

LEARNING WHAT YOU "OTTER" ABOUT Water Pollution



A special youth guide created by the Pennsylvania Association of Conservation Districts, Inc. with financial support provided by the Pennsylvania Chesapeake Bay Program and the EPA Section 319 Program.

Rivers "Otter" Be Clean!

Have you ever seen a river otter? They have long, slim bodies, short legs and webbed feet. They look like they were made to swim! Think about a river or stream near you. River otters used to live there. In the 1700s, river otters lived in every corner of Pennsylvania.

River otters need two things. First, they need lots of room. They don't like to live too close to people. Second, otters need fresh, clean water in which to swim. So, in the 1800s, otters started to move away from people to where the water was still clean. More people came. About 100 years ago, even in the deepest woods, we dirtied the water.

Trees were cut to build houses for all the people. The bare dirt flowed into streams, making the water muddy. Coal was dug out of the ground to heat those houses. Poisons ran out of the mines, killing crayfish and fish, which otters need to eat. So, otters started to die. Soon, there were almost no otters left in Pennsylvania.

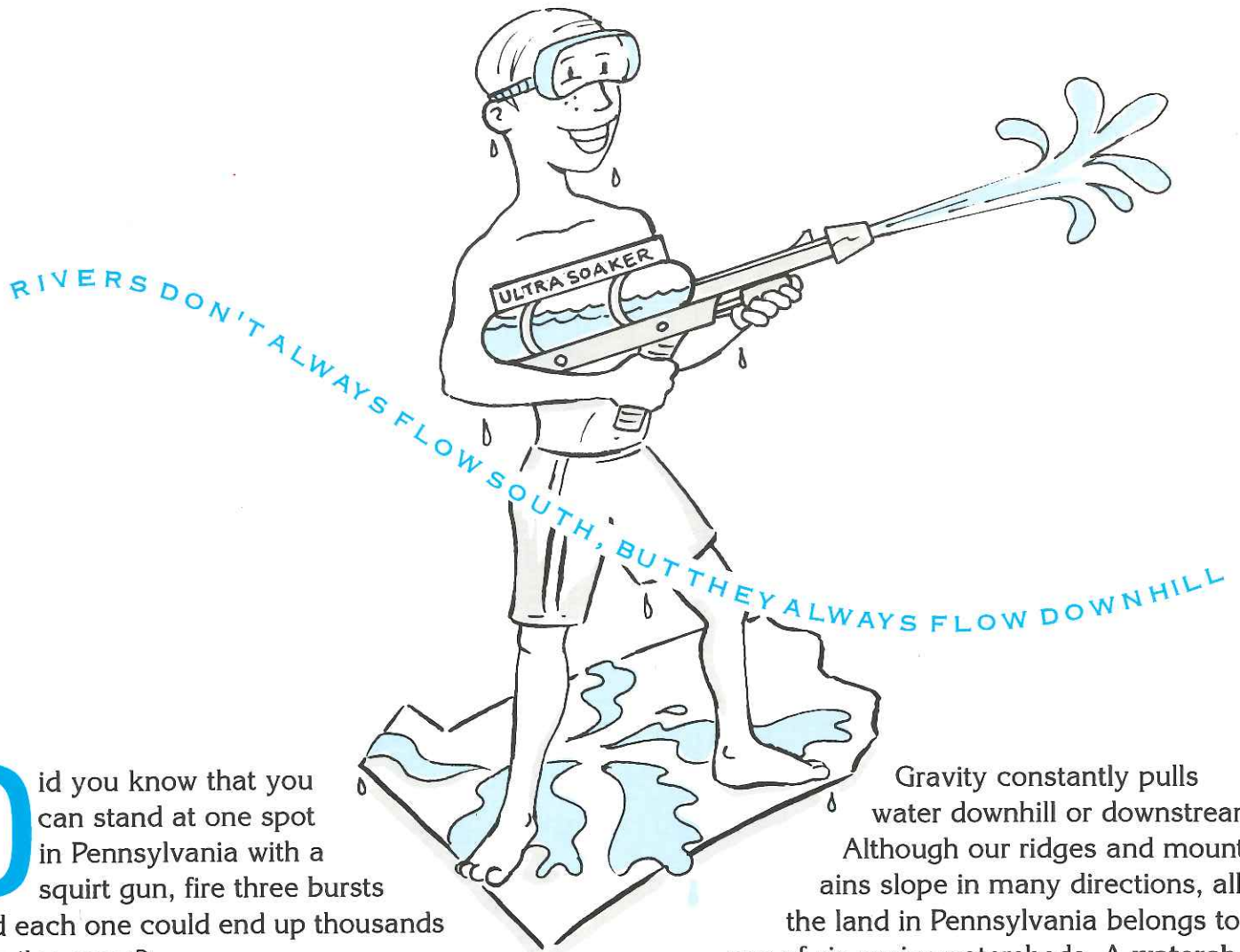
Today, otters are coming back. Our rivers are cleaner and there are some places where otters can live. Over the last ten years, biologists have captured otters in other parts of the country and set them free in places in Pennsylvania where the water is clean and they can find fish and crayfish to eat.

In the northern counties and the southwestern corner of Pennsylvania, look for signs of otters. In winter, you might see a "slide." It's a track in the snow where otters slide down hills into the water. You might find an otter's den, under a tangle of tree roots along a stream, or dug into the streambank.

