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South Carolina Home•A•Syst

An Environmental Risk-Assessment Guide for Protecting Water Quality

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Acknowledgments

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About South Carolina Home•A•Syst

South Carolina Home•A•Syst was adapted from materials produced by the national Farm•A•Syst / Home•A•Syst program, in cooperation with the Northeastern Regional Agricultural Engineering Service (NRAES). For information about South Carolina Home•A•Syst, contact your local Cooperative Extension office at the location listed on page 75 of this book.

About National Home•A•Syst

Home•A•Syst is a companion project of the Farm Assessment System (Farm•A•Syst). Farm•A•Syst pioneered the system of self-assessments on which Home•A•Syst is based. Home•A•Syst and Farm•A•Syst are national programs supported by the USDA Cooperative State Research Education and Extension Service (CSREES), the USDA Natural Resources Conservation Service (NRCS), and the U.S. Environmental Protection Agency (EPA). The national Farm•A•Syst / Home•A•Syst office provides guidelines and educational support to states. Each state and territory has a primary contact for the development and implementation of Farm•A•Syst / Home•A•Syst programs.

For information about the national Farm•A•Syst / Home•A•Syst programs, or to find out about programs in other states, contact Farm•A•Syst / Home•A•Syst Programs, B142 Steenbock Library, 550 Babcock Drive, Madison, WI 53706-1293; telephone (608) 262-0024; e-mail homeasyst@macc.wisc.edu.

Cover illustration by John Norton

South Carolina Home•A•Syst

Home Assessment System for Water Quality Protection

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What Is South Carolina Home•A•Syst?

Home•A•Syst, the Homestead Assessment System, is a program that teaches you how to help protect the quality of surface water and groundwater near your home and throughout your community. This booklet provides information to help you make the most effective use of the program. South Carolina Home•A•Syst consists of information and a series of confidential self-assessments that will enable you to identify and correct pollution sources and health risks in your home and around your yard.

Common practices in every home — large or small, new or old, rural or urban — can contaminate water and affect the health of your family, your community or the environment.

Home•A•Syst is particularly focused on what you can do to avoid polluting local water sources, such as streams, reservoirs, ponds or private wells. Your drinking water may come from any of these sources. Simple changes in your household routine can reduce pollution and protect the health of your family and the quality of the environment.

The six chapters in South Carolina Home•A•Syst cover topics that are important for every resident and homeowner to understand. Each chapter contains information about a specified topic and one or more assessment tables to guide you in identifying environmentally hazardous practices around your home. Since this book cannot answer all questions for all household situations, lists of additional references and contacts are provided at the end of each chapter.

South Carolina Home•A•Syst has been written to conform with pertinent South Carolina laws and regulations relevant to the specific chapter topics. However, you'll also need to comply with any local or county regulations. Check with local officials and Cooperative Extension agents to make sure that your home practices or any planned changes comply with local laws.

Who should use Home•A•Syst?

The Home•A•Syst program can be used by residents of rural, urban and suburban homes — whether you rent a room or own a house. It's a valuable reference for anyone who is concerned about their health and the environment and who is willing to make changes to improve how they run their homes.

The information in Home•A•Syst can help you protect your investment in your home and your community by identifying pollution risks on your property before expensive problems occur.

How do I use Home•A•Syst?

You can complete Home•A•Syst topics one at a time or all together — it's up to you. Whichever method you choose, take the time to identify risks and plan your course of action for reducing those risks. Involve your entire family in completing Home•A•Syst self-assessments — adults and children alike will benefit from learning what they can do to help.

To start your Home•A•Syst program, read the introductory information in a selected chapter. This will provide important details about why and how certain activities and conditions around your home could affect your water quality. Then complete the self-assessment table(s) associated with that topic. Easy-to-follow instructions are included with each self-assessment.

After you've completed each self-assessment, look back at the information preceding it to plan for changes that will remedy any risks you detect. If you need additional information to use the Home•A•Syst program, or want help after completing your self-assessment, contact your county Extension office or one of the other resources listed at the end of each chapter and the end of the book.

Home•A•Syst will help you accomplish three important objectives:

- Identify environmental risks, concerns or problems in and around your home.
- Learn how to manage your home and property better.
- Take preventive actions to safeguard your health and the environment.

Chapter 1

Site Assessment: Protecting Water Quality Around Your Home

Is your soil sandy or gravelly? Does it drain quickly? Does stormwater runoff from your property flow into a nearby lake or pond? Do you store hazardous chemicals on your homesite, and are they close to a well or next to a lake, stream or river?

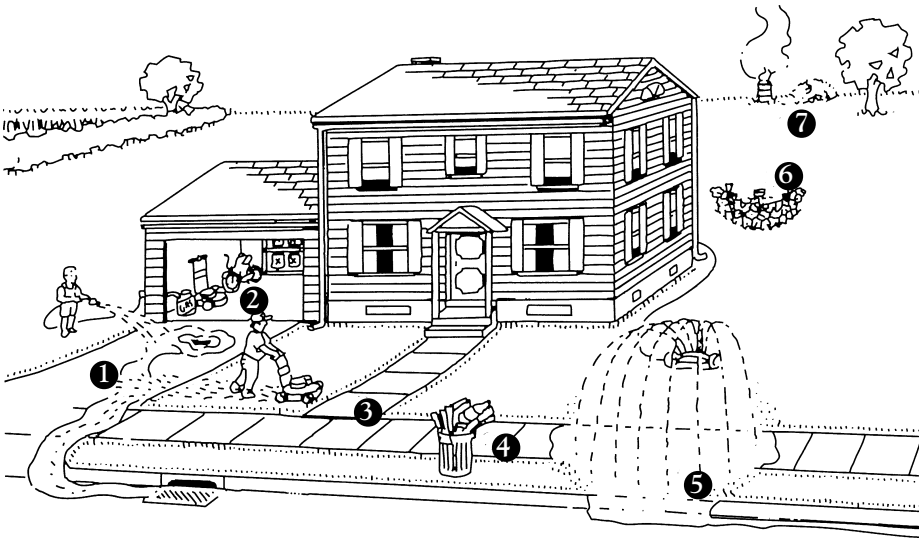
This chapter will help you become familiar with your homesite — and how you manage it — so you can recognize risks to water resources. Completing the chapter will provide background information you can use throughout this book. This chapter covers two areas:

1. ***Identifying the physical characteristics of your homesite.*** Examples of characteristics include soil type and depth; depth to bedrock; depth to the water table; and location of wetlands, streams or other surface water.

2. ***Making a map of your homesite.*** A map of your homesite showing buildings, roads and other constructed or natural features can help you identify potential sources of trouble.

Why should you examine your homesite's physical characteristics and how you manage your home?

What you do in and around your home can affect water quality both below the ground and in nearby lakes, streams, wetlands or coastal ponds. Identifying some important characteristics of your homesite — such as soil type, geology, depth to groundwater and nearness to surface water — will help you understand how the land around your home can aid — or complicate — your efforts to protect water quality.



1. Washing spilled motor oil and grass clippings into storm drains
2. Storing gasoline and other hazardous chemicals near children's toys
3. Paving walkways instead of using porous material so that runoff increases
4. Not separating garbage for recycling
5. Improperly adjusting sprinklers so that water is wasted
6. Planting flowers that may require fertilizers and pesticides around the well cap
7. Burning garbage, which adds toxins to air that eventually settle on the ground

FIGURE 1.1 Many everyday household activites can be harmful to water quality.

This chapter also invites you to draw a simple "aerial view" map of your homesite. Your completed map will show the locations of important features and help you recognize the activities in and around your home that may pose risks to your health and the environment.

Remember: This assessment is a starting point. It's meant to encourage you to complete some, or all, of the other Home•A•Syst chapters. Review Figure 1.1 for some examples of harmful practices, and think about how your habits and site conditions can threaten water quality.

What is a watershed?

The water from your tap and in nearby lakes, reservoirs or streams is part of a much larger water system. Not everyone lives next to a pond or stream, but we each live in a watershed — the land area that contributes water to a specific surface water body, such as a pond, lake, wetland, river, estuary or bay (Figure 1.2). The landscape's hills and valleys define the watershed, or catchment area.

A watershed is like a bathtub. The watershed outlet — the mouth of a pond, lake, reservoir or river — is the tub's drain. The watershed boundary is the tub's rim. The watershed's drainage system consists of a network of rivers, streams, constructed channels and storm drains, wetlands, and the underlying groundwater.

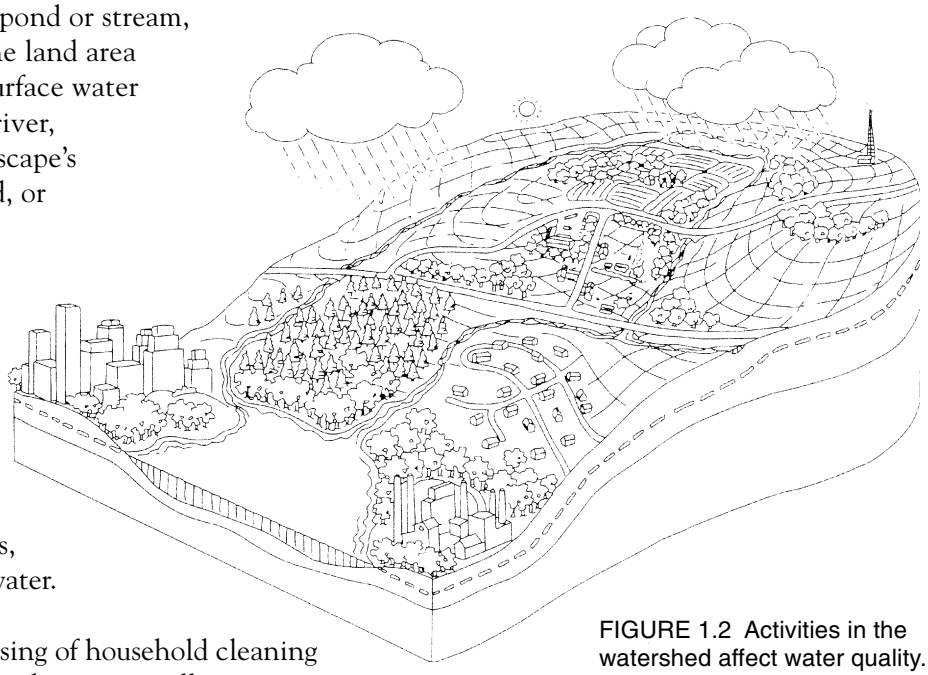


FIGURE 1.2 Activities in the watershed affect water quality.

Common activities — like disposing of household cleaning products or fertilizing your lawn and garden — can affect water quality, even when you do these things far from any shore. By paying careful attention to how you manage activities in and around your home, you can protect the watershed and the water you drink.

Do you know where your water comes from?

List the source of your home drinking water on the line below.

_____

What influences the quality of your water?

Understanding the site characteristics of your residence and identifying the locations of potential contamination sources are important first steps in protecting your water. In the hydrologic cycle, water moves through the air, over land, and through the soil (Figure 1.3).

Physical characteristics, such as soil type, depth to groundwater and distance to surface water, may speed up or delay a contaminant's effect on water quality.

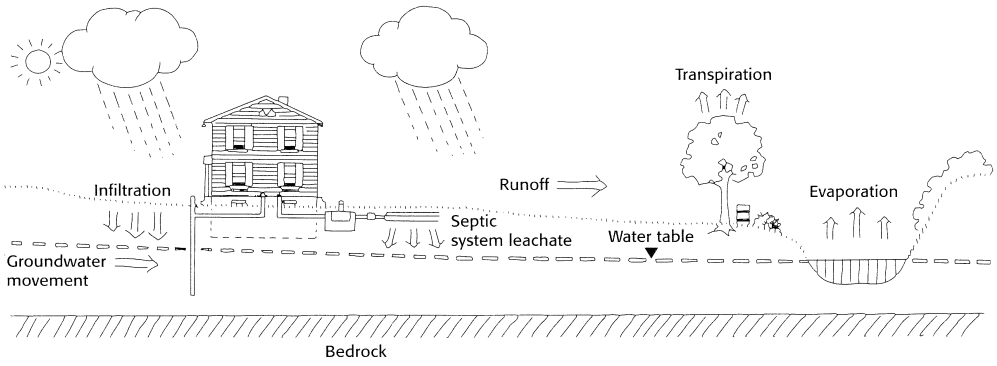


FIGURE 1.3 In the hydrologic cycle, water falls to earth as rainfall or snow. Water returns to the atmosphere through evaporation from wet surfaces and from plant leaves.

Activities that affect water quality include drinking-water well construction and maintenance, pesticide and fertilizer use and storage, septic system maintenance, waste disposal methods, and soil erosion.

Animal wastes are another threat to water quality, particularly if large amounts from horses, dogs or other animals are allowed to accumulate on your property. Pets and livestock are not the only threats to water quality, however; wildlife that congregate on lake shores, such as geese and other waterfowl, can contribute to water quality problems. To protect your water, all of these factors need to be considered.

Part 1.1 — Physical Characteristics of Your Homesite

Every home comes with its own unique set of physical site conditions. You cannot change these conditions, but once you are aware of them, you can better understand risks that may result from activities you can change. Assessment 1.1 on page 8 can help you determine your potential risks. The information below will help you answer the questions in the table.

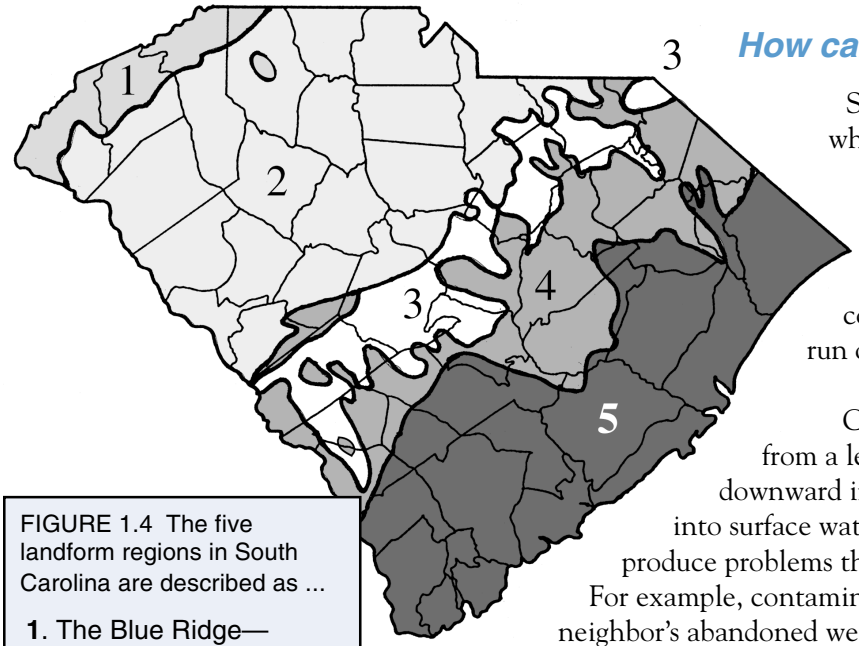


FIGURE 1.4 The five landform regions in South Carolina are described as ...

1. The Blue Ridge—a mountainous region.
2. The Piedmont—characterized by low, rolling hills.
3. The Sandhills—characterized by sandy hills and nutrient-poor soils.
4. The Coastal Plain—characterized by flat land, forests, and agriculture.
5. The Coastal Zone—characterized by active coastal processes.

Map and text from *SC Maps,* 1996.

How can soil type affect water quality?

Soil plays an important role in determining where contaminants go and how water moves. Nearly all soils are permeable, which means water and other fluids can percolate or seep through them. Different soils have different properties that permit water and contaminants to percolate through the soil or run off at variable rates.

Chemicals applied to a lawn and wastes from a leaking septic tank, for example, can flow downward into groundwater or across the land into surface water. Many household activities can also produce problems that go beyond property boundaries. For example, contaminants that enter groundwater through a neighbor's abandoned well may flow underground until they reach your well.

What is your soil type?

Soil is grouped into three basic types based on particle size: clay, which has small particles; silt/loam, which has medium particles; and sand/gravel, which has large particles. You can get a good idea about your soil type by rubbing a moistened sample between two fingers. Is it sticky like clay, gritty and crumbly like sand, or somewhere in between like loam? Consult the soil survey for your county or contact your local Cooperative Extension agent to learn more about your soil.

The state of South Carolina is composed of five distinct landform regions (Figure 1.4), each with its own topography and soil type. The type of rocks from which these soils were formed and the topography have a great influence on water quality.

Although there are more than 200 different soil types in South Carolina, they can be grouped as they occur in these landform regions.

The Blue Ridge Mountain soils occupy 2 percent of the state and are clayey to loamy. The primary agricultural use for this land is grazing and forestry. The Piedmont soils occupy 35 percent of the state and are characterized by red clay present at the soil surface. The Carolina Sandhills soils occupy 11 percent of the state. These are deep sandy soils with no appreciable clay present throughout the soil depth.

The South Carolina Low Country is made up of the Upper Coastal Plains soils (14 percent of the state) and the Lower Coastal Plains or Atlantic Coast Flatwoods soils (38 percent) of the state. These soils have a sandy texture with subsurface clay. In the Upper Coastal Plains soils, the subsoil clay is closer to the surface than it is in the Lower Coastal Plains soils. Some of the Lower Coastal Plains soils have a great amount of organic matter due to poor drainage and negligible erosion. Some of the Lower Coastal Plains soils also have no appreciable clay throughout their depth.

How does soil type affect groundwater?

Groundwater is the water below the surface of the earth that, from the water table down, saturates the spaces between soil particles or fills cracks in underlying bedrock. Soil particle size influences which pollutants are able to reach groundwater. Some soils are better at trapping pollutants than others.

Clay soils, which are made of tiny particles, slow the downward movement of water and in some cases can impede water movement completely. Sandy soils allow for rapid water movement, and silty soils occupy the middle range. Soils made of large particles pose the greatest risk, because water seeps downward through them readily without filtering out or decomposing pollutants.

The ideal soil is a mix of midsize particles to allow infiltration and tiny particles, like clay or organic matter, to slow water movement and filter pollutants.

What are the risks to surface water?

Soil type can also affect surface water contamination. Although runoff occurs from all soil types, clay soils — which are least permeable — are more likely to cause surface water runoff. During a storm or flood, or even when you water your lawn, this runoff can wash contaminants from the land's surface into nearby surface waters. Eroding soil is also considered a water pollutant. Bare soil, especially on sloping land, can force runoff into streams, rivers, lakes or estuaries. Runoff in cities goes into storm drains and then discharges into surface water bodies.

Soil type affects the potential for erosion. In South Carolina, soil erosion is greatest in the Blue Ridge and Piedmont regions, where rainstorms wash soil from the hilly terrain into local streams and reservoirs. The fine clay soils of the Piedmont may remain suspended in the water for extended periods of time. The sandy soils of the Sandhills region are much less likely to remain suspended in water bodies. Runoff from the land in the Coastal Plain is less intense, because of the generally flatter terrain. Thus, Coastal Plain streams carry less sediment, and it is deposited quickly to form sandbars or mudflats.

What is your soil depth?

The depth of soil influences risks to groundwater. Usually, the greater your soil depth, the farther water must seep down before reaching groundwater. Deep soils offer a better chance of filtering or breaking down pollutants before they reach groundwater. Generally, soils that are less than three feet deep present the highest risks for groundwater contamination.

How far down is the bedrock?

Bedrock depth varies; it can be at the land's surface, just below the surface or hundreds of feet down. The type of bedrock influences pollution risks. Shale, granites and other impermeable types of rock make effective barriers that block the downward movement of water and contaminants. Other rocks, such as limestone, can be highly permeable, allowing water to drain freely into groundwater. When bedrock is split, or fractured, water can move through it unpredictably, spreading pollutants rapidly over long distances.

How deep is the water table?

If you dig a hole, you will eventually reach soil saturated with water (Figure 1.5). This water table marks the boundary between the unsaturated soil (where pore spaces between soil or rock contain air, roots, soil organisms and some water) and the saturated soil, or groundwater (where water fills all pore spaces). In a wetland, the water table is at or just below the surface.

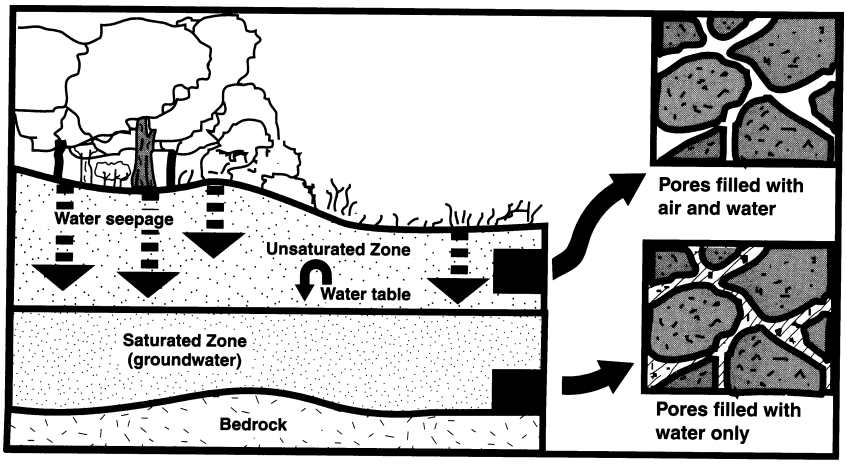


FIGURE 1.5 The water table is the boundary between saturated and unsaturated soil.

Your local water table fluctuates throughout the year but is usually highest in the wet months of spring and in late fall. In general, the closer the water table is to the land's surface, the more the groundwater is susceptible to contamination. Usually, a water table that is less than 10 feet from the surface presents a higher risk for groundwater contamination.

Groundwater and surface water are interconnected. Groundwater generally flows downhill, following the same path as surface water, and eventually discharges into rivers, lakes, springs, wetlands, bays or estuaries. If you keep impurities out of surface water but do not protect groundwater — or vice versa — contaminated waters may occur where you least expect.

What is underground at your site?

There are several ways to find out about soil depth, bedrock type, and other features below the ground. If you have a well, check your well-drilling records, ask a neighbor who has a well, call a local well-drilling company, talk to your County Extension agent, or call the local government office that gives permits for drilling wells. The Natural Resources Conservation Service maintains county soil surveys. You may also contact the South Carolina Geological Survey, the U.S. Geological Survey, or your local Soil and Water Conservation District (see page 96).

Assessment 1.1 — Physical Characteristics of Your Homesite

Record the characteristics of your homesite on the chart below. For each characteristic, three choices are given. These choices describe situations or activities that could lead to high, medium and low risks to human or environmental health. Mark your risk level (low, medium or high) in the right-hand column.

Do the best you can. For some questions, your well drilling records or local well drillers may be able to help. Some choices may not be exactly like your situation, so choose the response that best fits. Refer to Part 1.1 above if you need more information to complete the table. If no choice is applicable, leave that line blank.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Soil type and risks to surface water from runoff	Sand/gravel (large particles)	Silt/loam (mid-size particles)	Clay (very tiny particles)	❒ Low ❒ Medium ❒ High
Soil type and risks to groundwater from infiltration	Clay (very tiny particles)	Silt/loam (mid-size particles)	Sand/gravel (large particles)	❒ Low ❒ Medium ❒ High
Soil depth	Deep (over 12 feet)	Moderately deep (3-12 feet)	Shallow (less than 3 feet)	❒ Low ❒ Medium ❒ High
Bedrock	Solid, not permeable or fractured	Solid limestone or sandstone	Any kind of fractured bedrock	❒ Low ❒ Medium ❒ High
Depth to water table	Over 20 feet	10 to 20 feet	Less than 10 feet	❒ Low ❒ Medium ❒ High
Nearness to surface water	Over 100 feet	25 to 100 feet	Less than 25 feet	❒ Low ❒ Medium ❒ High

Responding to Risks

You can't depend solely on the physical characteristics of your soil, bedrock or other site features to protect water quality. You must take informed steps to prevent pollution. Although you can't change your soil type or the depth to bedrock, you can take these factors into account when choosing home management practices that are better for preventing environmental problems. Note especially the medium and high risks you identified. Keep them in mind as you complete your homesite map and work on other Home•A•Syst chapters.

Part 1.2 — Making a Map of Your Homesite

Why should you make a map?

Drawing a map of your homesite will help you to better understand your pollution risks. Although your property has physical features you cannot change, there are many things that you can do to minimize the threats to water quality. Your map will identify areas where you can focus your efforts. You'll add to this map in other Home•A•Syst chapters. And if you involve children as you make your map and conduct the assessment, you'll help teach them the importance of having clean water.

The materials you need to make your map are readily available: a measuring tape, a clipboard, a pencil and the grid provided on page 13. The map you create will be an aerial view — the way your property would look if you took a photo of it from the air. A sample map is provided in Figure 1.6 on page 10.

What potential sources of contaminants should you look for?

Several home management practices and home site characteristics can have major effects on water quality. As you survey your property to make your map, be especially watchful for the following:

- Improperly located or poorly maintained septic system or cesspool
- Underground or aboveground storage tank containing fuel oil, gasoline or other petroleum products
- Improperly constructed or abandoned well
- Stockpiled animal waste or animal pens, corrals or kennels close to a well or surface water body
- Improper storage, use or disposal of yard and garden chemicals and other hazardous products like paints and solvents
- Machine maintenance workshop near well
- Driveway or sidewalk de-icing materials that flow toward a well or nearby surface water body

What features should you include on your homesite map?

Homesite features to include are:

- Property boundaries
- House and garage
- Outbuildings, sheds
- Septic system and drainfield
- Nearest surface water
- Water wells
- Dry or abandoned wells
- Heating oil or other fuel storage tanks
- Building perimeter drains (french drains and others)
- Lawn areas
- Vegetable and flower gardens
- Other cultivated areas
- Animal waste storage areas
- Roads, driveways
- Drainage ditches
- Impervious surfaces (such as patios or sidewalks)

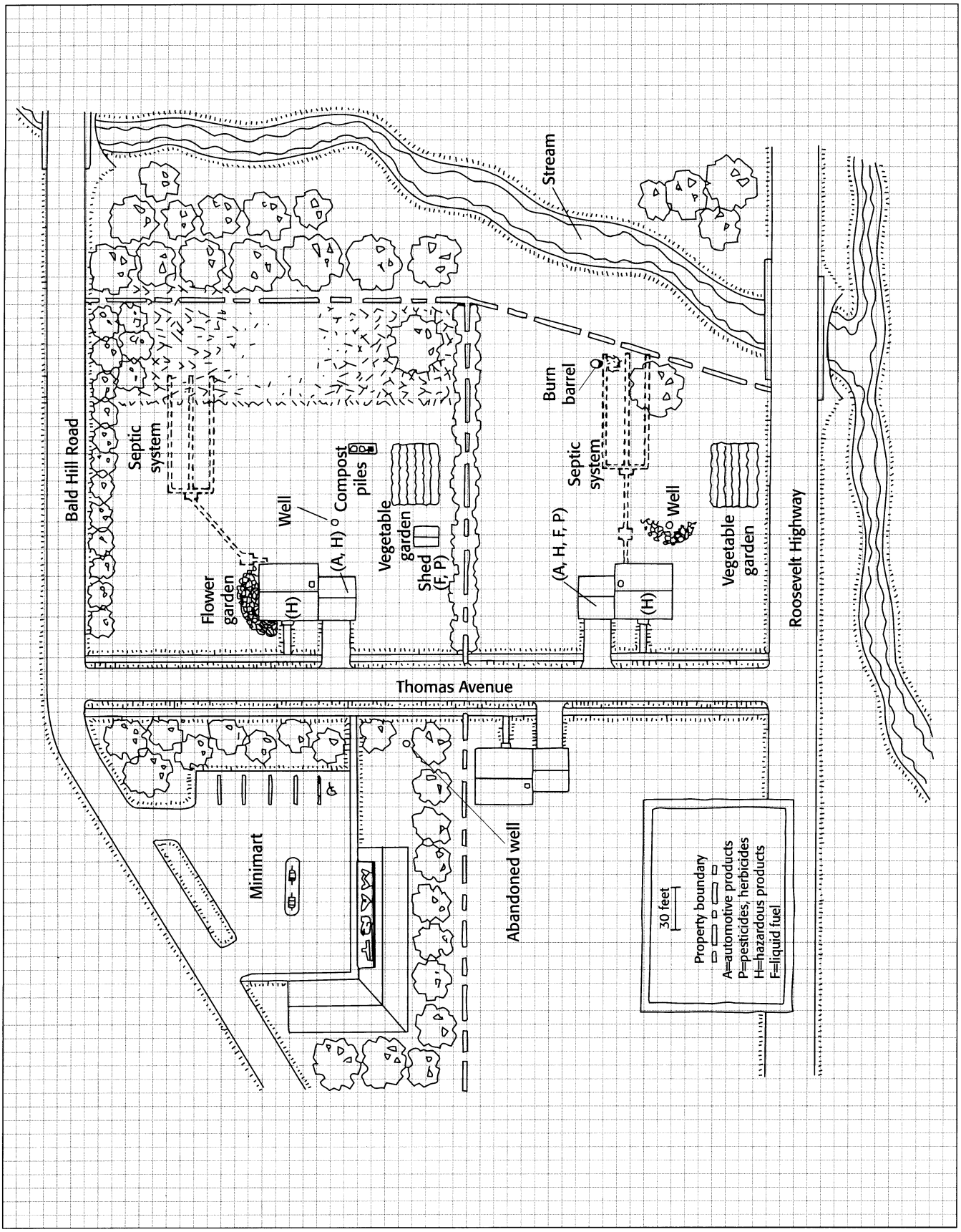


FIGURE 1.6 This example shows what a detailed homesite map might look like.

Invent codes to mark the locations of potential hazards.

On your map, note the areas where you store and use chemicals and other potential hazards by using letter codes. Make up your own code letters or symbols as needed. Examples are:

F = Fuel tanks for gasoline or heating oil
A = Automotive products such as motor oil, gasoline, and antifreeze
P = Pesticides (herbicides, insecticides, fungicides)
H = Hazardous products like solvents, acids, paints and thinners

Include more information on larger-view maps.

For larger-view maps, add landscape features such as hills, rivers and ponds and human-built features such as runoff drainways, roads and bridges. Note potential sources of contamination beyond the boundaries of your property such as farm fields, dumps and gas stations. Indicate seasonal changes at your homesite. For example, are there wet areas in the spring? Such areas might indicate a high water table.

Don't leave out things you can't see.

Learn about previous or current industrial or agricultural activities in the area. Check with your town or city hall for information. Old landfills and buried fuel tanks are just a few examples of what you might find. Find out if any underground fuel tanks exist on neighboring properties. If there are tanks, septic systems or other potential sources of contaminants upgradient (that is, uphill) from your well, they could affect the safety of your groundwater. These issues will be discussed in-depth in subsequent chapters.

