Watershed Stewardship Action Kit

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Introduction

To the Izaak Walton League of America

Welcome! We are excited that you have decided to become an active steward of our nation's streams, rivers, and wetlands. To help stewards like you, the Izaak Walton League of America has developed a variety of handbooks and videos about stream monitoring, habitat restoration, and wetland ecology and conservation. This Watershed Stewardship Action Kit is one of a series of introductory watershed education materials that helps citizens get their feet wet and their hands dirty to protect and restore waterways in their communities. The only job requirement is a desire to conserve these vital resources.

"THE LAND ETHIC SIMPLY ENLARGES THE BOUNDARIES OF THE COMMUNITY TO INCLUDE SOILS, WATER, PLANTS, AND ANIMALS..."

– Aldo Leopold
A Sand County Almanac

The Izaak Walton League is a national grassroots organization founded in 1922. Our mission is to conserve, maintain, protect, and restore natural resources, and to promote the responsible utilization of those resources. Since organizing the first national water pollution inventory in 1927, the League has won many important clean water battles. In the 1940s, League members helped to pass the first federal water pollution control act. The League also helped to pass the landmark 1972 Clean Water Act. More recently, the League won a major victory for clean water when it convinced the nation's fourth-largest utility, Xcel Energy, to clean up three of its coal-fired power plants. The great reductions in sulfur dioxide, nitrogen oxides, and mercury emissions will improve water quality by reducing acid rain and will protect human health by providing cleaner air and water. The League also helped create the Clean Ohio Fund, which provides $400 million for environmental clean-up and land preservation.

Our members have also achieved many watershed conservation successes. After being trained in the League's biological stream monitoring protocol, members of our Central New York Chapter used data they gathered about Bear Trap Creek to inform county officials of pollution from Syracuse International Airport. As a result, the airport was required to build a multimillion-dollar facility to filter its runoff. In Virginia, League members worked closely with the state and local university scientists to develop a statewide volunteer training program based on the League's national stream monitoring protocol. Virginia uses the data to prioritize rivers for restoration and to supplement information in the biennial state rivers assessment, sent to Congress and the U.S. Environmental Protection Agency. League staff and members also have restored thousands of linear feet of eroding stream banks across the country, protecting vital fish habitat and improving water quality downstream.

For more information, contact:
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Website: www.iwla.org

The League also has involved volunteers in citizen advocacy efforts to support strong federal, state, and local legislation to conserve wetlands. In 2003, we released a groundbreaking report that demonstrated that Congress intended full protection for all wetlands through passage of the Clean Water Act. This legal review has helped the League and partner organizations to counteract attempts to limit the ability of the federal government to regulate activities that harm wetlands.

Although the League's mission has maintained a central focus on clean water and habitat issues for more than 80 years, our agenda has varied in response to the growing list of new, complex problems facing the environment. Our national conservation programs address such issues as energy efficiency, wetland protection, sustainable development, farm conservation, and responsible outdoor behavior. Our members participate in local hands-on conservation projects in more than 300 chapters nationwide. Members maintain wildlife habitat, teach outdoor ethics, give scholarships to students for conservation studies, clean streams and roadsides, and work to make their communities healthier. Our national program staff educates League members and the public though publications, workshops, one-on-one consulting, public festivals, and speaking engagements. Staff and members also work to educate policymakers at the local, state and national levels and to promote good conservation legislation.

For more than 30 years, the League's watershed programs—Save Our Streams and Protect Our Wetlands—have developed innovative educational programs for groups and individuals. The League has educated and motivated citizens to clean up stream corridors, monitor stream health, restore degraded stream banks, and protect dwindling wetland acreage. These important watershed stewardship activities have been implemented nationally by League staff and in communities across the country Our success results from the technical assistance and fundamental science background we provide on today's environmental issues. We also equip people with the skills and tools to organize projects in their own communities.

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**A laminated, color version of the Field Guide to Aquatic Macroinvertebrates is available from the Izaak Walton League for an additional fee. The League recommends this durable version of the field guide for outdoor use.*

For more information on the League's watershed education materials, visit our Web site at www.iwla.org.

WATERSHED STEWARDSHIP ACTION KIT

This publication is an excellent introduction to watershed conservation for citizen stewards. The kit includes fact sheets about watersheds, water pollution, stream and wetland ecology, and regulations that conserve watersheds. In addition, the kit includes watershed conservation project ideas, water-quality monitoring instructions, and detailed information on volunteer monitoring, trash cleanups, stream enhancement projects, and wetland conservation projects. The kit also

provides guidance on obtaining funding and publicity for conservation projects. It comes in a two-pocket folder that makes it easy to store notes or additional educational materials. We hope that this publication will help you begin your efforts to become more involved in your community's environmental health.

A detailed listing of resources and contacts is available on our Web site at www.iwla.org/sos/resources. Resources include books, videos, Web sites, and other materials that provide additional information about subjects covered in this kit. Contacts include phone numbers of state and federal agencies that regulate water quality.

Individual fact sheets contained in this Watershed Stewardship Action Kit may be copied in small quantities and for educational purposes only. The Izaak Walton League name and contact information must remain on the sheets.

Understanding Your Watershed

The Vital Link Between Land Uses and Water Quality

WHAT IS A WATERSHED?

A watershed is the area of land and air that drains into a particular water body. A good way to understand watersheds is to think about what happens to one drop of rain when it lands on the ground. It could fall on a paved surface and run into a storm drain, through a pipe and into a stream. Or it could soak into the earth, become ground water, and slowly make its journey towards a wetland or river. A watershed can be large like the Mississippi River, which drains more than a million square miles of land from 33 states and two Canadian provinces, or as small as a few acres.

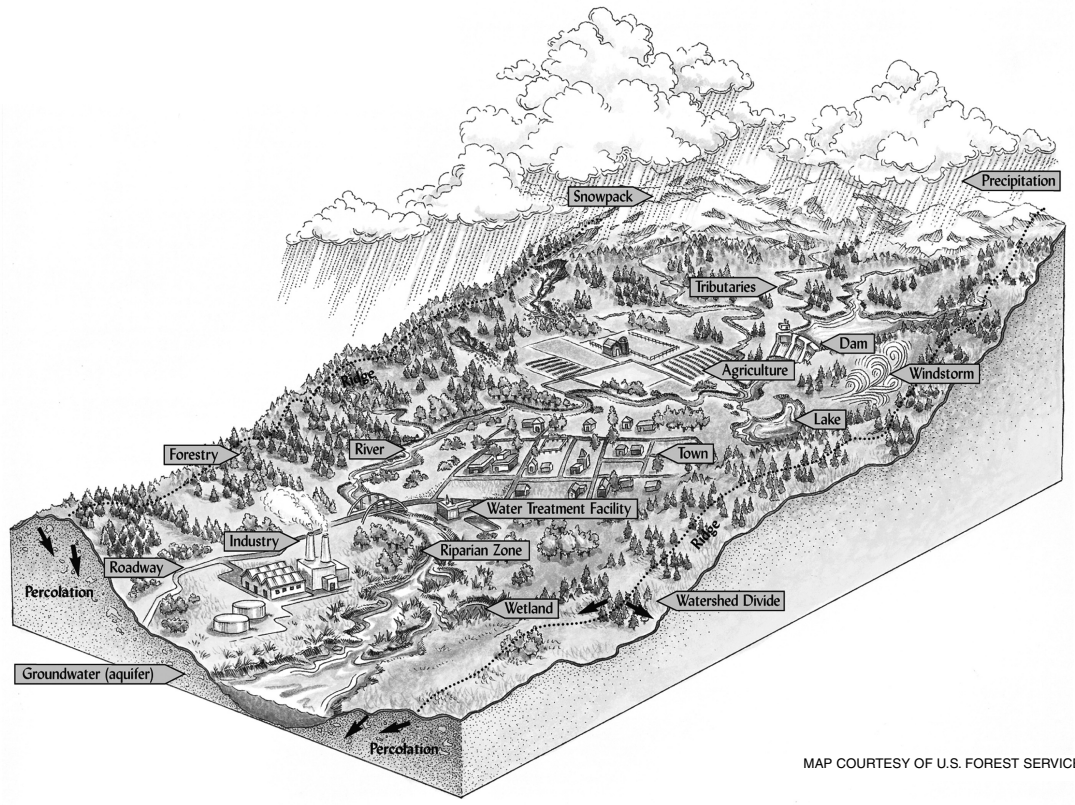
To locate your watershed, refer to the "Watershed Survey" factsheet in this publication.

HOW ARE LAND USES AND WATER QUALITY LINKED?

Any activity that occurs on the land can affect water quality because any pollutant on land or in the air can wash into waterways when it rains. Different land-uses have the potential to cause different types of water quality degradation. For example, rain that washes over your yard may pick up excess fertilizers and pesticides and carry them into your local water body. This may also happen on farmland. When rain washes over driveways, roofs, and streets, it can pick up oil, rubber and other residues. On hot days, these paved surfaces heat up rain runoff that can then enter a waterway and cause elevated water temperatures.

"WATER IS THE MOST CRITICAL RESOURCE ISSUE OF OUR LIFETIME AND OUR CHILDREN'S LIFETIME. THE HEALTH OF OUR WATERS IS THE PRINCIPAL MEASURE OF HOW WE LIVE ON THE LAND."

– Luna Leopold



MAP COURTESY OF U.S. FOREST SERVICE

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Once you have determined whether or not your waterway is degraded, an inventory of land uses within the boundaries of your watershed will help you locate potential sources of degradation. Refer to the "Watershed Survey" factsheet in this publication for information about conducting a land-use inventory.

SOURCES OF POLLUTION: POINT AND NONPOINT

When asked to picture pollution entering rivers, most people think of discharge pipes from factories spewing foul-smelling chemicals into the water. Factory discharge pipes also are known as point sources of pollution because they come from a single source. Point sources of pollution threaten the health of rivers and are subject to federal regulations under the Clean Water Act. The National Pollution Discharge Elimination System (NPDES) requires factories and other point source dischargers to obtain permits and adhere to standards. Since its enactment, the Clean Water Act has been directly responsible for removing more than 1 billion pounds of toxic chemicals per year and more than 6 billion pounds of oxygen-depleting pollution from wastewater each year.

The major threat to today's water quality is pollution without an easily identifiable source, or nonpoint-source pollution. Nonpoint-source pollution accounts for more than half of all surface water pollution. We all contribute to nonpoint-source pollution. Using fertilizer and pesticides on our lawns, failing to clean up after our pets, and washing our cars are all activities that cause nonpoint-source pollution. Every time it rains or snows, natural and man-made pollutants on the land are washed into streams and wetlands with the storm water. These pollutants include pesticides, fertilizers, metals, manure, road salt and motor oil that originate from farms, lawns, paved surfaces, landfills and home septic systems. In addition, air pollutants contaminate rain water.

Another significant contributor to nonpoint-source pollution is soil erosion. Although erosion is a natural process, an unnatural acceleration of this process may be caused by construction sites, dirt roads, and other land disturbances. In fact, according to the Environmental Protection Agency, eroded soil is the most widespread pollutant in rivers. Other possible sources of sediment pollution are cropland, surface mines, overgrazed pastures, landfills, logging operations and other activities that produce areas of bare soil. The texture of the soil and its potential for absorbing water, the steepness of the slope and the adequacy of protective ground cover are all factors that influence the extent of erosion.

Nonpoint-source pollution can degrade a stream quickly by introducing organic and inorganic pollutants that bury streambeds, decrease oxygen and negatively affect aquatic life. Nutrients, such as nitrogen and phosphorus, that enter streams through storm water runoff, cause excess algae growth in streams, lakes, wetlands and estuaries. When the algae dies, it decomposes, depleting dissolved oxygen required by fish and other aquatic organisms. Erosion of sediment into a stream can smother aquatic life and clog the gills of fish as well as diminish light that underwater plants need to grow. Bacteria washed into streams from septic tanks and animal waste runoff can make aquatic organisms and humans sick.

Nonpoint-source pollution problems are increased in urban and suburban areas because paved surfaces cause runoff to occur faster and in greater quantities. In a healthy and functioning watershed, pollutants are absorbed and filtered by soil and vegetation before they can reach waterways. Paved roads, parking lots and rooftops are called impervious because water is

unable to penetrate these surfaces to reach the soil beneath them. In many urban areas, storm water rushes over pavement, collecting nonpoint-source pollution. This water then flows into a storm drain and shoots through an outfall pipe directly into the stream. This high volume of storm water can erode streambanks, thus increasing the problem of sediment pollution downstream. New construction sites can also lead to sediment pollution if steps are not taken to prevent erosion of exposed soil. Impervious surfaces also cause thermal pollution because rainwater flows over hot pavement before entering the stream. As urban sprawl becomes the norm, nonpoint-source pollution becomes more and more difficult to address.

The Clean Water Act also regulates nonpoint-source pollution. For more information about the legislation and how you can participate in the regulatory process, refer to “Understanding and Using the Clean Water Act” in this publication. In addition, there are many actions you can take, both as an individual and as a part of your community, to prevent nonpoint-source pollution and to alleviate its effects on local waterways. There are choices we make every day that can affect the amount of nonpoint-source pollution entering our streams. This action kit can help you become a watershed steward by providing the tools to diagnose watershed problems and take action to improve the health of your watershed.

10 Steps to Cleaner Water

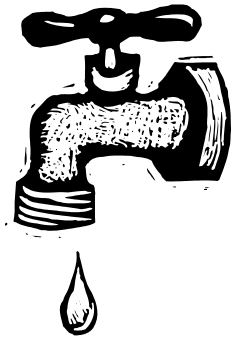
1. EDUCATE YOURSELF.

- Learn the characteristics of a healthy watershed and the functions and values of streams and wetlands.
- Learn how sediment, suspended solids, pH, nutrients, pesticides, metals, oil, and other potential pollutants harm local waterways.
- Gather information about how these pollutants may be affecting your watershed at your local library and on the Internet.
- Contact your state for copies of reports assessing the water quality of state rivers and wetlands. Your state may have a variety of pamphlets about river and wetland protection, habitat improvement, erosion control measures, volunteer organizing, and local environmental conservation laws.
- Check the Izaak Walton League's online resource list at www.iwla.org/sos/resources/.
- Research existing government and nonprofit programs and inform your local community and conservation groups about them.

2. CHANGE YOUR BEHAVIOR.

Find out how you can conserve water by making small changes in your everyday behavior. Here are some tips:

- Fix leaky faucets.
- Install low-volume toilets or reduce the volume of your existing toilets by placing water-filled plastic bottles in the tanks.
- Find and repair toilet leaks. To check for leaks, put food coloring in the tank. If colored water appears in the bowl after 30 minutes without flushing, there is a leak.
- Do not run water continuously while brushing teeth, shaving, or washing dishes.
- Only run dishwashers and clothes washers when there is a full load.
- Take shorter showers.
- Install a water-conserving showerhead.
- Consider not using garbage disposals because they consume large amounts of water and add organic materials to sewage treatment systems.
- Landscape your home with native trees, shrubs, and flowers that do not need to be watered or fertilized.



AT SOME POINT, THE WILL TO CONSERVE OUR NATURAL RESOURCES HAS TO RISE UP FROM THE HEART AND SOUL OF THE PEOPLE – CITIZENS THEMSELVES TAKING CONSERVATION INTO THEIR OWN HANDS AND, ALONG WITH THE SUPPORT OF THEIR GOVERNMENT, MAKING IT HAPPEN.

– Mollie H. Beattie, former Director, U.S. Fish and Wildlife Service

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■ If you need to water plants, use drip irrigation or soaker hoses.Capture rainwater from rooftops in rain barrels and use it to water plants.
■ Ask your state cooperative extension office for help in testing your soil to make sure you use the right amount of fertilizer. Excess fertilizer washes into streams when it rains, which may cause algae growth and reduced levels of dissolved oxygen.
■ Take used motor oil to a recycling center or a gas station that recycles it. Oil poured down drains goes into streams, and oil thrown away in the trash may leach from sanitary landfills to contaminate ground water.
■ Do not pour household chemicals such as paint or cleaners down drains, storm drains, or on the ground. Better yet, select household cleaning products with low toxicity or pick a non-toxic alternative (see table).
■ Participate in local programs for hazardous household waste disposal.
■ Inspect septic systems annually and pump them out every three to five years.
■ Clean up after pets and dispose of wastes in the trash or toilet.

3. BECOME A WATCHDOG FOR LOCAL WATER RESOURCES.

To be an effective watershed steward, you need to stay informed about the laws designed to protect our nation's water resources. Familiarize yourself with the Clean Water Act, which has provisions for citizen protection of rivers and wetlands, such as citizens' suits against polluting industries and citizen involvement in the permit review process. For more information on the Clean Water Act, see the fact sheet "Understanding and Using the Clean Water Act" in this kit. On a local level, you should also educate yourself about how particular industries might be affecting your watershed. All industries discharging wastewater into a waterway must have a National Pollution Discharge Elimination System (NPDES) permit, which regulates the type and amount of wastes allowed in industrial discharge. Contact your state's water-quality agency and get on its mailing list for permit review. Make comments on any permit applications that appear for your watershed, and encourage the use of alternative technologies that produce less pollution. Obtain copies of the permits already issued that affect your local stream. If you

ALTERNATIVES TO HAZARDOUS HOUSEHOLD CHEMICALS

Household Chemical	Environmentally Friendly Alternative (s)
Ammonia-based cleaners	Vinegar, salt and water
Abrasive cleaners	•Lemon dipped in borax •Salt and baking soda
Furniture polish	Lemon juice and olive oil
Toilet cleaner	Baking soda
Oven cleaner	Liquid soap, borax, and warm water
Disinfectants	Water and borax
Drain cleaners	Boiling water, baking soda, and vinegar
Upholstery cleaners	Dry cornstarch
Mothballs	•Cedar chips •Lavender flowers
Plant insecticide	Soap and water
Silver polish	Soak in water, salt, baking soda, and a piece of aluminum
Window cleaner	White vinegar and water

detect a permit violation in the field through water quality monitoring, document the problem and report it to your state's water-quality agency. A failure to comply with permit requirements is a violation of the Clean Water Act and is subject to enforcement and fines.

Permits also are required to fill in or destroy wetlands. Citizens can provide comments about applications for permits to alter wetlands and can report violations of wetland law. Regulatory agencies are unable to discover and address every wetland violation that occurs. Citizen complaints often trigger enforcement actions. You can ensure that you are notified of permit applications in your area by contacting the Army Corps of Engineers office in your state.

4. ADVOCATE FOR BETTER WATERSHED CONSERVATION LAWS.

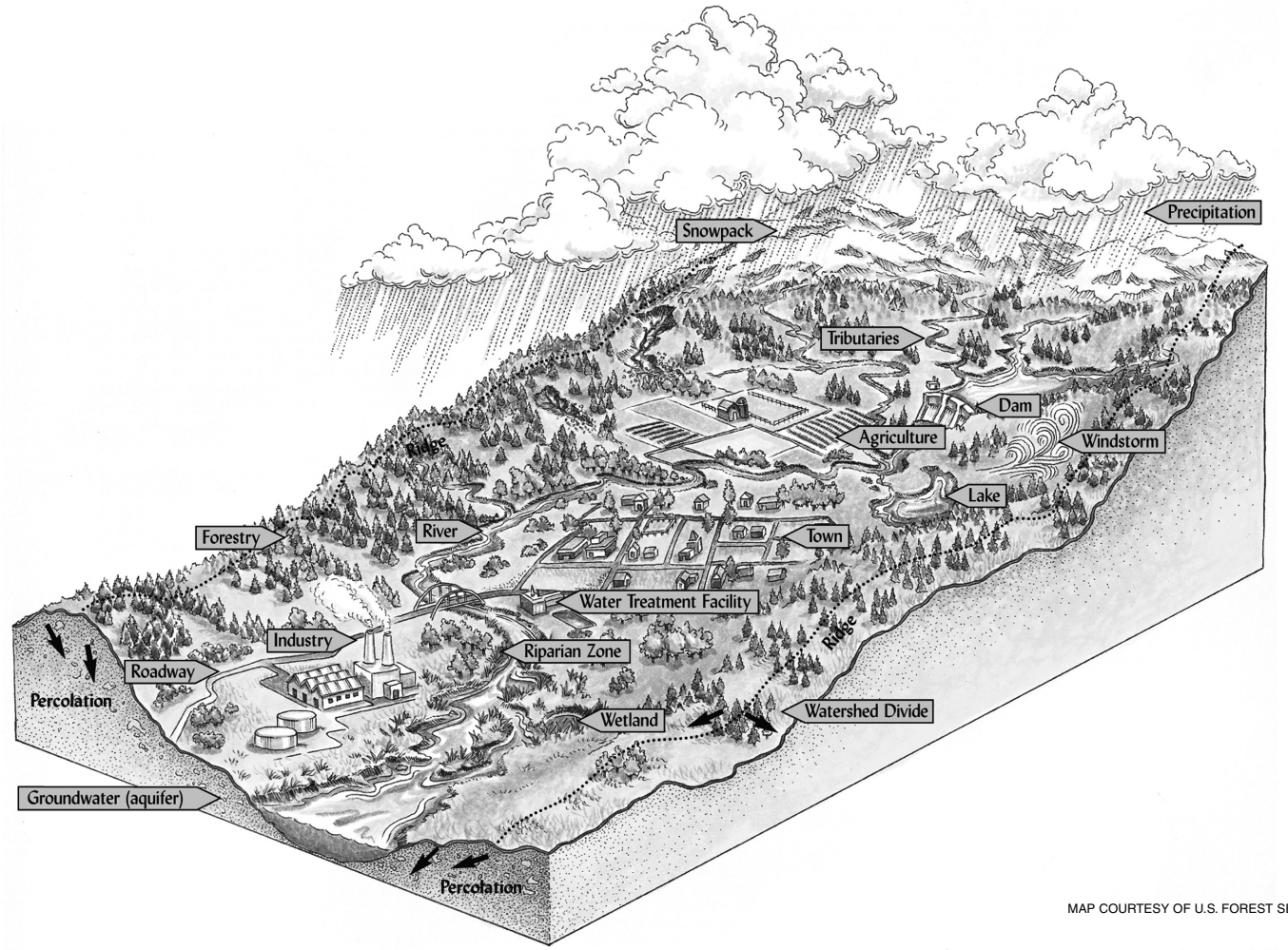
National and local regulation provide an excellent avenue for conserving the country's watersheds. For example, under the Clean Water Act, factories and other industries that discharge waste into waterways are required to apply for a permit and comply with certain standards or face steep fines or imprisonment. To keep current watershed conservation laws in place and to pass better laws, constituents need to tell their elected officials that clean water is an important issue. For more information on national watershed policy, advocacy tips, and action alerts on the most current conservation policy opportunities, please visit the League's Web page at www.iwla.org and click on "Take Action." This site also provides an easy way to send messages to members of Congress and to keep track of their votes on important conservation issues. In addition to advocating for better regulations on a national basis, you should get involved locally. Attend public hearings on watershed conservation issues. Present information about the importance of local water resources to planning commissions and local elected officials. For more information on getting started with local advocacy, contact the League.

5. JOIN AN EXISTING WATER CONSERVATION GROUP OR FORM A NEW GROUP.

Join a local Izaak Walton League chapter or a local watershed association. If there are no chapters or associations in your community, you may want to form a new League chapter or watershed group. There are many steps involved in getting started, but the first may be to find the right leader. The backbone of an organization is a strong leader, who should have enough time to devote to overseeing a project. This individual should be able to find the right people to fill various roles within the group and then be able to follow through in a supportive way to ensure that the work gets done. For more information on starting a group, refer to the factsheet "A Guide to Watershed Cleanups" in this kit.

Remember to work with other interested groups. All waterway conservation efforts can benefit from additional funds, volunteers, publicity, materials, technical knowledge, and other resources. Begin making a list of all the resources available to keep your project going. Survey your community for talent. Izaak Walton League chapters, other conservation organizations, civic associations, garden clubs, Boy and Girl Scout troops, government agencies, local corporations, universities, volunteer service corps, and many other groups can help. Many retired people have good backgrounds in natural sciences and can help with stream monitoring programs, water quality testing projects, fish and wildlife habitat areas, or legal and technical advice. Your city council, chamber of commerce, Conservation Corps, Junior League, or parks department might be able to donate equipment or funds. Approach local corporations and businesses for volunteers, project sites, funding, and in-kind donations. Many government agencies, private organizations, and foundations also fund local water conservation projects.

For more information on project planning and funding sources, contact the League's Watershed Assistance, Training, and Educational Resource (WATER) Center at (800) 284-4952 or sos@iwla.org. For information on League chapters near you or for information on forming a new chapter, visit the League's Web site at www.iwla.org.



MAP COURTESY OF U.S. FOREST SERVICE

6. MAP YOUR WATERSHED.

Mapping your watershed can help you locate potential sources of pollution. Since water runs downhill, the lay of the land determines the size of your watershed. Try to determine the area of land sloping down to your stream. Contact the U.S. Geological Survey for topographic maps of your watershed. Your county environmental or planning office might also be able to produce a map of your watershed using Geographic Information System (GIS) software.

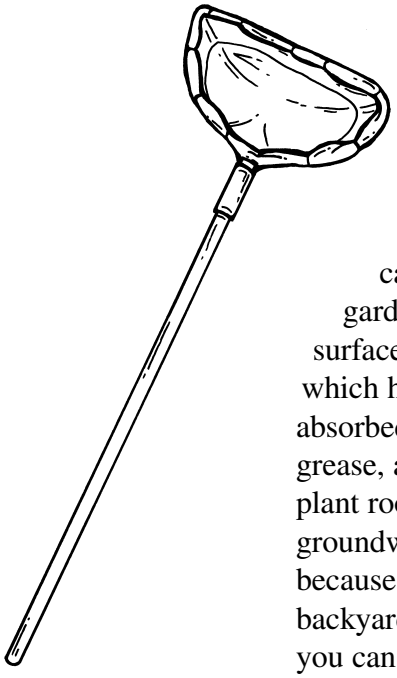
Knowing the boundary of your watershed is important because all land uses in the watershed affect the water quality. For example, if farming is a major activity in the area, your stream may suffer from an over-abundance of soil and nutrient pollution. If your stream is located in an urban environment with heavy development, it might suffer from excess sediment. By surveying your stream and the surrounding area, you can determine the types of land uses in your watershed and indicate them on a map. This way, if you notice a change in water quality downstream, you can track possible sources upstream.