Even if you don't see an otter, think about this. For Pennsylvania to have otters, the first thing we had to do was clean up the water. Only then would otters stay here when they were brought back. If we let the water get polluted again, the otters will disappear once more. River otters need clean water and so do people.

Where Does All The Water Go?

By Mark A. Nale



Did you know that you can stand at one spot in Pennsylvania with a squirt gun, fire three bursts and each one could end up thousands of miles apart?

This special spot is at the top of Headwaters Mountain, in Potter County.

- One squirt would flow north into the Genesee River, on to Lake Ontario and then into the Gulf of St. Lawrence.
- The second shot would seep west into the Allegheny River, which flows into the Ohio River at Pittsburgh, and on to the mighty Mississippi. It would finally enter the Gulf of Mexico at New Orleans.
- The third squirt would head south into the Susquehanna River and on to the Chesapeake Bay!

Gravity constantly pulls water downhill or downstream. Although our ridges and mountains slope in many directions, all the land in Pennsylvania belongs to one of six major watersheds. A **watershed** or **drainage basin** includes all of the land area that drains into a particular stream and its tributaries.

To picture a miniature watershed, stand with your feet on either side of a small ditch and face upstream. All of the land that slopes toward your ditch is a part of the ditch's watershed. Now, imagine all of the land that drains into a large river such as the Susquehanna, and you're beginning to understand watersheds. Let's look at each Pennsylvania watershed closely and see where your water goes.

LAKE ERIE

The streams that drain most of Erie County make up our next-to-smallest watershed. Walnut, Elk, and Twelve-Mile Creeks are three of the many small streams that flow through sand and shale deposits as they wind their way toward the lake. This watershed is 509 square miles and drains only 1 percent of the Commonwealth.

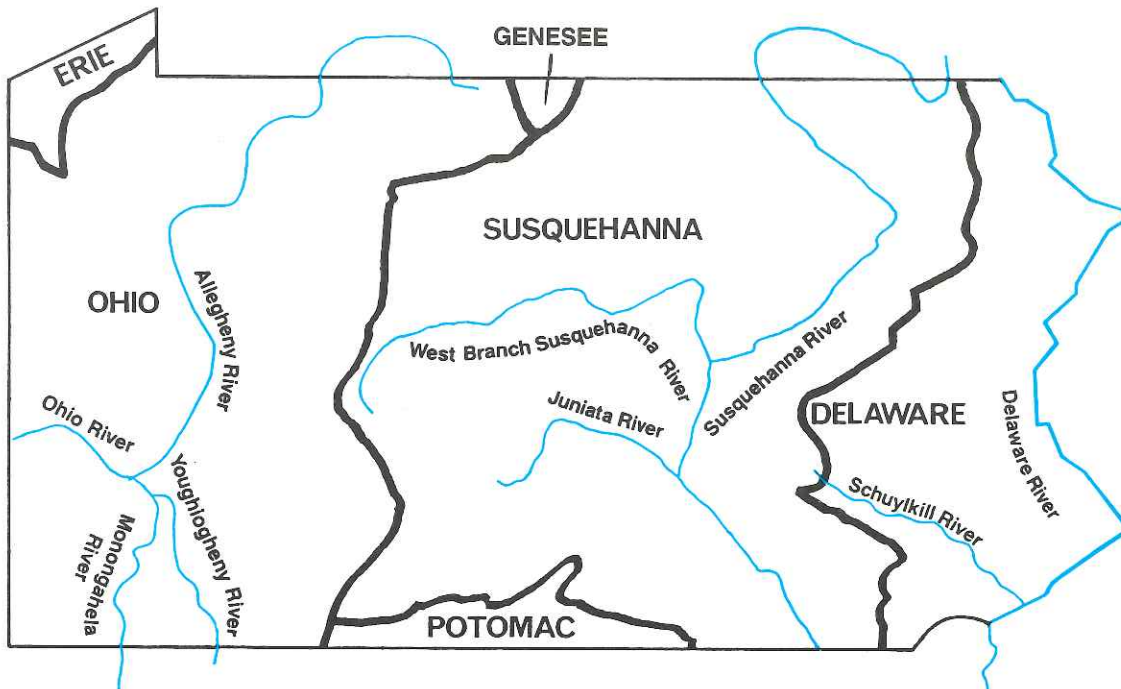
OHIO RIVER

Most of western Pennsylvania is drained by the two main arms of the Ohio River: the Allegheny and the Monongahela. This watershed contains our state's oil fields, some coal fields and our second largest city, Pittsburgh. The cities of Butler, Indiana, Oil City, Johnstown, DuBois and Washington are all a part of the state's second largest watershed, which drains 34 percent of Pennsylvania. The mighty Ohio joins the Mississippi River in Illinois and heads for the Gulf of Mexico.

GENESEE RIVER

Pennsylvania's smallest watershed is the Genesee River, which flows north into Lake Ontario. It's located in the rugged mountains of northcentral Pennsylvania and drains only 94 square miles of one county, Potter.

PENNSYLVANIA WATERSHEDS



POTOMAC RIVER

A tiny edge of southcentral Pennsylvania drains into the Potomac River. Water from here actually flows through Washington, D.C., our nation's capital, before joining the waters of the Susquehanna in the Chesapeake Bay. Chambersburg and Gettysburg are part of this watershed.

