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For More Information

The Virginia Water Resources Research Center has booklets and brochures about septic system maintenance, water wells, residential water conservation, rural and agricultural best management practices, urban and suburban best management practices, and the underground injection control program in Virginia. For more information about these booklets, call or write:

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Facts about Virginia's Groundwater

A vertical photograph of a forest stream. The water is clear and reflects the surrounding green foliage. A thin, vertical metal rod or pipe extends from the top of the frame down into the water. The background is a dense forest with various shades of green.

Sponenberg, Josten D.

What Threatens Groundwater Quality?

These activities and substances can degrade groundwater quality:

- Fertilizers and pesticides, particularly when these products are overused or improperly discarded, constitute a serious threat to groundwater quality. Chemicals used in termite control are long-lasting and are consequently a groundwater offender.
- Buried home-heating-oil tanks can corrode, leaking oil into the surrounding soil and contaminating groundwater. These tanks can endanger the quality of a homeowner's well water. If you have a buried fuel-oil tank that's more than 15 years' old, chances are good that it's leaking.
- Buried gasoline storage tanks at service stations are a threat to Virginia's groundwater. An estimated 1,500 to 2,000 of these tanks may be leaking. In some cases even a slow gasoline leak—a few gallons a day—can pollute an entire community's water supply.
- More than 4 million gallons of used motor oil are improperly discarded by do-it-yourself oil changers in Virginia each year. Used motor oil poured in backyards and streams, along roadsides, or down storm sewers can pollute ground and surface waters. Just one quart of oil can contaminate up to *2 million gallons* of drinking water.
- Solid waste—garbage and trash from homes, businesses, and industries—in improperly designed, used, and managed landfills and dumps is subject to *leaching*. Rainwater and snowmelt seeping down through such waste can dissolve hazardous substances and carry them into groundwater.
- Septic systems and cesspools are the most frequently reported sources of groundwater contamination in the nation. Wastewater from a septic system's drain field contains contaminants, such as bacteria, viruses, and nitrate, that can seep down from the drain field into groundwater. Septic systems located close to, or uphill from, water wells also can threaten water quality.

- Hundreds of improperly abandoned wells in Virginia pose threats to groundwater. They are often used for waste disposal.
- Hazardous waste dumps and burial sites pose threats to groundwater. In Virginia, more than 100 hazardous waste sites have been identified.
- Fowl and livestock wastes improperly placed in manure piles or lagoons can cause local contamination of groundwater.
- Improperly disposed radioactive waste from uranium mining and processing, nuclear power plants, nuclear weapons production, and laboratories poses a serious threat to groundwater.
- Drainage from coal mines can make groundwater so acidic that it cannot be used for many years.

What Can We Do?

Listed below are only a few of the ways we can make certain that future generations of Virginians will have clean, safe groundwater supplies:

- Store home-heating oil in an above-ground tank where leaks can be easily detected. A tank can be in a basement, attached garage, or outdoors.
- When using fertilizers and pesticides on lawns and gardens, follow the label's directions and do not use excessive amounts. Do not use fertilizers or pesticides within 20 feet of a drinking water well. Most labels contain directions for safe disposal of both the contents and the container.
- All toxic and hazardous substances—including pesticides—and their containers should be disposed of with extreme caution. Contact your local extension office or health department for information about safe, environmentally sound methods of disposal.
- Do not pour toxic or hazardous substances such as paints, varnishes, thinners, waste oils, pesticides, and herbicides into sinks or toilets.
- Collecting used motor oil for recycling is an easy way for do-it-yourself oil changers to protect

surface and ground waters. Used oil collection centers are located at participating service stations throughout the state. To find a collection center in your area call 1-800-552-3831.

- Have your septic tank pumped out regularly to remove solids that can clog the system. For more information on septic systems, consult your local health department.
- Cover your wellhead with a cap that will protect the well from vandalism and entry of airborne items. Grade the soil around the wellhead so that it diverts surface runoff water away from the wellhead.
- Do not store pesticides, fertilizers, and herbicides near a well. Do not dump waste near a well. Tanks for storing heating oil, gasoline, and diesel fuel should not be installed near a well. Do not build livestock pens or barns near a well.
- If you abandon a well, make sure that it is properly filled in and plugged; otherwise, the well can convey surface runoff water, and contaminants it carries, directly to groundwater. Do not put solid or liquid wastes into an abandoned well. Consult the State Water Control Board for help to ensure that the well you plan to abandon is properly filled in.
- Suspected illegal dumpings of hazardous wastes and similar problems in Virginia can be reported to the State Department of Health through this toll-free hotline: 1-800-552-2075. You may also contact your local health department or the State Water Control Board to report such actions or problems.
- Conserving household water saves not only water, but money and energy also. For less than a dollar, you can buy and install flow restrictors in faucets and shower heads that will reduce water use with little or no inconvenience to the user.
- Almost half of all water use in American homes is for flushing toilets. This amount can be reduced by rinsing out an empty plastic one-gallon milk jug, cutting off the top half, placing clean stones in the bottom half to add weight and displace water, and submerging it in the toilet tank so that it does not interfere with the flushing mechanisms.

