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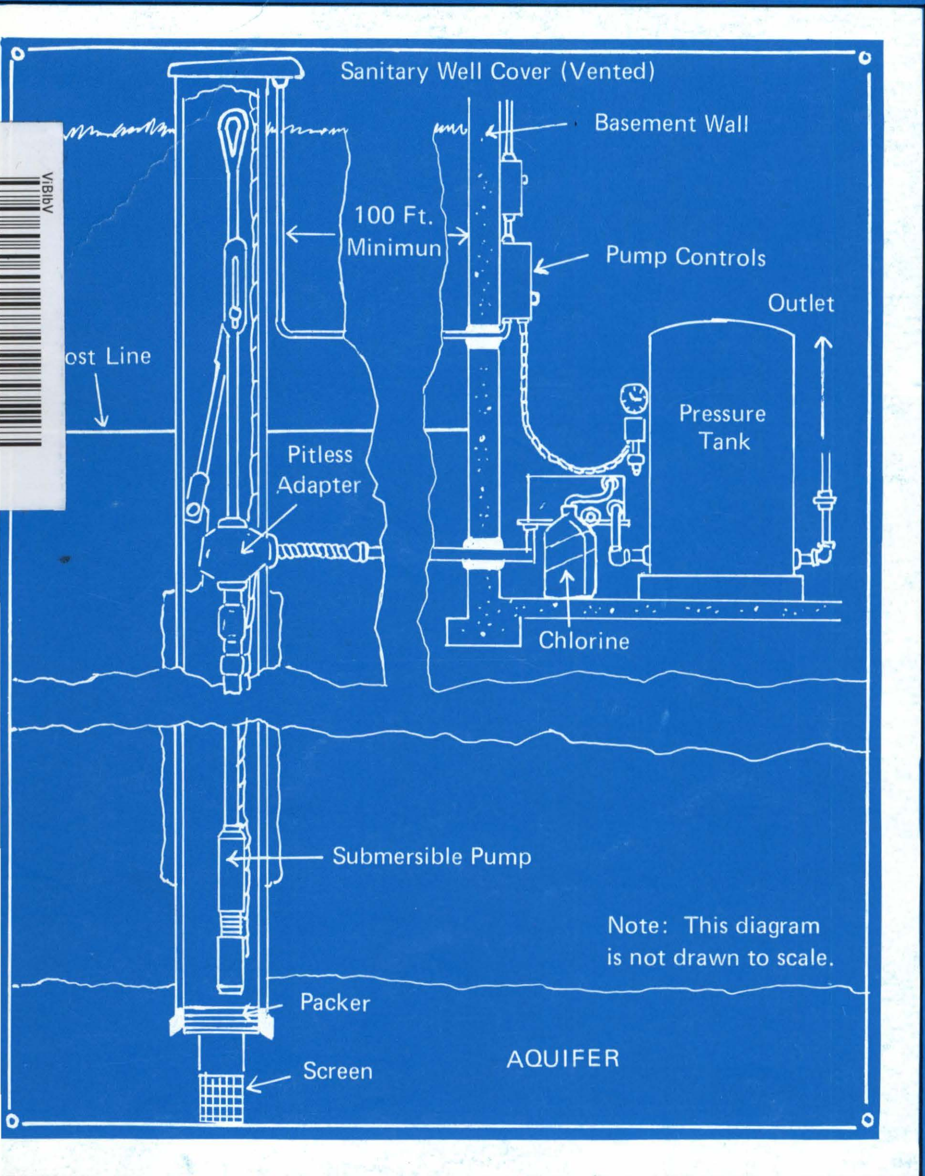

A Homeowner's Guide to Domestic Wells

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Introduction

Approximately 1.5 million Virginians obtain their domestic water supplies from private wells and springs, using an average of 100 gallons daily per person. Well users often take it for granted that their wells will always produce a dependable supply of clean, safe drinking water. However, neither the quantity nor the quality of the supply is guaranteed. If you rely on a well for your water, you may have some basic questions:

- Where does well water come from?
- How are wells constructed?
- Does a well need regular maintenance?
- Is well water always safe to drink?
- How can water quality be tested?
- How can water be treated to remove bacteria or unwanted minerals?

In this booklet we will answer these questions. We will also give you some tips about how to protect your water supply by avoiding practices that may contaminate groundwater. Let's begin by taking a brief look at groundwater—the natural resource that provides water to wells.

What Is Groundwater?

Groundwater is by far the world's largest source of fresh water. Scientists estimate the amount of groundwater is 400 times greater than all the surface water in lakes, reservoirs, streams, and rivers. The water on the earth's surface and in the ground is constantly moving through the hydrologic cycle, an endless circulation of water in nature (*Figure 1*). When precipitation falls on land, some water evaporates, some flows to streams and rivers, and some seeps into the soil and is absorbed by plant roots. Excess water in the soil may percolate farther down until it reaches a level, known as the *water table,* where all the pores or openings in the soil and rock are totally saturated with water. Water in the saturated zone below the water table is called *groundwater.*

An underground rock formation that holds and transmits enough groundwater to provide usable quantities of water to a well or spring is an *aquifer.* It may be of any size or thickness and may occur at depths of less than fifty feet or more than a thousand feet. Several aquifers may exist at various depths below a particular point on the land surface.

Groundwater moves very slowly through aquifers—usually less than one foot a day—until it eventually seeps into streams, lakes, wetlands, or the oceans. A spring is groundwater that has come to the surface. About 30 percent of the flow of U.S. streams comes from groundwater. In turn, rivers and lakes may contribute large amounts of water to an aquifer. The process of water entering an aquifer is known as groundwater *recharge.* The quality and the quantity of available groundwater are affected by the geology, climate, land use, and human activities in the area of recharge.

If more water is pumped from an aquifer than enters it, the aquifer eventually will be depleted of groundwater. Overpumping an aquifer eventually reduces the suppiy available for use and the amount available to flow into streams and surface water supplies. Overpumping in coastal areas, such as Virginia Beach, may cause salt water to enter freshwater aquifers and ruin drinking water supplies. Overpumping may also cause the land to subside, sometimes forming sinkholes.