SUSQUEHANNA RIVER

Almost half of our state is in the Susquehanna River watershed. Rain falling on this 20,926 square-mile section of central Pennsylvania all flows into the Chesapeake Bay. If you live near Lancaster, Altoona, Carlisle, Harrisburg, Williamsport, State College, Wilkes Barre or York, you live in the Susquehanna watershed.

DELAWARE RIVER

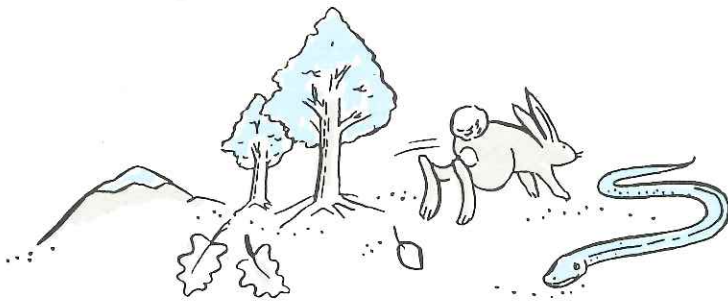
Our third largest watershed is the Delaware. It drains 6,470 square miles along the eastern edge of the state. Many of the Delaware's tributaries contain beautiful waterfalls that occur as the streams cascade into the Delaware Water Gap. The Schuylkill River is a major branch, which drains the southeastern corner of Pennsylvania. The Delaware is the largest free-flowing river in the eastern United States. It forms our eastern border with New York and New Jersey.

The people who live in or near Philadelphia, Reading, Allentown, Easton and Stroudsburg live in this watershed.

Getting Down

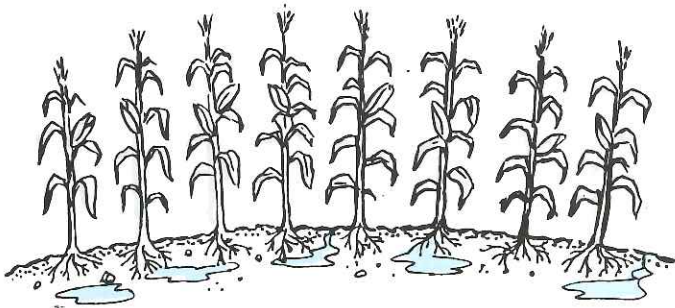
Think Dirt Doesn't Hurt?

Put a pinch of soil in the palm of your hand. Look at it closely. What do you see? Do you see large mountains? Do you see trees, or rabbits or other animals? Of course not! But, look again, because they're there!

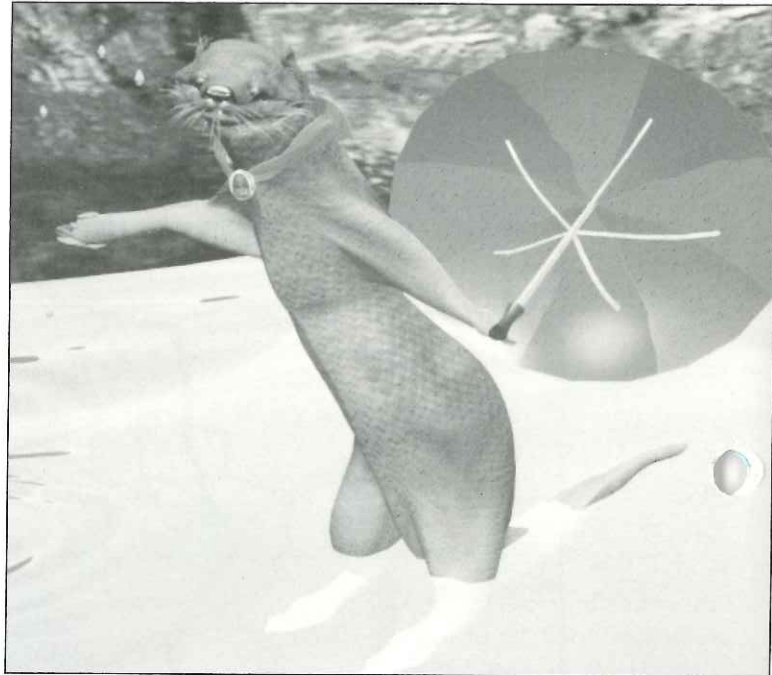


Soil is tiny bits of rock particles mixed with the remains of living things, like plants and animals. Some bits of soil start out as a rock that is slowly chipped away through erosion, weathering and the action of lichens. Some lichens expand and contract with the weather, pulling particles with it.

Soil can also be formed from animals and plants that decompose. It's a slow process. It takes 250 to 2,000 years to make one inch of topsoil!



Soil, or dirt, provides an anchor for plants to grow in. It holds water and lets it seep through the ground to dissolve the mineral salts plants need to survive.



Dirt can be dirty. When rain washes into a stream, it can carry dirt with it and make the water muddy. Very small particles of dirt are called silt. If enough silt clogs a stream, fish might not be able to breathe. Plants that live in the water may have problems growing. And birds that live by eating those plants may have less to eat.

