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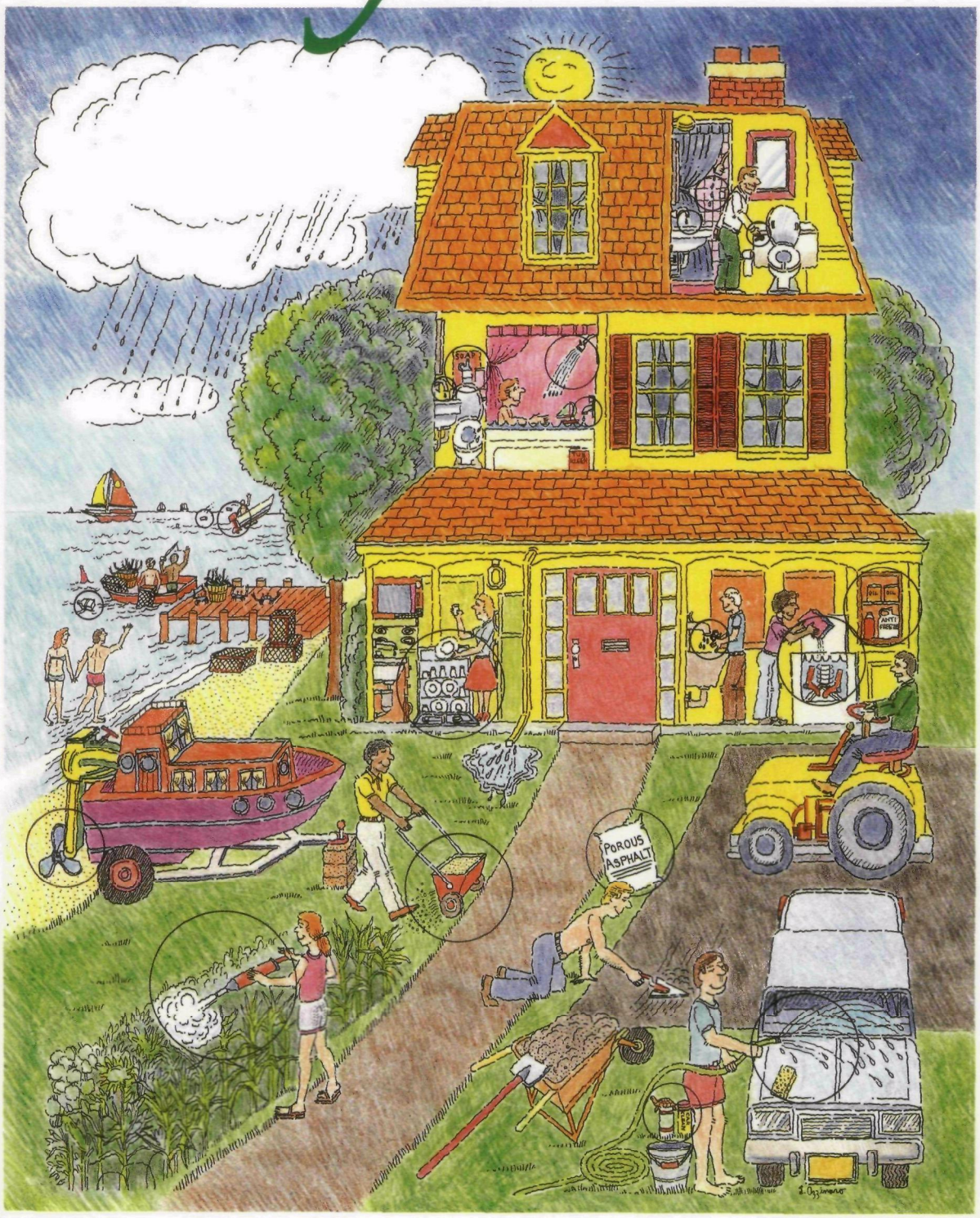
Baybook



A GUIDE TO REDUCING WATER POLLUTION AT HOME

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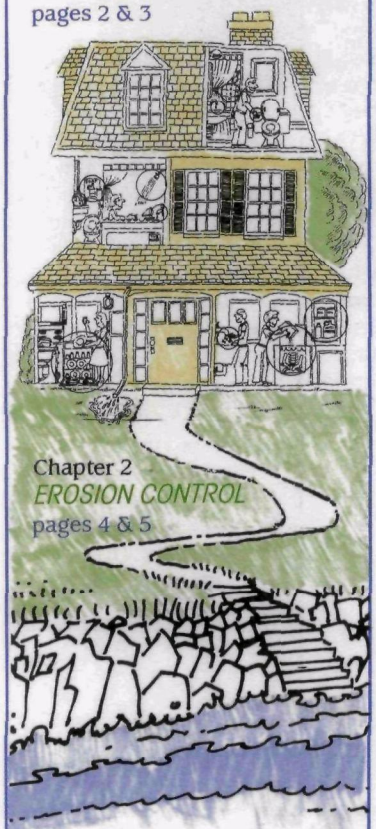
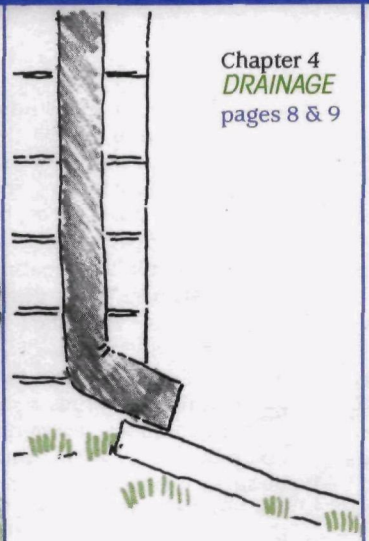
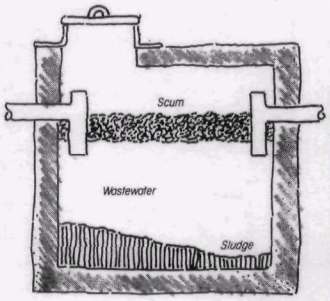
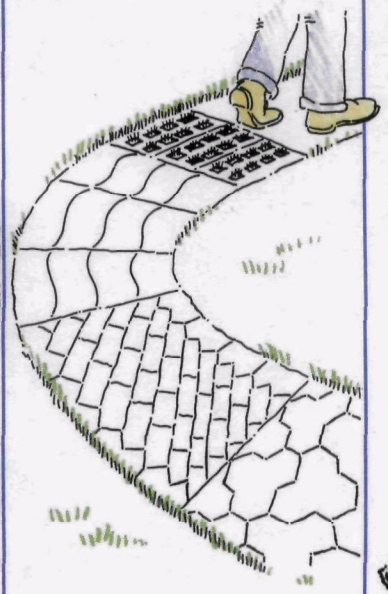
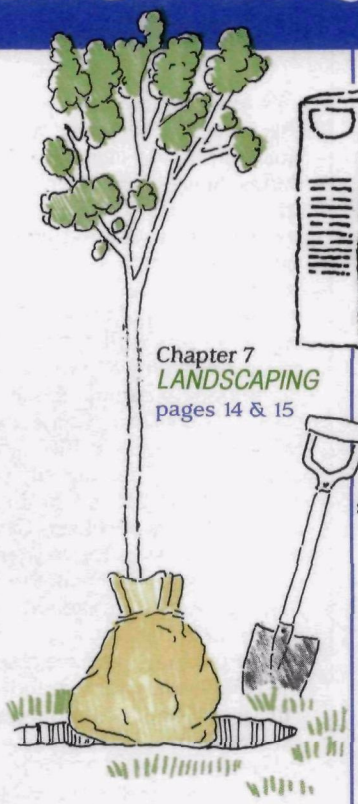
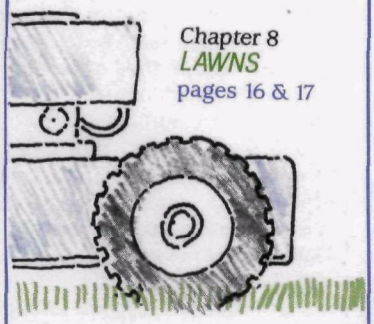


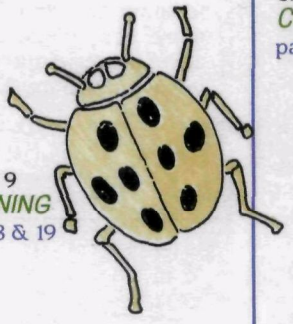


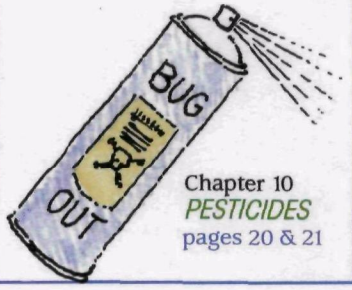


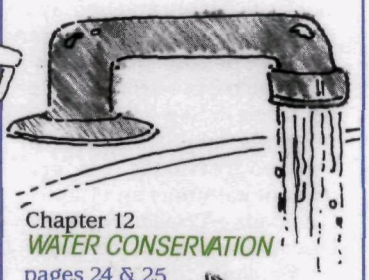


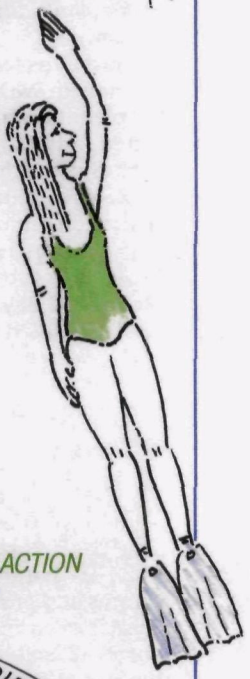


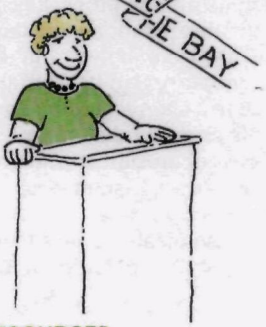












Chapter 1

A People's Bay

It's called a "people's Bay." The Chesapeake Bay watershed is home to more than 15 million people who live on dozens of rivers and thousands of creeks — people who enjoy the beauty and bounty of this immense estuary. Water in the Bay's 64,000-square mile drainage basin — from the Finger Lakes in New York, down the mighty Susquehanna River in Pennsylvania, to the thriving ports of Baltimore and Hampton Roads — provides us with food and recreation, cools our power plants, and fuels our economy.

Most of us tend to take this for granted. We expect clean and plentiful water to swim and boat in, water to nourish the crabs and fish the Bay is famous for, water in abundance when we turn on our taps. But if we don't take steps now to improve the quality of the water in the Chesapeake Bay, the waters we take for granted may one day be gone.

The Home — A Pathway to the Bay

Water is one of the most remarkable compounds in nature. Most of the features and processes of our physical environment — the atmosphere, soil, and all living things — ultimately depend upon its unique properties. Water absorbs more substances than any other liquid, and it is this property that helps make the Bay a chemical repository. It is this property that sustains the process of erosion and sedimentation — the constant washing and sweeping away of minerals, salts, chemicals, sand, silt, and soil from the land into the Bay.

We are an integral part of this process. Every time we wash our hands, clean our drains, or water our lawns, we add our wastes and excesses to the water flowing into the Bay. Heavy sediment loads in the Bay and its tributaries are now a major form of pollution, threatening the aquatic life that depends on clean water to survive. Continuous accumulation of toxic products from home use threaten fish and shellfish, and ultimately threaten our enjoyment of the Bay for swimming and recreation. Fertilizers can deprive the Bay of the oxygen needed to support life in the Bay. Our homes are indeed pathways to the Bay.

For too long, we have taken the Bay's bounty for granted. The largest and most productive estuary in the United States — home to more than 2,700 species of plants and animals — is slowly dying. An extensive seven-year, $27 million Environmental Protection Agency study confirmed that the Bay has been seriously harmed by environmentally unsound decisions made over a period of decades. Growing commercial, industrial, recreational, and urban activities in the Bay area are putting substantial pressure on the Bay's fragile ecology.

It's time we stopped taking the Bay for granted. If it is a people's Bay, then we must make its problems ours if we are to preserve and protect this great national treasure.

The Cleanup Begins

Since the EPA study was released in 1983, the private and public sectors have formed an unprecedented alliance. For the first time, Pennsylvania, Maryland, and Virginia — the three states that share the largest portion of the Bay watershed—and the District of Columbia have formally joined together to implement the EPA study recommendations. They are working on ambitious legislative and budgetary initiatives to address the problems of industrial pollution, agricultural runoff, and fisheries management. Now is the time for ordinary citizens like you and your neighbors to get involved.

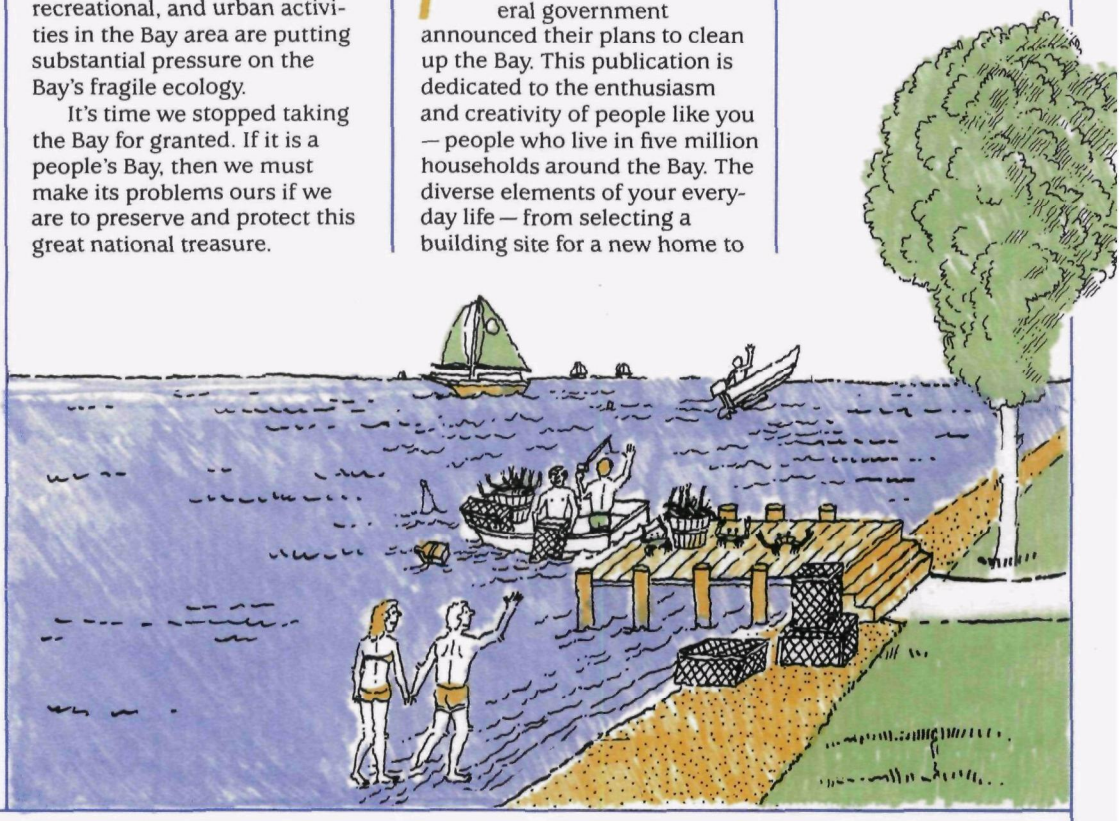
Citizen Participation — A Key Element

Public interest in the Bay has grown since the states and the federal government announced their plans to clean up the Bay. This publication is dedicated to the enthusiasm and creativity of people like you — people who live in five million households around the Bay. The diverse elements of your everyday life — from selecting a building site for a new home to

WHAT YOU CAN DO

In each chapter of this guide, there are specific suggestions about what you can do to improve the quality of life in your home, in your neighborhood, and in the Bay.

- Learn how your daily routines affect the Bay
- Read the Baybook for easy-to-do suggestions about how you can help preserve and restore the Chesapeake Bay

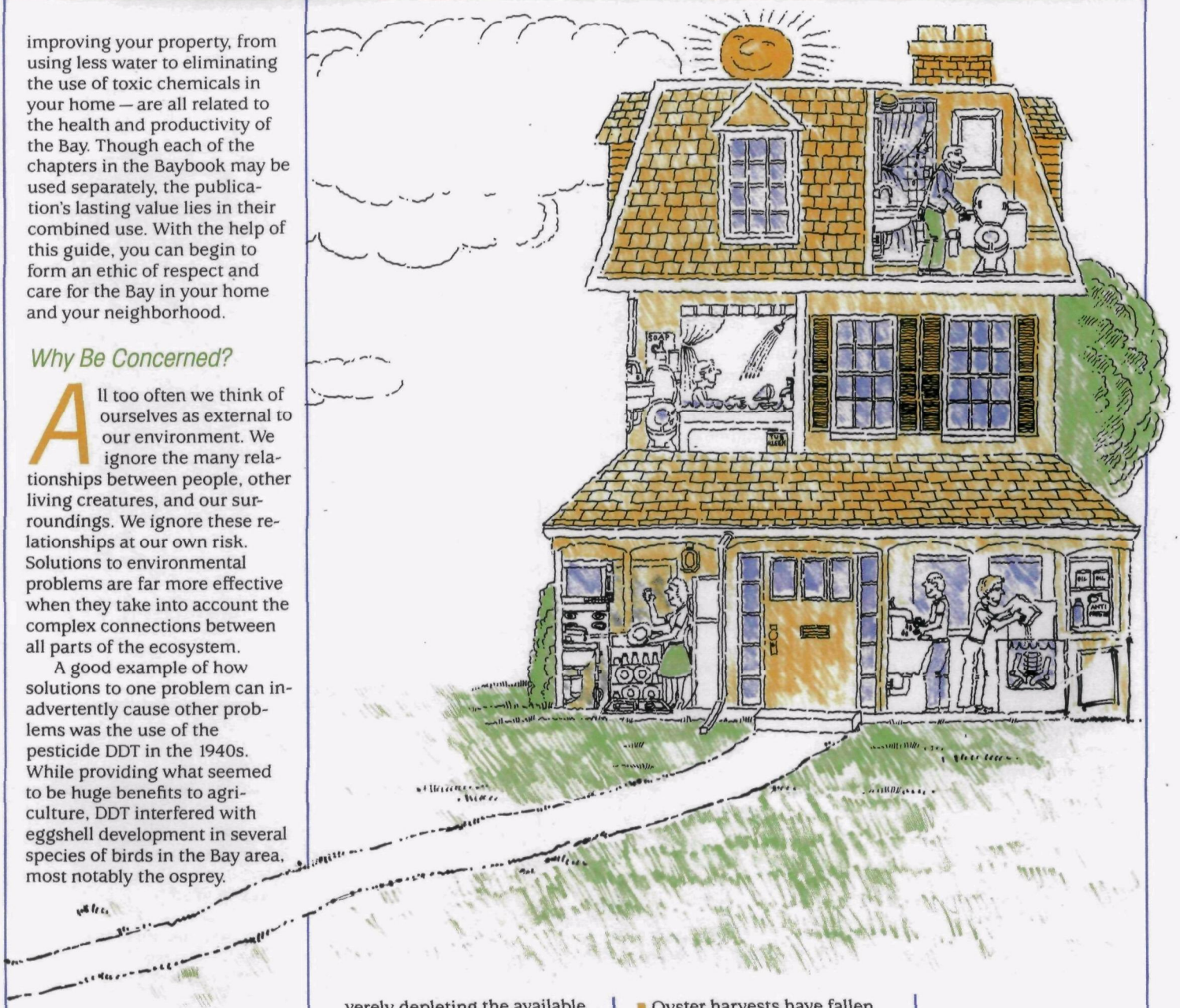


improving your property, from using less water to eliminating the use of toxic chemicals in your home — are all related to the health and productivity of the Bay. Though each of the chapters in the Baybook may be used separately, the publication's lasting value lies in their combined use. With the help of this guide, you can begin to form an ethic of respect and care for the Bay in your home and your neighborhood.

Why Be Concerned?

All too often we think of ourselves as external to our environment. We ignore the many relationships between people, other living creatures, and our surroundings. We ignore these relationships at our own risk. Solutions to environmental problems are far more effective when they take into account the complex connections between all parts of the ecosystem.

A good example of how solutions to one problem can inadvertently cause other problems was the use of the pesticide DDT in the 1940s. While providing what seemed to be huge benefits to agriculture, DDT interfered with eggshell development in several species of birds in the Bay area, most notably the osprey.



DDT is but one instance of how solutions to problems can create new areas of concern about the Bay. Among the many reasons for concern are:

- Overenrichment of the Bay by excessive quantities of nutrients washing off farmers' fields, urban areas, and residential developments and from inadequately treated sewage discharges. Overenrichment is causing massive algal blooms in the Bay, severely depleting the available oxygen in the water and disrupting all aquatic life.
- Submerged aquatic vegetation, which serves as food for waterfowl, a safe haven for juvenile crabs and fish, an anchor against erosion, and a sediment filter, is at the lowest level in the Bay's history. These declines are closely related to changing water quality conditions such as decreasing water clarity resulting from increased nutrient enrichment or higher loads of suspended sediments from dredging or land runoff.
- Oyster harvests have fallen from an average of two to three million bushels per year to 830,000 bushels last year. The Chesapeake Bay supplies a quarter of the nation's oysters. In the last 20 years the oyster business on the Bay has declined noticeably.
- Landings of certain fish species that spawn in the Bay, such as shad and herring have dramatically decreased due to pollution and overfishing. Striped bass (rockfish) stocks are at their lowest in history and their harvest is banned in a large portion of the Bay.