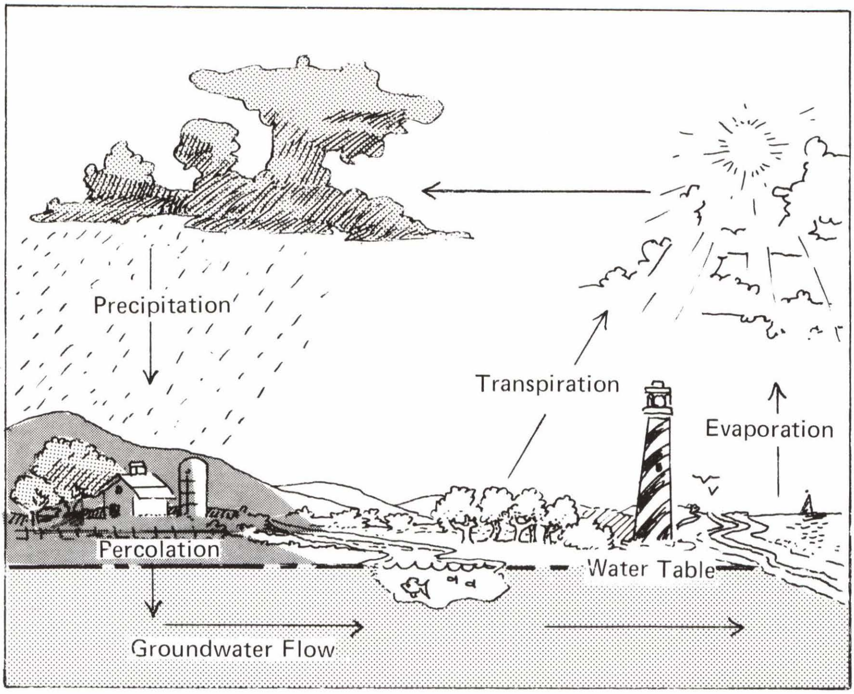


FIGURE 1
Groundwater is One Stage in the Earth's Hydrologic Cycle—the Continuous Movement of Water Above, On, and Beneath the Earth's Surface

Because groundwater frequently cannot cleanse itself of pollutants, contamination that reaches an aquifer can make a water supply unusable. Dangerous pollutants that contaminate groundwater are often difficult to detect. Contaminated groundwater may be colorless, odorless, and tasteless. Because groundwater generally moves slowly, contamination may go undetected for years. Unfortunately, groundwater contamination is almost always discovered by accident or after people have become ill from drinking contaminated water. Compared to many states, Virginia has had relatively few severe groundwater contamination incidents. However, the threat exists.

Groundwater in Virginia

About 8 of every 10 Virginians use groundwater—from public water supplies, private wells, or springs—for at least part of their daily water supply. Virginia's groundwater is generally of good quality and in many cases does not require treatment before use except as a precautionary measure. Dependable groundwater supplies for private wells are available at depths of less than 300 feet in most areas of the state. A well yield of at least 6 gallons per minute is usually needed for home use, though 10 gallons per minute is more desirable.

Groundwater quality, well depth, and well yield vary a great deal across the state. The Commonwealth has five distinct *physiographic provinces,* each of which has characteristic groundwater conditions *(Figure 2).* Well yield, well depth, and groundwater quality also vary locally, even on adjacent parcels of land.

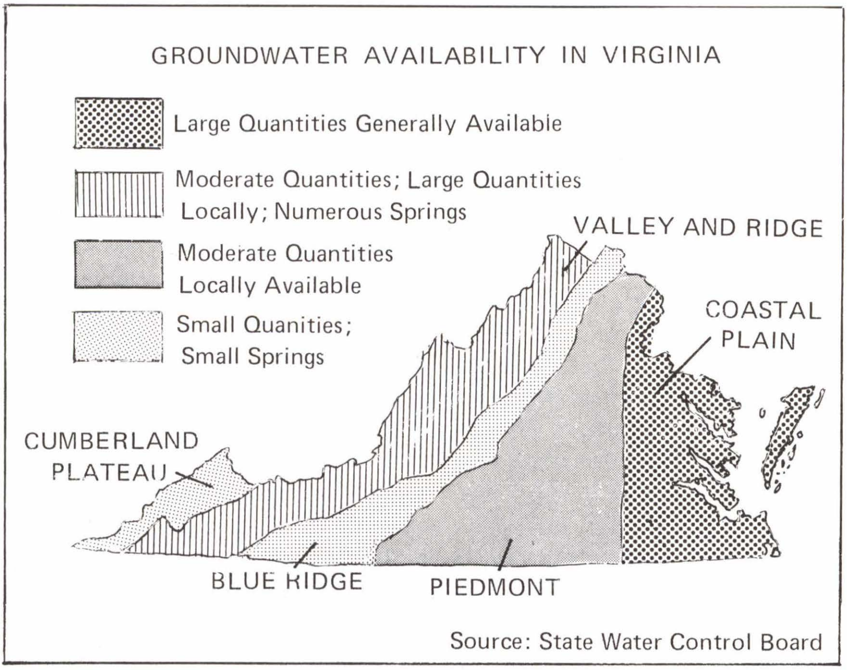


FIGURE 2
The Availability of Groundwater for Wells Varies Among Virginia's Five Physiographic Provinces

Domestic Wells in Virginia

Groundwater is made accessible for household use by a water well. It is important that the homeowner understand the factors affecting groundwater quality to ensure that the well is properly located, constructed, and sealed. The safety of a drinking water source depends on this conscientious effort by the homeowner to take every precaution to safeguard the water supply system.

A well consists of pipes extending into the ground through which groundwater is drawn from an aquifer to the surface *(Figure 3).* The well *casing* supports the walls of the well so that rocks and debris do not enter. In water-bearing sand and gravel formations, a well screen may be installed at the bottom end of the casing to prevent small particles from entering the well. In well structures without a screen, water from the aquifer enters the well at the open lower end of the casing or through the joints between the casing sections. The upper portion of the casing can serve as a housing for the pumping equipment. In some small wells the pump is connected directly to the top of the well casing or to a suction pipe inside the well. The groundwater is brought to the surface via the pump and pipe assembly.

Well Construction

Wells for drinking water are classified into three categories according to the method of construction and intended use of the well as defined in the Commonwealth of Virginia's *Waterworks Regulations* and *Sewage Handling and Disposal Regulations.* Class I and Class II wells are public water supply wells. Class III wells are for private drinking water systems and are constructed by four methods: drilling, boring, jetting, and digging. Private domestic well construction in Virginia is regulated only when it occurs in conjunction with construction of a septic system at the same site, in which case State Health Department sewage regulations apply. The most prevalent methods for constructing wells in Virginia are boring and drilling. Geologic conditions at the site and cost usually determine which method is used.