Dirt can even get dirty. Some soil particles have poisons, or pollutants, attached to them. You can see a pile of dirt, but you can't see the pesticides, or lead, or chemicals that attach to the soil and pollute it. If the dirty soil flows with water into a stream, it carries the pollutant with it. There, the pollutant can ruin our drinking water, or hurt plants and wildlife.

No matter where you live...

and Dirty

What do you get if you
cross a frog with a flower?
A croak-us.



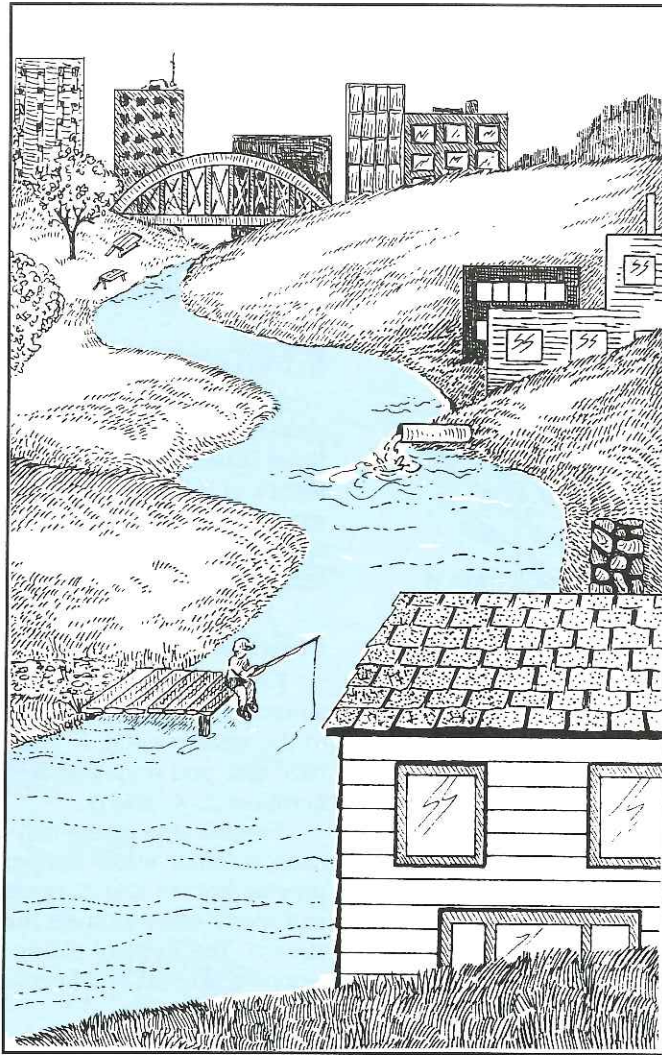
Does A City Make Dirt?

WHEN IT RAINS, water seeps into the ground. But it can't seep into paved roads, sidewalks or parking lots. So, water runs over those surfaces to get to the ground, where it soaks in, or flows on to a river.

AS RAINWATER RUNS along the road or parking lot, it picks up whatever it washes over. It might be...oil and other pollutants leaking out of cars in junkyards...salt and other chemicals used

to melt ice and snow on roadways...soil particles from new development and other disturbed lands. The result is that dangerous elements, like lead, zinc and cadmium, are washed into our streams.

PARKS IN CITIES HELP TO FILTER the pollutants that flow off city streets. But, if the park is improperly sprayed with pesticides, it may do more harm than good. Here's why. The grass is sprayed to keep weeds from growing. The trees are sprayed to control insects. The plants are eaten by many insects. The pesticide is now in the insects. They are eaten by songbirds. The songbirds could get sick because now they have eaten all the pesticide from every insect they ate. They could become weak and could easily be caught by a hawk. If the hawk eats a few of the weak birds, it could become sick, too.



WASTEWATER IS DISCHARGED INTO STREAMS and rivers from plants that treat sewage. Wastewater can contain the nutrients, phosphorus and nitrogen. Too many nutrients can lead to less oxygen for animals living in the water.

...controlling soil erosion is important.

Is Your Stream Sick?

Take Its Temperature And Find Out

By Mark A. Nale

You can tell if a stream is sick or well by checking its symptoms. Here are six things to look for...



Here's your chance to be a stream doctor!

1. IS IT A STREAM?

A stream is defined as flowing water. However, to support abundant stream life, most streams flow 365 days a year (366 this year!). If it went *completely* dry last summer, your stream may be ill!

2. BAD BREATH.

Is the water a weird color? Does it have a rainbow sheen? Does the stream have a chemical or "toilet" smell? Are the rocks stained orange? If the answer is "yes," you've got a sick stream.

3. SAY AAAHH!

A stream can't open its mouth and say aaahh, but you can use any column-type thermometer to take its temperature.

Fish are cold-blooded, so when water temperatures are too high, they need more food and oxygen. Warm water holds much less oxygen than cold water, so fish can die from lack of oxygen. Warm temperatures also allow some diseases, such as fungus, to attack trout. During cold-water periods, trout can usually fight off these invaders.

A summertime water temperature of 78°F, or higher, for several days in a row means a sick trout stream. Temperatures above 85° in the stream may harm bass and sunfish.

With the help of an adult, take the stream's temperature in its main flow. Use your own shadow to keep the thermometer out of the direct sun. Be careful: thermometers break.