Chapter 2

Streambank Erosion

The Chesapeake Bay is fed by 50 major rivers. These rivers, in turn, are fed by the thousands of creeks and streams, which form an intricate network throughout the 64,000-square mile drainage basin of the Bay. How you manage the land around the stream or creek in your neighborhood helps determine the quality and quantity of the freshwater flowing into the Bay.

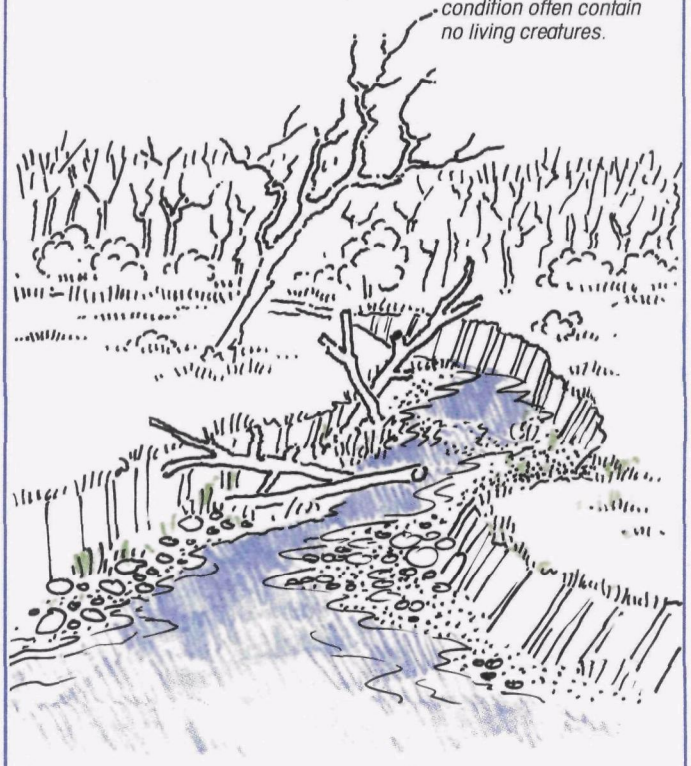
The condition of streams leading to the Bay depends on the answers to these questions:

- Is the stream receiving runoff from lawns, fields, highways, or parking lots?
- Are the banks of the stream unstable?
- Are there outfall pipes discharging sewage into the stream?
- Are failing septic systems polluting the stream?
- Is there a build-up of silt in the stream?
- Are the channels of the stream becoming wider and deeper?
- Are there fallen trees in the stream?

If you can answer yes to one or more of these questions, your stream — and ultimately the Bay — is in danger. Sediment from eroding streambanks can smother aquatic life, clog fish gills, and cut off needed light to underwater plants.

Streambank erosion is typical of urban, suburban, and rural areas where pavement, rooftops, compacted soil, and other impenetrable surfaces prevent rain from filtering down into the soil. As a result of these conditions, rain cannot enter the stream or creek through the groundwater. Instead, rain enters the creek directly, increasing the volume of water and sediment in the stream and causing the streambanks to erode.

You and your neighbors can minimize streambank erosion by taking a few simple steps (see "What You Can Do"). Another important erosion control measure is to make sure your stream is surrounded by plenty of trees. Trees are very important to both the stability of the streambank and the health of the stream itself. Trees should not be cleared away. Their roots are nature's best purifying system because they remove nutrients and sediments harmful

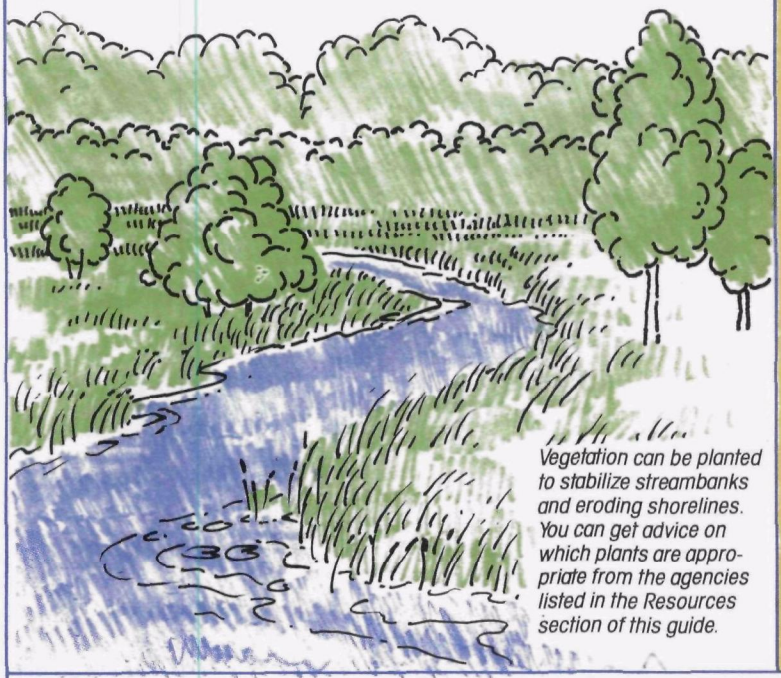


Eroding streambanks are common in suburban areas. Streams in this condition often contain no living creatures.

WHAT YOU CAN DO

Here are a few of the many things you and your neighbors can do to minimize streambank and shoreline erosion in your community:

- Remove obstructions from your creek, marsh, or stream
- Keep people, cars, and grazing animals away from the edge of the water
- Build steps or a ramp between the top and bottom of the bank if you need access to the water
- Avoid heavy loads on the top of streambanks or shoreline
- Control rainfall runoff (see chapter 3)
- Plant and protect vegetation on the slopes of the streambanks and on the areas adjacent to the slope
- Consult a trained engineer about structural solutions for controlling erosion
- Establish marshes to help control shoreline erosion*
- Seek advice from the resources listed in the back of this guide.



Vegetation can be planted to stabilize streambanks and eroding shorelines. You can get advice on which plants are appropriate from the agencies listed in the Resources section of this guide.

**Marshes are particularly important to the Bay ecosystem because they are the habitats for fish and crabs, the base of the Bay food chain. Marshes serve as a buffer against pollution, provide natural protection against erosion by absorbing the energy of approaching waves, and trap sediments that clog the Bay.*

to stream and Bay ecology. Trees provide shade, which decreases the temperature of the stream and creates a suitable environment for fish.

Before you attempt to plant trees on the banks of your neighborhood creek, call your state's forestry department (see the Resources section at the back of this guide) to see which types will do well in your area. Some state forestry departments even sell trees to homeowners at cost.

Sometimes streambank erosion has progressed too far for simple measures. Structural restoration measures may be necessary (see "What You Can Do"). Streambank restoration requires the assistance of a trained professional. In Maryland and Virginia, free advice on structural solutions is available from the state agencies listed in the Resources section. Permits from the Army Corps of Engineers are required for construction along waterways. The state and federal governments also have permit programs designed to protect streambanks and shorelines.

Shoreline Erosion Control

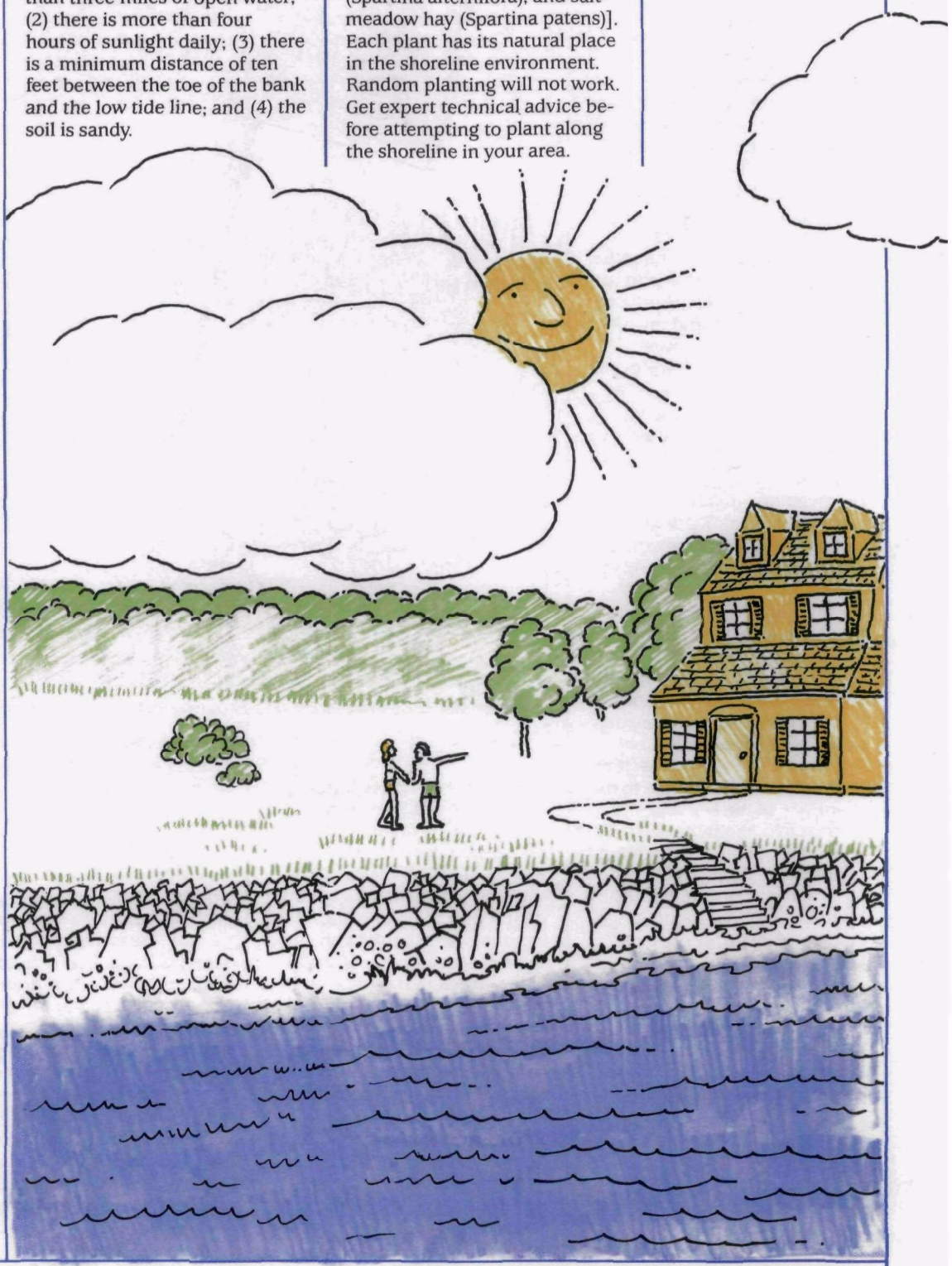
Certain parts of the Chesapeake Bay shoreline are subject to high rates of erosion. Areas with high banks, areas adjacent to open water, and areas subject to prevailing winds can erode an astonishing 10 to 12 feet per year. We contribute to this erosion by boating, clearing shorefront areas, altering marshes, and building close to the shoreline.

Shoreline and streambank erosion control strategies share many of the same techniques. Structural solutions to shoreline erosion problems can be expensive, work with varying success, and can cause erosion along other parts of the shoreline. Vegetative planting is less expensive and, in many situations, can be just as effective as structural solutions. Vegetation cannot provide protection in severe exposure situations, and it requires more maintenance. Vegetation is also susceptible to human disturbance and must be protected against people and cars.

Vegetative erosion control may be an alternative if: (1) the shoreline is adjacent to less than three miles of open water; (2) there is more than four hours of sunlight daily; (3) there is a minimum distance of ten feet between the toe of the bank and the low tide line; and (4) the soil is sandy.

If the shorefront meets these conditions, vegetative planting may be a feasible alternative to structural erosion control. Only a few plants will grow in this shoreline zone [American beachgrass (Ammophila breviligulata), smooth cordgrass (Spartina alternifora), and salt-meadow hay (Spartina patens)]. Each plant has its natural place in the shoreline environment. Random planting will not work. Get expert technical advice before attempting to plant along the shoreline in your area.

Correcting shoreline erosion sometimes requires structural solutions, such as constructing stone revetments (ripraps). On steep banks, build steps to give you access to the beach.



Chapter 3

Protect Your Investment

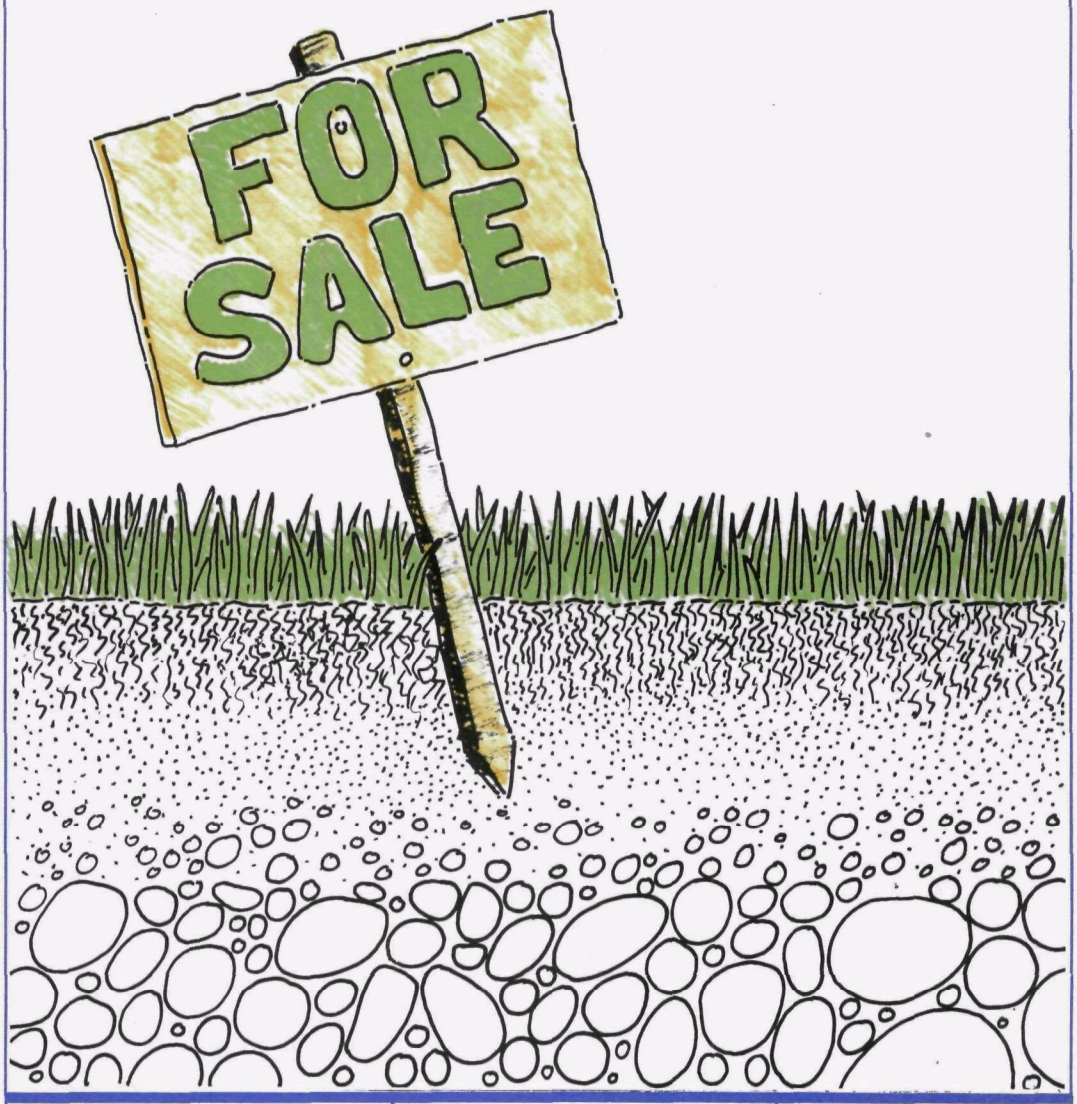
Buying or building a home is the biggest investment most of us will ever make. It's not a decision to leave to chance. Everyone checks out what's above the ground, but how many check below it?

It's important from both an economic and environmental standpoint to find out the type of soil on the site you are planning to buy. Building on the wrong soil can result in costly problems such as cracked foundations or flooded basements. It can also lead to water quality problems due to erosion, flooding, and improper filtration of sewage.

There are hundreds of soil types in the Chesapeake Bay watershed. Each soil has its own characteristics caused by parent material; percentage of sand, silt, or clay; slope; color; permeability; depth to bedrock; water table; and flooding. You can find out about your soil by checking the published soil survey for your county. Soil surveys contain aerial photographs showing the location and extent of each kind of soil. Soil surveys can help you answer the following questions:

- Will your basement stay dry or flood periodically?
- Can you use a septic system or will the effluent rise to the surface of the soil and present a health hazard?
- Is the lot subject to flooding or soil erosion?

Soil surveys are published by the U.S. Department of Agriculture's Soil Conservation Service (SCS) in cooperation with state agencies. Copies are on file at your local SCS, County Extension Service offices, and at most major public libraries.



There's more to soil than meets the eye. The soil surveys for your county will tell you about permeability, soil type, location of the water table, and flooding potential of the property you're thinking about buying.

Checklist for House Hunters

If you are house hunting, there are some visible signs of problem soil that you can look for. One easy way to identify wet soil is by the kind of vegetation growing on it. Common plants found in wetlands are skunk cabbage, rushes, sedges, cattails, and alder. Trees that grow well in wetlands include elm, pin oak, red maple, willow, sweet gum, or Southern red oak. Check with your county government to see if it has any regulations concerning development in wetland areas.

If you walk across an area and it seems soft and spongy, especially when it has not rained for a while, suspect poor drainage. Have a soil scientist investigate the site to verify the degree of wetness and suggest ways of dealing with the situation.

Before you build, consider carefully where you will place your house. Nearly level areas at the base of hills often tend to be wet. Areas adjoining streams flood. Ponds can form in depressions in the ground. Steep slopes can entail additional construction costs, and you may face potentially serious surface runoff problems. Concave areas and drainage ways tend to be wet and flood during storms. You can save yourself worry and expense by looking for these problems before you buy, instead of paying for them later.

Septic Systems

The soil characteristics that affect the functioning of septic systems are permeability, depth, water table, and slope. Proximity to streams, lakes, and the Bay are also important considerations when you are planning to install a septic system.

Permeability is the rate at which water, or effluent, moves through the soil. It is influenced by soil texture and drainage. It's best to install septic systems in moderately permeable soil. Effluent moves too quickly through sandy soil to allow enough time for treatment, causing groundwater or well pollution. Effluent travels too slowly through tight-grained clays and may cause plumbing backups or puddles to form on the ground around your home.

A *high water table* or impermeable layer near the surface are two factors that restrict soil depth. If the soil is not sufficiently deep, effluent from the septic system can't be properly absorbed and treated. Moderately permeable soils should be at least six feet deep above the impermeable layer.

Texture is determined by the percentage of sand, silt, or clay in the soil. Most soils are a combination of these materials.

Groundwater is the level to which the water rises in an excavated pit or hole. Groundwater levels can vary drastically from season to season. That's why health agencies require wet weather "perk" tests. They test soil percolation rates during the time of year when the ground is most saturated. If the perk rate is good then, your septic system should work well year round.

Steep slopes can cause construction and maintenance problems for septic systems. Controlling the downward flow of effluent is difficult because the effluent may move through the soil so rapidly that it collects in messy wet spots at the base of the slope. If the effluent should hit a dense layer of clay or rock in a slope, it will be forced to the surface and run down the face of the slope unfiltered.

Government regulations require that septic absorption areas be installed at a sufficient distance from streams, lakes, drainage ditches, flood plains, and the Bay. By placing the system far enough away from Bay waterways, you help ensure that the effluent won't have a chance to move sideways through the soil, causing health and pollution problems.

Your house may not sit on top of a hill, but to avoid drainage problems, make sure the ground is graded away from the house at a slope of one percent or more on all sides.

WHAT YOU CAN DO

One way you can avoid drainage problems in and around your home is to use this checklist while house hunting. By considering these factors before you buy or build, you will save yourself time and money.

Here are some things you should look for:

- Cracked basement or foundation
- Water stains on basement walls
- Standing water in basement
- Bright green spots in lawn (septic system malfunction)
- Sewage odor in basement
- Puddles of effluent on lawn
- Home site on same elevation as adjoining stream or river
- Wetland vegetation or conditions
- Soft, spongy ground
- Steep slopes
- Drainage ways
- Depressions in the soil surface

Chapter 4

Rainy Day Blues

How rain water moves over and through the ground is important to those of us who have experienced flooded basements, wet yards, or broken septic systems. Solving the problems associated with surface water runoff and poorly drained soil is also important to improving the health of the Chesapeake Bay.