Virginia's Hidden Resource

Every Virginian depends on a resource that is "hidden" in its natural surroundings—a resource that is used every day for manufacturing, washing, drinking, growing crops, and many other purposes. That hidden resource is *groundwater*.

What Is Groundwater?

Groundwater is water beneath the earth's surface. It's the water that's drawn from wells and flows from springs.

Groundwater is by far the earth's largest freshwater supply. Scientists estimate the amount of groundwater is *more than 400 times* greater than all the water in the world's lakes, reservoirs, and rivers.

A geologic formation containing a large amount of groundwater is called an *aquifer*. The process by which water seeps down from the ground into an aquifer is called *recharge*. The *recharge area* is the land area from which water filters down to enter an aquifer.

Groundwater is always on the move. It moves through and out of aquifers, appearing at the earth's surface as springs or seeps (the water appearing in the cover photograph is seeping from a rock fracture).

Common Misconceptions

Because groundwater is below the earth's surface, many misconceptions exist about it.

- For example, many people believe that all groundwater occurs in vast underground lakes and rivers. In truth, groundwater usually is found in tiny pores and cracks in geologic deposits.
- Another misconception is that groundwater rushes so rapidly underground that it can be heard. In reality, it generally moves very slowly through the earth, flowing only a few feet each year.
- Many believe that groundwater is quickly cleansed of contaminants as it flows through soil. Actually, different soils have varying capacities to filter and absorb wastes, and some man-made pollutants are scarcely affected by filtering through the earth.

What's the Groundwater Like Where You Live?

From a geological standpoint, Virginia is a complex state. It has five distinct areas, called *physiographic provinces*, of similar geologic structure and climate. Each province affects both the quantity and quality of groundwater found in it. Let's take a brief look at each.

Cumberland Plateau

The Cumberland Plateau is underlain principally by sandstone, shale, and coal. Groundwater of the best quality is generally obtained from bedrock above stream level. The first 100 feet of rock below stream level often contains water with high concentrations of sulfate, sulfite, nitrate, iron, and carbon dioxide. Water from coal seams and water contaminated by mine drainage is unsuitable for most uses. Wells generally yield from 10 to 50 gallons a minute. Overall groundwater quality, and the potential for pollution is moderate.

Valley and Ridge

Limestone, dolomite, shale, and conglomerate are the common rock types in the Valley and Ridge province. Where limestone dominates, groundwater yields are high. Ridges and upland areas are often underlain by sandstone and shale, which yield only enough water for rural and domestic use.

The relationship between groundwater and surface water is more easily recognized here than in other physiographic provinces. In limestone areas, sizable surface streams disappear into underground channels and, conversely, some large springs serve as headwaters of surface stream flow.

Natural groundwater quality is affected by the chemical composition of the rock

formations in this area. Limestone, for example, increases the "hardness" of the groundwater. The pollution potential is very high because many aquifers are directly recharged by surface water from streams and by runoff draining into sinkholes.

Blue Ridge

The Blue Ridge province is a relatively narrow zone of mountains with the highest elevations in the state. Groundwater use has been primarily limited to domestic needs. Springs are common and are used as private water supplies. Wells in the Blue Ridge usually yield less than 20 gallons a minute. Groundwater in the Blue Ridge is not highly mineralized because the rocks in contact with the water are relatively insoluble, but the iron content of the water is high in some locations. The groundwater pollution potential is high.

Piedmont

The central section of Virginia, between the fall line and the Blue Ridge Mountains, is known as the Piedmont province. Because the Piedmont's subsurface geology is diverse, there is wide variation in groundwater quality and well yields. In areas dominated by hard, crystalline rocks, most groundwater is found within a few hundred feet of the surface. Well yields commonly range from 3 to 20 gallons a minute.

Areas of sandstone and shale that were deposited beneath ancient inland seas (Triassic Basins, in blue on the map) are scattered throughout the Piedmont, and

they serve as fair to moderately good aquifers. However, urban and agricultural development in Triassic Basins is hindered by high aluminum content in the soil, so most of these areas remain forested. Seasonal fluctuation of the water table is also a problem in these basins.

Although overall, the pollution potential is poor to moderate, a State Health Department survey that included many residential shallow bored wells in this province revealed that more than 7 in 10 were contaminated by bacteria and chemicals—the result of poorly sealed wells, careless livestock and agricultural management practices, and faulty septic tank systems.

Coastal Plain

The Coastal Plain extends inland from the coast to an imaginary line that passes through Emporia, Petersburg, Richmond, Fredericksburg, and Fairfax.