Putting It All Together and Taking Action

The final step is to put both pieces of your assessment together — the results from Assessment 1.1 on page 8 and your homesite map. This will allow you to identify potential problem areas on your property. If you have rated any of the items in the table as medium or high risks and have identified potential contamination sources, then you should be concerned.

For example, you may have identified an underground heating oil tank or realized that you apply lawn or garden chemicals within 25 feet of a lake or stream. Perhaps your soil is sandy or a gasoline storage tank is close to your drinking-water well. Is there an old abandoned well on your property that isn't properly sealed? To protect your family's health and the environment, and to safeguard your financial investment, you'll want to take steps to correct these problems.

How can Home•A•Syst help?

If you recognize potentially hazardous or unsafe situations, what should you do? Each of the other Home•A•Syst chapters addresses specific concerns. These chapters will help you identify problems and develop an action plan for protecting your family's health and the local environment.

For more information about topics covered in Home•A•Syst, or for information about laws and regulations specific to your community, contact your local Cooperative Extension office.

For More Information

Publications

Turning the Tide: A Citizens's Guide to Reducing Nonpoint Source Pollution, a 24-page brochure providing information on reducing nonpoint source pollution, is available from the South Carolina Department of Health and Environmental Control at (803) 898-4187.

What is a Watershed? This publication describes what a watershed is and how you can protect yours. Request a copy by calling the South Carolina Department of Health and Environmental Control at (803) 898-4187.

Other South Carolina Department of Health and Environmental Control publications can be ordered at http://www.scdhec.net/eqc/admin/html/eqcpubs.html.

Educational Resources for Schools

South Carolina Maps and Aerial Photographic Systems, 1996, is available from:

SC Maps Distribution Center
South Carolina Department of Natural Resources
2221 Devine Street, Suite 222
Columbia, SC 29205
(803) 734-9100; FAX (803) 734-6633

or http://www.eng.clemson.edu/scmaps

Soil Testing

Agricultural Service Laboratory
171 Old Cherry Road
Clemson, SC 29634
(Contact your local Cooperative Extension office to learn more about this service.)

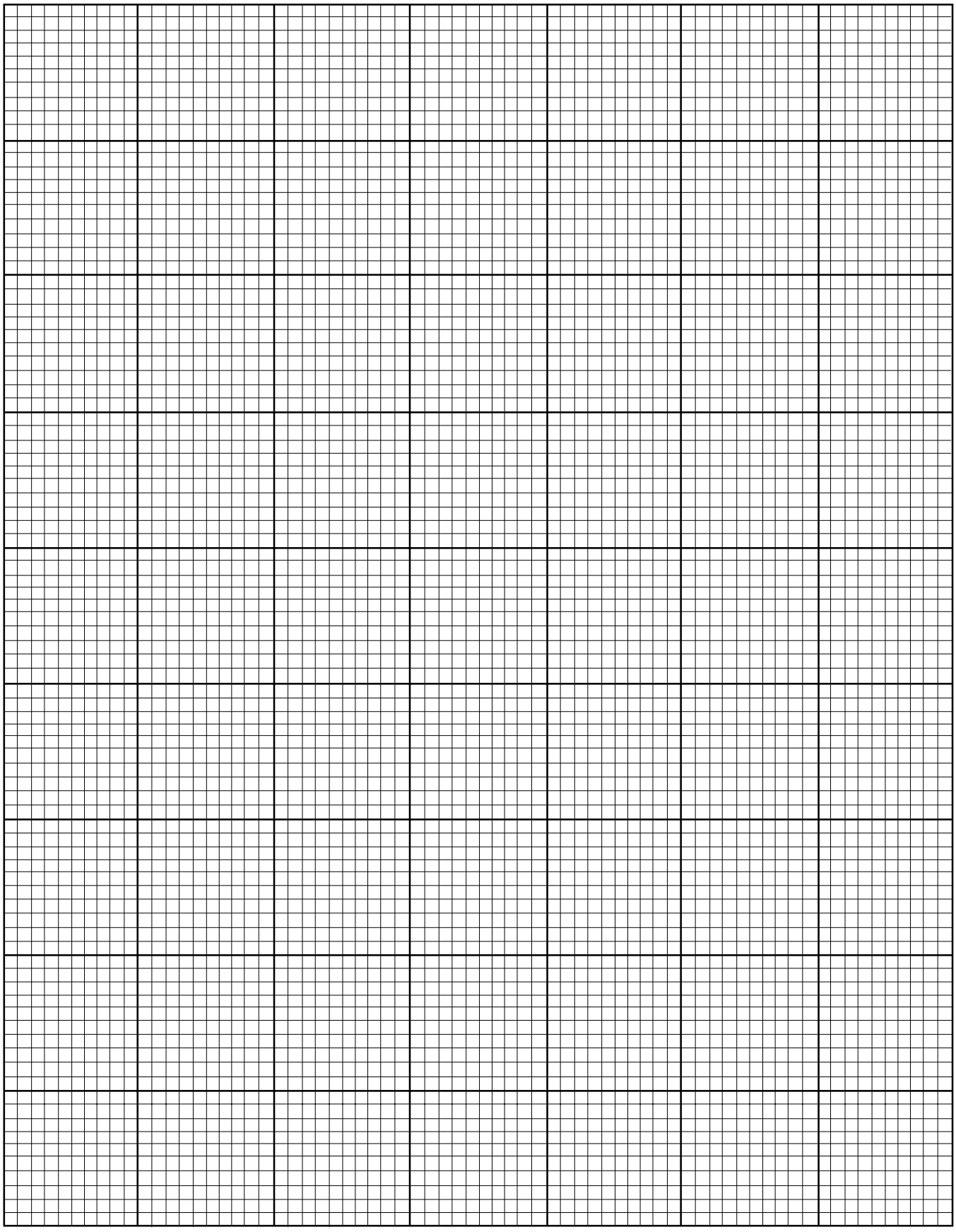
The fact sheet *Soil Testing* (HGIC 1652) describes collecting and submitting samples to the Agricultural Service Laboratory and is available in print from:

Clemson University Cooperative Extension
Bulletin Room
96 Poole Agricultural Center
Clemson, SC 29634-0129
(846) 656-3261

A digital version is available online from the Clemson Public Service Activities website at http://www.clemson.edu/psapublishing/.

This chapter was written by Alyson McCann, Water Quality Program Coordinator, University of Rhode Island Cooperative Extension, Kingston, Rhode Island and adapted for South Carolina by Barbara Speziale, Clemson University Cooperative Extension.

Graph Paper for Homesite Map
(one block = 1/10 inch = 10 feet)



Chapter 2

Stormwater Management

This chapter examines potential risks to the environment and to your health from stormwater runoff. Two areas are covered:

1. ***Reducing pollutants in runoff.*** Pollutants can include pesticides and chemicals, automotive wastes, grass clippings and yard waste, pet and animal wastes, and winter salt and de-icers.

2. ***Controlling runoff through landscaping and site management.*** Some ways to help control runoff are preventing soil erosion, providing basement flood protection, landscaping, providing proper roof drainage and minimizing paved surfaces.

Completing this chapter will help you evaluate how stormwater affects the environmental quality of your property and properties "downstream." You'll also learn ways to reduce pollution risks.

What is stormwater, and why should you be concerned?

Stormwater is water from rain or melting snow that doesn't soak into the ground. It flows from rooftops, over paved areas and bare soil, and through sloped lawns and fields. As it flows, this runoff collects and transports soil, animal waste, salt, pesticides, fertilizer, oil and grease, leaves, litter, and other potential pollutants. You don't need a heavy rainstorm to send pollutants rushing toward streams, wetlands, lakes and oceans. A garden hose can supply enough water all by itself.

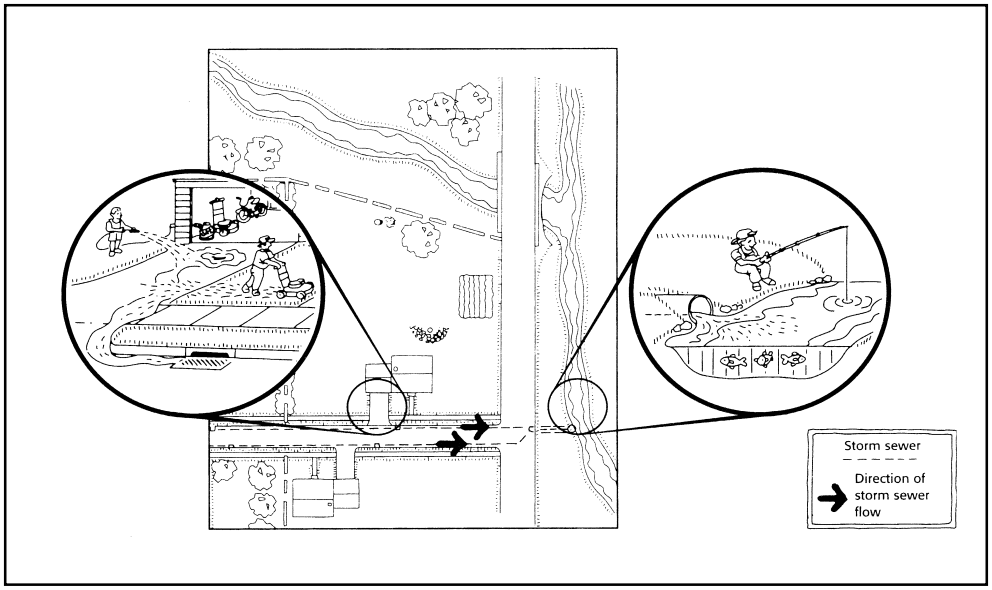


FIGURE 2.1 Runoff that flows into storm sewers goes directly to streams and lakes without treatment.

Even if your house is not on a waterfront, storm drains and sewers carry runoff from your neighborhood to the nearest body of water. Contrary to popular belief, storm sewers do not carry stormwater to wastewater treatment plants (Figure 2.1).

Polluted stormwater degrades South Carolina's lakes, reservoirs, rivers, wetlands and ocean bays. Soil clouds water and damages habitats for fish and water plants. Nutrients such as phosphorus and nitrates promote the growth of algae and aquatic plants, which can become a nuisance in lakes, ponds and streams. Toxic chemicals such as antifreeze and oil from leaking cars, carelessly applied pesticides, and zinc from galvanized metal gutters and downspouts threaten the health of fish and other aquatic life. Bacteria, viruses and parasites from animal waste can make nearby lakes, reservoirs and streams unsafe for wading and swimming after storms.

As many people have discovered, stormwater can be a problem closer to home. It can flow into basements and cause damage that is difficult and costly to clean up. Stormwater can infiltrate a poorly sealed well shaft and contaminate drinking water. In areas with very porous soils or geology, pollutants in runoff may reach groundwater.

Across the country, in urban and rural areas, public officials are turning their pollution control efforts from wastewater discharges to stormwater management. Stormwater pollution cannot be treated in the same way as water pollution from discharge pipes, because it comes from many sources (see Table 2.1 below). It is carried by stormwater from every street, parking lot, sidewalk, driveway, yard, and garden. The problem can only be solved with everyone's help.

TABLE 2.1 Common Sources of Stormwater Pollutants

Pollutant	Common sources
Silt, sand and clay particles and other debris	Construction sites; bare spots in lawns and gardens; wastewater from washing cars and trucks on driveways or parking lots; unprotected streambanks
Nutrients	Overused or spilled fertilizers; pet waste; grass clippings and leaves left on streets and sidewalks; leaves burned in ditches
Disease organisms	Animal waste and garbage
Hydrocarbons	Car and truck exhaust; leaks and spills of oil and gas; burning leaves and garbage
Pesticides	Pesticides over-applied or applied before a rainstorm; spills and leaks
Metals	Cars and trucks (brake and tire wear, exhaust); galvanized metal gutters and downspouts

Part 2.1 — Reducing Pollutants in Runoff

Stormwater is unavoidable, but its effects can be reduced by keeping harmful chemicals and materials out of the runoff. This section reviews potential sources of contamination and offers ways to minimize them. At the end of this section, fill out the assessment table to help identify stormwater risks on your property.

Where does stormwater go?

The next time you're home during a rain shower, head outdoors with your boots and umbrella and watch where the rainwater goes. On a sketch of your property, draw arrows showing the direction that stormwater flows off driveways, rooftops, sidewalks, and yards. A sample map is provided in Figure 2.2. (Instructions for making a homesite sketch can be found in Chapter 1, beginning on page 9.)

Does water soak into the ground quickly, or does it puddle in some spots and flow off lawns and driveways? Your soil type affects water infiltration (soaking into the ground). As you might expect, water infiltrates sandy soil quickly but has a hard time seeping into fine-grained silt or clay soils.

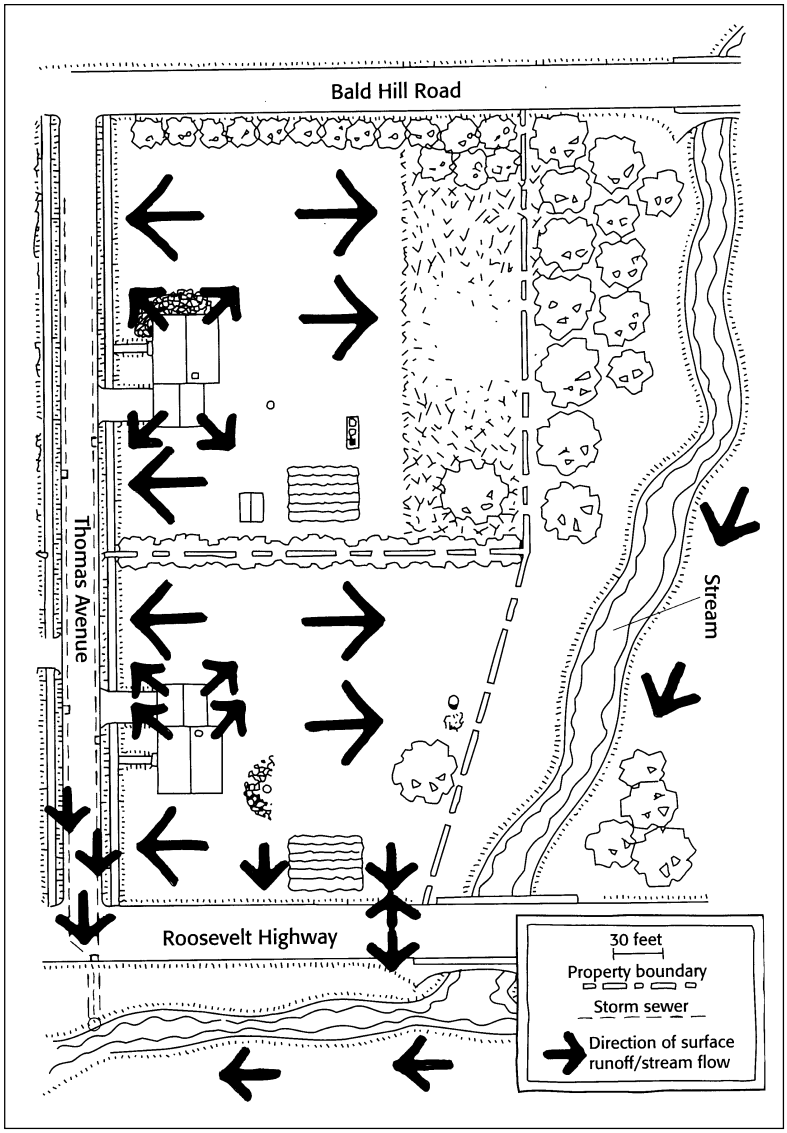


FIGURE 2.2 A homesite map with arrows showing the directions of surface runoff and stream flow

During your walk, note how far it is to the nearest storm sewer, ditch, wetland, stream or body of open water. Note whether runoff flows onto your land from adjacent streets, properties or stormwater systems. If you live at or near the bottom of a hill, you may have special problems. Be sure to go out during more than one rain shower to get a good understanding of runoff flow during small and large storms.

Are any car or truck wastes being carried away by stormwater?

Oil stains on your driveway and outdoor spills of antifreeze, brake fluid and other automotive fluids are easily carried away by a rainstorm. If the runoff from your driveway has an oily sheen, that's a sure sign that you need to be more careful.

Pans, carpet scraps and matting can catch drips. Routine maintenance can prevent your car from leaking and help identify potential leaks. If you change your own oil, be careful to avoid spills and collect waste oil for recycling. Store oily car parts and fluid containers where rain and runoff can't reach them.

Never dump used oil, antifreeze or gasoline down a storm drain, in a ditch or on the ground. These wastes will end up in a nearby lake or stream and may pollute your drinking water.

Washing your car in the driveway creates runoff without the help of a rainstorm — your hose provides the water. The dirty, soapy runoff drains directly into storm sewers, picking up oil and other pollutants as it goes. Try washing your car on the lawn or, better yet, take it to a commercial car wash or spray booth that sends its dirty water to a wastewater treatment plant.

Are household products stored outside the reach of stormwater?

Many households store lawn and garden products such as weed killers, insect killers and fertilizers outside. If stormwater or floodwater reaches these products, it can transport them into surface waters and possibly into your well. Pool chemicals, salt for water softeners and a wide variety of other chemical products can also cause trouble if they are washed away.

Keep these products in waterproof containers and store them up high and out of the potential path of runoff or floods. Avoid storage problems by buying only what you need for a particular task and then using up the product according to the instructions on the label.

Do you use and handle chemicals safely?

Safe storage is only the first step in preventing contaminated runoff. When mixing chemicals, try to do it within a washtub so spills will be contained. If you spill chemicals, act quickly to contain and clean up the spill. This is particularly important on paved surfaces.

Using more pesticides or fertilizers than you need invites pollution problems. Timing of applications is also important. DO NOT apply pesticides and chemicals if rain is expected within 24 hours. See Chapter 6, *Yard and Garden Care*, for more information on the proper use and handling of yard and garden products.

Do you use road salt or other de-icing products?

Road salt and de-icers eventually wash off paved surfaces and end up in the soil or water. Salt can readily flow from your driveway or sidewalk to storm drains and into streams and lakes. High concentrations of salt are harmful to wildlife and plants. Use less to keep these chemicals out of natural systems. If you use too much, clean up the excess. Consider using sand or regular kitty litter as less toxic alternatives. Chipping ice off pavements is an even better choice, although care must be taken not to damage the pavement surface.

How can you keep animal wastes from becoming a pollution problem?

Droppings from dogs and cats and other commonly kept animals such as horses, exotic birds, rabbits, goats and chickens can be troublesome in two ways. First, animal wastes contain nutrients that promote the growth of algae and aquatic plants if they enter streams and lakes. Second, animal droppings are a source of disease organisms.

The risk of stormwater contamination increases if animal wastes are allowed to accumulate in animal pen areas or are left on sidewalks, streets or driveways where runoff can carry them to storm sewers. Droppings that are not mixed with litter or other materials should be flushed down the toilet. Or, if local laws allow it, droppings may either be buried or wrapped and put in the garbage for disposal. If you bury droppings, don't bury them within 25 feet of a lake, reservoir, stream or your well. If you have many animals, your local Natural Resources Conservation office can help you develop a waste management plan.

Are yard and garden wastes kept out of stormwater?

If left on sidewalks, driveways or roads, grass clippings and other yard wastes will wash away with the next storm (Figure 2.1, page 15). Although leaves and other plant debris accumulate naturally in streams and lakes, homesites can contribute excess amounts of plant matter, especially in areas with many homes. As the plant materials decompose, they release nutrients into the water. These nutrients may then stimulate excessive growth of undesirable algae and aquatic plants.

Burning yard waste is not an environmentally friendly alternative — and in some areas or times of the year, it's illegal. Hydrocarbons and nutrients released by burning leaves contribute to water pollution as well as air pollution. Rain washes smoke particles out of the air, and runoff picks up dust and ashes left on pavement or in ditches. You can easily avoid the problem by sweeping clippings back onto the grass and composting leaves and garden wastes on your property to recycle nutrients.

Assessment 2.1 — Reducing Pollutants in Runoff

Use the following assessment table to rate your stormwater pollution risks. For each question, check your risk level in the right-hand column. If the choices do not exactly describe your situation, choose the response that fits best. Refer to Part 2.1 above if you need more information.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Automotive wastes	Oil drips and fluid spills are cleaned up. Dirty car parts and other vehicle wastes are kept out of reach of stormwater runoff.	Drips and spills are not cleaned up. Car parts and other vehicle wastes are left on unpaved areas outside.	Used oil, antifreeze, and other wastes are dumped down the storm sewer, in a ditch, or on the ground.	❒ Low ❒ Medium ❒ High
Car washing	Cars and trucks are taken to a commercial car wash or spray booth.	Cars, trucks or other items are washed on a lawn or gravel drive.	Cars, trucks, or other items are washed on a driveway, street, or other paved area.	❒ Low ❒ Medium ❒ High
Storage of pesticides, fertilizers and other potentially harmful chemicals	Chemicals are stored in waterproof containers in a garage, shed or basement that is protected from stormwater.	Chemicals are stored in waterproof containers but within reach of stormwater.	Chemicals are stored in non-waterproof containers outdoors or within reach of stormwater.	❒ Low ❒ Medium ❒ High
Handling and use of pesticides, fertilizers and outdoor chemicals	Spills are cleaned up immediately, particularly on paved surfaces. Minimum amounts of chemicals are applied according to label instructions.	Applications are not delayed to avoid rain.	Spills are not cleaned up. Products are used in higher amounts than what is recommended on the label.	❒ Low ❒ Medium ❒ High
Pet and animal wastes	Animal and pet wastes are flushed down the toilet; buried away from gardens, wells, ditches or areas where children play; or wrapped and placed in the garbage for disposal.*	Animal wastes are left to decompose on grass or soil. Wastes are scattered over a wide area.	Animal wastes are left on paved surfaces, concentrated in pen or yard areas, or dumped down a storm drain or in a ditch.	❒ Low ❒ Medium ❒ High
Grass clippings, leaves and other yard waste	Grass clippings, leaves and other yard wastes are swept off paved surfaces and onto lawns away from water flow routes. Leaves and other yard wastes are composted.	Leaves and other yard wastes are piled on the lawn next to the street for collection.	Grass clippings, leaves, and other yard wastes are left on driveways, streets, and other paved areas to be carried off by storm-water. Yard waste is burned on-site.	❒ Low ❒ Medium ❒ High

*Be sure to check local regulations regarding burying or landfilling pet and animal wastes.

Responding to Risks

Your goal is to lower your risks. Turn to the Action Checklist on page 23 to record medium- and high-risk practices. Use the recommendations in Part 2.1 of this chapter to help you make plans to reduce your risks.

Part 2.2 — Landscaping and Site Management to Control Runoff

You can control some stormwater risks by making changes to buildings, paved surfaces, the landscape and soil surfaces. This section reviews some easily addressed problems, as well as major landscape alterations you might want to consider.

Are there areas of bare soil around your home?

Areas of bare soil often exist in vegetable and flower gardens, on newly seeded lawns and around construction projects. Even on gentle slopes, water from rain and snow can remove large amounts of soil and carry it to wetlands, rivers and lakes. Planting grass or other ground covers is the best way to stop erosion. Putting a straw or chip mulch over gardens or newly seeded areas will slow erosion. Straw bales, diversion ditches and commercially available silt fences around construction sites can help slow runoff and trap sediment on-site. If you are working with a contractor, insist that precautions are taken to control runoff and erosion during construction. Sediment fences or traps are generally required for construction near lakes, streams and reservoirs.

Can you eliminate paved surfaces or install alternatives?

Concrete and asphalt roads, driveways and walkways prevent rainwater from soaking into the ground. When you have the choice, consider alternative materials such as gravel or wood chips for walkways. Avoid paving areas such as patios. Where you need a more solid surface, consider using a "porous pavement" made from bricks, interlocking cement blocks or rubber mats that allow spaces for rainwater to seep into the ground. If you must pour concrete, keep the paved area as short and narrow as possible.

Is your basement protected from stormwater seepage or flooding?

Stormwater in your basement can be a hazard in two ways. First, water can carry contaminants or disease organisms into your home. Second, water can pick up chemicals stored in your basement and carry them into the sewer or ground. Basement windows or doors are common stormwater entry points and should be sealed against leaks. It is best if window and door sills are at least a foot above ground level. If windows are at or below ground level, you can protect them with clear plastic covers available in building supply stores. Window wells that extend above ground level can help divert stormwater. Your yard should be sloped away from the foundation to prevent water from pooling near the house and leaking into the basement. Consult Clemson Extension Housing Leaflets 234 and 238 for specific recommendations.

Does roof water flow onto pavement or grass?

Your house roof, like pavement, sheds water. If downspouts from roof gutters empty onto grassy areas, the water will have a chance to soak into the ground. The Council of American Building Officials (CABO) building codes call for a controlled method of water disposal from roofs such that discharge of roof drainage to the ground occurs at least 5 feet from foundation walls or into an approved drainage system. Aim downspouts away from foundations and paved surfaces (see Figure 2.3). For roofs without gutters, plant grass, spread mulch, or use gravel under the drip line to prevent soil erosion and increase the ground's capacity to absorb water. Consider using cisterns or rain barrels to catch rainwater for watering lawns and gardens in dry weather. Keep these containers closed to avoid providing a breeding site for mosquitos.

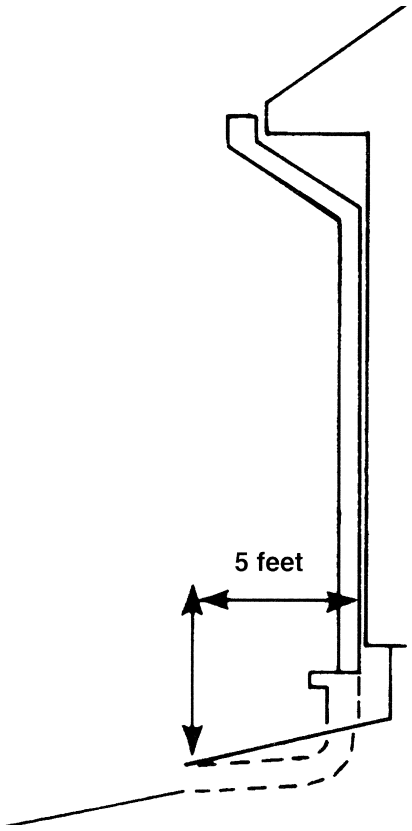


FIGURE 2.3 Roof drainage should be directed to the lawn, at least 5 feet away from the foundation and paved surfaces, and away from your septic system drainfield.

Can you change the layout of your landscape to reduce runoff?

An essential part of stormwater management is keeping water from leaving your property, or at least slowing its flow as much as possible. Many home lawns are sloped to encourage water to run off onto neighboring property or streets. Instead, you could landscape low areas with shrubs and flowers to encourage water to soak into the ground. If your yard is hilly, you can terrace slopes to slow the flow of runoff and make mowing and gardening easier.

If you have a large lot, consider "naturalizing" areas with native woodland or wetland plants. If your property adjoins a lake or stream, one of the best ways to slow and filter runoff is to leave a buffer strip of thick vegetation along the waterfront (Figure 2.4). Good sources for ideas are your local Cooperative Extension, Master Gardeners, Natural Resources Conservation Service, or Soil and Water Conservation District offices. Your local Master Gardeners group can provide planting suggestions.

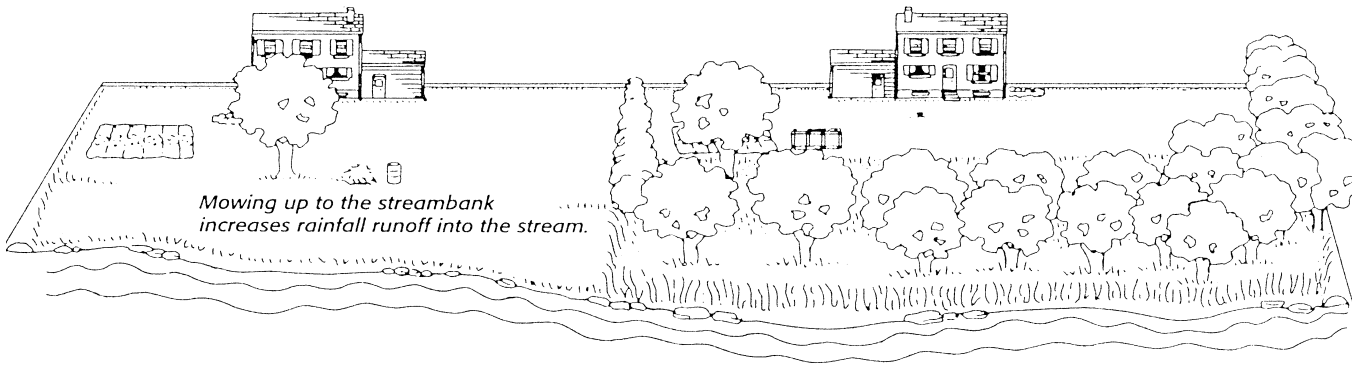


FIGURE 2.4 To help prevent erosion, leave an unmowed buffer strip of thick vegetation along streambanks and lakeshores.

Assessment 2.2 — Landscaping and Site Management to Control Runoff

For each question in this table, check your risk level in the right-hand column. Select the answer that best matches your situation. Refer to Part 2.2 above if you need more information to complete the table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Bare soil in lawns and gardens	Bare spots in the lawn are promptly seeded and topped with a layer of straw or mulch. Bare soil in gardens is covered with mulch.	Grass or other ground cover is spotty, particularly on slopes.	Spots in the lawn or garden are left (exposed) without mulch or vegetation for long periods.	❒ Low ❒ Medium ❒ High
Bare soil during construction	Bare soil is seeded and mulched as soon as possible (before construction is completed). Sediment barriers are used until grass covers soil.	Soil is left bare until construction is completed. Sediment barriers are installed and maintained to detain muddy runoff until grass covers soil.	Soil is left bare and no sediment barriers are used.	❒ Low ❒ Medium ❒ High
Paved surfaces	Paved surfaces are minimized. Other materials such as wood chips or paving blocks are used for walkways, patios and similar areas.	Some small areas are paved for patios or basketball courts.	Paved surfaces are used extensively.	❒ Low ❒ Medium ❒ High
Basement protection	Stormwater is diverted from basement windows by window well covers and other devices. Yard is sloped away from the foundation. Downspouts direct roof drainage away from the house.	No special water diversion methods are installed, but stormwater has never entered the basement.	No water diversion methods are attempted. Stormwater runoff has entered the basement or flows near the foundation.	❒ Low ❒ Medium ❒ High
Roof drainage	Downspouts and drip lines direct roof drainage onto a lawn or garden where water soaks into the ground.	Some downspouts and drip lines discharge water onto paved surfaces or grassy areas where water runs off.	Most or all drip or downspouts lines discharge onto paved surfaces, or downspouts are connected directly to stormdrains.	❒ Low ❒ Medium ❒ High
Landscaping and buffer strips	Yard is landscaped to slow the flow of stormwater and provide areas where water soaks into the ground. Unmowed buffer strips of thick vegetation are left along streams or lakeshores.	No areas are landscaped to encourage water to soak in, but yard is relatively flat and little runoff occurs. Mowed grass or spotty vegetation exists adjacent to a stream or lake.	No landscaping slows the flow of stormwater, especially on hilly, erodible properties. Stream banks or lakeshores are eroding.	❒ Low ❒ Medium ❒ High

Responding to Risks

As before, your goal is to lower your risks. In the Action Checklist on this page, record your medium- and high-risk practices. Use the recommendations in Part 2.2 to help reduce your risks.