Rain from roofs and driveways runs off, often eroding yards and destroying plants. Much of the soil washed off vacant lots and lawns is carried into streams and eventually reaches the Bay. This sediment smothers fish and shellfish. Nutrients, such as nitrogen and phosphorus from fertilizer in runoff, can cause excessive algae growth, using up oxygen needed by the Bay's aquatic life. This runoff may also contain pesticides, oil, antifreeze, and other substances toxic to life in the Bay.

Pollution also occurs when the soil is too wet to filter sewage outflow. Effluent can percolate into the groundwater without proper filtration, or it can rise to the surface and be carried into streams and drainage ways.

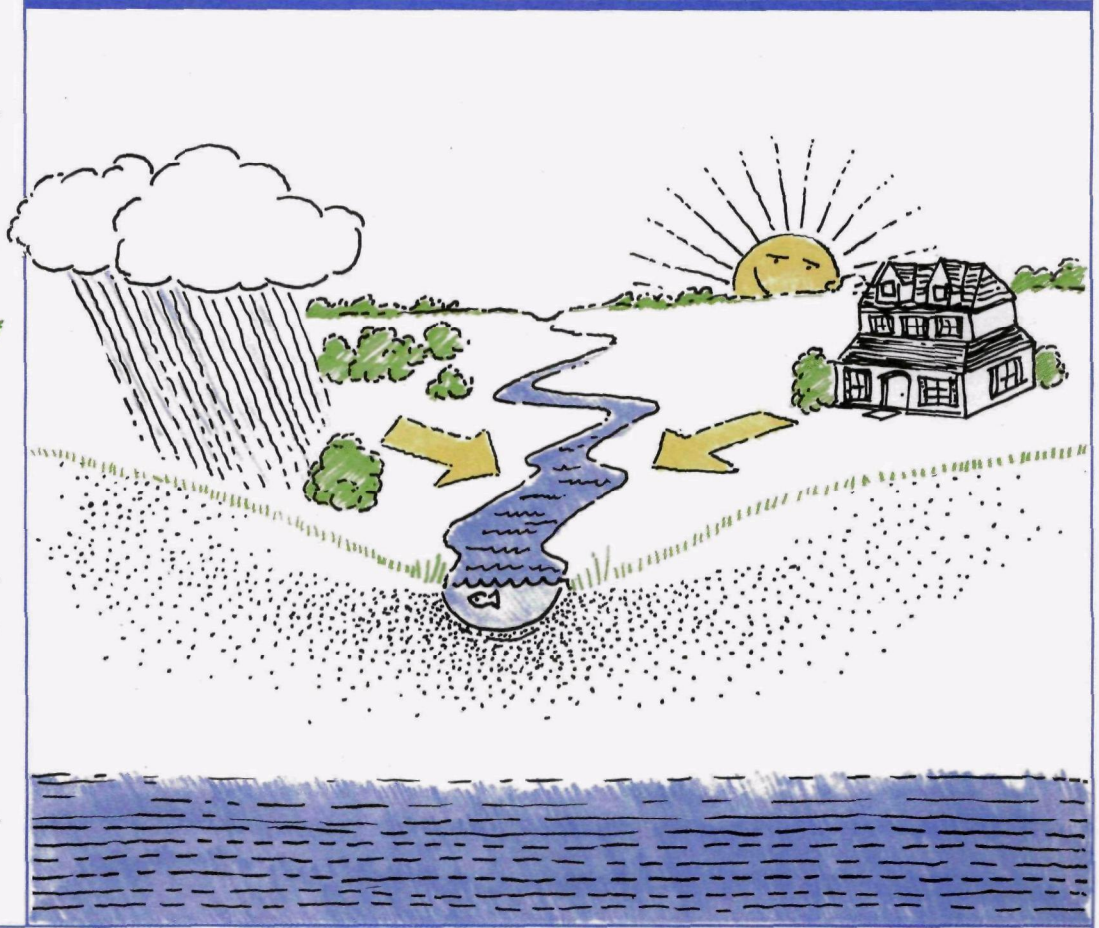
Dealing with Surface Runoff

On large tracts of land, controlling surface water flow (storm water management) is the developer's responsibility. There are inexpensive ways you can control excess runoff created by patios, driveways, sidewalks, and swimming pools. Whatever the soil drainage condition in your neighborhood, you can use swales, berms, and basins to control runoff on your property, reduce its speed, and increase the time over which the runoff is released. For example, land immediately adjacent to your house needs to have a downhill slope so that water does not seep through the foundation. Once the water has been carried ten feet from the house, you should regrade the surface so that runoff is released gradually.

Where drainage is good or where infiltration devices are in use, you can regrade the land to create a basin, which holds all runoff and allows it to infiltrate the soil over a longer period of time. The effectiveness of a basin depends on the soil's ability to absorb and filter the surface water. Soils with less than two feet of depth to bedrock or one foot of depth to a seasonally high water table, soil having a high clay content or a clay hardpan beneath the surface, and low-lying soil that receives runoff from a large land area may not have sufficient infiltration capacity. When you try to retain runoff in these situations, the soil will rapidly become saturated, and rainfall that should filter down through the soil will collect on the surface and either create health, safety, and use problems or move across the surface as excess runoff.

Be on the lookout for small wet patches in your yard. These wet spots mean that the soil around your house has settled and surface water is collecting on the ground. Plant growth is usually poor in these areas and erosion often occurs. Filling these pockets with topsoil and seeding them with grass will usually solve the problem by letting water flow on its natural path.

In some instances, you may be able to correct an existing wet soil problem by creating a system of berms and swales around your yard. When it's not feasible to avoid a wet area, you may be able to move it to a less used area of the yard (around shrubs or trees, for example) by installing a swale to carry the water across the yard. Plant the new



Rainwater runs downhill — some filtering through the soil, some running directly into nearby streams. By encouraging rainwater to move slowly across the soil so most of it filters into the ground, you will help prevent erosion problems.

wet area with the kinds of trees and shrubs that thrive in wet soils. There are some instances where a system of swales will not solve your drainage problem, and you will have to consider installing a subsurface drainage system.

Installing Infiltration Devices

The installation of various infiltration devices can enhance infiltration even on sites with well-drained soils. It is important to remember that surface runoff cannot infiltrate soils that are at or past their saturation point (by virtue of depth to water table or bedrock), contain a high percentage of clay, or rest on a clay hardpan. Under these conditions, surface runoff cannot infiltrate the soil even with an infiltration device.

Using berms and swales, you can speed site infiltration by channeling surface runoff into a gravel-filled seepage pit, a Dutch drain (see illustration), or a gravel-lined detention basin. You can also spread runoff over the land surface by using a series of terraces or runoff spreaders, which promotes greater infiltration by slowly spreading runoff in a fanshaped pattern across a vegetated land surface. Seepage pits, gravel-lined recharge basins, and terraces lose their effectiveness as infiltration devices when the land surface is clogged with clay, silt, or fine sand particles. Infiltration devices for large parcels of land are often constructed along with sediment traps, basins, or grassed sediment filters. These traps and filters remove fine particles from runoff before they reach the infiltration device. Sediment traps are less critical for most residential lots; most homeowners can use a system of swales or basins leading to the infiltration device as a sediment filter.

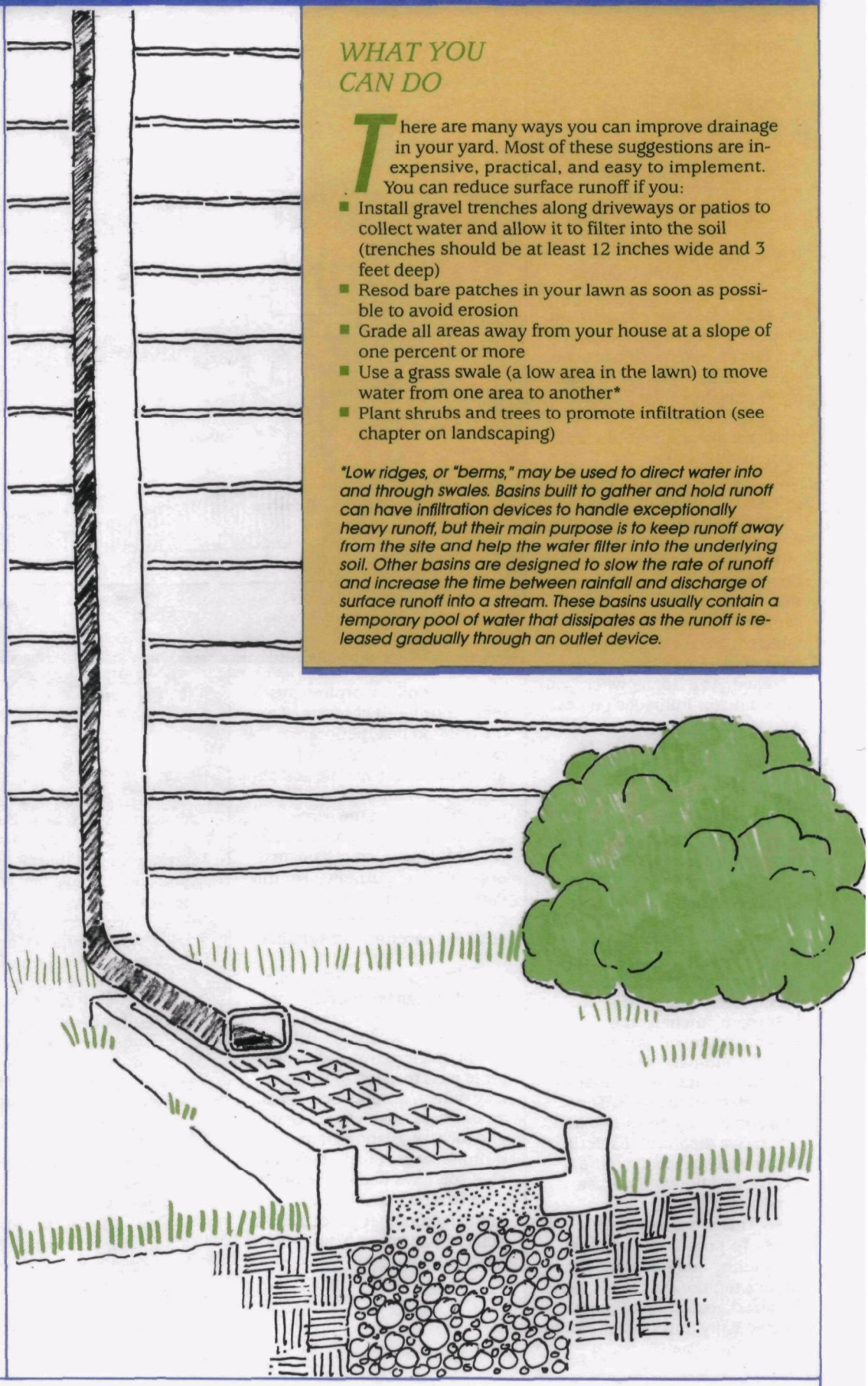
Dutch drains carry water from rainspouts into the soil, where it gradually filters into the ground.

WHAT YOU CAN DO

There are many ways you can improve drainage in your yard. Most of these suggestions are inexpensive, practical, and easy to implement. You can reduce surface runoff if you:

- Install gravel trenches along driveways or patios to collect water and allow it to filter into the soil (trenches should be at least 12 inches wide and 3 feet deep)
- Resod bare patches in your lawn as soon as possible to avoid erosion
- Grade all areas away from your house at a slope of one percent or more
- Use a grass swale (a low area in the lawn) to move water from one area to another*
- Plant shrubs and trees to promote infiltration (see chapter on landscaping)

**Low ridges, or "berms," may be used to direct water into and through swales. Basins built to gather and hold runoff can have infiltration devices to handle exceptionally heavy runoff, but their main purpose is to keep runoff away from the site and help the water filter into the underlying soil. Other basins are designed to slow the rate of runoff and increase the time between rainfall and discharge of surface runoff into a stream. These basins usually contain a temporary pool of water that dissipates as the runoff is released gradually through an outlet device.*



Chapter 5

How Well Does Your Septic System Work?

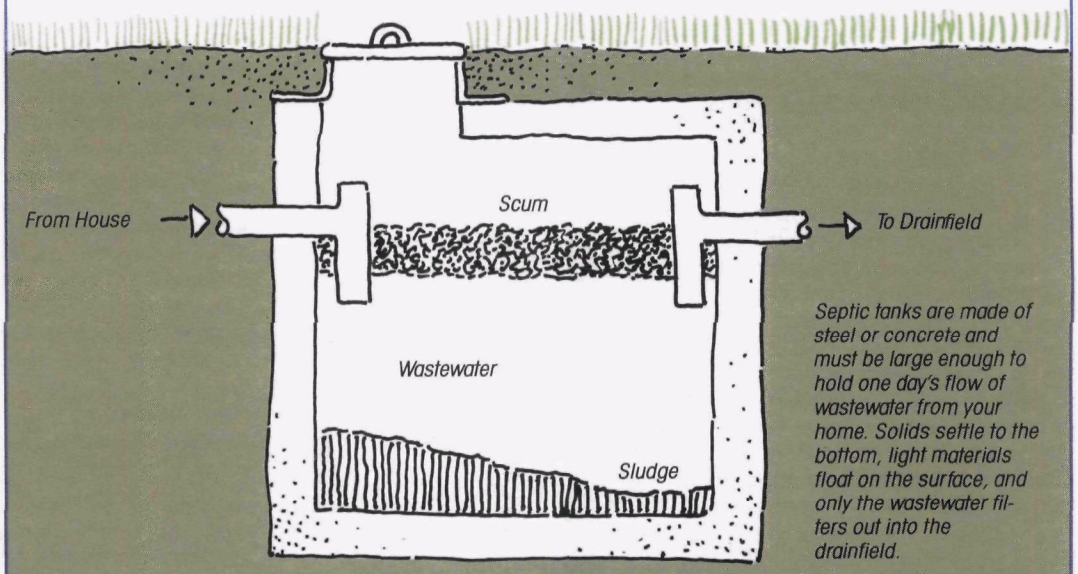
Nearly 24 percent of all homes in the United States are served by septic systems. Thirty percent of all homeowners in the Chesapeake Bay drainage basin rely on septic systems to treat and dispose of household wastewater. Because so much has been said recently about water quality, especially in the Bay area, you might wonder how environmentally acceptable septic systems really are.

Years of experience have proven that properly designed, installed, and maintained septic systems have little adverse effect on the environment. Government regulations ensure that septic systems conform to certain standards, and a reputable contractor can make sure your system will be properly installed. As a homeowner, you have a major influence on how well your septic system works.

How Septic Systems Function

Septic systems have two key components—a septic tank and a soil absorption system. The septic tank is a container, usually prefabricated from concrete according to a relatively standardized design. It receives wastewater from your bathroom, kitchen, and laundry room, allowing the heavy solid particles to settle and light materials to float to the surface of the tank. These materials become sludge and scum (*see diagram*). Bacteria in the wastewater feed on the sludge and liquify the waste products.

This process requires time. To permit enough time for settling and flotation, regulations require that septic tanks be sized according to the expected daily flow of wastewater from your home.



Septic tanks are made of steel or concrete and must be large enough to hold one day's flow of wastewater from your home. Solids settle to the bottom, light materials float on the surface, and only the wastewater filters out into the drainfield.

The soil absorption system (drainfield) consists of a distribution box, perforated distribution lines made of tile, and an area of soil. The soil absorption system receives wastewater from the septic tank and removes harmful, disease-causing microorganisms, organics, and nutrients. For this part of the system to function properly, it must be constructed carefully on suitable soil.

The soil also needs time to filter out these harmful materials from the wastewater. "Suitable soils" do not include sand (which permits wastewater to pass through too fast) or clay (which accepts only small amounts of wastewater). State and local regulations that determine what constitutes suitable soil have been developed after careful consideration of many factors that affect a soil's ability to adequately treat domestic wastewater.

WHAT YOU CAN DO

Maintenance is the single most important consideration in making sure a septic system will work well over a long period of time. Too often homeowners forget that whatever goes down the drain or toilet ultimately either finds its way into the soil or remains in the septic tank until it is pumped out. Use common sense and you should have few problems with your septic system.

The following maintenance practices will keep your system running smoothly:

- Know the location of all components of your septic system; keep heavy vehicles away from the system
- Don't plant trees or shrubs near drain tiles since their roots can clog drain lines
- Dispose of household chemicals properly—do *not* pour them down the toilet or drain; they can destroy the bacteria in the septic tank
- Distribute your laundry chores throughout the week to avoid overloading the system on any given day
- Don't use garbage disposals; they contribute unnecessary solids and grease to your septic system
- Conserve water whenever and wherever possible
- Don't use toilets as trash cans
- Monitor your septic tank yearly and have a reputable contractor remove sludge and scum every three to five years. (This helps ensure that there is enough space in the tank for wastewater, and prevents solids from escaping into the absorption system.)

Why Worry?

The threat of disease is a key problem with treating human wastewater. The epidemics that killed millions of people in the Middle Ages were caused by mixing of human waste with drinking water supplies. Domestic wastewater contains bacteria and viruses that cause dysentery, hepatitis, and typhoid fever. To protect your health, it's important to exclude these organisms from both surface and groundwater. That is why sewage treatment plants use chlorine and other biocides (substances destructive to many organisms). Fortunately, soil and soil bacteria can effectively remove pathogenic (disease-causing) microorganisms from wastewater treated in a properly functioning septic system.

Nutrients such as nitrogen and phosphorus, contained in domestic wastewater, can cause both health and nuisance problems if allowed to reach surface or groundwater supplies. Nitrogen in its nitrate form poses the most significant threat to our health. When ingested by infants, nitrate can interfere with the blood's ability to carry oxygen, causing "blue baby" syndrome. Nitrogen carried in septic tank wastewater is usually in the form of ammonia. This ammonia is readily transformed into nitrate, which can easily become part of ground and surface water supplies.

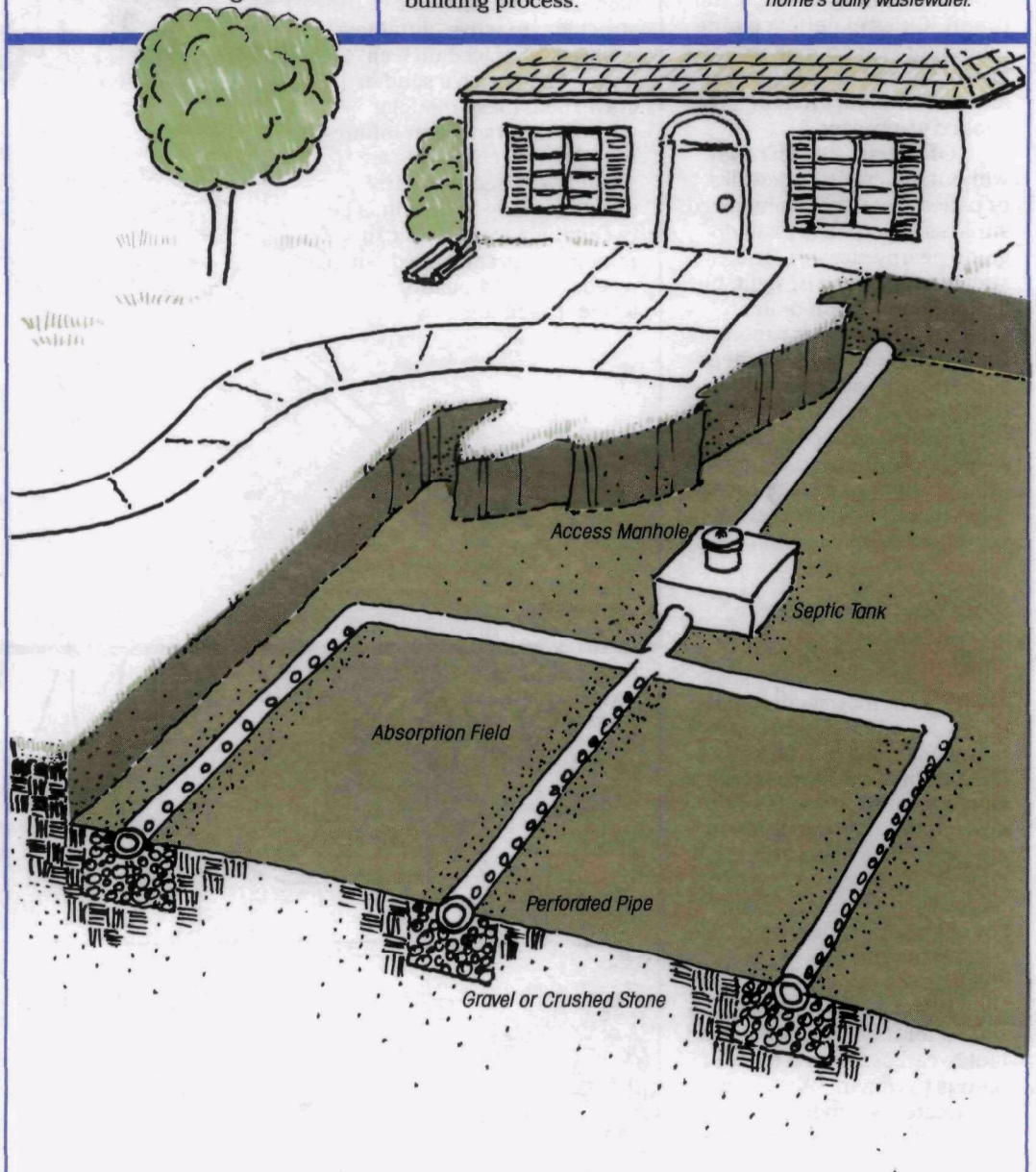
Nutrients also fuel the growth of algae and are responsible for the subsequent loss of oxygen, causing serious problems for the Bay. The EPA study confirmed that excessive nutrients are responsible for serious water quality problems in the Bay.