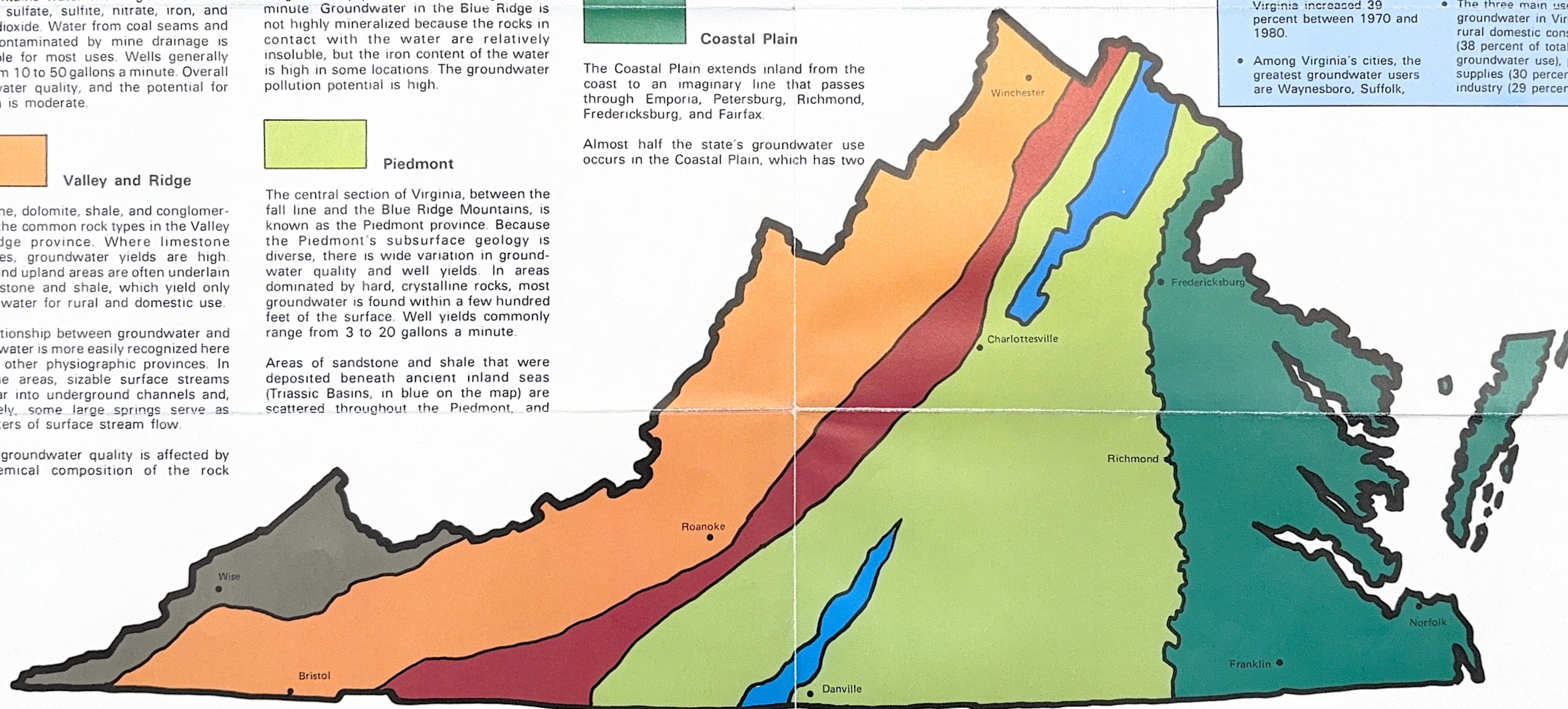
Almost half the state's groundwater use occurs in the Coastal Plain, which has two

separate groundwater systems, one shallow and one deep. The shallow aquifer system is the source of water for hundreds of domestic and other small-capacity wells, which withdraw more than 20 million gallons a day. The deep system of artesian aquifers (those under pressure from overlying rock formations) is the principal source of groundwater here, with deep wells withdrawing some 160 million gallons a day. Natural water quality is good, except in aquifers near the ocean, where saltwater zones commonly occur.

Geology of alternating layers of sand, gravel, silt, and clay, along with high population density result in a high pollution potential, especially in the shallow aquifers.

Groundwater Use in Virginia

- Although most Virginians get their household water from surface supplies, we use 389 million gallons of groundwater a day, an average of more than 70 gallons a person.
- Excluding surface water used to cool thermoelectric power plants, 31 percent of the fresh water used in Virginia is groundwater.
- About 12 percent of Virginians use household wells or springs to meet their domestic water needs.
- Groundwater use in Virginia increased 39 percent between 1970 and 1980.
- Among Virginia's cities, the greatest groundwater users are Waynesboro, Suffolk, Virginia Beach, Chesapeake, Franklin, and Manassas Park.
- Twenty-four of Virginia's 91 counties get at least 90 percent of their water from groundwater supplies.
- Virginia counties using the most groundwater are Accomack, Augusta, Isle of Wight, King William, and Rockingham.
- Irrigation accounts for only 2 percent of Virginia's groundwater use, though it accounts for 68 percent of groundwater use nationally.
- The three main uses of groundwater in Virginia are rural domestic consumption (38 percent of total groundwater use), public supplies (30 percent), and industry (29 percent).



Groundwater Protection—It's up to You!