Action Checklist

Go back over the assessment tables to ensure that all medium and high risks you identified are recorded in the following checklist. For each medium and high risk, write down the improvements you plan to make. Use recommendations from this chapter and other resources to decide on actions you are likely to complete. A target date will keep you on schedule. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to tackle the inexpensive actions first.

Stormwater Management

Write all high and medium risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Pet wastes left in areas where runoff occurs.	Bury wastes away from gardens, wells, ditches, or areas where children play.	One week from today: April 8

For More Information

Contact your local Cooperative Extension office and the affiliated Master Gardener groups for information on landscape management. Your local Department of Health and Environmental Control office can provide information on nonpoint source pollution and regulations regarding stormwater management for construction projects. Contact your local Natural Resources Conservation Services office for information on stormwater management.

Additional Resources

Landscape Management Checklist: Preventing Home Moisture Damage (HL 234) is a Clemson Extension publication available in digital format from the Clemson Public Service Activites website at http://www.clemson.edu/psapublishing/.

Big Ten Checklist (HL 238) is offered in both printed and digital formats. Request a leaflet by contacting:

Clemson University Cooperative Extension
Bulletin Room
96 Poole Agricultural Center
Clemson, SC 29634-0129
(864) 656-3261

See the publication online at the Clemson Public Service Activites website, http://www.clemson.edu/psapublishing/.

Turning the Tide: A Citizens Guide to Runoff Pollution offers information on preventing stormwater pollution. To request a copy, contact the South Carolina Department of Health and Environmental Control at (803) 898-4187.

Citizens Guide to Stormwater Pond Maintenance offers information for individuals and homeowners associations on the proper function and maintenance of stormwater ponds. To request a copy, contact the South Carolina Department of Health and Environmental Control at (803)744-5838, extension 105, or download a copy from http://www.scdhec.net/eqc/ocrm/pubs/ponds.pdf.

This chapter was written by Carl DuPoldt, Environmental Engineer, Natural Resources Conservation Service, Somerset, New Jersey and Carolyn Johnson, Water Quality Education Specialist, University of Wisconsin Cooperative Extension, Milwaukee and adapted for South Carolina by Barbara Speziale and Janet Ensor, Clemson University Cooperative Extension.

Chapter 3

Managing Hazardous Household Products

Some commercial products commonly used at home have the potential to harm your health and the environment. This chapter will help you identify potential product hazards and minimize your risks. It covers safe management of products, from purchase to disposal. The chapter is divided into three parts:

1. Product Selection, Purchase and Use
   - Product selection criteria
   - How much of a product to purchase
   - Safety precautions for use

2. Safe Storage
   - Child safety considerations
   - Containers and spill protection
   - Proper ventilation

3. Product Disposal

Why should you be concerned?

Although many people may not realize it, virtually every household produces hazardous wastes. Some products used around the home contain ingredients that can pose threats to your health or the environment if not handled properly (Figure 3.1).

Vapors from paint thinner and other solvents can be hazardous to breathe. Products such as motor oil or pesticides — if disposed of on the ground — may contribute to the pollution of your drinking water or a nearby stream. Even everyday personal care products like nail polish and remover, spot removers, moth balls, shoe polish, and some medicines produce potentially hazardous wastes when leftovers are discarded.

Unlike hazardous farm and industrial wastes, hazardous household wastes are not regulated by law. But since they often contain the same chemicals, you still need to handle these wastes with care.

For each chemical or product, there are many questions to consider. Which product best meets your needs? Are there safer alternatives? Is it dangerous to children? What's the best way to store it? How can you use it safely? How do you dispose of leftovers?

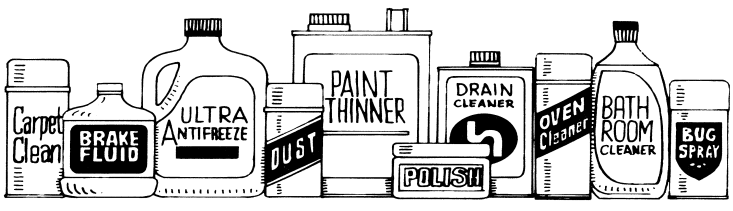


FIGURE 3.1 Some household products contain ingredients that can threaten your health or the environment if not handled properly.

This chapter will help you make choices that will reduce risks to your family and your watershed. Remember: You are responsible for the safe use, reuse, or disposal of any products in and around your home. It's up to you to understand how to make good decisions about controlling hazardous waste.

What does the word hazardous mean?

A thing or situation is hazardous if it has the potential to cause harm. For example, a child's rollerskate left on a stair is hazardous. The United States Environmental Protection Agency (EPA) defines a substance as hazardous if it's flammable, corrosive, or toxic, or if it can react or explode when mixed with other substances.

Household products are hazardous if they include ingredients that, when improperly handled, pose dangers to human health or the environment. Not every product in a category of products is hazardous—for example, some paints and strippers are less hazardous than others. To be safe, learn how to use, store, and dispose of products properly.

It's also important to know the difference between hazards to human health and hazards to the environment. These are explained below.

What hazards do household chemicals pose to human health?

Health problems can be caused by chemicals in some of the products in your home if product warnings and directions for proper use are not heeded. Health effects can range from minor problems, such as irritated skin or watery eyes, to more serious problems, such as burns, poisoning or even cancer. The box below lists some common household products that must be handled carefully to avoid injury or illness.

You can be exposed to a product ingredient by (1) ingestion, including accidental ingestion by drinking, eating or smoking when a substance is on your hands; (2) breathing dust or fumes (inhalation); or (3) contact with skin or eyes.

The potential for harm from exposure to a hazardous product depends on:

- The type of chemicals in the product
- How much of the chemical you are exposed to
- How frequently you are exposed
- Your size, weight and health

If exposure occurs, some harmful effects appear immediately. Typical symptoms are nausea, skin irritation, burning eyes, dizziness and headaches. Other effects, such as cancer or kidney or lung damage, take a long time to develop. A person who uses hazardous products frequently — without adequate safety precautions or proper ventilation — may experience these serious health effects.

Household Products That Could Be Hazardous If Improperly Managed

Building Suppiles: Sealants, some adhesives, wood preservatives

Vehicle-related Products: Antifreeze, oil, cleaning solvents, lead-acid batteries, gasoline

Home Maintenance Products: Oil-based paints, mineral spirits, products that can remove difficult greases or adhesives, paint stripper

Hobby and Recreational Supplies: Photo developer chemicals, marine paints, electronic equipment cleaners, swimming pool chemicals

Pesticides: Herbicides, insecticides, rodent poison, yard insect foggers, chemical strips, fungicides, aquacides

To avoid accidental exposure ...

- Follow the safety precautions recommended on the product label.
- Always work in a well-ventilated area, especially if the product contains a volatile solvent. (Volatile solvent-containing products are labelled "Flammable," "Combustible," or "Contains Petroleum Distillates.")

- Wear protective clothing such as gloves and goggles when the product label recommends it.
- Remember that label precautions are there for a purpose — to ensure your safety while using the product.

What hazards do household chemicals pose to the environment?

The way you handle products used on or near your property can affect the environment. Ingredients in some household products can be hazardous to plants and animals in natural environments. Pesticides or motor oil washing into a stream, for example, can harm fish. Human health can also be threatened if our food, water or air becomes contaminated through improper use or disposal of a household product.

Once released, some chemicals can be absorbed into the environment without any harmful effects. Others have lasting effects. Some chemicals can become integrated into living systems — including plants and animals — and be passed from one organism to another. If enough of a toxic chemical accumulates within an organism, it can destroy the ability to reproduce, damage the nervous system or impair the function of internal organs.

Most chemicals likely to cause environmental problems are regulated by federal law. But because it's difficult to keep track of the small quantities used by homeowners, we all need to do our part to minimize the impact of the use and disposal of hazardous household products. Some cleanup or disposal practices may seem safe, but even old habits should be examined for potential risks.

To protect the environment ...

- Avoid the following practices:
  - Dumping oils, paints, pesticides or any other household chemicals on the ground, on roads or down storm sewers
  - Dumping products in a wetland, stream or any other body of water
  - Washing chemicals off the driveway with a hose
  - Pouring pesticides or non-water-soluble chemicals into a drain that leads to a septic tank
  - Spraying pesticides on a windy day
  - Burning containers in a barrel or outdoor fire
- Use up a product according to label directions.
- Share any leftovers with a neighbor or local organization.
- Find out if and where a product can be recycled in your community.
- Find out if your community has a hazardous waste collection program. Use the community program to dispose of any leftover products listed in the inventory chart on pages 38 to 40 at the end of this chapter.

Part 3.1 — Product Selection, Purchase and Use

Your choice of products is the first step. If you carefully select a product for the job needed, you can control the degree of risk you bring to your home or property. Assessment 3.1 on page 30 will help you evaluate your risks regarding product choice and use. The information below will help you answer the questions in the assessment.

How can you tell which products are hazardous?

It pays to learn as much as you can about a household product and its potential hazards before bringing it home. Labels contain important information and often tell if a product could be hazardous. Health problems can be avoided by carefully following directions for use and safety.

Remember: The absence of a warning on a product label doesn't necessarily mean that the product is safe. Old products or products not designed for household use may not provide consumer information on the label. When using any chemical product, use it with care and caution.

In addition to product labels, up-to-date publications and advice from experts are also good sources of information. Ask questions and look for helpful ideas from health agency employees, Cooperative Extension staff, articles and books.

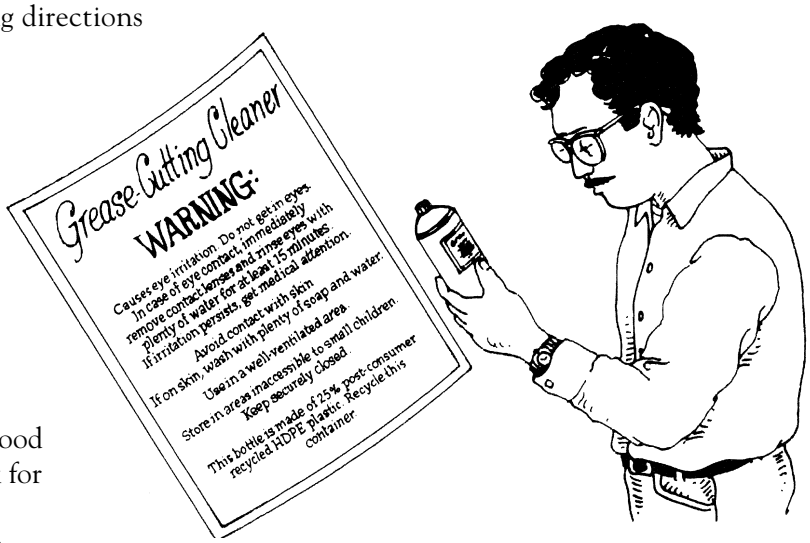


FIGURE 3.2 Labels provide details about how to safely use, store and dispose of a product.

What can product labels tell you?

Information on the product label can help you decide whether the product is right for the job and if it can be used safely in your situation. Before you purchase or use a product, take the time to read the label, even though the print is often tiny (Figure 3.2). Labels provide details about how to use, store and dispose of a product safely. First-aid instructions are often provided, too.

Household consumer products that are hazardous or contain hazardous substances are required to have human safety information, or warning labels. Pesticide labels are also required to provide detailed information on use, storage and disposal. As you read this section, take a look at the labels on some of the products in your home.

The signal words CAUTION, WARNING and DANGER draw your attention to important safety information. However, they can mean different things, depending on the product.

Labels on pesticides provide information about the poison level of the pesticide. On household products, they describe immediate health effects resulting from improper use. The signal word DANGER is required on any product that is extremely flammable, corrosive or toxic. Products labeled DANGER, FLAMMABLE, POISON, VAPOR HARMFUL or FATAL IF SWALLOWED may have ingredients that could cause environmental damage as well as health problems if used, stored or disposed of improperly.

In Case of Emergency

Poison Control Centers — whose resources feature a national computer data network — can provide emergency health information about a product. The **South Carolina Poison Control Center** phone number is **(800) 922-1117**. Keep this number close to your phone.

For information about **spills of hazardous products**, contact your state natural resources or agriculture agency or the National Response Center at **(800) 424-8802**.

To report **products that have caused you harm**, contact the U.S. Consumer Products Safety Commission at **(800) 638-2772**.

Beware of terms on labels that are vague and possibly misleading. The Federal Trade Commission has provided manufacturers with guidelines about terms such as "ozone safe" or "environmentally friendly," but the use of such terms is not regulated on any product except pesticides.

If you need more information about a product than is provided by the label, you may want to request a Material Safety Data Sheet (MSDS) from the manufacturer or consult a Poison Control Center (see box, page 28). Most manufacturers provide a phone number on their product label and are willing to answer questions by phone.

If you're not sure whether a particular household waste is hazardous or if you need other information, contact your county Solid Waste Department, local Department of Health and Environmental Quality Control office or county Extension office.

Can an alternative product do the job?

When choosing from among several brands of the same kind of product — paint strippers or degreasers, for example — read the labels to learn which product will meet your needs most safely. If you don't check first, you might buy a hazardous product such as a solvent-based cleaner when a detergent-based cleaner is available or a common alternative like kitchen cleanser will work.

Manufacturers are aware of consumer safety issues, and many offer a range of products. Some alternatives are suggested in the sidebar below. For more help in deciding which products to buy, consult the resources listed at the end of this chapter.

In an effort to reduce exposure to hazardous chemicals, many organizations have distributed information about making mix-at-home cleaners using readily available ingredients. Be advised, however, that your homemade product may not be a safer alternative. Some of these homemade alternatives are described in *Recipes for a Healthy House* on page 31. If you choose to make your own household products, be sure to consider these precautions:

- Use only one ingredient at a time. Never mix ingredients or products. Be sure to rinse the surface between products used on one place.

- Always test any cleaner on a small area before applying it to the whole surface.

- Do not use food products for cleaning (such as vegetable oil or milk). Food products may spoil or support growth of bacteria or mold on the surface being cleaned.

- Use clean containers when storing homemade products, and clearly label the container with the contents and date. Never store homemade products in old containers from commercial products.

Looking for an Alternative?

Adhesives: Use a water-based or latex adhesive.

Batteries: Choose rechargeable batteries (removable, so they can be recycled) and mercury-free batteries when possible.

Cleaners: Choose soap- or detergent-based cleaners when possible. Avoid non-water-soluble and corrosive cleaners when others offer an effective substitute.

Household pesticides: Look for ways to reduce your need for these products through appropriate cleaning and maintenance habits.

Floor and wood-finish strippers: Use a detergent or water-based stripper.

Paint stripper: Use sandpaper, a scraper or a heat gun for small jobs.

Wood preservative: Use a water-sealing coating.

Several of the above suggestions were provided by the Minnesota Pollution Control Agency.

Do you buy only what you need?

If you buy more than you need, household products will accumulate and create storage problems. If unused for long periods, product containers may become damaged and leak, and products may change chemically and not be effective when you finally try to use them. Some products such as pesticides may have been restricted or banned since they were purchased. If that occurs, safe and legal disposal becomes much more difficult. Avoid these problems by purchasing and using only what you need.

Assessment 3.1 — Product Selection, Purchase and Use

The risk categories and recommendations found in the table below apply to hazardous products in general. Management options for some products are not covered. If you're not sure what to do, don't take chances. Find out what is safe.

Use the table to rate your risks related to the selection, purchase and use of household products. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Refer to Part 3.1 above if you need more information to complete this table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Product selection	I always read labels, understand signal words, and respect the health or environmental hazards labels describe. I choose the least hazardous product needed for the job.	I don't read labels or don't understand what they mean, but I use a "common sense" approach to safety.	I never read labels. I purchase products without considering what the product is made of or how it will be used.	❒ Low ❒ Medium ❒ High
Quantities purchased	I buy only what is needed for a specific job. I use up most of the product within a few months after purchase or give excess away to someone else.	I buy excess product but provide safe and accessible storage.	I buy more than is needed, then purchase additional product without checking on current supplies.	❒ Low ❒ Medium ❒ High
Safety precautions	I follow label instructions and take recommended precautions against exposure (such as providing good ventilation and wearing safety goggles and gloves). I never mix products.	I occasionally read label instructions. I take some precautions. I occasionally mix products for specific cleaning tasks, but I always check safety precautions first.	I never follow label instructions and take no precautions — even when recommended. If one product doesn't work, I add in another without checking safety precautions.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your health risks and reduce potential harm to the environment. Turn to the Action Checklist on page 37 to record the medium- and high-risk practices you identified. Use the recommendations in Part 3.1 to help you plan actions to reduce your risks.

Homemade Cleaners: Recipes for a Healthy House

All-purpose Cleaner I
4 tablespoons baking soda
1 quart warm water
Dissolve baking soda in warm water.
Apply with a sponge. Rinse with clear water.

All-purpose Cleaner II
Apply baking soda to a damp sponge.
Rinse with clear water.

All-purpose Cleaner III
1 tablespoon ammonia*
1 tablespoon liquid detergent
1 pint water (2 cups)
Mix ingredients and put in spray bottle.
Spray on surface. Wipe. Rinse with clear water.
**Ammonia is a toxic ingredient. Handle it with care and store it safely.*
**DO NOT use a chlorine detergent.*

Window and Mirror Cleaner I
4 tablespoons ammonia*
1 quart warm water
Mix ingredients and put in spray bottle.
Spray on surface. Wipe.
**Ammonia is a toxic ingredient.*
Handle it with care and store it safely.

Window and Mirror Cleaner II
2 tablespoons vinegar
1 quart warm water
Mix ingredients and put in spray bottle.
Spray on surface. Wipe.

Drain Opener*
Use a plunger (plumber's helper). It may take a number of plunges to unclog the drain.
**Do not use this method if you have used a commercial drain opener and it may still be present in the drain.*

Drain Cleaner and Opener
Use a flexible metal snake. The mechanical snake may be purchased or rented. Thread it down the clogged drain, and you'll be able to push the clog away.

Furniture Cleaner and Polish
Wet a washcloth. Wring out as much water as possible. Wipe furniture surface with damp washcloth. Dry immediately with a clean, soft, dry cloth. (You can remove sticky fingerprints and dust safely from wood surfaces using this method, but furniture with an oil finish needs an oil-based cleaner.)

Lime and Mineral Deposit Remover
Soak cloth rags in vinegar. Apply the wet rags to the lime deposits. Leave them on for approximately one hour. The deposits will be softened and can be removed easily.

Aluminum Cleaner
2 tablespoons cream of tartar
1 quart water
To clean aluminum cookware, combine ingredients in cookware. Bring solution to a boil and simmer for 10 minutes. Wash and dry as usual.

Brass Cleaner I
Lemon juice
Baking soda
Make a paste about the consistency of toothpaste. Rub onto brass with a soft cloth. Rinse with water and dry.

Brass Cleaner II
Lemon juice
Cream of tarter
Make a paste about the consistency of toothpaste.
Apply to surface; leave on for five minutes.
Wash with warm water. Dry with a soft cloth.

Chrome and Stainless Steel Cleaner
Dip soft cloth in undiluted white vinegar.
Wipe surface.

Oven Cleaner I
Baking soda
Very fine steel wool
Sprinkle water on oven surface. Apply baking soda. Rub using very fine steel wool. Wipe off scum with a damp sponge. Rinse well and dry.

Oven Cleaner II
While oven is still warm, sprinkle water on the spill, then sprinkle salt on it. When the oven cools down, scrape the spill away and wash the area clean. Leave a layer of salt on the bottom of the oven to catch drips and make cleaning easy.

Toilet Bowl Cleaner
Baking soda
Vinegar
Sprinkle baking soda into the toilet bowl. Add vinegar. Scour with a toilet brush.

Skin Cleaner
Clean oil paint or stain off skin by rubbing with vegetable oil and then washing with soap.

Part 3.2 — Safe Storage

Leftover or used chemicals such as strippers, paint, waste oil, used antifreeze and solvents may need to be stored until their next use or disposal (Figure 3.3). How and where you store household products can determine how much risk may be present. Use the information below to help you fill out Assessment 3.2 on page 33.

Are your storage locations and containers really safe?

When storing household products, the primary concerns are child safety (Figure 3.4), indoor air quality, water contamination, and prevention of damage to household equipment or the environment. If you can smell a household product while it is in storage, the container lid may be loose or ventilation may be inadequate to protect your health.

When you store household products, do you:

- Keep them out of the reach of children and pets, preferably in a locked, secure area?
- Store them in their original containers?
- Clearly label and date any alternative containers?
- Keep containers tightly sealed and dry?
- Store products at least 150 feet from a well or waterway?
- Keep products in a well-ventilated area and away from sources of ignition?
- Store batteries and flammable chemicals in an area shaded from direct sunlight?

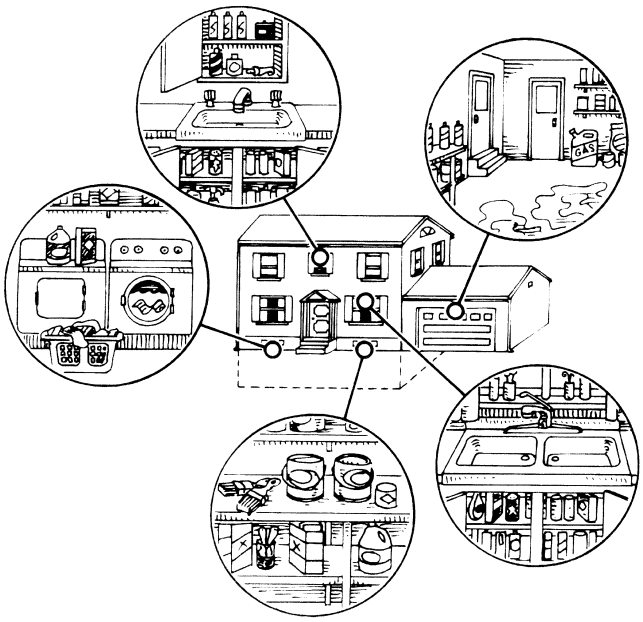


FIGURE 3.3 You might find hazardous products in many places in your house.

Use and store potentially hazardous products as far as possible from a private well. Do not use a wellhouse to temporarily store home pesticides or other hazardous products. Use care when using lawn or garden pesticides if your well is less than 100 feet away or if it is downhill of the application area. Immediately clean up oil, antifreeze, fuel or solvent spills.

Be sure to separate corrosives like acids or lye from each other and from other hazardous products to prevent dangerous chemical reactions. Reactions occur when corrosives leak from their containers and drip or flow to other products. Corrosive materials are often stored where equipment and appliances are located; be aware that they can corrode air conditioning and heating systems, hot water heaters, and other equipment or appliances. Routinely check areas where you store household products (under the kitchen sink, in the basement or garage) to make sure that containers are closed tightly and not leaking, and that the sides of containers are not bulging.

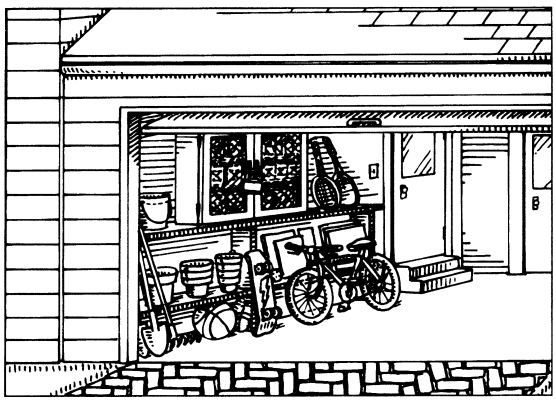


FIGURE 3.4 Hazardous products should be stored in a locked cabinet or other location inaccessible to children.

Assessment 3.2 — Safe Storage

Use the table below to rate your risks related to product storage. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that best fits. Refer to Part 3.2, opposite, if you need more information to complete this table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Child safety	I store hazardous products in a locked cabinet or other location inaccessible to children.	I keep products out of the direct reach of children (on a high shelf, for example) but still accessible.	My products are easily accessible to children (for example, in an unlocked cabinet on the lower shelf).	❒ Low ❒ Medium ❒ High
Containers, storage location and spill protection	I store leftovers in their original containers, properly sealed. Products are stored by type. My home environment is protected against leaks or spills.	I store original containers in a disorganized way. I don't provide protection against leaks or spills.	I transfer leftovers to other containers such as used milk jugs or glass jars. I store leftovers without caps or lids. I don't provide protection against leaks or spills.	❒ Low ❒ Medium ❒ High
Ventilation	I store volatile products (like solvents and petroleum-based fluids) in places with good ventilation.	I don't pay attention to storage location, but each container is in good shape and tightly sealed.	I store products in areas with poor ventilation such as basements, closets or crawl spaces. Containers are damaged or left open.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your health risks and reduce potential harm to the environment. Turn to the Action Checklist on page 37 to record the medium- and high-risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

Part 3.3 — Product Disposal

Unless a product is used up, you will have to dispose of it. For some products that are especially hazardous — like pesticides — even the product container will have to be disposed of properly.

In South Carolina, hazardous wastes from individual households are not yet regulated by law; however, specific wastes are banned from disposal in municipal solid waste landfills by the South Carolina Solid Waste Policy and Management Act of 1991. These include: lead-acid batteries; used oil; yard trash and land-clearing debris; whole waste tires; white goods (refrigerators, freezers, water heaters, washers, dryers); and small-sealed lead-acid batteries.

Some of these items can be taken to your local recycling or convenience center. Items accepted for recycling vary in each city and county. Check with your local center before bringing items to it. The *South Carolina Recycles* directory, listed under *For More Information* at the end of this chapter, lists all of the recycling centers in South Carolina.

You may be able to donate leftover paint, household cleaners or other products to local charity, church or service organizations. Theater groups, the local housing authority or nonprofit organizations such as Habitat for Humanity may be able to use small quantities of useable paint or cleaning products.

Part 3.3 provides tips for disposal of certain hazardous product categories. The disposal guides listed under *For More Information* on page 42 at the end of this chapter provide more detailed management recommendations.

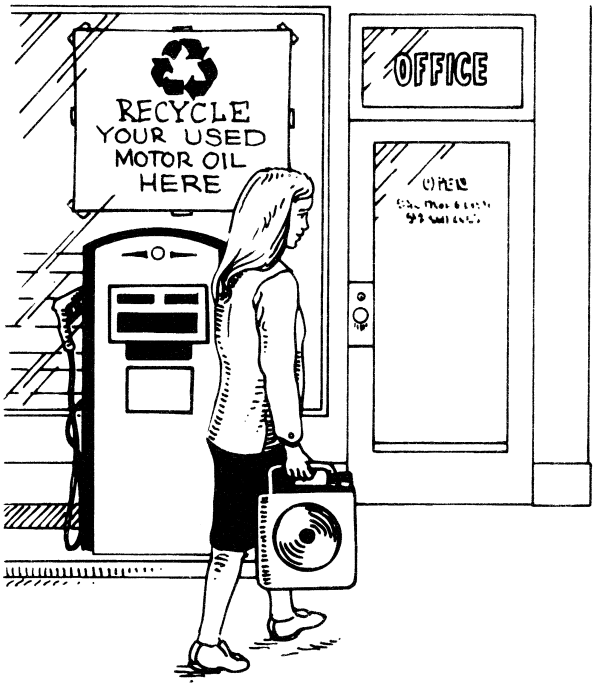


FIGURE 3.5 Used motor oil is accepted at many automobile service stations or recycling/ convenience center sites for recycling.

What is the best way to dispose of leftover hazardous products?

Disposal should be your last option because it is wasteful and, if not done properly, can be unsafe for you and the environment. You can avoid the disposal dilemma by buying only what you need, using up your leftovers or recycling. By giving leftover products to a neighbor or local organization who can use them, you can turn a potential waste problem into a cost-saving opportunity.

Some communities sponsor swap programs to encourage sharing, and options for recycling are increasing. Used motor oil and batteries, for example, are accepted for recycling in many automobile repair shops and recycling center sites (Figure 3.5). Some pesticide containers may be returned to where they were purchased for safe disposal.

Some cities and communities sponsor occasional or permanent household hazardous waste collection programs. Because only certain hazardous products may be accepted, contact the program to learn exactly what materials are accepted. If your community doesn't sponsor such a program, contact local sanitation officials for disposal advice.

Household quantities of some products can be safely sent to a landfill. For example, leftover paint — if local regulations permit — can be evaporated in its can. When dry, the can with its hardened contents can be discarded in household garbage.

Paint and pesticides merit special attention.

We all buy too much paint. Municipalities that collect leftover hazardous household products report that paints make up about half of the material that people bring and thus are a costly (but avoidable) disposal expense. The best practice is to avoid leftovers by calculating how much paint you'll actually need before you buy. Salespeople at paint stores can help you with these calculations.

Most leftover paint can be safely managed by sharing it with neighbors or organizations. However, leftover lead-based paints or exterior paints containing mercury or pesticides should be treated as hazardous waste.

We don't pay enough attention to how we manage pesticides. A 1992 Environmental Protection Agency study of pesticide use in homes and gardens provided disturbing information about how pesticides are used, stored and thrown away. Household practices showed that people fail to recognize the danger that pesticides can pose to child safety, human health or the environment when managed improperly.

Before you choose a pesticide, be sure that you have exhausted other options for controlling the pest, weed or fungus problem. If you do need to use a pesticide, read label information carefully before purchasing a product. Buy only what you need.

Pay attention to use and disposal recommendations described on labels. Before disposal, use up the product if possible. Rinse empty containers of liquid pesticides. Use the rinse water as part of your yard and garden management.

To reduce your need for pesticides in the home:

- Maintain regular cleaning habits, especially in the kitchen.
- Caulk cracks and other openings to the outside.
- Keep screens repaired.
- Keep houseplants healthy by providing appropriate care.

Is dumping or burning a safe alternative?

It's never appropriate to dump or burn hazardous products on your property, particularly near wells or water sources. Nor should products be poured down storm sewers. Water-soluble cleaning products may be safely disposed down the drain if you flush the drain with plenty of water.