System Failures

Design, construction, or maintenance problems are usually responsible for septic systems that are not working well. The principal signs of design problems are easy to detect—effluent rising to the ground or drains and toilets that operate sluggishly or not at all. These problems occur because the drainfield is either too small or is located on the wrong kind of soil.

Before a septic system is built, most health agencies require a "perk" (percolation) test to determine how fast the soil absorbs water. Soil examination by a professional soil scientist can provide an even more reliable assessment of the capacity of soil to accept wastewater. When designing a system, your builder should check the water table level to be sure it is at least four feet below the septic drainfield.

Construction problems and failures include tile laid on improper grades, incorrect joints and alignments between system components, and tiles broken or crushed during the building process.



The drainfield, or absorption system, is critical to how well your septic system functions. Perforated tile pipes must be laid in suitable soil, away from tree roots and manmade structures. The drainfield must be a large enough area to absorb your home's daily wastewater.

Chapter 6

Help Prevent Erosion

Most people in the Chesapeake Bay drainage basin live in cities and suburban areas. These areas are characterized by acres of hard surfaces—roads, rooftops, and parking lots. In contrast to forests and fields, which allow rainwater to soak in, these impermeable surfaces force more and more rainwater to run off. Every storm increases the volume and velocity of rainwater runoff. Cities experience nine times more runoff than wooded areas, causing flooding, topsoil and streambank erosion, and choked waterways.

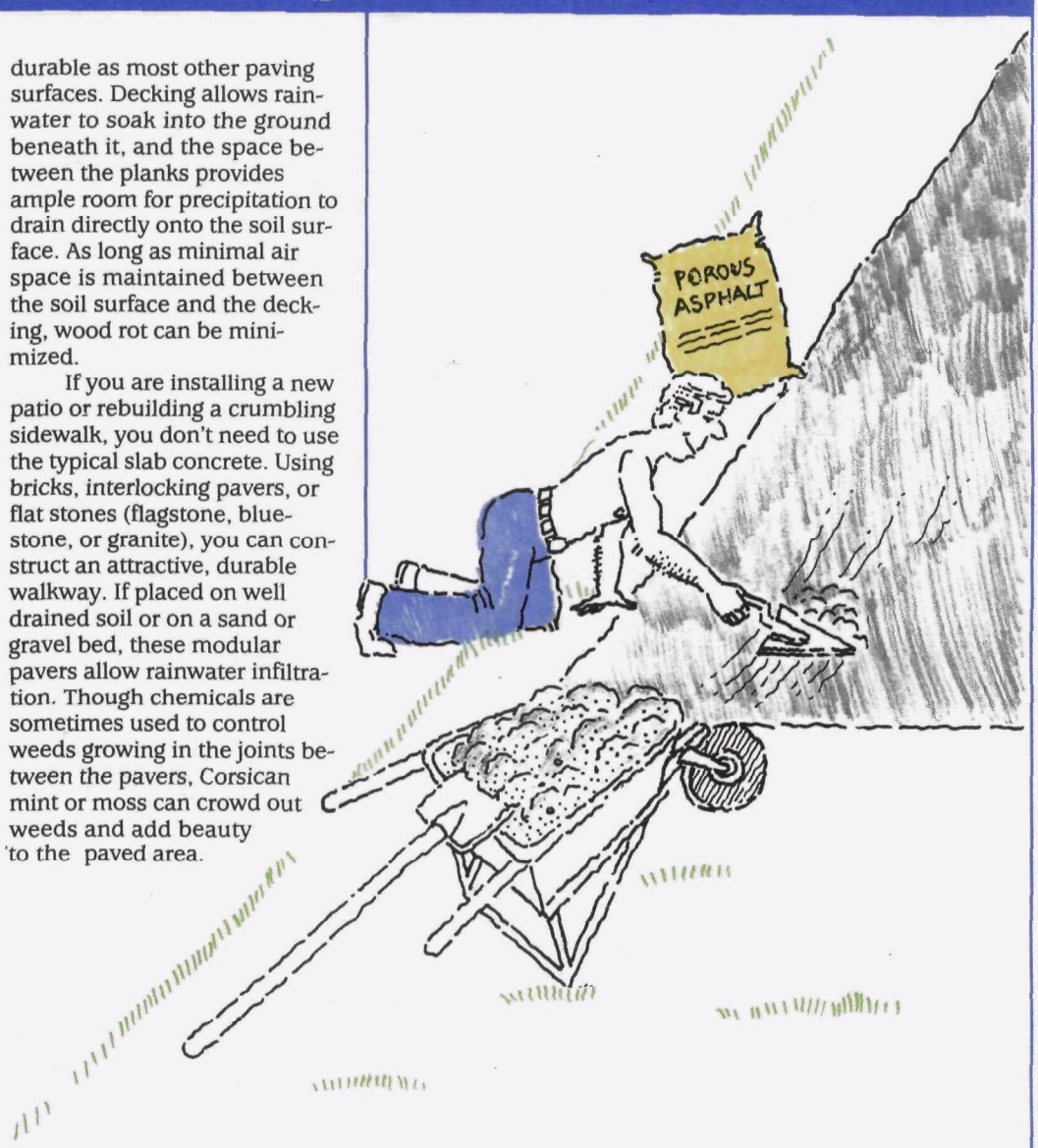
Of course, we can't live without driveways, sidewalks, or patios. But water from paved surfaces and rooftops can degrade nearby streams. The stream may be out of sight, but underground storm drains often carry rainwater runoff from the impervious surfaces surrounding your home directly into a nearby stream. By using paving surfaces that allow rainwater to soak into the ground, you can reduce excessive rainwater runoff and help prevent erosion.

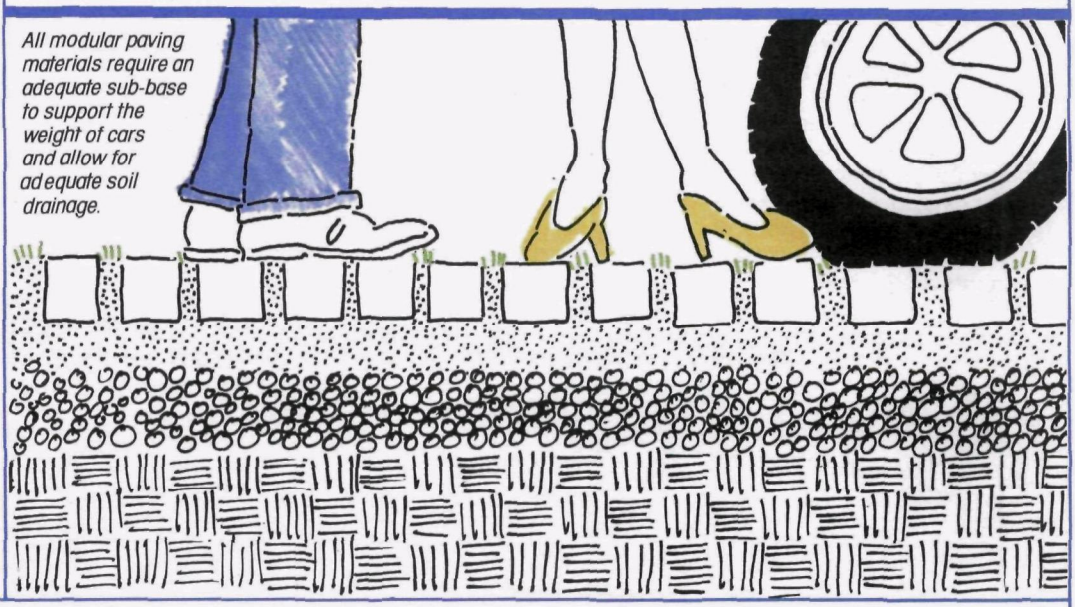
Permeable Paving Surfaces

A paving surface that allows water to soak in may seem impossible, but there are many materials that provide the durability of concrete while allowing rainwater to filter down into the ground. If you are planning a new patio, walkway, or driveway, and your home site has favorable soil conditions, there are several attractive alternatives to concrete.

Wood decks, usually installed for their functional good looks, can serve as a form of porous pavement. Redwood and treated Southern pine (the two most commonly used deck materials in this region) are as durable as most other paving surfaces. Decking allows rainwater to soak into the ground beneath it, and the space between the planks provides ample room for precipitation to drain directly onto the soil surface. As long as minimal air space is maintained between the soil surface and the decking, wood rot can be minimized.

If you are installing a new patio or rebuilding a crumbling sidewalk, you don't need to use the typical slab concrete. Using bricks, interlocking pavers, or flat stones (flagstone, bluestone, or granite), you can construct an attractive, durable walkway. If placed on well drained soil or on a sand or gravel bed, these modular pavers allow rainwater infiltration. Though chemicals are sometimes used to control weeds growing in the joints between the pavers, Corsican mint or moss can crowd out weeds and add beauty to the paved area.





All modular paving materials require an adequate sub-base to support the weight of cars and allow for adequate soil drainage.

Pre-cast concrete lattice pavers also rest on a bed of sand and gravel and allow rain to soak slowly into the ground. These kinds of paving materials can be used wherever natural soil drainage is good and there are no problems with either bedrock near the surface or seasonal high water. Lattice pavers won't work on clay or other soils that are already saturated with water.

Significant strides have been made in developing porous asphalt pavement in the last three decades. This material is similar to conventional asphalt in durability, but it contains a much smaller percentage of very fine particles. As a result, the asphalt allows water to soak through to the base material and into the soil below. Almost twice as much porous asphalt must be applied to achieve the same strength as conventional asphalt. The finished surface must be protected from excess silt and fine sand so that its pores don't become clogged. You can use porous asphalt on your new driveway or encourage its use on streets and parking lots in your community.

Diverting Rain From Paved Surfaces

For many years, pavement construction standards called for any rain reaching a paved surface to be controlled and directed by a system of pavement and pipe drains. Roof downspouts spill onto driveways that are graded down to street gutters, which, in turn, lead to storm-drains that dump the accumulated rainwater directly into streams. The destructive torrents of this collected rain have helped erode countless streambanks. In some urban areas, storm drains and sanitary sewers are combined, which means that after a storm, untreated sewage could spill directly into your neighborhood creek.

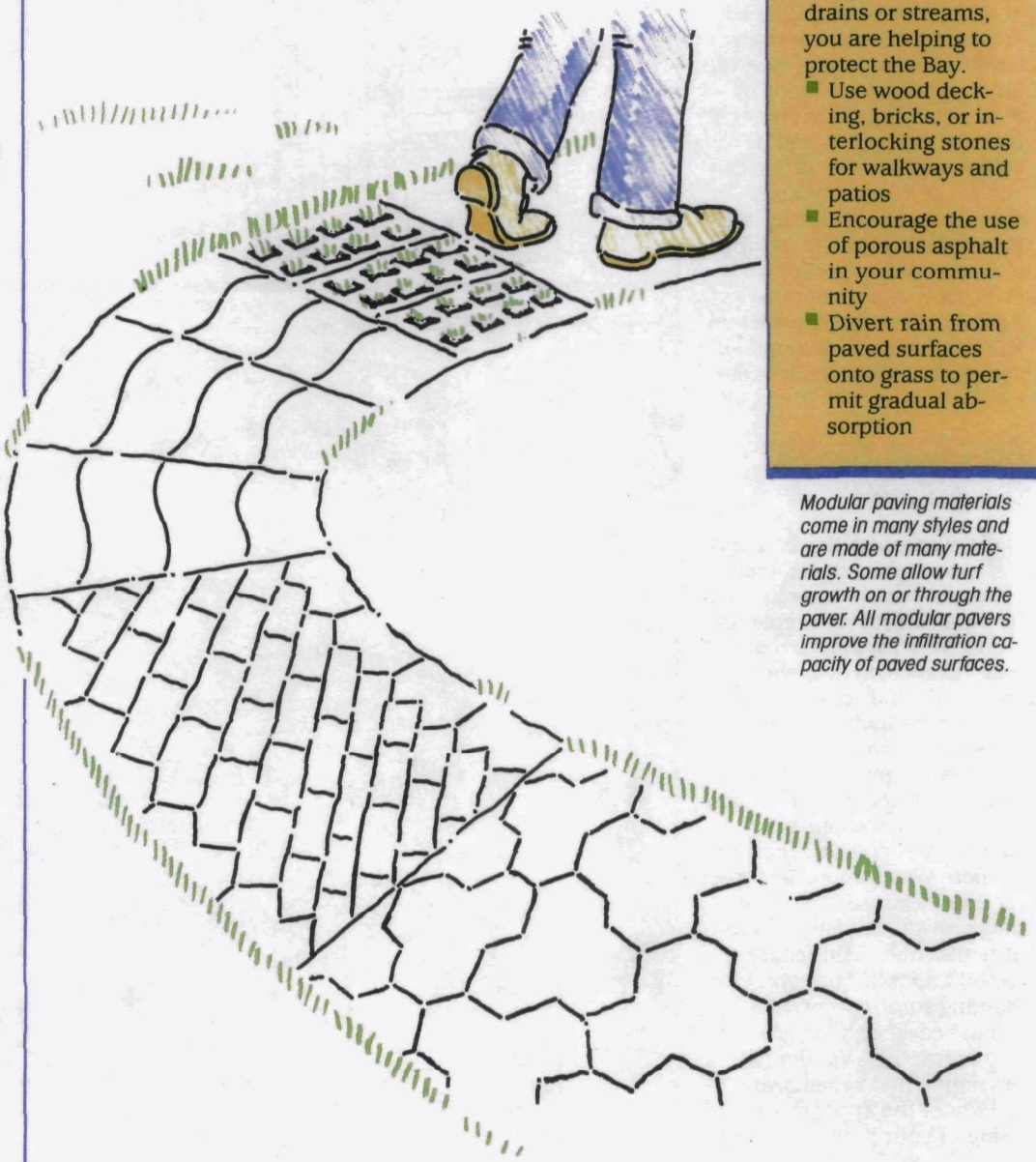
In places with good soil drainage you can capture, spread, and infiltrate rainwater runoff from paved areas and roofs to minimize the erosive force of the flowing water. Though many sidewalks and driveways are appropriately graded to spread runoff onto lawn areas where it can soak in, steep slopes, poor grading, or concentrated flow from downspouts can sometimes cause destructive and unsightly erosion. In these cases, stabilizing the eroding area where runoff leaves the pavement can dissipate the water's erosive force and allow infiltration. Dense vegetation, mulch (possibly held in place by nylon netting), or gravel can serve this purpose.

If the volume of runoff can't be effectively controlled, the runoff can be captured as it leaves the paved surface. The water can be channeled and spread to either a low-lying grassy area or a series of terraces, both of which allow gradual absorption into the soil. In more severe cases, gravel-filled seepage pits along the pavement's edge or Dutch drains can be used to take in large volumes of runoff and encourage infiltration.

WHAT YOU CAN DO

Think about the ultimate destination of rainwater. Consider the erosive force of runoff from the paved surfaces that are part of our daily lives. When you take steps to channel that runoff into areas where it can filter slowly through the soil instead of running directly into storm-drains or streams, you are helping to protect the Bay.

- Use wood decking, bricks, or interlocking stones for walkways and patios
- Encourage the use of porous asphalt in your community
- Divert rain from paved surfaces onto grass to permit gradual absorption



Modular paving materials come in many styles and are made of many materials. Some allow turf growth on or through the paver. All modular pavers improve the infiltration capacity of paved surfaces.

Chapter 7

Where Does the Rain Go?

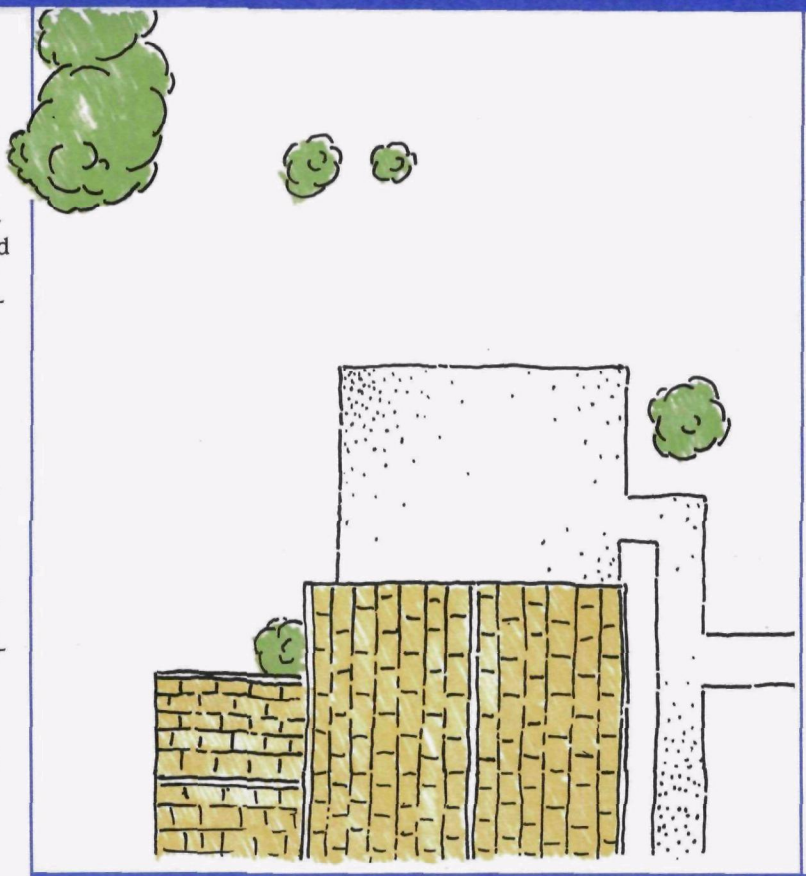
You probably don't realize that the rain falling on homes, lawns and driveways in 60 percent of Virginia, 90 percent of Maryland, 50 percent of Pennsylvania, and 30 percent of Delaware eventually finds its way into the Chesapeake Bay, carrying our pollution with it. Landscaping your property is one way to help reduce the erosive force of all this runoff.

What you do with and on your land directly affects the quality of the Chesapeake Bay. You and your neighbors can unintentionally change the volume, velocity, and timing of the surface runoff that flows from your property, and by your everyday actions you can add to the amount of toxic chemicals and nutrients that flow into the Bay. As the volume of runoff increases, so does the danger of surface flooding. Runoff also increases soil and channel erosion and delivers more sediment to the Bay.

Protect Your Property, Protect the Bay

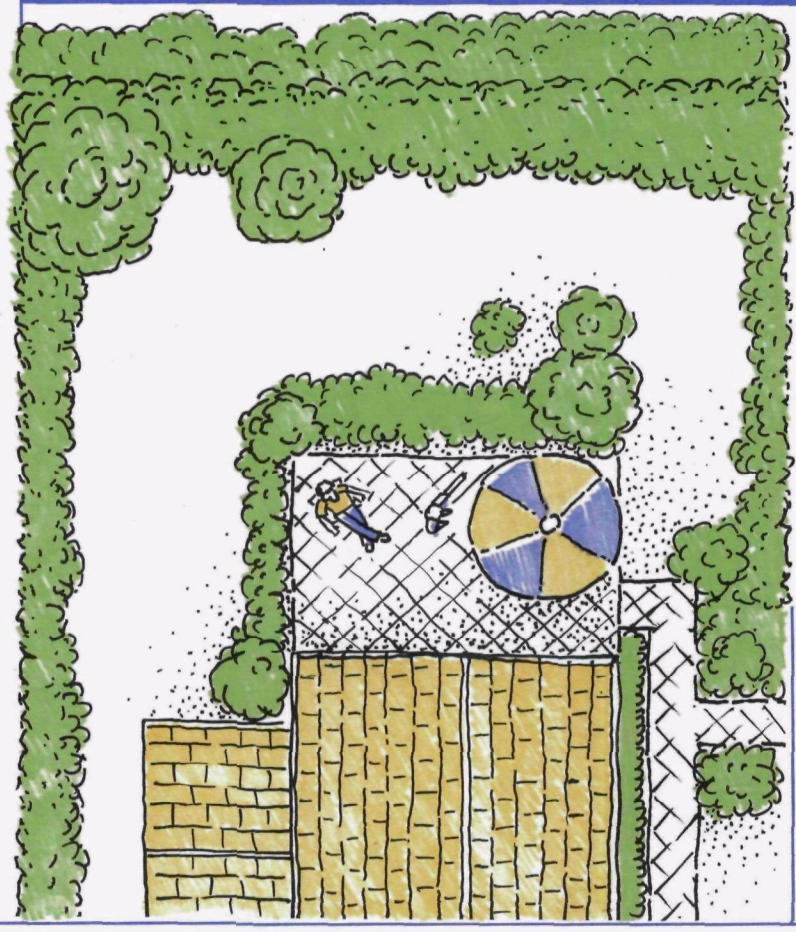
If everyone followed a few simple procedures, they could retain more rainwater on their property, replenish groundwater supplies, reduce their reliance on household chemicals and fertilizer, and improve the quality of the Chesapeake Bay.

