1000 Drops

Curriculum Guide
First Edition

Healthy Waters Institute®

Table of Contents

Introduction to 1000 Drops

The clouds combed overhead and broke against the mountains like waves breaking, and the water ran back toward the sea…gullies bled into bigger gullies, bigger gullies into freshets dry all summer, freshets into ditches choked full of Canada thistle and buffalo weed, and these ran into Elk Creek and Lorain Creek, and Wildman Creek and Tyee Creek and Tenmile Creek; sharp, steep, noisy creeks, looking like sawteeth on the map. And these creeks crashed into the Nehalem and the Siletz and the Alsea and the Smith and the Longtom and the Siuslaw and the Umpqua and the Wakonda Auga, and these rivers ran to the sea, brown and flat with the clots of swirling yellow foam clinging to their surfaces, running to the sea like lathered animals.

—Ken Kesey
Sometimes a Great Notion

OREGON PLAN FOR SALMON AND WATERSHEDS

The Oregon Plan for Salmon and Watersheds is a unique statewide effort that officially began in 1997. Passed by the Oregon Legislature with strong bipartisan support, the Oregon plan addresses water quality, watershed health, and the problems facing native salmonids throughout the state. The credo of the Oregon Plan is as follows:

The Oregon Plan for Salmon and Watersheds is a commitment by Oregon's citizens, landowners, businesses, organizations and governments to work together to ensure our children will inherit healthy watersheds. Oregon's unprecedented vision is to change the relationship between people and natural resources—people and land, people and water, people and fish—and to build communities that are sustainable and profitable in the long term. Most of all, it is a spirit of volunteerism and stewardship characteristic of Oregon and Oregonians.

With the *Healthy Waters Institute* and 1000 Drops program materials, Oregon Trout seeks to support the vision behind the Oregon Plan by informing, enhancing, and activating the relationship between Oregon students and their home waters. By engaging in both hands-on and in-class learning activities about the quantity and quality of their local waters, students will be better informed to write the story of their water drop. As inspired and engaged young Oregonians, students of the *Healthy Waters Institute* develop the spirit of volunteerism and stewardship characteristic of Oregon.

THE OREGON TROUT 1000 DROPS VISION AND MISSION

Since 1983, Oregon Trout has worked to protect native fish and their ecosystem through innovative education and habitat restoration programs. Our ultimate goal is to return health to streams statewide, while providing resources for teachers to enhance meaningful education opportunities and inform a generation of Oregonians inspired to act as stewards of their home waters.

From its beginnings, Oregon Trout has actively supported:

- Effective fish resource conservation advocacy at state, regional, and federal levels
- Coordinated and collaborative regional fishery management
- Funding for watershed restoration and habitat improvement
- Restoration of water quantity and water quality to support healthy, wild fish
- Protection of the last remaining healthy native fish populations
- Advocacy for watershed protection within natural resources planning

When the current educational model was designed, life was experience rich and information poor. Over the last century, this has reversed: students are now inundated with information but applied hands-on learning opportunities are rare. In an attempt to enhance education and create relevant, active, and regional learning programs, Oregon Trout developed the *Healthy Waters Institute*.

HEALTHY WATERS INSTITUTE

The mission of the *Healthy Waters Institute* is educating the next generation of freshwater stewards. The education arm of Oregon Trout that began its pilot phase in 2005, the *Healthy Waters Institute* seeks to connect every student with their home waters. Through meaningful outdoor educational experiences and a commitment to local communities, the *Healthy Waters Institute* cultivates informed citizens capable of maintaining the health of waters statewide. 1000 Drops is one of four education programs developed and coordinated by the *Healthy Waters Institute*. 1000 Drops seeks to reverse the trend of experience poor education by providing students with a better connection to their home waters through hands-on, inquiry-based educational activities. The interdisciplinary learning activities in 1000 Drops inform and equip students to better understand the cycle of their local waters. By tracing water from the roof of their school to the schoolyard and beyond, students will learn about immediate impacts to the health of local waters.

1000 DROPS PROGRAM GOALS

Guiding students through a thoughtful process to examine the path of their water drop, 1000 Drops seeks to encourage students to develop a more informed sense of place and a closer connection to their home waters.

1000 Drops is designed to foster:

- An informed understanding of the regional water cycle
- A strong recognition of local impacts to water quality
- An understanding of the role that humans play in maintaining clean water
- A sense of stewardship towards the environment through participation in community service projects

OREGON DEPARTMENT OF EDUCATION STANDARDS

1000 Drops program materials have been designed for upper elementary students and teachers. Although the activities have been aligned with Oregon Department of Education's Common Curriculum Goals (CCG) and benchmarks for 5th grade, the activities are appropriate and adaptable for 4th through 6th grade learners. Each section within the 1000 Drops curriculum guide includes a broad overview of the CCGs and benchmarks that can be met with the learning activities. A comprehensive table including the complete description of CCGs and benchmarks for each section can be found in the appendix.

1000 DROPS DELIVERY OPTIONS

Healthy Waters Institute works to serve participating teachers with the most practical mode of program delivery for each individual. In that spirit please find below the three different modes of program delivery available for 1000 Drops. *Not all methods are available in all watersheds.*

1. *Full Support—*In this delivery mode four staff or volunteers from Oregon Trout's *Healthy Waters Institute* come to your classroom and school grounds to deliver 1000 Drops all in one day. The staff and volunteers lead activities and full group introductions and wrap ups. All four stations are rotated through in small groups out on the school grounds. Teachers are expected to prepare the class for the activities as well as do some follow-up activities related to the 1000 Drops visit.
2. *Kit and Training—*In this delivery mode teachers go through a half day training to learn about 1000 Drops and to get hands-on experience using the station materials. The teacher then delivers the 1000 Drops stations themselves at their own pace. Teachers are responsible for all aspects of the program in their classroom.
3. *Assisted Delivery—*In this delivery mode the teacher would attend the training as above, but would also get limited staff support for delivery in the field. This mode could be delivered with all stations at once, or any number of stations on a single day or over the course of several days or weeks.

Teacher's Guide

If they are to fulfill their potential,
each purchase must be based on full knowledge of a tool's intended purposes
and a careful judgment of its probable usefulness to you.

—The Reader's Digest Complete Do-It-Yourself Manual

1000 Drops program materials are designed to provide an interdisciplinary approach to watershed education for upper elementary students. An integral component of Oregon Trout's *Healthy Waters Institute*, 1000 Drops helps guide teachers and students through hands-on learning activities and critical thinking writing prompts to encourage informed connections to home waters.

This curriculum is intended to serve as a port of entry for students into the watershed in which they live. Guiding students through a thoughtful process to examine the path of their water drop, 1000 Drops seeks to encourage students to develop a more informed sense of place and a closer connection to their home waters. This curriculum is divided into six sections representing interdisciplinary opportunities to create a foundation of understanding about how water moves through a watershed. Whether the sections are done in succession or as stand alone activities, our hope is that students come away with a more informed understanding of the cycle of their local waters.

Water & Your Watershed
This section begins with two hands-on activities that introduce students to basic concepts of global water use and watershed topography. By encouraging critical thinking about the global implications of our limited water resources, "Why is Water Important?" invites students to better understand the value of protecting and conserving clean water. In addition, students are actively introduced to the physical features that make up a watershed in general and their watershed specifically. By learning about their local watershed and the location of their school within it, students reach a better understanding of how their watershed is connected to the global water picture.

Maps and Mapping
Through the process of learning how to read a map, your students can use the map of their own watershed to think about where the water for the creeks and rivers near them comes from. The maps provided in the 1000 Drops program materials will help students learn some basic details about their home watershed and their place in it. By becoming familiar with their watershed maps, they will be able to see the connections between headwaters, rivers, ridges, and their school.

Non-Point Source Pollution
This section introduces students to the concept of storm water and the impact that non-point source pollution has on local waters. By using direct observation and first-hand data collection to examine non-point source pollution around their school, water quality issues and concerns may become meaningful and relevant to students. By learning first-hand what types of pollutants are on their school grounds, students can develop strategies for minimizing negative impacts to water quality and stream health.

Area & Volume
These lessons are designed to guide students through a process to learn about annual precipitation patterns for their community. Following this, the activities then invite students to ask important questions about the quantity and quality of water both before and after it hits the roof of their school. By measuring, calculating, or estimating the area of their school roof and the volume of rainwater or snow that falls upon it, students will consider the relationship between precipitation, runoff, and impacts to the health of their home waters. They will be asked to consider some positive and negative effects that the water leaving their school may have on any wildlife habitat that receives runoff.

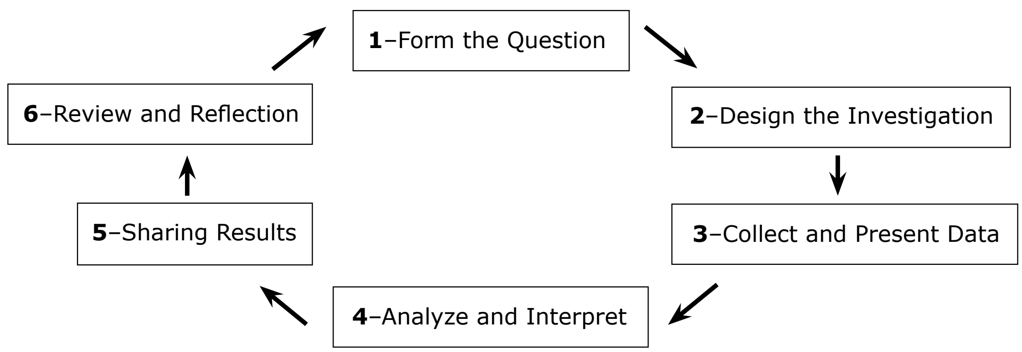
Soils, Slope & Sediment
The lessons in this section are designed to help students understand the interaction between water and the land upon which it flows. By comparing the different paths of water in different types of soil, and learning about slope, erosion, and infiltration, students can examine what human and environmental factors affect water as it travels throughout the watershed.

THE WATER CYCLE AND LEARNING CIRCLE

1000 Drops seeks to provide teachers with an adaptable program designed to encourage students to explore questions about the water cycle. Similar to the cyclical process and path of water, authentic student-centered learning is a circular process. The *Healthy Waters Institute* (*HWI*) is committed to supporting teachers and students through the process of asking authentic questions about water. Questions such as, "Where does the water that lands on our roof flow and go?" is one that opens the door to multiple explorations and activities that attempt to find an answer. Through engaged inquiry, students will learn about scientific processes as they discover the wonders of their own watershed.

The Circular Process

In order to help teachers acheive science inquiry goals, Oregon Trout suggests a circular process. This new method adapts the common inquiry approach with its familiar beginning and end, by looping it into a circular process, inviting entry into the loop at multiple points, depending on the program, students, and the needs of the teacher.



Using this approach, the teacher has the option of encouraging the student to enter the cycle at any point and follow it for a full rotation or more. One way that teachers and students might approach 1000 Drops could be used to engage in the learning process at dimension 3—Students can collect data and present data on the annual rainfall in their home watershed, then proceed to 4—Students analyze the precipitation data and interpret the implications, and students complete the rotation by 1—Framing a new question about the water that falls on the roof of their school, and 2—Designing an investigation to determine the quantity of water that falls on their school. We offer the circular process as another tool for teachers to use to help students enter into authentic question based learning.

OREGON EDUCATION ACT FOR THE 21ST CENTURY

> *By locating learning in the lives and concerns of students and their communities, place-based education takes advantage of students' natural interest in the world.*
>
> ***—Gregory A. Smith***

1000 Drops program materials have been aligned with the changes in Oregon's schools that were initiated in 1991. With the passage of the Oregon Education Act for the 21st Century, enhanced standards for Oregon students were implemented.

The 1000 Drops program will support elementary teachers in their work to raise student achievement by:

- Engaging and inspiring students with exciting hands-on activities
- Implementing an interdisciplinary approach to learning
- Using the local community as a learning resource
- Making learning relevant and meaningful by focusing on home waters and home watersheds
- Focusing curriculum and instruction on higher standards built on the basics
- Encouraging students' ownership in their own learning through engagement in local stewardship projects

SYMBOLS FOR COMMON CURRICULUM GOALS

At the beginning of each 1000 Drops activity, teachers will find a symbol that corresponds to the 5th grade Common Curriculum Goals (CCG) and benchmarks that are aligned with that activity. 1000 Drops integrates an interdisciplinary approach for students to more holistically learn about the water cycle and connect to their home waters; therefore, teachers will find cross-curricular CCGs and benchmarks.

The CCGs and benchmarks that can be achieved through comprehensive delivery of 1000 Drops program materials and activities are as follows:

SYMBOL GUIDE FOR BENCHMARK CATEGORIES

- Science Inquiry
- Science & Technology
- English Language Arts
- Earth & Space Science
- Life Science
- Science in Personal and Social Perspectives
- Physical Science
- Social Science
- Mathematical Problem Solving
- Geography
- Measurement

HEALTHY WATERS INSTITUTE RESOURCES

The *Healthy Waters Institute* (*HWI*) is a statewide provider of tools, programs and services. 1000 Drops is one of the programs of *HWI* that helps teachers and students connect with their local waters through active learning and community-based projects. *HWI* offers grants to help teachers engage students in active learning projects throughout their home waters. Grants range from $100 to $500 and may be used to pay for field trip transportation costs, substitutes, equipment, rentals, or other relevant science education tools or services. *HWI* encourages teachers to submit grant requests following the guidelines on the next page. The complete grant application is located in the appendix on page AP35. One role of the local *HWI* Regional Education Coordinator (REC) is to assist teachers in the grant application process. *HWI* encourages teachers to contact their local REC for more information and for assistance in creating a project that helps connect students with their home waters.

The mission of *HWI* is to enhance education by working with communities to engage all students with their home waters and Regional Education Coordinators are located around the state to coordinate and implement 1000 Drops. For more information about *HWI* and 1000 Drops, to hear about service-learning opportunities, to apply for funding, or to learn about any of Oregon Trout's additional programs and projects, please contact a REC in your area (see following page).

HEALTHY WATERS INSTITUTE GRANTS

Submissions:

- Individual grants range from $100 to $500
- Teachers may submit more than one request per cycle
- Rolling deadline

To Be Used For:

- Transportation
- Substitutes
- Equipment
- Rentals
- Other science education tools, books, materials, and services

Who Can Apply:

- Teachers within the pilot watersheds
- Salmon Watch teachers
- Other teachers with projects that further the *HWI* mission

How To Apply:

- Submit a completed Grant Application Form to your Regional Education Coordinator for consideration (see below).
- Please visit our website at www.healthywaters for an online application.

Additional Requirement:

- Successful applicants are required to submit a final report (with photos) for use online or in *HWI* journal

HWI Grant Application can be found in the appendix on page AP35 in the appendix.

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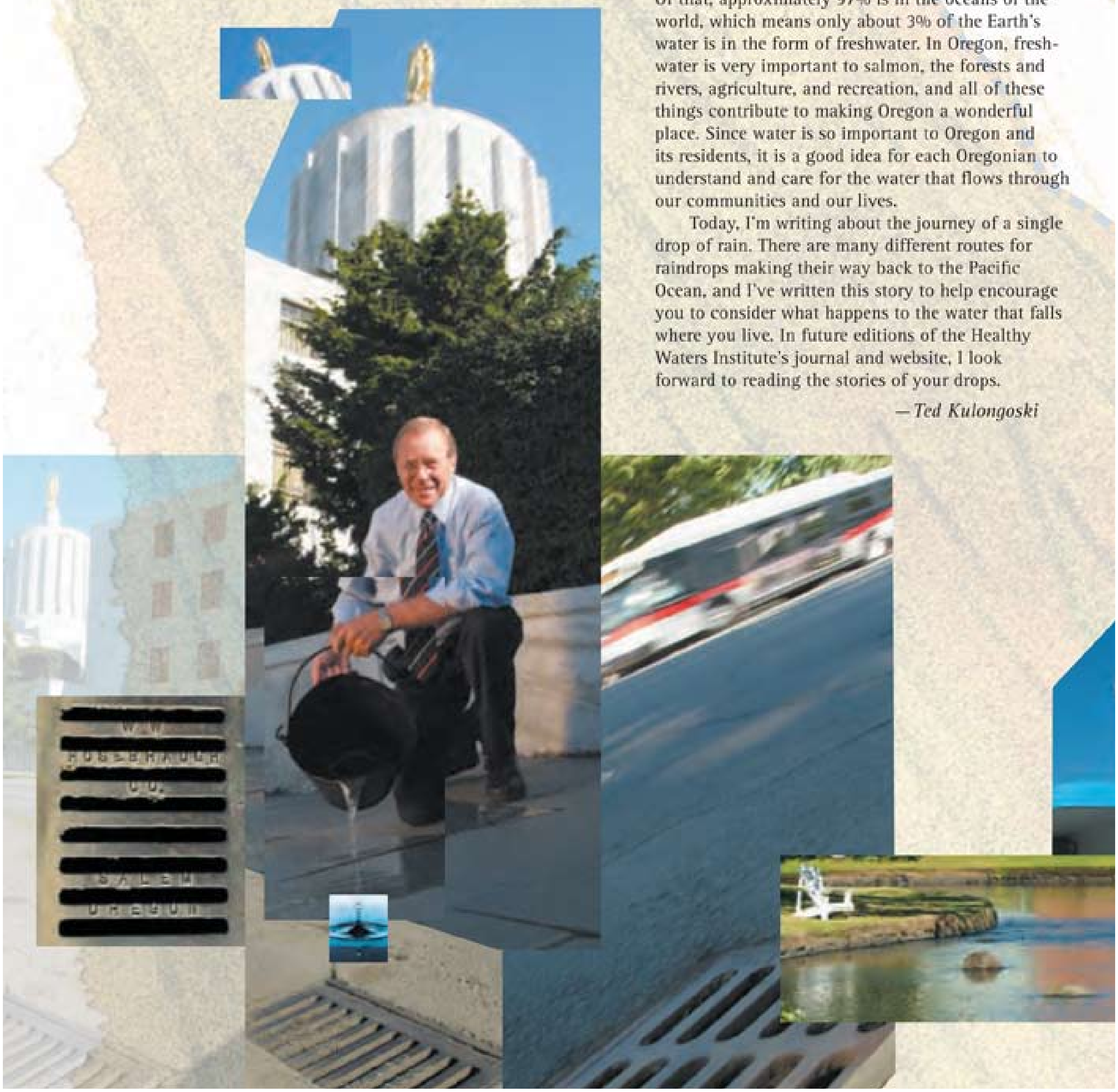
A Story of My Raindrop:

Dear Oregon Students,

More than 72% of our planet is covered in water. Of that, approximately 97% is in the oceans of the world, which means only about 3% of the Earth's water is in the form of freshwater. In Oregon, freshwater is very important to salmon, the forests and rivers, agriculture, and recreation, and all of these things contribute to making Oregon a wonderful place. Since water is so important to Oregon and its residents, it is a good idea for each Oregonian to understand and care for the water that flows through our communities and our lives.

Today, I'm writing about the journey of a single drop of rain. There are many different routes for raindrops making their way back to the Pacific Ocean, and I've written this story to help encourage you to consider what happens to the water that falls where you live. In future editions of the Healthy Waters Institute's journal and website, I look forward to reading the stories of your drops.

—Ted Kulongoski



A Capitol Drop: From Salem to the Sea. . .

My drop falls on a rainy winter day. It descends from the clouds and lands with a splat and a hop before it settles into place on the flat, flagstone roof of my office in the capitol building. The big white building is located in Salem just south of the intersection of Winter and Court Streets, and is easy to spot since it has a shiny gold woodsman on top. The drop pools with others and they begin to flow beneath the flagstone toward the drain that directs water from the roof to the pipes below the city.

My drop, along with the many others that collected on the roof plunge from daylight into darkness down into the pipes inside the building's walls. At ground level my drop makes a ninety-degree turn, leaves the building and flows through storm drains under the capitol grounds. On reaching nearby State Street, my drop pours into the 21-inch storm sewer pipe running west toward the next intersection at Cottage Street. Overhead, people who work in the Capitol are busy, unaware of the water flowing below.

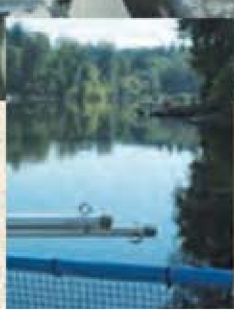
For the next half mile my drop winds its way through Salem in increasingly larger pipes, and drops from other roofs and streets join the flow. First it travels left, across the Cottage Street Bridge over the Mill Race Creek, then right, then left again, flowing downhill under the streets of Salem. The darkness of the pipes is interspersed with brief periods of light as the water passes under storm grates on the streets above. The grates let in more than just light, as rain rushing over the streets collects pollutants, leaves and other debris.

Beyond busy Church Street, my drop flows back into daylight as it pours from the 60- inch storm sewer pipe into Shelton Ditch shortly before the ditch's confluence with Pringle Creek. Now in more pleasant surroundings, my drop meets its first fish as it flows the final quarter mile northwest past Salem's Civic Center, main fire station and finally under an old pulp and paper mill before reaching Pringle Creek's confluence with one of our state's largest rivers, the Willamette. On a rainy day, the relatively polluted waters of the street-draining pipes will make my drop pretty dirty by the time it gets to Pringle Creek. But the creek as a whole is in cleaner condition than the water in the pipes, and later it flows into the Willamette where waters from the McKenzie, Long Tom, Marys and Santiam watersheds further dilute the dirty pipe water. Those watersheds have less pollution than our city streets and thus make my drop a little cleaner.

portland/st. john's bridge: mile seventy-eight

willamette falls: mile thirty-five

canby ferry:
mile thirteen



salem: mile one

My drop's journey from where the waters of Pringle Creek mix with the Willamette to the Pacific's salty swell on the Columbia Bar is approximately 185 miles long. Here is my drop's journey, find a detailed map and follow along:

Mile 1 – One mile from my office my drop passes under the Center Street Bridge and begins thirty-five miles of free flowing travel down chutes and channels, around islands, and through a corridor of tall, green trees. My drop passes many species of fish and wildlife, including Chinook salmon, steelhead, herons, and osprey.

Mile 13 – My drop brushes along the side of the Wheatland Ferry as the captain guides its cargo of cars across the Willamette River. Fifty miles further downstream this will happen again as my drop passes the Canby Ferry. The Canby is the Willamette's second remaining ferry, and has been running almost nonstop since 1914. At one time there were more than 100 ferries crossing the Willamette River linking communities along the river.

Mile 35 – While making the curve from a northerly course to an easterly one near Newburg, the velocity of my drop slows as the river reaches the Newburg Pool, the backup behind the Willamette Falls.