Septic system owners need to be especially careful, however. With septic systems, the rule of thumb is moderation. Don't dump large amounts of anything into the septic system. Septic systems are not designed to treat chemicals. If the product is specifically designed to be used in the home with water, then moderate use will not harm the system.

Burning hazardous wastes in a barrel or stove is never an alternative, and it's illegal in many states. Burning may release toxic gases and produce hazardous ash.

Assessment 3.3 — Product Disposal

General recommendations for disposal are provided in the table below. Check the waste category in the left column and see if any of your disposal practices present risks to human health or the environment. Consult the chart on pages 38 to 40 — *Hazardous Product Examples and Inventory* — for specific products affected by these recommendations.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Household trash (trash containing plastics or empty containers of hazardous ingredients)	I rinse empty yard and garden pesticide containers and include the rinse water in yard and garden management. I dispose of ash, mixed trash and empty product containers at the community landfill. I do not burn trash.	I dispose of ash from mixed trash, leftover pesticides and solvents on my property but away from my well or waterway. I burn hazardous containers.	I always dispose of ash from mixed trash, leftover pesticides and solvents near a well or waterway. I burn hazardous containers near people or animals.	❒ Low ❒ Medium ❒ High
Strong acids and bases (found in hobby and recreation products, concentrated building cleaners, and repair products)	I share any leftover products. I dilute strong acids and bases and pour them down a drain that connects to a sewage treatment facility.	I pour strong acids and cleaners down the drain without first diluting them with water. I send leftovers to a landfill (with proper protection for garbage haulers and employees).	I dump strong acids and cleaners directly into a storm sewer or waterway or on a paved slope leading to a waterway.	❒ Low ❒ Medium ❒ High
Antifreeze, waste motor oil	I recycle antifreeze and waste oil by taking them to properly qualified dumping stations.	I pour my used antifreeze into a septic system or municipal treatment system.	I dump my used antifreeze and waste oil always in the same place, near a well or waterway. I dump these materials directly into a waterway.	❒ Low ❒ Medium ❒ High
Batteries (may contain mercury, cadmium or lead)	I recycle batteries or take them to a hazardous waste disposal program.	I dispose of batteries in a community landfill.	I always dump batteries near a well or waterway.	❒ Low ❒ Medium ❒ High
Bottled gas	I recycle bottled gas containers.	I store containers that may still contain some gas.	I put containers in my trash or leave them lying around.	❒ Low ❒ Medium ❒ High
Fluorescent bulbs (contain mercury)	I recycle burned-out fluorescent bulbs or lamps.	I put my burned-out bulbs in the trash.	I leave my burned-out bulbs at a dump.	❒ Low ❒ Medium ❒ High

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Cleaning and repair products containing hazardous solvents (non-water-soluble) and paint	I share leftovers when possible. I take leftover products containing mercury, pesticides, or hazardous solvents to a hazardous waste disposal program.	I dispose of leftover products in a community landfill.	I always dump leftover products. I dump leftovers near a well or waterway. I dump my leftovers directly into a waterway. (NOTE: *This is illegal!*)	❒ Low ❒ Medium ❒ High
Pesticides	I use preventive actions to control pests, indoors and outdoors. I explore options for nonchemical pest controls. I properly choose, store, handle, apply and dispose of chemical pest controls.	When solving pest problems, I do not practice much prevention or explore nonchemical options.	I DO NOT handle pesticides as directed on the label.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your risks. Use the Action Checklist below to record the medium- and high-risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

Action Checklist

When you finish the assessments, go back over them to make sure you have recorded all medium and high risks in the checklist. For each risk you identified, write down the improvements you plan to make. Use recommendations from this chapter and other resources, such as those listed on pages 41 and 42, to plan your changes.

Pick a target date to keep you on schedule for making changes. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions first.

Managing Hazardous Household Products

Write all high and medium risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: *Cabinet with antifreeze and paint stripper is not child-proof.*	*Buy a lock and install it on cabinet.*	*One week from today: November 28*

Hazardous Products Inventory

Check for hazardous products stored in your home. Use the list below to plan ways to improve your use, storage and/or disposal of these products. If you're unsure about disposal, contact your local Cooperative Extension office or state environmental protection agency.

Category/product		Is it properly stored?	Is information about proper disposal needed?	Are there special precautions to keep in mind?
Household Trash	Ash/sludge from burned home or garage trash (Note: Burning trash is illegal in many states!)			
	Fluorescent bulbs/lamps (contain mercury)			
	Waste motor oil			
	Plastic wraps and containers (only hazardous when burned)			
	Pesticide or solvent containers			
	Empty containers from other product categories listed below			
Clothing or Fabric Care Products	Mothballs			
	Dry-cleaning fluids			
	Spot removers (solvent-based)			
	Shoe/leather polishes			
Hobby and Recreation Products	Artist paints and solvents			
	Charcoal lighter fluid			
	Strong acids/bases*			
	Bottled gas			
	Household batteries (may contain mercury or cadmium)			

* *See note on page 41*

Category/product		Is it properly stored?	Is information about proper disposal needed?	Are there special precautions to keep in mind?
Building and Wood Cleaners and Repair Products	Building and wood cleaners with organic solvent ingredients:			
	•Wood polishes			
	•Products for wood floor and panel cleaning			
	Building and equipment maintenance products:			
	•Strong acids, bases*			
	•Lead-based paint			
	•Oil/alkylic paints and primers			
	•Marine and exterior paints containing mercury and/or pesticides			
	•Aerosol paint products			
	•Stains and finishes			
	•Roof coatings and sealants			
	•Rust removers			
	•Silicon lubricants			
	•Other lubricants			
	•Adhesive removers			
	•Paint and finish preparation products			
	•Adhesives such as glues and caulk			
	•Wood-preserving products			
	•Products for brush or spray gun cleaning			
	•Water repellents for wood and cement			
	•Solvents, as those used in degreasers and paint thinners, stains, and varnishes			
Pesticides	Pesticides labeled "restrictive use"			
	General-use pesticides			
	Old pesticides			
	Unwanted pesticides			

* *See note on page 41*

Category/product		Is it properly stored?	Is information about proper disposal needed?	Are there special precautions to keep in mind?
Vehicle Maintenance	Vehicle maintenance products such as antifreeze, oil and grease, and transmission fluid			
	Solvents for oil and grease removal and disposal			
	Engine and parts cleaners such as carburetor and brake cleaner			
	Paints and paint preparation products			
	Lead acid batteries			
	Battery terminal protector			
	Tire cleaners			
	Rust removers			
	Ignition wire dryer			
	Gasket removers			
	Aerosol paint and primer products			
	Brake quieter			
	Brush and spray gun cleaners			

NOTE: You can identify strong acids or bases in the product you are using by noting:
- If the hazard warning label recommends that the user wear skin protection or avoid breathing the vapors or aerosol mists
- If the product was intended for commercial use (industrial-strength cleaner, for example)
- If the product was intended to manage difficult stains or dirt on hard surfaces (for example, rust or lime remover)

Now that you have completed this inventory, you are more familiar with hazardous products found in your home. Review the inventory once again and consider the following:

- Do I need all of these products in my home?
- Are there less hazardous alternatives I can use?
- Do I have as much information as I need to make good use, storage and disposal decisions?

For More Information

Hazardous Household Products

If you're not sure whether a particular household waste is hazardous or if you need other information, contact your county Solid Waste Department, local Department of Health and Environmental Quality Control office (DHEC), or county Extension office. Contact information for local DHEC and Cooperative Extension offices is listed on pages 91 and 92.

The Office of Solid Waste Reduction and Recycling was created by the South Carolina Solid Waste Policy and Management Act of 1991. As part of the South Carolina DHEC's Division of Solid Waste Management, the Office is committed to helping the state reach its goals to reduce the amount of solid waste generated in South Carolina. The Office has educational, public awareness and grant programs to attain these goals. For information on solid waste reduction and recycling, contact the South Carolina Department of Health and Environmental Control, Office of Solid Waste Reduction and Recycling, 2600 Bull Street, Columbia, SC 29201, (800) 768-7348.

Pesticides

The following Clemson Cooperative Extension Service Pesticide Information Program publications and information sheets

Pesticides Commonly Found in the Home
How to Use Homeowner Pesticides Safely (PIP 20)
How to Choose a Lawn Care Company (PIP 36)
Store Pesticides Safely (PIP 37)
Choosing a Professional Pest Control Company

are available from county Extension offices (see local phone listings or the directory on page 91) and the Clemson University Department of Entomology, at (864) 656-3111. You may also download these publications from the following website: http://entweb.clemson.edu/pesticid/saftyed/homeuse.htm#atClemson .

The Clemson Extension Home and Garden Information Center provides the following publications on the Internet at http://hgic.clemson.edu or through the mail by calling (888) 656-9988:

Pesticide Application Tips (HGIC 2752)
Pesticide Container Disposal (HGIC 2754)
How to Handle Pesticide Spills (HGIC 2753)
Reading the Pesticide Label (HGIC 2750)
Pesticide Safety (HGIC 2751)
Integrated Pest Management (IPM) (HGIC 2755)
Organic Pesticides and Biopesticides (HGIC 2756)
Understanding Cockroach Control (HGIC 2042)

These publications can also be obtained online from the Pesticide Information Program site, http://entweb.clemson.edu/pesticid/saftyed/homeuse.htm#atClemson.

For detailed guidance on pesticide management, see *Guides to Pollution Prevention: Non-Agricultural Pesticide Users,* United States Environmental Protection Agency, (1993), document EPA/625/R-93/009. This 58-page guide, which includes nine worksheets, is available from the National Center for Environmental Publications and Information, P.O. Box 42419, Cincinnati, OH 45242-0419; fax (513) 489-8695; or online at www.epa.gov/ncepihom/.

Disposal

The Clemson Cooperative Extension Service's *Disposal of Household Hazardous Waste* (WML 2) and *Reducing Hazardous Products in the Home* (WML 1) are both available on the Clemson Public Service Activities website at http://www.clemson.edu/psapublishing/.

Health Effects of Drinking Water Contaminants and How to Treat Them (WQL 3) is available in both printed and digital formats. Request a copy of the leaflet by calling the Clemson Public Service Activities Bulletin Room at (864) 656-3261, or visit the Public Service Activities website for the online version (see previous address).

South Carolina Recycles: A Directory of Recycling Programs and Markets. This directory is available from the South Carolina DHEC Office of Solid Waste and Recycling (see address above).

The Water Environment Federation's (WEF) waste disposal guide provides disposal recommendations for many kinds of products. You may be able to obtain one from your local sewage treatment facility or by contacting WEF, Public Information Department, 601 Wythe Street, Alexandria, VA 22314-1994; phone (800) 666-0206 or (703) 684-2452; http://www.wef.org.

Other guides are available from the Environmental Hazards Management Institute (EHMI). For more information, write to them at P.O. Box 932, 10 Newmarket Road, Durham, NH 03824, or send e-mail to emiorg@aol.com.

This chapter was written by Elaine Andrews, Environmental Education Specialist, Environmental Resources Center, University of Wisconsin Cooperative Extension and adapted for South Carolina by Barbara Speziale and Janet Ensor, Clemson University Cooperative Extension. Information on accidental exposure to hazardous products was adapted from a fact sheet produced by the Minnesota Pollution Control Agency. Information on reducing hazardous products in the home and the *Recipes for a Healthy House* were adapted from Clemson Extension publications by Joyce H. Christenbury. Review comments were provided by Edward Shuster.

Chapter 4

Home Septic Systems

Most people don't give much thought to the wastewater created in their homes from kitchen, bathroom and laundry area drains. Wastewater treatment is usually out-of-sight and out-of-mind — until problems occur. And yet many people don't realize that a septic system failure is more than a nuisance: It's a health hazard and a danger to the environment.

This chapter will help you evaluate your septic system and pinpoint risks before they become problems. It introduces you to what a septic system is and how it functions and provides general guidelines for safe management of household wastewater. Local laws, however, may impose more stringent or additional requirements. Contact your nearest Cooperative Extension office, a local health or environmental agency, or a septic system contractor for advice. You'll learn:

- How to plan the design and location of a new home's septic system
- How to determine whether your septic system is the right size for your home
- How to maintain a septic system
- How to prevent your septic system from failing

Why should you be concerned?

Knowing the basics about your household system and taking simple precautions to safeguard it can prevent the health risks posed by inadequate wastewater treatment.

When municipal sewer systems or household septic systems fail, untreated sewage can end up both on land and in water. This untreated wastewater may contain dangerous bacteria or viruses that can threaten human life and pollute and contaminate the environment.

Wastewater treatment systems are designed to remove or break down these contaminants before they enter groundwater — the source of drinking water via wells — or nearby lakes, streams or wetlands.

Keeping your system working properly is a wise investment — for both environmental and economic reasons. In addition to devastating natural resources, a failed system can cost thousands of dollars to replace.

Where is your wastewater treated?

Do you have a septic system or other on-site system to treat wastewater? This chapter is geared toward homeowners or tenants who have septic systems buried in their yards. When your wastewater is treated by such a system, you're responsible for how well the system does its job. You need to learn all you can about the routine maintenance and proper use of a septic system if you expect to keep your system in good working order.

Are you hooked up to a city or community sewer system? Even if you don't have a septic system on your homesite, there are still ways you can reduce the impact your wastewater makes on your community and the environment. Conserving water and being careful about what you put down the drain are easy ways to help. Using your municipal sewage treatment system wisely saves taxpayers' dollars and protects our water resources.

What is a conventional septic system and how does it work?

Most residential septic systems consist of a 1,000-gallon-capacity watertight septic tank buried in the ground and a drainfield that can fit within the front or back yard of the homesite (see Figure 4.1). Household wastewaters flow into the septic tank where the solids are retained. The liquid flows out of the tank to the drainfield where it leaches through the soil and is purified before reaching the groundwater.

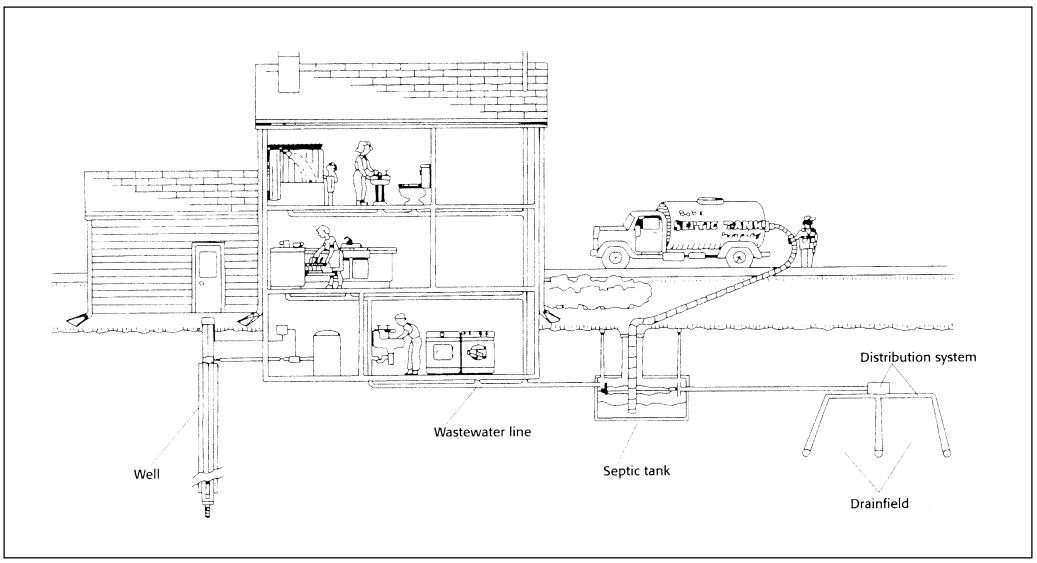


FIGURE 4.1 Household wastewater carries, dirt, soap, food, grease and bodily wastes "down the drain" and out of your house to an on-site septic or municipal wastewater treatment system.

The Septic Tank

First, wastewater flows through a sewer pipe out of your house and into the septic tank, a box or cylinder commonly made out of concrete (Figure 4.2). Fiberglass and polyethylene tanks are also used. The tank must be watertight to keep sewage from leaking out and groundwater from seeping in.

Lighter solids in the wastewater — such as grease, hair and soap — float to the top of the tank and form a scum layer. Heavier solids settle to the bottom and form a layer of sludge. Bacteria in the tank begin to break down some of the sludge into simple nutrients, gas and water. The remaining solids are stored in the tank until they are pumped out.

A baffle or a sanitary tee pipe at the tank inlet slows the incoming rush of water, so the sludge is not stirred up; another, located at the tank's outlet, keeps solids from leaving the tank. Inspection pipes at the top of the tank make it easy to see how well the inlet and outlet pipes, baffles and tee pipes are functioning.

The Distribution System

Next, the liquid waste, or effluent, flows out of the tank, through the distribution system, and into the drainfield or soil absorption field (Figure 4.3). The distribution system consists of a series of perforated plastic distribution pipes or concrete galleys laid in the ground, usually in gravel-filled trenches. Effluent can be fed into the pipes by gravity or by a pump. The effluent moves slowly out of the trench and is absorbed into the soil. An effluent filter at the tank outlet is recommended, because particles carried out of the septic tank can clog the drainfield.

A Conventional Septic System Has Three Components:

- The **septic tank**, which separates, stores and begins to treat solid wastes.
- The **distribution system**, which disperses the liquid effluent over a large area of soil.
- The soil in the **drainfield** or **soil absorption field**, which absorbs the effluent and treats it by natural physical, chemical and biological processes.

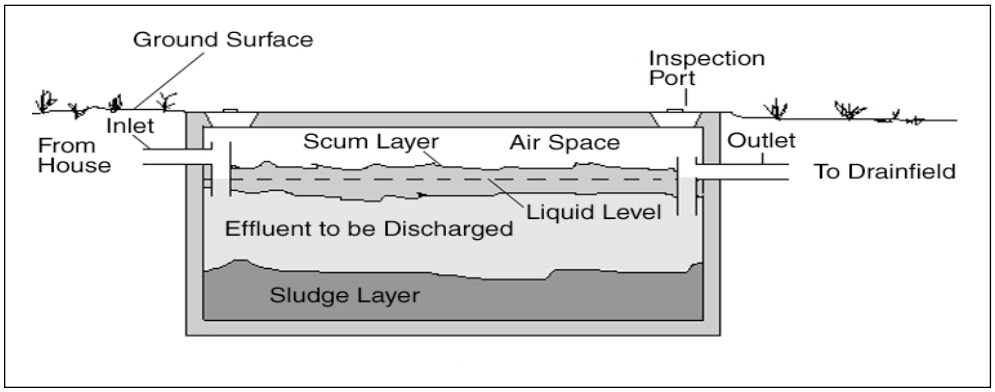


FIGURE 4.2 This cross section shows how wastewater separates inside the septic tank, permitting effluent to flow out to the drainfield.

The Drainfield

The soil must be of a suitable type and deep enough to treat wastewater before it reaches groundwater. The soil filters out larger particles and pathogens, which eventually die off in the inhospitable soil environment. Under the right conditions, beneficial soil microbes and natural chemical processes break down or remove most of the contaminants in the effluent.

Soils vary in their ability to absorb and treat wastewater. Well-drained, medium-textured soils such as loam are best. Coarse gravel or sandy soils allow wastewater to flow through too quickly for effective treatment. In fine clay or compacted soils, water moves too slowly. Soil microbes need oxygen to digest wastes quickly. If the air spaces between soil particles remain filled with water, the lack of oxygen prevents the rapid breakdown of wastes by aerobic (oxygen-requiring) soil microbes.

Anaerobic soil microbes (those that live without oxygen) digest wastes slowly and give off putrid, smelly gases characteristic of a failing septic system. Anaerobic conditions occur when soils are poorly drained, groundwater levels are high, surface runoff saturates the drainfield or excessive amounts of water are used in your household.

Good wastewater treatment depends on good dispersal of wastewater over the drainfield. A conventional distribution system uses gravity to move effluent through the distribution pipes. A dosing or enhanced-flow system has a pump or siphon to improve the distribution of effluent. In a pressure distribution system, effluent is pumped directly through small-diameter pipes, rather than through a distribution box, in order to distribute effluent evenly throughout the entire drainfield, promoting better treatment of wastewater and system longevity. An alternating trenches system provides a means of periodically aerating the distribution trenches (see Figure 4.4).

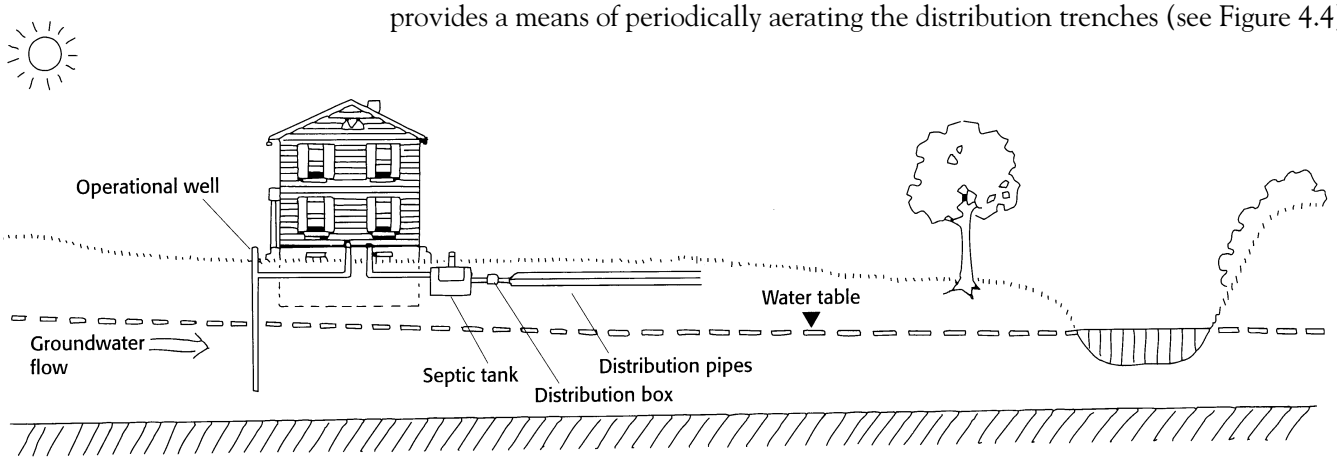


FIGURE 4.3 An overview of a septic tank and distribution system helps to demonstrate how a home septic system works.

Seepage pits and cesspools are perforated tanks or pits lined with concrete blocks or bricks through which wastewater can seep into the ground. They are usually less effective than other systems and are more likely to contaminate the water table. Cesspools are banned in many areas.

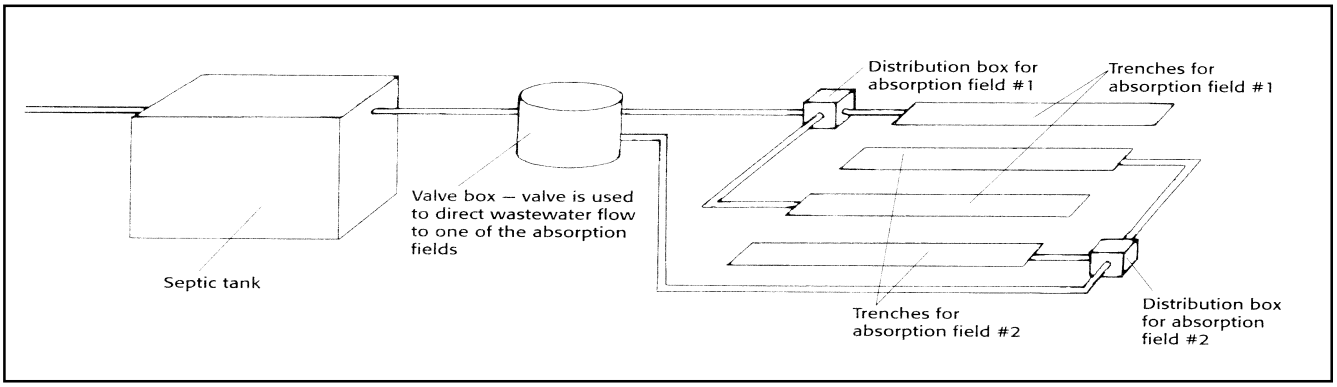


FIGURE 4.4 A septic system with alternating trenches offers another way to disperse wastewater over a drainfield.

Part 4.1 — Planning for a New Home: Septic System Design and Location

When buying property for a home, it pays to plan ahead, especially if the property doesn't have access to a public sewer. Most homes in rural and outlying suburban areas depend on individual septic systems for wastewater disposal. In the excitement of planning the appearance of your new house, it's easy to overlook practicalities like the disposal of your family's wastes.

Property that doesn't meet the standards for a conventional system may require a more expensive, alternative system. This can increase the cost of your system by $1,000-10,000 or more, and may require a larger land area for the system. Maintenance costs may also increase.

Unfortunately, not all soils can absorb wastewater or purify it. Septic systems installed in unsuitable soils usually malfunction by leaking raw, untreated sewage to the ground surface or into ditches or creeks or by contaminating the groundwater. Untreated sewage may contain deadly bacteria and viruses. It can be expensive to remedy the potential health hazards and odor problems that result from the use of septic systems in unsuitable soils.

South Carolina state law requires a comprehensive soil and site evaluation by the county health department to determine the suitability of the soils and the topography of the lot. A Permit to Construct must be obtained from the Department of Health and Environmental Control (DHEC) before construction begins on the home or the septic system.

Be sure to review your property before buying.

Before purchasing a lot for your home, review the lot yourself. Pay particular attention to any features that could affect the installation or operation of a septic system.

Separation Distances for Septic Systems*

DISTANCE FROM...	*MINIMUM DISTANCE*
Building	5 feet
Property lines	5 feet
Private well	50 feet
Public well	100 feet
Surface water	50 feet
Drainage ditch	25 feet

*Based on S.C. regulation as of 1996. Additional separation distances are required for certain types of alternative systems. Check with your county health department for any changes or additional local restrictions.

- Are there gullies, ravines, excessively steep slopes or other severe topographic conditions?
- Is the land prone to flooding? Are there streams or rivers near the property that are likely to flood?
- Does the land seem to be wet or to hold water? Does surface drainage seem to be a problem?
- Does the land contain designated wetlands? Has the extent of any designated wetlands been mapped on the property?
- Are any parts of the land rocky? Bedrock near the ground surface could make the site unsuitable for a conventional septic system.
- Is there enough space on the lot for the home, the septic system, the driveway and, if needed, a well? (See the box on page 46 for the required minimum separation distances.)

Even if the land appears suitable during your review, there may be conditions under the surface of the ground that make it difficult or impossible to install an adequate septic system. The only way to be sure is to ask your county health department to conduct a thorough evaluation of the property and determine its capacity to support a system.

Did You Know ...

In order to get electrical power to your home, your installed septic system must get final approval from the health department.

What do you need to know about choosing a site for your septic system?

As you can see, there are many factors involved in evaluating property. ***Keep in mind that the location of the septic system takes priority over the location of the house or other improvements.*** This is to assure that the best soils are used in treating your household wastewater in order to protect your family's health and the environment. If you haven't already done so, create a homesite map, as described in Chapter 1. Add the location of your septic tank, access hole and drainfield to that map.

How do you obtain the right permit?

Before you can begin to install a new septic system, you'll need to apply for a Permit to Construct. Taking the following steps can make the application process go smoothly:

- Obtain a permit application from your county health department and ask about any other required permits (such as local planning and zoning office) and fees. Keep in mind that local laws may impose additional or more stringent requirements than state laws. Contact your nearest Cooperative Extension office, a local health or environmental agency, or a septic system contractor for advice.
- Mark all of the property corners and stake the corners of proposed buildings and the center of the lot.
- Display a site locator card at the front of your property so it is easily seen.
- Make a sketch (as described in Chapter 1) showing dimensions and locations of your proposed and existing house, driveway, pool, other buildings, septic system and well. Include distances from proposed buildings to road and property lines.

- Find out where wells on adjoining property are located, and include a sketch of their sites.
- Provide complete, detailed information on the application and add copies of any plats or deeds required. Include the tax map number.

How much wastewater can your system handle?

Make sure your septic system can meet the demands of your household, whether you're planning for a new home or evaluating your existing system. Both the septic tank and drainfield need to be large enough to treat all the wastewater generated in your house, even at times of peak use. The system must be designed for the maximum occupancy of your home. An average household produces about 100 to 200 gallons of wastewater per bedroom per day.

The septic tank should be large enough to hold two days' worth of wastewater. (Two days is long enough to allow solids to settle out by gravity.) Typically, a new three-bedroom home is equipped with a 1,000-gallon tank. A two-compartment tank or a second tank in series can improve sludge and scum removal and help prevent drainfield clogging.

The required length of the drainfield trenches is based on how much wastewater is put into the system and how much water a unit area of soil can treat. The better the soil type or longer the trenches, the higher the system's capacity for wastewater treatment. If you're unsure about your septic system's age, design and location, contact your home contractor, septic system installer, local health department or environmental agency for any information they may have on file.

Keeping the size of your septic system in line with your needs is important: If water use in your household is greater than the system's designed capacity, you may suffer inadequate wastewater treatment or system failure. If you add rooms or water-using appliances to your home (such as a Jacuzzi, dishwasher or water softener) — or renovate a former vacation house for year-round use — you may need to increase the capacity of your system.

It's possible to reduce the size of the system you need by installing low-flow toilets and water-saving faucets. Conserving water and having the system pumped more frequently may also allow you to get by with a lower capacity system.

Is your septic tank capacity adequate?

Water usage in the United States ranges from 50 to 100 gallons per day (gpd) per person. Estimate the wastewater load from your household using the equation below. Your septic tank should be able to hold two days' worth of wastewater.

____ people in household x 75 gpd (average) = _____

____ gpd x 2 days = ____ gallons (**This is the minimum capacity for your septic system**.)

What is your septic tank capacity (in gallons)? _____
(If you don't know, ask your tank installer or pumper.)

Is your tank size adequate for your present household size?

_____Yes _____No

Calculate the wastewater load from your home if each bedroom was occupied by two people:

___ bedrooms x 150 gpd = _____ gpd x 2 days = _____ gallons
(This is the recommended tank size for your home if each bedroom were occupied by two people.)

Would your septic tank capacity be adequate if each bedroom was occupied by two people?