Bored wells are the type most often constructed in the south-central Piedmont and Coastal Plain *(Figure 4).* An earth auger is used to re-

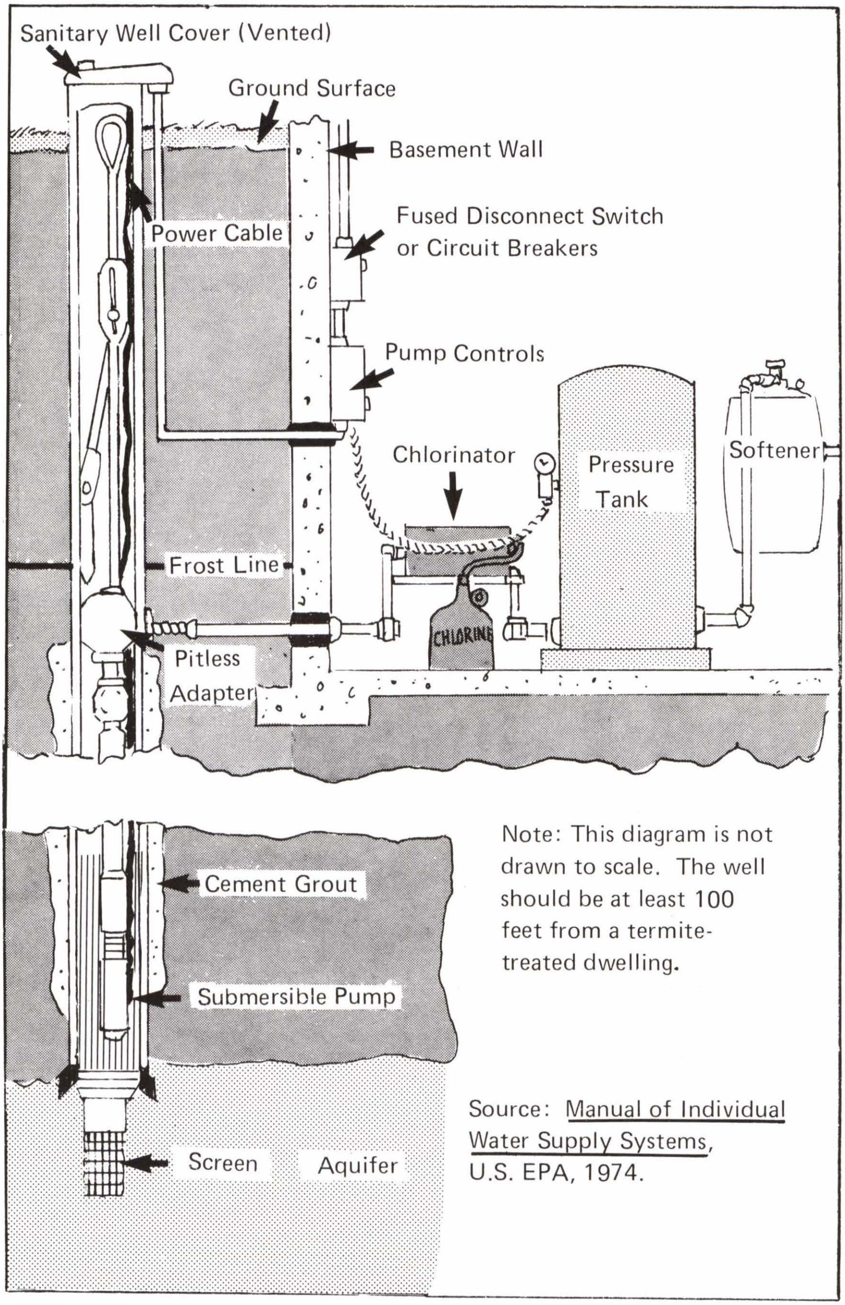


FIGURE 3
Water Is Pumped from a Domestic Well To Supply a Home Water System—Chlorinators and Water Softeners Are Used in Some Cases When Well Water needs Treatment before Consumption

move the earth and other material to reach the water-bearing formation. This method of construction is practical only at depths of less than 100 feet in areas where few large boulders exist. Bored wells are generally lined (cased) with open-jointed concrete pipe, and the space between the borehole and the well casing is filled with gravel from the bottom of the hole up to 20 feet below the land surface. From this point to the surface, the space must be sealed with cement grout to prevent contamination of the well water.

A drilled well can be constructed in many types of geologic formations using either a percussion or rotary hydraulic drilling rig *(Figure 5).* The percussion method uses a heavy drill bit to crush and dislodge pieces of rock. The cuttings and loosened materials are removed from the hole by a bailer. To prevent the hole from caving in during the drilling, a casing is driven into the ground as drilling progresses. In the rotary hydraulic drilling method, the drill bit breaks up the material as it rotates through the formation. A drilling fluid is used to carry the material up the hole to a settling pit on the surface. The drill pipe, which carries the fluid down the hole, is removed when drilling is completed and the well is cased. The space between the casing and hole wall is usually filled with cement grout to a depth of at least 20 feet.

To prevent contaminants from entering the well, the well casing should extend above ground and the top of the casing should have an overlapping, tight-fitting cover. If the top of the well casing is sealed with the pump and power units, the pump platforms and well covers should be constructed of watertight concrete and elevated above the ground.

Each method of well construction has advantages and disadvantages related to cost, type of geologic formations penetrated, well diameter and depth, sanitary protection, and intended use of the supply. The construction plans of a water well need to take into consideration the geologic and groundwater conditions of the area to make full use of the natural sanitary protection offered by the state.

Well Location

Good well construction in the proper location is of primary importance in ensuring a safe drinking water supply. To prevent contaminated runoff water or other materials from entering a well, it should be located on the highest suitable ground and as far from potential pollution sources as possible. Surface drainage should be directed away from the well site, and the well should not be located in an area subject to