4. TURN OVER A ROCK.

One of the best ways to check on a stream's health is to pick up a rock and look for stream insects. Stream insects spend at least 362 days living in the water. Look for mayflies, stoneflies, caddis flies and water pennies. Check several rocks or "pan" the bottom with an old spaghetti strainer. If your hunt turns up many different kinds of insects, you have a healthy stream. If the four insects mentioned above are all missing, you could have a problem.

The best time to check stream insects is early May. A book such as *The Golden Guides to Insects, Pond Life* or *The Field Manual for Water Quality Monitoring* will help with identification.

5. MUD BETWEEN YOUR TOES.

Healthy streams have a mixture of pools of slow-moving water, and riffles, where the water flows faster. In the riffles, the bottom should be stones of assorted sizes. Spaces between the stones provide homes for stream insects, crayfish and small fish. All of these make food for bigger fish and other life.

6. BARE BANKS.

Check the stream banks for plant life. Healthy streams have trees, shrubs or weeds growing up to the water's edge. If your stream's banks are bare dirt, you may also have problems with numbers 3, 4, and 5.

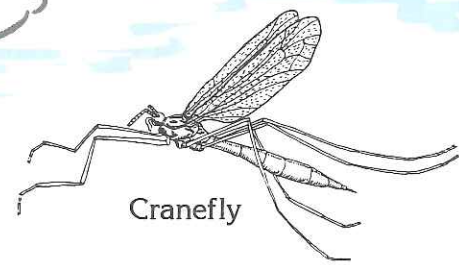
Stream-side plants help shade the water and keep summer water temperatures down. They provide homes and cover for frogs, turtles, ducks and many other animals that live in or near the stream. The roots of plants hold the soil in place, stopping erosion and keeping mud out of the stream.

Mark Nale, of Centre County, is a biology teacher with Juniata College's Science Outreach Program.

Use This as a Guide When Exploring a Stream



Dragonfly



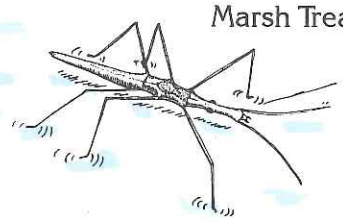
Cranefly



Black Fly



Mayfly



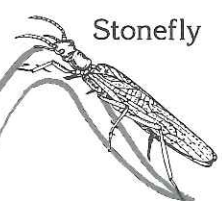
Marsh Treader



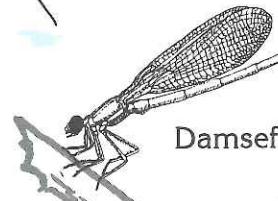
Whirligig Beetle



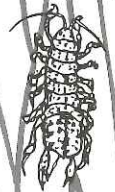
Dobsonfly



Stonefly



Damselfly

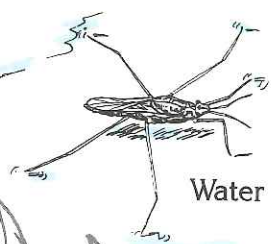


Sowbug

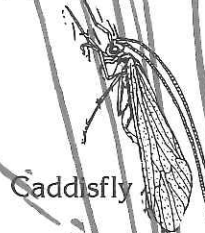


Fisher Spider

Midge



Water Strider



Caddisfly



Mosquito

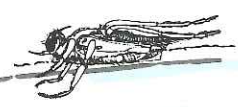


Scud (Sideswimmer)

Backswimmer

Diving Beetle

Crayfish



Water Boatman

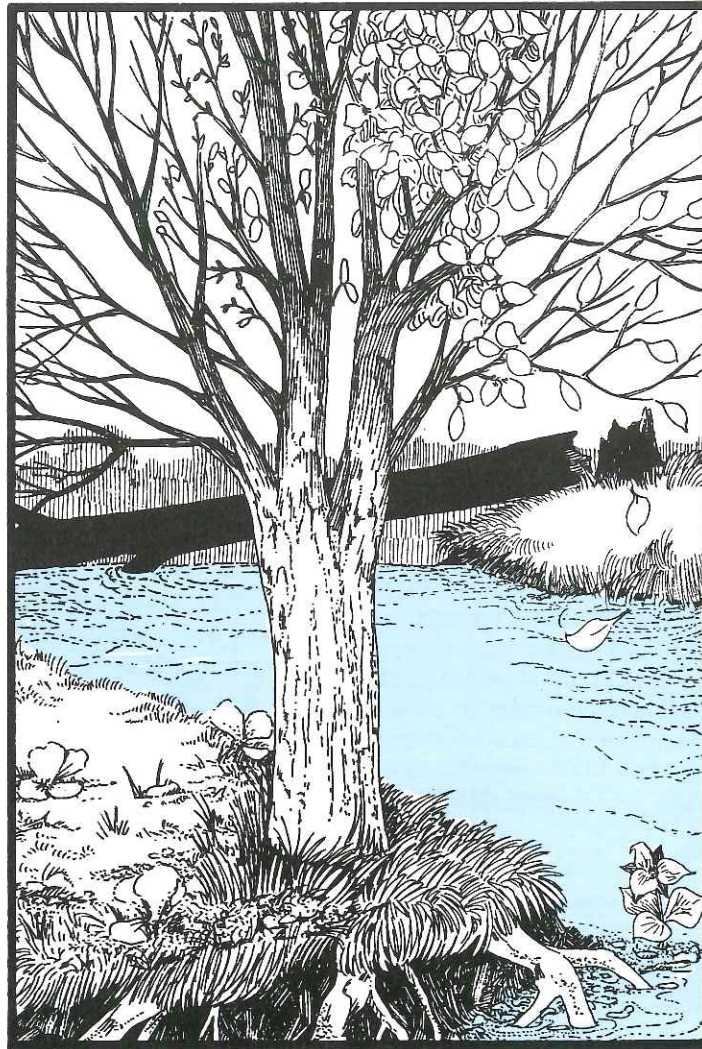


Rat-tailed Maggot

How Does A Tree Live Next To A Stream?