_____Yes _____No

Assessment 4.1 — Septic System Planning

Use the assessment table below to begin rating your septic system design and location. For each question, mark your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
New home planning	Before purchasing property for a home, I had a comprehensive site evaluation done by the county health department to determine whether the property was suitable for a septic system. I investigated the type and cost of system needed for the property.	I walked the property myself to determine whether any obvious limitations existed to prevent my getting a septic system permit.	I purchased property for a home without investigating my wastewater disposal needs and options.	❒ Low ❒ Medium ❒ High
Installation	I had a licensed septic system contractor install my system.	I had an unlicensed person install my system.	I installed my septic system myself.	❒ Low ❒ Medium ❒ High
Inspecting an existing system	Before purchasing an existing home with a septic system, I had the system evaluated by a professional.	Before purchasing an existing home, I asked the homeowner questions about the septic system location and what maintenance and repairs had been done.	I didn't even know the home had a septic system before I bought it.	❒ Low ❒ Medium ❒ High
Capacity of system	The tank in my septic system is designed to handle more wastewater than required, based on the size of the home.	The capacity of my system's tank just meets load requirements, but I watch out for factors indicating system overload. My family takes care to conserve water.	I've added bathrooms, bedrooms, or water-using appliances without reexamining the capacity of the wastewater system.	❒ Low ❒ Medium ❒ High
Separation distance	The drainfield is located farther than the required separation distance from any well or surface water.	The drainfield is located at the required separation distance from any well or surface water.	The drainfield is located closer than the required separation distance from any well or surface water.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower any health and environmental risks posed by your septic system's design or location. If your responses reflect any of the medium- or high-risk practices outlined in this self-assessment, record them in the Action Checklist on page 55. Make plans to reduce these risks by following the recommendations described in earlier sections of this chapter.

Part 4.2 — Septic System Maintenance

Once you have the correct capacity septic system in place, don't forget about it! With proper maintenance, a septic system can last for 20 to 30 years. Maintenance involves good daily habits as well as regular inspections and pumping of accumulated solids out of the septic tank. Responsible maintenance also calls for using your system to dispose only of the types and amounts of wastes that it's actually designed to handle.

Why should you maintain your system?

There are three important health reasons for maintaining your septic system. The first reason is the health of your pocket book. Poor maintenance results in failed systems requiring repairs at a minimum — and sometimes system replacement. Repairs or replacement costs can be thousands of dollars, whereas a periodic inspection and pumping costs about $150 to $250.

The second reason is the health of your family, your community and the environment. Untreated sewage water contains disease-causing bacteria and viruses, as well as unhealthy amounts of nitrate and other chemicals. Failed septic systems can allow untreated sewage to seep into wells, groundwater and surface water bodies, contaminating water meant for drinking and recreation.

The third reason is the health of your local economy. Contamination from failed septic systems pollutes water supplies, closes shellfish beds and recreational areas, and creates offensive odors. Quality of life, recreational opportunities and tourism decline, and with them do the property values and economic vitality of an area.

An ounce of prevention is worth a ton of cure!

Committing a little attention to the care of your system can help you avoid the inconvenience and expense of a failing system. As long as your septic system was properly located, designed and installed according to state codes, good maintenance habits will help your system work properly for years to come.

Pumping your septic tank is probably the single most important thing you can do to protect your system. If the buildup of solids in the tank becomes too high and solids move to the drainfield, this could clog and strain the system to the point where a new drainfield will be needed. Consult Table 4.1 for suggested pumping frequencies. To determine the optimum pumping frequency for your septic tank, have your system inspected yearly.

> ***Did You Know ...***
>
> A properly designed and installed septic system can be the safest, most economical way to treat your wastewater — as long as the system is properly maintained.

Sticking with other maintenance habits will also help to protect your system.

TABLE 4.1 Estimated Number of Years Between Septic Tank Pumpings

	Number of people in your household					
Tank size (gallons)	**1**	**2**	**3**	**4**	**5**	**6**
500	6	3	2	1	1	
1,000	12	6	4	3	2	2
1,500	19	9	6	4	3	3
2,000	25	12	8	6	5	4

Note: More frequent pumping is needed if a garbage disposal is used.
Source: Adapted from Karen Mancl, *Septic Tank Maintenance,* Publication AEX-740, Ohio Cooperative Extension Service, 1988.

Do's:

- Conserve water to reduce the amount of wastewater that must be treated and disposed of by your system. Doing laundry over several days, for example, will put less stress on a system than doing many loads all day long.
- Repair any leaking faucets or toilets. To detect toilet leaks, add several drops of food dye to the toilet tank and see if dye ends up in the bowl.
- Divert down spouts and other surface water away from your drainfield. Excessive water keeps the soil from adequately cleansing the wastewater.
- Keep your septic tank cover or lids accessible for inspections and pumping. Install risers with lids if necessary.
- Call your county health department or a licensed septic tank contractor whenever you experience problems with your system, or if there are any signs of system failure. (See page 52, *How can you avoid septic system failure?*)
- Keep a detailed record of repairs, pumpings, inspections and other system maintenance. Pass this on to the next homeowner if you sell your house.

Don'ts:

- Don't drive over your drainfield or compact the soil in any way.
- Don't dig in your drainfield or build anything over it, and don't cover it with a hard surface such as concrete or asphalt.
- Don't plant anything over or near the drainfield except grass. Roots from nearby trees and shrubs may clog and damage drain lines.
- Don't use a garbage disposal, or limit its usage at the very least. Disposals increase the amount of solid waste entering your tank by about 50 percent, so you have to pump your tank more often than normally suggested.
- For the same reason, don't use your toilet as a trash can.
- Don't poison your septic system and the groundwater by pouring harmful chemicals, cleansers or fuels down the drain. Harsh chemicals can contaminate sludge in the septic tank, kill the beneficial bacteria that purify your wastewater and seep into groundwater.
- Don't put in a separate pipe to carry wash waters to a side ditch or the woods. This graywater contains germs that can spread disease.
- Don't waste money on septic tank additives. The bacteria needed to treat wastewater is naturally present in sewage. Additives can re-suspend solids, causing your drainfield to clog. Additives do not eliminate the need for routine pumping of your tank.
- Don't allow backwash from home water softeners to enter the septic system.
- Never enter a septic tank. Toxic gases from the tank are deadly. If your system develops problems, get advice from your county health department or a licensed septic tank contractor.

How can you avoid septic system failure?

Any time your septic system is not treating or disposing of sewage in an effective manner, the system is failing. There can be many reasons for system failure. By far the most common reason for early failure is improper maintenance by homeowners. Call your county health department or a licensed septic tank contractor if you suspect your system is failing.

The following symptoms may indicate the failure of your septic system:

- Sewage backs up in your drains or toilets.
- Sinks, bathtubs and toilets drain slowly.
- Wastewater appears on the surface of the ground above or near the system.
- Lush, green grass grows over the drainfield, even during dry weather.
- Unpleasant odors are noticeable around your house.
- The growth of aquatic weeds or algae seems excessive in surface waters adjacent to your home.
- Well water test results show the presence of nitrates or bacteria.

Before these symptoms appear at your home, do all you can to keep your septic system in good working order. You can prevent septic system failure with routine maintenance and by following a few simple guidelines.

Know when your septic system was installed.

Septic systems should last anywhere from 15 to 40 years (or even longer), depending on how appropriately they were designed for a site and how well they are maintained. If your septic tank is made of steel, it will eventually rust and need replacement. The older your system, the less likely it is to meet the latest standards. Even a relatively new system can fail if it is undersized, improperly installed or maintained, or located in poor soil.

Install an effluent filter and gas baffle at the septic tank outlet.

Solids that don't settle in the tank can be carried out of the tank with effluent, clog the drainfield, and lead to premature system failure. Effluent filters on the outlet capture small particles and prevent them from clogging the drainfield; it's important to clean the filter periodically. Gas bubbles are produced by anaerobic bacteria slowly digesting wastes in the tank. A gas baffle near the outlet deflects the bubbles and the disturbed sludge away from the outlet.

Consider installing safety devices.

To prevent hazardous sewage overflows, tanks and chambers should have a storage capacity above normal working levels. In addition, an alarm should be installed on holding tanks or pumping chambers to warn you if the tank is nearly full. If your system depends on a pump (and not gravity), you may need to have a backup power supply available in addition to adequate storage capacity in the tank.

In flood hazard areas, backflow valves should be installed on the main distribution line to prevent waste from flooding back into the tank — and into your home.

Never flush...

- Coffee grounds
- Dental floss
- Paints, varnishes
- Thinners
- Cigarette butts
- Disposable diapers
- Kitty litter
- Waste oils
- Sanitary napkins
- Tampons
- Photographic solutions
- Pesticides
- Fats, grease or oil
- Paper towels
- Condoms

Assessment 4.2 — Septic System Maintenance

Use the table below to begin rating your risks related to septic system design and location. For each question, mark your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Upgrades	I upgrade my system when I make changes that significantly increase water usage in my home. (This could include adding bedrooms or installing a sauna or whirlpool.)	I have my septic tank pumped more frequently when water usage increases in my home, but I don't upgrade my system.	I never consider upgrading or increasing the pumping frequency of my septic system when making significant increases to water usage in my home.	❒ Low ❒ Medium ❒ High
Drainfield protection	I protect my drainfield by landscaping it to shed excess surface water, by keeping vehicles off of it and by planting only grass over it.	I have a general idea where my drainfield is located, but I occasionally park cars over it or allow water to pond on top.	My drainfield hasn't been protected. (You've extended your driveway or built a structure over part of the drainfield, or you allow water to pond over it, or you've allowed trees and shrubs to grow over or near it.)	❒ Low ❒ Medium ❒ High
Garbage disposal	I don't have a garbage disposal because I compost most of my vegetable waste or dispose of it in the trash can.	I rarely use my garbage disposal, or if I do, I have my septic tank pumped out more often than normally suggested.	I use my garbage disposal regularly and don't have my tank pumped out more often than is called for.	❒ Low ❒ Medium ❒ High
Inspection and pumping	I have my septic tank inspected annually and pumped out as needed.	I have my septic tank pumped out on a regular schedule, based on the number of people in my home (or more frequently because I use a garbage disposal).	I never have my septic tank inspected or pumped out.	❒ Low ❒ Medium ❒ High
Hazardous materials	I neither use my toilet as a trash can nor poison my septic system by letting harmful chemicals and cleansers go down the drain.	I'm aware of what should and shouldn't go into a septic system, but sometimes I allow harmful items down the drain.	I routinely dispose of cleaners, solvents, other chemicals or trash (such as coffee grounds, grease, cigarette butts and kitty litter) down the drain.	❒ Low ❒ Medium ❒ High

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Water conservation	I have installed water-conserving showerheads, faucets and toilets.	I put bricks in my toilet tank and try to conserve water as best I can by taking short showers, washing only full loads of clothes and dishes, or limiting water use in other ways.	I make no attempts to conserve water by adjusting my habits or using water saving devices.	❒ Low ❒ Medium ❒ High
System failure	I contact a licensed septic tank contractor or the county health department when I suspect my septic system is failing.	I periodically notice signs of failure, such as during and after a heavy rain, but choose not to investigate further or have the problem fixed. Instead, I alleviate the problem by not using my system during those periods of failure.	I continue to use my septic system despite obvious signs of failure.	❒ Low ❒ Medium ❒ High
Age of system or holding tank	My system is 5 years old or less.	My system is between 6 and 20 years old.	My system is more than 20 years old.	❒ Low ❒ Medium ❒ High
Effluent filter	An effluent filter is installed and cleaned regularly.	An effluent filter is installed but not cleaned often enough.	There is no effluent filter installed on the septic tank outlet.	❒ Low ❒ Medium ❒ High
Safety devices	An alarm on the pumping chamber or holding tank indicates that the tank is full or power has been cut off to the pump.		There is no alarm to indicate tank overflow or that power has been cut off to the pump.	❒ Low ❒ High
Backflow protection	A backflow valve is installed to prevent backup during floods.		No backflow valve is installed to prevent backup during floods.	❒ Low ❒ High

Responding to Risks

Your goal is to lower your risks. Your private well and nearby public waters are least likely to be contaminated by a home septic system if you follow as many of the low-risk practices outlined in this self-assessment as you can. Use the Action Checklist on page 55 to record medium- and high-risk practices. Reduce your risks by following recommendations in the preceding text.

Action Checklist

Go back over both assessment tables to ensure that all medium and high risks you identified are recorded in the following checklist. For each medium- and high-risk habit you identified, write down the improvements you plan to make. Use recommendations from this chapter and other resources to decide on actions you are likely to complete. A target date will keep you on schedule. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to tackle the inexpensive actions first.

Home Septic Systems

Write all high and medium risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: I've never had my septic system inspected or pumped out.	Consult the Yellow Pages for a licensed septic system contractor and call for an inspection appointment.	Within 48 hours: by April 8

For More Information

Septic Systems: Investigate Before You Invest (WQL 19) is a Clemson Extension leaflet available by calling the Clemson University Bulletin Room at (864) 656-3261 or by using the online ordering system at http://cufan.clemson.edu/olos/.

To order a copy of *Septic System Homeowner's Guide and Record Keeping Folder*, produced by the South Carolina Department of Health and Environmental Control, call or write

SCDHEC, Bureau of Environmental Health
Division of Onsite Wastewater
2600 Bull Street
Columbia, SC 29201
(803) 896-0641

The National Environmental Services Center (NESC) has several publications on septic system design and maintenance, as well as information about alternative systems. Contact them at NESC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064, or call (800) 624-8301 to request their catalog. To view the catalog and publications online, go to http://www.nesc.wvu.edu, and click on "Wastewater" or "National Small Flows Clearinghouse." Some of the publications available from NESC are:

- *Your Septic System: A Reference Guide for Homeowners*, WWBRPE17, describes a conventional septic system and how it should be cared for to achieve optimal results.
- *The Care and Feeding of Your Septic Tank System*, WWBRPE18, describes septic tanks and drainfields and provides guidelines to prolong their usefulness.
- *So…Now You Own a Septic Tank*, WWBRPE20, describes how a septic tank system works and how to keep it functioning properly.
- *Groundwater Protection and Your Septic System*, WWBRPE 21, provides information on how to maintain your septic system.
- *Preventing Pollution Through Efficient Water Use*, WWBRPE26, describes efficient water use and its role in preventing pollution.

This chapter was developed cooperatively by West McAdams, Clemson University Cooperative Extension Service, and the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management. Material was adapted from similar publications by the National Onsite Wastewater Recycling Association, Cornell Cooperative Extension, and the North Carolina Cooperative Extension Service. Barbara Speziale, Clemson Cooperative Extension, adapted materials from the Northeast Regional Agricultural Engineering Service's Home•A•Syst, by Barbara Kneen Avery of Cornell Cooperative Extension.

Chapter 5

Well Water: Keeping It Clean

Keeping your well water free of harmful contaminants is a top priority — for your health and for the environment. This chapter helps you examine how you manage your well and how activities on or near your property may affect well water quality. This chapter will include the following topics:

1. ***Well Location.*** How close is your well to potential pollution sources? How might your soil type affect water quality?

2. ***Well Construction and Maintenance.*** Do you know how old your well is and what type of well it is? Is your well casing properly sealed?

3. ***Water Testing.*** Have tests of your well water revealed any problems?

4. ***Unused Wells.*** Are wells no longer in use protected against contamination?

Why should you be concerned?

About 95 percent of rural residents use private wells to supply drinking water. These wells, which tap into local groundwater, are designed to provide clean, safe drinking water. However, improperly constructed or poorly maintained wells can create a pathway for fertilizers, bacteria, pesticides or other materials to enter the water supply. Once in groundwater, contaminants can flow from your property to a neighbor's well, or from a neighbor's property to your well.

Contaminants often have no odor or color and therefore are hard to detect. They can put your health at risk and are difficult and expensive to remove. Once your water becomes contaminated, the only options may be to treat your water after pumping, drill a new well or get your water from another source.

How will this chapter help you protect your drinking water and home environment?

This chapter is a guide to help you better understand the condition of your well and how you take care of it. Easy-to-understand assessment tables help you identify situations and practices that are safe as well as ones that may require prompt attention. Some rural residents use water sources such as lakes, rivers or cisterns for their drinking water. Additional information on how to safeguard all water sources may be sought from local Cooperative Extension offices, soil and water Conservation District staff, state and federal environmental agencies, and the library.

Part 5.1 — Well Location

Your well's location in relation to other features on or near your property will determine several pollution risks. The nearness of your well to sources of pollution and the direction of groundwater flow between the pollution sources and your well are the primary concerns. At the end of Part 5.1, fill out the assessment table to determine your possible risks. The information in the following paragraphs will help you answer questions in the table.

What pollution sources might reach your well?

Whether groundwater in your area is just below the surface or hundreds of feet down, the location of your well on the land surface is very important. Installing a well in a safe place takes careful planning and consideration. Where the well is located in relation to potential pollution sources is a critical factor.

When possible, locate a well where surface water (stormwater runoff, for example) drains away from it. If a well is downhill from a leaking fuel storage tank, septic system or overfertilized farm field, it runs a greater risk of becoming contaminated than a well on the uphill side of these pollution sources. In areas where the water table is near the surface, groundwater often flows in the same direction as surface water. Surface slope, however, is not always an indicator of groundwater flow.

Changing the location or depth of your well may protect your water supply, but not the groundwater itself. Any condition likely to cause groundwater contamination should be eliminated, even if your well is far removed from the potential source.

Does your well meet separation distance requirements?

Department of Health and Environmental Control (DHEC) regulations R.61-71 require that a completed water supply well be located no closer than 50 feet from surface water bodies, barns and stables, or a septic tank and its tile field; 3 feet from a building; or 100 feet from any other potential source of contamination. Potential contamination sources include animal pens, heating oil tanks and gardens.

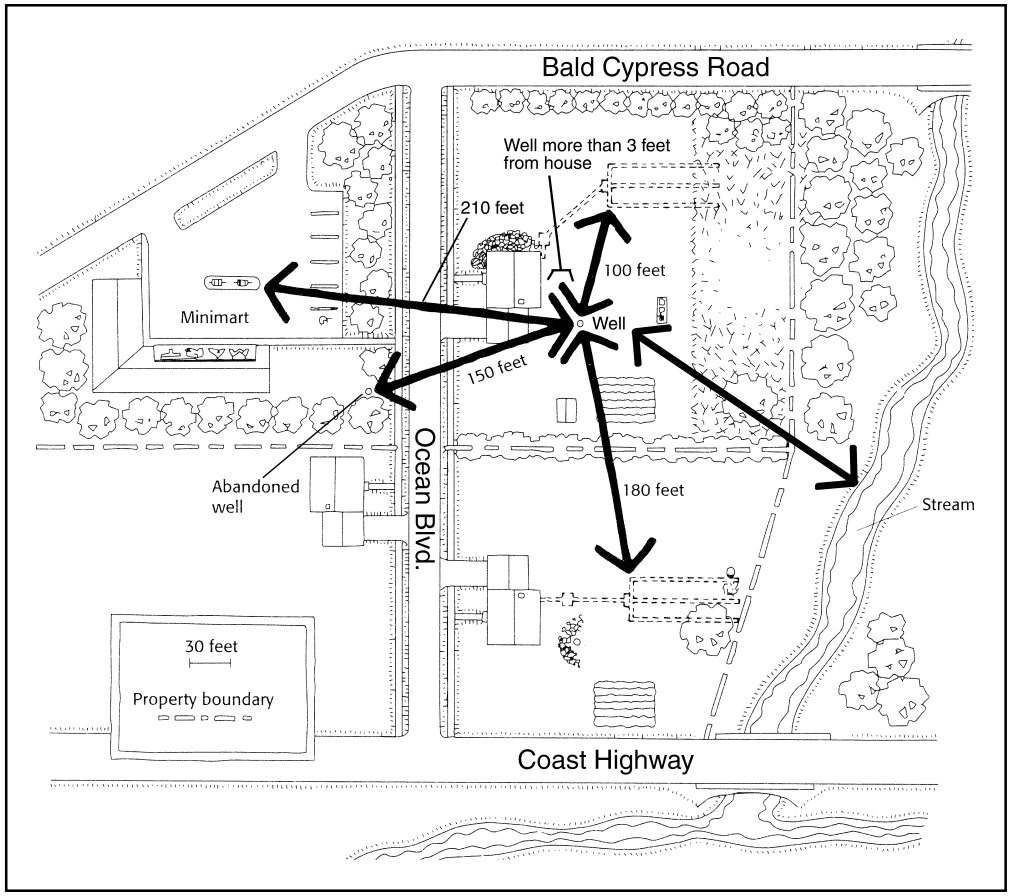


FIGURE 5.1 This homesite map shows the distances of pollution sources from a well.

A certified well driller may suggest an increased distance from a potential contamination source (Figure 5.1). You should provide as much separation as possible between your well and any potential pollution source — at least 100 feet. Separating your well from a pollution source may reduce the chance of contamination, but it does not guarantee that the well will be safe.

What's underground?

Pollution risks are greater when the water table is near the surface, because contaminants do not have far to travel. Groundwater contamination is more likely if soils are shallow (a few feet above bedrock) or if they are highly porous (sandy or gravelly). If bedrock below the soil is fractured — that is, if it has many cracks that allow water to seep down rapidly — then groundwater contamination is more likely. Check with neighbors, local farmers, the nearest Conservation District office or local well drilling companies to learn more about what's under your property.

Assessment 5.1 — Well Location

Use the table below to rate your well location risks. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 5.1 above if you need more information to complete the table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Position of well	Well is uphill from all pollution sources. Surface water doesn't reach well or is diverted.	Well is level or uphill from most pollution sources. Some surface water runoff may reach well.	Well is downhill from pollution sources or in a pit or depression.	❒ Low ❒ Medium ❒ High
Separation distance*	Distances from potential pollution sources meet or exceed all state minimum requirements.	Some but not all distances from potential pollution sources meet state requirements.	Distances from most or all potential pollution sources do not meet minimum state requirements.	❒ Low ❒ Medium ❒ High
Soil type	Soil is fine-textured like clay loams or silty clay.	Soil is medium-textured like silt or loam.	Soil is coarse-textured like sand, sandy loam or gravel.	❒ Low ❒ Medium ❒ High
Subsurface conditions	The water table is deeper than 30 feet.	The water table is deeper than 20 feet.	The water table is less than 20 feet.	❒ Low ❒ Medium ❒ High

*Suggested minimum separation distance is 100 feet.

Responding to Risks

Your goal is to lower your risks. Turn to the Action Checklist on page 73 to record the medium- and high-risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

Part 5.2 — Well Construction and Maintenance

Old or poorly designed wells increase the risk of groundwater contamination by allowing rain or snowmelt to reach the water table without being filtered through soil. If a well is located in a depression or pit or is not properly sealed and capped, surface water carrying nitrates, bacteria, pesticides and other pollutants may easily contaminate drinking water.

You wouldn't let a car go too long without a tune-up or oil change. Your well deserves the same attention. Good maintenance means keeping the well area clean and accessible, keeping pollutants as far away as possible, and having a qualified well driller or pump installer check the well periodically or when problems are suspected. At the end of this section, fill out Assessment 5.2 to determine risks related to your well's design or condition.

Before you begin construction ...

A permit is required from DHEC before you construct a drinking water or irrigation well, and a certified well driller is required to install the well. South Carolina must certify all well drillers operating in the state. The driller's certification indicates to the consumer that the driller has demonstrated a thorough working knowledge of well drilling and that the water can be expected to conform to established standards. Call the S.C. Environmental Certification Board at (803) 896-4430 for names of licensed well drillers in your area.

In South Carolina, residential well construction is covered under regulations R.61-44, "Individual Residential Well and Irrigation Well Permitting," and R.61-71, "Well Standards." Wells must be inspected, preferably during construction, to assure that they are compliant with these regulations. Owners are provided with a copy of the inspection results.

South Carolina regulation R.61-44 requires the owner, agent or well driller to file a Notice of Intent (NOI) and a $70 fee before the well is drilled. The fees collected fund inspectors in DHEC district offices. The NOI will include true and accurate information necessary for determining the location of and proper construction of individual residential wells, replacement wells and irrigation wells. This information should include owner name, address and telephone number; street address, including county, of the property on which the well is to be installed; proposed date of installation; proposed well location; whether the proposed well is a new well or replacement well; whether the proposed well is an irrigation well or individual residential well; signature of applicant and date; and (if available) name and license number of the licensed well driller constructing the well.

DHEC will review the NOI and either approve the well, provide comments or deny the application within 48 hours. The 48-hour period is calculated from the time and date of receipt of the NOI, excluding weekends and legal state holidays. If notice is not given to the applicant by the end of the 48-hour period, coverage under the general permit for individual residential wells and irrigation wells will be considered approved. The NOI is considered complete when a signed NOI with the necessary information and a check for the associated fees have been received by DHEC. The well driller must have a copy of the NOI before initiating well construction and must have a copy of the NOI on the drilling site at all times.

D H E C

PROMOTE PROTECT PROSPER

NOTICE OF INTENT (NOI)

CONSTRUCTION OF INDIVIDUAL RESIDENTIAL OR IRRIGATION WELL UNDER THE SOUTH CAROLINA GENERAL PERMIT # SCW00000000

SEE REVERSE FOR INSTRUCTIONS

Submission of this Notice of Intent constitutes notice that the party identified in Section III of this form intends to be authorized by a permit issued for construction of an individual residential or irrigation well in the location identified in Section II of this form. Becoming a permittee obligates the construction to comply with the terms and conditions of the permit. ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM. **A FEE OF $70 FOR INDIVIDUAL RESIDENTIAL WELLS OR $50 FOR IRRIGATION WELLS IS REQUIRED FOR COVERAGE UNDER THIS PERMIT. KEEP A COPY OF THIS NOI AT THE DRILLING SITE.**

I. Well Owner Information *(mailing address)*

SCW ____–____ Permit Number

Name: _____ (last) _____ (first)

Address: _____ Phone: (___) _____

City: _____ State: ___ Zip: _____–____

II. Well/Site Location Information

COUNTY: _____ **Proposed Start Date:** ___/___/___ (month / day / year)

Name: _____ (last) _____ (first)

☐ No Address Exists
Location Map Attached

Address: _____

City: _____ State: SC Zip: _____–____

☐ RESIDENTIAL ☐ IRRIGATION ☐ REPLACEMENT ☐ EMERGENCY

III. Well Driller Information

Well Drillers Name: _____ (last) _____ (first) SC Cert No: _____

Company Name: _____

Company Address: _____

City: _____ State: ___ Zip: _____–____

Phone: ___ ___–____

Fax: ___ ___–____

Please note: the driller must have a copy of this NOI at the drill site.

IV. Fee Information

Method of Payment: Check (# _____) Cash Money Order Visa MasterCard

(Credit card numbers can be provided via phone)

Transfer from: name _____ permit# SCW _____

If the NOI was faxed to SCDHEC, record the date: ___/___/___ (month / day / year) and _____ (time) the fax was sent.

V. Certification:

I certify that this document and all attachments were prepared under my direction or supervision and the information submitted is, to the best of my knowledge and belief, true, accurate and complete.

Print Name: _____ Title: _____

Signature: _____ Date: _____

DHEC 3647 (05/2001) COPY 1 TO SCDHEC, COPY 2 TO WELL OWNER, COPY 3 TO WELL DRILLER

FIGURE 5.2a S.C. Department of Health and Environmental Control Notice of Intent (NOI), front

This Notice of Intent (NOI) must be completed properly with the appropriate fee attached in order to construct a new or replacement individual residential well or irrigation well. Submitting a completed NOI with payment attached is preferred. Please do not mail cash. However, the NOI may be faxed to SCDHEC's Central Office and payment made with credit card (Visa or MasterCard only) via telephone. It is also acceptable to fax the NOI with a copy of the check payable to SCDHEC with receipt of the mailed check by SCDHEC within 5 days. Submitting the NOI with payment is Step One of the permitting process; construction of the well can begin 48 hours after SCDHEC's receipt of the NOI . Step Two in the process is providing the Department 48 hours prior notice of well installation. Steps One and Two can be completed at the same time. The NOI may be completed by the well owner, well driller, or the owner's agent. KEEP a COPY of the NOI; when the 48 hour prior notice is given, obtain the permit number from SCDHEC and put the number after 'SCW'in the spaces provided. Completed forms accompanied by the $70 fee for an individual residential well or the $50 fee for an irrigation well are to be sent to the following address:

SC DHEC
Bureau of Water
Private Well Program
2600 Bull Street
Columbia, SC 29201

Columbia Area Telephone Number: 898-3342
Columbia Area Fax Number: 898-4190

Toll-Free Telephone Number: 1-888-761-5989
Toll-Free Fax Number: 1-888-761-6681

ITEM BY ITEM INSTRUCTIONS FOR COMPLETING THIS FORM:

SECTION I: Well Owner Information

Enter the name of the well owner in the spaces provided. This can be the land owner or a developer. Enter the present mailing address and phone number of the well owner in the spaces indicated. This mailing address is not necessarily the well location. The Zip Code must be included.

SECTION II: Well/Site Location Information

If different from Section I above, enter the county in which the well is to be located, name of the well owner, the physical location of the well, to include the street or road, city, state, and zip code. This can also be a lot number for a new subdivision. Also enter the county , the phone number, and check the appropriate box for type of well to be installed. A residential well is intended to produce potable water for human consumption at a single residence. An irrigation well is intended to produce water for uses other than human consumption such as landscape watering and agricultural uses. A replacement well is being constructed to take the place of an existing well for which a fee has been paid within a year and is being taken out of service. No fee is reqiuired for a replacement well. An emergency well is intended to replace an existing individual residential well which has suddenly been rendered useless. The NOI and associated fee is to be submitted within 24 hours after construction of an emergency well.

Enter the date that construction is expected to begin. In accordance with R.61-44.D.5, the well driller shall give the Department 48 hours prior notice of well installation with the exact date, time, and location of well installation, which completes Step Two of the process.

SECTION III: Well Driller Information

Enter the name and SC certification number of the well driller installing the well. The NOI can not be submitted without the well driller's name; however, if the well driller changes after Step One, that change needs to be noted during Step Two. Enter the driller's company name, address, phone number, and fax number in the spaces provided.

Section IV: Fee Information

Circle the method of payment . If paying by check indicate the check number in the space provided. If paying by cash, staff will take the customer to the Bureau of Finance, which will provide a written receipt. If transferring fee from another NOI, indicate well owner and permit number. If the NOI was initially faxed to SCDHEC, include the date and time the fax was sent.

Section V: Certification

Print the name of the well owner, well driller, or owner's agent in the appropriate spaces. The owner, or designated representative, must sign the application **(the signature must be original)** and enter the date the application was signed in the indicated area.

The application is not considered complete unless accompanied by the $70 fee for an individual residential well or the $50 fee for an irrigation well.

DHEC 3647 (Rev. 05/2001)

FIGURE 5.2b S.C. Department of Health and Environmental Control Notice of Intent (NOI), back

NOI forms can be obtained by contacting the Private Well Program, toll-free, at (888) 761-5989 or by contacting one of the district DHEC Environmental Quality offices (see page 92). See Figures 5.2a and 5.2b on pages 61 and 62 for a copy of the NOI form. You may remove or copy this form and send it to DHEC. Send NOIs and payment to DHEC at the following address: S.C. Department of Health and Environmental Control, Private Well Program, Bureau of Water, 2600 Bull Street, Columbia, SC 29201.