Mile 59 – My drop approaches the Willamette Falls. The air is filled with a thundering roar, spray, and mist, all created as the water falls forty-one feet to the pool below. The pool represents the upper reach of the ocean's tidal influence, and from this point my drop's trip will speed up and slow down twice daily, at the mercy of the pulses of the tide. Sea lions are known to gather here near the fish ladder and feast on salmon as the fish migrate up the Willamette River to spawn in the streams in which they were born. Shortly below the falls, a pulse of fresh, cool water joins my drop as the mountain-fed waters of the Clackamas River flow in. Can you use a map to determine from where the Clackamas River flows?

Mile 78 – My drop is surrounded by the bustle, roar and riverbank development of Portland, our state's largest city. As my drop moves through Portland, the riverbanks are made of concrete to control where the river goes, and to protect the city from flooding. Here, like so many other places along the Willamette River, people are making positive changes to improve the river's health. Although there is still much room for improvement, there has been some success in helping to improve the water quality in the Willamette River. There was a time, not long ago that the Willamette River was so polluted that young fish were only able to survive in the water for a short time before they died.

Mile 85 – This is a big moment for my drop as the waters of the Willamette join and mix with those of the Columbia River. My drop blends with drops which may have fallen on mountaintops in the Canadian Rockies, a roof in Bozeman, Montana, a moose's antler in Wyoming's Yellowstone Park, the leaves of apple trees in Washington's Methow Valley, or the back of a cud-chewing cow in the Upper John Day watershed.

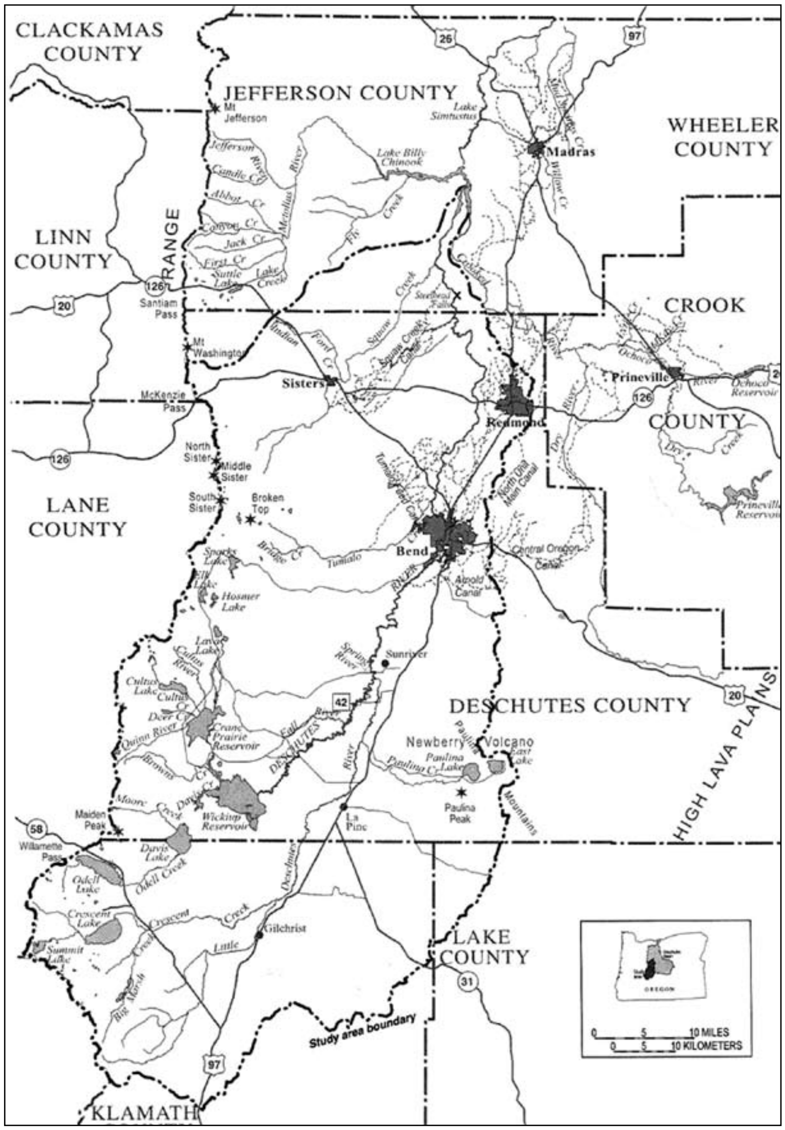
Mile 117 – Swinging to the west near the city of Longview, Washington, my drop meets water made murky by the ashy runoff from Mt. St. Helens. The ash is transported to this place by the Toutle and Cowlitz rivers.

Mile 171 – In the water off of Astoria, my drop mingles with salt water as the estuary's tide-driven mixing slows the big river's flow.

Mile 185 – The End! The drop that landed above my office reaches the Pacific Ocean.

My drop has passed city streets, creeks, flowing falls, fish, birds, wildlife, grasses, ferries, bridges, container ships, and entered the salty waters of the Pacific. What is the story of your drop?

Upper Deschutes Watershed



Where are the Upper Deschutes watersheds?

There are 2.2 million acres of land in the area that is drained by the upper Deschutes River. There are actually LOTS of watersheds in the part of Central Oregon that includes Bend, LaPine, Sisters, Redmond, Tumalo, and Terrebonnne.

Where is the Deschutes River? Do you know where it begins?

The Deschutes River begins at Little Lava Lake. Little Lava Lake is filled with groundwater inflow that starts in the snowfields of Mt. Bachelor and the Three Sisters mountains. Known to many as North Sister, Middle Sister, and South Sister, the Three Sisters mountains are also called Faith, Hope, and Charity.

From its headwaters at Little Lava Lake, the Deschutes River runs from north to south through Crane Prairie Reservoir and then to Wickiup Reservoir. Crane Prairie Reservoir was once a natural meadow until the dam was built in 1922. Wickiup Reservoir is an earthfill dam that was built in 1949. When the Deschutes River water is released from Wickiup it flows north through the communities of Sunriver and Bend. Downstream from Bend, the Deschutes River converges with the Metolius River and the Crooked River behind the dams that create Lake Billy Chinook.

Some of the tributaries that feed into the upper Deschutes River include Snow Creek, Brown's Creek, the Little Deschutes River, Fall River, and Spring River. The major tributaries to the Deschutes between Bend and Lake Billy Chinook are Whychus Creek and Tumalo Creek. If your school is in Bend, you have probably seen the Deschutes River. There are quite a few fun parks like Farewell Bend Park, Harmon Park, and Drake Park that are right next to the Deschutes. If your school is in Sisters, you might know how beautiful Whychus Creek is. It flows right through Sisters City Park! Also, the Little Deschutes River is really close to La Pine Elementary School.

Have you ever been camping or hiking up in the mountains? Some of the lakes you might have gone canoeing on are Odell, Davis, Cultus, Little Cultus, Lava, Little Lava, South Twin, North Twin, Hosmer, Elk, and Sparks. There are also over 400 smaller high elevation lakes in the Cascades.

How did the "Deschutes" river get its name?

The original native name for the Deschutes River was Towornehiooks. Lewis and Clark used this name when they traveled down the river in 1805, but when they returned home they called it Clarks River. Eventually though, among fur trappers, the Deschutes became known as "Riviere des Chutes," or River of the Falls because its mouth was just above Celilo Falls, the well-known falls of the Columbia River.

What was the river like before today?

The Deschutes River provided immeasurable sustenance and resources to Native Americans in the area. Containing abundant wildlife, what seemed to be a limitless amount of trout, and the lush vegetation that landscapes ranging farther east of the Cascades lacked, the Deschutes was so often used by Native Americans it was also referred to as the "Indian Road" to The Dalles by trappers and explorers.

Within Deschutes County, there have been three large archeological surveys conducted on the Deschutes River. The 1948 Smithsonian River Basin Survey recorded 32 Native American cultural sites upstream from Benham Falls, the 1983 USFS and Inn of the Seventh Mountain land exchange documented 12 sites on the west bank of the river near Lava Island Falls, and in 1983 the USFS also recorded 87 archeological sites from Meadow Camp to Wickiup dam.

Rock shelters, pictographs, and lithic scatters derived from obsidian materials found throughout the Upper Deschutes Watershed indicate substantial and widespread Native American occupation. Projectile point cross-dating has been used to estimate the relative age of sites along the Upper Deschutes River. Archeological evidence dates prehistoric occupation in the area from 8,000 to 7,000 years before present. The oldest site excavated thus far produced two knives beneath a layer of Mt. Mazama ash. Analysis of the knives indicates an age of over 7,000 years old. The Deschutes River and the areas surrounding it provided a home with abundant resources to Great Basin Native American tribes including the Klamath, Molalla, and Tenino for thousands of years prior to the 1813 arrival of the first white explorers.

Archeological evidence indicates that Native Americans participated in extensive hunting and fishing throughout the area, as well as collecting plants and herbs. The Native Americans of Central Oregon depended on deer, roots, fruits, other plants, and fish for food. Due to the abundance of native wild food sources in the area, agriculture was basically unnecessary as a means of food propagation. Instead, tribes of the upper Deschutes watershed made use of what could be found growing and naturally thriving in the area. Fish were pulled out of the rivers with long-handled dip nets and roots were dug out with specialized digging sticks called kapns.

How long is the Deschutes River?

Between the headwaters and Lake Billy Chinook, the Deschutes River travels 130 miles. The total length of the Deschutes River from the headwaters to the mouth at the Columbia River is 250 miles!! That's about the same distance as 1000 times around your school track!

What is the climate like in the upper Deschutes River watersheds?

Temperatures throughout the Deschutes River watersheds are considered moderate with relatively warm days and cool nights. About 10 days per year are really hot with temperatures over 90 degrees Fahrenheit. Winter lows average between 20 and 30 degrees Fahrenheit.

The high elevation portion of the upper Deschutes sees the most precipitation in the area. Often, greater than 75% of the annual total precipitation for the subbasin falls as snow between November and March. Snow creates a deep snowpack that stores water until spring. The mean annual precipitation varies widely throughout the watershed; ranging from 140 inches in the mountains down to 10 inches in the much drier lower elevation eastern parts of the watershed near Redmond, Terrebonne, and Lake Billy Chinook.

What are some things that affect watershed health?

Have you noticed that there are more people living in our area than there used to be? The population in Central Oregon has grown really fast since the 1990's. The current condition of the upper Deschutes watersheds is affected by land and water use patterns as well as the rapid growth occurring throughout the area. One of the things people love most about Central Oregon is the river! However, increased recreation on the river and a high demand for water for irrigation and municipal use has had an impact on the Deschutes River system and its aquatic life. Rapid population growth is the most challenging issue facing the upper Deschutes watersheds. The increase in growth is increasing demands for both groundwater and surface water. Stormwater management in rapidly growing urban areas is becoming an additional concern. Deschutes County is currently the fastest growing county in Oregon and the majority of that growth is due to new residents and families moving into the area.

What about fish?

Bull trout are currently listed as a Threatened species. Native to the upper Deschutes watersheds, numbers of bull trout declined following the construction and operation of Wickiup and Crane Prairie Reservoirs. The United States Fish and Wildlife Service has proposed to designate sections of the Deschutes River and Odell Lake as critical habitat for bull trout.

What is the stream flow in the Deschutes River?

The current stream flow patterns in the upper Deschutes River are different than they were prior to the management of Deschutes water for widespread irrigation purposes. Historic flows in the Deschutes River were very stable year-round. A groundwater-fed river, the Deschutes naturally retained a steady flow around 1200 cubic feet per second throughout the year. Since the construction and management of Wickiup Reservoir, winter stream flows downstream from the dam are much lower now than they were. Also, summer flows in the Deschutes below the City of Bend are much lower then they were before irrigation diversions were put in place. The differences in the amount of water in the river throughout the year has had a negative effect on water quality and fish habitat conditions. When there is not very much water in the river in the summer, the water temperatures heat up to temperatures that are unhealthy for fish and aquatic insects.

What is the land like?

Most of the surface landforms and topography as well as the subsurface geology of the upper Deschutes watershed are a diverse mix resulting from 35 million years of glacial and volcanic activity combined with structural faulting and erosion. In general, the geology found in the watershed includes a majority of basalt to andesitic lava. Pleistocene volcanic rocks traverse the crest of the Cascades and the High Cascade peaks are primarily composed of andesite on top of a foundation of basalt. In the Bend area, a series of Quaternary ash flow tuff units believed to have originated from the Broken Top area are combined with basalt flows originating in the Cascades. These features cover most of the area west of the Deschutes River. East of the Deschutes River, basalt from Newberry Caldera is the predominant rock type.

A large portion of the watershed had been glaciated in the past. Approximately 14,000 years ago, the Bridge Creek and Tumalo Creek drainage areas were overlain with almost 1,000 feet of ice. Consequently, all pre-glacial soils in these areas were first covered by glacial till and then later layered with coarse pumice and ash from the eruption of Mt Mazama. Mt. Mazama, located south of the watershed, erupted 6,850 years ago and buried much of the area beneath one to ten feet of volcanic material, thus contributing to the predominant soil composition throughout the watershed. The Mazama material is composed of rhyolitic ash and fine light-colored pumice fragments.

The oldest rock unit in the area is a basalt that is believed to be Pliocene to Miocene in age, or around 12 million years old. Awbrey Butte, a small shield volcano in the northwestern part of Bend, is composed of this type of older basalt. Additionally, the Pleistocene basalt occurs down along the west bank of the Deschutes River where the river flows around Awbrey Butte and along the west bank of the Deschutes farther to the south of Bend. The older basalt is overlain in places by varying combinations of Desert Springs Tuff, Bend Pumice, Tumalo Tuff, Shevlin Park Tuff, or younger basalt units. The Desert Springs Tuff, Bend Pumice, Tumalo Tuff, and Shevlin Park Tuff are volcanic ash and ash flow, or pyroclastic deposits, which originated in the Broken Top area of the Cascade Mountains.

How are rocks and water connected?
The general hydrogeologic setting of the assessment area includes lava beds that sit on top of several hundred feet of volcanic and sedimentary rocks. The subsurface geology of the upper Deschutes watershed defines and directs the storage and flow of groundwater. The type of subsurface rock and the levels of porosity and permeability within underground rocks direct how and where groundwater will flow. Porosity is based on the percentage of a rock that consists of air pockets or open space. Permeability is a measure of water's ability to move through the soil or rock. Geologic features that have large interconnected open spaces have little resistance to groundwater flow and are considered highly permeable. Rocks with very few, small or poorly connected open spaces have low permeability as they create blockages that stop or redirect groundwater flow.

Groundwater travels from high-elevation recharge areas in the Cascades towards the high lakes area, down to the Deschutes River, and then to lower elevation discharge areas near the confluence of the Deschutes, Crooked, and Metolius Rivers. With the exception of a slight gradient to the north, the water table around Bend, Redmond, and Sisters is primarily flat with elevations between 2,600 and 2,800 feet. The water table in Bend is hundreds of feet below the surface of the land; whereas in Redmond, the water table is closer to the land surface. This is due to the fact that the northward gradient of the water table is less than the northward downward slope of the land. Groundwater flows toward, and discharges into, streams that act as drains to the groundwater flow system. North of Redmond, the deep canyons of the Deschutes are incised down to the elevation of the regional water table, so the river is actually recharged by groundwater here. Water-level contours are generally parallel to the canyons in the confluence area, indicating flow directly toward the rivers.

Is the Deschutes River polluted?
There are many sections of the upper Deschutes River that do not meet the Oregon Department of Environmental Quality's water quality standards for either temperature, pH, dissolved oxygen, sedimentation, turbidity, or chlorophyll a. Water quality conditions in the upper Deschutes River are linked to water quantity and flow levels. Temperature, dissolved oxygen, and pH are affected by low stream flow conditions in Tumalo Creek, Whychus Creek, the Little Deschutes, and the Deschutes River.

What contributes to poor water quality in the Deschutes?
Low winter flows in the Deschutes River below Wickiup Reservoir and low summer flows below the City of Bend contribute to poor water quality conditions that are inhospitable for fish. Dewatered in the winter, part of the streambed and the stream banks below Wickiup are exposed to the effects of freezing and thawing. Trout redds are dewatered and the stream banks become more vulnerable to erosion when the flows increase in the spring. Similarly, low flows in the summer months impact fish habitat and water quality below Bend. At the same time as summer low flows, water temperatures below Bend exceed the state's temperature standard during the summer salmonid rearing period.

What about riparian areas?
Riparian areas are the area of land that are right next to rivers or lakes. The riparian areas of the Deschutes River between Wickiup Reservoir and the City of Bend are not doing very well. They have very little vegetation in many sections and they are eroding at a rapid rate. The low winter river flows and high summer flows of the upper Deschutes River have increased erosion of the stream banks. Stream bank erosion can lead to channel instability, land loss, poor water quality, and a loss of important riparian habitat for wildlife.

What about wildlife?
Have you ever seen an elk? If you live in the southwest part of Bend you probably have. There are two key elk habitats near the upper Deschutes River and herds of elk still travel to the river near Elk Meadow Elementary School. In this area, the Deschutes River provides a reliable water supply, valuable food sources, and secure calving areas for elk. This elk habitat could be hurt by excessive land development and land management activities.

Some of the other wildlife found throughout our watersheds include black bear, cougar, deer, beaver, river otter, and marmot.

Johnson Creek Watershed

Do you know where Johnson Creek is? Where does it start and where does it end?

Johnson Creek flows from the bottom of Mt. Hood to the Willamette River, a distance of about 25 miles. Johnson Creek carries rain, melted snow and ground water from the country to the city and then into the Willamette River, the Columbia River and finally into the Pacific ocean. The elevation at the source of the creek is about 350 feet and drops to about 25 feet at the mouth.

You know by now that where there is a creek there is a watershed. Well, the Johnson Creek watershed is about 54 square miles. Many smaller creeks, called tributaries, flow into Johnson Creek. You may have one of these tributaries flowing through your neighborhood or by your school. Have you heard of the Crystal Springs Creek; Kelley Creek; Butler Creek; Hogan Creek; Sunshine Creek; Badger Creek or Spring Creek?

What is the climate like in the Johnson Creek Watershed?

The climate of the Portland area can be described as mild with seasonal variation. Part of the year our weather pattern can be described as Marine West Coast with mild wet, winters. Our summer weather, which is usually hot and dry, is closer to a Mediterranean climate pattern. The average high temperature is 63ºF., average low is 47ºF. There are 155 days of measurable precipitation and an average rainfall of about 44 inches.

How did Johnson Creek get its name?

United States government land surveyors supposedly named this creek after William Johnson, an 1846 pioneer who in the 1850's built a sawmill near what is now the Lents neighborhood.

How has the Johnson Creek watershed changed since William Johnson settled there?

Since the days of William Johnson, many, many people have built homes and businesses in the Johnson Creek watershed. In fact, now there are over 170,000 people that live in the Johnson Creek watershed. That means that about 3,150 people live in each square mile of this watershed! In the lower and middle reaches of the watershed, the land has been developed into homes and businesses, but in the upper watershed there are still many farms and farmhouses. Even through there are some farms in the watershed, most people classify Johnson Creek as an urban stream.

This dense population of people has taken a toll on the creek, the fish and wildlife that also call this watershed home. It has changed the way that water moves through the watershed. Today, water runs off concrete and rooftops rather than soaking into ancient forest floors.

Is Johnson Creek polluted?

Yes. Johnson Creek is now polluted with e. Coli bacteria, poisonous chemicals called DDT and Dieldrin, and other toxins. Stormwater runoff drains quickly across roads and other paved surfaces carrying pollutants into the creek system. It also has high temperatures because of discharges into the creek and the lack of shade along its banks. These conditions make it very difficult for wildlife to live. It is no longer safe to drink or play in.

Salmon in Johnson Creek

Were there ever salmon in Johnson Creek?

Yes. Salmon runs in Johnson Creek helped feed the Clackamas Indians, as well as the farmers and others who settled here later. There are stories told of salmon runs in which the fish could be caught with a pitchfork, and were sold for ten cents. Some people say that the creek was so thick with fish during the fall runs that you could walk across the creek on the fishes' backs! This is not the case today.

Are there salmon in Johnson Creek now?

Yes, but just a few. Now many salmon species face the risk of extinction. These fish, once so plentiful, have shrunk to very small populations. From tens of thousands of fish in Johnson Creek 150 years ago, Johnson Creek's fish population has dropped to only a few chinook, coho, cutthroat, and steelhead/rainbow trout. Recent surveys have found all of these species in Johnson Creek and its tributaries, but in very low numbers. It's clear that the salmon populations in Johnson Creek have dropped sharply, although the work being done to restore habitat and clean the creek will help salmon populations to recover.

Wildlife in Johnson Creek

What other wildlife lived in the Johnson Creek watershed?

Black bear, bobcat, cougar, wolf, fox and elk were once very common in the Johnson Creek watershed.

What wildlife can we see in the Johnson Creek watershed now?

Black-tailed deer and coyotes are the only large mammals that can still be found in the watershed. Other mammals can also be found, including beaver, river otter, and raccoons.

Birds are the most abundant wildlife living in the watershed, including songbirds, ducks, geese, herons, hawks, owls and an occasional eagle. There are also some sensitive species that still call the watershed their home such as three types of salamanders, red-legged frogs, and painted turtles. We also know that sturgeon are living around the mouth of Johnson Creek.

The Johnson Creek Watershed Council

What can we do to stop more animals from dying and the creek from becoming more polluted?

Because many people in the community were worried about the health of the creek and its watershed, they formed a group called the Johnson Creek Watershed Council (JCWC) in 1994.

The JCWC and its partners started by making a plan for how to slow down the decline of the creek's health and start protecting the habitat, fish and wildlife that are a part of the watershed. They called this plan the Watershed Action Plan.

The JCWC now uses the Watershed Action Plan as a guide for deciding what projects need to be done in the watershed. The community supports the Council in doing these projects. The only way the restoration of Johnson Creek watershed will be successful is if we all work together to make it happen.

Bear Creek Watershed

Where is Bear Creek Watershed located? How big is it?

Located completely in Jackson County in southern Oregon, the Bear Creek Watershed is narrow and long, about twice as long as it is wide. Meandering approximately 30 miles down the middle of a narrow valley floor, Bear Creek drains a 400 square mile basin. Bear Creek's tributaries begin in the highlands of the Siskiyou and Cascade Mountains and Bear Creek ends at its confluence with the Rogue River. A watershed with a rapidly growing population, Bear Creek Watershed contains the largest urban areas in Jackson County including Medford, Ashland, Central Point, Talent, Phoenix, and Jacksonville.

All Mixed Up!

Bear Creek Watershed is a special place because it's all mixed up. It's located in a place where four different climate zones meet and where different mountain ranges {Cascades and Klamath-Siskyous} and soil types also come together. This makes the region especially variable. Wet influences from the coast in the west (called maritime weather) bump up against dry high desert weather from the east. California Mediterranean climate from the south bumps up against the Northern Temperate climate influences from the north! The overlapping climates make Bear Creek Watershed weather over time very unpredictable. Combine this climate pattern with unique soils, steep slopes that create lots of elevation changes and aspect (the direction a slope faces) differences, and you get many specialized local places. In a short drive around the Bear Creek Watershed you can see oak savanna grasslands, north slope conifer forests, shrub chaparral, and marshy wetlands. Of course, each unique place has its own kind of wildlife that likes to live there. Bear Creek Watershed is a melting pot for climate, geology, wildlife, and plant communities!