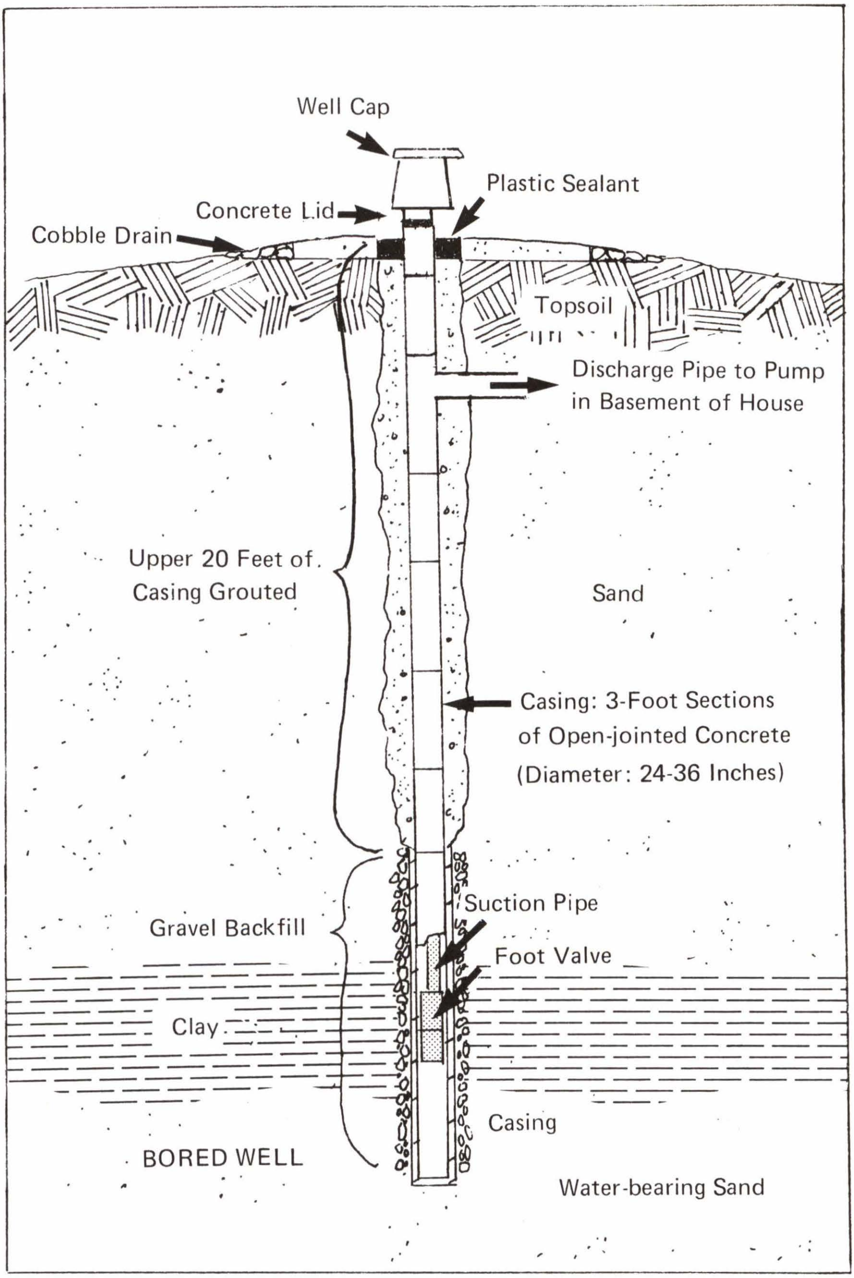


FIGURE 4
Bored Wells Are Grouted to a Depth of 20 Feet So That Contaminants Cannot Seep Through the Open-jointed Casing

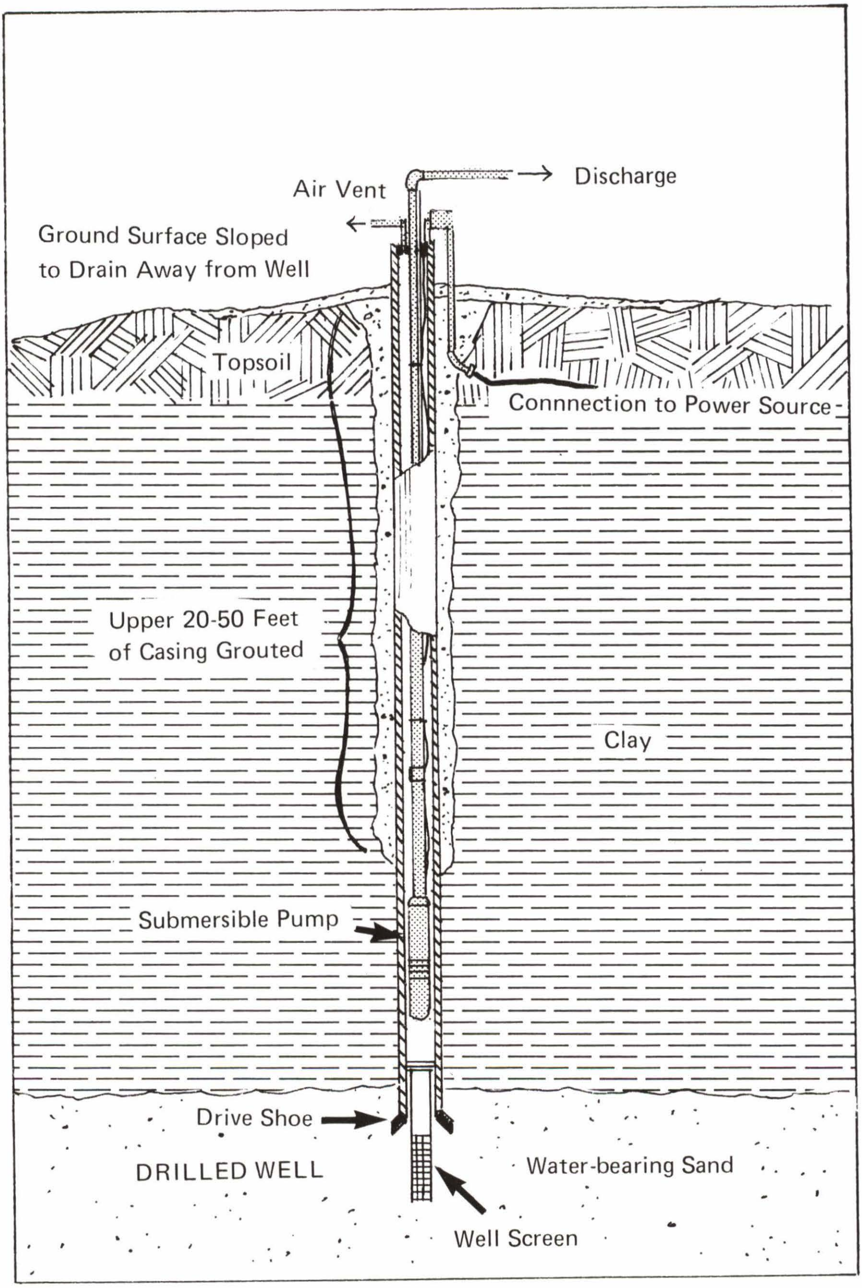


FIGURE 5
Drilled Wells Can Be Constructed to Much Greater Depths Than Bored Wells

flooding. Although specific site conditions may dictate different requirements, recommended *minimum* distances between wells and various natural and man-made features are given in *Table 1* and a suitable well location is shown in *Figure 6.*

Well Drillers

Private citizens can legally dig or drill their own well in Virginia if they have obtained a building permit, but most wells are constructed by contractors. Since the Commonwealth does not certify the *competence* of well drillers, the selection of a qualified well-drilling contractor is the responsibility of the homeowner.

In selecting a well-drilling company, consider the experience and reputation of a contractor, repair and emergency services offered, and the recommendations of previous customers. The names of local well drillers can be obtained from the local health department, extension agents, local banks, and neighbors who have wells. The homeowner should check to make sure the well driller is registered with the State Department of Commerce as a Class B contractor.