Obtain a written contract with the well driller.

A written contract is necessary! For your protection, the written contract should include at least the following information:

- Cost per foot for drilling.
- Number of feet of grout (at least 20 feet is required).
- Description of the pump, its horsepower and a copy of the manufacturer's warranty.
- Guarantee that a sanitary seal will be used to cap the well.
- Confirmation that the water will be free of sand, mud and harmful bacteria before or after the driller leaves the site (a bacteria sample should be collected to assure that the well was properly disinfected).
- Specification that the pump used by the driller to pump sand and mud out of the well is not the same one that he installs for your use.

What if the newly drilled well is dry?

Discuss the responsibility the well driller will accept in the event of a dry well. Some drillers will agree to drill another well in a different location at half price. Ask the driller to put in writing what responsibilities he will assume. Any abandoned boreholes must also be properly grouted to protect the groundwater and your new well located some distance away.

Keep records.

Get a copy of the water well record form and your pump warranty. Keep these with your household records. The well driller must send a copy of the well record to DHEC. These records are very useful in solving future problems.

What happens when a new well is needed quickly?

When an existing residential well has suddenly been rendered useless or the water quality is not fit for human consumption, a replacement well is needed to provide a potable water supply. In such cases, a well driller may replace an existing residential well immediately. The NOI and associated fee should be submitted within 24 hours of well construction.

How old is your well?

Well age is an important factor in predicting the likelihood of contamination. Wells constructed more than 50 years ago are likely to be shallow and poorly constructed. Older well pumps are more likely to leak lubricating oils, which can get into the water. Older wells are also more likely to have thinner casings that may be cracked or corroded. Even wells with modern casings that are 30 to 40 years old are subject to corrosion and perforation. If you have an older well, you may want to have it inspected by a qualified well driller. If you don't know how old your well is, assume it needs an inspection.

What type of well do you have?

Using DHEC's definition, a well is a bored, drilled or driven shaft, or a dug hole, whose depth is greater than the largest surface dimension, for the purpose of extracting or injecting water. These include, but are not limited to, wells used for water supply for irrigation or drinking water.

Four types of wells are typically found in South Carolina (see map, Figure 5.3). In the northwestern portion of South Carolina, (A) open hole/rock wells, (B) screened wells and (C) dug wells predominate. In the southeastern portion of the state, including the coastal zone, (A) open hole/rock wells, (B) screened wells, (C) dug wells and (D) jetted/driven wells can all be found. The general construction details of these four types of wells are shown in Figure 5.4.

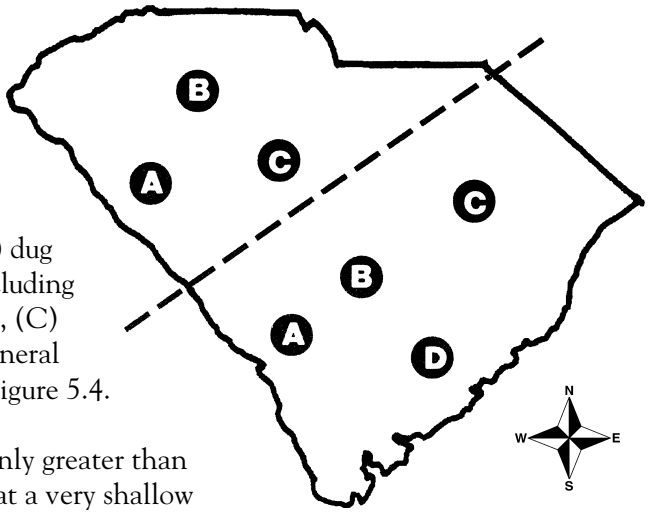


FIGURE 5.3 The type of well you have will be determined by whether you live in the northwestern or southeastern half of the state. Refer to Figure 5.4 for a description of well types A, B, C and D.

(Adapted from DHEC brochure, *Individual Water Supply Wells*.)

A *hand-dug* or *bored well* is a large-diameter well, commonly greater than or equal to 24 inches in diameter, which is typically installed at a very shallow depth and constructed of rock, concrete or ceramic material and where water can enter the well through joints in the top 20 feet of buried casing. *Jetted or driven-point (sand-point) wells* (D) are constructed by driving lengths of pipe into the ground. These wells are normally around 2 inches in diameter and less than 25 feet deep and can only be installed in areas with loose soils such as sand. The other types of wells (A and B) are *drilled wells* which, for residential use, are commonly 4 to 8 inches in diameter. Figure 5.5, opposite, shows a properly constructed drilled well.

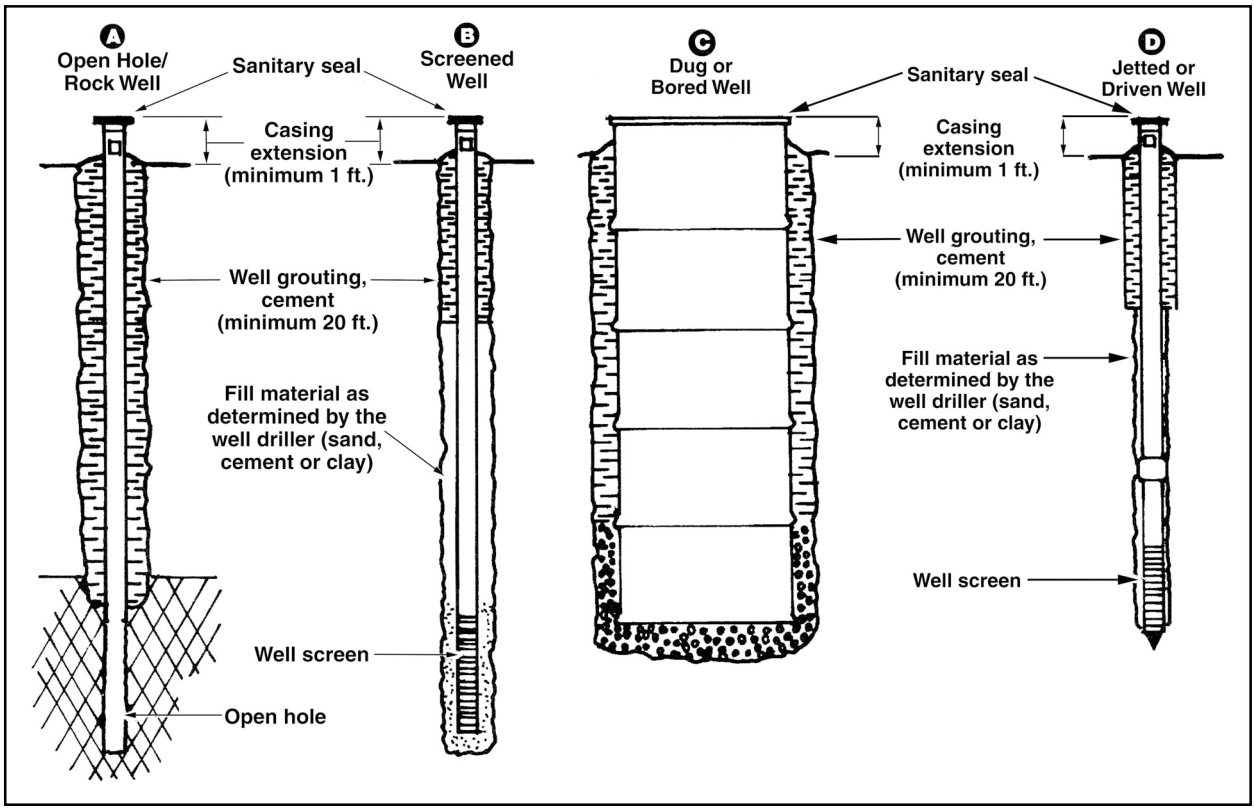


FIGURE 5.4 There are four types of wells in use in South Carolina.
(Adapted from DHEC brochure, *Individual Water Supply Wells*.)

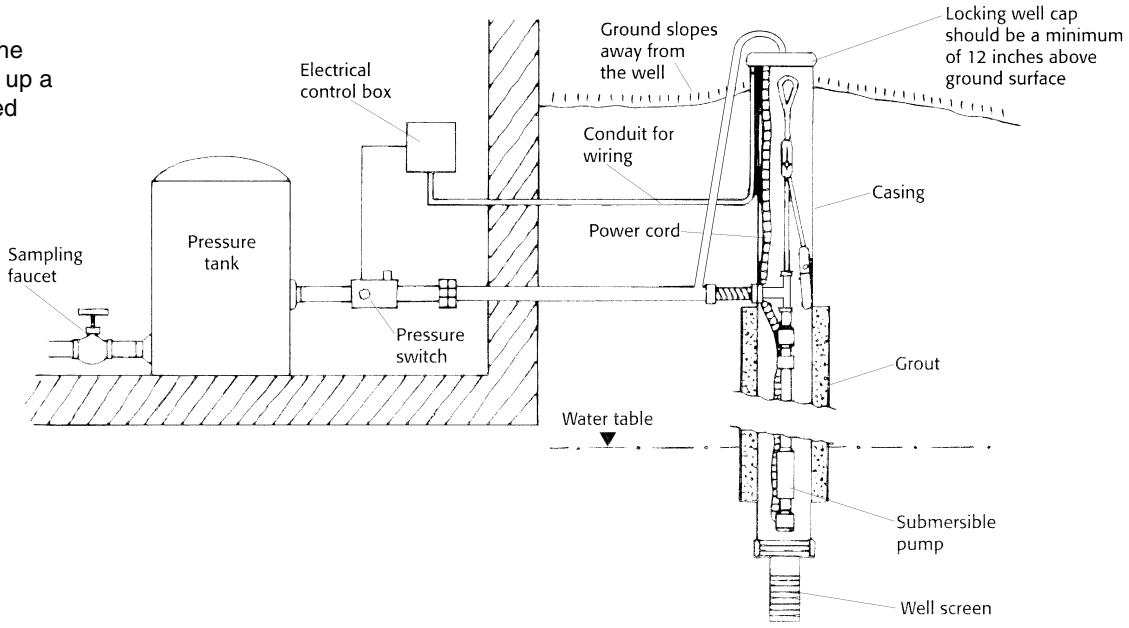


FIGURE 5.5 This illustration shows the features that make up a properly constructed drilled well.

State regulations require that the well have an attached plate that identifies it as a water supply well and includes the driller's name, the date the well was drilled, total well depth, casing depth, screen interval, well yield, water table depth and the date the well was completed. This information will be extremely valuable if the well requires any modification or repair.

Are your well casing, grouting and well caps protecting your water?

Well drillers install a steel or plastic pipe "casing" to prevent collapse of the well hole during drilling. The space between the casing and sides of the hole is a direct channel for surface water — and pollutants — to reach the water table (Figure 5.6, next page). To seal off that channel, drillers fill the space with grout — cement or cement mixed with a type of clay called *bentonite*.

Properly installed grout is one of the most important protective features of your well. It ensures that contaminants from the surface do not seep down into the water you will drink. DHEC regulations require a water supply well to have cement or a mixed cement/bentonite grout from the ground surface down to a minimum depth of 20 feet. Grouting around the casing seals the open space between the well casing and the drill hole wall. The seal prevents potential contaminants from entering the well by seeping down along the outside of the well casing. The minimum grouting required may occasionally be insufficient for this purpose. In such cases, a conscientious, experienced well driller will recommend the grout extend beyond the 20-foot minimum depth.

Watch while your well is being constructed. The driller should pump a wet grout mixture through a pipe that is lowered down the borehole to the bottom of the zone to be grouted. The pipe is raised slowly as the grout is pumped, sealing the well. This procedure is time-consuming and some well drillers might attempt to avoid it, or use minimal depth of grouting, to save themselves time and money. Ask

your well driller how many feet of grout will be installed (and have that written in your contract). Show the driller that you are an informed consumer. Don't be pressured and then have to drink from a second-rate well!

You should inspect the condition of your well casing for holes or cracks. Examine the part that extends up out of the ground. Remove the cap and inspect inside the casing using a flashlight. If you can move the casing around by pushing it, you may have a problem with your well casing's ability to keep out contaminants. Sometimes damaged casings can be detected by listening for water running down into the well when the pump is not running. If you hear water, there might be a crack in the casing, or the casing may not reach the water table. Either situation is risky.

The depth of casing required for your well depends on the depth to groundwater and the nature of the soils and bedrock below. In sand and gravel soils, well casings should extend to a depth of at least 20 feet and should reach the water table. For wells in bedrock, the casing should extend through the weathered zone and into at least 10 feet of bedrock. A minimum of 20 feet of casing should be used for all wells.

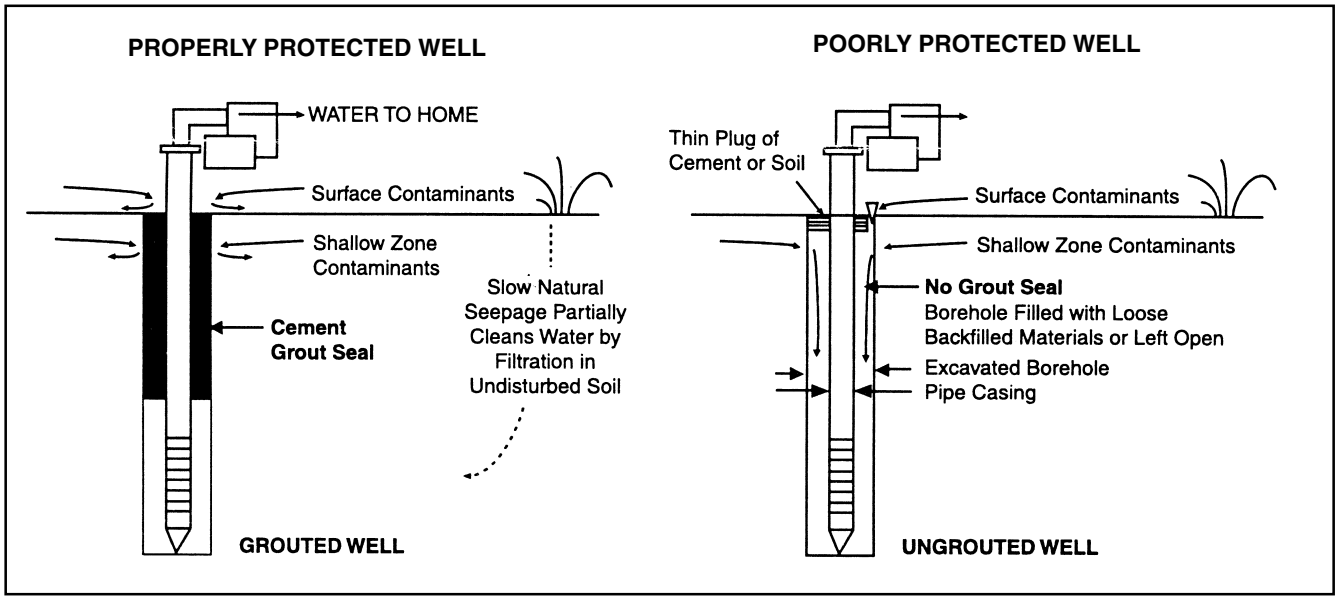


FIGURE 5.6 The differences between a poorly protected well and a properly protected well are evident.

How is the top of the well sealed?

Make sure your well has a sanitary seal or well cap. Water pipes and electrical connections passing through the top of the well must be properly sealed to keep out insects and other surface contaminants. Make sure the breather hole in the seal is either sealed or screened to prevent insects from entering.

DHEC regulations require that the well extend a minimum of a foot above ground level to the top of the casing to prevent rainwater runoff from flowing into the well. The cover on the well casing should be attached in such a manner that it is easily removable. Examine the seal periodically to ensure that it is in good condition and has not deteriorated. The casing must extend at least 12 inches above the ground surface. If there are occasional floods in your area, the casing should extend 1 to 2 feet above the highest flood level recorded for your property. The ground around the casing should slope away from the well head in all directions to prevent water from pooling around the casing.

The well cap should be firmly attached to the casing, with a vent that allows only air to enter. If your well has a vent, be sure that it faces the ground, is tightly connected to the well cap or seal, and is properly screened to keep insects out. Wiring for the pump should be secured in an electric conduit pipe.

Is your well shallow or deep?

As rain and surface water soak into the soil, they may carry pollutants down to the water table. Local geologic conditions determine how long this takes. In some places, the process happens quickly — in weeks, days or even hours. Shallow wells, which draw from groundwater nearest the land surface, are most likely to be affected by local sources of contamination. Wells less than 50 to 75 feet have more chance for contamination.

Do you take measures to prevent backflow?

Backflow of contaminated water into your water supply can occur if your system undergoes sudden pressure loss. Pressure loss can occur if the well fails or, if you are on a public water system, if there is a line break in the system. The simplest way to guard against backflow is to leave an air gap between the water supply line and any reservoir of "dirty" water. For example, if you are filling a swimming pool with a hose, make sure that you leave an air gap between the hose and the water in the pool. Toilets and washing machines have built-in air gaps.

Where an air gap cannot be maintained, a backflow prevention device such as a check valve or vacuum breaker should be installed on the water supply line. For example, if you are using a pesticide sprayer that attaches directly to a hose, a check valve should be installed on the faucet to which the hose is connected.

Inexpensive backflow prevention devices can be purchased from plumbing suppliers.

Before you drink the water ...

A new well must be disinfected upon completion. Disinfectant, at a concentration of 50 milligrams of chlorine per liter of water, should remain in the well for a minimum of four hours before being flushed from the well. The disinfectant process is used to kill harmful bacteria. Household chlorine bleach is commonly used as a disinfectant. Calcium hypochlorite (HTH) or sodium hypochlorite (Perchloron) can also be used.

When was your well last inspected?

Well equipment doesn't last forever. Every 10 to 15 years, your well will require inspection by a qualified well driller or pump installer. You should keep well construction details, as well as the dates and results of maintenance visits for the well and pump. It is important to keep good records so you and future owners can follow a good maintenance schedule.

Assessment 5.2 — Well Construction and Maintenance

Use the table below to rate your risks related to well construction and maintenance. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 5.2 above if you need more information.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Well age	Well is less than 20 years old.	Well is 20 to 50 years old.	Well is more than 50 years old.	❒ Low ❒ Medium ❒ High
Well type	Drilled well	Driven-point (sand-point) well	Dug well	❒ Low ❒ Medium ❒ High
Casing height	Casing is 12 or more inches above the surface. If the area floods, casing is 1 to 2 feet above the highest recorded flood level.		Casing is at the surface, up to 12 inches above the surface, or below the surface or in a pit or basement.	❒ Low ❒ High
Condition of casing and well cap	No holes or cracks are visible. Cap is tightly attached. A screened vent faces the ground.		Holes or cracks are visible. Cap is loose or missing. Running water can be heard or seen.	❒ Low ❒ High
Casing depth	Casing extends 50 or more feet below the land surface.	Casing extends 20 to 50 feet below the land surface.	Casing extends less than 20 feet below the land surface.	❒ Low ❒ Medium ❒ High
Backflow protection	Measures are taken to prevent backflow and, where necessary, anti-backflow devices are installed.	Measures are sometimes taken to prevent backflow. No anti-backflow devices are installed.	No measures are taken to prevent backflow. No anti-backflow devices are installed.	❒ Low ❒ Medium ❒ High
Well inspection	Well was inspected within the last 10 years.	Well was inspected 10 to 20 years ago.	Well was inspected over 20 years ago or date of last inspection is unknown.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your risks. Turn to the Action Checklist on page 73 to record the medium- and high-risk practices you identified. Use the recommendations above to help you plan actions to reduce your risks.

Part 5.3 — Water Testing

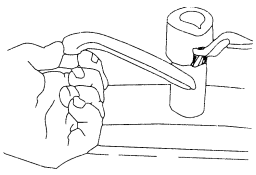
Water testing helps you monitor water quality and identify potential risks to your health. Contaminants enter drinking water from many sources. Many contaminants can only be detected through a water test.

When was your water last tested?

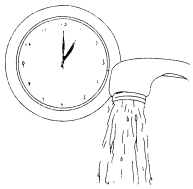
At a minimum, your water should be tested ***every year*** for the four most common indicators of trouble: bacteria, nitrates, pH and total dissolved solids (TDS). If you haven't had a full-spectrum, comprehensive water test, then you don't know the characteristics of your water.

A more complete water analysis for a private well will tell you about its hardness; corrosivity; and iron, sodium and chloride content. You may also choose to obtain a broad-scan test of your water for other contaminants such as pesticides, if there is a good probability that such contamination has occurred.

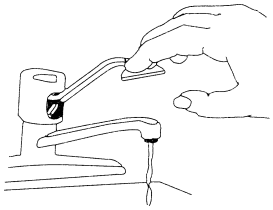
A good source of information on well water quality may be your neighbors. Ask them what their tests have revealed. Your county Extension agent or DHEC Environmental Quality Control office can also assist you in deciding what sort of water testing is needed. Some of the naturally occurring contaminants in water are listed in Table 5.1 (page 71).



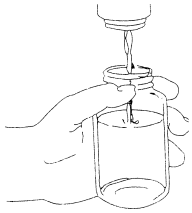
STEP 1: Remove the aerator from an indoor, leak-free cold water faucet. If testing for bacteria, wipe the inside and outside of the faucet with alcohol.



STEP 2: Let water run for five minutes to bring in water that has not been in contact with household plumbing.



STEP 3: Reduce the water flow until the stream is about 1/4-inch in diameter.



STEP 4: Fill a specially prepared container as instructed by the laboratory. Do not let anything touch the inside of the cap or container.

STEP 5: Close the sample container and transport it as instructed by the laboratory.

Notes:

- Corrosive water may dissolve lead, copper, zinc or iron contained in household plumbing. If testing for evidence of corrosion, let water stand in the plumbing system at least 12 hours.
- Laboratories specially prepare containers for each category of contaminant. Do not rinse laboratory containers or fill them to overflowing.
- Always follow laboratory directions.

FIGURE 5.7 Procedure for Collecting Water Samples for Routine Chemical Analysis

DHEC will analyze your water for you if there is reason to suspect a problem. For more information about the DHEC water testing program, consult the DHEC bulletin: *Drinking Water: Common Water Quality Problems and Their Treatment* (see page 74). The way in which you take the water sample, and the container that you use may affect the accuracy of the analysis (Figure 5.7, previous page). Before taking a water sample for analysis, contact your DHEC Environmental Quality Control office for specific instructions.

For routine chemical analysis of the water, a half-gallon sample of the water is required. The sample may be collected in a clean plastic container. DHEC analyses include lead, pH, alkalinity, chlorides, hardness, calcium, magnesium, copper, iron, manganese and zinc. DHEC charges $50 to perform these analyses. Other analyses, including uranium, are available upon request and at the discretion of the DHEC laboratory (see the list of publications on page 18 for more information). Because many types of analyses require special containers, preservatives or sample collection techniques, you should contact one of the DHEC Environmental Quality Control offices or your county health department offices prior to submitting any special requests for analyses. Costs for these analyses vary.

Drinking water samples may also be submitted for analysis at the DHEC Central Office, 2600 Bull Street, Columbia, SC. See instructions below for sampling drinking water for total coliform bacteria. Water samples for routine chemical analysis must be received in the DHEC laboratory within three days of collection. You will receive your sample results by mail in approximately eight weeks.

How to Sample Your Drinking Water for Total Coliform Bacteria

Obtain a sterile sampling bottle from a DHEC office.

The sample bottle is sterile and contains a dechlorinating compound. DO NOT open the bottle until the moment it is to be filled.

To collect the sample:

1. Remove any strainers or aerators from the faucet. Wipe them with alcohol. Open the faucet and allow the water to run for two to three minutes.
2. Without changing the flow from the faucet, remove the bottle's cap and fill the bottle to about one inch from the top. Be careful not to touch either the inside of the bottle or the cap. Do not let water splash from your hands into the bottle. Replace the cap.
3. Fill in all of the information on the enclosed sample form that applies to you. You must fill out your name, address and telephone number, and the date and time that the sample was collected.
4. Take the sample immediately to your county health department or the Environmental Quality Control district office nearest you.
5. If you have questions about sampling your drinking water, please call the Bureau of Water at (803) 898-4300.

Please note: A total coliform sample must be received in the DHEC laboratory within 30 hours after you collect it. Samples received more than 30 hours old must be discarded. Samples are accepted on Monday, Tuesday and Wednesday (except on holidays) by 4:00 p.m. the same day collected.

An invoice for $20 will be sent to you with the analytical results.

Table 5.1 Drinking Water Analysis: Naturally Occurring Contaminants in Water

Contaminant	Description	Recommended Limits
Alkalinity	This is a measure of the water's ability to neutralize acids, a process known as buffering. As alkalinity increases, the water is less likely to corrode household plumbing.	An alkalinity of more than 30 mg/L is desirable for drinking water.
Calcium Magnesium Hardness	Hardness is a measure of the amount of dissolved calcium and magnesium in the water. Some hardness is desirable to reduce corrosion of plumbing.	Excessive hardness (above 150 mg/L) may produce a hard scale in water heaters and may limit the effectiveness of soaps.
Chlorides	Chlorides measure the "salt" content of the water.	Chloride concentrations less than 250 mg/L are recommended.
Iron and Maganese	The presence of iron in well water can indicate that groundwater is moving through and among rocks with a high iron content or that you have rust accumulating in the well piping.	0.3 mg/L Iron 0.05 mg/L Manganese or a total of no more than 0.3 mg/L for both
Copper	Copper is most commonly dissolved into drinking water from copper plumbing. Copper can give the water a bitter taste and produce green stains in plumbing fixtures.	Maximum recommended limit: 1.0 mg/L
pH	A scale used to measure acidity. A pH of 7 is neutral, neither acidic nor basic. As pH increases from 7 to 14, water becomes more basic. As pH decreases from 7 to 0, water becomes more acidic.	pH range for drinking water: 6.5 - 8.5
Total Dissolved Solids (TDS)	TDS measures the amount of dissolved and suspended material in water.	Maximum recommended limit: 500 mg/L
Zinc	Zinc in drinking water usually results from corrosion of galvanized plumbing but may also result from natural deposits. Above the recommended limit, zinc can cause a metallic taste and milky appearance in water.	Maximum: 5.0 mg/L
Lead	Excessive lead in drinking water usually results from contact with lead-painted roofs or the use of lead pipes in plumbing. Lead in excessive amounts is a cumulative poison that can cause serious illness or death.	Maximum: 0.015 mg/L
Nitrates and Nitrites	Excessive nitrate concentrations may indicate contamination from animal manure. Can cause 'blue baby disease' in infants who drink nitrate-contaminated water or formula prepared from that water.	Maximum: Nitrate: 45 mg/L (10 mg/L as Nitrogen) Nitrite: 1 mg/L
Pesticides	Careless use of pesticides, including termite treatments, near wells can contaminate the water	
Sulfates	High concentrations of sulfates in well water are caused by leaching from naturally occurring deposits of sodium sulfate or magnesium sulfate.	Maximum: 250 mg/L
Sodium	Home water softeners add sodium to the water. The sodium content of water is unimportant for healthy persons but may affect persons on low-sodium diets. The usual low-sodium diet allows for 20 mg/L sodium in drinking water.	
Fecal Coliform Bacteria	Fecal coliform bacteria are organisms that normally live in the intestines of people and other animals. Though not themselves causes of disease, fecal coliform bacteria are used as indicators of fecal contamination of water.	Maximum: approximately 1 bacterium per 100 mL water

Abbreviations: mg/L = milligrams per Liter. In water, this is the same as one part per million, or about one drop of water in 55 gallons of water.

What contaminants should you look for?

Test for the contaminants that might be found at your location. For example, if you have lead pipes, soldered copper joints or brass parts in the pump, test for the presence of lead. Test for volatile organic chemicals (VOCs) if there has been a nearby use or spill of oil, liquid fuels or solvents. Pesticide tests, though expensive, may be justified if your well has high nitrate levels — more than 10 milligrams per liter (mg/L) of nitrate-nitrogen (NO_3-N) or 45 mg/L of nitrate (NO_3). Tests are also warranted if a pesticide spill has occurred near the well. Pesticides are more likely to be a problem if your well is shallow, has less than 15 feet of casing below the water table, or is located in sandy soil and is down-slope from irrigated lands such as farms or golf courses where pesticides are used.

You can seek further advice on testing from your local DHEC District Environmental Quality Control Office, Cooperative Extension office or county health department. You should test your water more than once a year if (1) someone in your household is pregnant or nursing; (2) there are unexplained illnesses in the family; (3) your neighbors find a dangerous contaminant in their water; (4) you note a change in water taste, odor, color or clarity; or (5) you have a spill of chemicals or fuels into or near your well. Water can be tested by both public and private laboratories. Once your water has been tested, keep a record of your results with your records on well construction and maintenance. This will allow you to monitor water quality over time.

Are there any abandoned and unused wells on your property?

Many properties have wells that are no longer used. Sites with older homes often have an out-of-use shallow well that was installed when the house was first built. If not properly filled and sealed, these wells can provide a direct channel for waterborne pollutants to reach groundwater (Figure 5.8).

A licensed, registered well driller or pump installer should be hired to close these wells. Effective well plugging calls for experience with well construction materials and methods, as well as knowledge of the geology of the site. The cost to close a well will vary with well depth, well diameter and soil/rock type. The money spent sealing a well will be a bargain compared to the potential costs of cleanup or the loss of property value if contamination occurs.

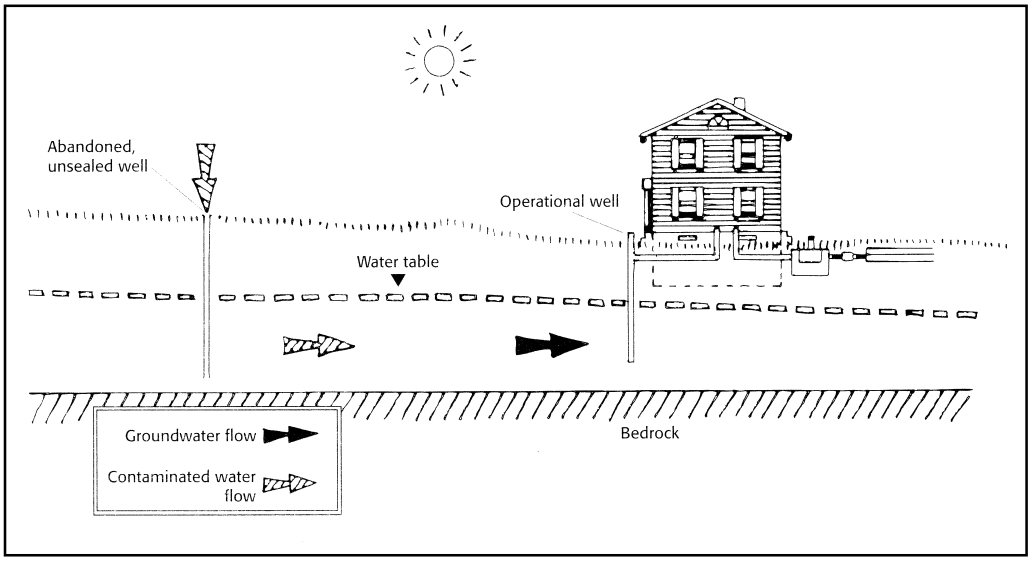


FIGURE 5.8 Improperly sealed unused wells provide a pathway for contaminants to reach groundwater.