Planting trees is one way you can protect your land and the Bay from the damage caused by excessive runoff and erosion. We all appreciate trees for their beauty and the shade they provide, but few of us realize that trees help reduce runoff and minimize erosion. Planting shrubs, trees, and ground cover on your property —landscaping—has definite environmental benefits, and it enhances the appearance and value of your property. Plants



Before

Unlandscaped property causes more rainwater runoff, increases soil and channel erosion, and delivers unnecessary sediment to the Bay.



After

Landscaping your yard reduces the erosive force of rainwater runoff and increases the value of your home. By planting trees, shrubs, and ground cover, you encourage excess rainwater to filter slowly into the soil instead of flowing directly into stormdrains or nearby streams. Choosing trees and plants that are appropriate for your soil and growing conditions will ensure that you'll have a beautiful yard.

and trees can create "outdoor rooms" for you and your family to work and play in. These plants can block cold winter winds and provide shade in summer.

Well planned landscaping can reduce heating and cooling costs for your house by as much as 30 percent. New shrubs and trees may attract birds and wildlife. Trees, shrubs, and ground cover also require less maintenance than grass. Because trees and shrubs require less fertilizer and fewer herbicides than grass, the chances of polluting the Bay are lessened. By choosing the appropriate trees and shrubs for your yard, you contribute directly to Bay cleanup efforts.

Choosing Appropriate Plants

All plants require different kinds of soil, nutrients, and exposure to the sun to flourish. All landscapes have a set of growing conditions, including soil properties, air temperature, moisture, and length of exposure to the sun. The most common mistake people make when landscaping their yards is to buy plants that need much more or far less moisture than the soil provides. Plants that need a lot of water will not grow well on dry sites unless you supply the water they need. Plants with high nutrient requirements will only grow in poor soils if you apply fertilizer. Plants susceptible to insect and disease problems will flourish only when these pests are controlled by some biological, chemical, or mechanical means. By choosing plants appropriate to your yard, you help reduce these potential problems.

Fortunately, nature has given us a partial solution to the problem of plant selection. Over time, plants native to a particular locale have adapted to whatever growing conditions they encounter. Plants that grow near the shore have adapted themselves to the relatively high salt content of the air and/or soil moisture through a variety of physiological mechanisms. Plants that grow naturally in the forests of the Chesapeake Bay region are bothered less by common disease and insect problems than are plants introduced from other areas. Ask a competent, professional nursery to help you select plants, trees, and shrubs appropriate for your yard and soil type.

Some introduced plants, such as bamboo and multiflora roses, grow faster than plants native to the Bay area. These plants spread quickly and can become a nuisance. Introducing new plants often entails more watering or chemical spraying. One way to avoid these potential problems is to select native plants, those preadapted to the growing conditions in your neighborhood.

WHAT YOU CAN DO

By following these few simple guidelines, you can make your home more attractive *and* help prevent erosion:

- Landscape your yard to minimize rainwater runoff
- Preserve the established trees in your neighborhood, which help minimize the damage caused by surface runoff
- Choose the appropriate plants, shrubs, and trees for the soil in your yard; don't select plants that need lots of watering (which increases surface runoff)
- Consult your local nursery for advice on which plants, shrubs, and trees will grow well in your yard

Chapter 8

Healthy Lawns

Most people want a dense, healthy lawn. A healthy lawn not only makes your home more attractive and valuable, but it also has important environmental benefits. When coupled with trees, shrubs, and groundcover, your lawn can help prevent erosion, moderate summer heat, and act as a filter for rainwater from roofs, downspouts, and driveways. A healthy lawn also benefits the soil by adding organic matter to improve soil structure and infiltration. Your local stream and ultimately the Bay will benefit from the reduced runoff and filtering capacity provided by your lawn and by landscaping.

It is estimated that there are 20 million acres of lawn in the United States. If well-managed and planted with shrubs and groundcover, these acres can be part of a healthy environment; if fertilizers and pesticides are used indiscriminately, lawns can be a source of pollution. The basic premise of environmentally sound turfgrass management is that a vigorous stand of grass will outcompete most weeds and be able to withstand damage from fungus and insects.

Test Your Soil

To help ensure you'll have a healthy lawn, test your soil before seeding or applying fertilizers. Call your county Cooperative Extension Service for assistance, or purchase a soil test kit at your local garden store. The results of the soil test will tell you how much fertilizer and lime your soil requires. Lawns in the Chesapeake Bay region often need to be tested for organic matter, pH and soluble salts. The results of these tests can suggest additional corrective measures that will help you avoid future problems. Compost, if mixed into the soil, can provide some of the organic matter and nutrients your soil needs.

Fertilizing the Lawn

The nutrients in fertilizers can contribute to the pollution problems in the Chesapeake Bay. That's why it's important to apply fertilizer according to instructions—at the proper time and rate—to prevent additional water quality problems. Avoid getting fertilizer on sidewalks and driveways, where it can easily be washed into storm drains and, eventually, into the Bay.

Soil tests will show how much lime, phosphorus, and potassium your fertilizer should contain. Nitrogen, a vital nutrient, can also be applied at the right time and in the right amounts. The recommended nitrogen rates for your area are available from your county Cooperative Extension Service.

The numbers on a bag of fertilizer refer to the percentages of plant nutrients—nitrogen, phosphates, and potash—in the material. In a 100-pound bag of a 5-10-10 mixture, for instance, there would be 5 percent (5 pounds) nitrogen, 10 percent phosphate, and 10 percent potash.

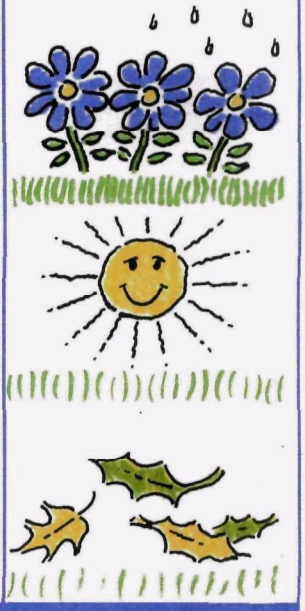
The wrong amount of fertilizer applied at the wrong time can cause disease and weed problems, poor root growth, or excessive top growth. Incorrect fertilization can reduce your lawn's ability to withstand extremes of temperature and moisture. Use fertilizer specifically formulated for lawns. Garden fertilizers will generally not be suitable for your lawn.

Lawn Pests

Both weeds and insects are considered by most homeowners to be harmful to the lawn. But 90 percent of the insects in your lawn are not harmful. Even a healthy lawn will have some weeds, which should not be a problem unless the turf becomes weakened and thin. For example, sheep sorrel is an indicator that the soil pH needs adjusting. Crabgrass can be effectively controlled with a preemergence herbicide.

Study your lawn before applying any herbicides or insecticides. If you suspect a problem, ask your cooperative extension agent to help you identify the problem and determine whether special treatment is necessary. The pre-

Applying the proper amount of fertilizer at the proper time will help ensure a healthy lawn. Experts recommend that fertilizer be applied three times a year to already established lawns. A soil test will tell you the appropriate combination of nutrients to use.



Mow your lawn to the proper height, depending on the type of grass you have.

ferred long-term strategy for a healthy lawn includes using sound management techniques, especially mowing and fertilization. Some aspects of Integrated Pest Management (IPM), especially hand weeding, can also help. See page 21 for more information on IPM.

Occasionally, certain insect activity may reach a level where the use of an insecticide is considered. Careful spot application of insecticides may be necessary when high populations are discovered, if other control methods are not effective. Choose an insecticide that is least harmful to other creatures.

Seed or Sod?

If you are creating a new lawn, there are several factors to consider when deciding whether to use seed or sod. Seeding is initially less expensive, but takes longer to grow and may require weed control measures. Sodding provides immediate erosion control and can be used at least a month sooner than a seeded area. Whatever you choose, have the type of grass approved by your state's Department of Agriculture. For a description of the types of grasses recommended for your area, talk to your county Cooperative Extension Service. Tall fescue varieties are more drought- and pest-resistant and are frequently recommended.

The best time to seed is from August 15 to September 30. During this time, there is less competition from weeds, and the early critical seeding stage misses the really hot weather. If you seed your lawn in early September and manage it properly, the grass will develop a root system and sufficient top growth to survive the winter and grow vigorously the following spring. Many of the weeds that germinate in fall seedings will be killed by the first hard frost. The next best time for seeding lawn grasses, and usually a poor second choice, is from February 15 to March 31.

Watering and Mowing

Overwatering and mowing too closely are the most common mistake we make with our lawns. Once a lawn is established, water it only during very dry periods, giving it only as much water as the soil can absorb. Moisten the soil to a depth of four to six inches, which usually means using about an inch of water. Avoid frequent shallow waterings on established turf; it causes shallow rooting, invites crabgrass invasion, and encourages disease.

Mowing is also crucial to the health of your lawn. According to turf specialists, the mowing height is probably the single most important factor in the formation of healthy turf. Bluegrass or fescue should be from two to four inches in height and cut frequently enough that no more than a third of the leaf area is removed. Bermudagrass and zoysiagrass should be mowed when they reach a height of one-half to one inch.

A Word About Lawn Services

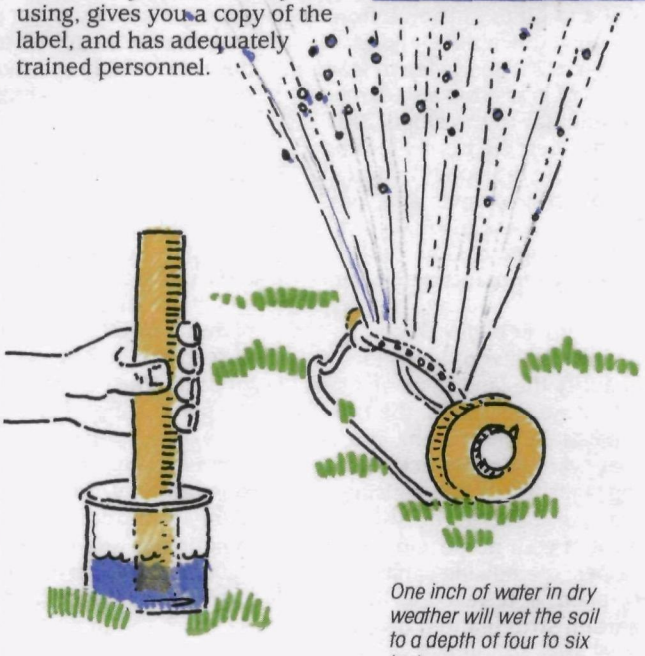
Lawn services are an increasingly popular alternative for lawn maintenance. You should know that some companies operate on a mass-production basis, with a fixed number of treatments a year in which customers are given a standard mixture of fertilizer and pesticides to deal with problems that might occur. You want a lawn company that will customize its service to your lawn's needs. Many of the lawn companies follow programs that have been prescribed by turfgrass specialists and use products that you can buy and apply yourself. Misuse of these chemicals can pose health risks to people, pets, and wildlife around your home. Herbicide misuse can cause damage to susceptible plants.

You need to be sure the company you choose does a soil test before applying any fertilizer or pesticides. Some people are very concerned about the pesticides used on lawns and shrubs. Before signing a lawn care contract, make sure the company is reputable, tailors its chemical use to specific lawn needs, notifies you about the pesticides they are using, gives you a copy of the label, and has adequately trained personnel.

WHAT YOU CAN DO

Lawns benefit the environment and add to the value and beauty of your home. Keep these things in mind when planning and maintaining your yard:

- Plant the right grass for your locale.
- Test your soil once per year.
- Use the right fertilizer at the right time.
- Don't overwater your lawn.
- Mow to the proper height—this is critical to the health of your lawn.
- Try Integrated Pest Management to control weeds and insects (see page 21).
- Consider groundcover plants as well as grass.



One inch of water in dry weather will wet the soil to a depth of four to six inches.

Chapter 9

Watch Your Garden Grow

Many of us enjoy growing our own vegetables, fruits, flowers, and herbs. By using the right gardening techniques, you too can produce plants to be proud of while preserving the soil and its fertility, enhancing the absorption of rainfall, and protecting local streams from sediments and chemicals.

To get the most out of your garden, it's important to pick the right spot for planting. Choose a sunny location with good natural drainage. Plant your garden on a fairly level site; avoid sloping areas and drainage channels, which let topsoil wash away during heavy rains.

Dealing With Slopes

If your garden is located on a slope, you can use the same techniques that farmers use on hilly fields to ensure good crops. Plant across the slope, not up and down the hill. This way, each row acts like a ridge (what farmers call contour planting) to trap rainfall. Contour planting prevents soil and plant nutrients from washing downhill. On long slopes, it's a good idea to leave strips of grass that also run perpendicular to the slope. This helps keep the rainwater and soil where it belongs by forcing runoff to slow down and soak in. These grass strips should be wide enough to allow easy access to your plants and vegetables.

Flower beds can be planted on steep slopes to beautify the landscape and stabilize the soil. Since the beds are usually permanent, you may want to construct retaining walls to hold the hillside in place and add to the appearance of your home. On longer slopes, the hillside can be stepped, or terraced, with a garden strip planted on each level area. Whether a series of retaining walls is used or not depends on how steep your slope is. On moderate slopes, the area between each level terrace should be a short, relatively steep slope. Such terrace/slopes must be densely planted with grass or other plants to stabilize the soil.

Enhancing Fertility

Though there are many ways to make a garden more productive, meeting the nutrient needs of the plants in your particular plot is the most important consideration. Many garden soils can benefit from the addition of organic matter and other nutrients. Composted vegetable scraps, grass cuttings, and leaves are excellent sources of both, and the more that goes in your compost pile, the less that goes in the already overcrowded landfill. Mulching can also add nutrients, make the soil more workable, aid rainwater penetration, and improve the moisture-retaining capacity of the soil near plant roots.

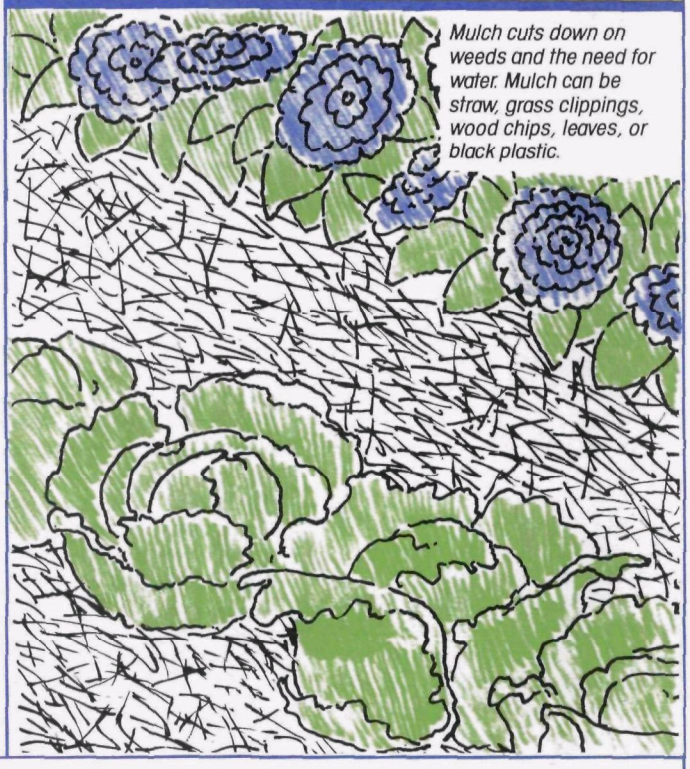
You should also mulch to minimize bare, exposed soil in your garden. Unprotected ground loses nutrients and needed topsoil much more quickly than planted soil. Bare soil places added stress on nearby plants by expanding temperature extremes and reducing available soil moisture. In addition to mulching, consider closer plantings of different, but compatible, plant species to make the most out of your working garden area.

Winter cover crops are highly recommended for vegetable plots. Rye, barley, and wheat are suitable for fall planting (two to three pounds of seed per 1000 square feet of ground). The cover crop holds the soil during the winter and adds organic matter to the soil when it is turned under the following spring. You can also plant shrubs or small trees as windbreaks around the garden to control wind erosion in sandy areas and to further protect bare soil from exposure to the elements.

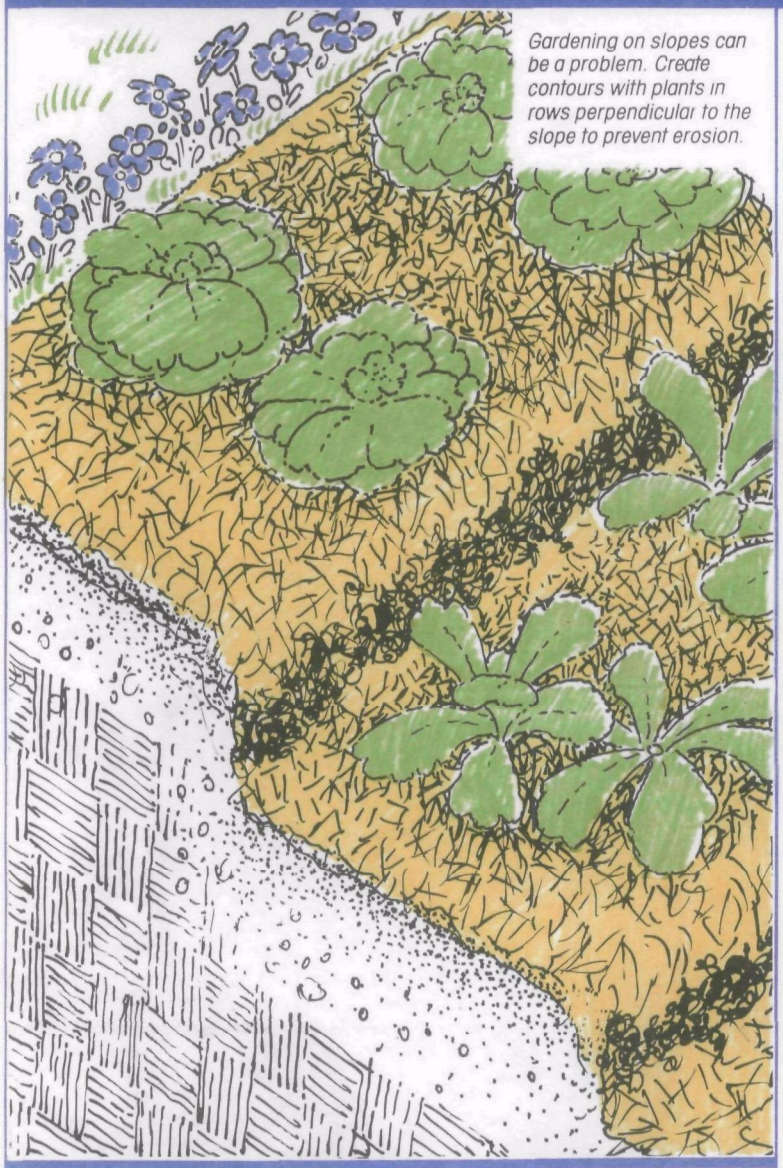
WHAT TO DO ABOUT BUGS

Your vegetable garden can suffer severe damage from insects and diseases. The following preventive measures lessen the likelihood that serious problems will develop:

- Rotate crops so that the same or a related crop does not occupy the same area every year. Repeated plantings encourage insect infestation and the buildup of soil diseases.
- Keep old sacks, baskets, decaying vegetables and other rubbish that may harbor insects and disease out of garden.
- Time plantings to avoid peak of insect infestations. For example, plant squash as early as possible to avoid borers that lay eggs in July. If you're going to plant a second squash crop, plant after mid-July to avoid the borers. Keep a record of the date insect problems occur for future reference.
- Inspect plants for egg clusters, bean beetles, caterpillars, and other insects early each morning. Hand pick such pests and destroy them. The squash borer can sometimes be cut out of the stems with a sharp knife, providing you cut parallel to the stem and no more than halfway through
- Dislodge pests with a spray of water. This works with aphids, red spider mites, and mealybugs.
- Construct insect barriers: Place screens over the plants; wrap aluminum foil around the plant base to limit cutworm damage.
- If you're having slug problems, place flat boards next to the plants. After the slugs crawl under the boards to escape sunlight, lift the boards and destroy the slugs.



Mulch cuts down on weeds and the need for water. Mulch can be straw, grass clippings, wood chips, leaves, or black plastic.



Gardening on slopes can be a problem. Create contours with plants in rows perpendicular to the slope to prevent erosion.

Fertilizer

Fertilizers are designed to supplement the nutrients already present in your soil. (See the chapter on lawns for more detailed information on which fertilizer or combination of fertilizers is right for the soil in your garden.) Know what your soil requires before you apply any fertilizer.

Too much fertilizer can damage roots, and the excess can reach your local stream and lead to water pollution problems. Avoid applying fertilizer on windy days or just prior to a heavy rain. For best results, always apply commercial fertilizers according to the directions on the bag.