IF A FIRE BURNS in a forest, it takes a long time to rebuild this “green house.” First, new blades of grass have to push up through the ashy dust. Wind and birds will drop seeds from plants and trees. Leaves will blow in to the area, keeping the soil from eroding off the bare ground. Slowly, animals will come back, and the forest will start to live.

BIG TREES keep the sun from beating constantly on the water, and that helps to keep the stream nice and cool, so certain fish and insects can live.



A FALLEN TREE makes the perfect spot for a ruffed grouse to “sing.” He uses his feet and tail to hold himself up, and beats his wings against his body. To us, it sounds like an engine far away. It starts slow. Then, it speeds up until it’s a rapid “putt-putt-putt.” To a female grouse, it’s an invitation to dance!

WATER IS SO POWERFUL that it can carve a gully from the side of a stream. It can even push the soil out from around the roots of a tree. If it cuts away too much of the roots, the tree could fall over in a storm. But, the water can also push dirt back into the cracks around those roots. Slowly, small plants will grow in the bit of soil, helping to hold the roots, and keep the tree in place next to the stream.

WHEN STREAMBANKS HAVE PLANTS on them that hold the soil in place, they’re called “stabilized.” Rainwater that runs off the land into the stream passes by those plants. They keep bits of soil and pollution from running into the stream. The soil stays in the plants, and the water flowing into the stream is cleaner. If there are too many nutrients, like nitrogen and phosphorus, flowing with the water, the tangle of stems, leaves and roots will take up as much as they can.

A Raindrop's Virtual Journey

By Mark A. Nale



I'm a raindrop and I get around. I've circled the earth many times. The sun sucked me out of the ocean and up into clouds, and then I fell back to earth again. You saw me. I was the rain in April. In December, I was the snow.

Some of my best times were right here in Pennsylvania. I saw George Washington cross the Delaware River. I gave white-tailed deer a drink. In the middle of summer, I kept corn and beans growing strong. I didn't think life could get any better than this.

But, last spring, a dreadful turn of events occurred. I fell onto the center part of Pennsylvania. It was the beginning of a journey I'll never forget.

I came down as rain and crashed into the loose bare rocks of an abandoned strip mine. A long time ago, coal miners dug deep into the ground for coal. They took as much coal as they could and left without closing up the mines correctly. Some of the chemicals they used remained and their mining habits also shook up other elements in the ground.

As gravity pulled me down between

the loose pieces of shale, I became part of a chemical reaction. I combined with the air and iron pyrite in the rocks to form sulfuric acid. I had become part of a sour, skin-burning compound.

In my new acid state, I looked clean and harmless, but I dissolved the iron from the surrounding rocks. I looked clear, but I was dangerous. I met up with other water drops, and we seeped out of the rocks.

People call us acid drainage. As we trickled down the slope, iron hydroxide began to coat the stream rocks. It made them appear orange-yellow. Some people mistakenly think this yellow color comes from sulfur, but it's really iron, a form of rust. It's a poison. It puts a coating on fish gills, so they have trouble breathing. It coats their eggs so they won't hatch. It keeps light from getting to plants in the water so they stop growing. That means insects have nothing to eat.

I kept watching for a deer or bear to stop by for a sip, but none showed. No animals could drink this nasty water.

Along my journey, in the middle of

some shrubs, my small polluted trickle was joined by Cold Stream. Cold Stream starts in large, forested hollows near the top of the Allegheny Mountains and its water is pure. People enjoy fishing for the wild brook and brown trout that live and reproduce here.

I could now see trout and many aquatic insects, but they all stayed in the cleanest water, away from me. Conditions improved again as clean water from Tomtit Run entered Cold Stream. I got separated from a lot of the other acid drops and that made the water cleaner. But, the poison still caused health problems for some of the trout and other life in the stream.

We flowed north toward Philipsburg and more water joined us. Some of it was clean and some of it was acid. In Philipsburg, a big shot of acid drainage surged in. From that point on, the stream was dead. You could tell because the rocks were iron-red.

There was no relief for me when we flowed into Moshannon Creek. It was dead, too, choked by acid drainage from dozens of other sites. We flowed along for 20 miles to the West Branch of the Susquehanna River, where I mixed with even more acid drainage. It's so sad. No kids fish here. No frogs croak. Farm animals can't drink this water. People don't want to build houses overlooking the water.

We flowed for more than 40 miles before we spotted fish. The river got much bigger in Northumberland, when the west branch met the North Branch of the Susquehanna River. I got separated from more acid drops. But I did see more fish and more insects, which means the water is cleaner. I saw a lot more people, too.