Assessment 5.3 — Water Testing

Use the table below to rate your risks related to water quality and unused wells. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to Part 5.3 above if you need more information.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Water testing	Consistent, good water quality. Tests meet standards for bacteria, nitrate and other contaminants.	Some tests do not meet standards or tests approach standards.	Water is not tested. Water is discolored after a rainstorm or during spring melt. There are noticeable changes in color, odor and taste.	❒ Low ❒ Medium ❒ High
Unused wells	There are no unused wells or there are unused wells that are properly sealed.	There are unused wells that are not sealed but are capped and isolated from contaminants.	There are unused, unsealed wells that are in poor condition, near pollution sources and/or uncapped.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your risks. Use the Action Checklist below to record the medium- and high-risk practices you identified. Refer to the information throughout the chapter to help you plan actions to reduce your risks.

Action Checklist

When you finish the assessment tables, go back over the questions to ensure that every high and medium risk you identified is recorded in the checklists on pages 59 and 68 and above. For each risk, write down the improvements that you plan to make. Use recommendations from this chapter and from other resources. Pick a target date that will keep you on schedule for making the changes. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to start with inexpensive actions.

Write all high and medium risks below.	**What can you do to reduce the risk?**	**Set a target date for action.**
Sample: Water hasn't been tested for 10 years. Smells different than it used to.	Have sample tested in state office of public health.	One week from today: April 8

For More Information

If you have further questions regarding well construction and maintenance, contact Jim Hess of the DHEC Source Water Protection - Private Well Program by calling (803) 898-3376, or at the following e-mail address: HESSJR@columb32.dhec.state.sc.us. You can also visit his website at http://www.scdhec.net/water/html/srcewtr.html.

Water Quality

For more information on water quality concerns and to request the following DHEC publications, contact DHEC's Outreach and Education Section, Bureau of Water, at (803) 898-4168 or (888) 761-5989, or visit their website at http://www.scdhec.net/water/html/outreach.html.

Lead in Your Drinking Water
Common Water Quality Problems and Their Treatment
Be Well Aware
What Should I Do If My Well Goes Dry?
Drilling Your Own Well
Residential Well Disinfection
Uranium and Private Wells in Greenville County (www.scdhec.net/water/html/uranium.html)

You can receive the following Extension publications by calling the Clemson University Bulletin Room at (864) 656-3261, by using Clemson's Public Service Activities website at http://www.clemson.edu/psapublishing/, or by contacting your county Extension office:

Preventing Groundwater Contamination: Proper Well Construction, PIP 32
Water Quality and Laundry Problems, WQL 8*
Iron and Manganese, WQL 9*
Home Water Treatment Systems, WQL 5*
Health Effects of Drinking Water Contaminants and How to Treat Them, WQL 3*
Hard Water: To Soften or Not to Soften, WQL 6*
Questions to Ask When Purchasing Water Treatment Equipment, WQL 4*
Testing Drinking Water, WQL 1*
Home Water Quality Problems, Causes and Treatments, WQL 2*
Crystal Clear or Dull and Cloudy?, WQL 7*
Ten Ways to Save Ten Gallons, WQL 10*
Use Water Wisely, WQL 13*

*These publications are available as digital publications at the Clemson PSA Publishing website.

Additional information about Clemson University Extension water quality programs is available at http://www.clemson.edu/waterquality.

Read the EPA publication, *Lead in Your Drinking Water*, EPA 810-F-93-001, by going to the EPA Office of Ground Water and Drinking Water website at http://www.epa.gov/safewater/Pubs/lead1.html.

The following publications are available from the Natural Resource, Agriculture and Engineering Service at (607) 255-7654 or http://www.nraes.org:

Home Water Treatment (NRAES-48), $15.00
Private Drinking Water Supplies: Quality, Testing, and Options for Problem Waters (NRAES-47), $8.00

Well Water/Drinking Water Testing

DHEC conducts a Residential Well Program, which provides the general public with technical assistance on matters pertaining to the drinking water quality and construction standards of residential drinking water wells. For more information, contact your district DHEC office (see list, page 92).

Drilling and Sealing Wells

Call the Environmental Certification Board at (803) 896-4430 for names of licensed well drillers in your area.

Drinking Water Quality Standards

Call the EPA's Safe Drinking Water Hotline toll-free at (800) 426-4791 from 9:00 a.m. to 5:30 p.m., EST, Monday through Friday, or visit their website at http://www.epa.gov/safewater/.

This chapter was originally adapted by Bill McGowan, Agriculture/Water Quality Extension Educator, University of Delaware Cooperative Extension, from Farm*A*Syst fact sheet #1, *Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition*, by Susan Jones, U.S. EPA Region V, Water Division, and University of Wisconsin Cooperative Extension. Material was adapted for South Carolina Home•A•Syst by Barbara Speziale, Extension Water Quality Coordinator, Clemson University Cooperative Extension, with the assistance of Jim Hess, SCDHEC.

Chapter 6

Yard and Garden Care

If yours is like most homes, it's surrounded by lawns, gardens, shrubs and trees that require regular maintenance. Unfortunately, the products and practices that keep your yard looking its best can also send contaminants flowing into local waterbodies. This chapter examines the potential impact of yard and garden care on the environment and your health. Topics covered include:

- Soil testing and fertilizer use
- Lawn type and maintenance
- Ground covers and erosion protection
- Composting
- Water conservation

By completing this chapter, you'll learn to identify, evaluate and reduce the pollution risks your yardwork may cause.

What are the environmental concerns?

Your yard and garden — the natural settings of your home and property — are probably the last places you'd expect to find sources of pollution. But beautiful landscapes can cultivate a variety of health and environmental threats.

On average, homeowners use 10 times more chemical fertilizers and pesticides per acre than farmers use on farmland. Especially if applied improperly, these chemicals can find their way into drinking-water wells and pollute nearby lakes and streams. Closer to home, children are particularly vulnerable to pesticides stored or used without proper safety precautions.

Other problems occur when exposed soil washes away during a storm, harming wildlife habitats and choking waterways. Indiscriminate watering of lawns and gardens wastes large amounts of water. Gasoline-powered mowers, weed cutters, leaf blowers and other devices make noise and pollute the air. Powered by a two-cycle engine, a lawnmower spews the same amount of exhaust in just an hour as a car driven 350 miles.

While it may seem that one person's contribution to pollution is minor, the effects of chemicals, soil loss and wasted water from hundreds or thousands of homes in your region can really add up.

Are you using your time and money effectively?

Americans spend a lot of money on garden gadgets, flowers, seeds and chemical products. They also dedicate many hours of leisure time to caring for their yards and gardens. Valuable time and money may be wasted, however, if you manage your lawn and gardens in an environmentally unsound way.

Think about the cost, time and effort it would take to replace a lawn or garden damaged by over-fertilization or misuse of pesticides. Consider the hard work required to return unsightly, eroded areas back to productive use. Imagine how much less time lawn care would take if grass clippings were left on the lawn instead of being raked and bagged.

You can have a low-maintenance lawn without losing the well-kept appearance of your home. Good management practices not only benefit the environment — they can save you time and money as well.

Part 6.1 — Soil Testing and Fertilizer Use

Most homeowners desire a well-kept yard with attractive flowers, woody plants and a green lawn. Normal applications of lawn and garden products generally pose few problems. A properly maintained home landscape, in fact, can help reduce soil erosion and increase water retention and soil fertility. Poor maintenance — either through neglect or excessive chemical use — can lead to soil problems, polluted runoff and unsafe well water.

Look over the topics below, and read those that will help you better understand your own yardwork and gardening habits. Fill out the assessment table on page 81 to see where you might need to make improvements.

Has your soil been tested?

Adding fertilizer without first testing your soil is like taking medicine without knowing if you need it. Your soil already has some of the nutrients needed for good plant growth, such as nitrogen, phosphorus and potassium. It's important to find out how much of each nutrient is present. Soil testing takes the guesswork out of how much fertilizer to use. Check with your local Cooperative Extension office, garden supply store or a neighbor about having your soil tested.

Testing involves taking small samples from several places in your yard and garden. The soil is analyzed, and you receive a lab report that lists the amounts of each nutrient in each sample. Because of local differences, some parts of your property may need regular applications of fertilizer, while other areas may need few or no applications. Soil tests should be conducted every three years.

How to take a soil sample:

You should need to test only one soil sample from your lawn, home garden or ornamental beds, but you'll need to collect samples from several locations in each of these areas in order to prepare an integrated sample for testing.

To take the sample, use a soil auger or shovel to collect soil from the surface to a depth of 3 inches. Collect and combine samples from 12 or more locations within each designated area — lawn, home garden or ornamental bed. Each of these 12 samples should be of equal size. Place all of the samples in a clean bucket and mix thoroughly. Fill a clean, 1-pint bag or a soil sample box (available from your local Cooperative Extension office) with the mixed soil. Label and number the box or bag. Take the labelled sample to your local Cooperative Extension office for processing. There will be a small charge for testing each soil sample.

What fertilizers are needed for your lawn?

Your soil tests will let you know if your lawn needs fertilizer, and if so, how much and where. Nitrogen is the key plant nutrient for building a thick, green lawn. Applied at the right time and in the right amount, fertilizers will supply the nitrogen your soil needs.

If you apply fertilizer at the wrong time or in the wrong amount, you may make conditions worse, even increasing insect and disease problems. Excess fertilizer is likely to wash away before the grass takes it up. Fertilizer in runoff contributes to unwanted plant and algae growth in nearby streams or lakes. Nitrogen and other chemicals can seep downward and enter groundwater used for drinking, especially in sandy soils.

What Fertilizer Analysis Numbers Mean

The numbers on a fertilizer bag — from left to right — give the percent by weight of nitrogen (N), phosphate (P_2O_5) and potash (K_2O).

For example, in a 10-4-6 fertilizer, nitrogen makes up 10 percent of the total weight of fertilizer, phosphorus accounts for 4 percent and potassium makes up 6 percent. The remaining weight of fertilizer (the total must add up to 100 percent) is comprised of a nutrient carrier material.

If you hire a lawn-care service, make sure they test your soil before applying fertilizer. Insist that lawn fertilizers only be applied when the weather is favorable — when rain is not expected for at least 24 hours. Be sure to keep children and pets away from treated lawns for at least 24 hours after fertilizer application. Sweep excess fertilizer off of walks and back onto the lawn before it is washed away by rain. Nonchemical fertilizers — such as compost and fish meal — and other soil amendments should be applied based on your lawn's actual needs.

Maintain the proper soil pH.

The acidity or alkalinity of a soil, expressed as pH, affects your lawn's ability to absorb fertilizers and other nutrients in the soil. A pH level of less than 7 is considered acid; a pH more than 7, alkaline. For most lawn grasses the soil pH should be between 6 and 7 to benefit the grass plants as well as the earthworms and other beneficial organisms in the lawn. Centipedegrass is an exception: the ideal pH lies between 5.5 and 6.0.

The amount of lime required on your lawn should be based on the results of a soil test. The results of the test will determine the amount of limestone required to increase the pH or the amount of sulfur necessary to lower the pH to the desirable level. The soil test will also provide information about the fertility levels of your soil.

Apply the proper amount of fertilizer according to the results of a soil test.

Too much fertilizer can be harmful to the lawn and may also lead to water contamination through runoff or leaching of nutrients. For an established lawn, the fertilizer ratios, analyses and rates listed below are adequate for most grasses.

Centipede and carpetgrass are low-maintenance lawn grasses — they don't tolerate excessive use of fertilizer, especially nitrogen. However, if you have a centipedegrass or carpetgrass lawn, use one-quarter of the application rate for these grasses. For example, if you are using a 12 - 4 -8 fertilizer, apply 2 1/2 pounds per 1,000 square feet to your centipede or carpetgrass lawn.

Fertilizer Ratio (N - P_2O_5 - K_2O)	**Fertilizer Analysis**	**Application Rate** (pounds per 1,000 sq. ft.)
3 : 1 : 2	10 - 4 - 6	10
	12 - 4 - 8	10
4 : 1 : 2	12 - 3 - 6	8
	16 - 4 - 8	6
	20 - 5 - 10	5

Fertilize your lawn with the proper amount of fertilizer at the right time.

Use the table that follows (Figure 6.1) to determine the appropriate fertilizer application times for your lawn grass.

FIGURE 6.1 Basic Fertilizing Schedule[1]

Lawngrass	Application Rate[2] lb. N/1000 sq. ft.	Application Time[3]
Bermudagrass	1	May, June, July, August
Carpetgrass	1/2	May, August
Centipedegrass	1/2	May, August[4]
St. Augustinegrass	1	May, June, July, August
Zoysiagrass	1	May, July, August
Fescue, bluegrass[5]	1	January, September
	2	November
Ryegrass (overseeded)[5, 6]	1	December, February

1 The kind of fertilizer you use should be based on current soil test recommendations. Without a soil test report, use a complete, balanced (N-P-K) fertilizer.
2 Use a nitrogen fertilizer which contains at least one-half of the total amount of nitrogen in a slow-release form.
3 On warm-season turfgrass, the first fertilizer application should be made two to three weeks after the lawn turns green in the spring.
4 Fertilize centipede using a low phosphorus, high potassium fertilizer. An additional fertilizer in late June may enhance centipede performance in sandy soils.
5 For late fall and winter applications, use a fertilizer source containing quick release nitrogen or slow-release nitrogen in the form of isobutylidene diurea (IBDU). The nitrogen release is independent of microbial activity; therefore, IBDU nitrogen is released more readily during cool weather when compared to other slow-release sources.
6 When applying a fertilizer to warm-season lawns overseeded with ryegrass, the warm-season grass should be dormant before fertilizing.

To determine the proper amount of fertilizer needed, especially if the N-P-K analysis of your fertilizer is not listed above, use the following procedure:

• To apply 1 pound of nitrogen per 1,000 square feet, divide the first number on the fertilizer bag into 100. For example, a 16-4-8 fertilizer should be applied at a rate of 6.25 pounds per 1,000 square feet (100/16 = 6.25).

• To apply one-half pound of nitrogen per 1,000 square feet, divide the first number on the fertilizer bag into 50. For example, a 10-10-10 fertilizer should be applied at a rate of 5 pounds per 1,000 square feet (50/10 = 5).

For slow, even, sustained growth, consider using *slow-release* fertilizers. These products make nitrogen slowly available over a long period of time, even several months, which results in gradual, steady growth. Slow-release materials include natural fertilizers, such as manures or composted sewage sludge. Synthetic slow-release fertilizers include UF (urea formaldehyde), SCU (sulfur-coated urea), IBDU (isobutylidene diurea), and methylene urea. These slow-release fertilizers are also good choices for areas where the potential for runoff is very high — slopes, compacted soil or sparsely covered lawns. Since the nutrients are released slowly, the potential for runoff and water contamination is less.

If a fertilizer contains a slow-release nitrogen source, it will be listed on the label. For urea formaldehyde-based fertilizers, the portion of the nitrogen that is slow-release is listed on the fertilizer bag as Water Insoluble Nitrogen (WIN). If WIN is not listed on the label, you should assume that all nitrogen in the fertilizer is in the quick-release form. For example, a fertilizer label might provide the following information:

Guaranteed Analysis	
Total Nitrogen	16%
8.50% Ammoniacal Nitrogen	
2.00% Nitrate Nitrogen	
5.50% Water Insoluble Nitrogen (WIN)	
Available Phosphoric Acid (P_2O_5)	4%
Soluble Potash (K_2O)	8%

Because the WIN is less than half of the total amount of nitrogen in the bag, this is a quick-release fertilizer.

$\frac{\%\ WIN \times 100}{\%\ total}$ = % of total nitrogen that is WIN or slow-release nitrogen

Therefore:

$\frac{5.5 \times 100}{16}$ = 34% of the total nitrogen is WIN or slow-release nitrogen

For applications on sloped areas, choose a fertilizer in which more than 50 percent of the nitrogen is in WIN form.

Assessment 6.1 — Your Fertilizer Use

The table below will help you identify potential environmental risks related to your use of fertilizers. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to the previous pages if you need more information to complete the table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Testing soil and applying fertilizers	Soil is tested for pH and nutrients. Fertilizer and lime are used as recommended.	Soil is not tested. Fertilizer and lime are used according to label instructions.	Soil is not tested. Fertilizer and/or lime are used in large amounts.	❒ Low ❒ Medium ❒ High
Selecting fertilizers	I use slow-release fertilizer on a sloping lawn near a waterbody or storm drain.	I use fast-release fertilizer according to soil-test results on a sloping, dense lawn near a waterbody or storm drain.	I use fast-release fertilizer on a thin, sparsely covered lawn near a waterbody or storm drain.	❒ Low ❒ Medium ❒ High
Fertilizer storage	No fertilizers are stored.	Fertilizers are stored away from the wells and waterbodies and any spills are promptly cleaned up.	Fertilizers are stored in or near well pump house and spills are not cleaned up.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your risks in using fertilizers. Complete the Action Checklist on page 89 to help you make planes to reduce your risks.

Part 6.2 — Taking Proper Care of Your Lawn

It will be easier to keep your lawn healthy if the type of grass is suited to local growing conditions, which include rainfall amount, temperature, soil type and available light. Contact your local Cooperative Extension office or the references at the end of this chapter for a list of recommended grasses for your region.

Cut your grass to the proper height.

Mow your lawn regularly. A good rule of thumb is to remove no more than one-third of the grass height at any one mowing. For example, if you are maintaining your centipede lawn at 1 1/2 inches, mow the lawn when it is about 2 inches high. Cutting off more than one-third at one time can stop the roots from growing and would require frequent watering during dry summers to keep the plants alive. Also, following the one-third rule will produce smaller clippings which will disappear quickly by filtering down to the soil surface.

Mow with a sharp mower blade. Sharp blades cut the grass cleanly, which ensures rapid healing and regrowth. When dull blades tear and bruise the leaves, the wounded grass plants become weakened and are less able to ward off invading weeds or to recover from disease and insect attacks.

Mow your lawn at the recommended height for your grass type. Cutting your grass to the right height is important; lawns cut too short invite weeds to invade. Use the following chart as a guide to proper mowing heights.

Lawn Type	Mower Setting (inches)	Mow At or Before This Height (inches)
Common Bermuda	1	1 1/2
Hybrid Bemuda	1	1 1/2
Zoysia	1	1 1/2
Carpetgrass	1 1/2	2
Centipede	1 1/2	2
St. Augustine	3	4
Tall Fescue	3	4

Recycle your grass clippings for a healthier lawn and environment.

In the early 1950s, the first bagging mowers made their debut on American lawns. Somehow, collecting and removing grass clippings and sending them to landfills caught on. Bagging clippings became an established ritual across the country, accounting for 20 to 50 percent of the solid waste entering landfills between the months of March and September.

However, faced with the rapid disappearance of landfills in South Carolina, new legislation has prevented grass clippings and other yard wastes from entering our landfills since May 27, 1993. So where should all the clippings go? That's easy: Adopt the old practice of returning them back to the lawn. "Recycle" the grass clippings by not collecting them.

What About Thatch?

Grass clippings do not contribute to thatch in any lawn. Thatch is a layer of living and dead plant parts that lies between the grass leaves and the soil surface. The plant tissue that makes up thatch contains a high amount of hard-to-decompose cell wall material called lignin. Grass leaves are mostly comprised of water (75 to 85 percent by weight), high amounts of protein and little lignin. The clippings break down quickly once they fall between the grass blades and onto the soil surface.

Recycling your grass clippings makes up part of a lawn care plan designed to produce a healthy lawn with savings in time, energy and money. At the same time, this lawn care plan will benefit your community and the environment. Grass clippings should be left on the lawn — in many cases, they supply enough natural fertilizer that only minimal additional fertilizer is needed to keep your lawn green and healthy. Grass clippings contain about 4 percent nitrogen, ½ to 1 percent phosphorus, 2 to 3 percent potassium and smaller amounts of other essential plant nutrients — basically a 4:1:3 fertilizer. When left on the lawn, these nutrients are eventually returned to the soil. Clippings should be swept off of paved surfaces so they aren't carried away by stormwater.

Use a human-powered mower for small lawns.

Switching to a standard push mower reduces air and noise pollution and provides exercise. If you already have a small lawn or reduce your lawn size by growing plants that require little maintenance, such a mower can be very practical.

Water wisely.

Because most plants can tolerate at least short dry periods, watering should be timed to meet the biological needs of plants. Watering slowly and deeply helps develop deep roots; in the long run, your plants will need less frequent watering. The plants that seem to benefit most from shallow watering are the ones you don't want — weeds.

Plants can absorb only so much water. Overwatering wastes water and can injure certain plants. Placing several containers with 1-inch marks under your sprinkler will help you gauge how much water your lawn or garden is getting (Figure 6.2).

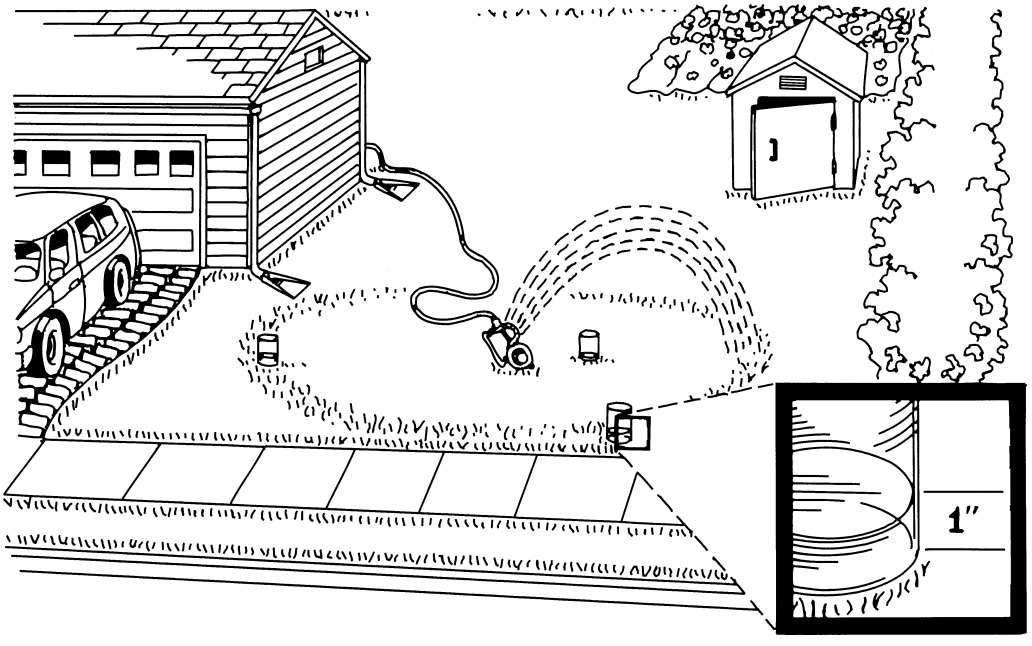


FIGURE 6.2 Placing containers with 1-inch marks under your sprinkler will help measure how much water you are applying.

You can choose not to water your lawn. During long dry and hot periods in the summer, you have two choices: (1) water the grass and keep it green, or (2) don't water and watch the lawn turn brown. Each choice has consequences. Watering will increase the need for mowing, raise your water bill and may stimulate disease outbreaks and weed growth. If you don't water, you can expect warm-season grasses — such as centipede, bermuda, St. Augustine or zoysiagrass — to remain alive and resume growth when conditions become more favorable. Cool-season grasses, such as tall or red fescue may be severely injured or killed.

If you irrigate your lawn, water deeply to develop grass plants with deep, extensive root systems. Water early in the morning for efficient water use and to discourage the development and spread of diseases.

During the driest part of our year, from April through September, plants and soil lose about 1.5 inches of water every seven days. Therefore, our lawns require about an inch of water every five to seven days. This will vary depending on soil type, turfgrass growth and rainfall. Sandier soils will require more frequent irrigation than do heavy soils. Apply 1/2 inch of water on coarse, sandy soil and 1 inch of water on heavy or finer-textured soil.

Do Your Yard Care Practices Save Water?

The average American uses approximately 200 gallons of water each day. About half of that water may be used for landscaping and gardening, depending on climate, time of year and plant species in the landscape. This is an immense amount of clean water — and only a small portion is actually used by your plants. If you convert your landscape plants to ones adapted to your region and climate, you'll take the biggest step in conserving water.

In places with dry climates, there are many plants that are drought-tolerant. Consider using drought-resistant turfgrass species like bermudagrass. Perennial flowers conserve water because their roots grow deeper than annual plants and require little or no watering once established. A shallow mulch (about 2 inches deep) of wood or bark chips over bare soil will reduce stormwater runoff and keep water from evaporating.

Most hose sprinklers apply 1/4 to 1/3 inch of water per hour, so they would need to run about four hours in one spot. If water runs off the lawn before 1 inch is applied, turn the sprinkler off, let the water soak in for about an hour, and then continue watering.

Use the following techniques to determine when your lawn needs water.

Color Test: When water has been unavailable for an extended period of time, your lawn will exhibit a bluish-gray color.

Footprinting: Walk across your lawn and examine the grass behind you to see if your steps left any footprints. Your footprints will appear in a lawn when the grass plants have low levels of water in their tissues. When you press the grass blades down with your feet, the low water levels prevent the blades from springing right back up. If your footprints remain for an extended period, the lawn should be watered to prevent the grass from turning brown and becoming dormant.

Screwdriver Test: Press a screwdriver or similar tool into the lawn. If the soil is very dry, it will be difficult to push the screwdriver into the ground. Use this test to confirm the results of the footprint method to help judge when you should water your lawn.

Leaf Check: During dry periods, grass leaves respond by wilting, rolling or folding. These symptoms are signs that you need to water your lawn to prevent it from becoming dormant.

Grow drought-tolerant plants.

One of the best ways to protect and conserve your local waterbodies is to use plants that are drought-tolerant and that are adapted to your area. Drought-tolerant or low-water-use plants can survive, once they are established, even during times of little rainfall. Because you don't need to water these plants, there is less chance that nitrates and pesticides will be carried into groundwater.

Xerophytes are plants specifically adapted to tolerate long periods of drought. Xeriscaping is a landscape plan that conserves water by using these plants. A xeriscape will require little or no additional watering. Many of the xeriscape plants that you choose may be native species. Consult the publication *Xeriscapes* (listed at the end of this chapter) and your local Cooperative Extension agent or Master Gardener for more information about drought-tolerant plants for your area.

Use landscape practices that help prevent soil erosion.

Ninety percent of the rain that falls finds its way into streams, lakes and reservoirs. Like pesticides and fertilizers, soil washed away by rain can pollute your local waterbodies. Even if you don't live near water, soil will eventually be carried to surface water in runoff from storms. Gardens, lawns and construction sites with areas of bare soil — especially on sloped land — are prone to soil erosion.

You can protect soil and reduce erosion by planting ground-cover vegetation or using wood-chip mulch or landscape fabric. On steep slopes, plant a vigorous ground cover but avoid turfgrass, which requires mowing. Building terraces or retaining walls on slopes can also help prevent soil loss. As with lawns, choose plants that are suited to your area and resistant to insects and diseases. Consult Chapter 2, *Stormwater Management,* for specific recommendations on reducing runoff.

Aerate your lawn regularly.

Physically removing cores of soil and leaving holes in the lawn is called core aeration. Aeration loosens compacted soil and improves your lawn's growing conditions by making air, water and nutrients available to the grass roots. It also creates ideal conditions for the growth of earthworms and microorganisms which break down clippings and thatch.

FIGURE 6.3 Pull weeds by hand instead of controlling with chemicals.

Apply pesticides wisely.

Although removing weeds, insects and other pests by hand is safest for the environment and your health, pesticides, if properly used, may pose only a minimal risk. The key to safe pesticide use is doing your homework before you start treatment. Correctly identifying the pest is the first step. Many plant problems are not caused by insects or disease but are related to temperature extremes, waterlogging or drought, damage caused by lawn mowers, or overuse of chemicals.

Learn when and where pesticides may be needed to control problems. Apply them only where pests occur. Select chemicals that are the least toxic or that break down quickly into less harmful substances. Check with your local Cooperative Extension office or garden supply store for information. Remember to read the pesticide label carefully and follow the directions for application rates and methods.

Pest prevention is often simpler (and cheaper) than pest removal. If you have disease-resistant grasses or other plants and keep them healthy, pests will be less of a problem. For the sake of clean groundwater and an environment with fewer chemical pollutants, ask yourself if you can tolerate a few more weeds and bugs around your yard.

Practice integrated pest management (IPM).

It sounds fancy, but integrated pest management (IPM) is simply a systematic approach to controlling pests in your landscape.

Although the use of nonchemical controls is preferred, chemicals may be used selectively if nothing else works. Weeds can be controlled by hand pulling (Figure 6.3) or hoeing, and bugs can be removed by picking them off vegetables and garden plants. Cleaning up dead leaves and debris removes potential pest habitats. Using natural predators to control pests is another method; you can release into your garden beneficial insects and microorganisms that feed on pest insects.

When you have no other choice, try to find nontoxic or low-toxic chemicals such as insecticidal soaps. Follow directions carefully, and mix only the amount you need. For IPM to work, you will have to give more time and attention to your yard and garden.

It's very important to identify the pest problem and understand its life cycle before choosing appropriate control measures. Consider controlling pests with cultural methods, such as properly mowing and fertilizing, or by using biological controls, such as milky spore to control Japanese beetles. If cultural or biological controls are unsuccessful, or if the pest population has gone out of control, then consider pesticides. Use pesticides sparingly and locally to control specific pest problems. Avoid general, catch-all pesticide applications.

Greening the White House

Take a cue from the White House, where the groundskeepers have launched a gardening and landscaping program designed to protect the environment. The staff now uses integrated pest management (IPM), an environmentally friendly approach that controls pests using a minimum of chemicals.

Groundskeepers at the White House fertilize according to local recommendations, limit watering to the early morning hours to save water, and leave grass clippings on the lawn where they decompose naturally.

Make compost.

Garden trimmings and food scraps make up more than 25 percent of what is thrown away in an average household. Composting is a cost-effective, natural way to handle leaves, grass clippings and other yard trimmings — materials that might otherwise end up in a landfill. Composting creates an organic, slow-release fertilizer and soil-enhancing material. It takes advantage of nature's recycling system for breaking down plant and other organic materials.