7. MONITOR STREAMS AND WETLANDS.

Use the League's biological stream-monitoring method to determine the water quality of a local stream. The League's method collects macroinvertebrate samples from monitoring stations every quarter of a mile along the stream. Monitoring data may be used to track changes in the water quality over time. Your state and local government agencies may accept your data to assess long-term water quality trends. For more information about the League's biological monitoring protocols, please review the factsheet "Stream Quality Survey Instructions" in this publication.

Use data forms and instructions from the Izaak Walton League's *Handbook for Wetlands Conservation and Sustainability* to record the vegetation, soils, hydrology, and wildlife in local wetlands. Use this record to track changes in wetland characteristics over time that may alert you to problems or changes in land use. These records also may be used in public hearings to illustrate the functions and values of the wetland that will be lost if a permit to change a wetland is granted. Stream and wetland monitoring information may be used to make land-use management decisions and to prioritize areas for restoration. For information on other wetland monitoring methods, contact the Izaak Walton League.

8. ENHANCE STREAM CORRIDORS AND WETLANDS.



Stream and wetland cleanups are easy projects that can help enhance both the beauty and quality of a waterway. Cleanup campaigns have many benefits, one of which is attracting publicity to get community members interested in watershed conservation efforts. Always get permission from landowners along the waterway if you plan to enter private property. Invite landowners and other community members to participate. Adding an educational component to the cleanup can address the sources of pollution and engage the community in future pollution prevention. More information on organizing cleanups and keeping volunteers safe can be found in the factsheets *"A Planner's Guide to Watershed Cleanups"* and *"Safety and Fun in Your Watershed"* in this publication.

Expand on cleanup efforts with other types of enhancement projects. Removing exotic invasive plant species can provide room for native plants to grow. Native plants are important because they provide food and habitat for wildlife. Planting buffers of vegetation around streams and wetlands improves wildlife habitat and water quality by filtering rain runoff. Buffers also prevent erosion because root systems stabilize streambanks, and they shade the water, lowering the temperature and allowing additional dissolved oxygen for fish, aquatic insects, and crustaceans. For more information on enhancement, please refer to the League's publication, *A Handbook for Stream Enhancement and Stewardship*.

9. PROMOTE STORMWATER SOLUTIONS AT HOME AND IN THE COMMUNITY

Incorporate water-saving and water-cleansing techniques at home such as rain barrels, rain gardens, and backyard wetlands. Invite neighbors to tour your yard, and let them know how they can become part of the solution to nonpoint source pollution in the community.

Rain barrels are large containers that collect and store rain from downspouts. The water can later be used for lawns and gardens. Rain gardens temporarily store rainwater from paved surfaces and downspouts in a low-lying garden area, which holds water for several hours until it is absorbed by the plants and soil. Fertilizers, pesticides, grease, and other pollutants are trapped by the soil and plant roots while the clean water trickles down into the groundwater. Homeowners benefit from rain gardens because they provide a colorful, low-maintenance backyard habitat. In addition to creating rain gardens, you can use native vegetation to transform soggy backyards into wetlands that further improve water quality and wildlife habitat.

Encourage your community to reduce nonpoint source pollution through conservation development. Conservation development relies on careful stewardship of the land and water to build livable communities. Often, conservation development involves grouping buildings close together in the least environmentally sensitive part of the site, while conserving the rest of the area as shared open space. Find out if the local regulations and ordinances support conservation development. If not, educate municipal officials and the community about how conservation development can improve water quality. Work with elected officials to pass zoning ordi-

nances that provide incentives to developers who design projects with conservation in mind.

Contact the Izaak Walton League for more information about rain barrels, rain gardens, backyard wetlands, and conservation development practices.

10. EDUCATE OTHERS.

One of the best ways to get others involved in watershed stewardship is to teach a friend, neighbor, or school group about watershed conservation. Talk to local civic groups and explain the need for their involvement. You can also target a specific audience for your message. For example, work with local landowners to develop land-use strategies for water quality, such as planting buffer strips of vegetation along streambanks. Or, host a watershed festival to raise public awareness. To reach a broad audience, keep the media updated about your project. Suggest a story about your stream or wetland project, and ask the media to cover local events. Explain that the project benefits the local community since clean water means a safer, healthier, and more aesthetically pleasing environment for everyone. You can also write letters and op-eds to local newspapers. Keep copies of any media coverage for future use.

Understanding and Using the Clean Water Act

AN UNDISTURBED RIVER IS AS PERFECT AS WE WILL EVER KNOW, EVERY REFRACTIVE SLIDE OF COLD WATER A GLIMPSE OF ETERNITY.

– Thomas McGuane, "Midstream," An Outside Chance

The survival of every person, plant, and animal depends on clean water. Unfortunately, many of our daily activities can degrade water quality. The Clean Water Act was established to strike a balance between our daily activities and the purity of our water resources.

Passed in 1970 with additional amendments in 1972, the Clean Water Act (CWA) is the primary piece of national legislation that protects water quality in the United States. It gives the U.S. Environmental Protection Agency (EPA) the authority to set and enforce water quality standards and regulate pollutants that are discharged into waterways. Although states and local governments have the authority to develop more stringent water quality regulations than those outlined by the federal government, in many cases the CWA may be the only legislation that a community or a state has to improve or protect their water quality.

The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Goals set forth in the CWA include eliminating discharge of pollutants into navigable waters by 1985 and achieving water quality that protects fish and wildlife and allows recreation in and on the water by 1983. The CWA strives to achieve these goals by prohibiting the discharge of toxic pollutants in toxic amounts and by developing and implementing programs for the control of nonpoint sources of pollution.

Since its enactment, the CWA has been directly responsible for removing more than 1 billion pounds of toxic chemicals from waterways and more than 6 billion pounds of oxygen-depleting pollution from wastewater each year. These improvements result in cleaner, safer water for public consumption and recreation, and improved aquatic habitat for fish and wildlife. However, much more needs to be done. In fact, approximately 40 percent of the waterways that have been assessed still are not safe for swimming and fishing. Fortunately, each of us can become involved in strengthening the Clean Water Act and using it to protect and improve the streams and wetlands in our neighborhoods.

WATER QUALITY STANDARDS

The CWA directs states and tribes to establish water quality standards for each waterway. These standards include designated uses, water quality criteria, and antidegradation requirements. The designated uses include current uses of the water body and future desired uses that require good water quality. Designated uses may include activities such as fishing, swimming, or boating. The water quality criteria are developed to describe the chemical, physical, and biological conditions needed to support each of the designated uses. The antidegradation policy prohibits activities that would pollute

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water to the extent that a current use is no longer supported. If a water body has exceptional ecological or recreational significance, this policy protects that water body from any activity that would degrade it.

The water quality standards established by the states are very important because all water quality protections for specific waterways are based on these standards. Each of us has an opportunity and a responsibility to make sure that the standards provide adequate protection for each watershed. Another way to become involved with water quality issues is to work on your state's triennial review of water quality standards by participating in public hearings and submitting written comments.

Also, under Section 305(b) of the CWA, the U.S. Environmental Protection Agency is required to report to Congress every two years on the status of surface water quality. Each state in turn reports to EPA on its water quality. The reports help determine priorities at the state and federal levels for pollution control and management. The reports are available to the public and provide current information on water quality.

POINT SOURCE DISCHARGE PERMITS

Under the Clean Water Act, it is illegal to discharge any pollution into a water body without a permit. All point-source pollution discharges require a National Pollutant Discharge Elimination System (NPDES) permit. Point sources of pollution include any pollution discharged through a pipe, ditch, conduit, or other discrete conveyance. Examples of point sources include municipal and industrial wastewater plants, stormwater and mining runoff, concentrated animal feeding operations (such as those located on factory farms), and sewer overflows. NPDES permits set requirements for the maximum amount of pollution allowed from each point source. The CWA also encourages the use of the best available technology for pollution control. The limits on pollution required in the permits are based either on the best available technology for reducing pollution or on the quality of the receiving water, whichever type is more stringent.

For more information on permits in your watershed, contact your state's water quality agency and place your name on its mailing list for permit review. With this knowledge, you'll be able to make comments on any permit applications that are submitted for your watershed. You might also want to obtain copies of the permits already issued that affect your local water bodies. If you notice a permit violation or an illegal discharge without a permit, document the problem and report it to your state's water quality agency. A failure to comply with permit requirements is a violation of the Clean Water Act and is subject to enforcement and fines. If the state agency or the EPA does not enforce permits when they are violated, individuals or groups may sue the polluters directly. For information on what to look for when reviewing NPDES permits and how to make effective comments, visit www.cleanwateract.org.

IMPAIRED WATERS AND TMDLS

The Clean Water Act requires states to identify impaired waters, which are waters that do not currently meet water quality standards, and threatened waters, which are not expected to meet those standards even after full implementation of existing per-

mits. Every two years, states review water quality data and update their lists of impaired and threatened waters, called the 303(d) list. States are then required to develop a Total Maximum Daily Load (TMDL) for every water body on the list. A TMDL is a pollution cap for the water body and includes a plan to make sure pollution levels do not exceed that cap. If the state does not develop an adequate TMDL for a water body, EPA is required to develop and implement one.

You may submit data to the state for consideration when listing impaired waters. Also, you may comment on the draft list that is circulated for public review before the list is submitted to EPA. In many states, the TMDL process has been jump-started by citizen action.

As of this update, EPA is reviewing the TMDL program. The program may move in a different direction in the near future.

NONPOINT-SOURCE POLLUTION CONTROL

Nonpoint-source pollution is defined by EPA as pollution "caused by rainfall or snowmelt moving over and through the ground and carrying natural and human-made pollutants into lakes, rivers, streams, wetlands, estuaries, other coastal waters, and ground water. Atmospheric deposition and hydrologic modification are also sources of nonpoint pollution." While the Clean Water Act has been very effective at reducing point-source pollution into waterways, nonpoint-source pollution reduction has been more difficult. As the name implies, nonpoint-source pollution comes from diffuse sources, posing a challenge to reduction efforts.

Section 319 of the CWA attempts to control nonpoint pollution by providing funding to states to implement specific watershed protection projects, including wetland restoration and streambank stabilization.

WETLAND PROTECTION

Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers and EPA to regulate

activities that affect wetlands. Anyone who proposes an activity that would discharge dredged material or fill material into waters of the United States is required to apply for a permit from the Corps.

Citizens can provide comments about applications for permits to alter wetlands and can report violations of wetland law. Regulatory agencies are unable to discover and address every wetland violation that occurs. Citizen complaints often trigger enforcement actions. You can ensure that you are notified of permit applications in your area by contacting the Army Corps of Engineers at www.usace.army.mil.

STATE WATER QUALITY CERTIFICATION

The Clean Water Act gives states the authority to review federally permitted activities that may result in water pollution. The state may allow the project without changes, place conditions on the project to protect water quality, veto the project, or waive its authority. Applicants for Section 404 permits are subject to the state Section 401 water quality certification process. Citizens can take action against federal permit holders that do not comply with the Section 401 water quality conditions of their permits. Citizens also can take action against a state for certifying a federal permit

despite evidence that the permit will violate water quality standards. Ask your state water quality agency for information about its procedures for public notice.

FUNDING

The Clean Water Act also provides programs for funding projects to protect water quality. In many cases, EPA distributes money to the states, which then disperse the funds to local governments and nonprofit groups to implement projects. For more information, visit the Catalog of Federal Funding Sources for Watershed Protection at www.epa.gov/OWOW/watershed/wacademy/.

OTHER OPPORTUNITIES FOR CITIZEN INVOLVEMENT

To keep current watershed conservation laws in place and to pass better regulations and laws, citizens need to contact their national, state, and local elected officials and let them know that clean water is important. When specific bills are proposed that will either improve water quality or harm water protection, contact your officials and let them know what position you would like them to take to protect clean water.

In addition to tracking legislation, you can also track and provide comments on regulatory action taken on existing laws. For example, because the U.S. Environmental Protection Agency administers and enforces the CWA, the agency develops rules that specify how it will implement the law. When EPA proposes a rule in the federal register, the public is invited to comment. EPA then incorporates comments into the final rule.

For more information on pending legislation and rules related to national watershed policy, advocacy tips, and action alerts on the most current conservation policy opportunities, please visit the League's Web page at www.iwla.org and click on "Take Action."

CLEAN WATER ACT RESOURCES

"The Clean Water Act: An Owner's Manual." A handbook on the Clean Water Act, its provisions, and opportunities for citizen involvement. Visit www.rivernetwork.org.

"Understanding the Clean Water Act." This online course by River Network provides information on the CWA based on the act itself and on problems such as agricultural runoff. It includes a quiz and links to other resources. Visit www.cleanwateract.org.

Watershed Survey

A watershed survey is a good first step when beginning a stream or wetland monitoring program. Water quality is affected by land uses because anything on the land washes into waterways when it rains or snows. Therefore, a survey of land uses in the watershed can provide important information to identify potential sources of pollution. In addition, a survey allows watershed stewards to locate sites for additional monitoring, educate volunteers and the local community about potential pollution sources, and recruit new volunteers for an overall watershed conservation effort. Watershed surveys are inexpensive and require minimal equipment and volunteer training.

A watershed survey can be divided into three steps: a background investigation, a land-use survey, and a visual stream or wetland survey. The background investigation is an indoor activity to gather information about the stream or wetland and its watershed. A watershed visual survey involves walking or driving through the watershed and recording land uses and potential sources of pollution. A visual stream or wetland survey involves walking or canoeing the waterway and recording its condition.

Always keep detailed records in a notebook or file folder of the information you uncover during your watershed walk. Information gathered in the field later can be transferred into a computer database or onto a map. Organized and well-presented data about your watershed will help future volunteers continue your conservation efforts and will help you create persuasive presentations about water conservation.

BACKGROUND INVESTIGATION

The background investigation is an important first step in conducting a watershed survey. Background information about the stream and its watershed only needs to be gathered once and the information will help you plan for field monitoring and future conservation activities.

Your investigation should determine the size (area) of the water body, the boundaries of the watershed, and the general land use within the watershed. Information about industries discharging to the stream or wetland, current designated uses for the water body (such as fishing, swimming, drinking water), historical land uses, agencies that have jurisdiction over the water body, and the laws that protect it also will benefit your efforts.

Maps are critical tools that can help you determine watershed boundaries, drainage patterns, stream length, tributaries, inlets and outlets to wetlands, size and shape of wetlands, and surrounding land uses. Topographic maps are available from the U.S. Geological Survey at (800) USA-MAPS. These maps show roads, streams, landmarks, and elevations. Road maps also show the locations of streams and can be useful when driving or walking the watershed during the visual survey described below. The U.S. Geological Survey also has copies of the National Wetland Inventory (NWI) maps. NWI

"...WHEN THE LAWYER IS SWALLOWED UP WITH BUSINESS AND THE STATESMAN IS PREVENTING OR CONTRIVING PLOTS, THEN WE SIT ON COWSLIP-BANKS, HEAR THE BIRDS SING, AND POSSESS OURSELVES IN AS MUCH QUIETNESS AS THESE SILENT SILVER STREAMS..."

– Izaak Walton, The Compleat Angler

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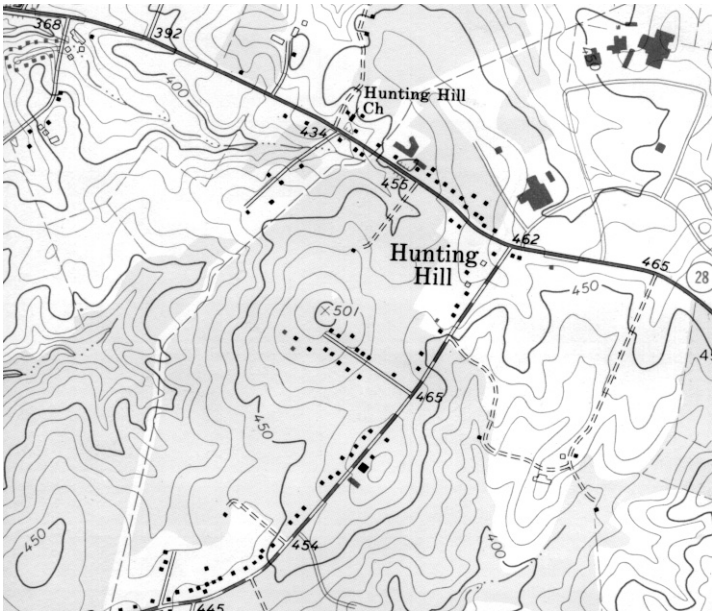


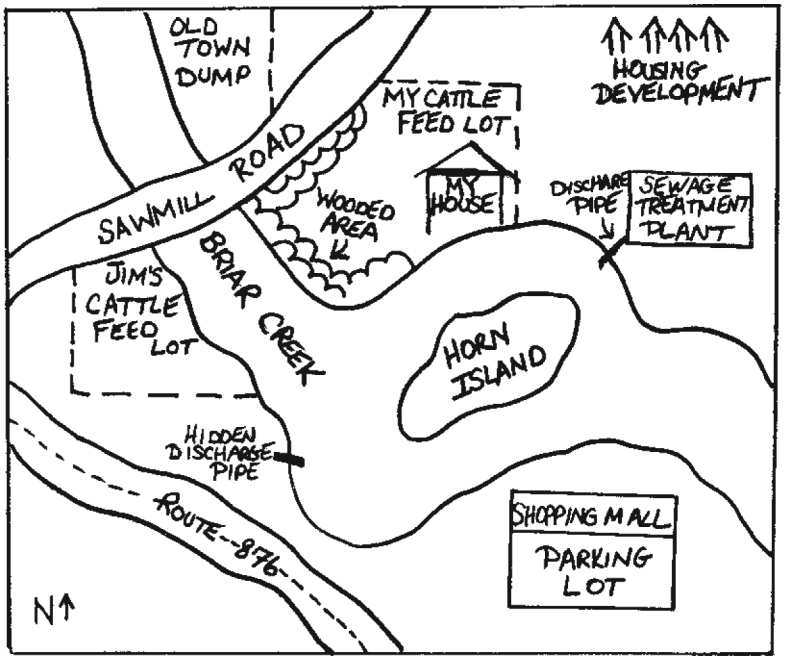
maps are based on topographic maps and include information on the wetland boundaries, vegetation, and hydroperiod (includes the frequency, timing, duration, and amount of flooding). Hydrologic unit maps, also available from the U.S. Geological Survey, can help you determine watershed boundaries. The county environmental office or local conservation district may also have watershed maps available or may be able to produce watershed maps using Geographic Information Systems (GIS) software.

Information about historical land uses may require a visit to the local historical society or library. Look for information about fish kills, chemical spills, floods, and other major events affecting the watershed. Residents also may be able to provide historical information.

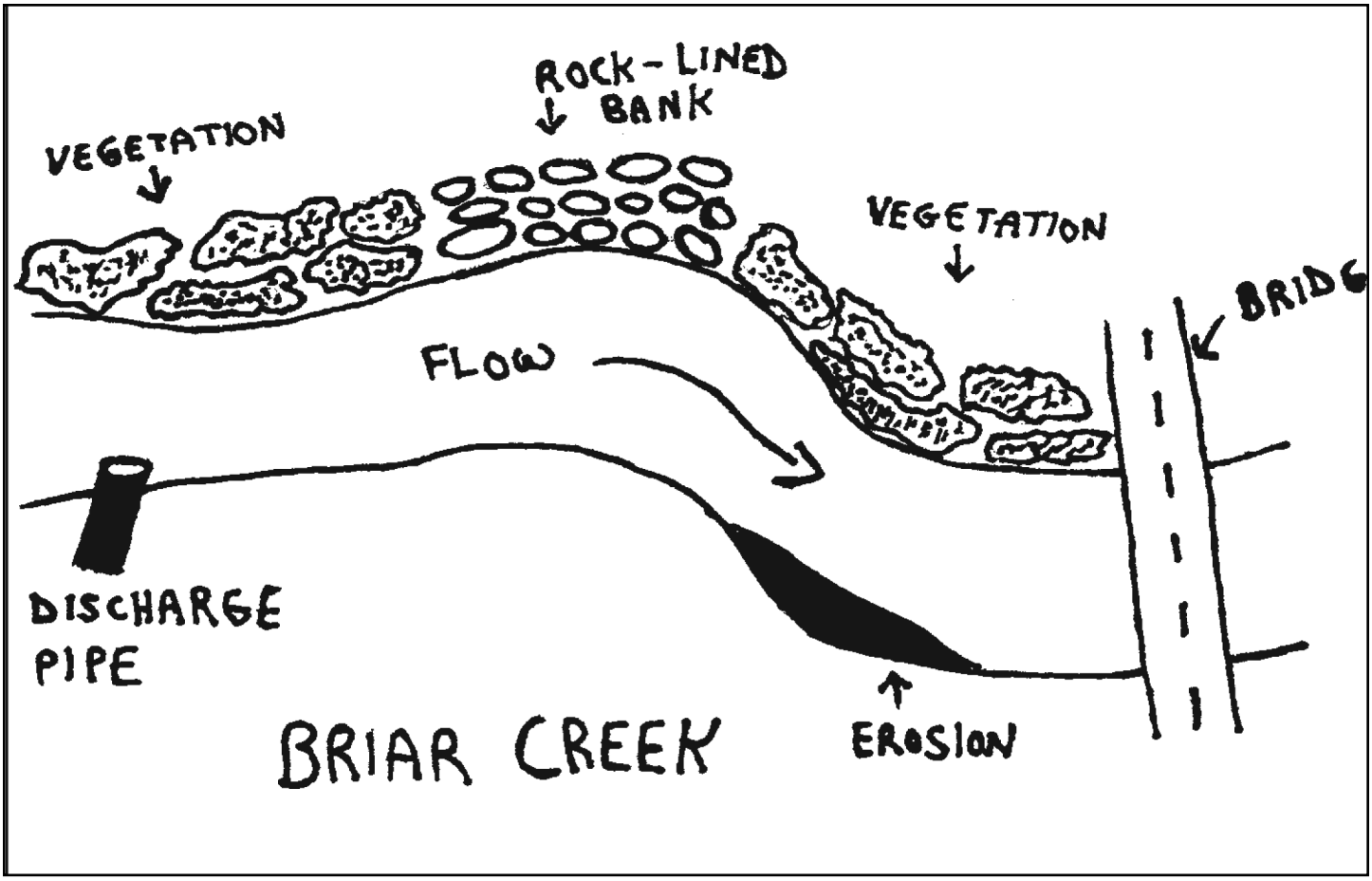
Under the Clean Water Act, state agencies and pollutant discharge permit holders are required to provide information about the quality of waterways to Congress and the public. Talk to your state and local environmental protection or water quality offices for more information about industries that discharge to the waterway and current designated uses of the stream or wetland. For information about Clean Water Act regulations and associated reports that affect streams and wetlands in your community, visit the Environmental Protection Agency's Web site at www.epa.gov/r5water/cwa.htm.

LAND USE SURVEY

A visual assessment of the watershed should take place at least once each year to observe changes over time in land uses and potential pollution problems. Ideally, the entire watershed should be surveyed. If you need to walk on private property, make sure that you have permission first. If you have limited time and volunteers, it is best to start assessing the watershed immediately adjacent to the water body and try to include as much of the surrounding watershed as possible. If you are unable to obtain permission to enter private property, you may need to limit the survey to roads and other areas with public access. If there are several volunteers, assign a different segment of the watershed to each group. Each group should have a road map or topographic map of the area, a base map or blank paper to record land uses and sources of pollution, additional paper to take notes, and relevant information from the background investigation, such as the location of potential pollution sources. In addition, volunteers may want to bring a camera to take photographs of potential pollution sources.



Drive or walk the watershed looking for land-use activities that might affect the stream or wetland. Construction sites, parking lots, other paved surfaces, areas of bare soil,



Land uses and activities to look for on the watershed survey:

- Residential
- Commercial
- Industrial
- Forest
- Park
- Grazing land
- Cropland
- Animal feedlot
- Construction
- Logging
- Mining
- Recreation
- Trash dumps
- Sanitary landfills
- Oil and gas drilling
- Areas of exposed soil
- Sewage pumping stations

farms, landfills, trash dumps, gas stations, and manicured lawns all may be potential pollution sources. Draw a map of your watershed, including potential pollution sources, forested land, and other natural features.

Take additional notes documenting the exact location of each potential pollution source. Estimate and record percentages of land that are developed, farmed, or wooded. Record the date on maps, photos, and notes.

STREAM SURVEY

Before conducting a stream survey, obtain permission from landowners and locate safe access areas. Walk or canoe the stream once each season to assess the condition of the stream and potential pollution sources. If you have several volunteers, assign a different stream segment to each group. Provide each group with maps, blank paper, and relevant information from the background investigation such as the location of outfall pipes for point-source discharges into the stream.

Draw a map of your stream segment. Mark the location of outfall pipes, bridges, and stream crossings. Also record areas of stream bank erosion, areas along the stream bank with little or no vegetation, concrete or rock-lined banks, other structures, and trash in or adjacent to the stream. Take photographs of these stream conditions and additional notes if needed.