A prospective contractor should supply information on the type and method of construction, expected depth and diameter of the well, an-

TABLE 1
Suggested Minimum Separation Distances from Wells

Feature	Distance (Feet)
Property Line	10
Building Foundation	10
Basement	20
Drainage Ditch	
Above Seasonal Water Table	10
Below Seasonal Water Table	70
Utility Line	10
Natural Lake or Impoundment	50
Stream	50
Septic Tank	50
Septic System Drain Field	100
Termite-treated Dwelling	100
Barnyard or Feedlot	50*

*Downhill from well

Source: State Health Department

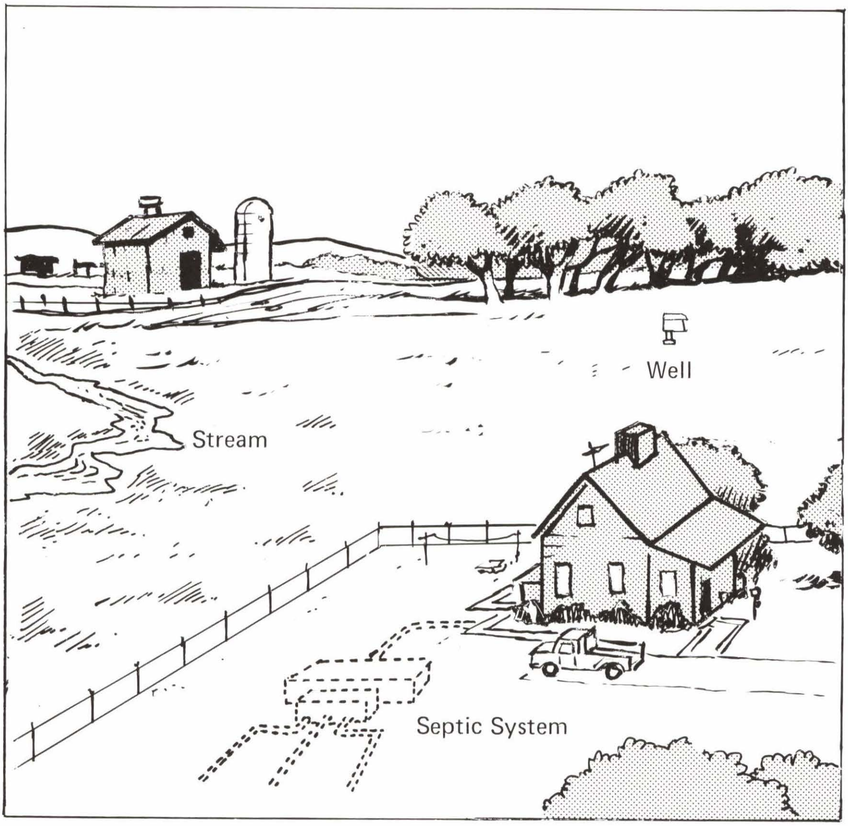


FIGURE 6
A Well Should Be Located Where It Will Not Be Threatened by Contamination from Surface Pollution Sources

ticipated yields, method of disinfection and sealing once the well is completed, and local water treatment requirements. Well contractors who also install the pumping equipment should provide the homeowner with quick, reliable pump service. The prospective contractor should itemize the drilling cost estimates and provide information on the type and extent of insurance the contractor carries.

Once negotiations have been completed and all questions have been satisfactorily answered, either the contractor or homeowner should provide a written contract specifying the work to be done, materials to be used, and the method and amount of payment. A written agreement helps avoid misunderstandings and provides protection for both the contractor and homeowner.

All phases of well construction should be *promptly* completed by the well contractor. If a well is drilled but not grouted until a later date, groundwater contamination is very likely. Any openings made through the well casing when the plumbing is installed should be properly sealed.

Upon completion of the well, the contractor should furnish pump operating manuals and a well log containing detailed information on all aspects of well construction and water quality tests.

Treating Drinking Water

Groundwater used for domestic purposes should be of the highest possible quality. The best protection against groundwater contamination is proper well siting and construction. Although most groundwater does not contain the disease-causing organisms and contaminants that surface water contains, treating well water to ensure safe drinking water is often advisable. Two general kinds of water treatment are disinfecting and conditioning. To ensure that the supply is free of harmful bacteria, water is *disinfected.* Objectionable tastes, odors, and matter are removed by *conditioning.*

Disinfection Methods

Drinking water is most commonly tested for coliform bacteria because their presence usually indicates that disease-causing bacteria from human or animal wastes are present. Coliform bacteria in a well are usually the result of a faulty septic system or contaminated surface water getting into the well or water delivery system. Although a bacterial test of the water supply may indicate the water is safe, continuous disinfection is a wise precaution for all wells. It is especially necessary for shallow or dug wells that are easily contaminated.

Materials and tools used in well construction are frequently contaminated with bacteria that live in the soil at the well site. Bacteria can be introduced into the water system while constructing the well, installing components of the piping system, or servicing any part of the water supply system. It is very important that the water system be disinfected following construction and after all repairs.

The four types of water treatment that can be used to remove bacteria are chlorination, ozonation, ultraviolet light, and heat. Chlorination is the most commonly used means of disinfection in Virginia. Homeowners selecting a disinfection method should check first with local health department officials for recommendations of appropriate methods for their area and for any restrictions or regulations.

Chlorination is widely used to disinfect private supplies because it destroys bacteria within a reasonable contact time and provides residual protection. Chlorine, readily available at a low cost, is easy to handle and is also effective in controlling algae. However, ordinary levels of chlorination are not always effective in destroying *Giardia* cysts, which cause a severe gastrointestinal illness. Super-high levels of chlorination, boiling, or filtering are the only effective methods to destroy or remove these cysts.

Five factors determine the efficiency of chlorination: (1) chlorine concentration, (2) type of chlorine, (3) contact time, (4) temperature of water, and (5) pH (acidity or alkalinity) of water. Disinfection is most effective when the chlorine concentration is high, the chlorine is in contact with the water for a long time, and the water is warm and acidic. The chlorine should be in contact with the water for at least 30 minutes. To provide sufficient contact time in the chlorination process, most household chlorination systems require a relatively large storage tank. Disinfection is more effective if the water is free of other compounds that might combine with the chlorine.

In individual water supply systems, chlorine compounds are usually added to the water in solution form *(Figure 3).* The chlorine added may be household bleach or soluble tablets or powder used for swimming pools. Chlorine in powder or tablet form is dissolved to the desired solution strength and then added to the system. The strength of the solution needed is determined by the rate of water flow and the equipment. Your local health officer can tell you how much chlorine is needed.

One method used to overcome the problem of insufficient contact time in some water systems is to add very high concentrations of chlorine. Then, to eliminate objectionable tastes and to remove excessive amounts of chlorine, the water is dechlorinated. Activated carbon filters are the most common devices used to dechlorinate water, remove objectionable chlorine tastes, and reduce corrosion of plumbing systems. Filters are available for installation in the water system or under the sink. While small household filters can improve the appearance and taste of well water, they should not be relied on to remove disease-causing bacteria. In some cases, filters installed on faucets have been the source of increased bacterial contamination because of the ideal bacterial growth environment provided by these units.

Of the many types of chlorination equipment available, positive displacement feeders are the most common type used in domestic systems. This type of equipment uses a piston or a diaphragm pump to inject the chlorine solution. These electrically powered chlorinators are adjustable during operation to give reliable application dosages—a desirable feature for systems where water pressure is low or fluctuating.

Chlorination systems require frequent testing to ensure proper disinfection levels are being maintained. The homeowner should keep accurate records of the amount of water treated, amount of chlorine used, time and location of tests, and all settings on the chlorinator.