To compost, simply put yard wastes in a pile, or install homemade or store-bought bins to contain the material. In addition to yard waste, you can add vegetable trimmings and fruit peels from your kitchen. Your compost pile will remain relatively odor-free if it is turned and aerated regularly (Figure 6.4).

South Carolina's Department of Health and Environmental Control (DHEC) recently instituted a statewide program to encourage backyard composting. The program offers backyard composting bins made out of recycled plastic to participating cities and counties at a discounted price. Local governments that purchase these

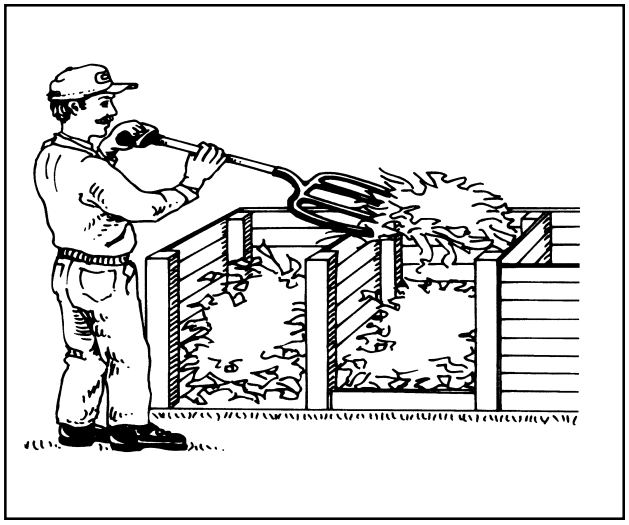


FIGURE 6.4 Compost piles will remain relatively odor-free if they are turned and aerated regularly.

bins from DHEC can then resell them to community residents and demonstrate how to make compost. For more information about this program, contact your local recycling coordinator or DHEC's Office of Solid Waste Reduction and Recycling at (800) 768-7348.

One word of caution: Animal manures contain high levels of nitrogen, and different types of manures have different levels. If manure is left in piles exposed to the weather, nitrogen-rich runoff may result. If you mix manure from horses, sheep, cows or other plant-eating animals into your compost, be sure to add plenty of high-carbon materials such as leaves, straw or sawdust to keep concentrations of nitrogen and other nutrients low. This will help prevent contamination of groundwater. Don't put pet wastes (from cats and dogs) in compost piles because of potential parasite and disease problems. Try to locate piles at least 50 feet from any wells, lakes or rivers.

Finished compost can be mixed into garden soil or spread on lawns as a slow-release fertilizer. Check with your local Cooperative Extension office, garden stores, the library and your neighbors for ideas on other ways to use compost.

Assessment 6.2 — Your Yard and Garden Care

The table below will help you identify potential environmental risks related to your yard and garden maintenance practices. For each question, indicate your risk level in the right-hand column. Although some choices may not correspond exactly to your situation, choose the response that best fits. Refer to the previous pages if you need more information to complete the table.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Lawn type and maintenance	Lawn grass is suited to soil type, available sunlight and climate. Grass is pest-resistant and mowed to the proper height.	Lawn grass is suited to the site but is well-fertilized and mowed short.	Grass type is not suited to available light, soil type or climate. Grass is pest-prone and mowed too short.	❒ Low ❒ Medium ❒ High
Mowing height	I mow the lawn frequently, removing no more than one-third of the leaf tissue at each mowing.	I mow the lawn once every two weeks.	I mow the lawn when I have the time.	❒ Low ❒ Medium ❒ High
Pesticides	Nonchemical or low-toxicity methods (such as integrated pest management) are used to control pests.	Chemicals are used according to label instructions.	Chemicals are used without regard to label instructions or conditions.	❒ Low ❒ Medium ❒ High

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Pesticides (continued)	Pest is identified and its life cycle is understood before choosing control methods.	A pesticide to control pests is used, according to label instructions, when I see the pests.	A pesticide is used to control pests when I see them. I use a little more than is recommended on the label.	❒ Low ❒ Medium ❒ High
Ground cover and other plantings	Ground covers, flowers, trees and shrubs are planted to reduce soil erosion. Plantings resist insects and disease.	A slow-spreading ground cover is used.	A hilly landscape or lack of ground cover causes soil erosion. Plants require insect- and disease-fighting chemicals to survive.	❒ Low ❒ Medium ❒ High
Composting	The compost pile is well-maintained: It is aerated regularly and contains yard waste, vegetable food scraps and a nitrogen source such as manure.	The compost pile is poorly maintained: It is not aerated or lacks the proper mix of materials. Dog, cat and other pet wastes are added to the pile.	The compost pile is poorly maintained: It contains excessive high-nitrogen material and is not turned regularly. The pile is less than 50 feet from a shallow well or surface water.	❒ Low ❒ Medium ❒ High
Water requirements of plants	Grass, flowers, trees and shrubs are able to survive with normal rainfall.	Landscape plants require light to moderate watering.	Heavy watering is required to keep the lawn and other plants alive.	❒ Low ❒ Medium ❒ High
Water usage	Watering is done in the morning or evening, only as needed. Low-water-use devices (like soaker hoses) are used. The sprinkler system is on manual control.	Watering is excessive. (For example: The sprinkler is left unattended, and much water lands on the pavements.	Watering is done during the heat of the day or late at night. The sprinkler system is used daily without regard to weather conditions. There is excessive water runoff.	❒ Low ❒ Medium ❒ High

Responding to Risks

Your goal is to lower your risks. Complete the Action Checklist, opposite, to help you make plans to reduce your risks.

Action Checklist

In the checklist below, write all medium- and high-risk practices you identified in the assessment table. For each risk, write down the improvements you plan to make and a target date for action. Use recommendations from this chapter and other resources to decide on actions you are likely to complete. You don't have to do everything at once, but try to eliminate the most serious risks as soon as you can. Often it helps to tackle the inexpensive actions first.

Write all high and medium risks below.	What can you do to reduce the risk?	Set a target date for action.
Sample: Lawn grass requires excessive pesticides.	Ask local Cooperative Extension agent to identify proper lawn grass for this area or proper care for the grass I have.	Two weeks from today: September 20
Sample: Fertilizers applied but soil has never been tested.	Find laboratory that does soil testing. Take samples and send them to lab.	One week from today: March 15

For More Information

The following publications are available from:
Clemson University Cooperative Extension
Bulletin Room
96 Poole Agricultural Center
Clemson, SC 29634
(864) 656-3261
http://www.clemson.edu/psapublishing

Centipede Grass Problems (EC 583), $2.00
Home Landscaping (EC 671), $2.50
How to Choose a Lawn Care Company (PIP 36)
Protecting South Carolina Groundwater Quality (PIP 5, PIP 6)
Recycling Yard Trimmings: Home Composting (IL 48)*
Recycling Your Grass Clippings (IL 49)*
Rainwater Runoff: Protecting Your Landscape (IL 55)*
Store Pesticides Safely (PIP 37)
Wildlife Planting Guide and Native Wildlife Plants in South Carolina (AFW 2), $8.50
Xeriscape (EC 672)
*These publications are also available as digital publications at the Clemson PSA Publishing website.

The Clemson Extension Home and Garden Information Center provides useful factsheets on many topics. Call (888) 656-9988 to request publications or visit their website at http://hgic.clemson.edu to see the factsheets online.

Soil Testing

Send samples to your local Cooperative Extension office or contact:
Agricultural Service Laboratory
171 Old Cherry Road
Clemson University
Clemson, SC 29634
Telephone: (864) 656-2068
FAX: (864) 656-2069

Poison Control Centers

National Poison Center: (800) 222-1222.

Palmetto Poison Center (statewide): (800) 922-1117 or (803) 777-1117. Assistance is available 8:00 a.m. to 12:00 p.m. daily. In emergency situations outside of these hours, dial 911. Visit their website at http://www.pharm.sc.edu/PPS/pps.htm.

This chapter was developed by K. Marc Teffeau, Regional Extension Specialist, Wye Research and Education Center, University of Maryland Cooperative Extension and Ray Bosmans, Regional Extension Specialist, Home and Garden Information Center, University of Maryland Cooperative Extension. It was adapted for South Carolina by Barbara Speziale and Marty Watt, Clemson University Cooperative Extension. Portions of the text were adapted from Clemson University Extension publications by Robert Polomski and L. C. Miller and from North Carolina Home•A•Syst.

Information and Services

Cooperative Extension offices are located throughout the state. Contact your local county Extension agent for assistance and additonal information about Home•A•Syst topics. Water Quality publications are available on the Clemson University Cooperative Extension Water Quality Web Site, http://agweb.clemson.edu/AgNews/Publications/Pages/water.htm. The Extension Water Quality Home Page (http://agweb.clemson.edu/agnat/water.htm) describes on-going water quality projects, research, education, and current issues.

County	Address	Telephone	Fax
Abbeville	394 Highway 28 By-Pass, Abbeville 29620	(864) 459-4106	(864) 459-2867
Aiken	1555 Richland Ave. East, Suite 500, Aiken 29801	(803) 649-6671 or 6297	(803) 649-6911
Allendale	511 Pine St., Allendale 29810	(803) 584-4207	(803) 584-1304
Anderson	313 S. Tower St., Anderson 29622	(864) 226-1581	(864) 226-0538
Bamberg	734 Calhoun St., Bamberg 29003	(803) 245-2661 or 2170	(803) 245-2170
Barnwell	Pechmann St.,, Barnwell 29812	(803) 259-7141	(803) 259-7145
Beaufort	2201 Boundary St., Suite 114, Beaufort 29901	(843) 470-3655	(843) 525-7243
Berkeley	227 First St., Moncks Corner 29461	(843) 719-4140	(843) 761-4221
Calhoun	112 Courthouse Annex, St. Matthews 29135	(803) 874-2354	(803) 874-2461
Charleston	259 Meeting Street, Charleston 29401	(843) 722-5940	(843) 722-5944
Cherokee	1100 Floyd Baker Blvd., Gaffney 29342	(864) 489-3141	(864) 489-3142
Chester	McAliley St., Chester 29706	(803) 385-6181	(803) 385-2556
Chesterfield	101 Main St., Chesterfield 29709	(843) 623-2134	(843) 623-6603
Clarendon	11A West Rigby St., Manning 29102	(803) 435-8429	(803) 435-4218
Colleton	219 S. Lemacks St., Walterboro 29488	(843) 549-2596	(843) 549-2597
Darlington	Russell & E. Hampton Sts., Darlington 29532	(843) 393-0484	(843) 393-9428
Dillon	200 S. 5th St., Dillon 29536	(843) 774-8218	(843) 774-7249
Dorchester	101 Ridge St., St. George 29477	(803) 563-3441, 832-0135	(803) 563-0171
Edgefield	304 Gray St., Edgefield 29824	(803) 637-3161	(803) 637-3162
Fairfield	1013 Kincaid Bridge Rd., Winnsboro 29180	(803) 635-4722	(803) 635-4918
Florence	2685 S. Irby St., Suite K, Florence 29505	(843) 661-4800	(843) 661-4899
Georgetown	1837 N. Frazier St., Hwy 701, Georgetown 29440	(843) 546-4481 or 6421	(843) 546-2852
Greenville	Greenville County Square, 301 University Ridge, Suite 4300, Greenville 29601-3660	(864) 232-4431	(864) 232-4738
Greenwood	600 Monument St., Suite 106, Greenwood 29648	(864) 229-6681	(864) 942-8592
Hampton	201 Jackson St. West, Hampton 29924	(803) 943-3427	(803) 943-7502
Horry	1949 Industrial Park, Conway 29526	(843) 365-6715	(843) 365-6719
Jasper	304 Green St., Ridgeland 29936	(843) 726-3461	(843) 726-3470
Kershaw	632 W. DeKalb St., Camden 29020	(803) 432-9071	(803) 425-7120
Lancaster	208 W. Dunlap St., Lancaster 29721	(803) 283-3302	(803) 286-6650
Laurens	219 Laurens Street, Laurens 29360	(864) 984-2514	(864) 984-2402
Lee	5 Courthouse Square, Bishopville 29010	(803) 484-5416	(803) 484-5812
Lexington	219 E. Main Street, Lexington 29072	(803) 359-8515	(803) 359-4245
Marion	Airport Rd., Marion 29571	(843) 423-8285	(843) 465-3259
Marlboro	S. Parsonage St. Extension, Bennettsville 29512	(843) 479-6851	(843) 423-8287
McCormick	201 E. Augusta St., McCormick 29835	(864) 465-2112	(864) 479-8444
Newberry	1512 Martin St., Newberry 29108	(803) 276-1091	(803) 276-1095
Oconee	S. Church & Broad Sts., Walhalla 29691	(864) 638-5889	(864) 638-7321
Orangeburg	1550 Henley St., Orangeburg 29116-1206	(803) 534-6280	(803) 534-5037
Pickens	222 W. Main St., Suite RR, Pickens 29671	(864) 868-2810	(864) 878-6712
Richland	2020 Hampton St., Columbia 29202	(803) 929-6030	(803) 929-6034
Saluda	201 E. Church St., Saluda 29138-1411	(864) 445-8117	(864) 445-8119
Spartanburg	142 S. Dean St., Room 216, Spartanburg 29304	(864) 596-2993	(864) 596-3602
Sumter	Box 2377, Sumter 29151-2377	(803) 773-5561	(803) 773-0070
Union	Route 6, 120 Kirby Street, Union 29379	(864) 427-6259	(864) 427-6250
Williamsburg	9 Courthouse Square, Kingstree 29556	(843) 354-6106	(843) 354-9450
York	6 S. Congress St., York 29745	(803) 684-9919	(803) 684-2297

The South Carolina Department of Health and Environmental Control's Office of Environmental Quality Management is involved with the protection of the environment and is organized into program areas concerning solid waste and hazardous waste management, drinking water protection, water pollution control, and air quality control. There are twelve district offices which are strategically located throughout the state and staffed with professionals who work in all EQC program areas

EQC District	Counties	Address	Phone and Fax
APPALACHIA I	Anderson, Oconee	2404 N. Main Street Anderson, SC 29621	Phone: (864) 260-5569 Fax: (864) 260-4855
APPALACHIA II	Greenville, Pickens	301 University Ridge Suite 5800 Greenville, SC 29601	Phone: (864) 241-1090 Fax: (864) 241-1092
APPALACHIA III	Spartanburg, Cherokee, Union	975 N. Church Street Spartanburg, SC 29303	Phone: (864) 596-3800 Fax: (864) 596-2136
CATAWBA	Lancaster, Chester, York	2475 DHEC Road Lancaster, SC 29720 mailing address: P.O. Box 100 Fort Lawn, SC 29714	Phone: (864) 285-7461 Fax: (864) 285-5594
CENTRAL MIDLANDS	Richland, Lexington, Newberry, Fairfield	Bldg #5/P.O. Box 156 State Park, SC 29147	Phone: (803) 896-0620 Fax: (803) 896-0617
LOW COUNTRY	Beaufort, Jasper, Colleton, Hampton	104 Parker Drive Beaufort, SC 29906	Phone: (843) 846-1030 Fax:(843) 846-0604
LOWER SAVANNAH	Aiken, Orangeburg, Barnwell, Bamberg, Allendale, Calhoun	206 Beaufort Street, NE Aiken, SC 29801	Phone: (803) 641-7670 Fax: (803) 641-7675
PEE DEE	Florence, Dillon, Marion, Marlboro, Darlington, Chesterfield	145 E. Cheves Street Florence, SC 29506	Phone: (843) 661-4825 Fax: (843) 661-4858
TRIDENT	Charleston, Berkeley, Dorchester	1362 McMillan Ave., #300 Charleston, SC 29405	Phone: (843) 740-1590 Fax: (843) 740-1595
UPPER SAVANNAH	Greenwood, Abbeville, Laurens, Saluda, Edgefield, McCormick	613 South Main Street Greenwood, SC 29646	Phone: (864) 223-0333 Fax: (864) 223-6935
WACCAMAW	Horry, Georgetown, Williamsburg	1705 Oak Street Plaza Suite #2 Myrtle Beach, SC 29577	Phone: (843) 448-1902 Fax: (843) 946-9390
WATEREE	Sumter, Kershaw, Lee, Clarendon	105 Magnolia Street Sumter, SC 29151	Phone: (803) 778-6548 Fax: (803) 773-6366

• Home•A•Syst National Office

Farm•A•Syst/Home•A•Syst
303 Hiram Smith Hall
1545 Observatory Drive
Madison, WI 53706-1289
(608) 265-2774 or (608) 262-0024
FAX: (608) 265-2775
e-mail: svantiem@facstaff.wisc.edu
website: http://www.wisc.edu/homeasyst

• Soil and Water Testing

Agricultural Service Laboratory
171 Cherry Road
Clemson, SC 29634
(864) 656-2068
FAX: (864) 656-2069

• South Carolina Water Quality Regulations

SC Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
(803) 896-8940
FAX: (803) 896-8941
website: http://www.scdhec.net/water/html/laws.htm

• South Carolina Health Regulations

For information on sanitation and well separation distances, contact your county health department.

• Spills of Pesticides or Toxic Materials

DHEC Emergency Response to Releases and Spills Hotline
(803) 253-6488, and toll-free (888) 481-0125

• Ingestion or Human Contact with Toxic Materials

Palmetto Poison Center
College of Pharmacy
University of South Carolina
Columbia, SC 29208
(800) 922-1117 or (803)765-7359 or (803) 777-1117
8:00 a.m. to 12:00 p.m., seven days a week; other times, dial 911.

• United States Geological Survey

(For groundwater information)

Eastern Region & Headquarters
USGS National Center
12201 Sunrise Valley Drive
Reston, VA 20192
(703) 648-4000
http://www.usgs.gov

South Carolina USGS
720 Gracern Road
Stephenson Center, Suite 129
Columbia, SC 29210
(803) 750-6100
http://scwater.usgs.gov/

• Pesticide Information

Clemson Univeristy
Pesticide Information Program
Department of Entomology
114 Long Hall
Clemson, SC 29634-0365
(864) 656-3111 or (864) 656-3113

Publications on pesticide use, storage and disposal can be obtained by calling your local county Extension office or downloaded from the following website: http://entweb.clemson.edu/pesticid/saftyed/.

Department of Pesticide Regulation (DPR)
511 Westinghouse Road
Pendleton, SC 29670
(864) 646-2150; FAX: (894) 646-2179
http://drpsp.clemson.edu

There are many DPR Field Offices throughout the state; contact the main office, listed above, for assistance in locating the field office nearest you.

• Master Gardener Program

The South Carolina Master Gardener Program is a volunteer training program administered by the Clemson University Cooperative Extension Service. Introduced in Charleston County in 1981, the Master Gardener program is now offered in 25 counties. The Master Gardener program is divided into two parts: instruction and service. In the first part, participants receive at least 40 hours of intensive, practical horticultural training. A few of the following topics are covered in the program:

- Soils and Plant Nutrition
- Basic Plant Pathology, Physiology, and Entomology
- Vegetable Gardening
- Tree and Small Fruit Culture
- Culture of Woody Ornamentals
- Lawn Management
- Basic Landscape Design
- Problem Solving

After successfully completing the classroom portion, which involves regular attendance and passing a final exam, participants receive the title of "Master Gardener." The Master Gardener graduates then volunteer at least 40 hours of service in the Clemson Extension office or in the community. Volunteer activities are coordinated through the local county Extension office.

Master Gardeners share their knowledge and skills in a number of ways: answering horticulture calls at the Extension office; speaking to garden and civic clubs; working with youth or senior groups; and assisting communities with beautification projects.

Many Master Gardeners far exceed the expected 40 hours of service, continuing in the program beyond the first year, motivated by their willingness to help others and the personal satisfaction derived from participating in this community service program.

If you have the desire, commitment, and time to learn and want to put your knowledge and skills to work through volunteer service, then apply for admission to the Master Gardener program. Contact your county Clemson Extension agent to see if a program is offered in your county. For those with internet access, log into the SC Master Gardener website at http://www.clemson.edu/Hort/ or http://virtual.clemson.edu/groups/hort/SCMG/mgprog2.htm#MGCOUNTIES to see which counties have active Master Gardener programs.

• Community Organizations

Lake and Watershed Association of South Carolina (LWASC): The purpose of the LWASC is to promote understanding, protection, and comprehensive management of water resources and their watersheds. This state chapter of the North American Lake Management Society can provide information about water resources activities in South Carolina and the Southeast. Contact LWASC to find out if there is a lake, stream or watershed association in your local area.

LWASC
P.O. Box 1241
Irmo, SC 29063
http://www.nalms.org/lwasc/index.htm

• General References

57 Ways To Protect Your Home Environment (and Yourself) (NCR 583), available on the Internet at http://idea.exnet.iastate.edu/idea/marketplace/57ways/ or by mail from the University of Illinois Marketing and Distribution Center, 1917 South Wright Street, Champaign, IL 61820; (800) 345-6087 or (217) 333-2007; e-mail: acespubs@uiuc.edu.

De Francesco, Dennis, *Farming for Clean Water in South Carolina: A Handbook of Conservation Practices*, South Carolina Department of Natural Resources and United States Department of Agriculture. To order, call your county conservation district office or the S.C. Natural Resources Conservation Service at (803) 765-5419, or visit the website at http://www.scnrcs.usda.gov. This publication is also available in Spanish.

• Curriculum Materials

Teaching Aquifer Protection: A *Curriculum Supplement for Grades 4 - 6* (1990), Cooperative Extension Service, Clemson University. Available from the Clemson University Bulletin Room, 96 Poole Agricultural Center, Clemson, SC 29634-0129, (846) 656-3261; http://www.clemson.edu/psapublishing/.

The Water SourceBook: A Series of Classroom Activities for Grades 3 - 5 (1995) and *The Water SourceBook: A Series of Classroom Activities for Grades 9-12* (1997), Georgia Water Wise Council, 1033 Franklin Road, Suite 9-187, Marietta, GA 30067-8004, (770) 483-9474; http://www.griffin.peachnet.edu/waterwise/wwc.htm.

Action for a Cleaner Tomorrow - A South Carolina Environmental Curriculum (1994), Office of Solid Waste and Recycling, South Carolina Department of Health and Environmental Control, 2600 Bull Street, Columbia, SC 29201, (800) 768-7348.

South Carolina Maps and Aerial Photographic Systems, South Carolina Department of Natural Resources, SC Maps Distribution Center, 2221 Devine Street, Suite 222, Columbia, SC 29205-0222, (803) 734-9100; http://www.eng.clemson.edu/SCMAPS.

Conservation District Offices

County	Address	Telephone	Fax
Abbeville	County Ag. Building 28 Bypass, Rt. 5, Box 354A Abbeville, SC 29620	(864) 459-5419	(864) 459-4467
Aiken	1555 Richland Ave. E., Suite 400 Aiken, SC 29801	(803) 649-4221	(803) 643-8633
Allendale	James Brandt Bldg., Room 111 Allendale, SC 29810	(803) 584-4234	(803) 584-1304
Anderson	1521 Pearman Dairy Rd. Anderson, SC 29625	(864) 224-4201	(864) 224-8914
Bamberg	799 S. Main St. Route 2, Box 400 Bamberg, SC 29003	(803) 245-2555	(803) 245-0054
Barnwell	1091 Virginia Ave. Barnwell, SC 29812-1845	(803) 259-7144	(803) 259-2400
Beaufort	281 Parris Is. Gateway Beaufort, SC 29902	(843) 521-0302	(843) 524-8427
Berkeley	223 N. Live Oak Dr., Room A-7 Moncks Corner, SC 29461	(843) 761-8340	(843) 761-7320
Calhoun	Courthouse Annex, Room 111 St. Matthews, SC 29135	(803) 874-3337	(803) 874-2820
Charleston	2420 Mall Dr., Suite 102 North Charleston, SC 29418-6520	(843) 727-4671	(843) 727-4541
Cherokee	110 Floyd Baker Blvd., P.O. Box 399 Gaffney, SC 29342	(864) 489-7150	(864) 489-2050
Chester	744-B Wilson St. Chester, SC 29706	(803) 581-1908	(803) 581-0852
Chesterfield	Agricultural Bldg. 106 Scotch Rd. Chesterfield, SC 29709	(843) 623-2187	(843) 623-2311
Clarendon	9-B W. Rigby St. Manning, SC 29102	(803) 435-2612	(803) 435-2786
Colleton	531 Robertson Blvd., Suite B Walterboro, SC 29488	(843) 549-1824	(843) 549-6001

County	Address	Telephone	Fax
Darlington	Monzingo Bldg. 300 Russell St., Room 113 Darlington, SC 29532	(843) 393-0483	(843) 395-6827
Dillon	411 W. Hampton St. P.O. Box 609 Dillon, SC 29536	(843) 774-8641	(843) 774-8968
Dorchester	5809 W. Jim Bilton Blvd. St. George, SC 29477	(803) 563-3412	(803) 563-3099
Edgefield	Agricultural Bldg., 304 Gray St. Edgefield, SC 29824	(803) 637-3340	(803) 637-3304
Fairfield	414-B S. Congress St. Winnsboro, SC 29180	(803) 635-4831	(803) 635-2081
Florence	401 W. Evans St., Rm. 248 P.O. Drawer 2028 Florence, SC 29503	(843) 662-4535	(843) 665-8284
Georgetown	1837 N. Fraser St. P.O. Box 573 Georgetown, SC 29442	(843) 546-7808	(843) 546-2243
Greenville	301 University Ridge, Suite 4500 Greenville, SC 29601	(864) 467-2755	(864) 467-7518
Greenwood	120 Main St., Suite B-10 Greenwood, SC 29646	(864) 229-2805	(864) 229-2845
Hampton	1005 Elm St., East Hampton, SC 29924	(803) 943-2367	(803) 943-5743
Horry	1949 Industrial Park Rd., Room 125 Conway, SC 29526	(843) 365-7645	(843) 365-6650
Jasper	406 Main St., P.O. Box 210 Ridgeland, SC 29936	(843) 726-8148	(843) 726-5763
Kershaw	632 W. DeKalb St., Room 210 Camden, SC 29020	(803) 432-2576	(803) 432-5931
Lancaster	1771-A Hwy. 521 Bypass S. P.O. Box 2108 Lancaster, SC 29721	(803) 286-4455	(803) 286-5598
Laurens	221 W. Laurens St., P.O. Box 348 Laurens, SC 29360	(864) 984-6921	(864) 984-3945
Lee	129 Fairview Ave., P.O. Box 726 Bishopville, SC 29010	(803) 484-6325	(803) 484-6554

County	Address	Telephone	Fax
Lexington	219 E. Main St., Rm. 106 Lexington, SC 29072	(803) 359-3165	(803) 359-7506
McCormick	P. O. Box 126 McCormick, SC 29835	(864) 465-2594	
Marion	Rt. 5, Box 651 Marion, SC 29571	(843) 423-1742	(843) 423-0337
Marlboro	210 Throop St. Bennettsville, SC 29512	(843) 479-4552	(843) 459-8386
Newberry	719 Kendall Rd. Newberry, SC 29108	(803) 276-0032	(803) 276-7887
Oconee	301 W. South Broad St. Walhalla, SC 29691	(864) 638-2415	(864) 638-6780
Orangeburg	550 Henley St. NE, Room 103 Orangeburg, SC 29115	(803) 534-2732	(803) 536-5827
Pickens	129 School House St. P.O. Box 245 Pickens, SC 29671	(864) 878-6155	(864) 878-5781
Richland	County Admin. Bldg. 2020 Hampton St., Rm. 3044 Columbia, SC 29202	(803) 929-6080	(803) 929-6034
Saluda	County Ag. Bldg. 201 E. Church St. Saluda, SC 29138	(864) 445-8110	(864) 445-7573
Spartanburg	Federal Bldg. 201 Magnolia St., Rm. 102 Spartanburg, SC 29306	(864) 583-0218	(864) 542-2143
Sumter	Federal Bldg. 101 S. Main St., Rm. 101 Sumter, SC 29150	(803) 773-9222	(803) 773-4174
Union	220 W. Main St., Suite C P.O. Box 200 Union, SC 29379	(864) 429-2801	(864) 427-8364
Williamsburg	208 Short St. Williamsburg, SC 29556	(843) 354-9622	(843) 354-5463
York	13 S. Congress St., Room 5 York, SC 29745	(803) 684-3137	(803) 628-0069

HOME•A•SYST EVALUATION

Please take the time to help Clemson University Cooperative Extension learn how you used these materials.

After answering the questions in this survey, send it to the Home•A•Syst Coordinator by removing this page from the booklet, folding on the lines indicated, taping the edge and mailing it. No postage is required.

1. What did you learn by participating in the Homestead Assessment System?

2. How much time did it take you to complete one of the Home•A•Syst chapters?

3. Number the chapters in order, from most useful (#1) to least useful (#6), according to your situation.

   ___ Chapter 1: Site Assessment

   ___ Chapter 2: Stormwater Management

   ___ Chapter 3: Managing Hazardous Household Products

   ___ Chapter 4: Home Septic Systems

   ___ Chapter 5: Well Water

   ___ Chapter 6: Yard and Garden Care

4. On a scale of 1 to 5 with 1 being the easiest, 5 the hardest, how easy or difficult it was to complete the risk assessment worksheets?

   Chapter 1: Site Assessment
   - ___ Part 1.1 Risk Assessment
   - ___ Part 1.2 Risk Assessment

   Chapter 2: Stormwater Management
   - ___ Part 2.1 Risk Assessment
   - ___ Part 2.2 Risk Assessment

   Chapter 3: Managing Hazardous Household Products
   - ___ Part 3.1 Risk Assessment
   - ___ Part 3.2 Risk Assessment
   - ___ Part 3.3 Risk Assessment

   Chapter 4: Home Septic Systems
   - ___ Part 4.1 Risk Assessment
   - ___ Part 4.2 Risk Assessment

   Chapter 5: Well Water
   - ___ Part 5.1 Risk Assessment
   - ___ Part 5.2 Risk Assessment
   - ___ Part 5.3 Risk Assessment

   Chapter 6: Yard and Garden Care
   - ___ Part 6.1 Risk Assessment
   - ___ Part 6.2 Risk Assessment

5. Do you plan to make any changes in the way you do things around your house as a result of this program?
   If not, why not?

   If so, what changes will you make?

6. Do you use pesticides, herbicides or fertilizers around your home?
   If so, how much and how often?

7. Do you use a lawn care company?

8. Do you use a pest control company?

9. Do you have: _____ a private well, _____a community well or _____city water?

10. Do you have: _____a septic tank or _____municipal sewage treatment?

11. Would you recommend South Carolina Home•A•Syst to others?

12. In which county do you live?

13. What could be changed to improve the South Carolina Home•A•Syst program?

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132 LONG HALL
1 CLEMSON UNIVERSITY
CLEMSON, SC 29631-9980

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For more information, contact:

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E-Mail: rexb@clemson.edu
http://virtual.clemson.edu/groups/waterquality/homasys.htm

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