Who Used to Live Here?

In pre-history and into historical times the Bear Creek Watershed was home to a number of Native Americans. Back then the valley floor of Bear Creek Watershed was different. The creek wandered over a much wider area and made oxbows and braided channels each year. There were thickets and hummocks in the lowlands as well as more wetlands. The people who most likely lived in the Bear Creek area were the Takelma. Other groups that were in the region were Shasta, Karok, and Yurok. The following groups also interacted with Bear Creek-- the Klamath to the east and the coastal tribes of the Shasta Costa, Chetco, Coos, and Coquille.

The Native American peoples managed the landscapes in the Bear Creek area by burning in certain seasons to keep the forests a mix of oaks and pines, which they used for food. The burning also made the area more useful for wildlife such as deer and elk. These animals as well as salmon and other fish were a main food source for the people. The Indians preferred to settle along the rivers, which allowed for transportation as well as access to food resources. The Takelma foraged, hunted, and planted. They relied on acorns, camas bulbs, deer, elk, and fish as staple foods. In the winter months they lived in semi-permanent villages in the lower elevations near the rivers. In the summer they moved upslope to camps where they hunted and gathered seasonal crops. They were closely connected to the land and the round of the seasons. Their religion and ceremonies were closely linked to daily life tasks.   Estimates of population were about 10,000 Native Americans in the area before 1850 when European diseases and the "Rogue Indian Wars" decimated their numbers.

Who lives here now? What kinds of work do people do?

A period of settlement began around 1850 with people being attracted to the area for mining, logging, and farming that included orchards. This brought many changes to Bear Creek Watershed with impacts from building irrigation canals and water ditches used for mining as well as draining of wetland areas to use for farms and town sites. Mining slowed down over time but farming and logging grew in importance. More people came to live in the valley and streams were impacted by residential development too.

Many historical influences affected what happened in Bear Creek Watershed over time including WWI, the Great Depression, WWII, and changes in government regulation. These larger national or international events created demand for lumber, and supported increased expansion of farming and ranching. Changes in government brought more regulation of building practices, zoning, and development of roads and water systems.

Today the most important economic sectors in the Bear Creek Watershed are 1) orchard and vegetable farming, 2) ranching, 3) small businesses, 4) medical, government, and social services, and 5) corporate manufacturing. Tourism and recreation are also a growing sector.

Fire is a key natural disturbance process in all of southern Oregon including Bear Creek Watershed. Large fires have played an important part in determining what kinds of plants and trees live in Bear Creek Watershed. Lightning fires and fires set by Native Americans kept the landscape more open than it is now for thousands of years. Fires were suppressed by people beginning in the 1900's which has led to changes in vegetation. Densely spaced stands of trees exist now and trees have migrated into former grasslands.   Frequent not-so-hot fires served to thin out the forests and keep the grasslands open. Scientists believe that fires burned here every five years or so in a natural cycle. Today there is more danger of much hotter fires when one starts since there is more fuel available.

How do we use water in Bear Creek Watershed? What needs attention in Bear Creek Watershed to make the water healthier as identified by the Oregon Department of Environmental Quality?

* Indicates situation that needs attention to improve. Bear Creek has water quality problems related to bacteria, warm stream temperatures, low dissolved oxygen, high pH, high nutrients, and algae growth.

Industrial water supply
Resident fish and aquatic life *
Fishing *
Anadromous fish passage
Irrigation *
Aesthetic quality *
Boating
Livestock watering
Wildlife and hunting *
Water contact recreation *
Salmonid fish rearing *
Salmonid fish spawning *
Municipal sources *

To learn even more about the Bear Creek Watershed read the Bear Creek Watershed Assessment. The document was prepared by the Rogue Valley Council of Governments for the Bear Creek Watershed Council. It can be viewed on the RVCOG website at www.rvcog.org.

Marys River Watershed

What is the Marys River Watershed? Where is it?

A watershed is more than the river that carries the water. It includes all of the land too. This means that the edges of a watershed are figured out when looking at the shape of the land that surrounds the streams and rivers, and includes everything in it. Pretend for a minute that your hand is a watershed. The lines in the palm of your hand are the creeks and rivers, but your whole hand is the watershed. Let's think about why.

Pretend now that you are looking at an imaginary egg held in the palm of your hand. Now take the egg away and notice the small nest like place where it was. Your fingertips are still pointing up toward the ceiling. The little nest, or pocket, is the bottom of the watershed, the common shared place where all the water wants to go, because it likes to flow to the lowest spot. The part of your hand that is not the pocket, but was holding the egg is the higher parts of the watershed. There are some very high spots, and some not so high spots. The sloping flat land, the higher foothills and mountains are all parts of the watershed, because it all drains water to a common river, stream or lake that is at the lowest spot.

The lowest spot in the Marys River watershed is Corvallis. If thinking about the ocean being at 0 ft elevation, Corvallis is 250 feet higher than that. The highest place in the Marys River Watershed is Marys Peak at 4,200 feet. Some water that flows from high headwaters in the Coast Range, travels down, flowing into the Marys River. Other water that flows from another spot in the Coast Range further south flows into Muddy Creek. The Muddy Creek meets up with and flows into the Marys River. The water keeps flowing downhill until it gets to Corvallis, where the Marys River finds the Willamette River. Then it flows north until finding the Columbia River. Finally it finds the lowest point, and flows into the Pacific Ocean. By the time the water gets to the Willamette River, it will have drained or flowed over 310 square miles of the Marys River Watershed.

Norton Creek, Tumtum River, Marys River, Philomath, Bellfountain, Benton County…What do these names have in common? They are all part of the Marys River Watershed. They all drain water to the Marys River, which is the common river. Many watersheds and watershed councils are named after the common river that much of the water flows into. Most of the Marys River Watershed fits inside Benton County, Oregon.

Puzzles…50 piece? 100 piece? 500 piece? 1000 piece? How big is the Marys River Watershed?

You might say that the Mary's River Watershed is a 50 piece puzzle, the edges of each piece being creeks, rivers and high hills or mountains. It fits inside a much bigger puzzle that might have as many as 1000 pieces, the Willamette River Basin Watershed. That puzzle fits into an even bigger one with about 4,000 pieces, the Columbia River Basin Watershed. A watershed can cover a large multi-state area like the Columbia River watershed or a relatively small area, like the watershed of a small stream, pond, or wetland. Larger watersheds are made of many smaller watersheds, often called sub-watersheds or sub-basins. No matter where you stand, a watershed surrounds you. Marys River Watershed a 50 piece puzzle

Imagine now that you are putting together the Marys River Watershed puzzle. Start on the left or west side. Of the 50 pieces, 12 pieces are for the forests. Moving further to the right or east, 28 pieces are going to be for growing crops. Now add 4 pieces for growing hay and pasture. Going the furthest to the right or east, another 4 pieces is for towns and cities or urban areas. The remaining 2 pieces are for William L. Finley Wildlife Refuge. Now imagine that you have to put most of the 80,000 people who live in the Marys River Watershed in the 4 pieces that you have for cities and towns. Of course we know that people live on farms, and in the forests in small homes, so some of these people could be on the other puzzle pieces too.

This tells you two things. One that land in Oregon is used for forests, growing crops, growing hay and pastures, towns and cities, and for a wildlife refuge. It also tells you that most of the land is for growing crops, less for growing forests, even less for growing hay and pastures, surprising little for towns and cities, and pitifully few for a wildlife refuge. Also, that most of the people live in towns and cities.

Now imagine on the puzzle pieces, where wildlife lives. You would be correct to say that wildlife lives mostly in the forests, on the wildlife refuge, less on land that grows crops, hay and pastures, and even less in towns and cities. Wildlife lives in streams and rivers on those pieces that have water, but this depends on the quality of the water. Birds seem to live on all of the pieces, but many depend on wildlife refuges, riparian zones along rivers and streams, wild or restored undisturbed areas to breed and nest. Riparian zones along creeks also become wildlife corridors for animals moving from place to place to find habitats for breeding and food.

A different time, the Kalapuya puzzle

The Marys River Watershed was here before the settlers in the covered wagons came between 1846 and 1879. It was here before Columbus "discovered" the Americas in 1492. A Native American tribe called the Kalapuya, were also here. We don't know exactly how long the Kalapuya were here, but we know the watershed was here for millions of years by studying the rocks. One way to figure out how long the Kalapuya were here is to know what archaeologists have found out. There is proof that the Kalapuyan way to roast filberts (a type of nut) and camas (a type of flowering plant that grows from a bulb) in stone-lined pits underground is about 9000 years old. That tells us that while the Euro/American settlers have been here for about 160 years, the Kalapuya were here for at least 9,000. That is why many native people are called the "First Americans" or the "original people."

The Lewis and Clark expedition in 1805-1806 wrote in their journals that at least six nations of Native Americans, estimated at 10,000-12,000 individuals total, lived in the valley. By 1841, only 400 or so Kalapuya survived in the Willamette Valley, their people wiped out by disease. We could have learned so much from the Kalapuya. For example, there is proof that the Kalapuya made important land decisions about how to manage the land. Early settlers came to the Marys River Watershed and found it clear of conifers (trees with needles like Doug-fir) and other plants thought to be a nuisance. The Kalapuya used a vegetation management technique termed "pyroculture," in which they would periodically burned large areas of the landscape to control unwanted plants. The plants that they valued, like camas, oak and huckleberries are still plants that are here today. The McLeod expedition wrote about seeing a Kalapuya digging roots with a digging stick on October 4, 1826, the first time in written history.

Getting back to the 50 piece puzzle of the Marys River Watershed in the time of the Kalapuya, there would still be only 12 pieces for forestry. The rest, however, was mostly for oak savannas, wetlands and riparian zones. Then, wildlife was on each piece of the puzzle almost equally, some species now extinct, endangered, threatened or displaced. Grizzly bears, California condors, wolves, Cutthroat trout, salmon, western pond turtles, fenders blue butterfly, western meadowlark, among others are some examples. But there were also more of lamprey eels, Willamette chub, wolverines, cougar, wolves, and elk in the Marys River Watershed. Habitats (homes) for wildlife were healthy and plentiful. Changing their homes came with agriculture and other land management practices along with growing populations.

A different time, the Euro/American puzzle

Liking the open prairies kept clear by the Kalapuya, the good soils, and plenty of water, European settlers flooded into the state between 1846 and 1879. Between 1849 and 1860, the population in Benton County went from 870 to 3,047 people. By the 1930's, settlers lived mostly in Corvallis (then Marysville) and Philomath. The puzzle started to change as farming became more important. The settlers stopped burning the unwanted plants, so the land that once were grasslands and open oak woodlands were overgrown by conifer forests. By the 1890's farmers raised poultry and sold their eggs. In addition, they planted orchards of pear, apple, cherry, walnut and filbert trees.

The forests were resources for Euro/Americans who liked to build houses and mills. Doug-fir seen as weeds to the Kalapuya, became very important to the settlers and their livelihood. The trees in the Pacific Northwest now provide wood and wood products for an international market. Mills were built close to where the trees were cut along rivers because water power was used to run them. Before railroads and other technology developed, oxen and horses moved big timber. The Marys River became the easiest way to send the logs to other places, put into the rivers higher in the Coast Range, and moving as far down as Corvallis. This damaged the rivers terribly, scouring the bottom and banks of the river, removing the cobble that once was for salmon redds (dug out pockets to lay and fertilize eggs) and other fish and wildlife habitats. This did not stop until the 1940's, when the railroads and other technologies improved moving logs from where they were cut, to where they were needed. The timber industry is still important to the economics of the Marys River Watershed, Hull- Oaks Lumber Company still using water power to this day.

By the early 1900's, the Willamette River was too polluted to use for drinking water. Levels of dissolved oxygen in the river were low, and fish put in the water died in a matter of seconds. Corvallis had to search for a new source of water, and found that the Marys River Watershed was a pure source. All of Philomath's and a portion of Corvallis's drinking water come from the Marys River Watershed.

In the 1930's, decisions about land and how to use it well had to happen. People then worried about flooding, so they built dams. Knowing about fish passage for migrating fish, today that decision might be different, or the dam built differently. Forests were cut and replanted so that the supply would not run out, much like forest practices today. People were taught how to be better farmers. Logs from log runs were cleared out of the river to prevent flooding. Since this harmed native fish habitat, this same decision would likely be made today, but for more or different reasons. Management decisions are made today based on what is important today.

The puzzle now, making decisions about the Marys River Watershed

Today, we are concerned about healthy water. We are concerned about having enough resources left for generations that follow, much like the Native American. The Kalapuya was an ancient tribe, but many Native Americans live today. You may have heard of the Siletz and Grand Rhonde tribe living on the other side of the Coast Range. They are smart about something called "sustainability and conservation." Sustainability involves replacing what is taken or used, conservation involves using only what is necessary and not using too much. They try to make decisions that not only benefit themselves but the next seven generations. It is something they have known and taught throughout time.

So how healthy is the Marys River Watershed?

The water quality in our rivers and creeks for sensitive wildlife, including salmon and cutthroat trout, is often not good enough. For example, sometimes, the water is too warm, and planting trees close to the river or stream creates what is called a Riparian Zone that shades the water to make it cooler. Water that runs off of agricultural fields, and parking lots, sometimes has things in it that pollutes the water. Also, the water quantity can be too low in the summertime, being less than what fish and wildlife needs. There are "in stream" problems, such as culverts, that stop fish such as salmon from migrating upstream to spawn. Wetlands need to be protected and in some cases, cleaned up and restored.

Taking action, working with the puzzle pieces

Looking at our 50 piece puzzle of the Marys River Watershed, 8 out of 50 pieces are owned by all of us, or publicly. Most of the puzzle or 42 out of 50 pieces is owned by individuals or privately. Therefore, it is important that everyone who owns land thinks about ways they can help our rivers and streams, our wildlife and us.

With more people in Marys River Watershed, we have to be smart. There are many ways that water can become polluted.   You can test water quality, and many students do this in the Salmon Watch and other school programs. It is important that rivers have enough dissolved oxygen for fish to be able to breath. Also that there is not too much phytoplankton (phyton or "plant" and "planktos", meaning "wanderer" or "drifter") or other suspended solids that make the water too cloudy or turbid. Water is also tested to see if there are chemicals, bacteria, or other stuff in it. Or if it is too acidic. (Testing the pH.)

Land use and decisions about how land is used (called land management) goes together like pieces a puzzle.   One of the jobs of a group of people like those in the Marys River Watershed is to be fair to all the people and wildlife that live within it. They also want to be sure that the water that flows off and through the watershed is as clean as possible when it goes into the streams and rivers. People depend on this water, but so does wildlife.

We hope that you help us put this puzzle together, and maybe change, restore or protect more wild places. Philomath and other schools are working hard to work on restoration sites that are right on their school properties. Many students do service-learning to benefit a nearby river or stream. A good example is on Philomath's Newton Creek in 2006, where students removed an unneeded dam, because Colby Davidson, a student from Philomath High School, found Cutthroat trout in the creek. Cleaning out and restoring a wetland, like the one behind Philomath Elementary School, would be important too. The Marys River Watershed and Oregon Trout's *Healthy Waters Institute*, hopes that you become an important decision maker.

Water & Your Watershed

Why is Water Important?

> ***A Piece of the Story***
>
> The water and watersheds section includes two hands-on activities that introduce students to basic concepts of global water use and watershed topography. This section is designed to help students understand the value of their water drop in the context of a limited global water supply of fresh water. Additionally, students are actively introduced to the physical features that make up a watershed in general and their watershed specifically. By learning about their home watershed and the location of their school within it, students develop an informed sense of the very real path their water drop might take as it travels through the watershed.

1000 Drops is an interdisciplinary program that is designed to encourage students to explore questions about their home waters. The first section in the 1000 Drops program materials, the Water and Your Watershed section invites students to start to think about water, water quantity, and **watershed**s in a new way.

This section begins with an activity to emphasize the limits of our global water supply. By encouraging critical thinking about the implications of our limited water resources, Why is Water Important? invites students to better understand the value of protecting and conserving clean water. Through the very important and very local process of reaching a better understanding and an informed connection to their hometown creeks and streams, it is helpful for students to develop a global concept of water quantity, water quality, and water consumption.

WATER PATH

Water quantity and quality varies around the world. Here in Oregon, we are lucky to have many beautiful freshwater sources throughout the state that watershed councils, agencies, and non-profits like Oregon Trout are working hard to protect and restore. As you begin to follow the exciting path of water in your hometown—where it comes from and where it goes—you will learn much more about the health of the water and the watershed around you.

What's a watershed? Is it a shed where people store water? NO! A watershed is the entire area that is drained by a river or creek system. Sometimes referred to as a catchment or a drainage area, a watershed is bound by its **ridgelines**. The ridgelines, or mountain crests that are formed by the juncture of two or more sloping planes, create the physical boundaries between watersheds.

Why is Water Important?

This activity raises student awareness of the amount of high quality drinking water on a global scale that is available to humans.

Approximate time: 15-20 mins.

The Why is Water Important? activity of 1000 Drops is designed to be interdisciplinary in its application. When the core activity is integrated within a classroom discussion regarding global water amounts and uses, and human uses and impact on their watershed, students can develop an understanding about water quantity and quality in their hometown, their role in contributing to the health of their water, and an understanding of their place in their own local watershed.

MATERIALS

- Map of watershed with sewage treatment plants marked, drinking water sources for local area marked, school marked, other? (for use during discussion activity)
- Laminated copies of *healthy waters* story on Governor Kulongoski (story provided on page vii)
- Five gallon container or one gallon jar for each group of students (4 to 5 groups)
- Colored water or food coloring to add to water for visibility
- Measuring devices for removing water—1 cup measuring cup, tablespoons, eye droppers (1 set for each group)
- Large mouth containers to receive removed water (6 to 8)
- Tiny vials for students to take home drinkable water amount (1 per student)

COMMON CURRICULUM GOALS AND BENCHMARKS

The Why is Water Important? activity can help teachers meet Oregon Department of Education common curriculum goals and benchmarks for fifth grade within the following areas:

*Science Inquiry—*Use interrelated processes to pose questions and investigate the physical and living world.

*Earth and Space Science—*Understand physical properties of the Earth and how those properties change.

*Physical Science—*Understand structures and properties of matter and changes that occur in the physical world.

*Social Science—*The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and comtemporary issues, understand global relationships, and make connections between the past, present and future.

*Mathematical Problem Solving—*Select, apply and translate among mathematical representations to solve problems.

*Science in Personal and Social Perspectives—*Understand that science provides a basis for understanding and acting on personal and social issues.

GOALS AND OBJECTIVES

Students will:

- Be able to name the source of their drinking water
- Be able to describe approximately how much drinkable water humans have access to on a global scale
- Be able to list three reasons why water is important to a watershed

PRE-ACTIVITY (Full classroom–inside–15 minutes)

Discussion:

Introduce yourself, helpers, and Oregon Trout/Healthy Waters. Tell students we are going to spend some time today thinking about water and the water that falls on their school. (See if the group has read the journal article about Governor Kulongoski's water drop.) See if they can explain the water cycle. Is there more water being created on Earth? Can we easily manufacture water?

Questions:

Using the chalkboard have students brainstorm why water is important. Record their responses.

Why is water important?

What kind of water resources do we have locally?

Do you know what source your drinking water comes from?

How healthy do you think our local water is? How could we tell? sight? smell?

Who would know about our water quality?

Where do you swim and fish and boat?

Any idea where your waste water goes? Anyone know where your waste water treatment plants are?

Any idea where water from your school building roof, play grounds, ball fields and parking lots goes?

Wow! Who knew there were so many interesting things to ask about just plain old water!

PROCEDURE

How much water do humans have for drinking?

1. Start with five gallons of water that can be contained in a bucket or an aquarium. Explain that 5 gallons represents all water on earth.
2. Ask students to think of water that we can't drink. Make a quick list of suggestions on the board.
3. Tell students that 5 gallons = 80 cups or 1280 tablespoons
4. Distribute wide mouth containers to student groups along with measuring tools. They will need one container to measure from and one to contain the specific volumes identified in the activity.
   - Give each group of students 2 cups of water, which is approximately 34 tablespoons or 2.8% of all the water on Earth, or water that is not part of the ocean.
   - Next, remove icecaps and glaciers=2% or 26 tablespoons (approx. 1 2/3 cups)
   - Then remove groundwater that is too deep to obtain—.6% which=8 tablespoons (approx. 1/2 cup)
   - Remove freshwater lakes—0.009%=28 drops
   - Remove inland seas/salt lakes—0.008%=25 drops
   - Remove all rivers—0.0001%=less than a drop
   - Drinking Water=an even smaller drop
5. You will end up with a fraction of a teaspoon—have students dropper this into the take home vial.

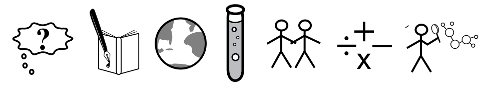
DISCUSSION

Wrap up with student thoughts on this activity

Ask if they can think of ways to use less clean drinking water—recycle **gray water**? Catch roof runoff for landscape use? Run full loads in dishwasher and cloths washers? Sweep drives and patios instead of hosing off?

Give students ten minutes to write their ideas down on paper.

We All Live in a Watershed



Approximate time: 15 mins.

(To be done outdoors on a grassy area)

This activity helps students understand and define a watershed. It also teaches students about the specific watershed in which their school is located. The We All Live in a Watershed activity of 1000 Drops is designed to be interdisciplinary in its application. When the core activity is integrated within a classroom discussion regarding water amounts and uses, regional and authentic watershed information, and human uses and impact on their watershed, students can develop an understanding about water quantity and quality in their hometown, their role in contributing to the health of their water, and an understanding of watersheds and their place in their own local watershed.

MATERIALS

- 10′ x 10′ tarp (larger if group is large)
- 5 gallon water container closed to pour from
- Long necked watering can
- Large open tub to drain water into at end of activity
- Large watershed map or maps (same map as used in Mapping Activity) and relief map if possible

COMMON CURRICULUM GOALS AND BENCHMARKS

The We All Live in a Watershed activity can help teachers meet Oregon Department of Education common curriculum goals and benchmarks for fifth grade within the following areas:

*Science Inquiry—*Use interrelated processes to pose questions and investigate the physical and living world.

*English Language Arts—*The practice of writing, prewriting, drafting, revising and publishing prepares students to better communicate across the subject areas.

*Earth and Space Science—*Understand physical properties of the Earth and how those properties change.

*Physical Science—*Understand structures and properties of matter and changes that occur in the physical world.

*Social Science—*The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and comtemporary issues, understand global relationships, and make connections between the past, present and future.