Conditions and structures to note on the stream survey:

- Dams
- Bridges
- Waterfalls
- Beaver dams
- Concrete bank
- Concrete stream bottom
- Rock-lined bank
- Trash heaps
- Pipes discharging into stream
- Areas of bank erosion
- Fish kills
- Flooding
- Areas without water flow
- Presence of vegetation along streambanks

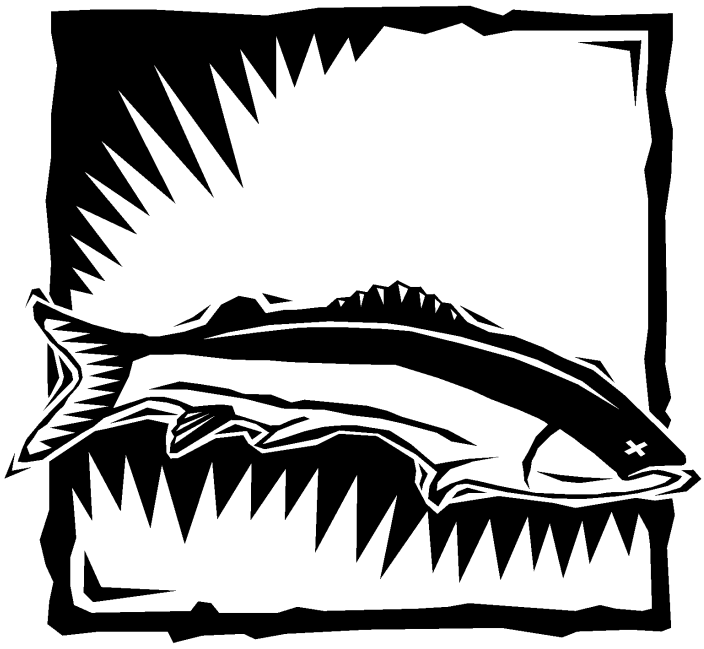
In addition, note the location of any unusual water conditions. If you encounter unusual conditions, attempt to trace the problem to its source. Take the factsheet located in this publication called "Recognizing and Reporting Stream Pollution" with you into the field for more information about unusual conditions and how to address them.

WETLAND SURVEY

Before conducting a wetland survey, obtain permission from landowners and locate safe access areas. Draw a map of your wetland. Walk around and through the wetland to get an idea of it size, vegetative communities, surrounding land uses, and potential wildlife habitats. Be sure to leave room between the wetland outline and the edge of the paper to sketch surrounding landscape features such as vegetative buffers, roads, fields, buildings, and any adjacent water bodies. Include the date, location, a directional arrow pointing north, and a key describing the scale of the map and the various features. Mark the location of any inlets and outlets, groupings of trees, shrubs or grasses, areas of open water, areas of floating plants, areas of exposed soil, beaver dams, and any man-made features. Take photographs of the wetland and additional notes if needed.

Look for and record the following signs of wetland degradation:

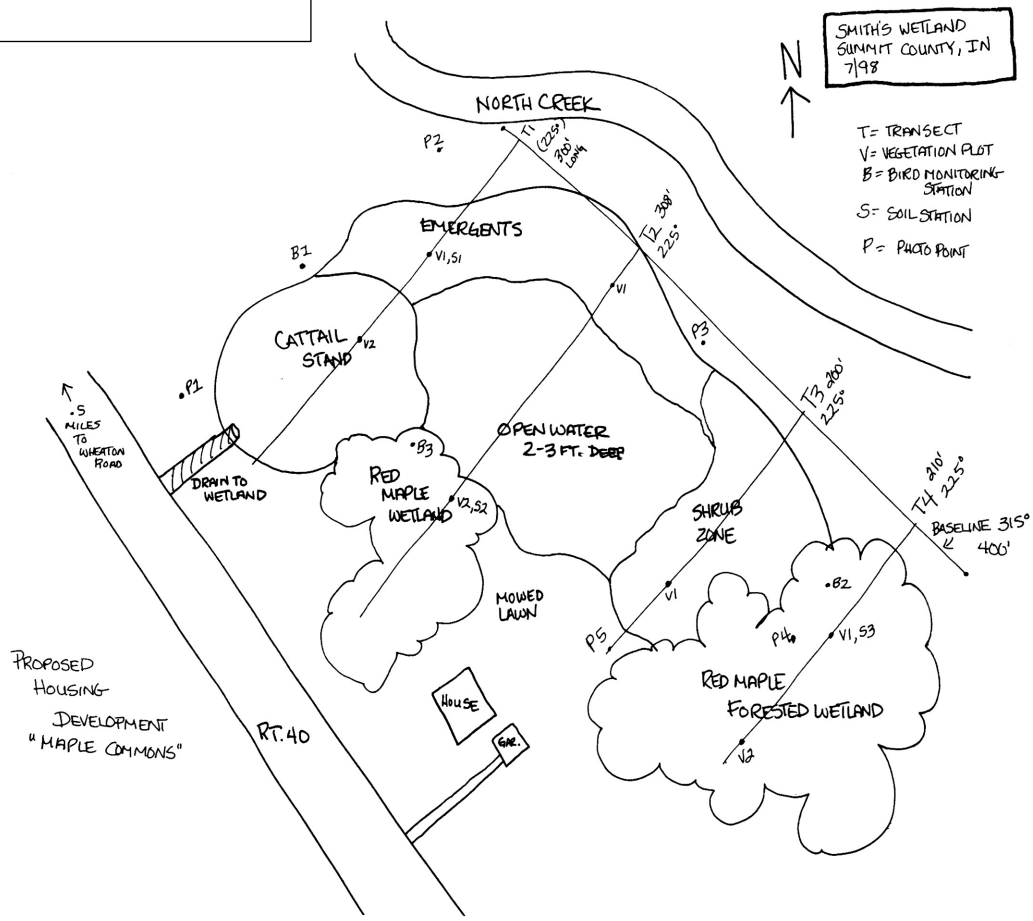
- Silt, sand, or gravel deposits
- Turbid water (opaque and milky or light brown)
- Stream bank erosion upstream of wetland (look for newly exposed soils)
- Exaggerated flooding
- Large stands of invasive plant species (varies with location but may include purple loosestrife, phragmites or common reed, hydrilla, buckthorn, etc.)
- Nutrients (signs include algae blooms in freshwater systems and excessive foaming that can be traced to an upstream outlet)
- Chemical pollution (look for obvious discharges and iridescent sheens that break up in globules)



Look for and record the following potentially harmful activities that may be taking place in the wetland:

- Dumping of soil, gravel, or vegetation
- Grading (look for heavy equipment tracks and scraped soil)
- Draining or channelizing of water (look for pipes or ditches within the wetland)
- Impounding (look for dikes or culverts leading downstream of the wetland)
- Bulkheads built between shore and wetland
- Tracks of recreational vehicles
- Livestock access (observe cattle in the area or look for cattle tracks)
- Pipes or culverts transporting stormwater into the wetland
- Clearing (look for fresh or old stumps in an area with few or no remaining trees)
- Dredging (dirt mounds next to open water areas or evidence of heavy equipment)
- Heavy recreational use

For more information on wetland surveys and other types of wetland monitoring, refer to the League's *Handbook for Wetlands Conservation and Sustainability* or contact the League. A list of additional resources is available on the League's Web site at www.iwla.org/sos/resources.



Volunteer Water Quality Monitoring

WHY MONITOR WATER QUALITY?

Water quality monitoring is the measurement or observation of a waterway over time. It allows people to assess water conditions and to determine if waters can support aquatic life, or whether they are safe enough for swimming and fishing. Monitoring data can be used to inform and educate your relatives, friends, and neighbors about the condition of local streams. It can help establish a baseline of water quality for a stream, since data for many streams can be sparse or non-existent. Monitoring data also can be used to identify pollution problems, determine whether pollution regulations are being followed, and gauge whether enhancement efforts are successful.

ONLY AFTER I BECAME FAMILIAR WITH HER MODES OF SPEECH – WINTER SILENCE, SPRINGTIME GROWLING ROAR, LAZY SUMMER TRICKLING, AND AUTUMN CALM – DID I UNDERSTAND THAT THE STREAM WAS NOT ONLY A PLACE WHERE I FISHED BUT ALSO A LIVING, BREATHING CELEBRATION OF HARDSHIP AND JOY.

–James Prosek, Trout

Check with your state or local water quality agency to see if they accept volunteer-collected water quality monitoring data. Many government agencies lack the funding and staff to thoroughly monitor the nation's waters. In fact, only 19 percent of waterways in the United States are professionally monitored today (EPA, 1996). Data collected by volunteers can be used by government agencies and university researchers to assess long-term trends in water quality. Volunteer monitors also may be able to help local governments by discovering acute pollution problems, such as sewer leaks, which require immediate attention.

Whether or not you are collecting data that will be submitted to a government agency or university, water quality monitoring can help you achieve your watershed conservation goals. Monitoring can identify degraded water bodies and prioritize them for enhancement. Continued monitoring after enhancement helps document the benefits and success of the project, and it can reveal a need for additional enhancement.

There are many monitoring methods available. The type you choose will depend on the goals of the monitoring effort. Monitoring can be conducted at fixed stations on a regular basis, at selected sites on an as-needed basis, on a temporary or seasonal basis (for example, during the summer at bathing beaches), or on an emergency basis (such as after a toxic spill). Increasingly, monitoring efforts are aimed at determining the condition of watersheds.

PHYSICAL MONITORING

Physical monitoring includes any type of monitoring of physical parameters such as the shape of stream banks, the water regime of wetlands, the presence of tree canopy cover, the width and species diversity of any vegetative buffer between the water body and other land uses, the habitat for fish and other aquatic life, or the stream bank erosion potential. Physical monitoring may be repeated seasonally to document changes over time. Watershed surveys are one type of physical monitoring that can be very helpful in determining current land uses and potential pollution sources. A background investigation of

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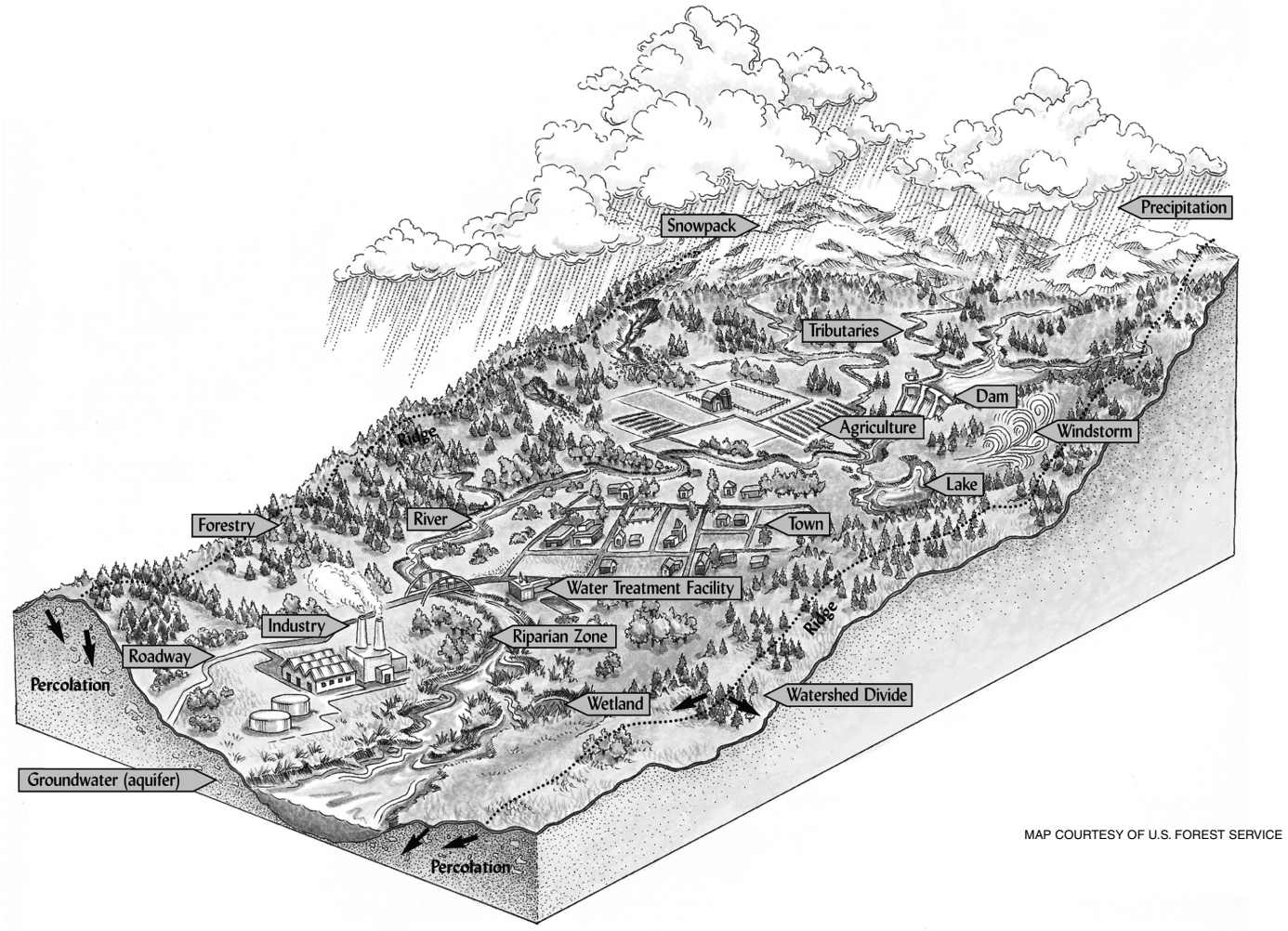


MAP COURTESY OF U.S. FOREST SERVICE

the stream or wetland, along with a visual survey of the waterway and its watershed, provides important information to identify potential sources of pollution, identify sites for additional monitoring, and educate volunteers and the local community about water quality issues. In addition, watershed surveys are inexpensive and require little equipment and minimal volunteer training. For more information on watershed surveys, refer to "Watershed Survey" in this action kit. For additional information on other physical monitoring parameters, contact the Izaak Walton League.

BIOLOGICAL MONITORING

The macroinvertebrates that live in a waterway are an indicator of water quality because all organisms require specific conditions to live. The Izaak Walton League uses the presence of benthic macroinvertebrates to measure water quality in streams. Macroinvertebrates also can be used to monitor water quality of wetlands. They are large enough to see with the naked eye (macro) and have no backbone (invertebrate). Benthic macroinvertebrates live in the benthos, or stream bottom, and include insect larvae, adult insects, and crustaceans.

Macroinvertebrates are good indicators of water quality because they differ in their sensitivity to water pollution. Some benthic macroinvertebrates are very sensitive to pollution and cannot survive in degraded water. Others are less sensitive to degradation. Benthic macroinvertebrates usually live in the same area of a stream for most of their lives. Monitoring these organisms provides a good sense of what the water quality has been for the past few months. If the water quality is generally poor, or if a pollution event occurred within the past several months, it will be reflected in the macroinvertebrate population.

For monitoring streams, the League identifies three groups of macroinvertebrates based on their sensitivity to pollution: Pollution sensitive, less sensitive, and

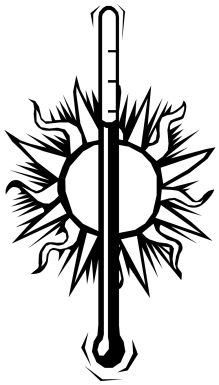
tolerant. The League's Volunteer Stream Monitoring Protocol method involves collecting a sample of macroinvertebrates from the stream, identifying the organisms, and rating the water quality. Water quality ratings of excellent, good, fair, and poor are based on the pollution tolerance levels of the organisms found and the diversity of organisms in the sample. A stream with excellent water quality should support organisms from all three tolerance groups.

In streams, fish also can be used to monitor water quality because, like macroinvertebrates, different species of fish have different tolerances to pollution. Many healthy streams support a wide variety of fish. There are several ways to collect information about fish populations in a stream. Fish can be trapped in nets, or they can be stunned with an electric current that causes them to float to the surface to be collected. Local anglers provide another source of information about fish populations. Monitoring fish alone may not be as effective as monitoring macroinvertebrates because fish can move away from pollution problems while benthic macroinvertebrates are relatively immobile. For assistance with fish monitoring, contact the U.S. Environmental Protection Agency or your state or local environmental agencies.

In wetlands, vegetation is another excellent biological monitoring tool. Different plant species have different tolerances not only to pollution, but also to the duration and quantity of flooding that takes place. Although scientists are continuing to develop new methods of assessing wetland water quality using both plants and macroinvertebrates, there are some established methods. In addition, several programs across the country train volunteers to monitor macroinvertebrates and plants in wetlands. For more information about biological monitoring in wetlands and for information on existing volunteer programs, contact the Izaak Walton League. The League also offers training on biological monitoring of streams and the ecology of wetlands.

CHEMICAL MONITORING

Chemical monitoring can be used as a supplemental activity to biological monitoring. When a pollution problem is detected by a lack of aquatic organisms, a chemical analysis of the water may help to pinpoint the cause of problem. Chemical monitoring involves taking a sample of the water and analyzing its chemistry to discover the presence of abnormalities. Volunteers can measure temperature, pH, dissolved oxygen, biological oxygen demand, turbidity, total dissolved solids, nitrates, phosphates, and fecal coliform bacteria. In addition, some state agencies recruit volunteers to collect water samples for analysis at accredited laboratories.



The disadvantage to using chemical monitoring alone is that it only provides information about the quality of the water at the moment the sample was taken. A pollution event may go unnoticed by chemical monitoring if it occurs in flowing water several days before a sample is taken. The results are affected greatly by temperature, time of day, and recent rainfall. In addition, because of the expense and difficulty involved, volunteers generally do not monitor for toxic substances such as heavy metals and organic chemicals such as pesticides and herbicides. When used alone, chemical monitoring needs to take place at least once a week at the same time of day and in the same location for several months to provide a good indication of water quality.

Recognizing and Reporting Water Quality Problems

THE SONG OF A RIVER ORDINARILY MEANS THE TUNE THAT WATERS PLAY ON ROCK, ROOT AND RAPID. THE LIFE OF EVERY RIVER SINGS ITS OWN SONG, BUT IN MOST THE SONG IS LONG SINCE MARRED BY THE DISCORDS OF MISUSE.

– Aldo Leopold,
A Sand County Almanac

Before monitoring your stream, review this background information about various types of water quality problems. Each water quality problem is described, and potential sources of pollution are listed. Please note that many of these water quality problems may also occur in wetlands.

LOW pH LEVELS

pH is a logarithmic scale (increasing exponentially) that measures the acid or base concentration of the water. In a range of 1 to 14, pH of 1 is most acidic, pH of 7 is neutral, and pH of 14 is least acidic, or most basic. It is important to remember that for every one-unit change on the pH scale, there is approximately a ten-fold change in how acidic or basic the water is. For example, water with a pH of 5 is roughly ten times more acidic than water with a pH of 6, while water with a pH 4 is roughly one hundred times more acidic than water with a pH of 6. Normal rainfall is actually slightly acidic, with a pH ranging from 5.6 to 5.7. Most organisms have adapted to life in water of a specific pH. Therefore, any change in a water's pH level can harm aquatic life. The majority of freshwater fish require pH levels ranging from 6.0 to 8.5. At a pH value of 6.5, brook and brown trout numbers are severely reduced. In addition, rainbow trout eggs have a much-reduced hatching rate. At a pH value of 5.5, smallmouth and largemouth bass are unable to survive. Below pH 5, most species of fish are absent. Highly acidic or basic water also can kill the fishes' food sources.

One reason for high acidity is acid rain. "Acid rain" is a broad term used to describe several ways that acids fall out of the atmosphere. A more precise term is acid deposition, which has two parts—wet and dry. Wet deposition refers to acidic rain, fog, and snow. Wet deposition occurs when sulfur dioxide and nitrogen oxides in the atmosphere become sulfuric acid and nitric acid. Dry deposition refers to acidic gases and particles. About half of the acidity in the atmosphere falls back to earth through dry deposition. The wind blows these acidic particles and gases onto buildings, cars, homes, and trees. Dry-deposited gases and particles can also be washed from trees and other surfaces by rainstorms. Prevailing winds blow the compounds that cause both wet and dry acid deposition across state and national borders and sometimes over hundreds of miles. In addition, acids can be released suddenly during the spring thaw when snowmelts occur, freeing the acids concentrated in the ice during the winter months.

In the United States, about two-thirds of all sulfur dioxide and one-quarter of all nitrogen oxides are generated by electric utilities that rely on burning fossil fuels such as coal. Automobile emissions also are a significant source of these acids. Another source is coal mine drainage. Rain and groundwater leach sulfuric acid from abandoned underground mines into nearby waterways, harming the aquatic life.

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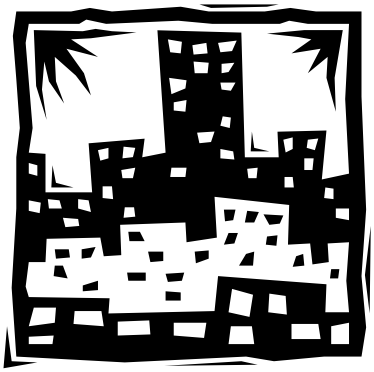
Changes in acidity can also be caused by plant and animal decomposition and by the weathering of surrounding rock. How an acidic input affects a body of water depends on several factors: the initial pH of the affected waterway, the surrounding geology, and the normal pH of the rainfall itself. Limestone, a basic rock, neutralizes the effect of acids on local waterways.

High acidity levels in a water body are not detectable with the naked eye. Fortunately, the pH level of the water is relatively easy to test. You can purchase small sampling kits to determine the pH. Since pH fluctuates daily and seasonally, it is best to sample pH throughout the year, at the same time of day, and at the same location. Also, you should test the stream after heavy rainfalls or large snowmelts. Compare this data with types and numbers of fish and aquatic insect populations observed.

THERMAL POLLUTION

Thermal, or heat, pollution occurs when water temperature is elevated. Elevated temperatures can decrease the capability of water to hold dissolved oxygen, which is crucial to the survival of aquatic organisms. Thermal pollution can impair feeding, growth, and reproduction of aquatic organisms and can cause death. Fish species vary in the level of thermal pollution they can withstand. Fish can adapt to gradual seasonal temperature changes, but not to an abrupt temperature increase. Even a small change in temperature can affect a fish's life cycle drastically. Spawning activities, metamorphosis, and migration can be triggered at the wrong time of year by a slight change in temperature. This, in turn, can decrease or destroy a species's chance for survival.



We all contribute to thermal pollution. Water heats up as it runs over hot pavement and rooftops and then into waterways. Other sources of thermal pollution are power plants and factories that take water from nearby waterways for cooling, then discharge heated water back into the local waterway. An obvious sign that water temperature has been drastically altered is a sudden fish kill. To discover whether or not thermal pollution is occurring, first determine the stream's normal temperature by taking regular temperature measurements. Starting at the mouth of the stream, measure the temperature every ten miles and along any tributaries. An abrupt increase of five degrees Fahrenheit or more could indicate a thermal pollution problem. If an abrupt increase is found, look for discharge pipes entering the stream upstream of the point of increase. The pipes might be supplying heated water and raising the stream's temperature.

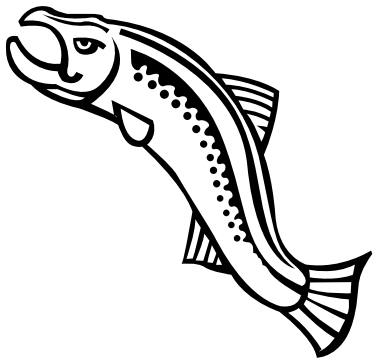
Also, look for dams or stretches of poorly shaded areas, which would allow increased exposure to the sun. Streams that flow through a dam have banks that are not shaded by trees and other overhanging vegetation, flow slowly, and are subjected to much more direct sunlight than normal.

NUTRIENTS AND OXYGEN DEPLETION

Excess organic matter causes many problems in streams, including blocking light from reaching submersed aquatic plants, odor and surface scum, clogged irrigation systems, competition for natural fish food sources, interference with spawning areas, disappearance of native fish populations, and limited opportunities for recreational water use. In addition, an increase in the level of organic matter in a stream can cause a rise in the biochemical oxygen demand. This is a measurement of the oxygen required to carry out the stream's natural processes, such as decomposition. There is a limited supply of oxygen in the water. Therefore, oxygen supplies will decrease as increased amounts of organic matter decompose. Native fish populations are thus deprived of oxygen and cannot survive. Low oxygen levels in an aquatic environment provides conditions for growth of waterborne diseases, which can be toxic to people and wildlife. Nutrients such as nitrogen, phosphorus, carbon, and other elements entering the aquatic environment can encourage excessive algae growth, which lowers oxygen available for other aquatic life.

Sewage from broken sewer lines, wastewater treatment plant overflows, or septic tank failures may also cause waterborne diseases. In addition, sewage contains excess nutrients that cause excessive growth and decay of organic matter in streams. This, in turn, lowers dissolved oxygen levels and may harm fish and other aquatic life. Other potential sources of organic waste enrichment are manure from livestock feedlots; fertilizer from farms, lawns, and gardens; pet waste, grass clippings, or leaves dumped into a gutter or stream.

Direct observation of the types and numbers of aquatic organisms present can provide a good indication of a stream's oxygen level. For example, trout have a high oxygen requirement. Trout may be replaced by carp, which have a lower oxygen requirement and can survive in more polluted water. It is important to note that the eggs and recently hatched young of some species have a greater oxygen demand than the adult fish. This makes species regeneration impossible when the available oxygen supply is lowered. Insect species also provide a good indicator. For example, midge and blackfly larvae can survive in a stream with low oxygen levels, while stonefly larvae require a higher dissolved oxygen level.



A chemical testing kit is another method to measure nitrogen and phosphorus levels in the stream or to determine the level of dissolved oxygen. Generally, the oxygen level should not go below 6.0 mg/liter in trout streams. In other streams, the concentration should remain above 5.0 mg/liter. The amount of oxygen water can hold diminishes with increasing water temperature, yet fish require more oxygen as water temperatures rise and respiration increases. This correlation between temperature and the water's ability to hold dissolved oxygen makes it important to measure temperature as well as dissolved oxygen to determine the actual oxygen level of a water body. Ask the supplier of the chemical testing kit for a chart that relates temperature to dissolved oxygen. After testing for dissolved oxygen and reading the temperature, consult the chart to determine if oxygen levels are adequate.

TOXIC SUBSTANCES

Toxic substances can bioaccumulate, or increase in concentration, and become more dangerous as they move up the food chain, beginning with microorganisms and continuing up to humans. An element is considered toxic if it injures the growth or metabolism of an organism above a certain concentration. Toxic substances can poison aquatic life, destroy aquatic food supplies, and deform fish larvae. If the discharge is acute (of high intensity but lasting for a short duration), it may not last long enough to produce long-term effects on aquatic life. But if the discharge is chronic (of long duration over an extended period of time), its effects may take longer to become apparent, but will be easier to measure. Toxic substances have both natural and man-made sources. Natural sources of toxic substance include rocks, volcanoes, sediments, and soils. Human activities that add toxic substances to the environment include smelting, manufacturing, refining, chemical processing, fertilizer application, irrigation, and waste disposal.