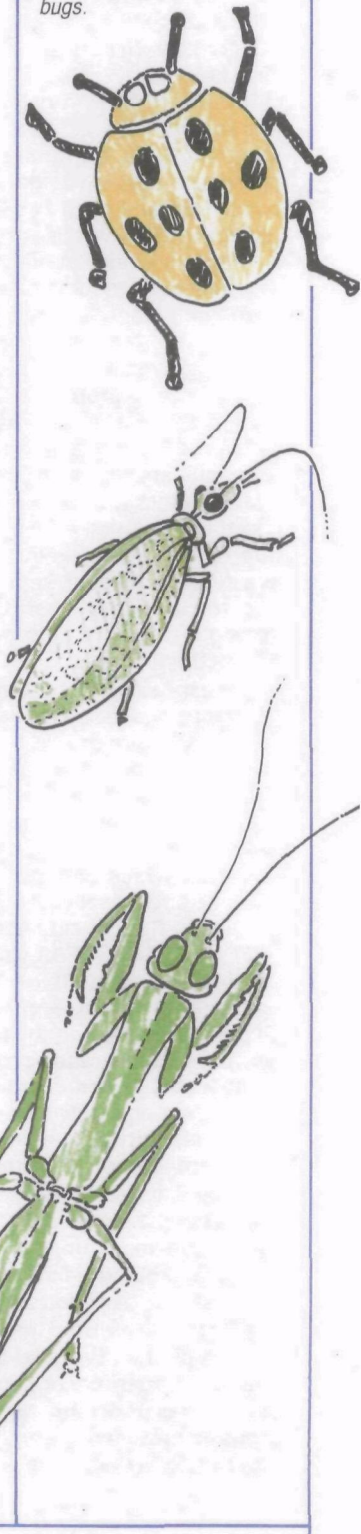
Controlling Pests

Among the many ways you can control garden pests are to:

Use pest-resistant flowers, plants, and vegetables whenever possible

- Handle minor pest problems by hand weeding and destroying insects
- Wrap tomato stems in aluminum foil to stop cut worms
- Plant borders to repel insects
- Encourage ladybugs, praying mantises, and other insects that eat garden pests
- Use pesticides only when other methods have failed, and use them according to the manufacturer's instructions
- Seek expert advice if none of the above measures works

Some insects will eat garden pests, precluding the need for chemical pesticides. Examples of "good" bugs are ladybugs, praying mantises, lacewings, dark ground beetles, soldier beetles, and the larvae of lightning bugs.



Less Toxic Pest Control Products

When used according to label instructions, the four products listed below are less toxic to the environment than other commercially available products. The products are available at garden stores with large inventories.

Insecticidal Soap

This natural soap destroys pest membranes. It is effective against: aphids, mealybugs, white flier, scales, earwings, rose slugs, crickets, spittlebugs, and many more.

BT (Bacillus Thuringiensis)

BT is particularly effective against leaf-eating caterpillars. It kills them by paralyzing the digestive tract.

Milky Spore

Milky spore is a natural bacteria that kills the grub phase of Japanese beetles. The milky spores actually remain alive in the soil, preventing new infestations for a few years.

Dormant Oil Sprays

Oil sprays can be used either during the dormant or growing season to control scale insects, red spider, mites, mealybugs, and whitefly larvae on shrubs, evergreens, woody plants, fruit trees, shade trees, azaleas, roses, and other ornamentals.

Chapter 10

Pesticides: Handle With Care

To many homeowners, pest control is synonymous with chemicals, and quick eradication is the goal. *Pesticides* is an umbrella term that includes herbicides, insecticides, fungicides, and rodenticides. Designed to kill "pests," this big family of chemicals can also be dangerous to human health and the environment. There is considerable controversy about the potential risks associated with pesticides. Some toxicologists believe that pesticides can trigger allergic reactions or cause chronic health problems, while other toxicologists say that if used properly, pesticides pose no significant risks to human health unless a person is exposed to too much either through a large exposure (such as a spill), or through small exposures over a long period of time, particularly if no protective clothing is used.

Pesticides first became an environmental issue for many people with the publication of Rachel Carson's book *Silent Spring* in 1962. Since then, the regulatory approach to pesticides has been changed by Congress, which amended the 1947 Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) in 1972. FIFRA gave to the Environmental Protection Agency the job of re-registering all pesticides then on the market. The re-registration process includes a detailed examination of data on safety as well as both short-term (acute) and long-term (chronic) health effects. To date, about 200 of the 600 principal active chemical ingredients in commercially available pesticides have been re-registered. Therefore, it is not correct to assume that because a product is available in your local hardware or garden store, it has undergone rigorous environmental and health effects evaluation procedures.

Some pesticides that were once widely used have now been banned or severely restricted. These include DDT, chlordane, aldrin, heptachlor, dieldrin, lindane, silvex, tributyltin and 2,4,5-T. In the Bay states, chlordane is registered only for use against termites but must be applied in a very specific manner. In Maryland, chlordane has been found in fish tissue. Check with your Cooperative Extension Service concerning disposal of these products.

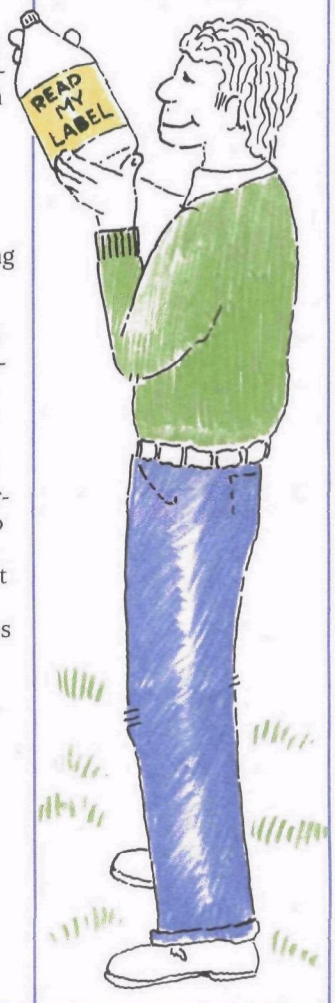
Alternatives to Pesticides

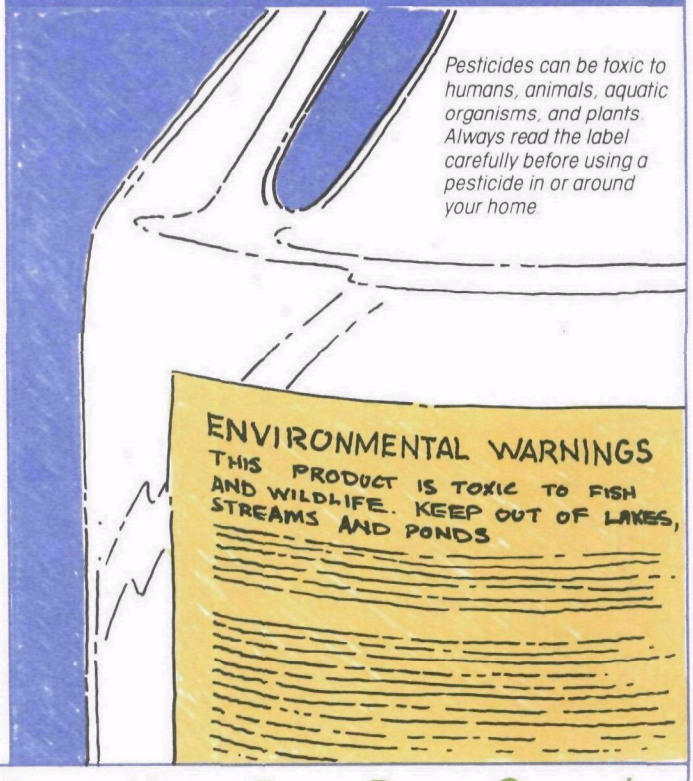
It may be possible to control a pest problem without a pesticide. Check the chart on integrated pest management on the next page and the gardening ideas on page 18. In some cases, alternatives that are nontoxic are readily available. For example, to deter termites, remove wood piles near your home. Your county Cooperative Extension Service can provide advice on the best strategy for controlling pests in and around your home. Alternative methods of pest control should be considered before you consider use of a commercial pesticide.

Minimizing Pesticide Hazards

To minimize the potential hazards of pesticides, follow these guidelines:

- Read the label carefully.
- Buy only the quantity you need.
- Wear any protective clothing specified on the label.
- Wash your hands immediately after applying the pesticide.
- Apply only the amount specified on the label and only to the plants and areas listed in the instructions.
- Make sure people and pets are out of the area during application and until the spray has dried.
- Some counties in Maryland have passed ordinances requiring that a warning sign be posted on the sprayed area for at least two days after application.
- Cover or remove exposed foods, fish tanks, and pet food and water dishes during and after application.
- Never apply near wells, streams, ponds, or marshes unless the instructions specifically allow for such use.
- Never apply to bare ground or eroded areas (when it rains, many pesticides bind tightly to soil and can be carried along with sediments to storm sewers and streams).
- Don't apply if rain is forecast unless otherwise specified on the label (some pesticides do need to be watered in after application).
- Choose the least toxic pesticide (those with the signal word "caution" on the label are considered least toxic whereas the signal word "warning" indicates moderate toxicity).





Pesticides can be toxic to humans, animals, aquatic organisms, and plants. Always read the label carefully before using a pesticide in or around your home.

Storage

Poisonings and environmental contamination have occurred where pesticides were stored improperly. To be safe, you should store unused pesticides in an area well away from living areas. The place you choose should have a cement floor, be well-lit and well-ventilated, insulated from temperature extremes, out of direct sunlight, and out of a child's reach. For example, a locked metal cabinet in your garage is usually a good storage place for pesticides. Always keep pest control products in their original containers with labels intact. Most pesticides stored under these conditions should remain effective for two years, although this varies widely.

Spills

It can be extremely difficult to completely decontaminate an area when a pesticide has been spilled. For this reason, you never want to store these products in the kitchen or other living areas.

If a pesticide leaks or is spilled in the garage, on the driveway, or other outdoor areas, do not hose down the spill. This will cause further contamination and may carry the pesticide to storm sewers or other water sources. The best way to clean a small spill is to:

- Surround the contaminated area with dirt.
- Sprinkle sawdust, kitty litter, vermiculite, or some other absorbent material over the spill.
- Shovel or sweep the absorbent material into a sturdy plastic bag and put it in the trash.
- Wear rubber gloves, long pants, and rubber boots while cleaning up.
- Keep pets and other people away.
- Wash down the area (if a garage floor or other hard surface) with a solution of water and bleach, ammonia, or a strong detergent.

If pesticides spill directly into water, notify public health authorities and your state fish and game agency immediately. Keep people and pets away from the spill. In small streams, it may be possible for you to prevent further contamination by building a soil dike downstream from the spill.

What To Do With Leftovers?

Pesticides should never be buried in your yard, burned, or poured into storm drains or your toilet. Some pesticides and their containers release toxic fumes when burned or wetted, and sewage treatment plants do not employ the kinds of microbes that would neutralize the pesticide's harmful effects. Septic systems can be harmed by pesticides as well. The best method for safely disposing of pesticides is to buy only as much as you plan to use within a two-year period, and to use them up according to label instructions.

Federal law now requires that pesticides made for home use be labeled as to the appropriate disposal method. Again, it is essential that you read the label carefully and follow its directions. Consult your county Cooperative Extension agent for guidance in disposal of older pesticides with unreadable labels.

Pest Control Companies

Pests inside the home—termites, cockroaches, insects, and mice—often mean professional pest control services for the consumer. Check out the company before you sign a contract, and insist on knowing what pesticides they plan to use. The pest control operator should be willing to give the consumer a copy of the pesticide label, explain why a particular pesticide has been chosen for the job, describe what techniques will be used, and list the precautions you may need to take after the operator leaves.

WHAT IS INTEGRATED PEST MANAGEMENT (IPM)?

Currently there are two opposing philosophies of pest control practices in the management of landscape plants and lawns. The oldest and most common approach places relatively complete reliance on the use of synthetic chemical pesticides, even to the point of spraying on a regular basis for preventive purposes. The newer concept, called Integrated Pest Management or IPM, emphasizes frequent monitoring to assess pest population buildup, and the evaluation of all factors including environmental effects, before pesticides are applied. Some IPM tactics that may reduce or eliminate the need for pesticide sprays are listed below.

- *Natural predators:* introducing the types of animals that will naturally gobble up pests. Ladybugs, lacewings, praying mantids, garter snakes and toads are all examples of natural predators that eat insect pests.
- *Habitat changes:* changing the habitat to physically control many pest species. For example, by getting rid of all the old tires in your neighborhood you can cut down on the number of mosquitoes breeding in your area. (The tires fill up with rainwater, making perfect breeding sites for mosquitoes.)
- *Timing:* regulating planting and harvesting to avoid those times when insects are most abundant and damaging.
- *Mechanical:* removing eggs, larvae, cocoons, and adults from plants by hand.
- *Resistant plants:* when buying plants for the garden always request those that are relatively free of major pests and diseases.
- *Growing conditions:* plants such as azaleas that require some shade are more susceptible to pests when grown in full sun. Moisture and pH levels also affect a plant's ability to withstand stress and pests.
- *Mixed plantings:* planting mixed stands of trees or crops instead of planting large areas with just one type of plant. Mixed stands are not as susceptible to insect damage.
- *Natural pathogens and parasites:* introducing bacteria, viruses, and insect parasites that will kill pests but won't harm other types of animals.
- *Insect hormones:* using insect hormones to prevent an insect from growing into a sexually mature adult. (Just as in people, hormones control growth and development in insects.)
- *Chemicals:* using synthetic pesticides only as needed. In IPM, chemicals are just one small part of the whole plan. By studying an insect's life cycle, the right amount of pesticide at the right time can be used effectively. Less pesticide and careful application mean a more healthful environment and better pest control.

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Chapter 11

Be Cautious At Home

Some of the products found in American homes have chemical ingredients that are potentially harmful. Look under the kitchen sink, in the bathroom, the garage, and the basement for examples. There you'll find oven cleaners, paint remover, bug killers, solvents, drain cleaners, and more. These products are potentially harmful to people and to the environment and should be used with care.

Public concern about the use and disposal of hazardous chemicals has grown dramatically in recent years. In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA), which set up regulatory procedures governing generation, storage, transport, treatment, and disposal of hazardous materials. This was followed in 1980 by the passage of Superfund, which provides money to clean up hazardous waste sites such as the infamous one at Love Canal. There is, however, no regulation of household hazardous wastes, which must be taken care of by the individual consumer.

This chapter of *Baybook* describes the different categories of products commonly used at home, and the appropriate disposal methods for each.

Household Cleaners

Many of the products used at home, such as soaps and detergents, are meant to be washed down the drain. These products are biodegradable and, if the wastewater from your home is properly treated, they pose no problem to the environment.

However, there are products commonly found on kitchen shelves that are toxic to people and to the environment Oven cleaners, floor wax, furniture polish, drain cleaners, and spot removers are examples. Check the labels of products such as these for the following toxic components: lye, phenols, petroleum distillates, trichlorobenzene. Products containing these chemicals pose a potential threat to health, if improperly used, and also present real environmental hazards when it comes to disposal.

It is often possible to use an alternative, less toxic method to clean or to polish. Ovens, for example, can be cleaned by applying table salt to spills, then scrubbing with a solution of washing soda and water. A combination of lemon oil and linseed oil makes a good furniture polish. Clogged drains can sometimes be cleaned with a metal "snake" instead of toxic chemical cleaners.

When you feel that it is absolutely necessary to use a product containing toxic chemicals, some cautions should be observed. As with pesticides, the rule of thumb is to read the label and to use the product only as directed. Some products become even more dangerous when mixed with others; for example, chlorine bleach mixed with ammonia can produce deadly chloramine gas. Protective clothing and rubber gloves may be necessary; good ventilation is a must.

A Word About Detergents

One of the most-used home cleaning products is detergent. Many of the detergent products formulated for automatic washing machines and dishwashers contain phosphorus, which has been shown to cause water quality problems in lakes and bays. The detergent industry has responded to this problem by developing products that contain little or no phosphate. For example, all liquid detergents are phosphorus-free, as are some powders. Again, the label will clearly tell you the phosphorus content. The range is from about 13 percent, in some automatic dishwashing detergents, to none. When you have a choice, buy the low phosphorus product.

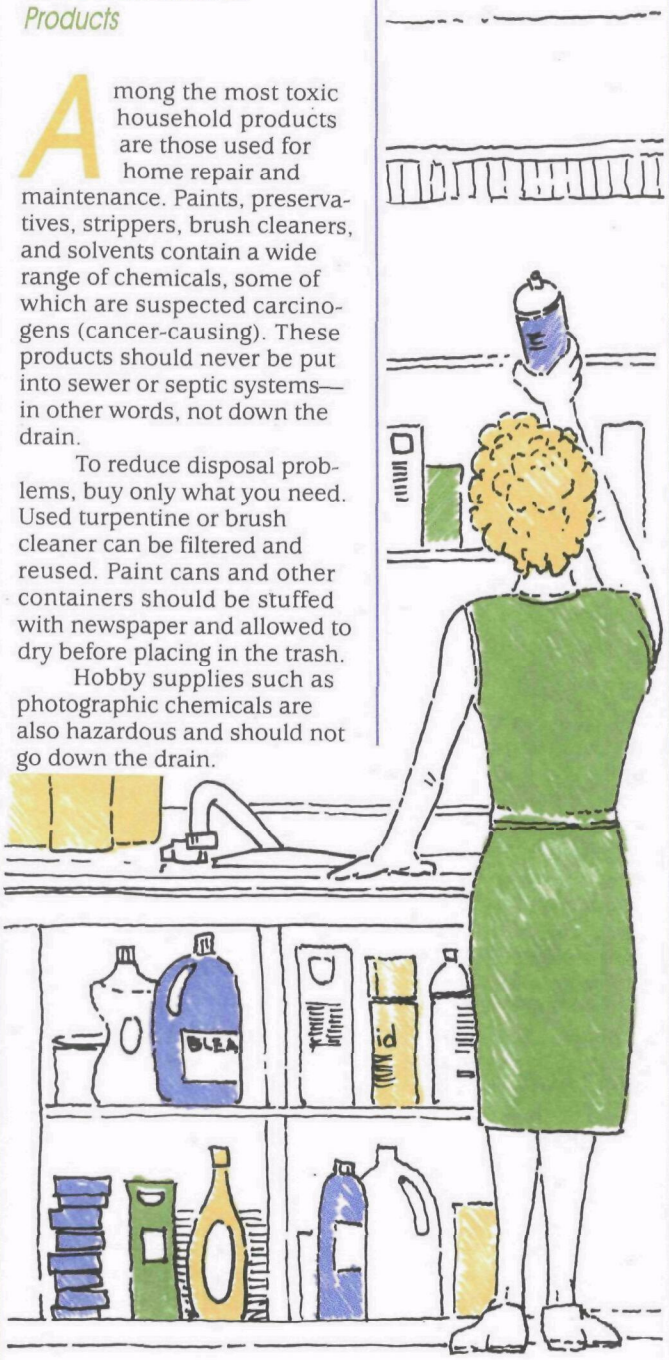
Home Maintenance Products

Among the most toxic household products are those used for home repair and maintenance. Paints, preservatives, strippers, brush cleaners, and solvents contain a wide range of chemicals, some of which are suspected carcinogens (cancer-causing). These products should never be put into sewer or septic systems—in other words, not down the drain.

To reduce disposal problems, buy only what you need. Used turpentine or brush cleaner can be filtered and reused. Paint cans and other containers should be stuffed with newspaper and allowed to dry before placing in the trash.

Hobby supplies such as photographic chemicals are also hazardous and should not go down the drain.

Household chemicals, especially petroleum-based formulas, are potentially toxic and not readily biodegradable. All household chemicals should be used with care.



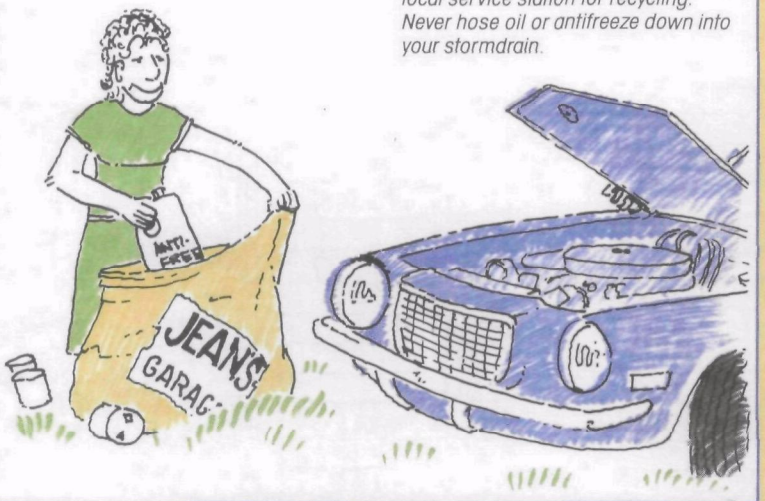
Car Care

Motor oil, battery acid, gasoline, car wax, engine cleaners, antifreeze, degreasers, radiator flushes, and rust preventatives are examples of automotive products containing toxic chemicals. Some car owners do their own maintenance work: 25 percent change their car's oil, and many of these people pour the used oil down the storm drain. One quart of oil can contaminate up to two million gallons of drinking water. The oil from one engine—four to six quarts—can produce an eight-acre oil slick.