*Mathematical Problem Solving—*Select, apply and translate among mathematical representations to solve problems.

*Science in Personal and Social Perspectives—*Understand that science provides a basis for understanding and acting on personal and social issues.

GOALS AND OBJECTIVES

Students will:

- Be able to verbally describe a watershed
- Be able to verbally identify in which watershed their school is located
- Be able to name three components of a watershed unit

PROCEDURE

We all live in a watershed. So what's a watershed?

1. Outside, take a blue tarp and have students surround the edges to hold it up.
2. One or two students create a mountain by getting under the tarp.
3. Other students "rain" water on the mountain, catching it by keeping the edges of the tarp high enough (ridge lines). Six to eight students can hold the edge of the tarp while one to two students use the long neck watering can to pour water into the center of the tarp. Students will form lakes, and streams from one area of tarp to another by raising and lowering different sections of the tarp. The challenge is to keep the water contained and then students pour it off the tarp back into large container.

DISCUSSION

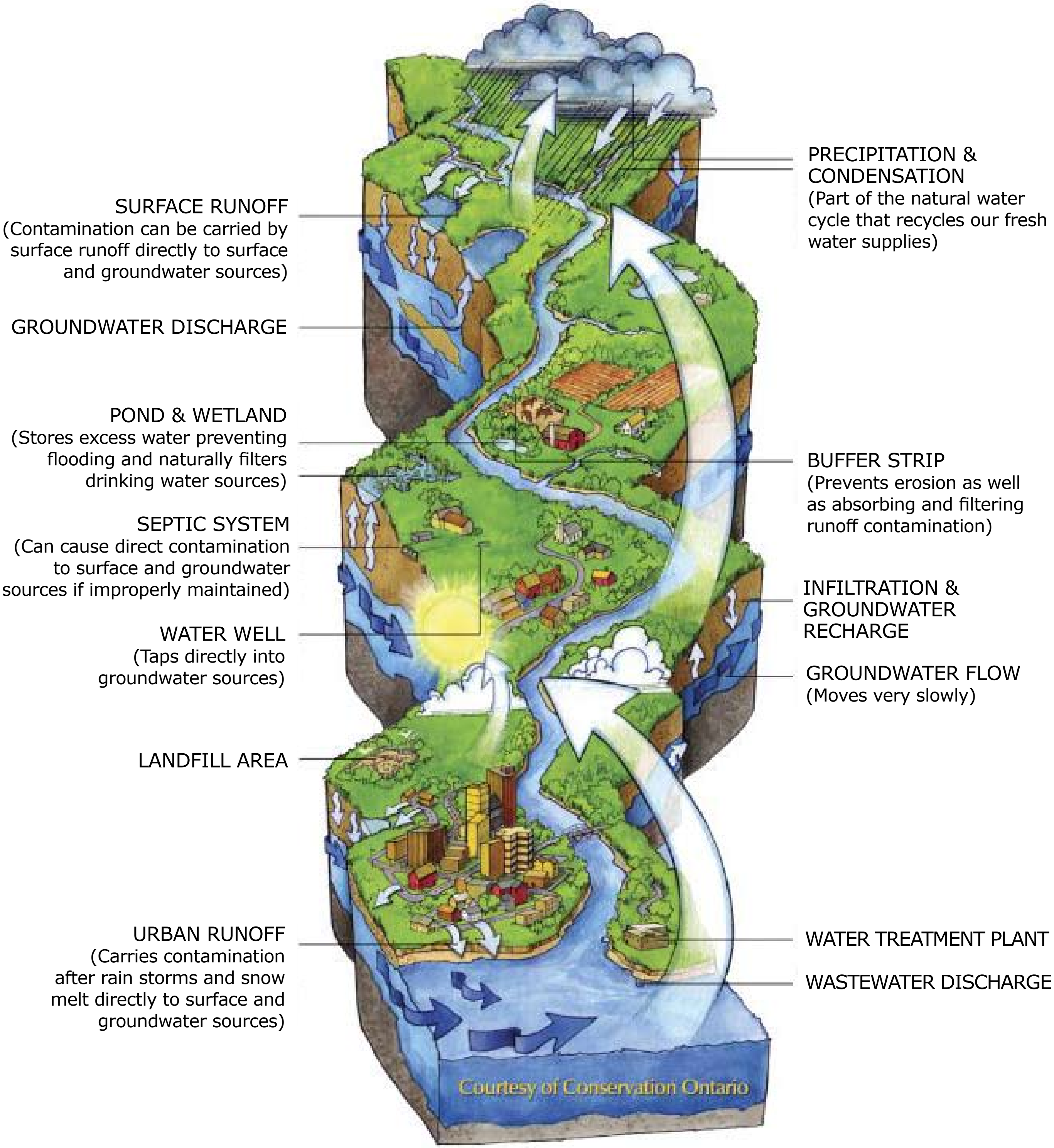
Transition to maps. Identify your local watershed and its boundaries using the same terms you used in the activity. (**Upland**s, ridgelines, **basin**, watershed, **stream channels**, rivers, lakes, ponds etc.) Have a relief map of a watershed if possible to compare to the model you created with the tarp. All water is cycling through and we use it again and again.

QUESTIONS

- Where are we in our watershed? Have students refer to relief map or *HWI* map.
- Who is downstream of us?
- Who are we downstream of?
- Is it important how we treat our water as it flows by us?

Tumalo Creek Watershed
With Mount Bachelor and Tumalo Butte in the distance, the ridges and valleys of the Tumalo Creek drainage are part of the larger upper Deschutes watershed.

Watershed Diagram



GLOSSARY: WATER & YOUR WATERSHED

Basin—A region drained by a single river system.

Gray water—Wastewater from bathroom, kitchen, and laundry activities, esp. as it may be recycled for toilet and outside water uses.

Ridgelines—The horizontal line formed by the juncture of two sloping planes.

Stream channels—The bed of a stream or river.

Upland—Land or an area of land of high elevation, especially when level.

Watershed—The region draining into a river, river system, or other body of water.

WRITING PROMPTS

Water & Your Watershed

Where does the water that falls on the roof of our school go and what happens to it along the way?

- What type of investigation could you design to try to answer questions about the path of your water drop? Can you think of a realistic plan that you can do with your class? List the activities, research, or strategies you could do to learn more about what happens to your drop of water after it falls on the roof of your school.

- Write a brochure for fish and wildlife. Now that you have learned a bit more about your home watershed, think about creative ways that you would create a brochure for your watershed. Just like an advertisement for an amusement park, write a description of all the great things about your watershed. Instead of people though, pretend like you are writing a brochure for fish and wildlife! Try to convince fish, birds, deer, owls, etc., that your watershed has the most beautiful habitat, the best rivers, or greatest trees in all of Oregon.

- Think about all of the information you have learned about your watershed. Is there anyone in your community you could interview to find out exactly where they think the water traveling away from your school would end up? Interview them and then add their answers to everything else you have learned about the way that water flows through your watershed. What does it all mean? Write the story tracing the path that a drop of water takes after falling on the roof of your school.

- Tell a story! Organize a presentation for parents, teachers, or community members to tell them about all the cool stuff you found. Tell them the story of your drop.

1000 DROPS

Water & Your Watershed

PRE/POST EXAM

Name ____

Teacher ____

Grade ____________________   Date __________________

1. Do you think there is more water being created on Earth? Explain.

2. Think of all the things you use water for. How much water does a human use on a daily basis?

3. What exactly is a watershed?

4. In which watershed do you reside?

5. Please describe at least three components of the watershed unit that you live in.

6. Can you recycle water?

7. Name three things you can do to conserve water on a daily basis.

Maps & Mapping

What's in Our Watershed?

A Piece of the Story

The mapping section introduces students to their watershed. Students can learn about the path of water from higher elevations to lower parts of the watershed. By learning about what a watershed is and where their school is located within their watershed, students develop an informed sense of the path that their water drop would likely take.

Welcome to the world of **map**s! A map is an important tool to help understand the world around us. Maps are also valuable for use in recreational activities like hiking and backpacking and for many careers too. The goals of this mapping section are to help students learn more about maps and to help them acquire some basic map reading skills.

After learning how to read a map, your students can use the map of their own watershed to think about where the water for the creeks and rivers near you comes from. Is your school near the mountains? Do you know where the water comes from? Where does it go?

HEALTHY WATERS INSTITUTE MAPS

The maps provided in your 1000 Drops program materials will help students learn some basic details about their home watershed and their place in it. By becoming familiar with their watershed maps, they will be able to see the connections between headwaters, rivers, ridges, and their school.

Take a look at your watershed on your *Healthy Waters Institute* map. What do you notice? Have you ever seen a map like this before? What you think the different colors and bumpy lines represent?

Land and water resource managers, watershed councils, and scientists use maps like this one all the time. Created using Geographic Information Systems (GIS) technology, this map emphasizes watershed boundaries instead of just political boundaries. The higher and lower parts of the watershed are depicted by differences in shading. The bumpy lines represent ridges and mountains. Most importantly, this map shows the headwaters for the creeks and rivers in your watershed. Find the headwaters for your local stream and follow the path of the water down to your home or school.

After completing the mapping activities in this section, students can use their watershed map to inform the story of their water drop.

BACKGROUND

Maps are not new. In fact, from the time man first began to inhabit the earth, maps have appeared in some form or other—i.e. on cave walls, drawings in the sand, early print forms, and now present day examples.

Today, one can find maps that range from the very basic to those that are very complex, both in terms of the information provided as well as the techniques used to portray the information.

Map Legends

Map legends are included on most maps in order to help the map user interpret the information presented on the map. This information is characterized by symbols or shading denoting specific qualitative or quantitative information that the mapmaker wants the viewer to understand. Map legend information often includes text and symbol identifiers for cities and towns, rivers and lakes, roads, airports, schools, parks, land ownership, **relief**, etc. **Map scale**s and compass orientation are also commonly included in the map legend.

Map Scale

A map is a scaled representation of a portion of the Earth's surface. The map scale allows the user to determine how much of the Earth's surface is actually being represented on the map. Most maps are smaller than the area they actually represent and are a generalized representation of what is actually on the ground (See **Figure 1**).

What is the scale of your local watershed map?

Example: 1 inch = 2 miles

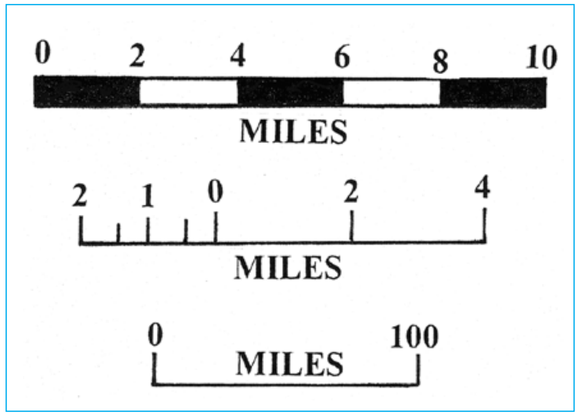


Figure 1. Map Scale Examples

Relief

Relief is defined by Webster as "the difference in elevations or inequalities of a land surface." In simple terms, relief is the measured distance between the high and low elevations of any given area.

*Shaded relief—*Known as plastic-shading in the United States, shaded relief tries to give the viewer the impression of relief in three-dimension. Steeper elevations appear darker or more shaded. Although maps using this technique are easy to visualize, exact elevations cannot be obtained unless the map includes **contour** lines or other techniques such as spot elevations.

*Contour lines—*Contour lines or contours connect all points of the same height, above or below, a common pre-determined elevation. The biggest problem with using contour lines is that many people have trouble visualizing elevation changes using contours. (Please see The Deschutes River photo with contour lines on page AP15 in the appendix.)

*Spot elevations—*A simple system that indicates heights at various locations on maps. This technique provides accurate and precise information for selected locations on the map. It is useful when used with other methods of showing relief.

Getting to Know Your Watershed

Approximate time: 45-55 mins.

Using a **globe** and a laminated world map, determine what is the major difference between a globe and flat maps?

MATERIALS

- Laminated world map
- 11″ x 17″ student map—Oregon watersheds
- 11″ x 17″ student map—specific watershed
- Laminated watershed wall map
- Plastic raised-relief map of students' watershed
- Colored string (15′ per class)
- Plastic mountain contour model with basin and lid
- Globe (showing political boundaries)
- Five sets erasable markers—black, blue & brown colors
- 12″ rulers
- Handheld calculators
- Clear transparencies (1 sheet per group)
- White paper (1 sheet per group)
- Masking tape
- Clean water to add to plastic mountain contour kit

COMMON CURRICULUM GOALS AND BENCHMARKS

*Geography—*Understand and use geographic skills and concepts to interpret contemporary and historical issues.

*Social Sciences—*The study of the social sciences (civics, economics, geography, and history) prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between the past present and future.

GOALS AND OBJECTIVES

Students will:

- Be able to describe the difference between a globe and a map
- Be able to describe why maps are an important and useful tool in determining location of self and other items on Earth
- Be able to identify the different watersheds within Oregon on a map, and locate their specific watershed in which they live.
- Know that Oregon has many watersheds within their state boundary and that their specific watershed is part of the total
- Be able to trace, on a map, the flow of water within their watershed as well as its flow to the ocean
- Be able to trace the flow of water within their watershed as well as its flow to the ocean

PROCEDURE

1. Using the plastic mountain contour model and the accompanying water basin with lid, place the mountain inside the container (see **Figure 2**).
2. Pour water into the container until it reaches the one-inch level on the ruler. Then remove the ruler and put the clear top on the basin. Tape a clear transparency on to the top's surface and use a black marker to trace the level of the water on your transparency. This line represents the first contour line on the mountain.
3. Remove the top and pour additional water to each inch mark on the ruler. At each inch mark, follow the steps above and trace the water level on your transparency.
4. When the water reaches the top of the mountain, remove the transparency and place it over a piece of white paper. View it from a position directly above to see what the contours would look like if drawn on a map. **Figure 3** shows an example of a view from this position.

DISCUSSION

- Where do you think the steepest areas are located (mark these areas with brown pen)?
- Where would the fastest water flows be located (mark these areas with blue pen)?
- What is your highest contour number?
- Is that the highest elevation on your clay model?
- How do you think this information would compare with the contour information that is included on a U.S. Geological Survey topographic map? Use the USGS map provided in your kit to answer this question.

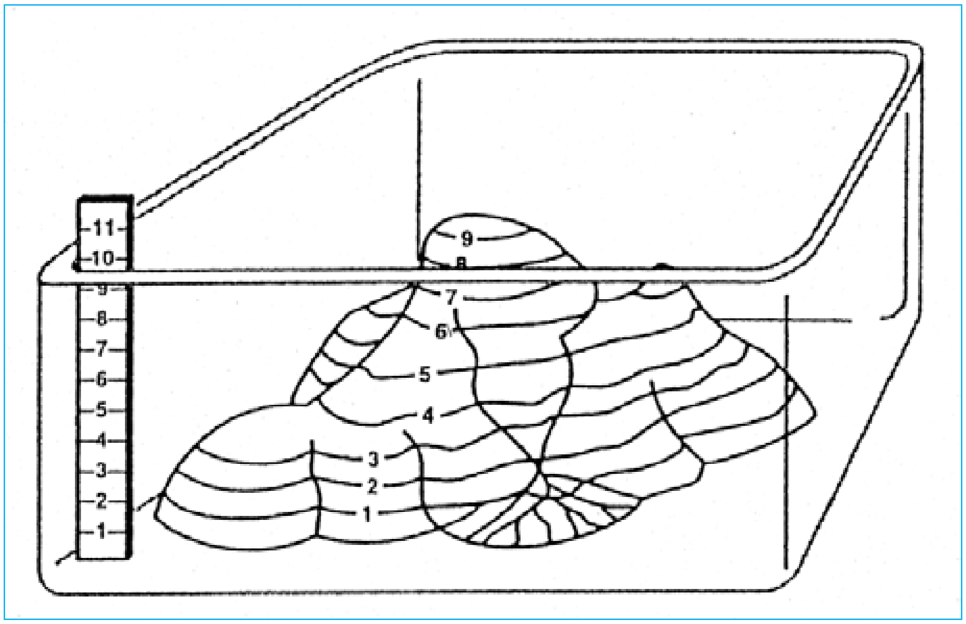


Figure 2. Introducing Students to Contours

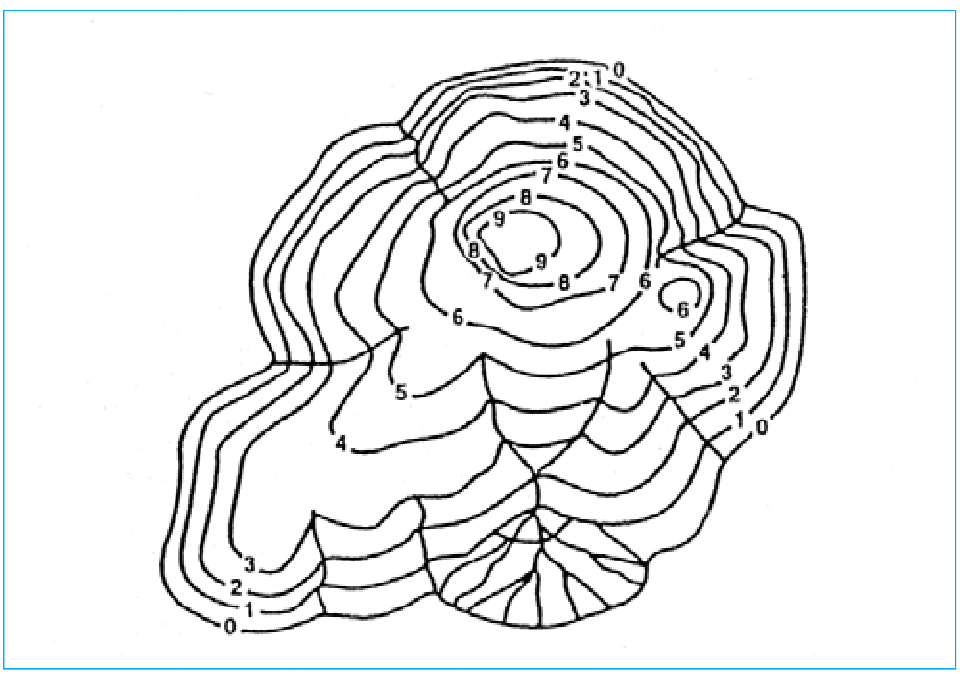


Figure 3. Top View of Contour

Contour—Lines that connect points of the same height above or below a given elevation.

Globe—Ball shaped representation of spherical Earth.

Map—A scaled representation of a portion of the Earth's surface.

Map legend—Key (or explanation section) that helps map users understand the symbols and/or information included on the map.

Map scale—A graphic, verbal, or fractional means of telling map users the amount of the Earth's surface that is included on the map.

Relief—Measured distance between the high and low elevations of any given area.

STUDENT WORKSHEET—Getting to Know Your Watershed

Use the watershed maps provided to answer the following questions:

Map Legends

Map legends are included on most maps in order to help the map user interpret the information presented on the map. This information is characterized by symbols or shading denoting specific qualitative or quantitative information that the mapmaker wants the viewer to understand. Map legend information often includes text and symbol identifiers for cities and towns, rivers and lakes, roads, airports, schools, parks, land ownership, relief, etc. Map scales and compass orientation are also commonly included in the map legend.

What information is included in the legend for your specific watershed map? ____________________

____

____

____

Map Scale

A map is a scaled representation of a portion of the Earth's surface. The map scale allows the user to determine how much of the Earth's surface is actually being represented on the map. Most maps are smaller than the area they actually represent and are a generalized representation of what is actually on the ground.

What is the scale of your local watershed map? Example: 1 inch = 2 miles ______________________

What is the scale of the Oregon Statewide Watershed Map? ___________________________________

Using the 11" x 17" student watershed maps of Oregon and specific watershed:

- ☐ Locate your watershed—and mark the boundaries with a black marker.
- ☐ Using a blue pen—trace the flow of the streams and their tributaries in your watershed (from headwaters to the ocean).
- ☐ Label the headwaters and exit locations of these streams within your watershed.

  What direction does this water flow? ________________________

  What influence does relief have on the movement and direction of the water flow?

  ____

  ____

  ____

  Determine how many miles this water has to travel before it finally reaches the ocean. (Start your measurement from the headwaters in your watershed and use the map scale to determine your map distance.) ____

  ____

- ☐ Locate the watersheds next to your watershed.

Do their streams join your watershed's flow or do they flow into another watershed system?

____

____

____

Use your detailed watershed wall map to answer the following:

What cities and/or towns are located in your watershed? ______________________________

____

____

____

Does your stream (or one of its tributaries) pass through any of these communities?

____

____

☐ Locate your school on the map.

☐ Locate the highest elevation point in your watershed.

Using the plastic raised relief map of your watershed:

☐ Outline the boundary of your watershed with colored string.

What is the major difference between paper maps and the raised relief maps? ____________

____

____

____

Which is easier to use? ____

____

WRITING PROMPTS

Ridgetop to Ridgetop

- Have you ever gone hiking or walking up in the hills or mountains? What is the coolest spot you have been to in your watershed? What did it look like? Imagine you are on the trail again. Write a paragraph describing the smells, sounds, and sights around you.

- What is the highest spot you have been to in your watershed? What did it look like? Imagine you are on the trail again. Draw a sketch of how the contours might look on a map. Describe the landforms; provide details of any water feature you saw.

- Do you live in a valley or on a hill? Can you see the mountains from your school? How are the higher areas of the watershed different from the valleys? Compare and contrast the higher elevation areas in the watershed to the lower valleys.

- Pretend you are taking a hike up a hill on a summer day. The trail you are walking on is right next to a pretty creek. When you stop to rest, you look into the water and notice that there are no fish at all. Where have all the fish gone? Tell a story about what might have happened in the creek.

- Are uplands connected to rivers and streams? If so, how?

- Do you think that it is important to protect or restore watersheds? Write your opinion about watershed protection or restoration.

1000 DROPS

Maps & Mapping

PRE/POST EXAM

Name ____

Teacher ____

Grade ____________________ Date __________________

1. Locate your local watershed on the map of Oregon watersheds.

2. Locate your school on the local watershed map provided.

3. Where in the watershed is your school located? Is it inside an urban area or outside an urban area?

4. What cities and/or towns are located in your watershed?

5. What is the closest stream to your school?

6. What is the distance to the mainstream channel from your school?

7. What is the approximate distance from your school to the source or headwaters of your local stream?

8. What is the approximate distance from your school to the mouth of your local stream?

9. How many miles does the water travel before it finally reaches the ocean (start your measurement from the headwaters in your watershed)?

10. What is highest elevation point in your watershed?

Non-Point Source Pollution

What's in Our Watershed?

A Piece of the Story

The non-point source pollution section introduces students to the concept of storm water and the impacts that non-point source pollution has on local waters. Through direct observation and data collection, the activities will help students tell an informed story of their drop as it travels off the rooftop, across the playground, onto the street, and down a storm drain. This section is designed to help students understand the interactions between their water drop and the pollutants present on the land upon which it flows.