Although there are hundreds of toxic chemicals released into the environment through industrial effluents, legal limits exist on only a small proportion. The U.S. Environmental Protection Agency has classified only a fraction of these toxic substances, and many chemical compounds are only now being recognized as harmful. In addition, many chemicals become toxic only in combination with the presence of other chemical compounds or under certain environmental conditions, making measurements of their effects and the setting of acceptable concentration limits difficult.

UNUSUAL STREAM COLOR

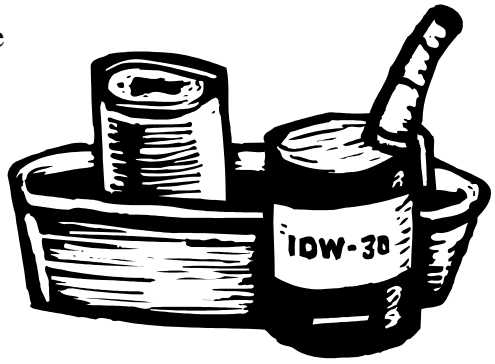
Unusual stream color caused by industrial discharge can block light to aquatic plants and prevent growth. A variety of activities can contribute to a change in water's normal coloration. Algae growth and decaying plants are natural processes that can cause water color to become green, brown or yellow. Others include

industries such as pulp and paper mills, textile mills, refineries, manufacturers of chemicals and dyes, nailworks, and tanneries. Also, slaughterhouses, construction sites and mine drainage can contribute light-blocking colors.

SEDIMENTATION

Excess soil erosion can cause serious problems for a stream or waterway. Sediment suspended in a stream can smother bottom-dwelling aquatic life and clog the gills of fish, as well as block light that underwater plants need to grow.

A healthy stream will have naturally suspended sediment because the stream acts as a large conveyor belt, carrying sediment, silt, and organic matter while carving out valleys and shaping the landscape. Although erosion is a natural process, an unnatural acceleration of erosion levels can be caused by land-disturbing activities. One major source of excess sediment is construction sites where erosion barriers are improperly maintained or not in place. Agriculture is another major source of excess sedimentation. This results from poor farming practices such as farming on highly erodible land or hillsides, overplanting, or allowing livestock to graze along streambanks. Surface mines, logging operations, and excess water runoff from paved urban areas all contribute to erosion. When these sources of excess erosion are not abated or prevented, a stream can be seriously degraded for three to five years and recovery may take as long as fifty years.



OIL

Petroleum products severely affect all types of aquatic life in streams. Free-floating oil and emulsions can coat the membrane surface of a fish's gills and interfere with respiration. Petroleum products can destroy the fish's food sources by coating and destroying algae and other plankton. Additionally, the flesh of the fish can be tainted when contaminated algae and plankton are ingested. If the oily substance settles, it can coat the waterway bottom, destroying bottom-dwelling organisms and interfering with spawning areas. Films of oil on the water's surface can interfere with plant photosynthesis and respiration. Surface films also destroy algae and reduce the oxygen level.

Sources of oil pollution include industrial plant wastes, grease and fats from lubrication of machinery, the manufacturing process of hydrogenated glycerides, rolling mills, stormwater overflows, gas stations, and car oil dumped into storm drains by homeowners.

REPORTING STREAM POLLUTION

Each of us can play a vital role in the discovery and abatement of poor water quality simply by being aware of potential problems and ensuring they are reported. If a water quality problem is discovered, attempt to trace the pollution to its source. Then inform your local water pollution officials.

Remember, you may know your stream and be able to identify changes in the water quality much better than anyone who is not familiar with the stream. If you identify a possible source when you report a problem, it is more likely the local authorities will be able to investigate and take action.

For state and local environmental agencies and their contact information, look in the telephone book under your county, city, or state listings. Report the name of the stream and its exact location, the problems you found, and the possible causes. When speaking with government officials, ask them how you can help to remedy this problem.

The following are a few tips to keep in mind when reporting pollution problems to your state or local agencies:

- Keep accurate records of the dates and times you contact government agencies as well as the names of the officials with whom you speak.

QUICK REFERENCE FOR STREAM CONDITIONS AND POSSIBLE CAUSES

Condition	Possible Cause
Muddy water	May be caused by the erosion of soil in upstream areas. In tidal areas, could also be caused by high winds.
Greenish water	May result from microscopic cells called algae. Algae growth may exceed normal limits due to excessive amounts of nutrients entering the water. Nutrient sources include fertilizers, pet waste, grass clippings, and leaves.
Yellow-brown to dark brown water	May be caused by acids released from decaying plants. Naturally occurs each fall when dead leaves collect in streams. Also common in streams draining marshes or swamplands.
Colored sheen on water surface	May indicate oil has entered the stream, particularly if it also has an oily odor.
Orange to red coating on streambed	Can result from bacteria consuming iron. May indicate a high erosion rate or industrial pollution.
Yellowish coating on streambed	May indicate polluted water draining from a coal mine.
White cottony masses on stream bed	May indicate "sewage fungus." The presence of this growth indicates sewage or other organic pollution.
Foam	When foam occurs in a few scattered patches, is less than three inches high, and is cream colored, it is probably natural. If the foam is extensive, white in color, or greater than three inches high, it may be caused by detergents in the stream.
Rotten egg odor	Often indicates sewage pollution. Odor may also be present naturally in marshes or swamplands.
Musky odor	May indicate presence of untreated sewage, livestock waste, algae, or other conditions.
Blue-green algae	May indicate sewage or other organic pollution if growth is excessive.

- Record any comments the agency makes about state, county, or city regulations or proposed actions.
- Call the agency back to find out if and when action was taken. If no action was taken, continue to follow up.
- Revisit the site to look for signs of improvement.

We urge you to call for environmental action and answers. If you get no results from the state or local government, you may want to involve the media to gain public support for your problem. Often when the community becomes aware of a problem, officials are forced to take corrective measures. Listed below is additional information about regulations governing particular water quality problems and additional action you can take to become a good watershed steward.

WATER QUALITY REGULATIONS

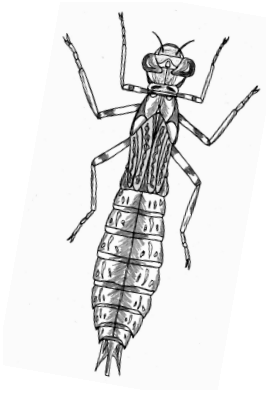
Familiarize yourself with federal, state, and local regulations governing the various potential sources of watershed degradation. With this knowledge, you will be able to judge if there are violations and present an informed description of the problem to state authorities.

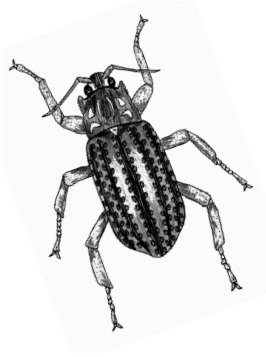
Under the Clean Water Act, all point-source pollution discharges require a National Pollutant Discharge Elimination System (NPDES) permit. Point-sources of pollution include any pollution discharged through a pipe, ditch, conduit, or other discrete conveyance. NPDES permits set requirements for the maximum amount of pollution allowed from each source. The Clean Water Act also addresses nonpoint-source pollution by requiring states to designate Total Maximum Daily Loads (TMDLs) for waterways. A TMDL is a calculation of the maximum amount of a single pollutant that a water body can receive from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes designated by the state. Also, each TMDL further divides this maximum allowed amount of a specific pollutant into the amounts that can come from each source of the pollutant in the watershed. States also may have regulations that govern logging operations, mining sites, landfills, construction sites, and handling and storage of oil. For more information on the Clean Water Act, read the factsheet "Understanding and Using the Clean Water Act" in this publication or contact the Izaak Walton League.

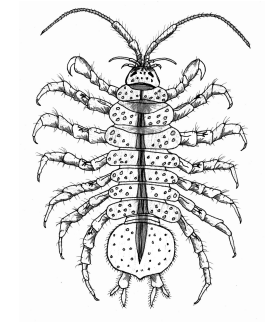
State and local governments may also have additional regulations to protect waterways. For more information about state and local regulations, contact your state or local environmental protection office.

Stream Quality Survey Instructions

IZAAK WALTON LEAGUE VOLUNTEER STREAM MONITORING PROTOCOL







Surveying stream macroinvertebrates provides information about the health of your stream. Many stream-dwelling organisms are sensitive to changes in water quality. Their presence or absence can serve as an indicator of environmental conditions.

Before selecting a site to monitor, please follow these rules:

- Check with state and county agencies to make sure you are not disturbing a survey area used by government agencies (over-monitoring may harm the stream).
- Review "Safety and Fun in Your Watershed" and carefully prepare for your trip.
- Always contact local landowners before monitoring to make sure you are not trespassing.
- Ask for permission if you need to cross private land. Most landowners will give permission for your study and may even want to help you conduct your survey.

Monitoring should be conducted at the same station (location) each time you sample during the year. If you want to monitor several stations on your stream, make sure the stations are spaced no closer than one quarter-mile apart. If the stations are spaced more closely, the monitoring activity may become the main impact to the water quality. If you want to monitor a one-mile segment of a stream, you can have a maximum of four monitoring locations.

Carefully record the location of your monitoring station on your Stream Quality Survey form. Include roads, bridges, and significant landmarks. If you can locate your station on a topographic map, record your station according to longitude and latitude. By providing this information, you allow your station to be located from anywhere in the world and easily described to government officials and others. A free catalogue of topographic maps is available from the U.S. Geological Survey at (800) USA-MAPS, or online at www.usgs.gov.

THINGS TO CONSIDER

If you are monitoring more than one station, begin monitoring downstream and move upstream. This will prevent macroinvertebrates disturbed by the first test from washing downstream and being captured in your net a second time. Each survey should record only the organisms present at that particular location and time.

Monitoring should be conducted four to six times per year at each station. Monitor once each in the spring, summer, winter, and fall and at two other times during the year. These times may be after floods or other pollution events. The extra surveys, when compared to the regular seasonal surveys, will help to determine water quality

For more information, contact:
Izaak Walton League of America
Watershed Programs
707 Conservation Lane
Gaithersburg, MD 20878-2983
Phone: (301) 548-0150
(800) BUG-IWLA
E-mail: sos@iwla.org
Website: www.iwla.org

impacts. Monitoring once each season will accurately record the yearly life cycle in the stream. Less frequent monitoring, while still useful, will not give the complete picture of stream life.

When scheduling monitoring events, remember that excessive monitoring can become the major threat to stream health because each monitoring event disturbs the stream bed and dislodges macroinvertebrates. In general, monitoring stations should have two months to recover from a monitoring event. It is crucial to the integrity of your data that you do not over-monitor your stations. There is some flexibility in this rule. For example, if an oil spill occurs, you might want to monitor your stream, even if you have done your six surveys for the year. The data you collect might be the only data available on the immediate impacts of the spill. Be sure to follow safety precautions from the "Safety and Fun in Your Watershed" factsheet. Do not monitor streams where strong oil or chemical odors are present because they could indicate a health risk.

The methods described in these instructions are for use in wadable streams. To be wadable, the water level in the stream must not exceed the height of your knees. When planning monitoring sessions for younger people, please remember that knee height varies greatly between adults and children.

There are two sampling methods available to collect aquatic macroinvertebrates. Muddy Bottom Sampling is used in streams that do not have riffles, a streambed feature with cobble-sized stones between 2 to10 inches in diameter where the water bubbles over the rocks. If your stream has riffles, please refer to the Rocky Bottom Sampling section.

MUDDY BOTTOM SAMPLING

The Muddy Bottom Sampling Method is intended for volunteers sampling streams that do not have rocky bottoms or riffles. Muddy bottom streams are composed of muddy or sandy substrate, overhanging bank vegetation, and submerged woody and organic debris. This method enables sampling of streams where kick-seining techniques do not yield the best representative sample of macroinvertebrates or allow easy collection from the most productive aquatic habitats.

Monitoring is conducted using an aquatic D-frame or dip net with 1/32-inch mesh and a four-foot pole. The dip net is used to sample a wide variety of habitats and collect many different kinds of organisms.

Following are simple descriptions of the habitat types and collection techniques for each habitat:

Steep banks/vegetated margins

The area along the bank and the edge of the water body consists of overhanging bank vegetation, plants living along the shoreline, and submerged root mats. Vegetated margins may be home to a diverse assemblage of dragonflies, damselflies, and other organisms. Move the dip net in a bottom-to-surface motion, jabbing at the bank to loosen organisms. Each scoop of the net should cover one foot of submerged area.

Silty bottom with organic matter

Silty substrates with organic matter can be found where the water is slow-moving and where there is overhanging vegetation or other sources of organic matter. The substrates harbor burrowing organisms such as dragonflies or burrowing mayflies. Collect samples by pushing the net upstream with a jabbing motion to dislodge the first few inches of organic layer.

Woody debris with organic matter

Woody debris consists of dead or living trees, roots, limbs, sticks, and other submerged organic matter. It is a very important habitat in slow-moving rivers and streams. The wood traps organic particles that serve as food for the organisms and provides shelter from fish and other predators.

To collect woody debris, approach the area from downstream and hold the net under the section of wood you wish to sample, such as a submerged log. Rub the bottom of the net frame along the surface of the log for a total surface area of one foot. It also is good to dislodge some of the bark, as organisms may be hiding underneath. You also can collect sticks, leaf litter, and rub roots attached to submerged logs. Be sure to thoroughly examine any small sticks you col-

Equipment:

- One D-frame aquatic dip net with mesh of 1/32 inch
- "Field Guide to Aquatic Macroinvertebrates"
- *Monitor's Guide to Aquatic Macroinvertebrates*
- Stream Quality Survey data forms
- Fahrenheit thermometer
- Two small magnifier boxes (optional)
- Magnifying glass (optional)
- Plastic shallow pan
- Specimen jars or ice cube trays for sorting organisms
- One screen-bottom bucket with a mesh of 1/32 inch (optional)
- Tweezers or forceps (optional)
- Clipboard (optional)
- White sheet or plastic trash bag (optional)
- Old sneakers or sandals that secure to your feet. Waders may be preferred in colder weather or for additional leg protection when water is cloudy.

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lect with your net before discarding them. There may be caddisflies, stoneflies, riffle beetles, and midges attached to the bark.

Sand/rock/gravel substrate

In slow-moving streams, bottoms are generally composed of only sand or mud because the water is not fast enough to transport large rocks. Sometimes you may find a gravel bar located at a bend in the river. The bottom can be sampled by pushing the net upstream with a jabbing motion to dislodge the first few inches of gravel, sand, or rocks. You may want to gently wash the gravel in your screen bottom bucket and then discard gravel in the river.

Before you begin monitoring, familiarize yourself with the four main habitats that can exist along muddy bottom streams: steep banks/vegetated margins, silty bottom with organic matter, woody debris with organic matter, and sand/rock/gravel substrate. Search for these habitats along a 50-foot section upstream from the monitoring station.

To provide for accuracy of collection and comparability of data from one station to another, take 20 scoops from the different habitats. Each scoop involves a forward motion of one foot. The D-frame net is one foot wide, so one scoop equals one square foot being monitored.

Ideally, you should identify the location of all four main habitat types, and then collect the following number of scoops from each habitat:

- 10 scoops from steep banks/vegetated margins
- 3 scoops from silty bottom with organic matter
- 4 scoops from woody debris with organic matter
- 3 scoops from sand/rock/gravel substrate

If one of the habitat types is not present, divide the number of assigned scoops from that habitat between the other habitat types that are present. For example, if the stream does not have sand/rock/gravel substrate, take one extra scoop from each of the other three habitat types. The most important thing is to have a total of 20 scoops and to make sure all habitat types that are present are represented.

If you have large rocks (greater than two inches in diameter), it is important to dislodge any burrowing organisms. To do this, hold the net on the downstream side of the rocks. In a one square foot area in front of the net, gently kick up the rocks with your toes or push them free with your fingers. This should dislodge burrowing organisms and allow them to wash into your net.

Each time you sample, sweep the mesh bottom of the D-frame net back and forth through the water (not allowing water to run over the top of the net) to rinse fine silt from the net. This will avoid a large amount of sediment and silt from collecting in the pan and clouding the water.

After collecting some samples, dump the net into a shallow white pan filled with a few inches of water. It is a good idea to do this every few scoops to avoid clogging the net. Clearing the net periodically also prevents having to sort too much debris at once.

Collect organisms from the net or pan and place them in similar groups as you go through the sample. This will make your identification quicker when you are ready to record results on your survey form. Plastic ice cube trays are helpful when sorting the sample. For example, put all organisms with two tails in one section and all organisms with three tails in another section. See "Identification" in this fact-sheet for information on identifying the organisms in your sample.

ROCKY BOTTOM SAMPLING

The Rocky Bottom Method is intended for volunteers sampling streams that have rocky bottoms or riffles. A kick-seine net, a finely meshed net with supporting poles on each side, is the best tool to use for collecting macroinvertebrates in rocky bottom streams. The League's Rocky Bottom Sampling method uses a kick-seine net that is 3 square with 1/16 or 1/32-inch mesh. While both net mesh sizes are adequate for obtaining accurate results, some state and local government agencies require use of the 1/32-inch mesh. Both sizes capture the full range of macroinvertebrate species included in this monitoring method. However, the 1/32-inch mesh net will provide you with a larger sample because it captures younger, and therefore smaller, organisms of each species.

Select a riffle that is a shallow, fast-moving area of water with a depth of 3 to 12 inches and cobble-sized stones (2 to 10 inches) or larger. Before entering the stream, record observations about riffle composition on the back of the stream quality data form.

Place the kick-seine at the downstream edge of the riffle. Remember to use rocks to secure the net tightly against the streambed so that no organisms escape under the net. Also, don't allow any water to flow over the top of the net; organisms can escape over the net. Also, if water is flowing over the top of the net, the water level is too high for safe monitoring.

Monitor the streambed for a distance of three feet upstream of the kick-seine and across the width of the net. Firmly and thoroughly rub your hands over all rock surfaces to dislodge any attached insects. Carefully place all large rocks outside of your three-foot sampling area after you have rubbed off any macroinvertebrates. Stir up the bed with your hands and feet until the entire area has been searched. All exposed and detached organisms will be carried into the net. Then, for at least 60 seconds, use the toe of your shoe to jab the streambed with a shuffling

Equipment:

- Kick-seine
- "Field Guide to Aquatic Macroinvertebrates"
- *A Guide to Aquatic Insects and Crustaceans*
- Stream Quality Survey data forms
- Fahrenheit thermometer
- Two small magnifier boxes (optional)
- Magnifying glass (optional)
- Shallow plastic pan
- Specimen jars or ice cube trays for sorting organisms
- Tweezers or forceps (optional)
- White sheet or plastic trash bag (optional)
- Clipboard (optional)
- Camera (optional)
- Squirt bottle (optional)
- Glass sample vile for your macroinvertebrate collection and 70-percent alcohol for specimen preservation (optional)
- Old sneakers or sandals that secure to your feet. Waders may be preferred in colder weather or for additional leg protection when water is cloudy.

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motion towards the net. Disturb the first few inches of sediment to dislodge burrowing organisms.

Before removing the net, rub any rocks that you used to anchor the net to the stream bottom and remove the rocks from the bottom. Firmly grab the bottom of the net so that your sample does not fall from the net, and then remove it with a forward-scooping motion. The idea is to remove the net without allowing any insects to be washed under or off it.

Placing a white trash bag or white sheet under the net before separating the sample will catch any tiny organisms that may have crawled through the net. Use a watering can or spray bottle to periodically water your net. The organisms will stop moving as the net dries out. Occasionally wetting the net will cause the organisms to move, making them easier to spot. Watering the net is especially important on hot, dry days.

Place the net on a flat, bright area, out of direct sunlight. Using tweezers or your fingers, separate all the organisms from the net and place them in your collecting container which should be half full of water. Sort organisms into similar groups as you separate your sample. This will make your identification quicker when you are ready to record results on your survey form. Plastic ice cube trays are helpful when sorting the catch. For example, put all organisms with legs in one section and all organisms with no legs in another section. Any organism that moves, even if it looks like a worm, is part of the sample. Look closely, since most aquatic macroinvertebrates are only a fraction of an inch long.

IDENTIFICATION

Once organisms are collected through either the Rocky Bottom or Muddy Bottom methods, they are sorted and identified using IWLA's "Field Guide to Aquatic Macroinvertebrates" and *A Guide to Aquatic Insects and Crustaceans.*

The Izaak Walton League's macroinvertebrate guides provide a general overview of the significance of macroinvertebrate types found across the United States. The composition of macroinvertebrate populations varies depending on local geography and geology. Try contacting your local environmental protection agency or universities for more information about local macroinvertebrates. Local experts might be able to share additional field guides that are specifically designed for your area.

Not all organisms in your stream are listed in the guides. For instance, macroinvertebrates such as whirligig beetles, water striders, and predaceous diving beetles are not included on the survey sheet. They are surface breathers and do not provide any indication of water quality.

When beginning your identification, ask yourself the following questions to identify an organism:

- How large is the organism?
- Is the body long and slender, round, or curved?
- Does the organism have any tails? How many?
- Does the organism have any antennae?
- Does the organism have legs? How many? Where?
- Is the body smooth and all one section, or is it segmented (two or more distinct sections)?
- Does the organism have any gills (fluffy or plate-like appendages)?
- Where are the gills located? Sides, back, underside, under its legs?
- Does it have pinching jaws like a beetle larvae?
- Are any legs or antennae missing because they were broken off in the net?
- What color is the organism?
- Does the organism swim under water or remain on the surface?

When using the macroinvertebrate guides, remember to read the descriptions for each organism. The sizes of the organisms are also noted for reference. However, if you catch a young macroinvertebrate that has just hatched and has not yet reached full size, it may be smaller than indicated in the guides. Specimens can be put into magnifying boxes to ease

identification. Volunteers also can call the IWLA toll-free help line at (800) BUG-IWLA.

After identifying the organisms, record your results on the IWLA Stream Quality Survey data form. Return the organisms to the stream after sampling is completed. Also include information relating to habitat and physical parameters of the stream in the survey on the back of the data form. Tabulate your results to determine the water quality using the instructions on the survey sheet. Use letters to indicate the number of each type of organism (A=1–9, B=10–99, C=100 or more). Add the number of letters in a column and multiply by the index value at the bottom. Add the subtotal for each column to arrive at your final stream rating.

You will notice that the letter (A, B, or C) does not affect the final rating score of excellent, good, fair, or poor. This is because the survey is based primarily on diversity, not the number of individual organisms found. However, the letters are valuable because they document changes in populations over time. For instance, your spring survey has only C's in the "pollution sensitive" column and only A's in the "pollution tolerant" category. In your summer survey, you find only A's in the sensitive range and C's in the tolerant range. Although your rating would remain the same, you might conclude that overall water quality was declining because populations of the tolerant organisms are increasing (A to C) while those in the sensitive category are decreasing (C to A). You should monitor for an entire year to get a clear picture of your stream. Consult with local or state biologists to discuss your findings.

The League updates the sensitivity rankings for macroinvertebrates based on the most recent scientific research. To download a copy of the latest stream survey form, please visit our Web site at www.iwla.org/sos/sostools.html.

SURVEY DATA FORM QUESTIONS

On the back of the survey data form there are a number of questions about the land and vegetation surrounding the stream. These questions help characterize the quality of stream habitat and its ability to support a healthy population of stream organisms. The land-use information also paints a picture of the stream for other people who might review your survey form. Guidelines for correctly answering these questions are given below. Record the answers based on the area that is upstream from your monitoring site; generally, you should record the data for the area that you can see. For land-use information, include uses for one mile upstream from your site or the section of stream you have adopted. If necessary, take a walk or consult a map for this information.

Fish water-quality indicators: The survey form asks if fish are present. Different fish have different tolerances to pollution. The type of fish present may indicate the type of water quality expected. If you collect fish but don't recognize the type, write a description of the fish on the survey form or take a picture to use for later reference. You can find fish identification charts or experts to help with fish identification at local schools, agencies, libraries, or online.

Barriers to fish movement: The question concerning barriers to fish movement is important to consider because the absence of certain fish types in your stream section may be due to a dam or other large obstacle, not because of the water quality. Note on your survey form if the dam is upstream or downstream, and measure its distance from your survey site. Waterfalls should only be recorded if they are large enough that a fish could not reasonably jump over them or swim around them. Usually, waterfalls of a few feet or less are not impediments to upstream movement of fish.

Surface water appearance: Check more than one of the colors listed, but not all of them. Note if strange colors are present throughout the stream or only in one section, such as immediately below a discharge pipe or highway culvert.

Streambed deposit (bottom): Record the general overall appearance of the stream bottom. If the streambed does not have any apparent coating, you may note it as "other" and write in "normal."

Odor: Note any unusual odors. Odors may come from

natural processes or may indicate potential water quality problems.

Stability of stream bed: An unstable stream bed can mean that soil is eroding from the bottom of the stream and may indicate water quality problems. When standing in the stream, determine how frequently the bed sinks beneath your feet.

Algae color: Algae feels slimy. You will notice it as you rub rocks during monitoring. A great deal of algae may indicate too many nutrients in the water. Sometimes more algae will appear in the spring after snowmelt releases extra nutrients into the stream. However, take note of the percent and type of algae present in the stream to make sure it is not increasing over time.

Algae located: Estimate the percentage of stream bed that is covered by algae. Algae often is present in small quantities in healthy streams. Excess algae may indicate water quality problems.

Stream channel shade: Over the course of the day, estimate what percentage of the stream channel is shaded by stream-side trees, shrubs, and grasses. Shading helps keep water cool and can be beneficial for aquatic life.

Streambank composition: Remember to look at both sides of the stream's banks. When questions ask for a percentage, use the information for both the left and right bank and combine values. For instance, if one side of the bank is completely bare from erosion while the other side is well vegetated, you should record the percent of bank coverage as 50 percent.

When recording total percentages of shrubs, grasses, and trees, you should also look at both sides of the bank. However, if one side has artificial structures such as rock riprap or concrete, you will have to account for such ground cover. For instance, if the left side of the bank is not vegetated, you cannot have more than 50 percent of shrubs, grasses, and trees total when those values are added together.