Conditioning Methods

In addition to bacteria that may exist in domestic water supplies, contaminants include minerals that naturally occur in the soil or enter groundwater as a result of human activities. While many natural contaminants such as iron, sulfate, and manganese are not considered serious health hazards, they can give drinking water an unpleasant taste, odor, or color. Conditioning the home water supply makes the water more pleasing to the senses. Conditioning the water supply may include water softening, iron removal, neutralization of acid water, turbidity control, removal of objectionable tastes and odors, and aeration. Water softening and filtering are the most common methods of conditioning well water.

Hard water is a problem for many Virginia well owners, especially those west of the Blue Ridge Mountains. Hard water contains minerals, such as calcium, magnesium, and iron, that can reduce the cleaning action of soaps and detergents and can form a scale in cookware, hot water pipes, and water heaters. Domestic water supplies are commonly softened by using a tank containing an ion-exchange material, which takes up the calcium, magnesium, and small amounts of dissolved iron from water in exchange for sodium *(Figure 3)*.

A serious problem associated with water softeners is that iron bacteria or high iron concentrations can clog the ion-exchange material and make the water softener ineffective. The clogging can be prevented by chlorinating or filtering the water prior to softening. Filtration removes iron, reduces objectionable tastes and odors, and makes water clear. Filtration may be used in conjunction with chlorination to destroy iron bacteria and to remove hydrogen sulfide, the substance often recognized by a rotten egg smell.

Another potential problem with water softeners is the addition of sodium to the water. Before installing a water softener, individuals on a sodium-restricted diet should talk with their physician about drinking softened water. An alternative is to soften only the hot water supply and leave the cold water available for consumption by those on sodium-restricted diets.

Groundwater of high acidity is frequently a problem in the Cumberland Plateau. In some cases, acid water can corrode plumbing and leach toxic metals into drinking water, creating a health threat. The four most common methods of neutralizing acidity and controlling corrosion are aeration, caustic soda feed, soda ash feed, and calcium carbonate filters. To detect the cause of the acidity and to select the most appropriate treatment method, the pH value (a measure of acidity), hardness, and gas concentration of the water must be analyzed.

Many homeowners find the quality of their water is improved by a supplemental treatment that adds air (aerates) the supply. Aeration is helpful in removing hydrogen sulfide, methane, and carbon dioxide gases and in removing bad tastes or the flat taste of oxygen-deficient water. Aerating water also helps remove iron.

Conditioning equipment should be chosen on the basis of the characteristics of your water supply as determined by laboratory analysis (see "Testing Drinking Water"). Distributors of treatment devices frequently offer basic water tests—such as pH, hardness, and iron content—as a free service for potential customers. The specifications and prices of various kinds of treatment equipment should be compared prior to purchase or rental, and the equipment should always have a performance guarantee.

Well Maintenance

Wells require regular maintenance to perform properly. Many homeowners tend to forget the value of proper maintenance until problems reach crisis levels that demand immediate and often drastic action. Maintaining a well involves early detection and correction of problems that could reduce well performance. Keep up-to-date records of well installation, repairs, pumping tests, and water tests. Periodic chemical analyses of your water supply are more reliable than sporadic testing which may not reveal a decline in water quality over time. A regular maintenance routine is important because the problems that affect well yields often occur out of sight inside the well.

A number of factors affect well yield. The normal wear of pump parts, the changing conditions in and around the well, incrusting deposits on metal parts, and corrosion of the well screen can hinder well performance and shorten the useful life of the entire water system. Increased power consumption, indicated by a higher-than-normal electric bill, without increased water delivery could be evidence of reduced pump performance or a problem in the well.

Periodic chemical analyses of the water can indicate the presence of chemicals that cause incrustation in wells, the type of incrustation that might form, and the rate at which it will form. The formation of incrusting deposits depends on the mineral content of the groundwater and the rate of pumping. if incrusting deposits are not treated early, rehabilitation will become more difficult, or even impossible, as deposits grow thicker. Although there are no methods that will completely prevent incrustation in wells, it can be delayed by using properly designed well screens and by reducing pumping rates.

One method to remove incrusting deposits is to put acid into the well and agitate it out through the screen openings into the surrounding formations. Chlorine treatments are an effective way of loosening clogs caused by bacterial growths and slime deposits caused by iron bacteria. A third treatment method uses chemical cleaning agents to dislodge the incrusting deposits rather than dissolve them as the acid and chlorine treatments do. Removal of incrusting deposits should be done by a professional and not by most homeowners.