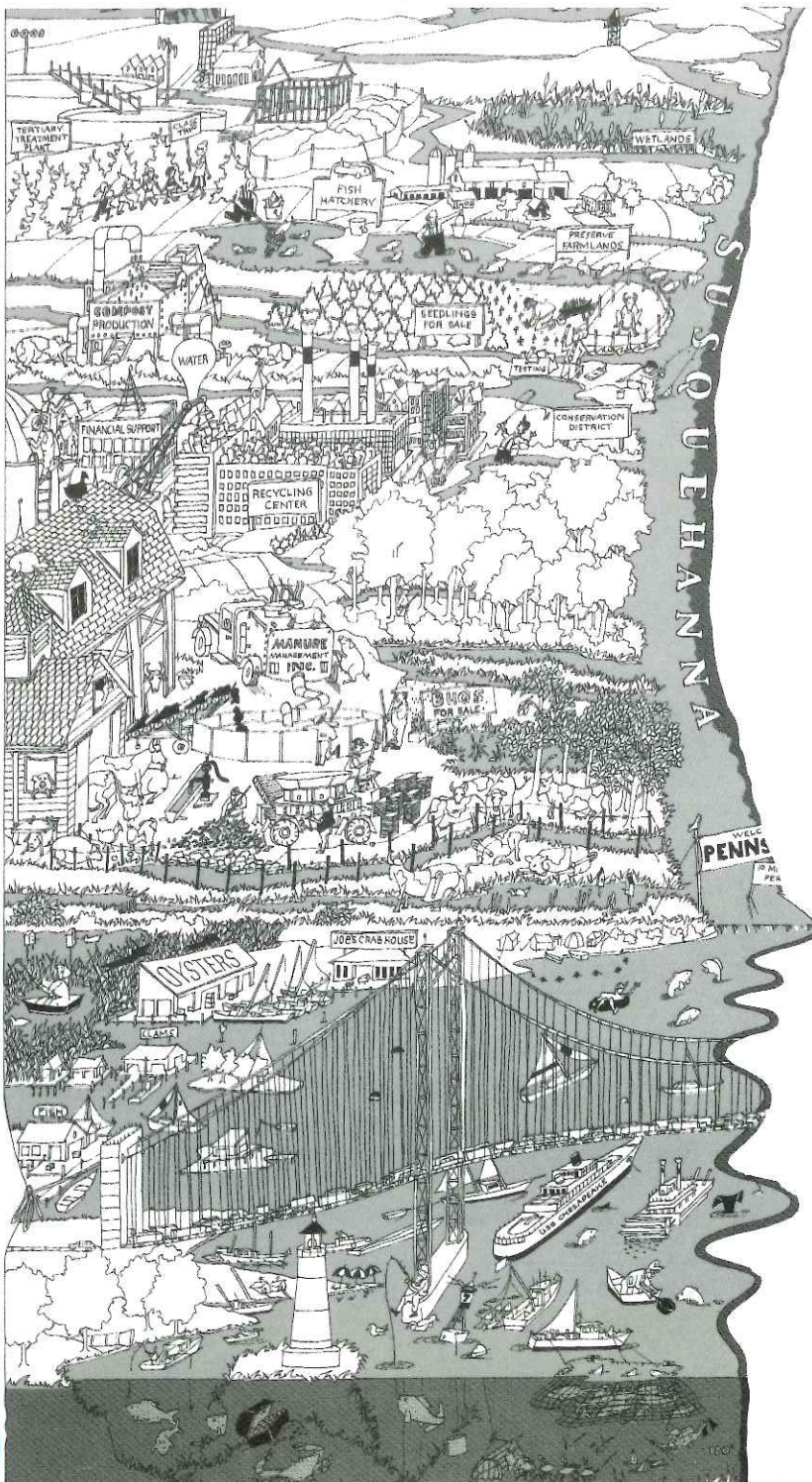
I was set to float all the way to the Chesapeake Bay. But, it was sunny and I evaporated. I came back down to earth halfway around the globe, but I'll never forget my ride as an acid pollutant. *I hope I never do it again.*

What Happens

Every time it rains, the water either flows over the land or seeps into the ground. As it travels, rainwater can pick up and carry pollutants. Eventually, the rainwater finds its way to small streams which, in turn, feed larger streams or even bigger rivers. The rivers then empty into a larger body of water, such as the Chesapeake Bay.

By now you've learned that many things can create water pollution. But you should also realize there are many different steps we can take to help prevent and control pollution. The pictures below show some ways to help protect water quality.

IN THIS PICTURE, CAN YOU FIND...



COWS WITH DIAPERS?

Cows do not, of course, wear diapers to keep animal waste out of the water. But farmers do have ways to keep cows out of the stream.

A STREAM WITH A FENCE ALONG ITS BANKS?

To help keep water clean, farmers have placed fences along streambanks with special areas for the cows to cross the water.

A TANK FOR STORING ANIMAL MANURE?

Farmers can store manure in large holding tanks and then spread the manure on their crop fields where crops can use the manure's nutrients for growing.

A HAPPY CRAB?

By keeping nutrients and sediment out of the Chesapeake Bay, we are making the bay's water clean so that crabs and other fish can thrive. The cleaner the bay, the more crabs for us to eat!