Streambank erosion: Again, looking at both sides of the bank, determine the percentage of soil erosion.

Riffle composition: This question refers to the 3x3-foot area of stream sampled for rocky bottom sampling techniques with a kick-seine net. Do not fill out this question when using the muddy bottom sampling technique.

If you used a kick-seine to conduct the Rocky Bottom Sampling Method, answer this question before you disturb the site. The organisms you collect are most abundant in riffles composed of predominantly cobble-sized stones (more than 70 percent cobbles is a good riffle habitat). Start with the largest rocks first when recording bed composition. If you don't have any boulders (rocks larger than 10 inches), record cobble-sized stones and continue until your percentages equal 100 percent. A typical riffle in a medium-gradient stream might be recorded as 5 percent boulders, 65 percent cobbles, 15 percent gravel, 10 percent sand, and 5 percent silt. Ranges are given on the survey form for the rock sizes. For the smaller rock sizes, remember that silt feels like talcum powder and sand feels gritty. If your riffle had 40 percent silt, 10 percent gravel, and no cobbles, you should either find another station to monitor or switch to the Muddy Bottom SamplingMethod.

Land-uses in the watershed: The survey form asks if land-use impacts are high (H), moderate (M), slight (S), or none (N). Although these questions are somewhat subjective, determining the impact is easy and straightforward. Note "H" for a land-use if it comprises the majority of land in the watershed and is polluting the stream, such as a stream traveling through land that is being strip-mined for coal. Mark "H" if the land-use has a severe impact on stream quality even though the land-use does not utilize a great deal of land, such as a construction site that has caused the stream to be full of silt. Note "M" if the land-use is definitely contributing to stream degradation, but is not the major cause for degradation (or is one of many causes). For example, parking lot runoff and trash from a shopping mall may contribute significantly to stream pollution, but they may not be the only causes of stream degradation. Note "S" for a

land-use if its impacts only slightly pollute the stream. For example, although a farm may be present, good farming practices and conservation measures may mean the pollution impact is negligible. If the land-use is present but causing no pollution, write "N" for none. If the land-use is not present, do not write anything. Also, you should take the time to drive or walk through your watershed before filling out this section to determine if these land-uses are present and impacting the stream.

When considering land-use as the controlling factor in stream quality, look not just at the area visible from the stream, but at all the land draining to the stream—the watershed. If the stream collects water from an intensely developed or agricultural area, do not be surprised if no organisms are found. Should this be the case, consider visiting a forested stream of the same size in the same watershed for sampling comparison. You might be surprised at the different types of organisms you find.

You can identify a pollution source by sampling the stream at quarter-mile intervals upstream from the initial sampling point (where a pollution impact is suspected) until quality improves. The pollution sources should be identified somewhere between the point where degraded conditions were first found and the point where water quality improves.

Comments: Use this space to record observations that are not noted elsewhere on the data form. This may include current and potential future threats to the stream's health.

STREAM PROBLEMS AND THEIR EFFECTS ON STREAM ORGANISMS

1. *Physical Problems* may include excessive sediment from erosion, street runoff, or discharge pipes. Sediment can create poor riffle characteristics, contribute to excessive flooding, reduce flow, change water temperature, and smother aquatic life. The result is usually a reduction in the number of macroinvertebrates in the study area.

2. *Organic Pollution* is from excessive human or livestock wastes or high nutrient enrichment from farm or yard runoff. The result is usually a reduction in the diversity of insects.

3. *Toxic Pollution* includes chemical pollutants such as chlorine, acids, metals, pesticides, and oil. The result is usually a reduction in the number of insects.

MACROINVERTEBRATE COUNT AND WATER QUALITY

Observation:	Analysis:
High diversity, high numbers, many sensitive species such as stoneflies, caddisflies, and mayflies	No problem; good water quality
High diversity, low numbers	Possibly due to poor habitat conditions
Low diversity, high numbers	Organic pollution (nutrient enrichment) or sedimentation; excessive algae growth from nutrient enrichment
Low diversity, low numbers; or no bugs but the stream appears clean	Toxic pollution (e.g., chlorine, acids, heavy metals, oil, herbicides, insecticides)

THE IZAAK WALTON LEAGUE OF AMERICA

Save Our Streams

Stream Quality Survey

Date _____

Time _____

Name _____

Please refer to the Izaak Walton League's volunteer stream monitoring protocol and identification guides to learn how to complete this form. Please use the League's *Field Guide to Aquatic Macroinvertebrates* to complete portions of this stream quality survey form. For assistance, please call (800) BUG-IWLA or send an e-mail to sos@iwla.org.

Stream _____ Station # _____ County/City _____

Location _____

Weather Conditions (last 72 hours) _____

Water temperature_____ F°? C°? Avg. stream width _____ ft. Avg. stream depth _____ ft. Flow rate _____
(above or below average)

Rocky Bottom Sampling

Before sampling, record riffle composition on the back of this form. Take 3 samples in the same riffle area, fill out this form, and keep the highest scoring sample for your records. To help track the number of samples you have collected, check one of the boxes below:

☐ Sample 1 ☐ Sample 2 ☐ Sample 3 ☐ Is this your highest score sample?

Muddy Bottom Sampling

Record the total number scoops taken from each habitat type and provide details to best describe the specific habitat on the lines below.

☐ Steep bank/vegetated margin _____

☐ Woody debris with organic matter _____

☐ Rock/gravel/sand substrate _____

☐ Silty bottom with organic matter _____

Macroinvertebrate Count

Consult the stream monitoring instructions on how to conduct the macroinvertebrate count. Use letter codes (A = 1-9, B = 10-99, C = 100 or more) to record the numbers of organisms. Add up the number of organism types (or number of letters) found under each category (sensitive, less sensitive, etc.) and multiply by the indicated index value. Although A, B, and C ratings do not contribute to the water quality rating, the letters track the population size in each category to see how the macroinvertebrate community changes over time.

SENSITIVE	LESS SENSITIVE	TOLERANT
_____ Caddisflies (except net spinners) _____ Mayflies _____ Stoneflies _____ Watersnipe flies _____ Riffle beetles _____ Water pennies _____ Gilled snails	_____ Dobsonflies _____ Fishflies _____ Common net spinning Caddisflies _____ Crane flies _____ Damselflies _____ Dragonflies _____ Alderflies _____ Crayfish _____ Scuds _____ Aquatic sowbugs _____ Clams _____ Mussels	_____ Aquatic worms _____ Black flies _____ Midge flies _____ Leeches _____ Lunged snails
____ # of letters multiplied by 3 =_____	____ # of letters multiplied by 2 =_____	____ # of letters multiplied by 1 =_____
Now add the three totals from each column for your stream's index value. Total index value = _____		

Compare the final index value to the following ranges of numbers to determine the water quality of the stream sample site.

Water Quality Rating

_____ Excellent (> 22) _____ Good (17-22) _____ Fair (11-16) _____ Poor (< 11)

Fish Populations: ☐ scattered individuals ☐ scattered schools ☐ trout ☐ bass ☐ catfish ☐ carp ☐ other	Barriers to fish movement: ☐ beaver dams ☐ man-made dams ☐ waterfalls (> 1 ft.) ☐ other ☐ none	**Refer to the IWLA monitoring instructions to learn how to score these stream characteristics**	
Surface water appearance: ☐ clear ☐ clear, but tea-colored ☐ colored sheen (oily) ☐ foamy ☐ milky ☐ muddy ☐ black ☐ grey ☐ other _____	Stream bed deposit (bottom): ☐ grey ☐ orange/red ☐ yellow ☐ black ☐ brown ☐ silt ☐ sand ☐ other _____	Odor: ☐ rotten eggs ☐ musky ☐ oil ☐ sewage ☐ other _____ ☐ none	Stability of stream bed: Bed sinks beneath your feet in: ☐ no spots ☐ a few spots ☐ many spots
		Algae color: ☐ light green ☐ dark green ☐ brown coated ☐ matted on stream bed ☐ hairy	Algae located: ☐ everywhere ☐ in spots _____ % of bed covered
Stream channel shade: ☐ > 80% excellent ☐ 50%-80% high ☐ 20%-49% moderate ☐ < 20% almost none	Stream bank composition (=100%): _____ % trees _____ % shrubs _____ % grass _____ % bare soil _____ % rocks _____ % other	Stream bank erosion: ☐ > 80% severe ☐ 50%-80% high ☐ 20%-49% moderate ☐ < 20% slight	Riffle composition (=100%) _____ % silt (mud) _____ % sand (1/16" – ¼" grains) _____ % gravel (1/4" – 2" stones) _____ % cobbles (2" – 10" stones) _____ % boulders (> 10" stones)

Land uses in the watershed (upstream and surrounding sampling site):
Indicate whether the following land uses have a high (H), moderate (M), slight (S), or none (N) potential impact to the quality of your stream.

___ Oil & gas drilling
___ Housing developments
___ Forestry
___ Logging
___ Urban uses (parking lots, highways, etc.)
___ Sanitary landfill
___ Active construction
___ Mining (type: _____)
___ Agriculture (type:_____)
___ Trash dump
___ Fields
___ Other _____

Comments: Indicate the current and potential future threats to the stream's health and attach additional pages or photographs to better describe the condition of the stream.

_____

_____

_____

A Guide to Watershed Cleanups

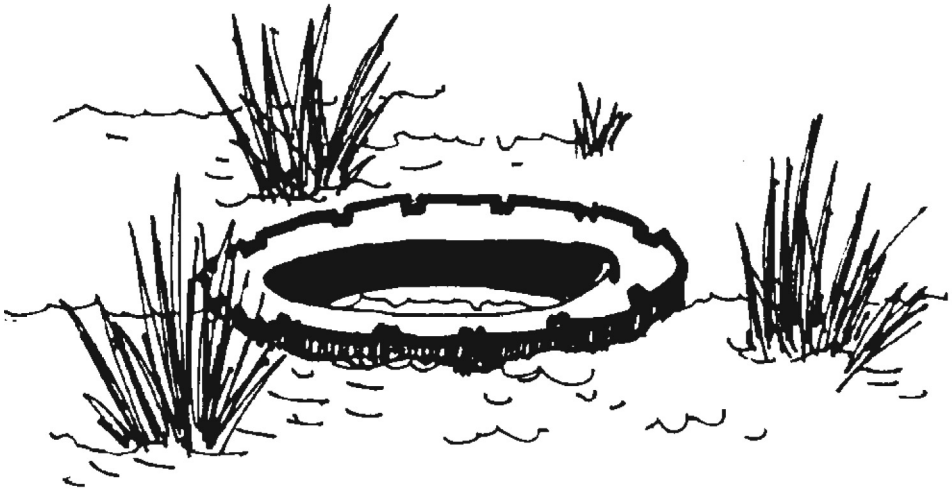
It is important to keep the area around your local waterways clean. When left on the ground, litter eventually will be blown or carried by wind or rain into a waterway, where it can interfere with spawning beds and injure fish, wildlife, and people. Litter can also block free-flowing water and hinder recreational uses.

You can help keep local water bodies litter-free by conducting a watershed cleanup. A watershed cleanup is easy to plan and allows the entire community to participate. It can also be an excellent way to start the community working on larger, more comprehensive watershed conservation projects. This factsheet describes how to organize a fun and successful stream, wetland, or highway cleanup in your watershed.

ORGANIZING THE CLEANUP

The first part of organizing a cleanup is determining the person or group that will lead the cleanup effort. It is important to have one overall leader and several other people willing to work on the event. This group should meet to determine all of the tasks that will be involved in conducting the cleanup and to assign tasks to each person. Some of the tasks that need to be accomplished include:

- Obtaining permission from property owners to access the site. If the site is a park or other public property, contact the park managers to request permission.
- Obtaining equipment and supplies. This includes determining what equipment will be needed and the cost of equipment and supplies, including food for volunteers and first aid supplies.
- Fundraising and soliciting donations of time and supplies.
- Publicizing the event. This includes greeting reporters who attend the cleanup and following up with reporters after the event.
- Manning the registration table at the event.



LIKE WINDS AND SUNSETS, WILD THINGS WERE TAKEN FOR GRANTED UNTIL PROGRESS BEGAN TO DO AWAY WITH THEM. NOW WE FACE THE QUESTION WHETHER A STILL HIGHER 'STANDARD OF LIVING' IS WORTH ITS COST IN THINGS NATURAL, WILD AND FREE. PERHAPS OUR GRANDSONS, NEVER HAVING SEEN A WILD RIVER, WILL NEVER MISS THE CHANCE TO SET A CANOE IN SINGING WATERS.

– Aldo Leopold, A Sand County Almanac

For more information, contact:
Izaak Walton League of America
Watershed Programs
707 Conservation Lane
Gaithersburg, MD 20878-2983
Phone: (301) 548-0150
(800) BUG-IWLA
E-mail: sos@iwla.org
Website: www.iwla.org

- Speaking about the project and reviewing safety information at the event.
- Taking pictures at the event.
- Following up with thank you letters to donors and volunteers.

The event leader may want to hold additional meetings and keep in regular contact with all people working on the event to track overall progress.

OBTAINING EQUIPMENT

The following is a list of suggested equipment and supplies needed for a cleanup. You can provide these items or ask volunteers to bring them.

- Work gloves
- Work boots
- Long pants and long-sleeved shirts
- Rakes
- Shovels
- Pitchforks
- Tin snips
- Heavy-duty rope
- Heavy-duty trash bags
- Orange safety vests
- Glass jars to dispose of hypodermic needles and other sharp objects
- Posterboard for signs
- Cameras and film
- Map of cleanup area
- First-aid kit
- Beverages and snacks
- Flagging or stakes
- Educational materials on watersheds and pollution prevention (copies of fact sheets from this *Watershed Stewardship Action Kit* would work well)

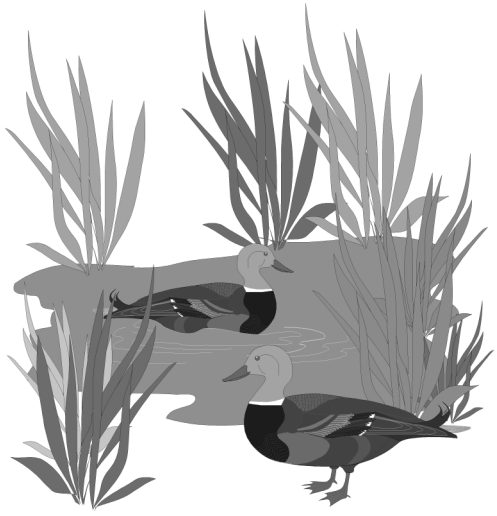
If there are large items such as cars and appliances that need to be removed, you may need heavy equipment to remove them. Trees or logs should only be removed if they are causing erosion and flooding problems or are restricting water flow. Contact your local government or state transportation agency. They might be willing to donate equipment and labor. Also, contact local construction contractors and developers who might want to lend a hand. Many local governments also can provide trucks, trash bags, maps, and personnel. Contact your recycling coordinator or landfill staff for more information on how to recycle or dispose of items in your community.

FUNDRAISING AND SOLICITING DONATIONS

Little money, if any, is needed to hold a cleanup event. Ask local grocery stores to donate food and drinks for your volunteers. Manufacturers such as Pepsi and Coca-Cola routinely give free drinks to community projects. Dairies might donate milk and ice-cream. Local hardware stores, pharmacies, and other stores might donate rakes, trash bags, and gloves. If there are canoe liveries on your river or wetland, ask them to donate canoes to participants. This will allow people to reach floating trash safely. Be sure to explain that you will recognize donors both at your event and through all publicity prior to and following the event. Simply post a sign or banner (which you might be able to get donated as well) at your event that reads something like, "Beverages made possible by a generous donation from _____." Also, be sure to thank all donors in press releases, flyers, and community announcements.

PUBLICIZE THE EVENT

After organizing the cleanup, send notices of your cleanup to local media outlets. Emphasize how the project will benefit the entire community. Remember to ask local civic groups, environmental organiza-



tions, and schools to participate and help publicize the event. Also, be sure to invite residents who live in the cleanup area. Local media often are happy to print or air announcements and may even do a story on your project. Invite a reporter to cover the event. Be sure to greet any reporters at the event and follow up with reporters after the cleanup.

AT THE EVENT

Post a sign at your cleanup site so volunteers know they are in the right place. Set up a table with food, water, and a greeter. The greeter should welcome participants and get their names, addresses (mailing and e-mail), and phone numbers so that you can contact them about future events.

You may want to start the cleanup effort with a brief program. Welcome and thank volunteers and discuss safety issues. You also can use this time to educate volunteers about watersheds and pollution prevention, to introduce your group and explain why the cleanup is important, and to thank volunteers and donors. If you are organizing the cleanup as part of a larger conservation effort, be sure to inform the volunteers of your other plans and activities. Invite their participation in the larger effort.

Warn volunteers to be aware of slippery rocks, glass, poison ivy, ticks, snakes, and steep banks. Suggest that volunteers work in pairs. Also, take the time to teach volunteers how to use tools properly. If you suspect there are hypodermic needles in the area, you may want to assign one person with the task of collecting them and instruct other volunteers to mark their presence with flags or stakes. Refer to "Safety and Fun in Your Watershed" in this publication for more information on making the event safe.

If you are cleaning up a large area, you may want to separate the area into segments and assign team leaders. Deposit piles and bags of trash in previously designated spots for collection. You may want to keep separate bags for recyclable materials.

Make sure that you take plenty of pictures and document how many tons or bags of trash you collect. The volunteers will feel proud of their accomplishment if you can quantify their hard work. Donors also like to know what you have accomplished with their support. Send information about the cleanup and pictures of the event in a thank you note to donors.

DON'T FORGET TO HAVE FUN!

Invite everyone back to a central location at the end of the day for a picnic or barbecue. You may want to arrange for music or a speaker to provide entertainment. A post-cleanup party can be your way of saying "thank you" and ensuring that the volunteers will be happy to help you again.

Stream Enhancement

NEVER IN HIS LIFE HAD HE SEEN A RIVER BEFORE – THIS SLEEK, SINUOUS, FULL-BODIED ANIMAL. ... ALL WAS A-SHIVER – GLINTS AND GLEAMS AND SPARKLES, RUSTLE AND SWIRL, CHATTER AND BUBBLE.

–Kenneth Grahame, The Wind in the Willows

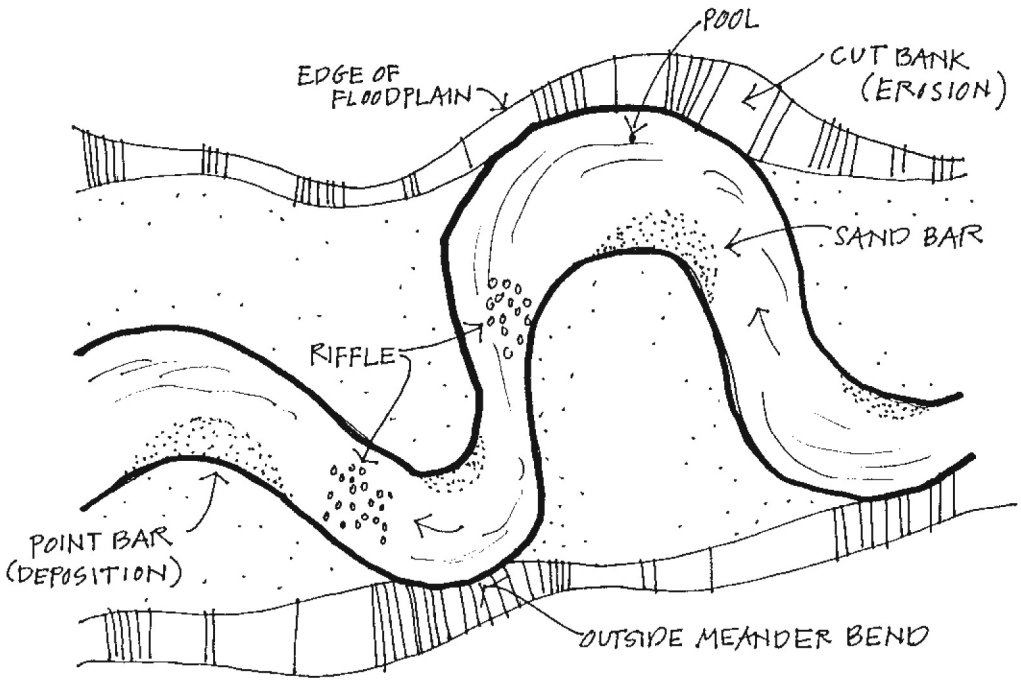
STREAM ENHANCEMENT

As you examine your watershed and assess the water quality of its streams, you might find eroding stream banks, areas devoid of vegetation, deep and narrow stream channels, or wide and shallow channels. These are some of the characteristics of streams adjusting to changes in the watershed or within the stream channel. It is possible to remedy stream degradation, and volunteers can help streams to readjust to the changing landscape.

EFFECTS OF DISTURBANCES ON STREAMS

Healthy streams recover from disturbances quickly by changing shape to accommodate increased stream flow. Healthy streams have vegetated banks, meandering channels, and in-stream habitat such as riffles, runs, and pools. These streams maintain a state of equilibrium between the rate of sediment erosion and deposition. Where land is being or has been developed, however, water runs off with increased speed and volume as a result of paved surfaces, stormwater channels, and land disturbances in the

STREAM IN DYNAMIC EQUILIBRIUM



For more information, contact:
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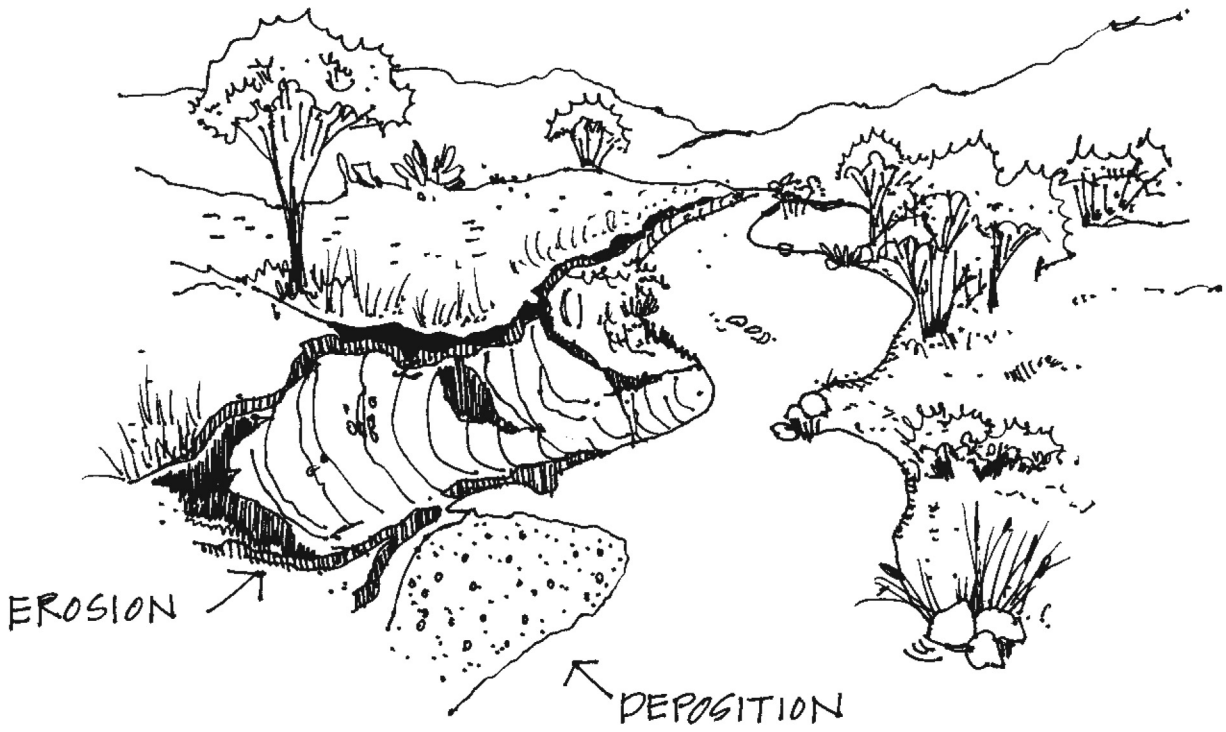
ERODING STREAMBANK



watershed. The high, fast flows that result from runoff can erode banks, carry pollutants, and smother aquatic life with excess sediment. Streams without vegetation on the banks are even more susceptible to erosion and flooding. In heavily farmed areas, vegetation is often removed from the stream banks to make room for more cropland. When livestock are allowed to wade into streams, they also erode the banks and damage water quality.

WHEN THE SOLUTION IS THE PROBLEM

Throughout history, people have settled in the floodplains of streams and then tried to keep them from flooding or changing shape. Traditional engineering practices are designed to prevent flooding and erosion by lining streams with concrete and building reservoirs and levees. A major problem with these structural techniques is that they replace dynamic living streams with concrete ditches devoid of life. In addition, these projects require extensive maintenance and are very expensive to install and repair. Concrete channels collect sediment along the bottom and need to be dredged. Natural streambanks that are located downstream from engineered streambanks often erode because water deflected off the hard, man-made surface hits the softer, natural surface with more force.

STREAM RESTORATION VERSES ENHANCEMENT

Stream restoration means returning an ecosystem to a close approximation of its condition prior to disturbance. Ecological restoration may no longer be possible or desirable. Landscape changes in the watershed may no longer support previous conditions, especially in areas where land-uses and infrastructure such as roads, buildings, and water-control structures have been built. Nevertheless, stream conditions can be enhanced through structural and non-structural techniques.

Structural enhancement involves recreating the shape of the stream bank and often includes adding materials such as rock to harden the bank. Riprap and/or large boulders are used to to anchor the toe (the bottom of the bank), redirect erosive flows away from a

portion of the bank, or armor the entire bank. In-stream work involves placing structures within the stream to help re-create fish habitat such as pools and riffles. Non-structural work includes incorporating conservation measures to minimize the effects of land use, such as prescribed grazing or planting riparian vegetation. These types of enhancement projects can help to improve or protect an ecosystem. Maintenance and monitoring are important components of successful stream enhancement.

