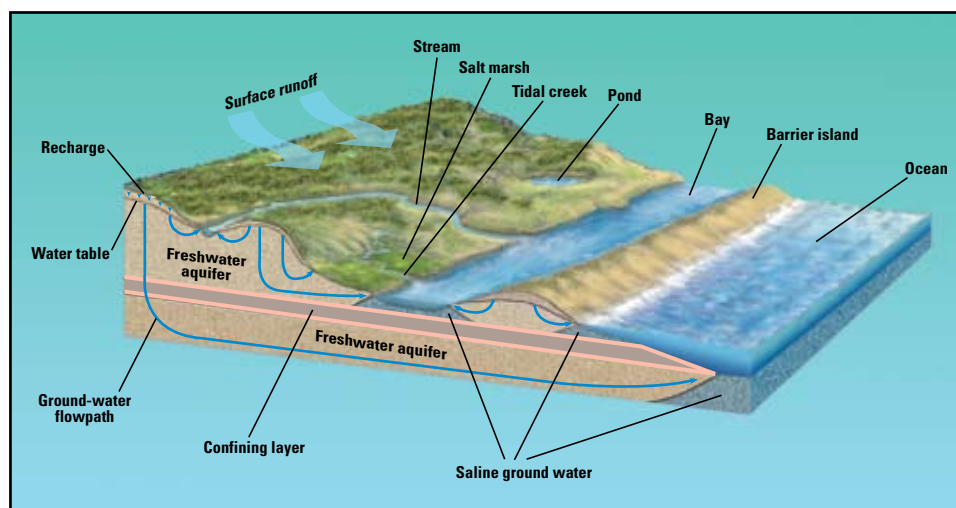
On the Coastal Plain, several computer ground-water flow models have been developed and are being updated. Along the densely populated Atlantic coast, demand for fresh water is strong. Care in this region, however, must be exercised to prevent overpumping of wells, which can allow salt water to intrude where fresh water once was. Ground-water flow models are valuable tools that help unravel the complex interactions among fresh water, salt water, and ground water along the coastal margin (fig. 2). The models allow predictions to be made of the location of the fresh water/salt water interface under different pumping regimes. These predictions are especially important on the Eastern Shore, which is underlain by a thin (less than 300 feet thick), shallow aquifer system that is the only source of fresh water. The Virginia WSC collects water samples from approximately 20 wells each year from a monitoring network of 156 wells in the Coastal

Plain. The samples are analyzed for chloride concentrations. Elevated chloride concentrations are an indication of salt-water intrusion, likely caused by over pumping ground water.

In the Shenandoah Valley, a regional ground-water flow model is being developed to assess the availability of ground water. Ground-water flow models are useful tools in this region, which is underlain by fractured-rock carbonate aquifer systems. Ground water can flow along torturous—and difficult to predict—paths in such an environment. As development pressure increases in the northern Shenandoah Valley, accurate predictions of ground-water availability are mandatory, and the Virginia WSC is conducting investigations of the aquifer systems in Frederick, Warren, and Clarke counties.

State wide, the Virginia WSC is participating in studies designed to evaluate ground-water/surface-water interactions to determine low-flow and base-flow characteristics of streams. These studies will provide estimates of water availability for regulatory flow and water-supply planning requirements.

For information about water resources in Virginia, see <http://va.water.usgs.gov> or contact Mark Bennett, Director, USGS Virginia Water Science Center, 1730 East Parham Rd., Richmond, VA 23228; 804-261-2643 ([dc\\_va@usgs.gov](mailto:dc_va@usgs.gov)).



**Figure 2.** Ground-water flow paths in an example coastal Virginia watershed. Fresh ground water is bounded by saline ground water beneath the Chesapeake Bay and Atlantic Ocean. Fresh ground water discharges to coastal streams, ponds, salt marshes, and tidal creeks and, directly to the bay and ocean.