TREES ALONG A RIVER BANK?

Trees and other plants keep soil in its place and soak up extra fertilizer (nutrients) from rainwater. They also shade the water to keep it cooler, and their leaves provide food for fish and aquatic bugs.

A FENCE AROUND A HOUSE BEING BUILT?

Plastic fences, called filter fences, can help catch soil washing away from a construction site. These fences keep soil from eroding, which can pollute streams.

WETLANDS?

Important wetlands should be preserved because they act like a sponge and soak up nutrients, sediments and other pollutants before they drain into a stream or river.

When it Rains?

Test Your Water Knowledge

Now you're ready to "Test Your Water Knowledge." Look at the pictures below and see if you know how the activities can create water pollution. Write your ideas down and then check the box at the bottom of the page for some possible answers.

WHAT'S WRONG WITH THIS PICTURE?

COWS STANDING IN A STREAM?

A MAN WHO IS FERTILIZING HIS GARDEN TOO CLOSE TO THE WATER?

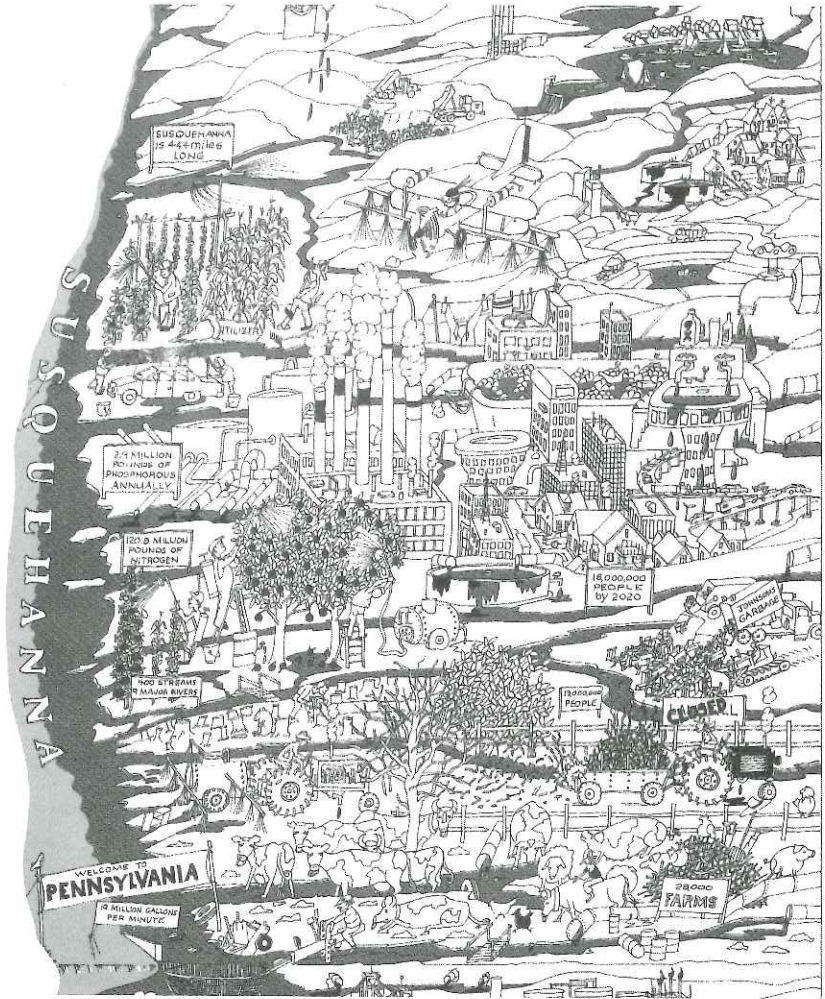
TWO PEOPLE WASHING A CAR?

A BOTTLE WITH A "POISON" LABEL?

A CONSTRUCTION SITE?

TREES CUT DOWN NEXT TO THE WATER?

A LEAKING FAUCET?



POSSIBLE ANSWERS

A LEAKING FAUCET?
 Fixing a leaky faucet can save water and money. A fast drip can waste 600 gallons of water each month! Save water by turning faucets off when washing your hands or brushing your teeth.
 For more information:
 check back through this booklet,
 OR contact
 your county conservation district
 OR call the
 PA Association of Conservation Districts, Inc.
 at 717-236-1006.

A BOTTLE MARKED "POISON"?
 Many household products are dangerous and should never be swallowed or dumped down the drain.
A CONSTRUCTION SITE?
 Special steps need to be taken to control soil erosion on construction sites.
TREES CUT DOWN NEXT TO THE WATER?
 Trees: 1) help to control soil erosion; 2) use excess nutrients that could enter water resources; 3) keep water temperatures cool; 4) provide important habitat for wildlife.

COWS STANDING IN A STREAM?
 Cows can trample streambanks and stream beds causing soil erosion. Cows may also add nutrients directly to the water.
A MAN WHO IS FERTILIZING HIS GARDEN TOO CLOSE TO THE WATER?
 Always follow directions. Use only what is needed to save money and help reduce the chance of water pollution.
TWO PEOPLE WASHING A CAR?
 Detergents may flow into the water and cause pollution. Always wash a car on the lawn, so the grass can absorb the soap and rinse water.