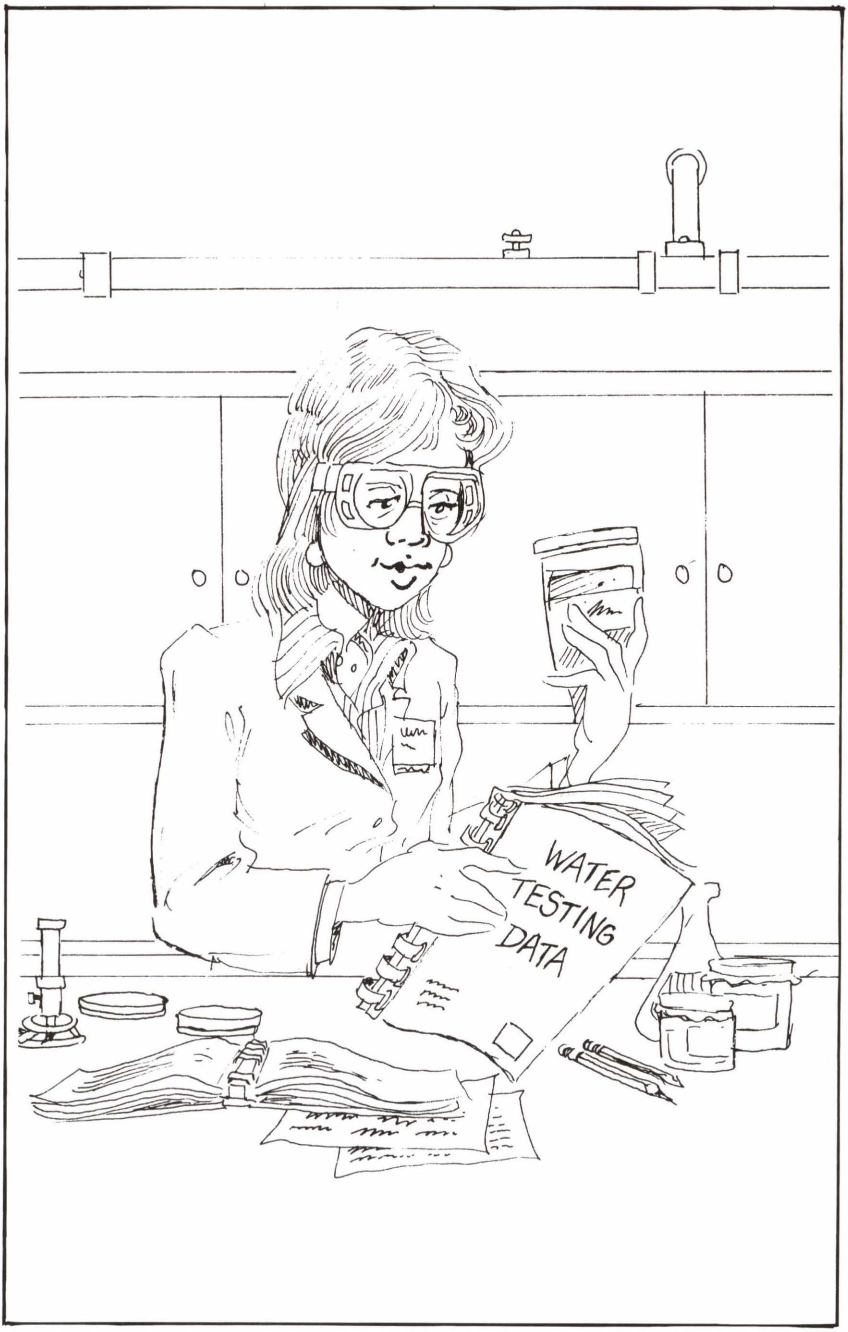


FIGURE 7
Laboratory Tests Can Reveal Water Quality Problems That May Not Be Apparent to Well Users

Testing Drinking Water

The quality and quantity of the supply delivered to the rural home is usually the responsibility of the homeowner. Homeowners with wells should have their water tested for bacteria at least once a year and for chemicals every three years *(Figure 7)*. If an unexplained gastrointestinal illness develops suddenly among any of the water users, the supply should be tested immediately and the local health department consulted. If the taste or color of the supply changes suddenly, an extensive chemical analysis may be warranted. Notify the local health department or the regional office of the State Water Control Board of unusual conditions.

Water Testing Laboratories

Approximately 100 public and private laboratories are certified by the State Health Department to test drinking water quality in Virginia. However, most of the state-approved labs are certified to test only for the presence of bacteria. The state laboratory and three private Virginia laboratories listed below are currently certified to test for bacteria and a wide range of organic and inorganic chemicals:

Division of Consolidated Laboratory
Services-State Laboratory
1 N. 14th St.
Richmond, VA 23219
(804) 786-1155

Commonwealth Laboratory Inc.
2209 E. Broad St.
Richmond, VA 23223
(804) 648-8358

Environmental Systems Service
Laboratories
218 N. Main St.
Culpeper, VA 22701
(703) 825-6660

Aqua-Air Laboratories, Inc.
P.O. Box 4006
Charlottesville, VA 22903
(804) 295-1716

A list of all state-approved water labs can be obtained by writing to the director of the Division of Consolidated Laboratory Services at the address given above.

Each laboratory sets its own prices for water testing, but Virginia laboratories generally charge fees similar to those of the state laboratory. In the spring of 1985, the state laboratory's fee was $15 a sample for bacterial testing, $150 for complete inorganic chemical analysis, and $350 for complete inorganic and organic chemical analysis.

Precautions for Home Buyers

Several precautions should be taken *before* you buy a house that is served by a private well. The present owner should provide written information about the location and construction of the well, along with the type and age of the well, pump, and piping. If the house is served by a septic system, information should be provided about its location, age, and maintenance. Copies of the original installation and operation permits for the septic system may be obtained from the local health department if the system was not installed too long ago.

The water should be tested by a reputable laboratory and the household plumbing should be checked by a plumber to determine if any components of the system need to be replaced. You should also look for obvious problems with the well itself, such as inadequate grout around the well casing, leakage around the point where the supply pipe (to the house) leaves the casing, and—in bored wells—leakage around the joints of the upper casing.

You may wish to consult with an attorney to see if the purchase agreement should be contingent, in writing, on proof that the water supply system provides adequate quantities for domestic use, does not pose a health threat, and is acceptable to the buyer. This precaution may save you hundreds of dollars and prevent unforeseen trouble.

If you are planning to buy land on which to build a house, have a percolation ("perk") test done to see if the soil appears suitable for a septic system. Your local health department can provide information about perk tests and septic system construction regulations. Before buying property, it is wise to talk to neighboring landowers, local well drillers, extension agents, reputable realtors, and the local health department about well depths, well yields, and groundwater quality in the area. Keep in mind that local variations are such that you may not find water at the same depth and of the same quality as your neighbor.

Protecting Your Groundwater

A wide variety of compounds and toxic chemicals have been developed, used, and disposed of in recent years without regard to their impact on our water resources. In the past some experts felt that the pollution effect of many chemical wastes would be reduced through dilution or by percolation through the soils. Today we know that numerous man-made compounds are contaminating groundwater. The toxic effect of these materials—many of which are carcinogenic—is often not reduced by filtration through soils. In fact, some compounds react with other components in the soil to produce other toxic substances.

The ability of water to pick up and release a variety of substances in the environment has important implications for well owners. Since the recharge area that serves a well is frequently on the same property as the well, the homeowner is responsible for the quality of his well water. Many well users are unaware that the quality of the well water is affected by activities on the land surface and by waste and fuel storage tanks buried in the ground. For example, between 1979 and 1983, the State Water Control Board (SWCB) received 182 complaints of contamination of well water in Virginia by petroleum products. Such contamination of an aquifer is not easily corrected. One SWCB official estimates that at every one of those 182 locations the use of the groundwater has been lost for a lifetime.

Although well users cannot control every potential threat to groundwater, eliminating practices that can result in serious contamination of well water can help maintain a clean, safe supply *(Figure 8)*. Described below are some practices that well users should adopt and some they should avoid.

- Fertilizers, pesticides, and herbicides should be used with caution and applied according to the manufacturer's instructions. Many of these chemicals can dissolve in rain or irrigation water and percolate through the soil into the groundwater. Never mix, store, or use these chemicals near a well.

- Improper disposal of leftover pesticides and herbicides and their empty containers can harm humans and animals and can be a