When water hits the roof of your school, your home, or the ground it becomes known as storm water. Storm water is a form of surface water also referred to as runoff which is the primary carrier of **non-point source pollution**. Non-point source pollution refers to all of the pollutants that enter a waterway from land area. The types of non-point source pollution vary from watershed to watershed across Oregon.

Did you know:

- In many communities throughout Oregon anything and everything that enters storm drains feeds directly into our rivers and stream without being treated.
- Pet waste is a major source of bacteria in our rivers and streams.
- Any chemical, including fertilizer, that you use on your lawn or garden can wash into waterways and harm fish and other aquatic life.

A drop of water that falls onto the roof of your school can take many different routes throughout the water cycle to reach the ocean. It might evaporate back into a cloud, it might fall off the roof onto the soil into a thirsty plant's roots, or it may runoff through the school parking lot and travel into a storm drain to reach a nearby river or stream.

In Governor Kulongoski's story, his raindrop fell onto the roof of the State Capitol and traveled through a storm pipe. His drop flowed under the streets of Salem and experienced the "darkness of the pipes interspersed with brief periods of light as the water passed under the storm grates on the streets above. The grates let in more than just light, as rain rushing over the streets collects pollutants, leaves, and other debris." The Governor's drop of water took the path of storm water through Salem.

What about YOUR water drop? What would it experience?

By using direct observation and first-hand data collection to examine non-point source pollution at their school, water quality issues and concerns become meaningful and relevant to students. Students can consider connections between polluted storm water and the health of their local waters. By learning first-hand what types of pollutants are on their school grounds, students can develop strategies for minimizing negative impacts to water quality and stream health.

After completing the activities in this section, students should have an informed understanding of the sources of non-point source pollution on their school grounds. These activities provide the opportunity for students to directly observe water pollutants first-hand.

BACKGROUND

Defining Pollution: Non-Point Source vs. Point Source

Point source pollution comes from an identifiable source such as a pipe. Non-point source comes from wide areas such as runoff from roads and parking lots, erosion from upland activities, road building, and agricultural activities.

Sources of Pollution

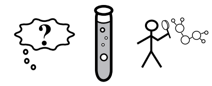
Generally we associate water pollution with pollutants that come from a pipe, such as discharges from factories and sewage treatment plants. Point source pollutants include heavy metals, toxic chemicals, heated water, sewage, radioactive materials and other pollutants from industrial or municipal sources. Often, point source pollutants are the most dangerous. But they are not the only pollutants.

In terms of the volume of pollutants, the largest source is non-point source pollution in the form of surface water runoff. Rainwater and melting snow pick up and carry soil, garbage, and various toxics as they wash over streets, roofs, lawns, construction sites, logging sites, and farm fields. It is estimated that non-point sources are responsible for half or more of all nitrogen, coliform bacteria, iron, phosphorus, oil, zinc, lead, chromium, and copper that enter the surface waters of the United States. Sediments from non-point sources alone are responsible for an estimated $6 billion in damage per year. Even though many non-point sources alone are less toxic than some industrial wastes, they still damage fish and wildlife and their habitats, degrade drinking water supplies, promote **eutrophication**, and damage the aesthetics and the recreation potential of Oregon's waters.

Non-point source pollution carried with surface water runoff is hard to detect and control because it does not come from a single source. It is hidden in many everyday activities. Non-point source pollutants come from farm fields, pastures, backyards, parks, streets, roads, mines and construction sites. Anything on the surface of the land can be carried with surface runoff to gutters, storm drains, or ditches and then on to streams and rivers. Some common sources of non-point source pollutants include:

- Household chemicals, and soaps from driveways, roofs, and yards
- Fertilizers and pesticides from farm fields, yards, parks, golf courses, and landscaped areas
- Oil, anti-freeze, and other toxic materials from streets and roads
- Eroded soil from farm fields, logging areas, and construction sites
- Failing septic tanks

Parking Lot Investigation



Approximate time: 30-40 mins.

MATERIALS

- Spritzer bottles (4 or 5)
- Sponges
- Rubber gloves
- Sample jars with wide lids
- Clipboards for data sheets
- Pencils for data sheets
- Things to filter water samples (coffee filters? sand?)
- Sealed sample jars of common parking lot substances–oil, anti-freeze, tire dust, brake pad dust, (gasoline if that wouldn't blow up!)
- Laminated photos of parking lot swales, leaf traps, retention areas—whatever solutions people are applying to this problem
- Storm drain stencils and kits if applicable

COMMON CURRICULUM GOALS AND BENCHMARKS

*Scientific Inquiry—*Use interrelated processes to pose questions and investigate the physical and living world.

*Physical Science—*Understand structures and properties of matter and changes that occur in the physical world.

*Science in Personal and Social Perspectives—*Understand that science provides a basis for understanding and acting on personal and social issues.

GOALS AND OBJECTIVES

Students will:

- Use observation skills and data recording skills to locate and record sources of non-point source pollution on their school parking lot
- Be able to name two strategies to help reduce the impact of non-point pollution sources
- Manure from livestock and pets

TEACHER PREPARATION

Pollution samples will be used to help students see the effects pollutants have on clean water. Teachers may use anything that is readily available that will visually replicate effects. Use small jars or vials to contain samples; baby food jars work well. Use tape to seal the jars containing hazardous materials.

Sample pollutants may include:

- Brake dust
- Lead weights
- Anti-freeze
- Transmission fluid
- Windshield cleaner
- Oil
- Trash
- Pet waste (rubber facsimile from novelty store would work or animal scat model)
- Fertilizer
- Dirt

PRE-ACTIVITY DISCUSSION

Students will do a visual survey of the parking lot at their building looking for substances on the surface. Students will tally the number of places where they spot oil or other foreign materials. Students will look for and record types of trash that could be swept into the water flow during storm runoff events. Students will examine the parking lot for where the water is directed when it rains. Will it be treated in some way? Students will use spray bottles to put water onto one of the areas they located. What happens? Students will use a sponge and rubber gloves to soak up the sample created and squeeze it out into a sample jar. If there is time students could experiment with filtering the water. What kinds of things do they think are on the parking lot surface?

This activity could lead to storm drain stenciling or going on field trips to see bio swales or leaf litter filters. (Photos of examples of these can be found in the appendix on page AP13 in the appendix.)

NON-POINT SOURCE POLLUTION DATA SHEET AND MAP OF STUDY SITE

Create map/sketch of school area where non-point source pollution activity will take place, see **Figure 1**. Include structures/buildings, playground areas, landscaped areas, parking lots, other features that could impact the flow of stormwater.

Have students make a mark on the map for each foreign substance or stain they find.

Have students look around the parking lot to determine where water is directed during rain events, where does the parking lot drain? Mark these places on the map.

What kind of system is in place? Is it curbs and gutters? Are storm drains stenciled?

Is there trash or other debris such as loose dirt, gravel, mulch, other materials, that could be swept into the storm drains?

What happens to this water? Is it treated after it is captured in a pipe? Does it go directly into a stream? If so what stream? Would this water be filtered in the system that is in place now?

Are there landscape features in place that help to filter water, green streets, **bioswale**s, **ecoroof**s, etc.?

Please include these features in your map if they are present or impact your study area.

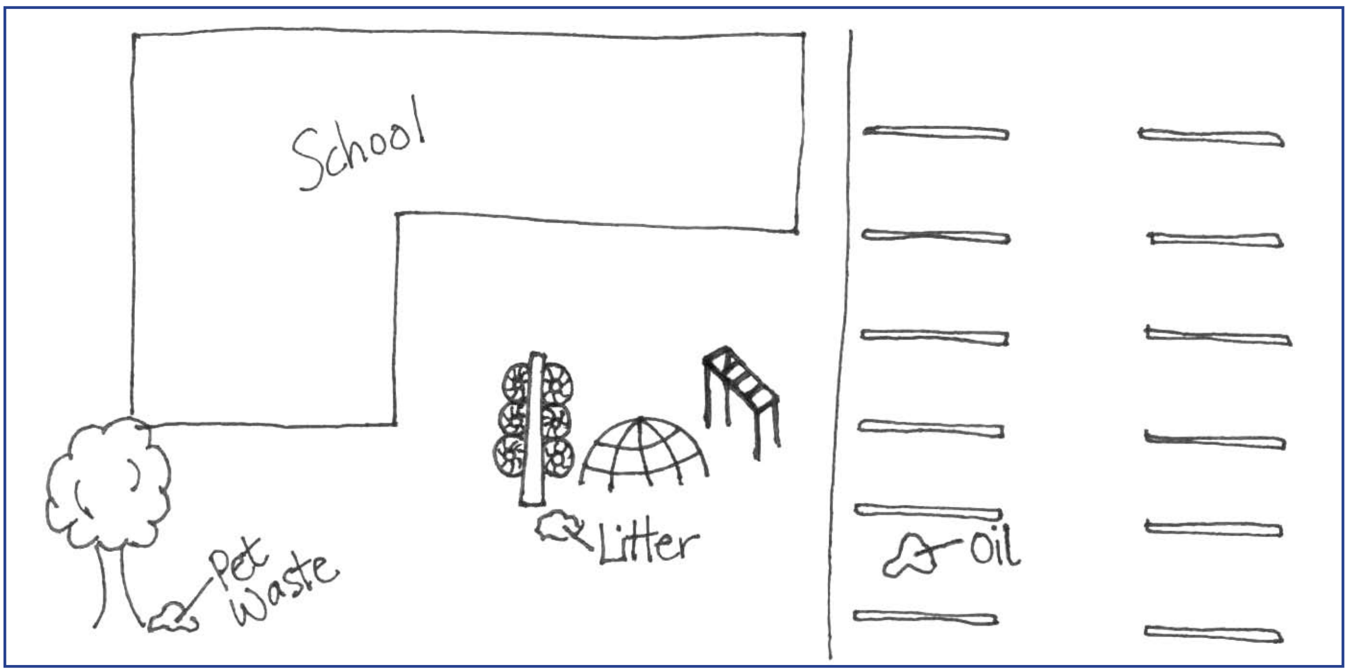


Figure 1. Example of Student Parking Lot Drawing

PROCEDURE

1. Gather the students in the chosen parking lot. Have a brief discussion about water pollution. Let students know that much progress has been made in limiting point source pollution over the years—have them think of some of that type of pollution source. Some ideas include pipes from factories, dyes, process wastes from wood and food manufacture, heated water, etc. Try to think of local examples. Talk with the students about one of our hardest-to-solve water pollution problems now—non-point sources. Compare with point sources and have the students consider why non-point is much harder to deal with. Non-point source pollution is more challenging as it comes from many different sources including brake pad wear, leaks and spills, dust, lawn chemicals, etc.
2. Tell the students that we are going to take a closer look at a non-point source right there at school—the parking lot! Have them consider how many parking lots there are in their town.
3. Find a place outside where the students can sit and make a rough sketch of the parking lot (see **Figure 1**). They can include stripes and structures to make it easier to use as a map. If it is a big parking lot you could divide the group into small groups to take a tally of a certain section and then have them report back. If the parking lot is small the group can stick together.
4. Have the students make a mark on their sketch for each foreign substance stain they can find. You may need to peer under parked cars. As you do this have the students speculate on what the substances might be. You can show the pollution samples you have prepared at this time.
5. How many stained places did they find? What did they think most of the substances on the parking lot are? After you have completed a tally, have the students choose one spot to work with.
6. Have them spray the area with the water bottles.
7. Have them make observations about what happens to the water. This information can be recorded on the sketch/data sheet.
8. Wearing gloves, have them soak up the water with sponges and wring the water out into the sample jar.
9. Make observations about how the quality of the water is changed. Set the sample jar aside for the moment.
10. Have the students look around the parking lot to determine where water is directed during rain events, where does the parking lot drain?
11. Mark these places on the sketch.
12. Have the students make observations about what kind of system is in place. Have them describe it on their sketch/data sheet. Is it curb and gutter? Are the storm drains stenciled? Is there trash or other debris that will be swept into the storm drains? What do the students think happens to this water? Is it treated? Does it go directly to a stream? If so, what stream?
13. If there is time you can have the students try to filter their dirty water through a coffee filter or a coffee filter full of sand. Does this help? Does it remove everything? Would the water be filtered in the system we have now? Use this idea to introduce the idea of parking lot swales and bio-bag filters, etc.
14. Have a number of large laminated photos to show examples. Have some local examples of storm water management that kids might have seen—as at OMSI or other public facilities. (See appendix, page AP11-AP14)
15. Wrap up by saying that folks can make a difference by keeping cars repaired—not leaking. And that it's really helpful to have bioswales in new construction and leaf-bio-filters in already established parking areas. Emphasize that keeping trash out of storm drain systems is important.

STUDENT DATASHEET—Parking Lot Investigation

Visual Survey

How many spots of oil or other foreign materials do you observe? ______________________________

What are these materials composed of? ____

____

____

After spraying the areas identified with water, what happens to the water?

Area 1: ____

Area 2: ____

Area 3: ____

Area 4: ____

Area 5: ____

After collecting samples into jars, make observations about how the quality of the water has changed (some things to note might be color, clarity, presence of solid materials, etc.)

Sample 1: ____

Sample 2: ____

Sample 3: ____

Sample 4: ____

Sample 5: ____

In addition, record types of trash that could be swept into water during a storm event.

_______________, _______________, _______________, _______________, _______________.

If time permits students can try to filter dirty water through a coffee filter or a coffee filter full of sand.

Does this help? ____

____

Does it remove everything? ____

____

Would this water be filtered in the system that is in place now? ______________________

____

Are there landscape features in place that help to filter water? Some examples might be green streets, bioswales, ecoroofs, etc. ____

____

Storm Drain Stenciling

Approximate time: 1-2 hours

MATERIALS

Storm drain stenciling kits can be checked out from local water district offices, watershed councils or environmental services depending on your location.

COMMON CURRICULUM GOALS AND BENCHMARKS

*Social Science—*The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and comtemporary issues, understand global relationships, and make connections between the past, present and future.

*Science in Personal and Social Perspectives—*Understand that science provides a basis for understanding and acting on personal and social issues.

GOALS AND OBJECTIVES

Students will:

- Be able to discuss the function of a storm drain
- Be able to describe the connection between human choices and surface and/or groundwater water quality
- Be able to list three reasons why they played an important role in watershed health through their storm drain stenciling project

PRE-ACTIVITY DISCUSSION

Have students research where water entering the storm drain system ends up. Untreated oil, antifreeze, litter, and pollutants washing directly down into storm drains can impact local streams

Students can inventory the number of storm drains in their neighborhood and create a plan to stencil the message "Dump No Waste...Drains to Stream," next to the storm drains. Students can also create brochures to be distributed in the project area that explain the effect of storm drain runoff on local streams. They can also offer prevention strategies such as:

— Picking up and disposing of pet waste

— Using less fertilizer

— Planting native, drought-resistant plants on property, which require less water and chemicals to survive

— Recycling used oil instead of dumping it

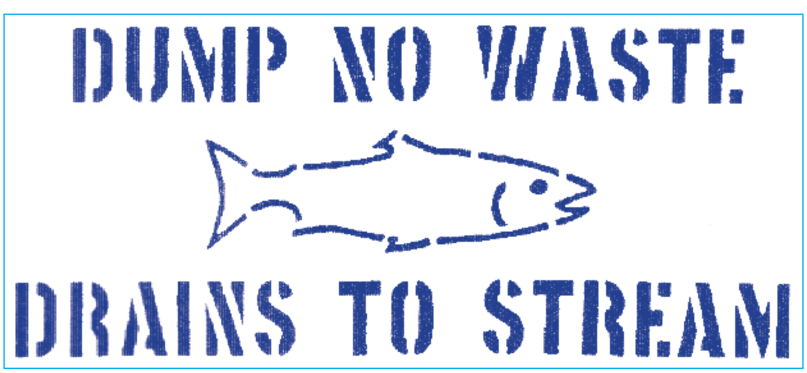
— Maintaining cars to prevent leaks

— Use car washes that recycle water

— Disposing of household hazardous waste on collection days

PROCEDURE

Follow procedure provided by your local water district offices, watershed councils, etc.



GLOSSARY: NON-POINT SOURCE POLLUTION

Bioswale—Broad open channel that is lined with grass and/or other vegetation, which acts as a filter to remove pollutants from runoff.

Ecoroof—A roof planted with vegetation.

Eutrophication—Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth (algae and nuisance plants/weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges.

Non-point source—Materials that come from wide areas such as run- off from roads, parking lots, erosion from upland activities, road building, agricultural activities.

Pollution—Quality of water has been degraded

Point source—Materials that come from an identifiable source such as a pipe.

Stormwater Curb Extension—Green street feature that is landscaped with plants that help filter pollutants from stormwater runoff as well as reduce stormwater flow.

WRITING PROMPTS

What's in the Water?

- Have you ever watched water run down the road during or after a big storm? What does the water look like? Do you see any trash or oil washing down with the water? Describe what the water looks like in your community.
- Pretend you are a fish that lives in a nearby stream. Look around your watery home. What does the water look like? Is the water clean or dirty? Is the water warm or cold? Write a story about your life as a fish living in your home waters.
- How far away is your school from a river or stream? Do you think the water in your local rivers and streams is affected by the parking lot at your school? How?
- Invite a representative from the Oregon Department of Environmental Quality or your local watershed council to visit and be interviewed by your class. Write a list of at least five questions to ask the water quality expert.

1000 DROPS

Non-Point Source Pollution

PRE/POST EXAM

Name ____

Teacher ____

Grade ____________________ Date __________________

1. What is non-point source pollution?

2. What is point source pollution?

3. What happens to rain/stormwater that falls on the roof of your school and the area around the school (parking lots, playgrounds, planted areas)?

4. What are some of the sources of non-point pollution on your school grounds?

5. Name three things that might pollute the water that runs off the roof of your school.

6. Are there any landscape features (retention ponds, planted areas, etc.) or structures (gutters, downspouts, etc.) on your school grounds designed to capture and/or treat storm water runoff?

7. Name four things that you can do to help prevent water pollution.

Non-point Source Pollution Extensions

COMMON CURRICULUM GOALS AND BENCHMARKS

*Scientific Inquiry—*Use interrelated processes to pose questions and investigate the physical and living world.

*Physical Science—*Understand structures and properties of matter and changes that occur in the physical world.

*Social Science—*The study of the social sciences (civics, economics, geography, and history) prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between the past, present, and future.

*Science in Personal and Social Perspectives—*Understand that science provides a basis for understanding and acting on personal and social issues.

A-Maze-ing Water

Students guide a drop of water through a maze of drainage pipes to learn how actions in the home and yard affect water quality.

Approximate time:
Option 1—20-25 minutes
Option 2—Prep: 2 to 3 days; Activity: 10-15 mins.

MATERIALS

For Option 1.
- Can or bottle labeled "chemicals" or "oil"
- Chalk
- Pieces of self-sticking paper, flour, or other materials to represent pollutants found in urban runoff

For Option 2.
- Cardboard 8" x 10" (1 per student or group)
- Sugar, salt, pepper, food coloring, oil, and other materials to represent pollutants found in urban runoff
- Clay or modeling dough (to the right is a simple recipe for modeling dough)
- Wax paper
- Tape
- Wood glue
- Water
- Wax marking pencil
- Pipette or eyedropper
- Pencil and paper

GOALS AND OBJECTIVES

Students will:
- Be able to list and describe urban forms of pollution
- Be able to list and discuss reasons why people should monitor what they put on their lawns or in streets.
- Be able to describe the ways in which urban runoff can be treated

Modeling Dough Recipe

Knead together 1 cup flour, ½ cup salt, ¾ cup boiling water, 1 tablespoon salad oil, and 1 tablespoon alum (optional). If too sticky, add more flour and salt.

BACKGROUND

Most students have washed family cars, seen litter on the sidewalk, or walked a dog. In urban settings, carwash detergent, litter, animal waste, paint, and oil all wash into the street and down storm drains. Investigating what happens to these materials after they enter drainage systems helps students understand how these materials can affect water supplies and aquatic plants and animals.

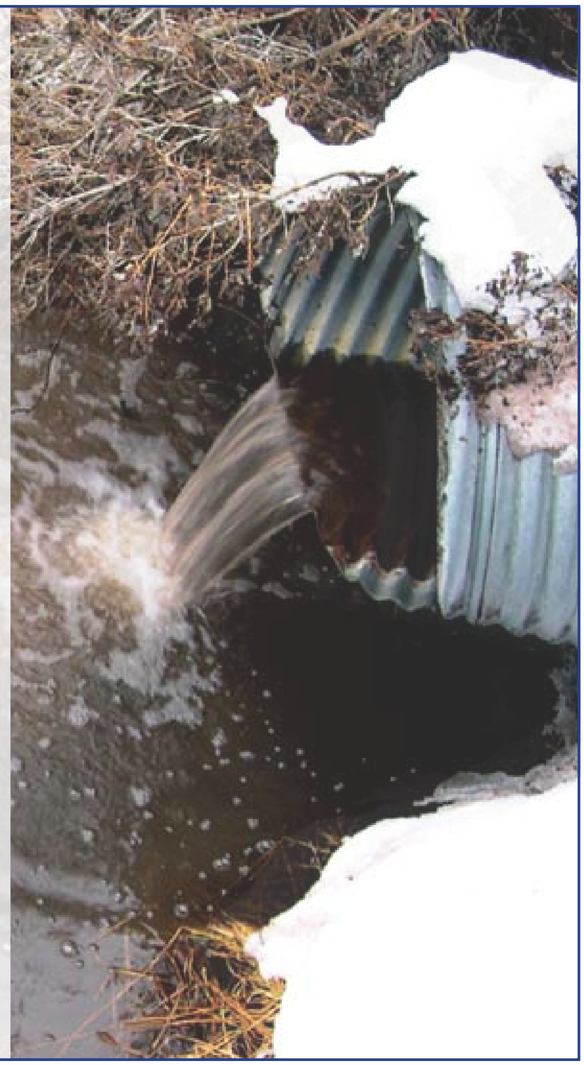
Removing water quickly and efficiently from city streets, parking lots, and schoolyards following precipitation or snowmelt is an important task for municipal governments. Water flowing through city drainage pipes is often referred to as an urban watershed. Before storm drainage systems were common, cities experienced localized flooding because of poor or nonexistent drainage patterns and flooded sewer systems that overflowed with storm water. Both circumstances caused significant health and safety concerns that warranted solutions. Today, most city governments require housing developers to install city-approved storm water drainage systems.

Traditionally, water diverted to storm water systems received little or no treatment before flowing into a stream or body of water. Environmental agencies found that water draining off lawns, sidewalk, driveways, parking lots, and streets carried significant amounts of pollutants. These pollutants included fertilizers, motor oil, litter, pesticides, animal waste, and other contaminants. Receiving waters were degraded, and aquatic plants and animals were affected. Some communities resolved the problem by channeling storm runoff into wastewater treatment plants. But this is an expensive procedure, and some plants are unequipped to process the inorganic materials found in urban runoff. A more cost-effective system was needed to treat storm water discharge. The scenario below describes one such water treatment system.