The only recommended way to dispose of used oil is to put it into a sturdy container, like a plastic milk jug, and take it to your neighborhood garage or oil recycling center. Maryland, Pennsylvania, Virginia, and the District of Columbia all have a number you can call to find an oil recycling station near your home.

Disposing of antifreeze is also a problem. Antifreeze contains ethylene glycol, which is poisonous to people, fish, and wildlife. Many cats and dogs have died after drinking sweet tasting puddles of antifreeze they find on driveways in the winter.

Instead of pouring antifreeze down the drain or washing it into storm drains, ask your local service station to add the liquid to their used antifreeze storage drum. You can also dilute the antifreeze and pour the mixture into a gravel pit or any area with good drainage. This method takes advantage of the soil's natural filtering capacity.



Oil can be recycled. Used oil and antifreeze should be taken to your local service station for recycling. Never hose oil or antifreeze down into your stormdrain.

Disposing of Household Toxics

The kinds of household toxics described in this chapter should not be disposed of "down the drain." Your drain leads either to a home septic system or a municipal treatment plant, neither of which is designed to completely remove toxic chemicals from wastewater. At least some of the toxics pass through the treatment process and end up in a stream, river, or groundwater. Read the section in this guide on septic systems for further cautions.

Effective sewage treatment is essential for treating the large volume of wastewater that comes from our homes. Improving municipal treatment plants is a part of the strategy to clean up Chesapeake Bay. Well-run treatment plants can remove some nutrients, organic materials, and heavy metals from wastewater. The chlorine used to disinfect can also be removed by a process called dechlorination. Individuals and communities should insist that the publicly-owned treatment plants that serve them are maintained and operated at peak efficiency. This may mean added cost to consumers, but is essential to good water quality in our rivers and Bay.

The products described in this chapter should also never be poured on the ground or into gutters where they will eventually enter storm sewers, which generally lead directly to a nearby stream.

In many areas, the only available disposal method is the local landfill. While probably better than flushing a toxic chemical down the drain, landfills are not a good long-term solution to our waste disposal problems. New energy needs to go into finding better solutions.

Where household hazardous wastes must be sent to a landfill, a couple of steps can be taken to reduce the environmental risk. First, wrap the product in its original container in newspaper, and then wrap in an old plastic bag. Liquids can be poured into containers filled with absorbent kitty litter, then wrapped in plastic.

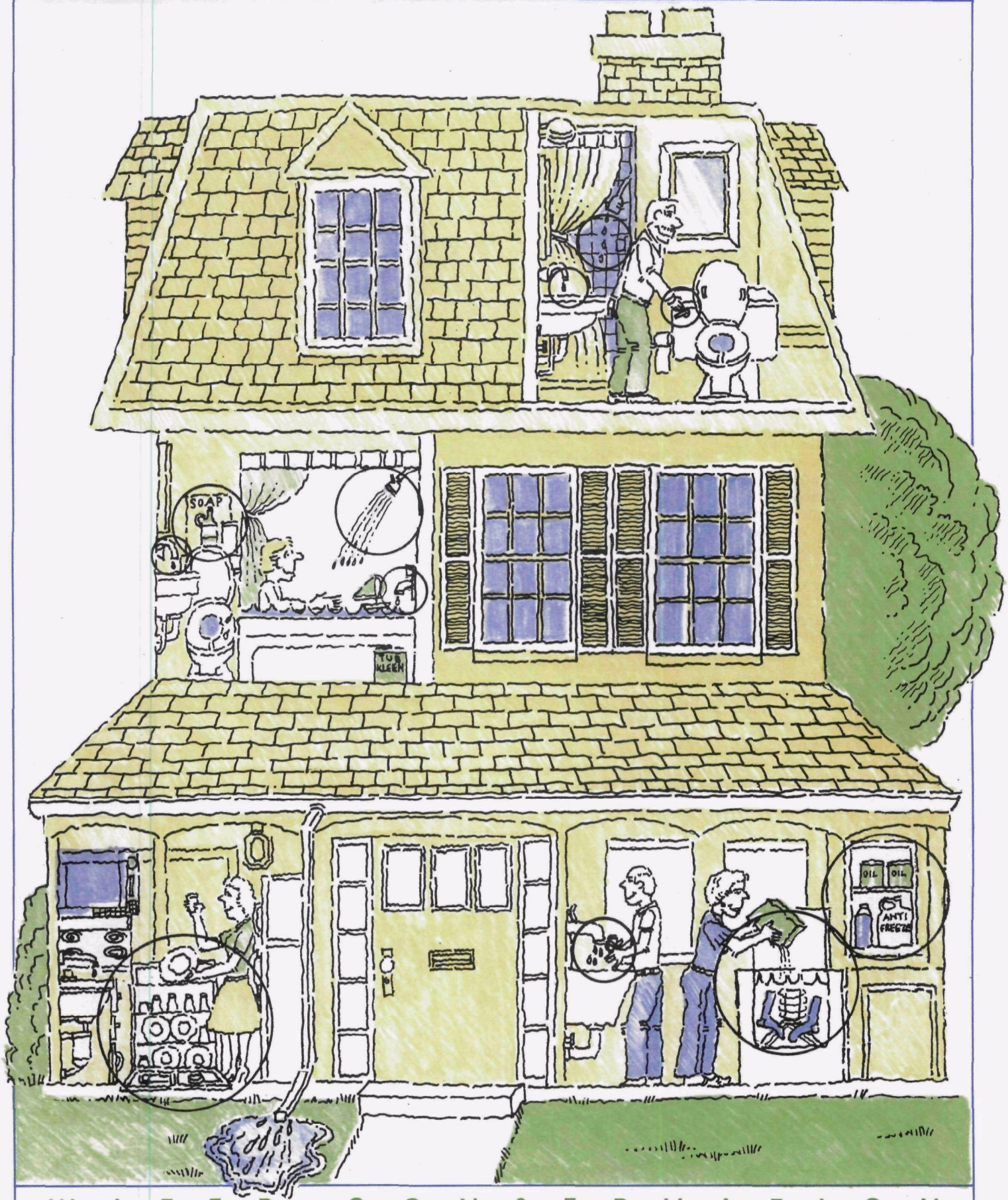
Some states are dealing with the problem of hazardous household wastes by sponsoring amnesty days. On amnesty day, small quantities of your unwanted household chemicals and pesticides are collected and disposed of in an approved facility. The actual collection and disposal of the waste should be performed by technicians who know which chemicals should not be mixed together. Amnesty days are designed to educate the general public about the potential hazards of improper use and disposal of consumer products that contain toxic chemicals. Check with your state or county government to find out about amnesty days in your area.

WHAT YOU CAN DO

Here are some general rules of thumb for handling and disposing of household chemicals:

- Read the label—know what you are buying and what the potential hazards are.
- Store products in their original containers so the label can be referred to whenever the product is used.
- Use alternative, less harmful products whenever possible (for example, boric acid is very effective in controlling roaches).
- Use the least toxic product you can find and never buy more than you need.
- Dispose of your unwanted household chemicals in sanitary landfills. Pour liquids such as cleaning fluids into a plastic container that is filled with kitty litter or stuffed with newspaper. Allow it to dry outdoors before taking it to the landfill.
- Take used motor oil and antifreeze to a gas station with an oil recycling program.

Insist on effective sewage treatment for your community.



WATER CONSERVATION

Chapter 12

Where Does Water Go?

Everyone knows about water conservation. In the western United States, the limited availability of drinking water has made water conservation mandatory. In other areas, reducing water use is sometimes necessary when groundwater supplies are contaminated by landfills, toxic waste dumps, saltwater intrusion, or when drought reduces surface water supplies.

To understand the importance of water conservation, it helps to understand where water goes. A certain percentage of all freshwater used in the Bay area is lost through evaporation. These losses total hundreds of millions of gallons daily, and they are increasing.

As a result of water loss, freshwater inflows to the Bay are declining. This means that during dry spells, the salt content of the Bay increases significantly, which, in turn, can drastically alter the Bay ecosystem. Water conservation measures can help maintain freshwater inflows to the Bay and prevent the adverse consequences of too much salt.

Water conservation is good for more than just the Bay. Reducing your water use can mean substantial savings on your sewer, energy, and water bills. For those with septic tanks (30 percent of the population), conserving water reduces wear and tear on your system, and requires less energy for pumping well water.

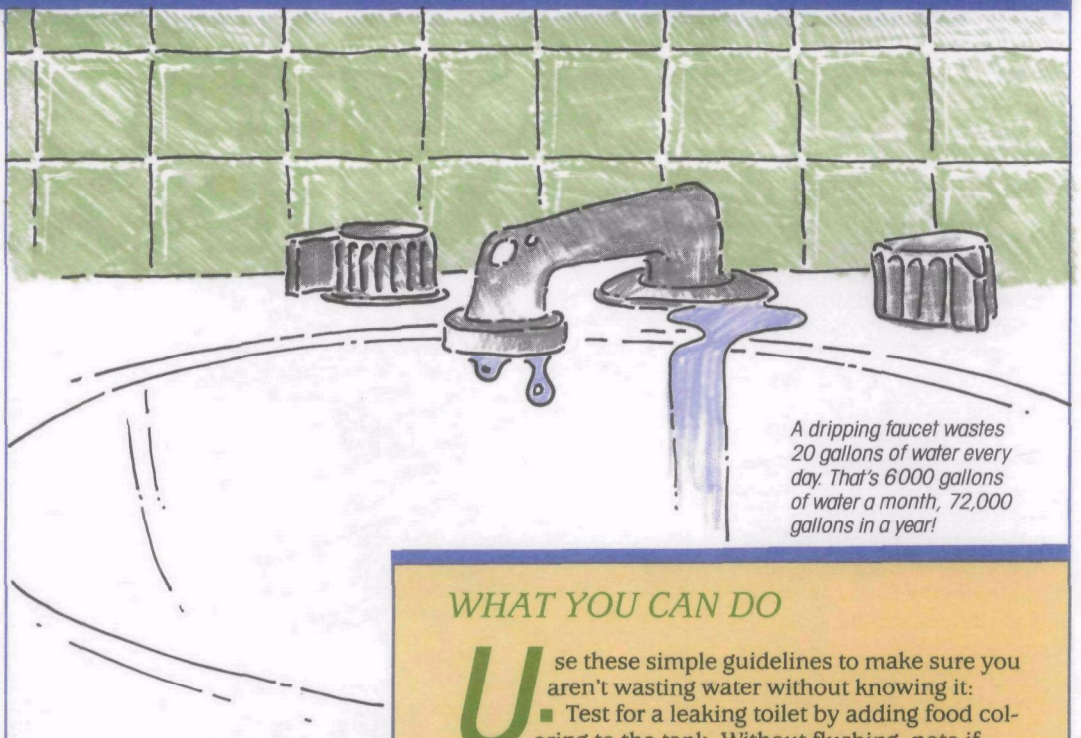
Beyond Your Home

Widespread reduction in water usage could reduce the need for new or expanded sewage treatment facilities. If the amount of water every family uses is reduced, so is the volume of water entering our sewage treatment plants. The tax dollars saved by not having to expand existing plants can be used to improve water treatment techniques.

Only 4 of the 100 gallons of water we each use every day are actually necessary. We can decrease water consumption in our homes by 15 to 20 percent without major discomfort or expense. All we have to do is acquire good water use habits. Many conservation techniques are simple, common sense ideas.

The first step in conserving water around your home is to check for and eliminate any leaks in faucets, toilets, hoses, and pipes. At the water pressure found in most household plumbing systems, a 1/32" opening in a faucet can waste up to 6000 gallons of water per month. A steady drip wastes 20 gallons a day. A leaking toilet can waste 200 gallons of water a day without making a sound.

Water conservation is as simple as thinking before you turn on the faucet. Many of us developed our water use habits before the time of water shortages and water quality problems. Now that we understand the potential impact of the way we use water, it should be easy to make water conservation a part of our everyday lives.



A dripping faucet wastes 20 gallons of water every day. That's 6000 gallons of water a month, 72,000 gallons in a year!

WHAT YOU CAN DO

Use these simple guidelines to make sure you aren't wasting water without knowing it:

- Test for a leaking toilet by adding food coloring to the tank. Without flushing, note if any color appears in the bowl after 30 minutes. If color appears, you have a leak.
- Check your water meter while no water is being used. If the dial moves, you have a leak.
- Turn off your water and hot water heater when going on a trip.
- Run your dishwasher only when you have a full load. Use the cycles with the least number of washes and rinses.
- Don't run water continuously when washing dishes in the sink.
- Add your garbage to the compost or trash instead of putting it down the garbage disposal. Disposals not only use a great deal of water, but they also add solids to an already overloaded sewer system.
- Wash clothes only when you have a full load. Set the water level control appropriately. The permanent press cycles may use an additional 10 to 20 gallons of water.
- Buy a suds-saver washing machine when you need to buy a new machine.
- Install a water conservation shower head. They are inexpensive and reduce flow by at least 25 percent.
- Place two half-gallon plastic bottles filled with water in your toilet tank. This cuts the number of gallons used per flush from five to four.
- Take short showers instead of a bath. Remember, baths can use 30 to 50 gallons of water.
- Do not let water run in the sink while shaving, brushing your teeth, or lathering your face and hands.
- Water your lawn and wash your car only when absolutely necessary.
- Wash one section of the car at a time and rinse it quickly. Use a hose that is high pressure, low-volume, and has a pistol grip nozzle.
- Water your lawn during the coolest part of the day to avoid rapid evaporation.

Chapter 13

Boating on the Bay

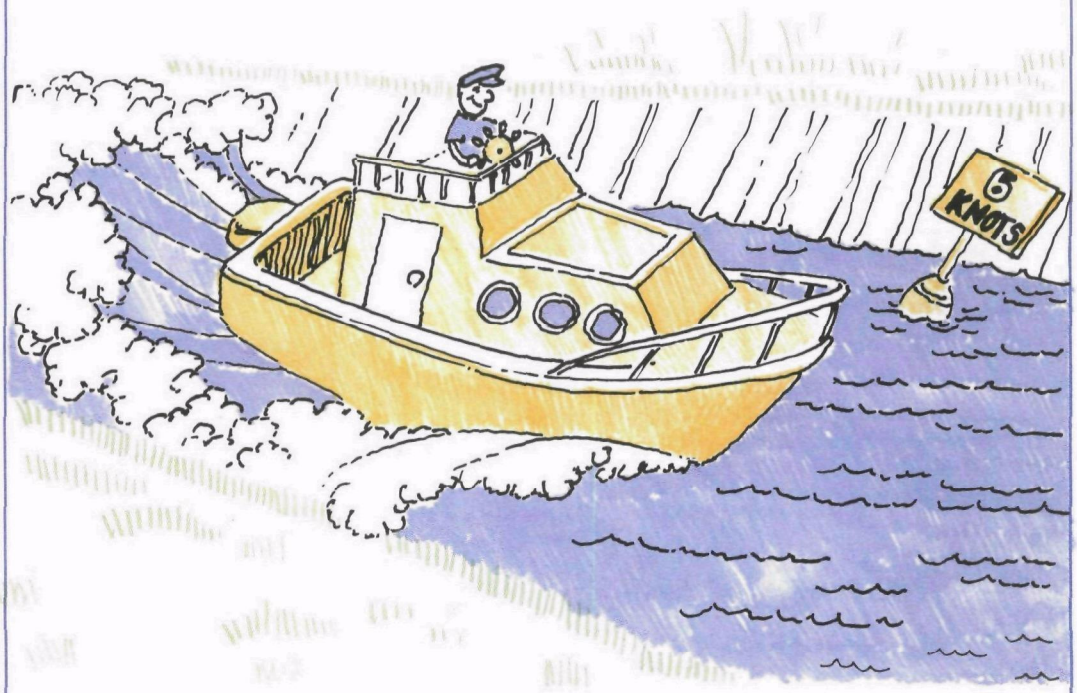
Recreational boating provides relaxation and enjoyment for many thousands of Bay area residents. Boating is also an important Bay industry, bringing in $5 to $7 billion in revenue each year. However, boating also contributes to the Bay's environmental problems. All of us—especially boaters—have a lot to lose if Bay waters continue to deteriorate. As a boat owner, you can play a major role in improving water quality in the Bay. The first step is to understand the potential impact of your boating activities. By understanding, you help ensure that you won't damage the Bay that brings you so much pleasure.

Boats Cause Erosion

In narrow creeks and coves, boat wakes contribute to shoreline erosion. While this loss of land is a problem for shorefront property owners, it also affects boaters. Eroded sediments create unwanted shoals, cause shallowing, and cut off light to underwater life, especially plants. All this creates tremendous problems for the Bay ecosystem.

The extent of shoreline erosion caused by boat wakes depends on the wake's energy. This energy, in turn, is related to four factors: distance from the shore, hull size, boat speed, and creek depth. To minimize shoreline erosion, boats should not produce wakes within 500 feet of the shore.

In many tributaries and coves, a boat speed only two knots above the posted six-knot limit creates a wake with great erosive force. The impact of your boat's wake on shoreline erosion can be greatly reduced if you slow down before, not after, the speed limit marker. Speed limits were designed to protect both you and the marine environment.



Chemicals on Board

The phosphates in the soap you use to wash your boat contribute to excessive algal growth in the Bay. If you rinse and scrub your boat with a brush after each use instead of using soap, you will be helping the Bay. If your boat is stained, use phosphate-free soap or laundry detergent to get it clean. When possible, avoid products that remove stains and make your boat shine. They are extremely toxic. Products with warnings on the label can kill marine life if washed overboard.

Fuel overflows from gas tanks are dangerous to people and toxic to fish and other aquatic life. The traditional method for determining if you have a full tank is to look for fuel spilled from the tank overflow vent. You can prevent these overflows by estimating fuel consumption relative to your tank capacity. With a little practice, you will become an expert at gauging when your tank is full.

The Chesapeake Bay is suffering from the effects of nutrient enrichment, which contributes to algal blooms and oxygen depletion. Human waste contains disease-carrying bacteria and the very nutrients that are choking the Bay. By minimizing or eliminating the discharge of boat sewage, you will be helping the Bay survive and flourish.

There is increasing concern about the effect of chlorine on aquatic life. Many Type I and Type II marine sanitation devices use chlorine and other disinfectants. The adverse impact of chlorine can be lessened if you discharge waste only in waters deeper than 20 feet, where tidal movement will disperse the contaminated waste. Boats with Type III systems and those berthed at marinas should use on-shore sanitary facilities. Because marina pilings hamper the water's ability to flush through the area, overboard dumping at a slip

Boats can damage the environment if they aren't used and maintained with care. Boat wakes cause shoreline erosion, bottom paints are toxic, and boat wastes add to water pollution. Follow the suggestions listed here to make your boat a non-polluter!

will deteriorate water quality in the immediate area of your boat and lead to foul-smelling water.

Trash is the most visible kind of Bay pollution. You should designate a storage area on your boat specifically for trash. Beer cans and tabs, styrofoam cups, plastic bags, and other debris can trap, injure, and kill aquatic life. Most of this debris doesn't disintegrate; instead, it remains in the Bay for years.

Maintaining Your Boat

Boats are normally hauled once a year for repairs, painting, and general maintenance. Many of the cleaning, dissolving, and painting agents used for maintenance are toxic to aquatic life. A few simple precautions can prevent these chemicals from unduly harming the Bay.

Copper and tributyltin (TBT) bottom paints, used to prevent fouling, cause particular environmental damage. In fact, the use of tributyltin is now greatly restricted by federal legislation. Bottom paints are a necessary evil, but their impact can be lessened if you control the amount that enters the Bay. When scraping the boat bottom, catch the scrapings with a drop cloth. Throw the cloth away when you're finished. If you don't have a drop cloth, sweep up the scrapings and throw them in the trash.

Marina owners and operators can participate in the Bay cleanup effort. By installing and maintaining a used oil drum, they make it easier to recycle your boat's oil. If the marina needs new pavement, encourage the operator to use the porous asphalt discussed in chapter 6. Any of the practices that increase infiltration (see chapters 1, 2, and 3) will also help the Bay. Marinas also provide logical places for the distribution of educational materials to boaters.