In many situations, a stream will be able to recover and develop a more natural appearance and structure on its own if disturbances are removed. Therefore, changing land-use practices or protecting land along stream corridors might be enough to see a stream on the road to self-recovery. This approach, however, could take a hundred years or longer for the stream to stabilize, making a combination of structural and non-structural techniques more desirable.

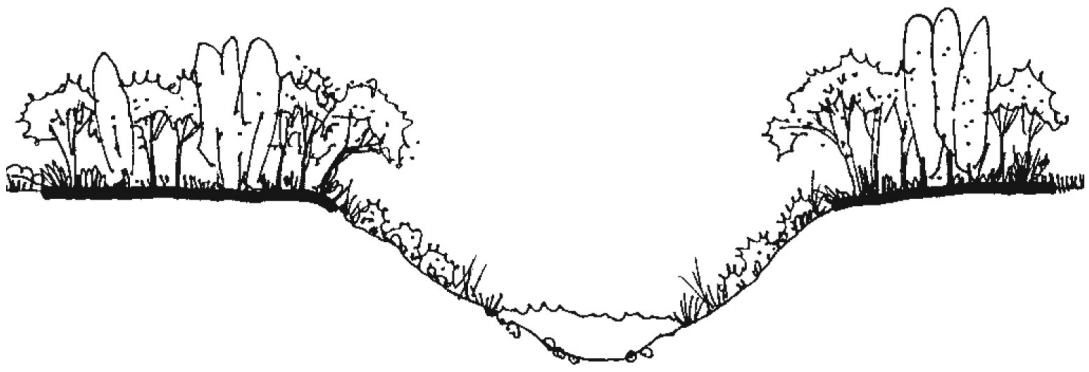
BIOENGINEERING TO ENHANCE STREAMS

Bioengineering is a stream enhancement technique that uses natural materials such as vegetation, rock, and soil to stabilize stream banks. Steep banks are graded back to a gentler slope to encourage growth of vegetation. Cuttings from native vegetation that root easily are installed in specific patterns to maximize bank stability. Dead vegetation and rocks can provide additional support. Trees, shrubs, and grasses often are planted adjacent to the stream to improve wildlife habitat and provide additional stabilization. In cases of extreme erosion, some structural components such as supporting walls of logs, tree revetments, or dirt-filled wire crates (gabions) can be used with vegetation to prevent or control erosion.

There are many advantages to choosing bioengineering rather than traditional engineering techniques. Bioengineering projects cost much less than structural engineering projects and are easier to maintain. Bioengineering stabilizes stream banks, creates habitat for aquatic organisms, and improves water quality. Plants that are used to stabilize stream banks also provide food for aquatic organisms as well as shade, which lowers the water temperature and increases the water's capacity to store dissolved oxygen that is vital to aquatic life. In addition, streamside vegetation is aesthetically pleasing. Properly installed bioengineering techniques actually reduce downstream flooding and erosion.

Many bioengineering projects can be installed with the help of volunteers. Volunteers can maintain and monitor enhancement projects after installation, and trained volunteers can assist professionals with project design.

VEGETATION STABILIZES STREAMBANKS AND ENHANCES WILDLIFE HABITAT



ENHANCING RIPARIAN BUFFERS

Vegetation growing by the stream in the riparian corridor provides shade and food necessary for aquatic habitat. Establishing or expanding stream corridor vegetation is a simple and effective step toward improving water quality. A buffer is especially important for streams adjacent to farmlands; vegetation in these areas helps trap and break down pesticides, fertilizers, and other pollutants before they enter the stream. In urban areas, buffers help to catch sediment and slow runoff from paved surfaces that can cause erosion.

Organizing a riparian buffer planting can be a fun, easy, and cost-effective way to improve stream water quality. Selecting vegetation that is appropriate to the specific conditions of the site is crucial to the success of the project. Factors to consider when selecting vegetation include soil moisture, available sunlight, elevation, potential for animal damage (such as grazing or rubbing by deer), and plant competition. Choosing the right time to plant and providing regular follow-up maintenance are also essential to the project's success.

Use shrubs and trees that are native to the area. Locally obtained plants are generally better adapted than plants obtained from distant sources. Consult with local experts to determine which native plants have deep, branching roots, provide good shading, and live long. It is important to determine which plants root easily and can develop roots from all plant parts, including buried twigs. For sources of native plants, visit the Izaak Walton League's Web site at www.iwla.org/sos/resources or contact your state or local native plant society.

Control or removal of invasive plants may be an important part of a stream enhancement strategy. Non-native vegetation often prevents growth of native plants that are needed by riparian wildlife. Invasive plants can be controlled physically, chemically, or biologically. There are advantages, disadvantages, and important considerations associated with each technique. Please feel free to contact the Izaak Walton League for additional information.

GET INVOLVED IN LAND-USE PLANNING

Establishing riparian buffers and installing bioengineering techniques to stabilize stream corridors, create habitat, and filter contaminants from surface water and groundwater are most effective when combined with a sound land-management plan. Land-uses affect the quality and quantity of water reaching streams and other water bodies. The land-use planning process incorporates several opportunities for public participation in decision-making.

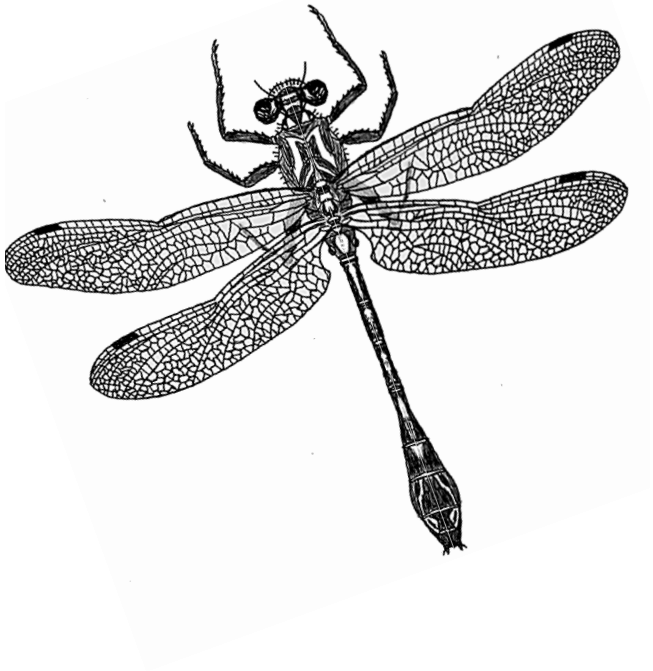
Each town, city, or county usually has a land-use plan. If a town does not, it's probably time to develop one. This plan is a guide for where homes, businesses, and parks are to be developed and built. It also includes conservation areas such as wetlands, streams, historic sites, and other areas of importance. A community's plan can be found at the planning or zoning office, at the planning commission, or in the community's public library.

Although the land-use plan guides development, the legal means of managing growth and development can be found in zoning ordinances and subdivision regulations. Zoning, for example, sets rules for the location of land uses, density of dwellings or businesses, height of buildings, and other restrictions. Subdivision rules govern the layout of each grouping of homes or commercial buildings within each zone. Subdivision ordinances govern such things as how far back from the street houses must be, the amount of parking, and the width of streets.

Many communities have outdated standards in their ordinances that may hinder watershed

The following are ways in which volunteers can play an important role in watershed enhancement:

- Monitor and assess streams to prioritize areas for enhancement.
- Work with local experts to design bioengineering projects.
- Help install, maintain, and monitor stream bank stabilization projects.
- Organize watershed cleanups (See "A Guide to Watershed Cleanups" in this publication).
- Plant native trees, shrubs, herbs, and wildflowers throughout the watershed.
- Remove invasive species that have little value for local wildlife, can crowd out native species, and can increase stream erosion problems.
- Fence livestock out of streams.
- Conserve wetlands and other natural areas in the watershed.
- Participate in public meetings about zoning and land-use planning.
- Get involved with local planning and conservation task forces and commissions.
- Run for an elected position within your community.



protection efforts. For example, subdivision ordinances may require roads that are wider than needed by the community. Reducing road width could allow more rainwater to filter through the ground before reaching streams and other waterways.

There are many opportunities for citizens to get involved with local land-use planning. Citizens can attend planning commission meetings. At these meetings, the planning commission makes recommendations to the county or town council concerning changes in land-use plans or zoning and requests by developers for particular projects. Citizens may also consider sitting on a commission or task force that is reviewing local planning regulations. They can also participate in the process for reviewing and making changes to the local land-use plan or zoning ordinance, which usually occurs every few years.

Wetland Ecology

WHAT IS A WETLAND?

A wetland is an ecosystem that has both terrestrial and aquatic characteristics. Although wetlands are often covered in water or saturated to the surface, some are wet only during certain times of the year. Swamps, marshes, bogs, and fens are types of wetlands commonly found in the United States. Marshes are dominated by soft-stemmed vegetation, while swamps include mostly trees and shrubs. Marshes and swamps can be freshwater or saltwater. Saltwater marshes are dominated by a few species of salt-tolerant grasses. Saltwater swamps contain mangroves – the only salt-tolerant tree. Bogs are freshwater wetlands often formed in old glacial lakes, with spongy peat soils, evergreen trees and shrubs, and sphagnum moss. Fens are freshwater, peat-forming wetlands covered mostly by grasses, sedges, reeds, and wildflowers.

There are many different definitions of wetlands, some scientific and some legal, which affect wetland regulations and protection. Most definitions include three main characteristics of wetlands: 1) presence of surface water or water in the root zone; 2) hydric soils (soils formed under waterlogged conditions); and 3) vegetation (hydrophytes) that has adapted to living in wet conditions. Countless variations of these characteristics often make it difficult to determine whether or not a particular area is a wetland.

Wetlands can be found in every county and climatic zone in the nation. One way to find out if there is a wetland in your area is to consult a National Wetland Inventory (NWI) map. For copies, call (888) ASK-USGS, visit the NWI Web site at www.nwi.fws.gov, or contact your local Natural Resources Conservation Service office. Please remember that NWI maps include areas of open water and likely wetland areas. For more accurate information about wetlands in your watershed, your local conservation service or planning department may have specialists trained in identifying wetlands.

WHY ARE WETLANDS IMPORTANT?

Wildlife Habitat — Wetlands provide shelter, food, and spawning and nesting sites for many species of birds, fish, mammals, reptiles, and invertebrates. Although wetlands make up only about 5 percent of land in the United States, they support about 190 amphibian species and one-third of all bird species in the country. Almost 43 percent of the federally listed threatened and endangered animal species are in some way dependent on wetlands for survival.

Floodwater Storage — Depending on the area's topography and location in the watershed, wetlands store water and slowly release it. This process slows the water's momentum, reduces erosion, allows for groundwater recharge, and reduces flooding. In 1972, the U.S. Army Corps of Engineers determined that the destruction of wet-

IN A GREEN PLACE LANCED THROUGH WITH AMBER AND GOLD AND BLUE – A PLACE OF WATER AND WEEDS, AND ROSES PINKER THAN DAWN AND RANKS OF LUSH YOUNG REEDS AND GRASSES STRAIGHTLY WITHDRAWN FROM GRAVEN RIPPLES OF SANDS THE STILL BLUE HERON STANDS.

- Theodore Goodridge Roberts

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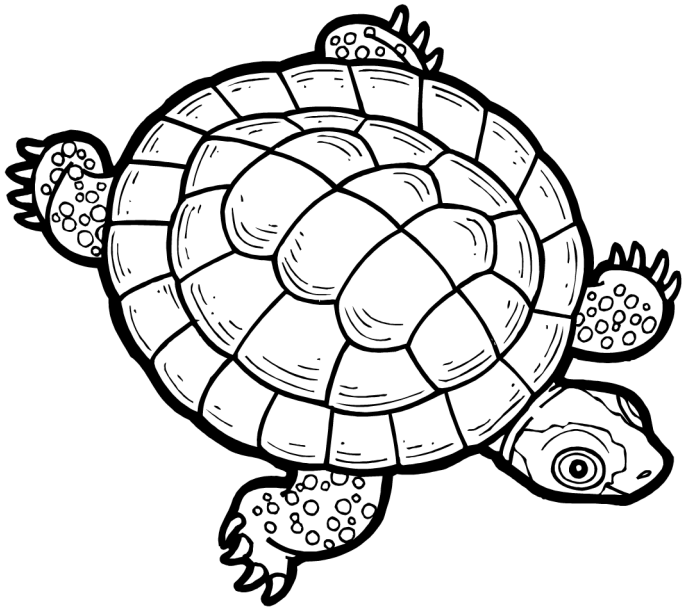
lands along the Charles River near Boston would have caused $17 million in annual flood damage. In fact, one acre of wetlands can store more than 360,000 gallons of water if flooded to a depth of one foot. This is enough water to fill 12,000 bathtubs.

Erosion Control — Coastal wetlands shield coastlines and dissipate storm energy. They act as buffers against wind, rain, and wave action. In 1992, Hurricane Andrew caused $20 billion in damage to the developed coasts of Florida. But when Andrew hit the Louisiana coast with the same force, it cost only $2.5 billion to repair the damages because Louisiana's coastal wetlands provided a protective barrier. Wetlands also reduce channel erosion that occurs during floods by storing water runoff and releasing it back into streams at a slower rate.

Water Purification — Wetlands help purify drinking water by naturally filtering polluted runoff from city streets, buildings, and agricultural lands. Wetland plants, soil, and organisms living in the soil trap sediments, accumulate nutrients, transform a variety of toxic substances such as pesticides and heavy metals, and can remove potentially dangerous bacteria from surface waters. For example, if half the wetlands in the country were destroyed, 684 million kilograms of nitrogen would be released from the wetland soils and plants and contaminate our waters. In other words, the United States would need to spend more than $62 billion per year to upgrade our current sewage treatment system to match the cleansing power of those wetlands. Some types of wetlands are so good at filtration that environmental managers construct artificial wetlands to treat stormwater and wastewater.



Economic Benefits — Fish, shellfish, cranberries, timber, wild rice, and other commercially important products are harvested from wetlands. More than 95 percent of the commercially harvested fish and shellfish in the United States are wetland dependent during some stage of their lives. The commercial fishing industry provides nearly 2 million jobs nationwide and contributes $152 billion annually to the economy. Commercial hunting of wetland animals such as alligators, geese, beavers, and muskrats contributes hundreds of millions of dollars to the economy each year. Recreational activities in wetlands also contribute to the economy. In 1996, recreational hunters of migratory birds spent $720 million on equipment and $576 million on travel. Anglers spent an additional $37.8 billion on equipment, licenses, travel, and lodging in the same year.

Recreation — Wetlands provide great diversity and beauty simply for our enjoyment. They provide endless opportunities for popular recreational activities such as hunting, canoeing, bird-watching, and hiking. More than half of all adults across the nation hunt, fish, bird-watch, or photograph wildlife. Even people who may never visit a wetland may be happy just knowing that wild and beautiful places, such as natural wetlands, still exist.

Education — Wetlands make excellent and inexpensive outdoor laboratories. Students of all ages can benefit from experiencing the specialized habitat of wetlands firsthand. The complexity of wetland ecosystems makes them excellent subjects for research projects such as vegetation surveys and studies of water quality or wildlife.

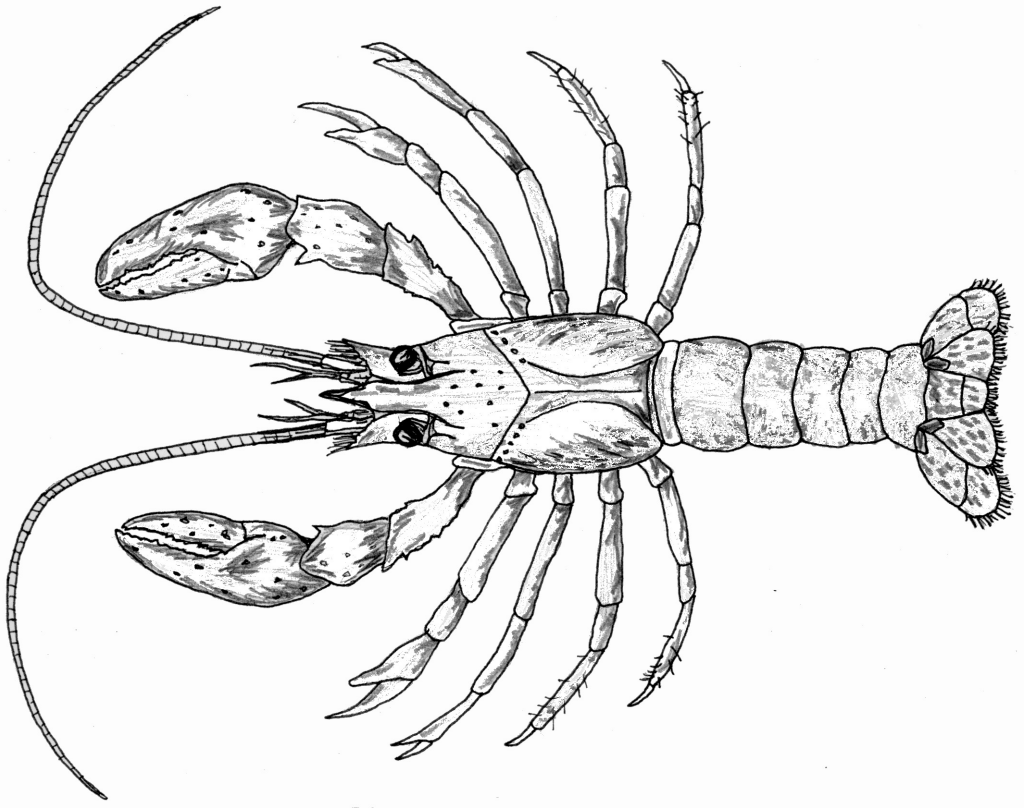
WETLAND STATUS

Since the mid-1800s, more than half the nation's original wetlands have been lost to development. Although wetland losses have declined from about 458,000 acres per year during the 1950s through the 1970s, annual loss is still about 117,000 acres.

Some types of wetlands have sustained particularly large losses. Ninety-eight percent of losses between 1986 and 1997 were to freshwater wetlands. More than 90 percent of California's vernal pools have already been destroyed, causing the loss of associated plant and animal species. Approximately two-thirds of the Midwest's prairie potholes, which are vital to the survival of migratory waterfowl, have been lost since the 1780s.

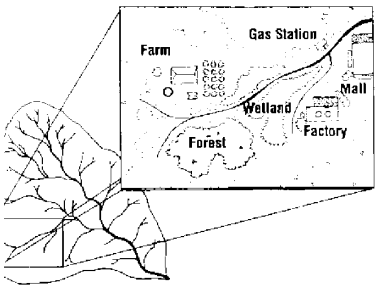
Wetland losses can be attributed to urban development (30 percent), rural development (21 percent), agriculture (26 percent), and forestry (21 percent). Other causes include natural changes in hydrology, land subsidence, and saltwater intrusion. Unfortunately, many remaining wetlands are in poor condition and many man-made wetlands fail to replace the diverse plant and animal communities of those that have been destroyed.

Although it is harder to identify and quantify, wetland degradation is as big a problem as wetland loss because degraded wetlands are less able to perform the functions that are so valuable to people and wildlife. Activities that degrade wetlands include any activities that load wetlands with excessive pollutants such as sediment, fertilizer, human sewage, animal waste, road salts, pesticides, and heavy metals. Grazing by domestic animals, removal of vegetation, and introduction of nonnative plants that compete with native species can impair wetlands. With the addition of pavement and other hard surfaces, water and pollution runoff is increased, thus causing wetland degradation.



Wetland Conservation Projects

With almost 75 percent the nation's wetlands in the hands of private owners, it is vital to change our society's attitudes about them. Knowing and understanding the roles that they play on our landscape will create a shift in the way we value and protect them. This large private ownership also means that is important for every community to participate in wetland management and conservation. There are many actions that you can take individually or as part of a group to conserve wetlands. This factsheet includes ideas for a wide range of conservation projects to accommodate your interests, availability, and resources.



"AT SOME POINT, THE WILL TO CONSERVE OUR NATURAL RESOURCES HAS TO RISE UP FROM THE HEART AND SOUL OF THE PEOPLE — CITIZENS THEMSELVES TAKING CONSERVATION INTO THEIR OWN HAND AND, ALONG WITH THE SUPPORT OF THEIR GOVERNMENT, MAKING IT HAPPEN."

– Mollie H. Beattie

SUPPORT WETLAND CONSERVATION

Support local conservation efforts by donating time, money, and materials. Other ways you can invest in wetlands is by purchasing federal duck stamps from your local post office or through the U.S. Fish and Wildlife Service Web site at www.fws.gov. Proceeds from these $15 migratory bird-hunting stamps support wetland acquisition and restoration.

CONSERVE AND ENHANCE WETLANDS ON YOUR PROPERTY

If you currently have wetlands on your property, you have the privilege and the responsibility of owning a precious ecosystem that is valuable to people and wildlife. If you develop or improve your property, plan to avoid affecting the wet areas. If you feel you cannot avoid altering a wetland, request technical assistance from your state environmental agency to make sure the impacts are minimal.

Another way to conserve wetlands is to place a conservation easement on the property. An easement allows landowners to retain ownership and use of the property, but it limits the present and future uses of the land. Alternatively, consider donating or selling the property to a land trust, nonprofit group, or government agency. For more information on these land preservation options, contact the Land Trust Alliance at www.lta.org.

Enhance your property by building a wetland in your backyard. For more information, visit the U.S. Department of Agriculture's Web site at www.nrcs.usda.gov/feature/backyard/. For information on vernal pool construction, download *A*

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Guide to Creating Vernal Ponds from www.southernregion.fs.fed.us/boone/vernal.pdf. For an even healthier wetland, plant native grasses or forested buffer strips on your property.

Also, remember to reduce the amount of fertilizers, herbicides, and pesticides applied to lawns and gardens.

MONITOR AND ASSESS WETLANDS IN YOUR COMMUNITY

Several scientists have pioneered wetland biological monitoring techniques that rate the health of the ecosystem based on vegetation, macroinvertebrates (insects and crustaceans large enough to see with the unaided eye), amphibians, and other components. Most of these techniques are specialized for particular types of local wetlands and cannot be standardized. The U.S. Environmental Protection Agency has compiled information on the latest techniques for assessment in a series of modules called *Methods for Evaluating Wetland Condition*. These modules are available by calling (800) 490-9198 or on the Web at www.epa.gov/owow/wetlands/bawwg/.

Although assessing the health of a wetland may seem difficult, it is useful to collect data and keep records about the hydrology, soils, plants, and animals present in the area. This information will be useful if you are interested in pursuing restoration or enhancement or if you are opposing its development. In addition, changes in the wetland over time may alert you to problems that may need to be addressed. For example, changes in plant life may indicate that the wetland is gaining or losing water. Changes in vegetation or wildlife also may show that an invasive species of plant or animal is taking over native populations and needs to be controlled. Monitoring the wetland also can be a great educational tool for adults and students. The Izaak Walton League's *Handbook for Wetland Conservation and Sustainability* includes data forms and monitoring instructions that can be used for any type of wetland across the country to track long-term trends and changes. Contact the League for information on obtaining this publication.

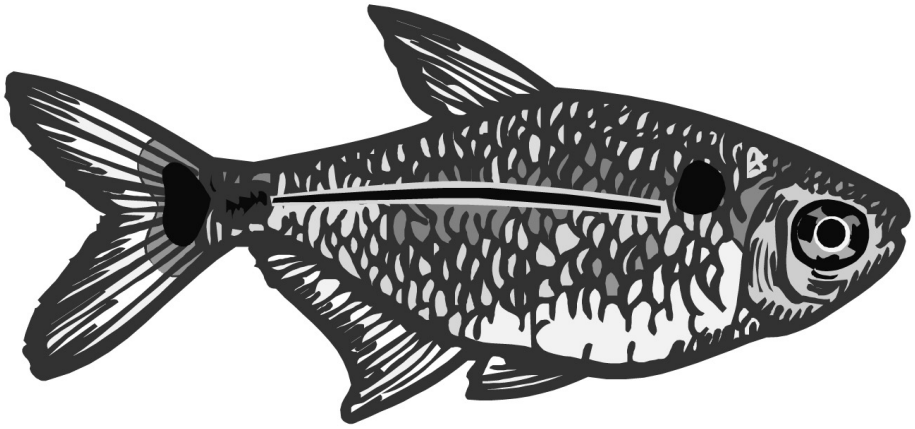
For more information on wetland monitoring, including volunteer monitoring information and links to related organizations and agencies, visit www.epa.gov/owow/wetlands/monitor.

WETLAND ENHANCEMENT, RESTORATION, AND CREATION

To ensure success, get the advice and involvement of experts.

Wetland enhancement involves creating additional wildlife habitat. For example, planting native bird-nesting boxes can provide shelter.

Wetland restoration returns disturbed or altered wetlands to a natural state. The most important step in restoration is restoring the hydrologic scheme, because hydrology is the driving force behind the soils, vegetation, and wildlife present. In some cases, restoration may be as simple as removing drainage tiles or plugging drainage ditches.



Wetland creation is the conversion of an area that was historically an upland into a wetland. Creating a wetland on school grounds, in a public park, or in your backyard can be ecologically and aesthetically rewarding. Like restoration, creation begins with the establishment of wetland hydrology. This may involve excavating a depression to collect rainwater and lining it with fish-grade plastic to prevent water from draining through the soil, or diverting runoff from a parking lot or roof into the wet area. Please remember that our limited scientific understanding of wetland ecology makes it difficult to restore wetlands, let alone create new ones. Therefore, the League recommends that we protect natural wetlands first, then look for opportunities for restoration. Creation should be used as a last resort or for educational purposes.

For more information, refer to *An Introduction to Wetland Restoration, Creation, and Enhancement* by the Interagency Workgroup on Wetland Restoration. This document is available on the Web at www.epa.gov/owow/wetlands/finalinfo.html. You can also contact the Izaak Walton League for information.

EDUCATION

Education is a powerful tool in changing people's attitudes. One of the best methods to educate people about wetlands is to give them a hands-on experience. Begin by coordinating field trips to local wetlands for clubs and school groups in the community. Invite an ecologist to lead the tour. If possible, provide access, such as boardwalks, for people to visit local wetlands without damaging plants. Post informative signs throughout the area to support self-guided tours. You could also hold a volunteer event such as a trash cleanup, a tree planting, or a wetland monitoring session.