SCENARIO

Imagine the parking lot of a large shopping center. Each year thousands of cars park in the lot, each depositing a small amount of engine oil and grit (loosened road materials). A gentle rain begins to wash the lot. At the lot's lowest point, oil and gas tainted runoff water begins to flow into the street's gutter. A few blocks away, an urban river flow, filled with floating debris, sediment, and multi-colored water from another street, then another, and another. The flow now nearly fills a ditch constructed to channel urban runoff. From a distance the storm water in the drainage system appear dark-colored. How about the paint a neighbor pours into the gutter? The pet waste near the sidewalk? Whoosh, more water moves by! What next? What about the nearby stream and the people using water downstream for their drinking supply?

You follow the water to a large pond that the city constructed to catch storm water. The water in the pond is now moving slowly through cattails and other emergent wetland vegetation, and its color has started to change. Where is the debris and the sediment? And what about other waste materials? A woman from the city health department tests the water as it enters a small stream; she concludes that the water is cleaner than the river it is about to enter.



Solutions to urban stormwater pollution problems require participation by everyone. Homeowners can help by carefully following directions when applying pesticides and fertilizers, using biodegradable products whenever possible, cleaning up pet wastes, not disposing of household wastes in the street, and fixing oil leaks in vehicles. City sanitation departments can supply information on proper disposal procedures for paint cleaners, used oil, or leftover paint. In addition to developing wetland systems to help treat urban runoff, many city governments periodically sweep roadways to remove wastes. They plant greenways and preserve green spaces to help filter runoff from streets and parking lots. (For a photo of wetland plants that filter stormwater, please see pages AP11-AP12 in the appendix.)

Cities may also install green streets, which help direct stormwater from streets through planted areas which help filter as well as reduce the volume of water before it enters storm drains. Also the installation of ecoroofs can help reduce the amount of storm run-off by providing plants and soil that help to capture run-off before it funnels into gutters. What happens to the water that is captured in rain gutters?

PROCEDURE

Warm Up

Show students a can or bottle labeled "chemicals" or "oil." Tell students you need to dispose of the chemicals and plan to dump them in the street in front of the school. Ask students if they think this is a good idea. Have student s describe what they think will happen to the waste material.

Read the first paragraph of the scenario. Ask students what they think might happen to the runoff.

Following are two options for simulating urban runoff being collected within a storm drain system.

Option 1.

1. Discuss how water is used to clean things, such as the surface of a table after a spill. Relate how rainwater washes the outdoors. Explain that as it flows over plants, soil, and sidewalks, it picks up and carries away soil and other materials. Inform students that cities use water to clean the waste from city streets and sidewalks. Often the water goes down storm drains, collects in pipes, and flows to a river or treatment plant. If a water table is available, younger students can use pieces of tubing and plastic pipe to create a mini-water transport system. They can explore how pipes help water travel over distances by pouring water into one end of a tube and watching it run out in a different location.

2. Draw a simple but large maze on the school blacktop (see Figure 1 on following page) or arrange the chairs in the classroom to form the maze. The maze represents underground pipes that collect and transport surface water that has flowed down storm drain. Have students run the maze. Inform them they are water flowing through the drainage pipes to the river or treatment plant.

3. Discuss sources of water that run into the storm sewer system. Some locations that are sources of water include streets, lawns, parking lots, etc. What might this water carry? Some ideas include oil from cars, fertilizers, litter.

4. To simulate surface water transporting pollutants into drainage pipes, have several students position themselves along edges of the maze. They represent storm drains and the contaminated water flowing through them. They should hold pieces of self-sticking paper or bowls of flour to symbolize the pollutants. When other students run through the maze, the students representing storm drains stick pieces of paper or sprinkle flour onto the clothing of the maze runners to represent contaminated water mixing with water (that may or may not be clean) flowing through the system. Allow students to take turns playing different roles.

5. After several trips through the maze discuss what happens to this dirty water. What if it flows into the river? Can treatment plants process all the waste? Have students summarize why they should not litter.

6. To represent a treatment system, have two students stand at the maze exit. Similar to the game London Bridge, the two treatment students "trap" each passing water student and remove as many pollutants as possible before he or she goes into the river. What are students' attitudes about the quality of this water passing into the river?

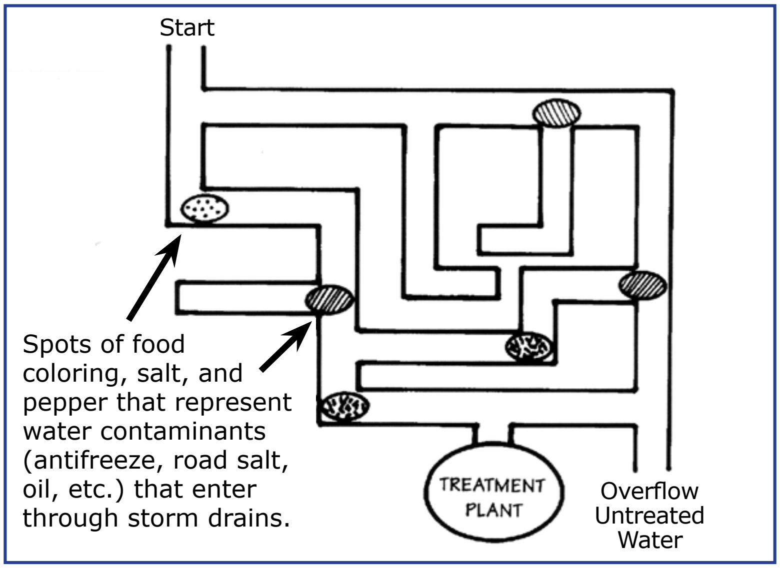


Figure 1. Suggested Maze Pattern

Option 2.

1. Prepare or have students make mazes representing storm pipes carrying away street runoff. (See Figure 1 above) Build each maze on a piece of cardboard covered with wax paper. The walls of the maze are made from clay or modeling dough. Coat the walls and floors of the maze with wood glue and allow to dry.
   NOTE: Both clay and glue will need one day to dry completely.
2. The maze should have one starting point and two exits. One exit leads to a sewage treatment plant, and the other flows into a stream. Use a wax pencil to label the exits.
3. Have students list materials people purposefully or inadvertently add to gutters and storm drains. Have students draw a picture of a city street depicting these activities. They can switch drawings with a partner to see if their classmates can identify the polluting activities.
4. Place drops of food coloring, salt water, and sugar water mixed with pepper on different places in the maze. Allow one day for the water to evaporate. Drops of oil can also be placed at certain locations. These all represent contaminants added to urban waste systems.
5. Tell students to place a drop of water at the starting point and to tilt the maze so that the drop flows slowly toward one of the exits. Toward which one should they aim?
6. As the drop flows through the paths, it should pick up dye from the food coloring, particles from the salt and pepper, and possibly oil droplets. This represents water moving through a municipal storm water system.
7. When the drop reaches the exit, have students describe what the drop looks and feels like. If it ended in the treatment plant, the drop gets replaced with a clean drop of water. If it ended in the overflow ("untreated water" exit), the drop is added to a cup labeled "stream."

DISCUSSION

Discuss the problems associated with untreated urban runoff entering rivers or other bodies of water. Have students identify or research ways contaminated water affects aquatic life and drinking water supplies.

Introduce students to the many actions people can take to limit contaminants entering urban runoff. These include properly disposing of pet waste and litter, and discarding chemicals and oils according to manufacturer's directions. Inform students that many cities have developed systems to treat run-off. Have the students read aloud the scenario on page NPE2.

Fred the Fish

Approximate time: 20-25 mins.

Without water life would be impossible, we use it in many ways—for drinking, bathing, recreation, farming, and manufacturing. We depend on a continuous supply of clean water, yet each time we use it we change it, and each time it rains changes may occur due to runoff and non-point source pollution. Fred the Fish's well-being is drastically threatened in this activity focusing on both point and non-point sources of pollution which adversely affect Fred's habitat.

MATERIALS

- Script page (see following page)
- Scissors
- 9 large index cards
- Glue stick or tape
- Light-colored sponge
- Yarn needle
- Small weight (metal nut)
- String
- Wide-mouthed jar or large beaker
- Cold tap water
- Pencil
- 5 small cups of baby food jars
- Soil
- Brown sugar ("fertilizer")
- Pancake syrup or molasses ("oil")
- Salt
- Punched paper dots ("litter")
- Medium beaker or glass jar
- Detergent
- Warm tap water
- Red food coloring ("sewage")
- Green food coloring ("toxic waste")

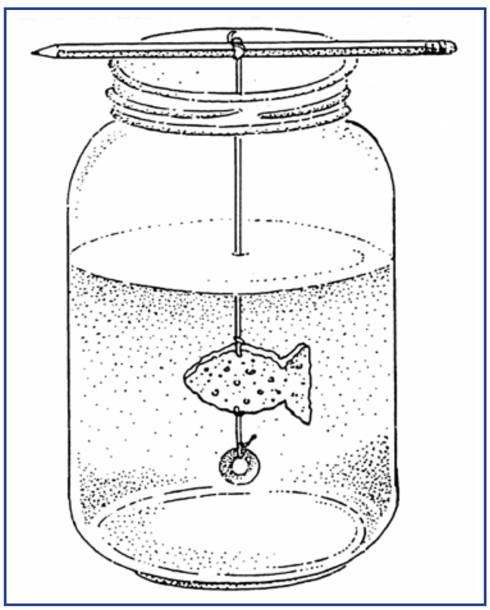


Figure 2. Fred the Fish

GOALS AND OBJECTIVES

Students Will:

- Be able to describe the ways in which our water is polluted
- Be able to discuss the ways in which the polluted water can be cleaned
- Discuss way in which polluted water affects fish and other wildlife
- Develop and identify strategies for preventing water pollution

BACKGROUND

As students read the script cards (see following page), discuss whether each event affecting Fred is the result of point or non-point source pollution. Remember, point source pollution comes from one identifiable, discreet source and can usually be treated at that point to minimize the harmful effects of the pollutant. Non-point source pollution is usually the result of runoff carrying sediment contaminants from the Earth's surface into a body of water.

PRE-ACTIVITY PREPARATION

1. Copy and cut apart the nine roles from the script (see following page), and attach them to the large index cards with tape or glue.
2. Cut a fish shape out of the sponge, use the yarn needle to thread a string through the bottom of the fish, and then attach the weight so it hangs below the fish.
3. Fill the large glass jar or beaker two-thirds full with cold tap water. Thread another string through the top of the fish, and suspend it in the water by tying it to a pencil positioned across the mouth of the jar. Adjust the length of the string until the fish is suspended midway in the jar of water (see **Figure 2**).
4. Number the paper cups or baby food jars 1 through 5, then place soil in cup 1, brown sugar ("fertilizer") in cup 2, pancake syrup ("oil") in cup 3, salt in cup 4, and paper dots ("litter") in cup 5. Pour detergent and warm water into the medium sized jar, and set out red and green food coloring ("sewage" and "toxic waste").

SCRIPT PAGE

Duplicate one sheet per use, cut apart and distribute one script to each of nine students.

---

1. Imagine a clean river as it meanders through a protected wilderness area. In this river lives Fred the Fish. **How is Fred?** Fred has lived in this stretch of the river all his life. But now he is going on an adventure of traveling downstream.

---

2. Fred swims into farm country. He passes a freshly plowed riverbank. It begins to rain and some soil erodes into the river. (Dump soil into Fred's jar.) **How is Fred?**

---

3. Fred nears a housing development. Some fertilizer from the pastures and lawns washed into river awhile back. (Place brown sugar in Fred's jar.) The fertilizer made the plants in the river grow very fast and thick. Eventually the river could not give them all the nutrients they needed, and so they died and are starting to decay. Their decomposition is using up some of Fred's oxygen. **How is Fred?**

---

4. Fred swims beside a large parking lot. Some cars parked on it are leaking oil. The rain is washing the oil into the river below. (Pour pancake syrup into Fred's jar.) **How is Fred?**

---

5. During a recent cold spell, ice formed on a bridge. County trucks spread salt on the road to prevent accidents. The rain is now washing salty slush into the river. (Put salt in Fred's jar.) **How is Fred?**

---

6. Fred swims past the city park. Some picnickers didn't throw their trash into the garbage can. The wind is blowing it into the river. (Sprinkle paper dots into Fred's jar.) **How is Fred?**

---

7. Several factories are located downriver from the city. Although regulations limit the amount of pollution (may be warm water) the factories are allowed to dump into the river, the factory owners are not abiding by them. (Pour warm, soapy water into Fred's jar.) **How is Fred?**

---

8. The city's wastewater treatment plant is also located along this stretch of the river. A section of the plant has broken down and untreated waste is entering the river. (Squirt two drops of red food coloring into Fred's jar.) **How is Fred?**

---

9. Finally, Fred swims past a hazardous waste dump located on the bank next to the river. Rusty barrels of toxic chemicals are leaking. The rain is washing these poisons into the river. (For each leaking barrel, squeeze one drop of green food coloring into Fred's jar.) **How is Fred?**

PROCEDURE

1. Introduce Fred the Fish to the class. Tell them that he has grown up in a protected stream in a nature preserve, but he is about to leave the preserve and journey downstream. The class has been invited to share in his adventure.

2. Distribute the script cards, cups, food coloring, and jar of warm, sudsy water to 9 student volunteers.

3. Ask all the students in the class to number their papers from 1 to 9. As the students with script cards read, those with the appropriate ingredients should dump them into Fred's jar on cue. Every student should write down a different descriptive adjective each time they are asked the question, "**How is Fred?**"

4. After all the ingredients have been dumped in, lift Fred out of the jar, and discuss the change in his appearance and that of the water.

DISCUSSION

Ask students to compare their lists of adjectives, and then draw cartoons depicting Fred's adventure. (See the example below.)

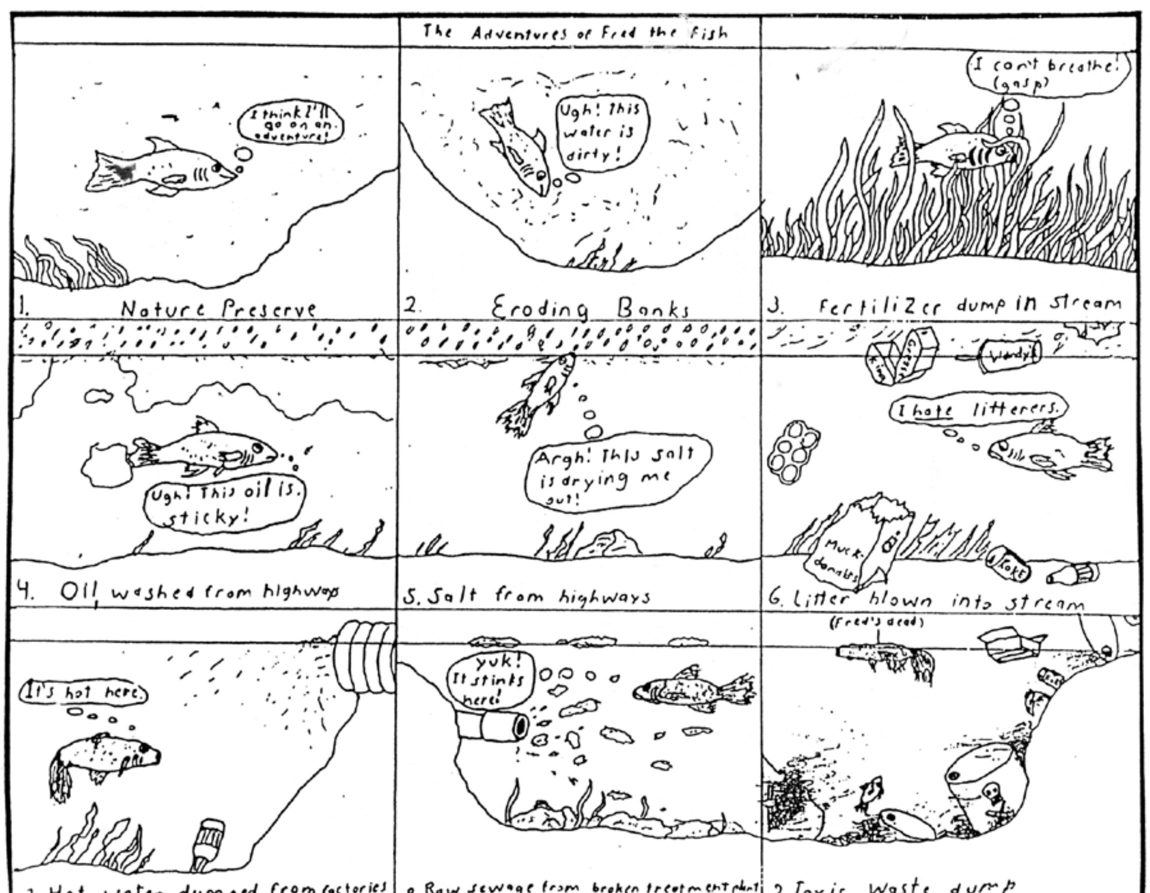
What are some other ways to dispose of Fred's polluted water?

What are the environmental consequences of each alternative?

Where does water go when it is flushed down the toilet? Poured down the sink?

Find out where the wastewater in your home or school goes. Contact your local health department regarding septic systems, or visit a wastewater treatment plant in your community.

TEACHER NOTE: Do not dump the contents of the large jar down the sink. Instead, pour the contents through a strainer over a large, grassy area where natural filtration can take place. Throw away the paper dots strained from the water.



Adventures of Fred the Fish—Cartoon Example

What's Wrong With This Picture?

Approximate time: 10 mins.

GOALS AND OBJECTIVES

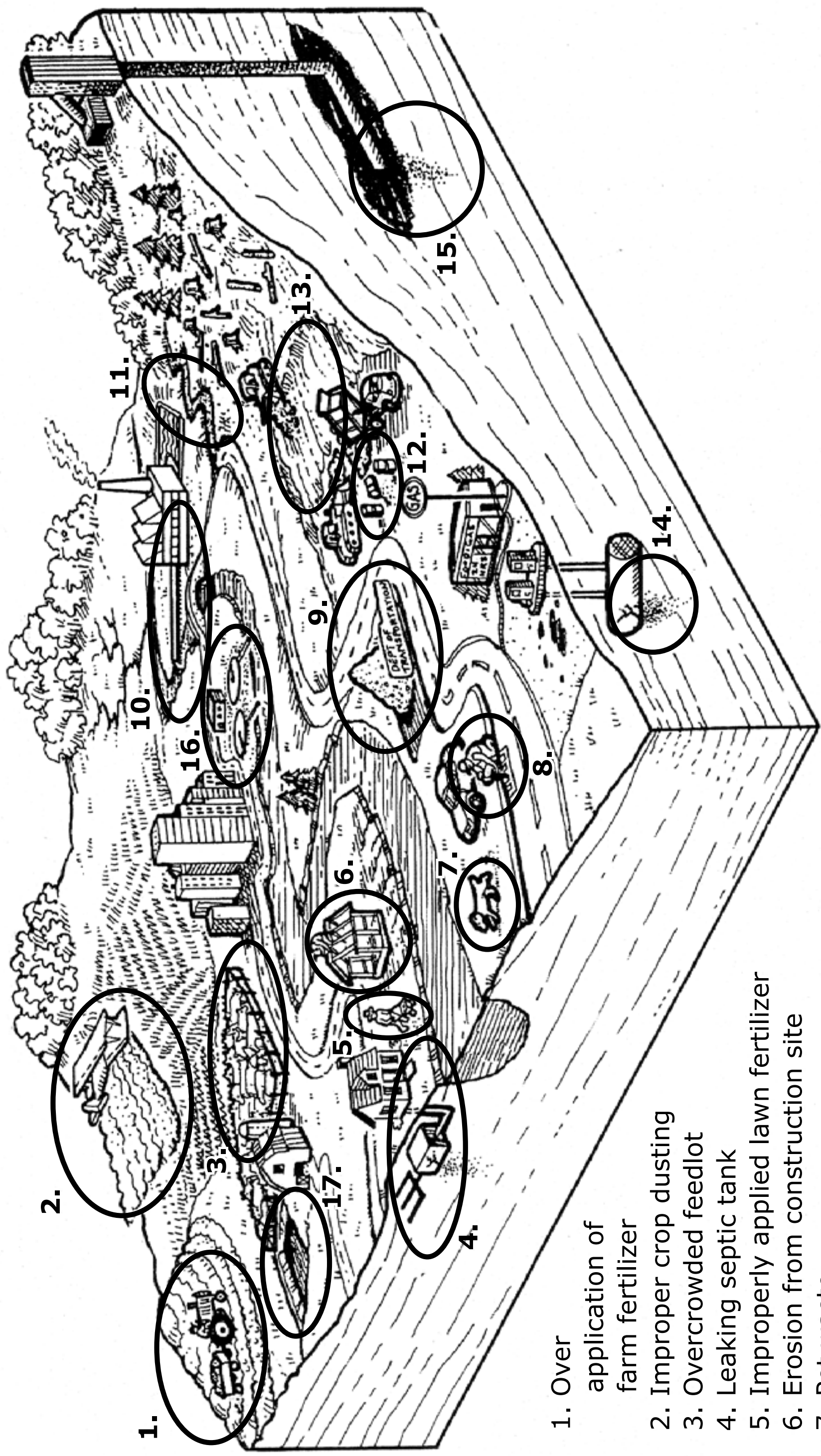
Students Will:

- Be able to identify sources of pollution in the following graphic. Once identified they will determine whether they are point sources or non-point sources pollution

PROCEDURE

Have students work on the student worksheet either in pairs or independently. Help guide them to find and circle potential sources of water pollution.