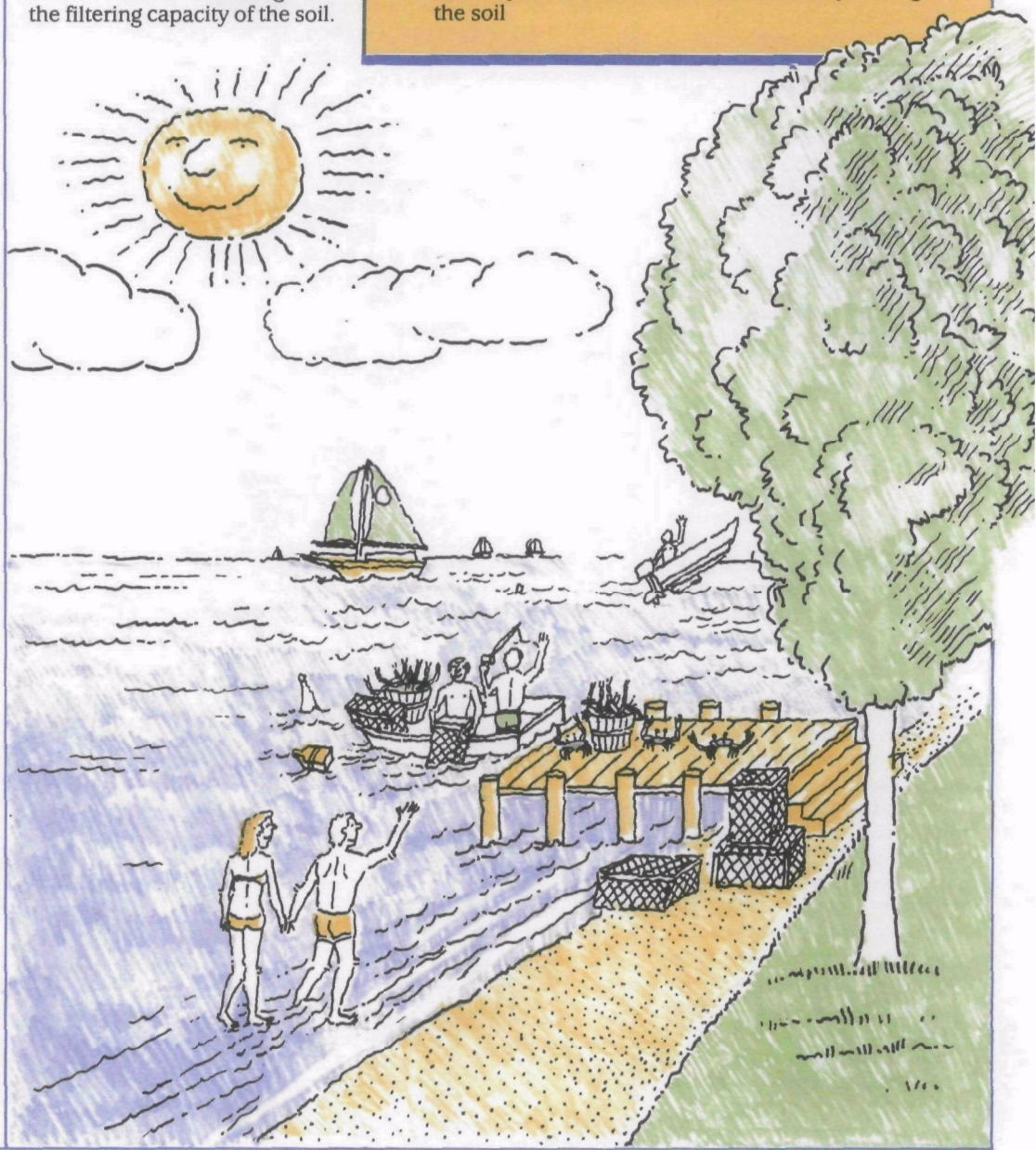
Swimming Pools

Many of us enjoy the pleasures of a backyard swimming pool. Pools require substantial doses of chemicals, especially chlorine, to keep the water bacteria-free. If you have to drain your pool, take care to prevent the chlorine from contaminating storm drains or nearby streams. Since chlorine dissipates rapidly, you should allow the pool water to sit for a few days before draining. Wherever possible, drain your pool onto an expanse of lawn to take full advantage of the filtering capacity of the soil.

WHAT YOU CAN DO

By observing the precautions outlined in this chapter, you will be helping to preserve the Bay for the enjoyment of many more generations of boaters, swimmers, and water sports enthusiasts:

- Observe posted marine speed limits
- Do not produce wakes within 500 feet of the shore
- Use phosphate-free detergents if you must wash your boat
- Discharge boat sewage into waters deeper than 20 feet or use on-shore sanitary facilities
- Do not throw trash overboard
- Use extreme caution when using cleansers, paint, and antifouling compounds on your boat
- Drain your pool only when necessary, and then onto a large expanse of lawn to allow the chlorine to dissipate and the water to filter slowly through the soil



Chapter 14

Restoring the Bay

The water that eventually finds its way into the Chesapeake Bay drains from countless parcels of property like yours in hundreds of counties in six states and the District of Columbia. To reduce pollution and restore the Bay to its former productivity, everyone—governments, communities, and individuals—must work together. The commitments made by the federal and state governments are a direct response to public concern about cleaning up the Bay. This public partnership will make the difference between the Bay as it has been and the Bay as we want it to be.

Many community groups in the Bay area have already organized activities and projects designed to improve water quality. This chapter describes educational activities and projects designed to help your community clean up and protect local streams and rivers.

Getting Started

Garden clubs, church and scout groups, civic associations, and service organizations all have a stake in improving local water quality. Groups such as these might want to consider devoting one or more meetings to learning about the Bay. You could feature a knowledgeable speaker, show a film, organize a panel discussion with local officials, or sponsor a half-day workshop on Bay issues.

Your county or city planning department or any number of Bay advocacy organizations can help you find speakers for your meeting. Bay advocacy organizations can also loan films and slide shows to your group. After you've had one or two meetings about the Bay, you can tackle a project that will begin to have an effect on water quality in your neighborhood creek and in the Bay.

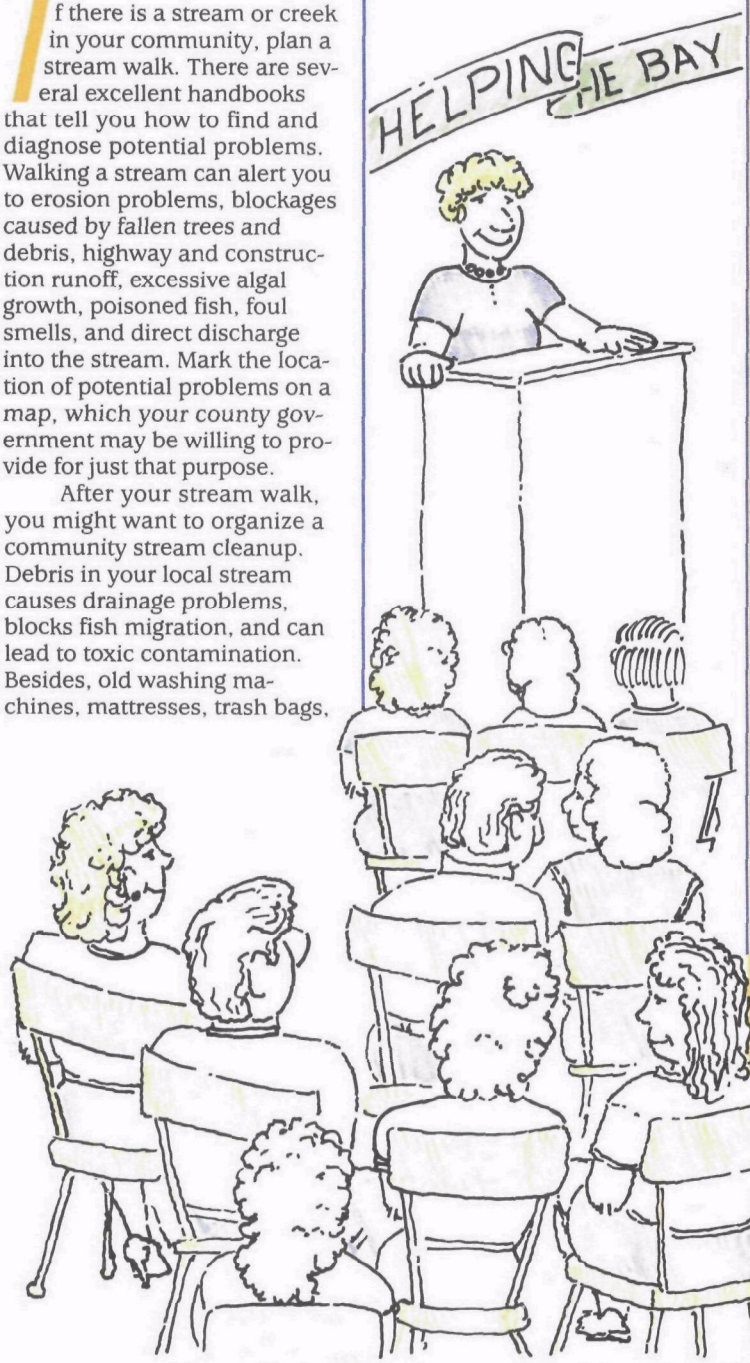
Your group should plan to see the problems discussed in your meetings about the Bay. If your local sewage treatment plant or landfill gives you cause for concern, arrange a tour and learn about the problems firsthand. Invite your city or county council member along to discuss ways of dealing with the problems you see.

Take a Stream Walk

If there is a stream or creek in your community, plan a stream walk. There are several excellent handbooks that tell you how to find and diagnose potential problems. Walking a stream can alert you to erosion problems, blockages caused by fallen trees and debris, highway and construction runoff, excessive algal growth, poisoned fish, foul smells, and direct discharge into the stream. Mark the location of potential problems on a map, which your county government may be willing to provide for just that purpose.

After your stream walk, you might want to organize a community stream cleanup. Debris in your local stream causes drainage problems, blocks fish migration, and can lead to toxic contamination. Besides, old washing machines, mattresses, trash bags, and fallen trees don't do much to improve the landscape. An excellent source of information about stream pollution and cleanup is an organization called Save Our Streams. SOS will help you plan and execute a community project. Their number is listed in the Resources section of this guide.

Educate your neighbors about the damage the soft



WHAT YOU CAN DO

After reading this guide, you know that there are many changes you and your family can make in household routines to help improve the quality of water flowing into the Bay. This chapter of the *Baybook* is about how you and your neighbors can join together to make a real difference in the future of the vast estuary known as the Chesapeake Bay.

- Encourage your church group, civic association, and other community groups to get involved in the area-wide efforts to preserve and restore the Bay
- Organize a stream cleanup project in your neighborhood
- Let your elected representatives know that your community is concerned about the quality of life in and around the Bay
- Call one of the local Bay advocacy organizations for more information about how your group can help monitor and improve water quality in the Bay
- Become a steward of the Bay's natural resources

drink cans they toss away can cause. Get everyone to remove trash and leaves from their gutters and stormdrains. This kind of debris should be thrown in the trash, not down the stormdrain, where it contributes to stream pollution.

Get Involved With Government

You and your neighbors can take part in comprehensive plan development and the zoning for your city or county. Through this process, areas adjacent to waterways can be given special consideration. One of the most effective ways you can influence decisions about how your county is developed or what happens with the local sewage treatment plant is to get your civic association involved. Some of the most successful citizen involvement stories are the result of community associations tackling an issue, becoming informed, challenging the "experts," conducting publicity campaigns, and coming up with an alternate plan.

The results of many scientific studies suggest a strong relationship between land use and declining water quality in the Bay. The health of the Chesapeake Bay clearly depends upon wise use of the watershed. Controlling the effects of future growth is important since the population in the Bay region continues to increase. By getting involved in the planning stage, you can help limit the adverse effects of uncontrolled development.

Land use policy decisions are a local government prerogative in Maryland, Pennsylvania, and Virginia. Each county or town has a comprehensive plan that forecasts needs and suggests possible land uses for the future. Some cities, towns, and counties are zoned for particular uses. Certain areas are designated for open land, residential or commercial development, or agricultural uses. These plans often take areas of significant ecological importance into account. For more information about how you can participate in the planning process, call your city or county planning office.

If you're not a member of your local civic association, join. If there's no association in your area, consider starting one. For issues that affect more than the immediate neighborhood, a coalition of community organizations may be effective. Coalition newsletters are useful tools for getting important information about Bay issues to members quickly and inexpensively.

Protecting the Bay: Good Habits Begin at Home

Stewardship—the wise use of natural resources—begins at home. Stewards are people who use natural resources wisely. This guide is designed to help all of us become stewards of the Bay. Only when we understand how our daily routines affect the Bay can we restore its productivity and preserve its beauty. By taking care when disposing of household chemicals, using pesticides only when absolutely necessary, conserving water, planting trees, shrubs, and plants, and maintaining your lawn, you are contributing to Bay-wide cleanup efforts.

You *can* make a difference. That's the point of this guide—to tell people that what they do every day makes a difference for the Bay. And whatever you do to benefit the Bay will, in the long run, benefit you, your family, and your community.

While you can implement many of the suggestions offered in this guide, there are some areas where you'll need more detailed advice. Find the issue you're concerned about and call the number listed for your state. With these resources and the information contained in the Baybook, you will be prepared to help preserve and restore the Chesapeake Bay and its watershed.

For a complete listing of citizen groups, government agencies, and business and trade associations involved in Chesapeake Bay issues, contact the Alliance for the Chesapeake Bay, Inc. (numbers on page 31) and ask about "Chesapeake Citizen Directory."

PREVENT EROSION ON YOUR PROPERTY/TEST YOUR SOIL

- Maryland Cooperative Extension Service (301) 405-2907
- Pennsylvania Cooperative Extension Service (814) 863-0331
- Virginia Cooperative Extension Service (703) 231-6705 (703) 231-6893 (soil test)
- D.C. Cooperative Extension Service (202) 576-6951

FIND SUITABLE TREES FOR SOIL STABILIZATION

- Maryland Forest, Park and Wildlife Service (410) 974-3776
- Pennsylvania Bureau of Forestry (717) 787-2703
- Virginia Dept. of Forestry (804) 977-6555

LOCAL GOVERNMENT CONCERNS

- Local Government Advisory Committee 1-800-446-5422

STABILIZE THE SHORELINE

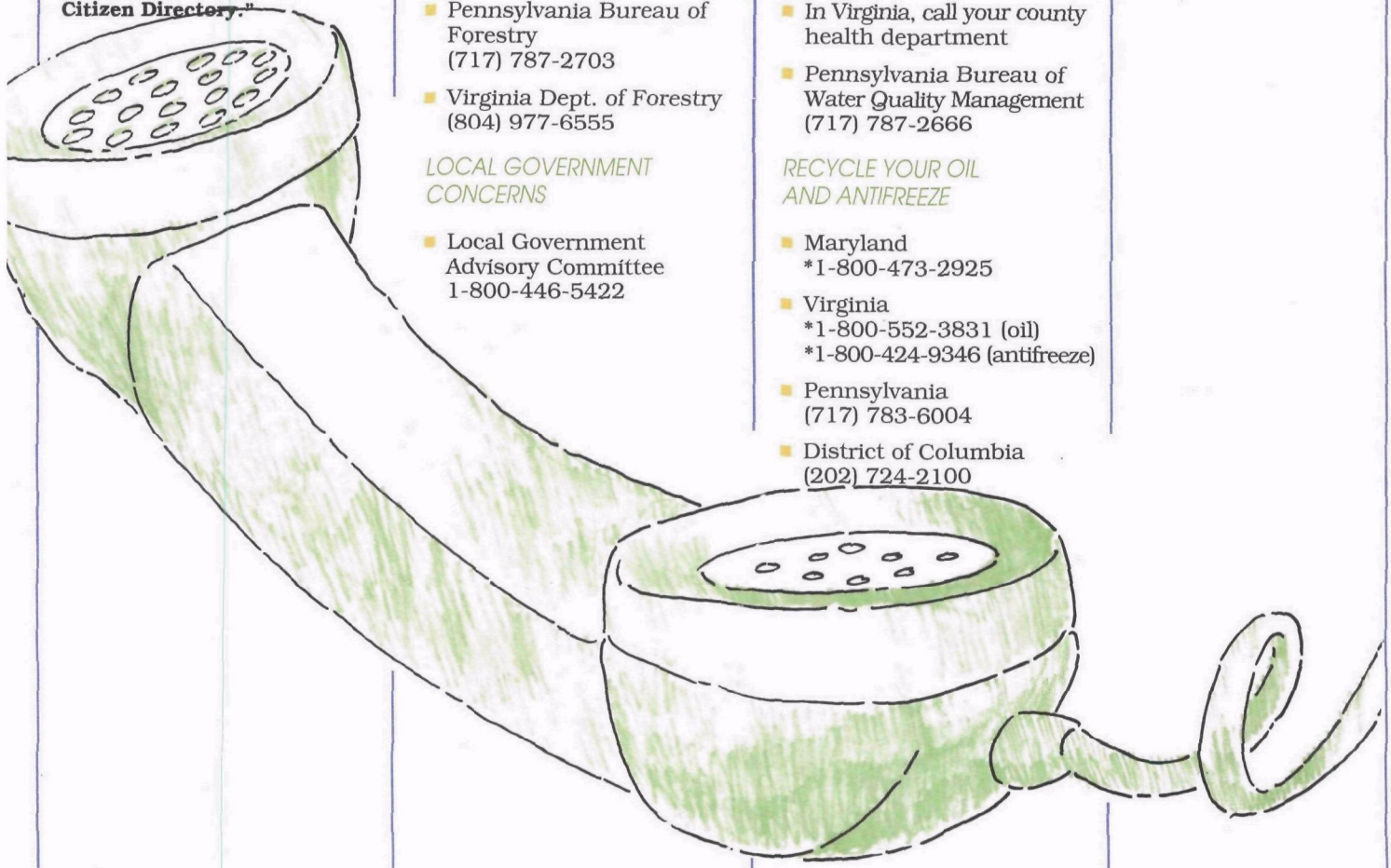
- U.S. Army Corps of Engineers (410) 962-3670
- Maryland Department of Natural Resources, Shore Erosion Control (410) 974-3727
- Virginia Shoreline Erosion Advisory Service (DCR) (804) 642-7121
- District of Columbia Erosion Control (202) 404-1146

LEARN ABOUT SEPTIC SYSTEM PLACEMENT AND MAINTENANCE

- Maryland Department of the Environment (410) 631-3652
- In Virginia, call your county health department
- Pennsylvania Bureau of Water Quality Management (717) 787-2666

RECYCLE YOUR OIL AND ANTIFREEZE

- Maryland *1-800-473-2925
- Virginia *1-800-552-3831 (oil) *1-800-424-9346 (antifreeze)
- Pennsylvania (717) 783-6004
- District of Columbia (202) 724-2100



DISPOSE OF PESTICIDES AND HOUSEHOLD CHEMICALS PROPERLY

- Maryland
  (301) 631-3305
- Pennsylvania
  *1-800-322-9214
- Virginia
  *1-800-424-9346
- District of Columbia
  (202) 404-1167

PREVENT EXCESSIVE EROSION

- Maryland Department of Agriculture
  (410) 841-5865
- Maryland Department of the Environment
  *1-800-922-8017
- Virginia Department of Conservation & Recreation, Division of Soil & Water Conservation
  (804) 786-2064
- Pennsylvania Department of Environmental Resources, Bureau of Land and Water Conservation
  (717) 787-5267
- D.C. Department of Consumer and Regulatory Affairs
  (202) 727-7170
- Local USDA Soil Conservation Service office
- Local Soil Conservation District office

ALERT OFFICIALS TO OIL OR TOXIC CHEMICAL SPILLS

- Maryland
  (301) 974-3551
- Virginia (and Fish Kills)
  (804) 527-5200
- Pennsylvania
  1-800-541-2050
- Environmental Protection Agency
  (410) 267-0061

*NOTE: 800-523-2281 used within the designated area

SHOW YOUR CONCERN FOR THE BAY

If you want more information about the Bay or your local river or stream, or if you want to become more involved in issues affecting the Bay, call:

- Alliance for the Chesapeake Bay, Inc.
  (410) 377-6270 (Maryland)
  (717) 236-8825 (Penn.)
  (804) 775-0951 (Virginia)
- Chesapeake Regional Information Service
  1-800-662-CRIS
- Chesapeake Bay Foundation
  (410) 368-8816 (Maryland)
  (804) 780-1392 (Virginia)
  (717) 234-5550 (Penn.)
- Save Our Streams
  (410) 969-0084
  800-448-5826

CONTACT YOUR STATE AND FEDERAL AGENCIES

- Pennsylvania Department of Environmental Resources
  (717) 783-2300
- Virginia Council on the Environment
  (804) 786-4500
- Maryland Department of the Environment
  (410) 631-3000
  800-633-6101
- District of Columbia Department of Consumer and Regulatory Affairs
  (202) 727-7000
- Governor's Ches. Bay Communication Office
  (410) 974-5300

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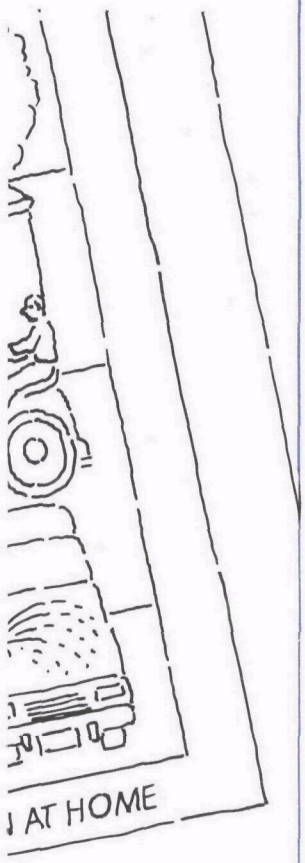

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Chesapeake Bay Program

Alliance for the Chesapeake Bay