There are many creative ways to reach people who may not be ready to get their hands dirty, such as:

- Writing letters to local newspapers and talking to reporters about the functions and values of wetlands.
- Sponsoring community forums and educational workshops.
- Creating a wetland display and taking it to fairs, exhibits, and other events.
- Making presentations to environmental clubs, civic organizations, schools, and other groups.

Introduce schools to wetlands as outdoor laboratories. Wetlands provide a perfect tool for an interdisciplinary approach to teaching about the environment. Monitoring data forms and instruction sheets from the Izaak Walton League's *Handbook for Wetlands Conservation and Sustainability* can be used in classes to explore ecology and to introduce students to dichotomous identification keys. See the resource listing on the Web site www.iwla.org/sos/resources or contact the League for more educational materials.

ADVOCACY

There are many ways to advocate for wetland conservation at the federal, state, and local levels. To keep current conservation laws in place and to pass better laws, constituents need to contact their local, state, and federal elected officials and let them know that wetland conservation is an important issue. For more

information on national wetland policy, advocacy tips, and action alerts on the most current policy opportunities, please visit the League's Web page at www.iwla.org and click on Take Action. This site also provides an easy way to send messages to members of Congress and to track their votes.

Under Section 404 of the Clean Water Act, a permit is required for any activity or development that affects wetlands. This program is administered by the U.S. Army Corps of Engineers and, in a few cases, by your state's environmental agency. You can participate in the Section 404 program and state regulatory programs by reviewing public notices and commenting on permit applications. Contact your local Army Corps of Engineers district office to get on the mailing list for public notices. Information on your local office is available at www.usace.army.mil.

Locally, encourage neighbors and developers to protect the function and value of wetlands. Also, work with your local municipalities to develop laws and ordinances. Attend public hearings on watershed conservation issues and, when asked, present information about the importance of local water resources to planning commissions and elected officials. For more information on getting started with local advocacy and for draft wetland protection ordinances, contact the League.

Safety and Fun in Your Watershed

There are several important things to remember when you are working outside. If you follow these safety tips, you will have a fun and enjoyable experience.

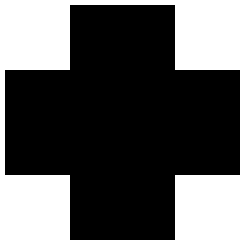
BEFORE YOU GO

Remember to tell a friend or relative the date, time, and location of your watershed activity. Work with a partner so if you are injured, someone can go for help.

Find the phone number and location of the nearest medical center to your work site. Carry a cellular phone with you and note the location of a pay phone. Remember that cell phones do not always work in rural areas, so do not rely on them at all times.

Bring a first aid kit that includes these items:

- Adhesive and cloth bandages
- Antiseptic spray or ointments
- Surgical tape
- Hydrogen peroxide
- Tweezers
- Cotton balls
- Aspirin or non-aspirin pain reliever
- Bee-sting neutralizers



Review safety rules and tips with everyone in your work group before each outdoor project.

SAFETY RULES

The League recommends that groups never get into a stream when the water is at flood stage or is flowing much more swiftly than normal. It is better to delay monitoring or cleanup projects than to risk personal harm. Water should always be below the knee level of the people who will be in the water. Remember that the knee level of children may be much lower than the knee level of adults. Avoid steep and slippery banks.

When in contact with water, keep your hands away from your eyes and mouth, as not all pollution can be seen or smelled, and waterborne diseases are often transferred by way of eyes or mouth. Always wash your hands thoroughly with soap and water after being in contact with stream or river water. You may also want to bring antibacterial hand gel to the field site for use immediately after water contact.

"THE ULTIMATE TEST OF A MORAL SOCIETY IS THE KIND OF WORLD IT LEAVES TO ITS CHILDREN"

– Dietrick Bonhoeffer

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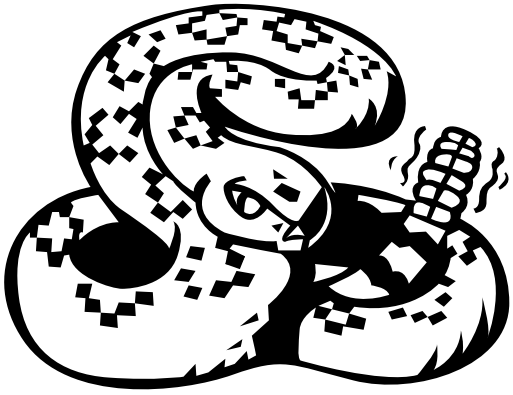
If the water is posted as unsafe for human contact or appears to be severely polluted, (strong smell of sewage or chemicals, unusual colors, lots of dead fish) do not touch the water. If these signs of severe pollution are not present, but you are unsure of conditions or would like additional protection, take the following precautions:

- Wear rubber boots high enough to keep water from coming in contact with your skin.
- Wear heavy rubber gloves that go up to your shoulders (available at most automotive supply stores). Surgical gloves will not work. They can be punctured easily by snags or sharp objects, and they are not long enough to protect your arms.
- Wear a protective covering for your mouth such as a painter's mask (available at most drugstores or hardware stores). You can get sick if you breathe in vapors from sewage-contaminated water.
- Report any pollution problems to your state's water regulatory agency.

OTHER AREAS OF CONCERN

Snakes: Snakes can be a concern when you are in an aquatic environment, especially slow-moving waters with overhanging vegetation. To avoid an encounter with a snake, observe the following rules:

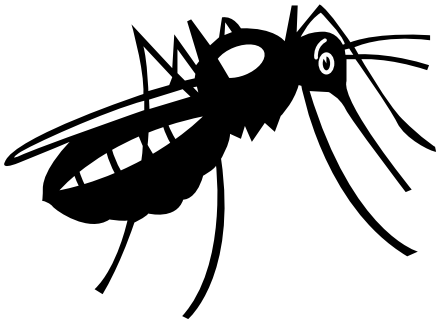
- Check rocks, logs, and stubs for snakes. Snakes must get out of the water to dry their skin and will lie on flat surfaces exposed to sunlight.
- If you have to approach the water through high grass, thump the ground in front of you with a stick. Snakes will feel the vibrations and move away. Snakes are deaf and respond only to vibrations.



- If you come upon a snake at close range, simply move away. The snake probably will leave the area when it no longer perceives you as a threat. Remember, you are much bigger than the snake, and it is more afraid of you than you are of it. Allow the snake a chance to back off, and it usually will.

Most snakes associated with aquatic environments are not poisonous. However, because it's difficult to distinguish between poisonous and non-poisonous snakes without getting too close, the best advice is to stay away from them all. If a snake bite does occur, follow these simple steps:

- Elevate the bitten area. Do not apply ice or a tourniquet to the wound. Do not cut the wound open or attempt to suck out the venom.
- Remain calm. Take a few deep breaths and keep movement to a minimum. Walk calmly to your vehicle and have your partner carry your equipment.
- Remove all watches and jewelry if bitten on the hand or arm. Snake venom will cause the bitten area to swell.
- Seek immediate medical attention.



Insects: If you are allergic to any type of insects, bring your antidotes or medicines. Ask other members of your group about their allergies before you go to the site. If a volunteer gets an insect bite that swells up to an unusual size or has severe redness, seek medical attention immediately.

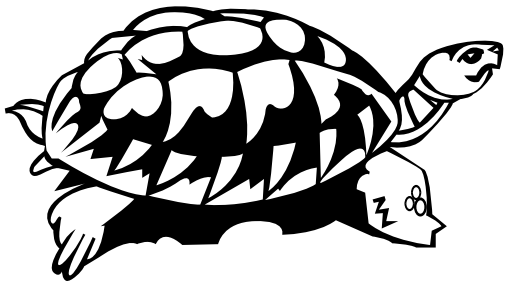
Many people have concerns about West Nile virus. Female mosquitoes transmit the virus primarily among birds. Occasionally, mosquitoes transfer the virus from birds to humans, most of whom experience no symptoms. About one in five infected people

develop West Nile fever, which resembles the flu. Infections can be fatal in people with weak immune systems, but this is rare. To avoid mosquito bites, wear long sleeves and pants. Avoid areas of standing water during dawn and dusk, when mosquito activity is at its peak. Consider using mosquito repellants that contain DEET. Do not spray DEET underneath clothes. For more information on West Nile virus, see the U.S. Environmental Protection Agency factsheet "Wetlands and West Nile Virus" online at www.epa.gov/owow/wetlands/facts/WestNile.pdf, or contact the Izaak Walton League.

Ticks: Ticks are prevalent in grassy or woody areas. It is important for volunteers to check their bodies for ticks. Feel along the scalp for any loosely attached bumps. If it is a tick, do not pull it out. Yanking the tick may cause an infection if its head remains in the scalp. Grasp the tick with tweezers and gently twist it counterclockwise for several rotations until the tick is free. Swab the area with hydrogen peroxide to clean the area. If you want to kill the tick, burn it with a match or suffocate it with nail polish or petroleum jelly after it has been removed from the skin.

One type of tick, called a deer tick, can carry a serious illness called Lyme disease. Deer ticks resemble common ticks except they are much smaller (only a few millimeters across.) Symptoms of Lyme disease include chills, malaise, and fever. Often the first sign of Lyme disease is a bull's-eye shaped mark on the skin, but this is not always present. Treatment requires a shot of prescribed antibiotics. If not treated, this disease can remain in your body for a lifetime. If you exhibit any of the symptoms, it is recommended that you see your doctor and ask for a Lyme disease test.

Alligators and turtles: In southern states, you may encounter alligators and large aquatic turtles. These animals are not dangerous if left alone. Alligators under 18 inches in length are juveniles and may be near their mothers. Female alligators are very protective and may be dangerous. If you see alligators, leave the area immediately. Snapping turtles and soft-shelled turtles usually will move out of an area if the water is disturbed. Although turtles are not poisonous, treat a turtle bite with the same care as a snake bite.



Bears: Black bears and grizzly bears live in forested areas around the United States. Black bear encounters are more prevalent in the eastern United States, while grizzlies may be encountered in the Northwest.

- When in an area with the potential for bear encounters, make sure you stay with a group of people and make noise to alert the bear of your presence. It is also a good idea to carry bear pepper spray, just in case.
- If you see a bear and it does not see you, quickly leave the area while keeping your distance from the bear, giving it plenty of room to escape should you startle it.
- If you encounter a bear and it sees you, do not run. You cannot outrun a bear. Stay calm and slowly back away from the bear. Look for an escape route that gives the bear plenty of space; try to stay out of its "comfort zone" and avoid direct eye contact.
- Climbing trees to escape is a common suggestion, but be aware that bears can follow you up a tree.
- If a bear should charge you, do not run. Drop to the ground and cover your head, face, and neck with your arms for protection. If you are wearing a backpack, make sure it faces the direction of the bear so it can absorb punishment from any attack. Bear attacks are often "hit and run" and don't last very long. Lay motionless and give the bear time to leave the area. Seek medical treatment as soon as possible for any injuries.
- If you feel an attack is predatory, disregard the above strategy and fight back with everything you have. This also applies to mountain lion attacks. Seek medical treatment immediately and report the attack to wildlife authorities.
- Never go near a cub because the mother bear is always nearby and will become very aggressive in trying to protect her young.

Media and Publicity

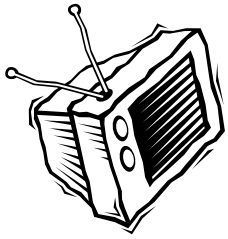
The media and other public forums offer unlimited opportunities to publicize programs and events. Getting publicity for a cleanup, educational program, or other function can be a way to educate the community about the importance of water resource protection and help to attract volunteers to your group or activity. The more publicity you get for your program, the more opportunities you might have to sign up new participants.

"MOURN NOT THE DEAD...BUT MOURN THE APATHETIC THRONG — THE COWED AND MEEK WHO SEE THE WORLD'S GREAT ANGUISH AND ITS WRONG, AND DARE NOT TO SPEAK"

– Ralph Chaplin

BELOW ARE A FEW IDEAS FOR PUBLICIZING ACTIVITIES:

- Posters or flyers on bulletin boards in stores, libraries, schools, town halls, and other public places.
- Flyers distributed door-to-door or by mail.
- Articles in your newsletter or in other groups' newsletters.
- Displays describing your group and projects in parks, at malls, and at special events.
- Postings on Web site calendars and e-mail list serves. Visit www.iwla.org/sos/awm/events to post information on the League's Watershed Activities Calendar.
- Articles, announcements, or ads in newspapers and magazines.
- Radio and TV public service announcements or talk shows.



HOW TO WRITE A NEWS RELEASE

Most press people are very willing to hear news tips, story ideas, or announcements of events by phone or in person. But they will usually ask you to give them written information first. That means you should send them a news release, even if you're announcing a cleanup or a watershed association meeting.

Writing a news release doesn't require a polished writing style—the reporter or editor will likely rewrite it anyway. It does require that you get the information and the focus of the story across quickly, simply, and accurately. The following are some points to keep in mind.

The Five W's—Who, What, When, Where and Why: It is very important that you tell the reporter or editor (and therefore the reader) what's happening, who's doing it, when and where it's taking place, and the purpose of the event, project, or award. This information should be included in the first paragraph. This paragraph should also get people's attention. The best way to do that is to tell readers how it will affect them. That should be the focus of the story.

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Quotes: People always like to read what someone else has to say. In a news release, quotes help the reporter write the story. He or she may want to interview you or the key person involved in the project, but may not have the time. When you supply a ready-made quote or quotes, the reporter can write a story that sounds as if he or she did an interview.

Photos: Ask reporters if they would like a photo. Daily papers may not want one if the story is an announcement. If the story has a human-interest angle, a photo will improve the presentation of the story and help you get more space. Make sure the photo is clear, has good definition, and is either 5x7 or 8x10 glossy. (Matte finish does not reproduce well.) Photos with people, especially children, engaged in hands-on activities are the most successful. Reporters may use their own photographer if they're doing an interview.

Format: Certain key information must be on the release; otherwise, the reporter might be confused, want more information, or need to verify facts. Each press release should include the following:

1) Type FOR RELEASE or FOR IMMEDIATE RELEASE at the top righthand corner of the first page. Underneath put the date you want the story to be released. Underneath that, put the names of two contact people and their phone numbers. If one person cannot be reached, the reporter has an alternative.

2) Include a simple headline. State the facts in the first paragraph, keeping the focus up front. For example: "Izaak Walton League Stops Erosion in Beaver Creek." This headline draws the readers' interest by telling them they will benefit from the project. Ideally, they'll want to find out why and how, and read the story. It is not necessary to copy actual headline style. The paper's headline writer will sometimes rewrite it, depending on size and shape of the space allotted for the story. Radio and TV will do the same. Your headline will give them the focus of the story.
3) Include a dateline. Put your city or town in capital letters at the beginning of the first paragraph, followed by your state's abbreviation, so the reporter knows where the information originated.

4) Use double-spaced lines for easy reading. Put each new idea in a separate paragraph and keep all paragraphs short. Single spacing and long, unreadable paragraphs will lose the reporter's and the reader's interest.

5) If the release is more than one page, put "More…" at the bottom of each page. At the end of the release, type "-30-." This is a universal symbol that will tell the reporter they have reached the end. Keep the release short. One to two pages are ideal.

6) Make sure your dates, times, and places are accurate. Make sure names are spelled correctly.

7) Your last paragraph should be a short (2-3 sentences) description of the event or program.

Deadlines: When you contact reporters, ask about deadlines and make sure you are on time. Try to have your release arrive a day or two before you want the story to appear. If you send it too far in advance, the release might get misplaced. Too late and, well, it's too late. When reporters call you for information, be sure to ask for their deadline.

Follow up: Be sure to call reporters and editors to follow up on your release. Ask if the release was received and offer to answer any questions. Ask if they will print the announcement. Invite a reporter to attend the event. Personal contact will help you develop a relationship with reporters and editors so they will be more likely to cover future events.

Funding Watershed Conservation Projects

Accomplishing your individual or group watershed conservation goals often requires soliciting resources from outside funders. Raising money is time consuming and requires hard work, but the reward is that you will be able to achieve your goals of conserving your watershed.

First, it is important to have a fundraising plan. Determine the amount of money or types of funding sources that are needed to complete your project or fulfill your group's goals. Develop a budget that shows the amount of money needed for equipment, telephone, office space, printing, postage, office supplies, consultants or contractors, salaries (if paid staff are involved), food, etc. This budget will help you to calculate how much money you need to complete the project and to draft a wish list for in-kind donations.

"FUNDRAISING IS THE GENTLE ART OF TEACHING THE JOY OF GIVING"

– Hart Rosso

IN-KIND DONATIONS

No matter how large or small your project, seek in-kind donations. The more materials, printing, tools, refreshments, meeting space, and professional services that are donated, the less money needs to be raised. In-kind gifts also can be used to leverage grant funds. Many funders require matching funds from other donors, including in-kind donors. Remember to ask the donor for a letter that states the value of the in-kind contribution that the organization received.

Let members of your group know about your wish list and talk about which businesses to approach. Group members might have personal connections with businesses. Also, make your in-kind donations known by publishing a wish list in your newsletter or Web site. Call or visit local businesses to request in-kind donations. Many donors will want a written request, so follow up with a letter. Be sure to start this process early and try to target at least three sources for every in-kind item that you need for your project. Finally, give the donor a positive giving experience by thanking them personally and publicly. Encourage your members and partners to patronize businesses that donated the in-kind gifts to your project.

FINDING GRANT-MAKERS

In addition to in-kind donations, you may want to seek grants or donations. The first step in this process is finding potential funders. Government agencies, some nonprofit organizations, foundations, and corporations are all potential sources of grant funds. Most grantors require proof of 501(c)(3) nonprofit status. If your group is not incorporated as a nonprofit with a tax classification assigned by the Internal Revenue Service, you may want to consider incorporating and applying for nonprofit status. However, your group may also find a partner organization with 501(c)(3) status that may be will-

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Website: www.iwla.org

ing to pass grant money through to your group as a subcontractor.

Start locally. Many foundations and corporations contribute only to local organizations. Ask local businesses or corporations that may contribute to your project. Also ask members of your group and their network of friends if they have contacts with any local businesses or other prospects. Next, look for foundations and corporations in your state. Finally, tap regional and national funders.

There are many directories and other resources to help groups identify foundations and corporations for fundraising. Look for a statewide foundation directory at your local library or purchase a copy for your use. You also can ask a larger nonprofit or a local foundation to donate last year's edition of a regional or national directory. There are online resources as well. Many online directories and databases for funders charge a fee, but there are also free resources. You can locate prospects by searching the Internet. Other sources of information about potential funders are the annual reports of other organizations that have similar programs. Read these reports to see which foundations, agencies, and corporations are supporting the work of these organizations and may be interested in your group's work.

It is important to target your solicitations. Sending out dozens of unsolicited proposals to foundations without first reading their guidelines is unlikely to yield results. When researching grant-makers, pay attention to geographic restrictions, types of projects funded, and the size of grants. Obtain the most up-to-date grant guidelines, annual report, and brochures by contacting the foundation directly or visiting its Web site. In addition to grant guidelines, pay close attention the types of projects the foundation, corporation, or agency has previously funded. For example, a foundation may list water quality as an interest, but a review of past grants may show that it gives primarily to university research rather than volunteer monitoring projects. The list of past grantors will also provide information on the range of funding you might request.

WRITING GRANT PROPOSALS

Before writing a proposal, it is wise to contact the funder to find out whether or not they have grant guidelines, what the deadlines are for submittal, and whether or not your project is within the funder's area of interest. If the grant guidelines specify that the foundation does not accept telephone calls, remember to honor that request.

Start with a thorough outline of the project. Think about why the project is needed and make that clear. It is important to keep asking yourself whether this particular project or program is the best thing you can do to solve the problem you are addressing. Think about the project goals, work plan, time frame, and budget. This information will work well for either a brief letter of inquiry or a full proposal. If submission guidelines are available, make sure you follow them with regard to length, format, and content. Tailor each proposal to the particular funder. Review information on the funder carefully and get a sense of its philosophy and interests. Keep the proposal short, concise, and reader-friendly. Use short, powerful sentences and a logical structure. Proofread the proposal carefully and ask others to review it. Be sure to allow sufficient time to complete the proposal and submit it by the funder's deadline.

After sending the proposal, follow up with the funder. If your project is approved, send a thank-you letter immediately. If your project is not funded, you may want to call and inquire why the funds were denied.

Remember that people give money to people. Developing relationships with grant-makers is very important. A good way to establish relationships with funders is to meet them in person. Send a letter requesting a meeting with the funder and follow up with a phone call. Also, invite the funder to observe your group in action by attending your next event.

RESOURCES

Catalog of Federal Funding Sources for Watershed Protection. This comprehensive listing of federal funding available for watershed projects includes detailed information on each funding source and links for more information. Call (800) 490-9198 or (513) 489-8695 or visit www.epa.gov/OWOW/watershed/wacademy/.

The Chronicle of Philanthropy. This publication's Web site features a free, searchable database for all the grants listed in its issues during the past several years. Visit www.philanthropy.com.

Environmental Finance Center. Features an online, searchable database for watershed restoration funding including federal, state, private, and other funding sources for the Pacific Northwest. Also has free software that helps users estimate the costs of their projects and determine funding needs. Visit sspa.boisestate.edu/efc/Tools&Services/Plan2Fund/plan2fund.htm or call (866) 627-9847.

The Foundation Center. Offers free links to grant-maker Web sites, including private and public foundations, corporations, and community foundations. This site also includes a short course that teaches the basic elements of writing a good proposal. A comprehensive online directory of funders is available for a fee, or you can visit one of their libraries and research all of their information for free. Call (800) 424-9836 or visit www.fdncenter.org.

Grants.gov. This site allows organizations to electronically find and apply for competitive grant opportunities from all Federal grant-making agencies. Visit www.grants.gov.

National Fish and Wildlife Foundation. This private, nonprofit organization provides matching grants for on-the-ground conservation projects through a combination of private and public sources of funding. Visit www.nfwf.org.

River Network. This group's Web site includes fact-sheets on foundation research, grant writing, and raising funds through boards, the Internet, bequests, workplace giving, and in-kind donations. Its Directory of Funding Resources lists more than 300 private, corporate, and federal funding sources for river and watershed groups. The directory is available as a hard copy for a fee. Call (800) 423-6747 or visit www.rivernetwork.org.

For a comprehensive listing of funding resources, visit the Izaak Walton League's online resource listing at www.iwla.org/sos/resources.

FACT SHEET

CLEAN WATER

Clean water is essential to life. Unfortunately, 40 percent of the nation's assessed streams, lakes, and estuaries are not clean enough to support fishing and swimming. As an organization founded by anglers, the Izaak Walton League believes this is simply unacceptable. That's why we are committed to improving the health of America's waterways through local action and national advocacy.

MONITORING AND RESTORING STREAMS

For 40 years, the League's Save Our Streams program has taught thousands of citizens how to monitor and restore the health of local streams. Guided by our publications, workshops, expert consultation, and other tools, citizens become active stewards of their local waterways. In addition to assessing water quality, our volunteers take action, such as notifying state agencies of pollution problems or planting trees along stream banks to reduce erosion and improve fish habitat.

CONSERVING WETLANDS

Wetlands provide critical habitat for countless birds, amphibians, fish, insects, and other species. They also act as natural filters, cleansing pollutants from groundwater and runoff. Unfortunately, since the 1600s, more than half of America's wetlands have been drained. Protecting those that remain is vital to safeguarding clean water and habitat.

The Izaak Walton League educates Americans about wetland ecology, functions, and values, and provides communities with the tools they need to conserve these valuable ecosystems. Aided by our Protect Our Wetlands program, our American Wetlands Month campaign, hands-on workshops, easy-to-read educational materials, and technical assistance from our staff, our volunteers are leading the fight to conserve our nation's remaining wetlands.

STOPPING THE SPREAD OF INVASIVE SPECIES

In recent years, invasive species such as zebra mussels and Eurasian milfoil have infested America's waterways, crowding out native species and causing billions of dollars in damage to marinas, recreational fisheries, and other facilities. One way these plants and animals spread between waterways is via recreational boaters, who unknowingly transport invasives on their equipment. To combat the spread, the Izaak Walton League launched a nationwide Clean Boats Campaign. Through public service announcements, articles, and a Web site, www.cleanboats.org, millions of boaters are now learning how to properly clean their gear so that they don't spread harmful invasive species from one waterway to another.

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FACT SHEET

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EDUCATION

The League's Protect Our Wetlands program offers numerous publications, videos, and online resources to educate citizens about the importance of wetlands. We publish the Handbook for Wetlands Conservation and Sustainability, which explains wetland ecology, functions, and values and provides tips for organizing your community to monitor, conserve, and restore local wetlands. A companion video, Wetlands Stewardship: A Call to Action, is also available, highlighting wetland restoration activities in communities across the country.

On our Web site, citizens can learn about wetland conservation through Webcasts, fact sheets, and links to other resources. They can also read copies of our electronic newsletter, Wetland Sights & Sounds, which contains educational information on topics ranging from invasive species to global warming.

PROTECTION

Through workshops and technical assistance, the League puts the power of wetland protection directly into the hands of citizens. Our Wetlands Ecology and Stewardship Workshop teaches educators, business leaders, community planners, and other citizens what wetlands are, how they function, and why they are important. The participants spend time in the field monitoring hydrology, plants, soil, and surrounding land uses. Our Wetland Conservation and Policy Solutions Workshop focuses on current wetland conservation policy and how to advocate for better laws, draft and adopt model ordinances, and effectively read and comment on permit applications.

Nationally, the League works to ensure that laws like the Clean Water Act continue to protect wetlands, and that agencies have the resources they need to enforce wetland regulations. Through coalitions, media outreach, and direct lobbying, the League is making sure that wetlands receive the protection they need and deserve.

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FACT SHEET

MONITORING AND RESTORING STREAMS

Not too long ago, streams, rivers and lakes across America were so polluted with chemicals, sewage and garbage that the water was dangerous for swimming, fishing and drinking. The problem got so bad the Cuyahoga River in Cleveland caught fire and burned in 1969. This event captured national attention and galvanized the American people and Congress to action.