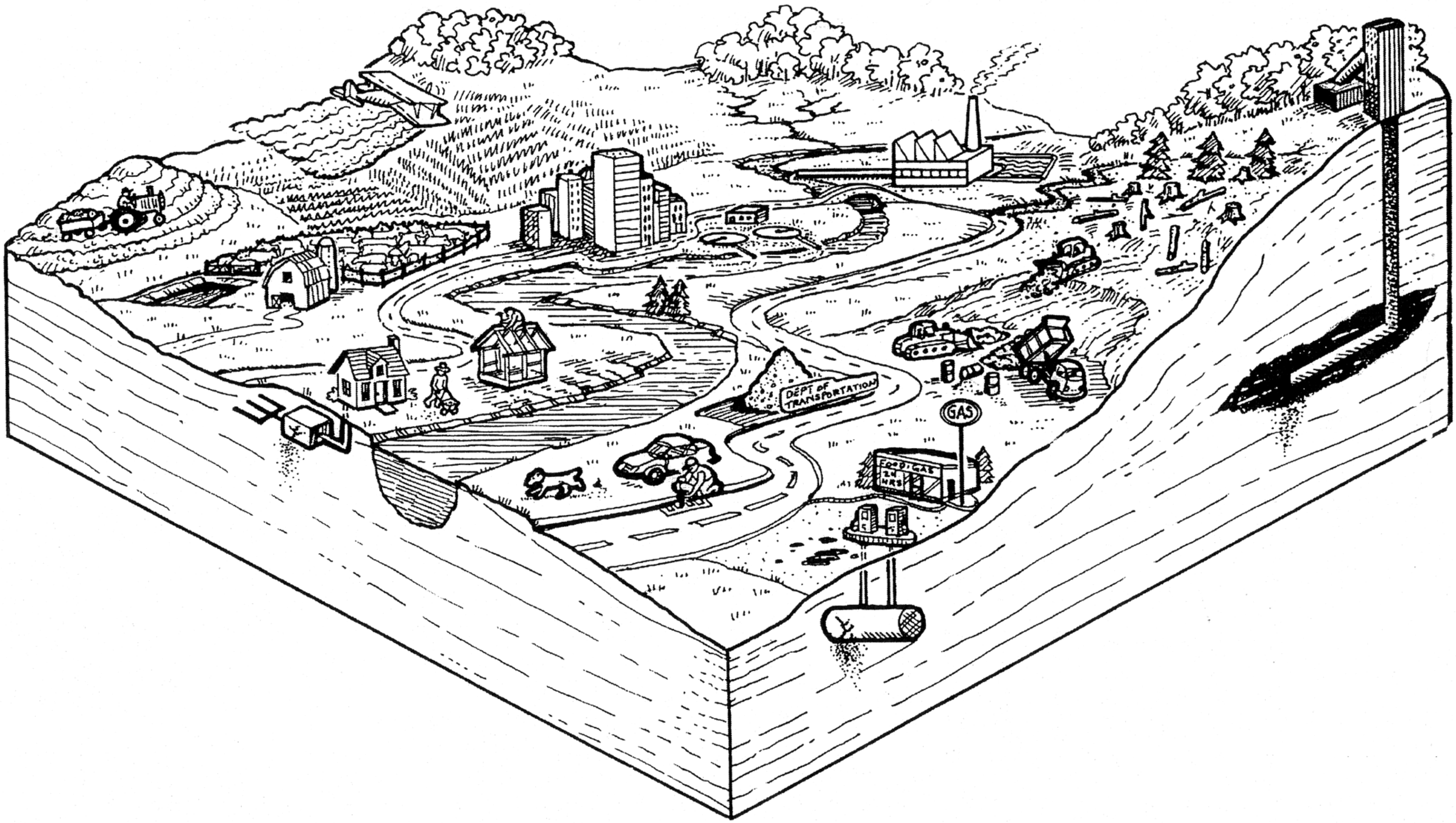
Teacher's Key



1. Over application of farm fertilizer
2. Improper crop dusting
3. Overcrowded feedlot
4. Leaking septic tank
5. Improperly applied lawn fertilizer
6. Erosion from construction site
7. Pet waste
8. Improper disposal of motor oil
9. Road salt
10. Industrial discharge
11. Erosion from logging road
12. Improper disposal of toxic chemicals
13. Landfill
14. Leaking underground storage tank
15. Leakage from mine
16. Municipal sewage
17. Leaking animal watse storage lagoon

STUDENT WORKSHEET—What’s Wrong With This Picture?

There are 17 potential sources of water pollution in this diagram. Circle them and label each one. Determine which ones are point source or non-point source.



Area & Volume

How Much Water Do You Think Falls on the Roof of Your School?

A Piece of the Story

The area and volume section of 1000 Drops is designed to guide students through a process to learn about annual precipitation patterns for their community. After learning about precipitation, students will discover how much water lands on the roof of their school. Students' story of their water drop will be well-informed with information about the climate of their home watershed.

For centuries educators have discovered and used the power of flowing water to draw students into learning. Much as the campfire's flame holds our stare, water flowing out of sight around the curve calls to students and their teachers to follow along on the ever-changing journey. One of the many dynamic moments of water's journey is **precipitation**.

The **area** and **volume** section of 1000 Drops invites students to ask important questions about the quantity and quality of water both before and after it hits the roof of their school. By measuring, calculating, or estimating the area of their school roof and the volume of rainwater or snow that falls upon it, students will consider the relationship between precipitation, runoff, and the impacts to the health of their home waters. Students will consider some of the positive and negative effects that the water leaving their school may have on any wildlife habitat that receives **runoff**.

This activity will inform students about the water that falls on the roof of their school. The knowledge gained will help them tell the story of their drop as it reaches the rooftop and eventually contributes water to the local stream system.

BACKGROUND

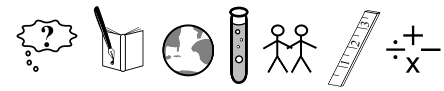
Calculating the **weight** and volume of rainfall will help students consider the relationships between rainfall and runoff, including effects on wildlife and the environment. Rainfall is one form of precipitation and is one way water enters aquatic habitats. Once rain falls upon a surface, water begins to move both laterally outward and vertically downward.

In many parts of the state including central, south eastern, and eastern Oregon, most of the precipitation in the area falls in the winter months as snow. In parts of central Oregon near the Deschutes River the snow melts and then percolates through the porous soils to recharge groundwater. Groundwater emerges through seeps and springs and replenishes the surface water in the Deschutes River. The role that snowmelt plays varies around the state, but generally, mountain snow fields act as natural temporary reservoirs, storing precipitation during the winter until the spring when most or all of the snow pack melts and releases water into rivers, streams, or into groundwater. (Please see photo of snow melt fed Tumalo Creek on page AP15 in the appendix.)

Lateral movement of water is called runoff and finds its way into streams, rivers, and lakes. Vertical movement of water seeps into the soil and porous rock and recharges groundwater supplies.

Runoff is necessary to renew the aquatic habitats that depend on the inflow of water. In most parts of Oregon, runoff is the dominant way that water moves from one location to another. Impermeable surfaces such as roads, parking lots, and paved playgrounds create rapid drainage that can dramatically change runoff characteristics in an area. Non-point source pollution causes more than half the water pollution problems in Oregon. Through runoff, many non-point source pollutants find their way into rivers and streams. Additionally, runoff is responsible from the **erosion**, transport, and deposition of sediments scoured from the land.

Up on the Rooftop



Approximate time: 35 mins.

MATERIALS

- Calculator
- Trundle wheel
- Yardstick
- Rain gauge
- Twine
- Water cycle graphic (see pg. A7)
- GPS units

COMMON CURRICULUM GOALS AND BENCHMARKS

*Science Inquiry—*Use interrelated processes to pose questions and investigate the physical and living world.

*English Language Arts—*The practice of writing, prewriting, drafting, revising and publishing prepares students to better communicate across the subject areas.

*Earth and Space Science—*Understand physical properties of the Earth and how those properties change.

*Physical Science—*Understand structures and properties of matter and changes that occur in the physical world.

*Social Science—*The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and comtemporary issues, understand global relationships, and make connections between the past, present and future.

*Meassurement—*Students will apply appropriate techniques, tools and formulas to determine measurements.

*Mathematical Problem Solving—*Select, apply and translate among mathematical representations to solve problems.

GOALS AND OBJECTIVES

Students will:

- Be able to determine the approximate surface area of the roof of their school building and/or the area of their school grounds
- Be able to read graphs or tables to determine yearly rainfall and/or snowfall in their watershed
- Use formulas to calculate the amount of water that is possible to collect off the school roof
- Calculate the number of gallons that would be contributed to the local stream system annually
- Be able to define runoff
- Begin to ask important questions about the roles that humans play in affecting the quality and quantity of runoff
- Be able to discuss surface water management

PROCEDURE

1. Determine the total area for the study site. If you choose to calculate the area for your entire school grounds, the outer dimensions will be sufficient. You do not need to subtract the area of the buildings because precipitation falls on them as well. If you choose to study only the area of your school roof, you can measure the on-the-ground footprint of the buildings. The length and width of the study site must be measured.

   The formula for calculating area of a rectangle is:

   Area = Length x Width
   (or A = L x W)

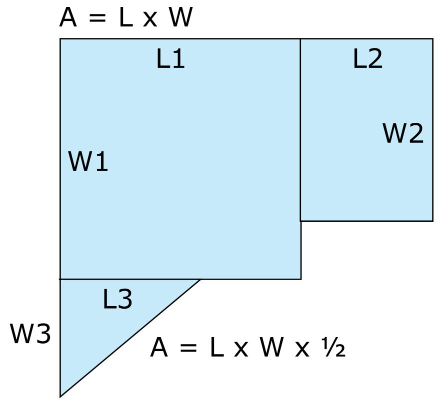
   The formula for calculating area of a triangle is:

   Area = Length x Width x ½ the area of a rectangle
   (or A = L x W x ½)

2. The students can use a tape measure or a length of twine (30 meters in length). Use an ink marker to mark the twine every meter (every 3 feet). If available, a trundle wheel can be used for measuring.

NOTE: Calculating the area in this activity might be made more challenging due to irregularly shaped study sites. However, there are easy ways to break the study site into more regular shapes for calculating.

Here is one example:



Area 1 = A1 = L1 x W1
Area 2 = A2 = L2 x W2
Area 3 = A3 = L3 x W3 x ½

Area Total = A1 + A2 + A3

3. Once the area of the study site has been established, the next step is to determine the amount of precipitation that falls in the area.

   Students may:

   - Research annual precipitation averages, highs, and lows by contacting resource agencies such as the Forest Service, USGS, watershed councils, soil and water conservation districts, or local meteorologists.
   - Use a rain gauge to measure the amount of rain over a period of time.
   - Calculate the amount of rain that falls in a given storm.
   - Use a yardstick to measure the depth of the snow pack over a period of time. Have the students take daily measurements for at least one week and make a chart with their findings.
   - Work with USGS to discuss water content in snow.

   Once the students have decided on a way to measure the amount of rain or snow that falls during a specified period of time, have them calculate the amount. This calculation will give students a value for the depth of rainfall or snow pack on the surface of the land.

4. Calculate the volume of rainfall. If the area of the study site is 4,500 square meters (50,000 square feet) and the annual rainfall is 15 meters (0.5 feet) then the students' calculation would look like this:

   4,500m2 x 0.15 m = 675 m^3 of rain

   (50,000 ft^2 x 0.5 feet= 25,000ft^3)

   The volume of rain is 675 cubic meters (25,000 cubic feet) of rain.

5. Once they know the volume, students will be able to calculate the weight of rain. Water weighs 62.5 pounds per cubic foot (lbs/ft^3) or 1,000 kilograms per cubic meter (kg/m^3). Therefore, the weight of rain would be:

   675 m3 x 1,000 kg/m3 = 675,000 kg

   25,000 ft3 x 62.5 lbs/ft3 = 1,562,500 lbs

   The weight of snow varies due to the snow's water content. Students will have to either estimate the weight for each cubic foot of snow or complete extension number four on page A7.

6. All measurements and calculations in this activity inform and emphasize for students that there are high volumes and weights of water moving through the **water cycle**. All of the water that students measure and study is eventually a part of wildlife habitat. This is important to note within a discussion about humans' role in the quality and quantity of water that eventually reaches aquatic habitats.

7. Use context and comparisons to make the volume amounts more meaningful for students. (Example: The rainwater amount would fill a swimming pool.)

8. Lead a class discussion and assign writing activities using the critical thinking writing prompts provided.

GLOSSARY: AREA & VOLUME

Area—The size or surface of an enclosed two-dimensional region.

Erosion—Movement of soil by water or wind.

Precipitation—Rain, snow, hail, or sleet falling to the ground.

Runoff—Water that drains over the surface of the land.

Volume—The amount of space occupied by a three-dimensional object as measured in cubic units.

Water cycle—The continuous circulation of water in systems throughout the planet; including condensation, precipitation, runoff, evaporation, and transpiration.

Weight—A measure of the heaviness of an object.

STUDENT DATA SHEET—Up on the Rooftop

Names of Student(s):____ Date:_____________

Field Notes *(describe the site, weather conditions, other observations):*

Total Area of Study Site	
Annual Precipitation Average	
Volume of Rainfall at Study Site	
Weight of Rain	

Questions:

1. Does your watershed receive more precipitation as rain or as snow? ______________________

2. What kind of container could hold the amount of water that falls on the roof of your school? ________

____

____

3. What could you do with the water if you collected it? _________________________________

____

____

____

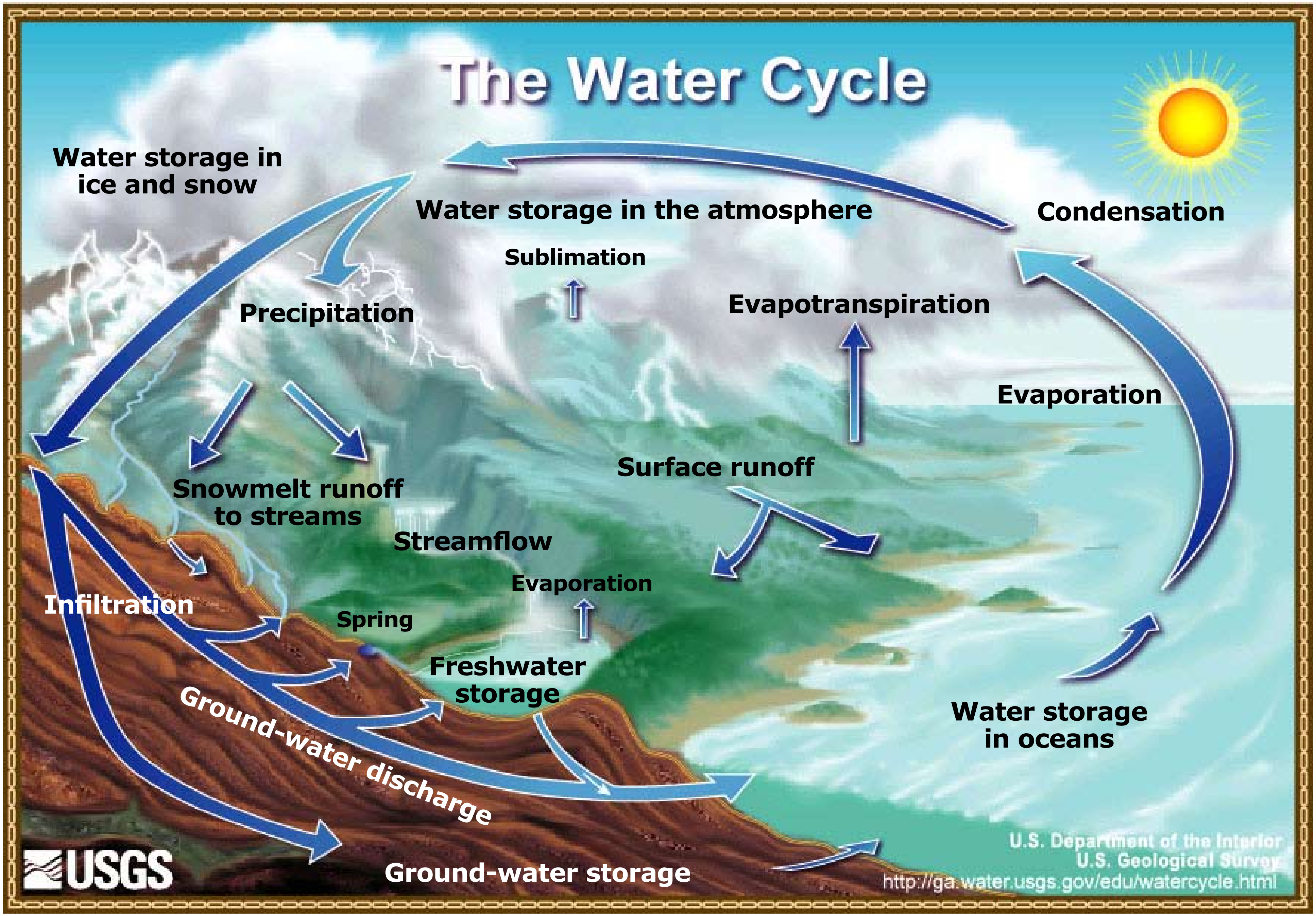
____

____

4. How much water do you think falls on the roof of your home? __________________________

____

____



The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Surface runoff
Snowmelt runoff to streams
Streamflow
Evaporation
Infiltration
Spring
Freshwater storage
Water storage in oceans
Ground-water discharge
Ground-water storage
USGS
U.S. Department of the Interior
U.S. Geological Survey
http://ga.water.usgs.gov/edu/watercycle.html

WRITING PROMPTS

Up on the Rooftop

- Write one paragraph about the roof of your school. Is it steep? How big is it? How could you find out?

- Write down at least five questions that you would ask if you could interview an expert and then invite a hydrologist from your local forest service or watershed council to come visit your class. Do you live in a part of Oregon that gets a lot of rain? How many days a year do you think it rains? Think of some local agencies or businesses that might have information about annual rainfall amounts in your area.

- Write a story about what the playground at your school would look like if it rained every single day for two months. Where would the puddles or ponds form? Would the ground be super mushy? Would different plants grow? Do you think there would be different birds or animals visiting the area? In a paragraph or two, describe what your playground would look like.

- Write down some of your ideas for using the water reclaimed from the roof of your school. Think about the water that collects on the roof of your school. Is there a way to collect that water? If so, what could you do with it? Research the term "reclaimed rainwater" on the internet. What did you find?

- Write one paragraph about the different paths water might take around your schoolyard. Is your school surrounded by grass? Concrete? Trees? How much water do you think is absorbed by the different surfaces at your school? How much water runs off?

1000 DROPS

Area and Volume

PRE/POST EXAM

Name ____

Teacher ____

Grade _____________________ Date ___________________

1. What is the surface area of the roof of your school?

2. What would you do to find out how much rain or snow your hometown receives every year?

3. What is the yearly rainfall and/or snowfall in your hometown?

4. Either from rain or snow, how many gallons of water falls on the roof of your school?

5. What is runoff?

6. Name three things that might pollute the water that runs off the roof of your school.

7. Name four things that you can do to prevent water pollution.

Area & Volume Extensions

GOALS AND OBECTIVES

Students will:

- Be able to engage in discussion of storm water runoff and drainage around their school grounds
- Be able to point out the location of school downspouts and drains
- Use rain gauges to measure precipitation patterns in their watershed
- Be able to list potential impacts to groundwater and surface water health
- Be able to discuss their personal role in conserving water and contributing to groundwater and surface water health
- Be able to use alternate methods to calculate the amount of water that is possible to collect off the school roof
- Be able to engage in discussion about storm water management and be able to list 3 impacts storm water has on local rivers and streams

TEACHING SUGGESTIONS

1. Obtain a map of the study site and check it against the accuracy of the one made by the students. Make a copy of the study site map and plot runoff routes on it. Identify drainage patterns during rainstorms. Estimate how much water is draining in specific places.
2. While outside, locate downspouts and drains.
3. Place a rain gauge on the grounds and measure actual amount of rain. Repeat your calculations.
4. Get active! Have students make a snowball in the shape of a cube. Use a ruler or a yardstick to ensure that it is one cubic foot and then place the snow cube on a scale. How much does it weigh? Use this weight in the above calculation for determining the weight of rainwater.
5. Encourage your students to ask additional questions about the health of both surface water and groundwater. How might groundwaters become contaminated and affect the health of humans and/or wildlife? Have students research the possible sources of groundwater or surface water contamination in your watershed. What can be, or is being done to reduce or eliminate sources of pollution?
6. Ask students to brainstorm alternate ways to determine area. Some ideas include pacing, estimates, or using a GPS unit.
7. Discuss ideas about people saving and using rainwater.
8. Try to guess how many gallons of water accumulates when one inch (2.5 cm) of rain falls on one acre of land. **(A: About 27,154 gallons or 102,800 liters of water!)**

Soils, Slopes & Sediment

How Does Soil and Slope Affect Water Flow?

A Piece of the Story

The Soils, Slopes & Sediment section is designed to help students understand the interaction between their water drop and the land upon which it flows. By learning about slope, erosion, and infiltration, students can begin to examine what human and environmental factors affect water as it travels along its path.

As you continue on your quest to learn about water—where it comes from and where it goes—you will eventually begin to look closely at the path of water on the ground. The point in the water cycle when water has precipitated out of the clouds and has fallen upon the roof of your school or the schoolyard, the riverbanks or the road is the point at which water affects and is affected by the land. The Soils, Slopes & Sediment section of 1000 Drops explores what happens to water when it interacts with the land.

Hydrology is the study of water and hydrologists study the many properties of water. Specifically, hydrologists examine the path that water flows through creeks, rivers, and even across the land. The factors that influence where and how water flows are many; they include vegetation types, land management decisions, soil type, and gradient.

GRADIENT

The term gradient refers to the degree of slope, or steepness of a topographic feature. You probably already know that water flows downhill but, do you know what happens to it along the way? In addition to spending a lot of time studying water as it flows, hydrologists also examine how water affects the land that water flows across. The waters of Oregon and everywhere in the world play a dramatic role in a process called erosion. Erosion refers to the movement of soil by water or wind. When water runs over the surface of the ground it picks up and transports some of the materials that it flows over. The Erosion Boards activity in this section helps to demonstrate how different surfaces on slopes affect runoff and erosion.

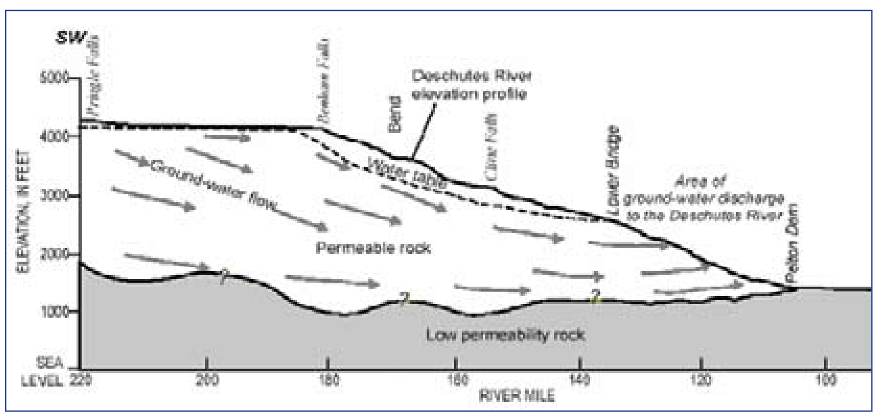


Figure 1. Deschutes Watershed Groundwater Table

INFILTRATION

Water doesn't always just flow over the ground, however; sometimes it flows INTO it. The term used to refer to the entry of water into soil is infiltration. Depending on the soil type in your watershed, water infiltrates into the soil at different rates. The soils in the upper Deschutes watersheds are volcanic and very porous so water infiltrates through the soil and into groundwater supplies very quickly. The Compacted and Uncompacted Soils activity in this section is designed to help students begin to think about the connection between water and soil in their watershed. By comparing the different paths of water in compacted versus uncompacted soils, students can consider the role of human impact on soils, runoff, and water quality.