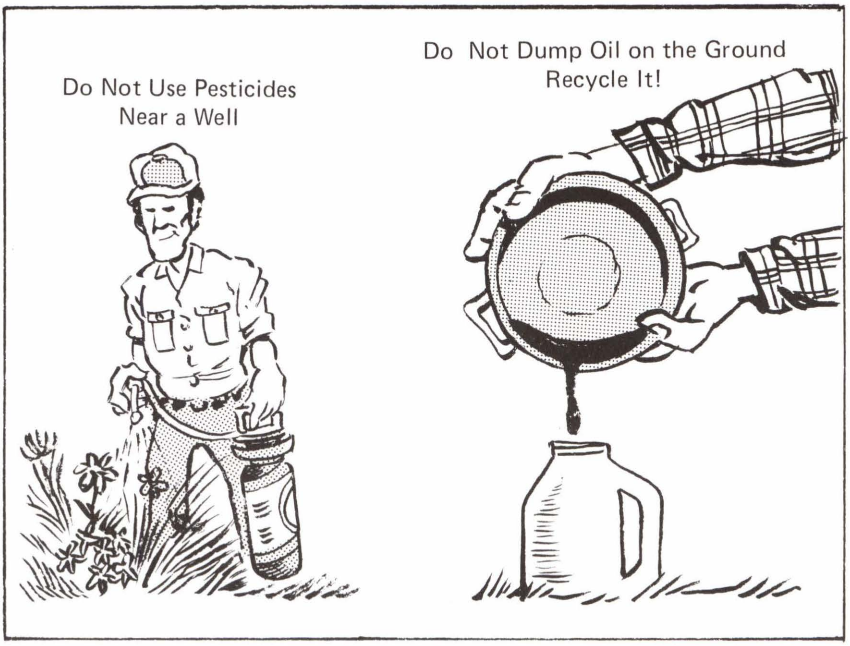


FIGURE 8
Many Everyday Activities Have the Potential to Pollute Groundwater and Endanger Domestic Water Supplies

source of dangerous water contamination. Unused pesticides and their containers should be taken to an approved landfill or incinerated.

- Sprayer equipment should be carefully checked for proper calibration so that recommended application rates are not exceeded. Excessive pesticide use may increase the potential for percolation of residues into groundwater. Devices to prevent back-siphoning should be installed on all faucets and hoses used to fill pesticide and herbicide sprayers.

- An improperly located and maintained septic system can contaminate well water. Septic system wastewater carries disease-causing bacteria and viruses into the soil. If the drain field is not operating properly or if the septic tank is full, groundwater drawn by the well can become contaminated and infect well users.

- Toxic and hazardous substances poured or flushed into household plumbing can pass through your septic system without being treated and contaminate groundwater. Such chemicals include paints, varnishes, photographic solutions, paint thinners, waste oils, pesticides, antifreeze, wood preservatives, and household cleaners that contain lye or petroleum distillates. Proper disposal of these substances is essential. Consult the fire department or health department for acceptable methods of disposal. Disposing of these substances through a septic system can destroy the beneficial bacterial action in the septic tank.

- Careless land use can contaminate groundwater. Locate livestock pens and barns as far downhill from the well as possible. Utilize sound agricultural practices to reduce soil erosion and prevent surface runoff. Routinely check for leaks in underground tanks used to store home heating oil or gasoline.

- Collect used motor oil for recycling at oil collection centers located at participating service stations throughout Virginia. Call 1-800-552-3831 for information on the nearest collection center.

- Practice water conservation. Reduce the amount of water used by installing inexpensive flow restrictors in faucets and shower heads and by using conservation equipment in toilets. Repair leaks promptly. Virginia has abundant groundwater, but the quantity is not unlimited.

- Each individual discards an average of five pounds of material each day. Practice proper litter control and recycle aluminum cans, newspapers, and paper products. Improve garden soil by composting kitchen wastes and lawn trimmings. Reduction of the amount of solid waste disposed in landfills will contribute to the preservation of groundwater quality.

- Wells that are no longer usable or are abandoned must be properly sealed to prevent possible contamination of groundwater and to preserve the yield and pressure of the aquifer. The well should be chlorinated before it is sealed, and the lower portion of the hole should then be sealed as far down as possible with concrete to prevent surface water from entering the aquifer. The proper sealing of an abandoned well should restore the geological conditions as closely as possible to what existed before the well was constructed. An abandoned well should *never* be used for disposal of wastes of any kind.

Conclusion

As a homeowner and well user the single most important point to remember is that *you* have a large degree of control over the quality of *your* groundwater supply. Your use of the land and your waste disposal practices can have a detrimental effect on the quality of the well water that you and your neighbors need each day for drinking, washing, and cooking. By being careful about activities that could potentially contaminate groundwater, you can help ensure a safe, dependable water supply for years to come.

For More Information

Publications

The following publications may be helpful to well owners.

Manual of Individual Water Supply Systems, 1982. EPA-570/9-82-004. U.S. Environmental Protection Agency, Washington, DC 20460.

Manual of Individual Water Supply Systems. 1982. EPA-570/9-82-004. U.S. Environmental Protection Agency, Washington, DC 20460.

When You Need a Water Well. National Water Well Association, Worthington, OH 43085.

The Water You Drink. 1984. Watertest Corporation, New London, NH 03257.

Private Water Systems Handbook. 1979. Midwest Plan Service, Iowa State University, Ames, IA 50011.

Government Agencies

Your local health department can provide help on problems concerning wells, quality of well water, and septic systems. Virginia Cooperative Extension agents in your area may be helpful in providing information on local groundwater conditions. Telephone numbers for local health departments and extension agents are listed in your phone book under the county or city offices.

Regional offices of the State Water Control Board (SWCB) can give advice in choosing well sites. Their addresses and telephone numbers:

Southwest Regional Office,
State Water Control Board
408 E. Main St.
Abingdon, VA 24210
(703) 628-5183

West Central Regional Office,
State Water Control Board
5312-F Peters Creek Rd., NW
Roanoke, VA 24019
(703) 982-7432

Northern Regional Office,
State Water Control Board
5515 Cherokee Ave., Suite 404
Alexandria, VA 22312
(703) 750-9111

Tidewater Regional Office,
State Water Control Board
Pembroke II, Suite 310
Virginia Beach, VA 23462
(804) 499-8742

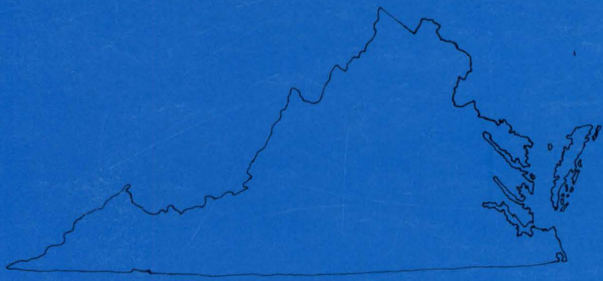
Valley Regional Office,
State Water Control Board
116 N. Main St.
Bridgewater, VA 22812
(703) 828-2595

The Soil Conservation Service has information on "Best Management Practices" to protect groundwater. Write or telephone:

Soil Conservation Service
400 N. 8th St.
Richmond, VA 23240
(804) 771-2685

The Division of Mines, Minerals, and Energy offers information on oil and gas drilling activities that may affect groundwater quality. Write or telephone:

Oil and Gas Inspector
Division of Mines, Minerals,
and Energy
P.O. Box 1416
Abingdon, VA 24210
(703) 628-8115



Groundwater Protection – It's Up to You!

The Virginia Water Resources Research Center
has other general-audience booklets and brochures
on groundwater protection and residential water conservation.
To obtain a list of these publications write:

Publication Services
Virginia Water Resources Research Center
Virginia Polytechnic Institute
and State University
617 North Main Street
Blacksburg, VA 24060-3397