That same year, the League launched Save Our Streams to help citizens safeguard the waters in their communities. Save Our Streams was founded on the premise that, with a little help, any person can monitor water quality and use what they learn to work for better protections. Over the past 40 years, the League has trained thousands of citizen stream monitors. We also empower citizens to achieve watershed conservation and restoration goals using their monitoring data. Guided by our publications, workshops, expert consultation, and other tools, these citizens have become some of our strongest advocates for clean water.

MONITORING

The League offers several workshops, books, and videos focused on stream monitoring. For example, our Volunteer Water Quality Monitoring Workshop teaches individuals the basics of identifying water quality challenges and solutions, monitoring a stream, identifying aquatic insects and crustaceans, and assessing stream habitat and watershed health. Our Train the Trainers Workshop provides leadership training and resources to experienced monitors so that they can initiate and manage local volunteer monitoring programs. And our Introduction to Stream Stewardship Workshop teaches citizens about the science behind watershed systems, the basic principles and planning of stream bank enhancement, and the techniques used to assess a watershed. Monitoring handbooks, aquatic insect and crustacean identification guides, and instructional videos used in our workshops are also available for purchase.

RESTORATION

Once volunteers have identified a problem through stream monitoring, the League helps them solve it through stream enhancement and restoration. Each of our publications and workshops contain a restoration component, teaching citizens how to develop restoration plans, restore stream banks, plant buffers, minimize runoff pollution, and take other actions to improve a stream's quality. Our Handbook for Stream Enhancement and Stewardship, and a companion video, helps people plan and carry out environmentally sound, cost-effective stream corridor assessment, enhancement, and stewardship programs.

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FACT SHEET

STOPPING THE SPREAD OF INVASIVE SPECIES

In recent years, invasive species such as zebra mussels and Eurasian milfoil have infested America's waterways, crowding out native species and causing billions of dollars in damage to marinas, recreational fisheries, and other facilities. Many of these species arrive in the ballast water of ships, particularly in the Great Lakes, and then are accidentally transported to other waterways on the equipment of recreational boaters, anglers, and other outdoor users. Stopping their spread requires both better regulation of ballast water and better education of recreationists.

BALLAST WATER

Scores of exotics plants and animals have entered the United States in the ballast water of ocean-going ships, and new ones are arriving each year. Safe from the predators and diseases of their native habitat, they reproduce exponentially, out-competing native species for food. Consider the effect zebra mussels have had on Great Lakes fish populations. The University of Wisconsin's Sea Grant Institute has found that since 1990, when zebra mussels really began to take hold, Lake Michigan's yellow perch population has decreased by about 80 percent.

At the national level, the League is working to improve the regulation of ballast water to prevent the introduction of new invasives. We are calling on the Coast Guard to better enforce the ballast water regulations it is responsible for under the National Invasives Species Act, and urging the U.S. Environmental Protection Agency to aggressively regulate ballast water discharge under the Clean Water Act. We are also working to pass legislation in Congress requiring cargo ships to chemically treat all ballast water to kill any living organisms it might contain.

CLEAN BOATS CAMPAIGN

Although ballast water is a major source of invasive species, recreational boaters and anglers have unknowingly contributed to the spread of aquatic invaders by not properly inspecting and cleaning their equipment. More than 230 small lakes in the Great Lakes region have thriving populations of zebra mussels that were unintentionally introduced by people on a recreational boat ride or fishing trip.

To address this problem, the League has organized the Clean Boats Campaign. Through public service announcements, articles, contests, and a Web site, www.cleanboats.org, we teach boaters and anglers how to clean their equipment to remove any unwanted hitchhikers. Working with partners such as the BoatUS Foundation, U.S. Fish and Wildlife Service, National Fish and Wildlife Foundation, and Healing Our Waters Coalition, we have reached more than 2 million boaters and anglers.

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FACT SHEET

MANAGING THE MISSOURI RIVER

As America's longest river (2,431 miles), the Missouri spans 10 states. Due to man-made changes of the river's natural flows for navigation, significant habitat for fish and wildlife—including a number of endangered and threatened species—is being degraded. Agricultural pollution is also a threat. The League is working with government agencies and other organizations on restoration and recovery of the river, protecting it for future generations.

NAVIGATION

Over the decades, the lower Missouri River's curves have been straightened, its backwater floodplain areas cut off, and its main channel lined with riprap. One reason for this reengineering of the river is to accommodate barge navigation. Unfortunately, channelization has destroyed a great deal of habitat along the river, pushing many species such as the piping plover, least tern, and pallid sturgeon into threatened and endangered status. Compounding the problem is bad flow management. Water is periodically released from the river's dams to support a small amount of barge navigation. These releases draw down water supplies upriver, threatening habitat and recreation opportunities upstream.

In 2007, League members in Iowa, Nebraska, and South Dakota joined to create the Missouri River Initiative. We are working with federal and state agencies and private groups to assess the environmental challenges facing the river, and to find commonsense solutions that work for both the region's ecology and economy. That includes restoring more natural flows, repairing backwater habitat along the river, and increasing opportunities for recreation.

AGRICULTURE

As the Missouri River has been altered, it has been separated from wetland areas. These wetlands historically filtered nitrogen, phosphorus, and chemicals from agricultural runoff before it reached the river. Without the river-wetland connection, more of these pollutants are now being flushed downstream, where they end up in the Mississippi River and contribute to the creation of a 14,000-square-mile dead zone in the Gulf of Mexico.

The League works at the local, state, and federal levels to improve farming practices and reduce the amount of pollutants entering the watershed. We teach farmers how to build riparian buffers along streams to soak up runoff. We are also working to strengthen federal farm policy so that it encourages farmers to retire marginal farmland, reducing erosion and preserving habitat. A key component of our approach has been the creation of a Sodsaver provision in the Farm Bill, which discourages the conversion of virgin prairie into cropland. Although this program is new and only available in portions of five Upper Missouri River states, the League is working to make sure it gets implemented as widely as possible.

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FACT SHEET

MANAGING THE UPPER MISSISSIPPI RIVER

The Upper Mississippi River is one of the most complex ecosystems on Earth. It provides habitat for 50 species of mammals, 45 species of reptiles and amphibians, 37 species of mussels, and 241 species of fish. The Izaak Walton League has been a strong defender of these resources ever since we led the fight to create the Upper Mississippi River National Wildlife and Fish Refuge in 1924. Today, our efforts focus on reforming the river's lock-and-dam navigation system and reducing polluted runoff from farms.

NAVIGATION

The Mississippi River has long been a major avenue for shipping and commerce. The government has built an elaborate system of locks and dams along the river to make navigation easier, but often at the expense of habitat. Unnatural flows have led to increased flooding, sedimentation, drainage of backwater areas, and other problems that are bad for both people and wildlife.

The League's Upper Mississippi River Initiative works with government agencies and regional conservation groups to increase habitat restoration along the river. In addition, we have been vocal opponents of lock-and-dam expansion that is not only economically unjustified but detrimental to wildlife. We also advocate in Congress for increased funding to protect and restore areas along the river that have been harmed by navigation expansion.

AGRICULTURE

Located in America's agricultural heartland, the Mississippi River receives a great deal of nitrogen, phosphorus, and chemicals from agricultural runoff. These pollutants eventually enter the Gulf of Mexico, where they contribute to the creation of a 14,000-square-mile dead zone, devoid of all life. The river also suffers from sedimentation and unnatural flooding, which are tied to farming practices that have historically encouraged farming of erosion-prone soils and draining of wetlands.

The League is working aggressively to improve farming practices in the watershed. Through improved federal and state policies, we are encouraging rotational grazing and next-generation energy crop production that can reduce negative impacts on the river, while at the same time being profitable for farmers. We are also working with agencies to step up enforcement of existing regulations, to make sure that bad farming practices aren't rewarded with government subsidies. In the future we will work to develop methods for tracking specific problems, such as manure spills or chemical runoff, so that offenders can be more readily identified and held accountable.

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Izaak Walton League of America (IWLA) Stream & Wetland Publications

(See reverse side for ordering information.)

Handbook for Wetlands Conservation and Sustainability

by The Izaak Walton League of America

This handbook explains wetland ecology, functions, and values. It provides tips for organizing your community to monitor, conserve, and restore local wetlands. It includes wetland definitions, ecology, functions and values, monitoring instructions, wetland project ideas, regulatory avenues for wetland protection, case studies, and an updated and extensive resource section. **$39.95/Softcover**

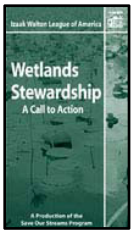
ISBN 0-941675-05-X

Unlocking the Secrets to America's Wetlands

by The Izaak Walton League of America

This is an introductory guide to wetlands. It helps interested citizens understand wetland ecology and why these valuable ecosystems are important for clean water, wildlife habitat, fisheries, and more.This is a good publication for students. **$7.95/Softcover**

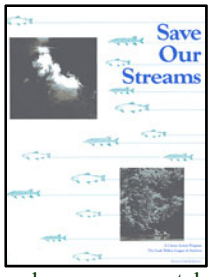
ISBN 978-1-880686-08-9



Wetlands Stewardship--A Call to Action

by The Izaak Walton League of America

This 28-minute video serves as a companion to the ***Handbook for Wetlands Conservation and Sustainability.*** The video can be used to motivate citizens, educators, planners, government, business leaders, and students to participate in the conservation of our nation's wetland resources. The video demonstrates the importance of wetlands to the environment and shows activities that have been initiated in communities across the country. **$14.95/VHS**



Watershed Stewardship Action Kit

A Series of Fact Sheets Displayed in a Folder

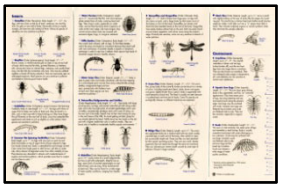
by The Izaak Walton League of America

The ***Watershed Stewardship Action Kit*** is designed for volunteers, students, and landowners who want to make a difference in their communities. The kit covers watershed ecology, water quality problems, and actions individuals and groups can take to conserve watersheds. Educational fact sheets address stream and wetland ecology, water monitoring, and federal regulations. Action fact sheets teach the reader to fundraise, organize watershed cleanups, reduce water usage at home, survey watersheds, and monitor water quality. This publication includes the instructions and data form for IWLA's biological stream monitoring method. Use this resource to start your own watershed stewardship projects or to teach others about the importance of water conservation. **$10.95/Folder**

Restoring America's Streams

by The Izaak Walton League of America

This 28-minute video shows how to become a "stream doctor" and cure sick streams. The video explains stream processes and causes of stream instability. It demonstrates techniques for restoring streams using native vegetation and features case studies of successful projects. **$14.95/VHS**



Field Guide to Aquatic Macroinvertebrates

by The Izaak Walton League of America

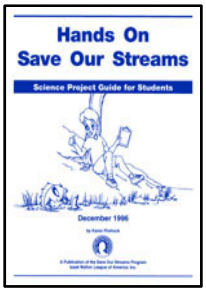
This handy reference tool is designed to help volunteer monitors identify aquatic macroinvertebrates when conducting water quality surveys. This two-sided, **four panel laminated brochure** is convenient and durable for outdoor use. The diagrams of the macroinvertebrate larvae and adults are grouped by biological type and display common features that characterize each animal. Symbols indicate the relative sensitivity categories (sensitive, less sensitive, and tolerant) based on the general Save Our Streams classification system. Most macroinvertebrates are identified to the order level for easy and accurate identification in the field. **$4.95/brochure**

S.O.S. for America's Streams

A Guide to Water Quality Monitoring

by The Izaak Walton League of America

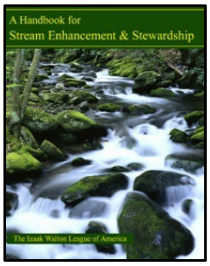
This 28-minute DVD demonstrates biological stream monitoring methods, macroinvertebrate identification techniques, and how to adopt a stream. This is a great resource for training volunteers or introducing schools or community groups to monitoring. **$19.95/DVD**



Hands-On "Save Our Streams" Science Projects Guide

by The Izaak Walton League of America

This is the student's companion guide to the SOS teachers manual. It contains project ideas, monitoring instructions and information about stream ecology. It takes students through the steps to plan a successful science fair or community project. It includes monitoring instructions and data forms. This book is recommended for grades six through twelve. **$6.95/Softcover**



A Handbook for Stream Enhancement & Stewardship

by The Izaak Walton League of America

A Handbook for Stream Enhancement and Stewardship is a basic resource intended to help individuals, groups, organizations, companies, communities, and governments plan and carry out environmentally sound, cost-effective stream

Over, please….

corridor assessment, enhancement, and stewardship programs. Using the watershed as the basic unit of reference, the ***Handbook*** provides ideas and information with which readers can assess and document local stream conditions, learn about and evaluate methods of enhancement, devise and implement enhancement plans, and then maintain the stream and stream corridor in its enhanced state of better health and balance. While not a comprehensive technical manual for professionals trained in stream restoration, this resource does provide a solid foundation by which volunteers may become informed observers, advocates, and organizers of stream enhancement programs and participants in their implementation. This handbook is a co-publication of the McDonald and Woodward Publishing Company and the Izaak Walton League of America.

$34.95/Softcover
ISBN 978-0-939923-98-4

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by J. Reese Voshell, Jr.
illustrated by Amy Bartlett Wright

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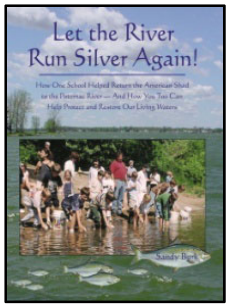

Let the River Run Silver Again!

- How One School Helped Return the American Shad to the Potomac River--And How You Too Can Help Protect and Restore Our Living Waters

by Sandy Burk

Selected as the Izaak Walton League of America's "2005 CONSERVATION BOOK OF THE YEAR" in the Adult and Youth Categories!

Recommended by NSTA * Green Earth Book Award 2006

Let the River Run Silver Again! documents an environmental conservation success story for students ages 10 to 15 and the teachers, parents, and others who mentor them. It is a source of information and insight for those who want to learn about and benefit from the success of others as well as those who are interested in developing environmental restoration programs in their own watershed, regardless of where they live. The full-color format presents engaging, action-packed photographs along with maps, graphs, and original art that extends the information presented in multiple directions and dimensions. A short section at the end of the book draws upon the insights offered by the students' story while identifying pathways for students and their mentors to the development and implementation of water, wetland, and watershed restoration projects that could be implemented in other locations and circumstances. The students' experience thus serves as a model and inspiration for student or youth-group conservation projects anywhere. If you are a teacher using this book in the classroom, a downloadable activities guide is available on M&W's website. **$14.95/Softcover**
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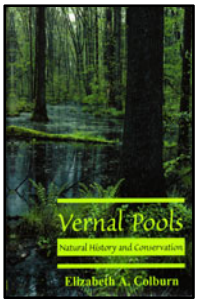

Vernal Pools

- Natural History and Conservation

by Elizabeth A. Colburn

Vernal Pools is the first book-length synthesis of the natural history, ecology, and conservation of the seasonally wet pools that occur throughout the formerly glaciated region of eastern North America -- essentially the Great Lakes Basin, New England, and adjacent areas of Canada and the United States. Introductory chapters define vernal pools; provide overviews of their formation and physical-chemical-hydrological characteristics; and present data critical for assessing, regulating, and managing pool ecosystems. The chapters that immediately follow the introduction explore the biology of microscopic life forms such as bacteria, algae, and fungi and the great variety of higher plants associated with vernal pools. Descriptions, distributions, habitat requirements and life-history strategies of pool animals, and the ecological processes and patterns associated with the composition and dynamics of pool communities over time are also included. A final chapter discusses research needs and conservation considerations that are a part of the ongoing effort to recognize, understand, protect, and manage vernal pools as viable elements in the landscape of eastern North America.

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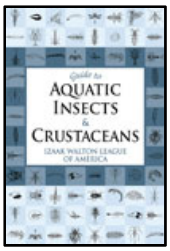

Guide to Aquatic Insects and Crustaceans

by The Izaak Walton League of America

An updated version of the original ***Save Our Streams Monitor's guide to Aquatic Macroinvertebrates***, this 64-page fully illustrated guide is designed to enable anyone to identify aquatic insects and crustaceans. It includes a dichotomous key, detailed description of each organism, and tips for proper identification. A handy resource for anglers, students, biologists, or anyone else spending time near rivers and streams. **$8.95/Softcover**
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Visit www.mwpubco.com/conservation.htm for complete descriptions of these titles, along with ordering information, or call

800-233-8787

Watch for additional water-related publications coming soon from McDonald & Woodward Publishing!

Izaak Walton League of America
Watershed Stewardship Training Workshops

Volunteer Water Quality Monitoring Workshop educates individuals to identify water quality challenges and solutions, monitor a stream using the SOS biological monitoring technique, identify aquatic insects and crustaceans, and assess stream habitat and watershed health. A half-day certification can also be used as a follow-up to this workshop that assures quality of volunteer-collected data and expands potential uses for the data. A "train the trainers" workshop qualifies volunteers to develop a stream monitoring program and to teach the introductory and certification workshops. Trainer workshop participants are taught and tested how to gather quality data that could be used by state agencies or other organizations. They receive equipment and presentation materials, and they learn about designing a monitoring plan, working with the media, and keeping volunteers involved. (One day for introductory water monitoring workshop; half day for certification; one day for train-the-trainers workshop)

Educators Workshop: This workshop instructs formal and non-formal classroom educators and interested citizens how to plan a hands-on watershed education program based on several excellent stream and wetland curricula. Each educator workshop is designed to target no more than 3 consecutive grade levels and can focus on stream studies, wetland studies, or both. This workshop may also include special instruction for volunteers interested in serving as classroom resources to help teachers bring watershed conservation to life for their students. (One, two or three days)

Stream Buffer Workshop: Forest buffers play an essential role in stream health. Through this workshop, participants will learn how to protect and restore buffers to ensure healthier streams and rivers. This workshop is an introduction to forest buffer restoration for anyone interested in helping to organize volunteer projects to protect and restore streams and their buffers. This workshop covers the following topics: an introduction to stream and forest buffer ecology; effects of land-use decisions on stream and forest buffer health; steps for planning, implementing and monitoring a forest buffer project; and hands-on experience in installing a forest buffer project. (One or Two days)

Introduction to Stream Stewardship Workshop: This workshop provides participants with a "crash course" in the science behind stream and watershed systems, the basic principles and planning of stream bank enhancement, and the techniques used to assess a watershed and inventory the health of a site (biological, habitat assessment, and stream channel classification). Participants will learn various causes of stream degradation and

several ways to enhance stream corridors, including the participation in land-use planning and the installment of structural techniques. Each participant will receive a copy of the League's stream stewardship handbook, a valuable reference tool for future activities. (One or two days)

A follow-up workshop on the planning of a bioengineering stream enhancement project can be arranged through the League's watershed programs staff.

***Stream Corridor Assessment*:** Participants learn how to conduct a thorough stream walk, noting problems such as areas of erosion, channel alteration, exposed pipes, fish barriers, lack of riparian buffer, and more. The workshop also teaches participants about stream ecology and how stream systems work, what causes problems like those assessed in the stream walk, why these problems harm stream life, and how to fix them. During the stream walk, participants complete detailed data forms, take photographs of each problem area, mark locations on a map, and take GPS coordinates. All of this information can then be uploaded to a database and integrated with GIS software to give coordinators a very good picture of stream problems for prioritization. (Two days).

Wetlands Ecology and Stewardship Workshop: This workshop is designed to teach educators, business leaders, community planners and other citizens about wetland stewardship. Participants learn about wetland ecology, functions and values, monitoring, regulations and project ideas. Participants will hear from local experts regarding wetland soil types, wetland vegetation, and wetland hydrology. Each workshop includes time spent in the field monitoring hydrology, plants, soil, and surrounding land uses. Each participant will receive a copy of The League's Handbook for Wetlands Conservation and Sustainability, a useful reference tool for future activities. (One or two days)

Wetland Conservation and Policy Solutions Workshop: This workshop focuses on current wetland conservation policy and how to advocate for better laws, how to draft and adopt model ordinances, and how to effectively read and comment on permit applications. Other skills include learning the basics of land-use planning and how other individuals and groups have put this knowledge to use protecting and restoring water resources in the community. This workshop also includes a brief introduction to wetland ecology, functions and values and assistance for individuals and groups in planning future wetland conservation projects. (One or two days)

Workshop participants are asked to conduct at least one related project in the six months following the workshop. The League follows up with workshop participants to learn of their progress in conducting projects and to provide assistance. The workshop elements can be mixed and matched, tailored to fit the needs of the participants. Workshops can be scheduled in a progressive series to enhance the stewardship capacity of communities over time - starting with biological monitoring and advancing to monitoring and maintenance of a stream bank restoration.

THE IZAAK WALTON LEAGUE OF AMERICA

Save Our Streams

Stream Quality Survey

Date _____

Time _____

Name _____

Please refer to the Izaak Walton League's volunteer stream monitoring protocol and identification guides to learn how to complete this form. Please use the League's *Field Guide to Aquatic Macroinvertebrates* to complete portions of this stream quality survey form. For assistance, please call (800) BUG-IWLA or send an e-mail to sos@iwla.org.

Stream _____ Station # _____ County/City _____

Location _____

Weather Conditions (last 72 hours) _____

Water temperature_____ F°? C°? Avg. stream width _____ ft. Avg. stream depth _____ ft. Flow rate _____
(above or below average)

Rocky Bottom Sampling

Before sampling, record riffle composition on the back of this form. Take 3 samples in the same riffle area, fill out this form, and keep the highest scoring sample for your records. To help track the number of samples you have collected, check one of the boxes below:

☐ Sample 1 ☐ Sample 2 ☐ Sample 3 ☐ Is this your highest score sample?

Muddy Bottom Sampling

Record the total number scoops taken from each habitat type and provide details to best describe the specific habitat on the lines below.

☐ Steep bank/vegetated margin _____

☐ Woody debris with organic matter _____

☐ Rock/gravel/sand substrate _____

☐ Silty bottom with organic matter _____

Macroinvertebrate Count

Consult the stream monitoring instructions on how to conduct the macroinvertebrate count. Use letter codes (A = 1-9, B = 10-99, C = 100 or more) to record the numbers of organisms. Add up the number of organism types (or number of letters) found under each category (sensitive, less sensitive, etc.) and multiply by the indicated index value. Although A, B, and C ratings do not contribute to the water quality rating, the letters track the population size in each category to see how the macroinvertebrate community changes over time.

SENSITIVE	LESS SENSITIVE	TOLERANT
_____ Caddisflies (except net spinners) _____ Mayflies _____ Stoneflies _____ Watersnipe flies _____ Riffle beetles _____ Water pennies _____ Gilled snails	_____ Dobsonflies _____ Fishflies _____ Common net spinning Caddisflies _____ Crane flies _____ Damselflies _____ Dragonflies _____ Alderflies _____ Crayfish _____ Scuds _____ Aquatic sowbugs _____ Clams _____ Mussels	_____ Aquatic worms _____ Black flies _____ Midge flies _____ Leeches _____ Lunged snails
____ # of letters multiplied by 3 =_____	____ # of letters multiplied by 2 =_____	____ # of letters multiplied by 1 =_____
Now add the three totals from each column for your stream's index value. Total index value = _____		

Compare the final index value to the following ranges of numbers to determine the water quality of the stream sample site.

Water Quality Rating

_____ Excellent (> 22) _____ Good (17-22) _____ Fair (11-16) _____ Poor (< 11)

Fish Populations: ☐ scattered individuals ☐ scattered schools ☐ trout ☐ bass ☐ catfish ☐ carp ☐ other	Barriers to fish movement: ☐ beaver dams ☐ man-made dams ☐ waterfalls (> 1 ft.) ☐ other ☐ none	**Refer to the IWLA monitoring instructions to learn how to score these stream characteristics**	
Surface water appearance: ☐ clear ☐ clear, but tea-colored ☐ colored sheen (oily) ☐ foamy ☐ milky ☐ muddy ☐ black ☐ grey ☐ other _____	Stream bed deposit (bottom): ☐ grey ☐ orange/red ☐ yellow ☐ black ☐ brown ☐ silt ☐ sand ☐ other _____	Odor: ☐ rotten eggs ☐ musky ☐ oil ☐ sewage ☐ other _____ ☐ none	Stability of stream bed: Bed sinks beneath your feet in: ☐ no spots ☐ a few spots ☐ many spots
		Algae color: ☐ light green ☐ dark green ☐ brown coated ☐ matted on stream bed ☐ hairy	Algae located: ☐ everywhere ☐ in spots _____ % of bed covered
Stream channel shade: ☐ > 80% excellent ☐ 50%-80% high ☐ 20%-49% moderate ☐ < 20% almost none	Stream bank composition (=100%): _____ % trees _____ % shrubs _____ % grass _____ % bare soil _____ % rocks _____ % other	Stream bank erosion: ☐ > 80% severe ☐ 50%-80% high ☐ 20%-49% moderate ☐ < 20% slight	Riffle composition (=100%) _____ % silt (mud) _____ % sand (1/16" – ¼" grains) _____ % gravel (1/4" – 2" stones) _____ % cobbles (2" – 10" stones) _____ % boulders (> 10" stones)

Land uses in the watershed (upstream and surrounding sampling site):
Indicate whether the following land uses have a high (H), moderate (M), slight (S), or none (N) potential impact to the quality of your stream.

___ Oil & gas drilling
___ Housing developments
___ Forestry
___ Logging
___ Urban uses (parking lots, highways, etc.)
___ Sanitary landfill
___ Active construction
___ Mining (type: _____)
___ Agriculture (type:_____)
___ Trash dump
___ Fields
___ Other _____

Comments: Indicate the current and potential future threats to the stream's health and attach additional pages or photographs to better describe the condition of the stream.

_____

_____

_____

IZAAK WALTON LEAGUE OF AMERICA • 707 Conservation Lane • Gaithersburg, MD 20878 • 301-548-0150

For assistance, please call (800) BUG-IWLA or send an e-mail to **sos@iwla.org**.