After completing the activities in this section, students should have an informed understanding about the interaction between water and soils. These activities provide a peek into the path of their water drop over and under the ground.

Compacted and Uncompacted Soils

Approximate time: 30-40 mins.

MATERIALS

- 2 large cans of the same size with bottoms cut out to make open cylinders—coffee cans work well (with multiple groups you will need a set for each group as they get damaged easily)
- Rubber hammer to tap can into soil
- Stopwatch
- Water
- Water measuring cups—4 cup measures work well
- A quadrat for plant type observations

COMMON CURRICULUM GOALS AND BENCHMARKS

Understand changes occurring within lithosphere and hydrosphere of Earth.

*Earth & Space Science—*Recognize that soils vary in color, texture, components, reaction to water, and ability to support plant growth.

*Life Science—*Group or classify organisms based on characteristics.

GOALS AND OBJECTIVES

Students will:

- Measure, record, and discuss water **infiltration** in compacted and non-compacted soils
- Record and discuss the differences in plant types in compacted and non-compacted soils
- Be able to discuss how compacted and non-compacted soils affect water infiltration, which affect plant survivability

BACKGROUND

Soils ability to support plant growth can be affected by being compacted, not allowing water to penetrate and making water and nutrients unavailable to plants. Large areas of **compacted soil**s with little vegetation can cause an increase in runoff, a decrease in water retention, and an increase in sediment loads in stream systems.

Soils and vegetation in a watershed can influence what plants and animals live there, how long into the summer the streams flow, water temperature, and water quality.

PROCEDURE

1. Select two sites to test. One should be a heavily used walking area and one should be a low traffic area.
2. Tap the coffee cans into the soil ½ inch deep.
3. Pour equal amounts of water into each can.
4. Students will time and record how long it takes each measured amount to drain into the soil.
5. At the same sites use a **quadrat** to set off an area around the coffee can.
6. Have students complete a visual assessment and record the number of different types of plants present.

DISCUSSION

1. How does walking on trails and other areas affect soils porosity?
2. What makes the difference between sites?
3. What will happen to rain water at each site?
4. Are there differences between types and numbers of plants observed at each site?
5. Do you think this activity would be different at a sandy beach? On a rocky mountain slope? On a rich farm? Why or why not?

STUDENT DATA SHEET—Compacted and Uncompacted Soils

Names of Student(s):____ Date:_______________

Vocabulary: *Soil porosity*—How fast water can pass through soil.
Compacted soil—Soil that is tightly pressed together.
Uncompacted soil—Soil that is loose.

Question: How does walking on trails affect the soil porosity and plant diversity?

Hypothesis:

If people______________________________________, then______________________________________.

Design:

- Select two sites
  1. High traffic site
  2. Low or no traffic site
- Plant diversity sample: Use a quadrat.
- Soil porosity sample. Use the following equipment to test soil porosity:
  1. Coffee can
  2. Trowel
  3. Hammer
  4. 1 cup of water
  5. Stop watch

Tap the coffee can ½ inch into the ground. Pour 1 cup of water into the middle of the can and record the time that it takes for the water to drain into the soil.

Data:

	High Traffic Site	Low Traffic Site
Plant Names	1:	1:
	2:	2:
	3:	3:
	4:	4:
	5:	5:
	6:	6:
	7:	7:
	8:	8:
	Total number of plant species:	Total number of plant species:
	Soil porosity time:	Soil porosity time:

Analysis:

	High Traffic Site	Low Traffic Site
Average for all the groups for plant diversity		
Average for all the groups for porosity time		

After considering your data, was your hypothesis supported? Were the results what you guessed? How do you know? ____

____

New Question: What new questions do you have after doing this experiment that could lead to further investigation? ____

____

Erosion Boards

Approximate time: 30-40 mins.

MATERIALS

- 2 erosion boards—one covered with sponges or carpet, one bare—boot trays work well—cut a V or drill a large hole in one end of the tray—don't worry about this if using wooden boards
- 2 watering cans—can be gallon sized
- 2 dish tubs to catch water
- Food coloring or Kool-Aid —can represent loose soil on bare board or other pollutants in sponge set up

COMMON CURRICULUM GOALS AND BENCHMARKS

*Earth & Space Science—*Understand changes occurring in the hydrosphere and lithosphere.
Identify effects of water on Earth materials using models.
Identify factors affecting water flow, soil erosion, and **deposition**.

GOALS AND OBJECTIVES:

Students will:

- Be able to demonstrate how different surfaces on slopes affect **runoff** and **erosion**
- Be able to identify three kinds of runoff deposited in stream systems during precipitation events and discuss how they affect plants and animals in the stream

BACKGROUND

Vegetation protects soils from being broken down and compacted by rain. Healthy soils contain large amounts of decomposed **organic matter** (**humus**). Humus can absorb lots of water just like a sponge. Spaces between soil particles can also hold water. Compacted soils hold less. The make up of soils determines how much water they can absorb.

Healthy soils will absorb rain and snowmelt until they become saturated. In this situation water seeps into streams more slowly, reducing erosion and sediments. It also reduces the chances of flooding since the water is stored in the soils.

Plants benefit from healthy soils too as they have water available for longer periods of time. Plant roots grow and open up more channels that allow the water to enter the soil more easily. Plant stems and leaves physically slow water flow also reducing erosion and sediment loads.

In a healthy watershed, streams flow clear even after heavy rains.

River systems with poor soils experience flooding and sedimentation in streams. Raindrops hitting exposed soils makes the fine soil particles fly into the air and as they collect on the soil surface again they clog up the spaces in the soil creating a "seal". The water then has no way to soak in but quickly runs off carrying sediments that end up in the streams.

Sediments that end up in streams can harm aquatic plants and animals. Muddy, murky water blocks sunlight which plants need to make food. Sediment can also settle on leaves making it hard for plants to produce food. Sediments can even just bury plants.

Sediments can clog fish gills causing suffocation. Sediments also settle into spaces in the gravels reducing oxygen for fish eggs and fry and can make aquatic insect habitat unsuitable.

PROCEDURE

1. Prepare the 2 trays or boards—one should represent hard ground the other covered with sponges or outdoor carpet to represent vegetation.
2. Set both trays or boards in a dish tub to catch the water. If you like you can add food coloring or sprinkle Kool-Aid on the surfaces to make the water paths more visible.
3. Sprinkle both trays or boards with the watering cans at the same rate of flow for the same amount of time.

4. Make observations about differences between the two surfaces. You can repeat at different angles to show how steepness affects runoff as well.

DISCUSSION

1. Is the amount of water in each tub the same? Why or why not?
2. Why is it important to pour the same amount of water into each board system when doing this experiment?
3. Would the amount of water or the rate that we poured it onto the boards make a difference in the outcome? How?
4. Why is vegetation important in a watershed system? How would the presence or absence of vegetation affect a stream?
5. How does excess sedimentation affect plants and animals in a stream?
6. Do you think road building, construction, farming, logging, grazing, or other types of development would influence erosion and sedimentation in streams?
7. How could those impacts be minimized?

Erosion
This is an unvegetated streambank on the Deschutes River. Many studies have been completed on erosion and sedimentation problems in the Deschutes and this type of steep bare bank discharges substantial amounts of sediment into the river when water flows are high.

STUDENT DATA SHEET—Erosion Boards

Name ______________________________ Date ______________________

	Hard Cover Board	Vegetation (Soft) Cover Board
Amount of Water in Tub	Trial 1:	Trial 1:
	Trial 2:	Trial 2:
	Trial 3:	Trial 3:
	Average:	Average:

Sediment Jars

Approximate time: 10-20 mins.

MATERIALS

NOTE: It would be best to use local soils for this activity!

- Strong clear plastic quart jars. Mayonnaise or peanut butter jars work well.
- Soils of different particle sizes—clay, loam—whatever soils are common in your area
- Small gravels or sands—again what would be common in your stream systems
- Black tape or other strong tape to seal lids

COMMON CURRICULUM GOALS AND BENCHMARKS

*Earth & Space Science—*Understand changes occurring in the hydrosphere and lithosphere.
Identify effects of water on Earth materials using models.
Identify factors affecting soil **erosion**,
and deposition. Make observations.

GOALS AND OBJECTIVES

Students will:

- Be able to describe how different soil types and sizes settle out in disturbed water
- Be able to draw or describe their observations of soil and water dynamics with this deposition model
- Discuss how the model would apply to a stream system

BACKGROUND

Moving water is a very effective transporter of **soils** and gravels and rocks. As water velocity and volume increases more and more particles of larger and larger sizes can be moved. **Sediment**s drop out of the moving water when the water slows. Heavier particles drop away most quickly forming areas with similar sized particles in stream systems. Fine particles can remain suspended the longest. Erosion and **deposition** are important in creating stream structure, such as gravel bars and islands, as well as meanders, pools, and riffles.

River systems with poor soils experience flooding and sedimentation in streams. Raindrops hitting exposed soils makes the fine soil particles fly into the air and as they collect on the soil surface again they clog up the spaces in the soil creating a "seal". The water then has no way to soak in but quickly runs off carrying sediments that end up in the streams.

Excessive sediments that end up in streams can harm aquatic plants and animals. Muddy, murky water (**turbidity**) blocks sunlight which plants need to make food. Sediment can also settle on leaves making it hard for plants to produce food. Sediments can even just bury plants.

Sediments can clog fish gills causing suffocation. Sediments also settle into spaces in the gravels reducing oxygen for fish eggs and fry and can make aquatic insect habitat unsuitable **Figure 2**.

PROCEDURE

1. Prepare the sediment jars.
2. Put in soils and gravels samples to fill the jar about half full.
3. Top off the jar with water.
4. Put the lid on tightly.
5. Wrap the black tape around the lid to keep it sealed.
6. Have the students shake the jars well to model a large storm event.
7. After a good mixing let the jars settle without disturbing them. It would be good to have the students set them on a table or on the ground to avoid continued disturbance. Allow the jars to sit for several minutes. Depending on your local soil types most things will settle in less than 5 minutes. (Clays may stay suspended for days!)

8. Have the students make observations of the jars.

9. Have student make a sketch of their observations.

DISCUSSION

1. How would you describe our soil samples that went in the jar? Clayish? Lots of organic materials? Sandy? Full of stones?

2. What material is on the bottom of the jar after shaking? What is on the top?

3. Why do you think the soils and gravels did what they did as they settled?

4. How do you think this pattern might apply to our stream in a storm?

5. How does normal deposition affect plants and animals? How would excessive sedimentation affect plants and animals in a stream?

6. What size particles do you think move the farthest in a stream? Do you think the **velocity** of the water would make a difference? Why or why not?

7. After settling is your water completely clear or turbid? How long do you thin the water would take to become clear again?

Figure 2. Clear River (left) vs. Sediment in River (right)

Compacted and Uncompacted Soils

Compacted soil—Soils that have been pressed down making the soils particles get close together.

Infiltration—Entry of water into soil.

Quadrat—A data collection tool that sets off a measured area (usually a square meter) to make collection of information standardized.

Soil porosity—Tiny spaces in between soil particles that can allow water and air to enter.

Erosion Boards

Deposition—Depositing of material by a stream, generally at points of reduced velocity.

Erosion—Movement of soil by water and wind.

Humus—Decayed organic matter in or on the soil's surface.

Organic matter—Broken down bits of living things that are a component of soil.

Runoff—Water that drains over the surface of the land.

Saturated soil—Soil that has absorbed as much water as is possible.

Vegetation—Plants and trees.

Sediment Jars

Deposition—Depositing of material by a stream generally at a point of reduced velocity.

Erosion—Movement of soil by water or wind.

Soils—Loose upper layer of the Earth in which plants grow.

Sediment—Solid particles carried and deposited by water.

Turbidity—Degree to which light penetration is blocked by muddy or cloudy water.

Velocity—The speed at which something is moving.

WRITING PROMPTS

Water Flows Downhill

- Does your school sit on a hill? In a valley? Are there any streams or rivers nearby? Write a paragraph describing your schoolyard.

- Define slope. Explain how slope affects runoff at your school.

- Does your schoolyard have lots of bushes or trees? Does it have grass? Is there bare soil anywhere? What happens to the bare areas when it rains? Write a paragraph describing at least two ways that erosion affects rivers or streams.

- What is sediment? Are there places on your school grounds that might add sediments to a local stream?

- Think of at least three questions about the impact that erosion or sediment has on fish. Invite a fish biologist from your local forest service to come to your class for an interview.

1000 DROPS

Soils, Slopes, and Sediment

PRE/POST EXAM

Name ____

Teacher ____

Grade _____________________ Date ___________________

1. What is erosion? Can you name two things that slow erosion down?

2. How does healthy soil full of humus affect erosion and runoff?

3. Please list three things that can happen to plants and animals if a stream has cloudy or muddy (turbid) water flowing in it.

4. Name two possible sources of sediments that could end up in your local stream?

5. Does the steepness of a slope have an effect on how much erosion is caused by water running down it? What is the effect?

6. What sized particles settle out first in your sediment jar? Why?

7. Is it easy for water to soak into soil that gets walked on a lot? Why or why not?

8. Does soil compaction have an effect on plant growth? Why or why not?

Soils, Slopes & Sediment Extensions

Gradients can help determine the **velocity** of a stream. High gradients are usually found at the headwater of a stream. They are characterized by lots of white water and have the energy to move large objects. Low gradients are often found near the mouth of a stream. Low gradients stream portions have slow moving water and lack the energy to carry large suspended materials. As a river slows, the larger material in the load drops out, until only fine suspended material remains. This material is often what makes a river or stream look murky.

BACKGROUND

Gradient is the slope of a stream usually this measurement is represented as change over distance. Gradient influences stream velocity. Gradient varies from stream to stream and within streams. The headwaters of a stream may have a gradient of 123 feet per mile, where the mouth of a river will have smaller gradient. The Mississippi River has a gradient of 3 inches per mile. The gradient of a stream bed effects the velocity at which the water flows.

The ability of a stream to erode and transport materials is directly related it its velocity: thus, it is a very important characteristic. Even slight variations in velocity can lead to significant changes in the **sediment** load a stream can transport. Factors affecting the **erosion**al capabilities of a stream are gradient; shape, size and roughness of channel; and discharge. We will focus on gradient for this activity.

Lowe Creek
Steep, unvegetated banks like this one can discharge high quantities of sediment into the water column.

Sandy River
The Upper Sandy River after a major flood event in November 2006.
Heavy rain along with above freezing temperatures helped to break up the Sandy glacier up on Mt Hood sending a large quantity of sand mixed with water down the river. The sand was deposited throughout the watershed and created sand banks up to 20 feet tall in some parts of the upper watershed. Also, large boulders along with uprooted trees were deposited in the stream channel.

The Slope of a Stream

Approximate time: 30-40 mins.

MATERIALS

- Stadia rod
- Level line (string)
- Clipboards

GOALS AND OBJECTIVES

Students will:

- Be able to use a hand level and stadia stick
- Be able to use formulas to determine the % gradient of an area on their school grounds
- Be able to define gradient
- Be able to discuss
- Be able to explain how gradient affects runoff at their school
- Be able to name three things that having sediment in water does

PROCEDURE

For both methods have students break up into groups of three. Each student will have a responsibility, one will record data, and the other two will do the measuring.

Note this activity was designed using a stream. If you do not have a stream within walking distance of your school look for a small hill on campus, or if your gym has bleachers or if there is an elevated stage on campus use these to measure an elevation change. Have a student stand on the floor (point A) with a stadia stick, and have another student stand on the bleachers or stage (point B).

You can choose to do one or both of these methods. Data sheets are provided for each method. If you choose to do both methods there is a data sheet that will help you compare the two.

Math Note

The formula we have provided may seem difficult, but it is really rather simple and will introduce the idea of symbols in math to your students.

The formula is % gradient = $(\Delta E/D) \times 100$

To verbalize the formula one would say "Percent Gradient is equal to the Change (Δ) in Elevation (E) and is divided by the Distance (D) multiplied by 100.

The delta symbol Δ is used in math and science to represent change.
The change is elevation (ΔE) is equal to the height of the line at point A minus the height above the ground at point B.

Example problem:

The height of the line at point A is 27 inches, and the height of the line above the ground at point B is 7 inches. Then, $\Delta E=27-7=20$ inches. Let's say the distance between point A and point B is 5 feet (60 inches), so $D=60$ inches. Then,

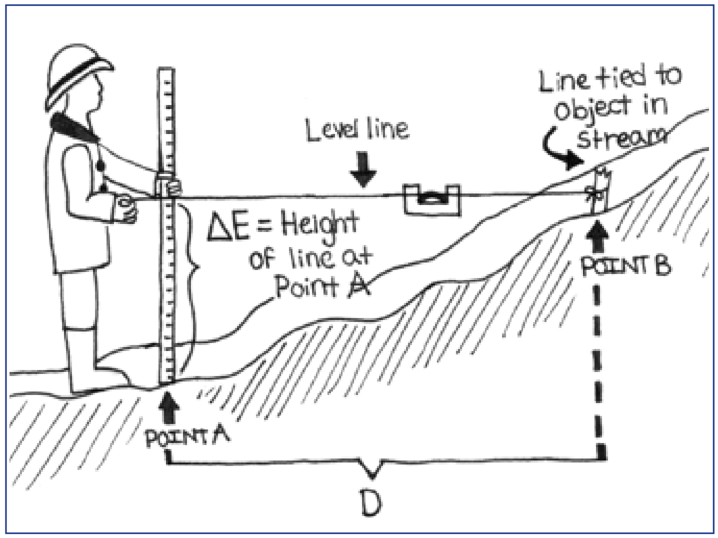
% gradient = $(\Delta E/D) \times 100$ =

% gradient = $(20/60) \times 100$ =

% gradient = $(0.33) \times 100 = 33.3$

Level Line Method

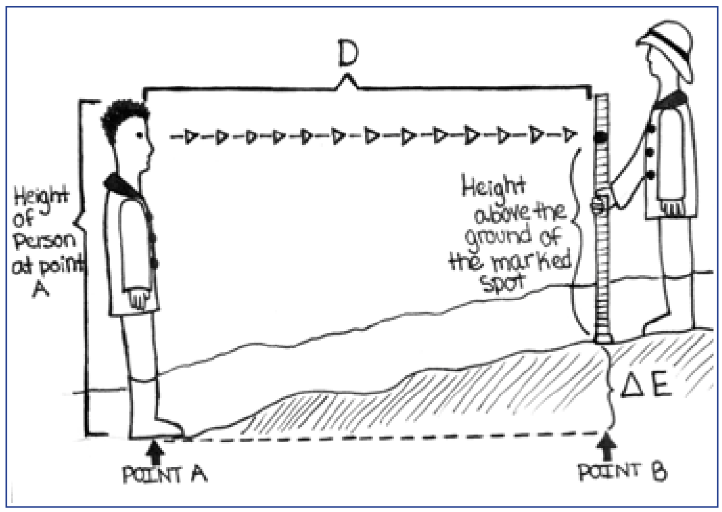
1. Have a student hold a line at the upstream point (point B). Have a second person stand at a point downstream (point A) holding a stadia rod. Attach the string to the stadia rod, and keep the string level to the line on the stadia rod.
2. Keeping the string level, measure the height of the line off the ground. Also, measure the distance between the two points, which will be the length of the line between where the student holding the stadia stick is and where the other student is.
3. Use the formula to determine the % gradient of the location you have chosen to use.



Drawings provided by Kayla Waldorf
Corvallis Middle School

Line of Sight Method

1. One person stands downstream at point A and looks straight and level at a stadia rod held by a second person standing upstream at point B.
2. The person at point A notes the exact spot on the stadia rod that their level line of sight reaches. The person holding the pole at point B then marks this spot and measures the height of the spot above the ground.
3. Use a tape measure or line held taut above the ground to measure the distance between points A and B. Make sure you do not measure the distance at ground level, because this will be greater than the true straight-line distance between the two points, unless the gradient is very flat.
4. Use the formula on the next page to calculate the % gradient between points A and B. Repeat this procedure for two other sections of your reach and then find an average value for the gradient of your location.



GLOSSARY: SOILS, SLOPES & SEDIMENT EXTENSIONS

Erosion—The wearing down of material by various forces of weather, man, or chemical processes.

Gradient—The slope of a stream; generally measured in feet per mile.

Sediment—Solid fragments of inorganic or organic material that come from the weathering of rock and are carried and deposited by wind, water, or ice

Sedimentation—The process of matter settling to the bottom of a liquid.

Velocity—The rate of change of position along a straight line with respect to time; the derivative of position with respect to time.

Weathering—Erosion by weather.

STUDENT DATA SHEET—Slope of a Stream: Level Line Method

Name ____ Date ______________________

Level Line Method—Select two locations to take measurements in. Take three measurements in each location and record the measurements below. To determine the average % gradient at each location, total the measurements for each location and then divide the sum by 3.

Measurement #	**Location 1**	**Location 2**
M1		
M2		
M3		
Average % gradient		

Describe Location 1 and Location 2:

1. What are your estimates for % gradient for your location?

2. How did your estimates compare with the actual measurements?

3. What do the actual % gradients tell you about the area you measured?

4. Do you think the water would move quickly or slowly in your location?

STUDENT DATA SHEET—Slope of a Stream: Line of Sight Method

Name ____ Date ______________________

Line of Sight Method—Select two locations to take measurements in. Take three measurements in each location and record the measurements below. To determine the average % gradient at each location, total the measurements for each location and then divide the sum by 3.

Measurement #	**Location 1**	**Location 2**
M1		
M2		
M3		
Average % gradient		

Describe Location 1 and Location 2:

1. What are your estimates for % gradient for each location?

2. How did your estimates compare with the actual measurements?

3. What do the actual % gradients tell you about the area you measured?

4. Do you think the water would move quickly or slowly in Location 1 and Location 2?

STUDENT DATA SHEET—Slope of a Stream: Combined Method

Name ____ Date ______________________

Level Line Method—Select two locations to take measurements in. Take three measurements in each location and record the measurements below. To determine the average % gradient at each location, total the measurements for each location and then divide the sum by 3.

Measurement #	Location 1	Location 2
M1		
M2		
M3		
Average % gradient		

Describe Location 1 and Location 2:

Line of Sight Method—Follow the same directions as before to complete this table.

Measurement #	Location 1	Location 2
M1		
M2		
M3		
Average % gradient		

1. What are your estimates for % gradient for each location?

2. What are your estimates for % gradient for each method?

3. Are your estimates different for each method If yes, why?

4. How did your estimates compare with the acutal measurements?

5. What do the actual % gradients tell you about the area you measured?

6. Do you think the water would move quickly or slowly in Location 1 and Location 2?

INVITATION TO WRITE FOR PUBLICATION

The Story of My Drop

Where does it come from...?
Where does it go...?

- Close your eyes for a minute and imagine one drop of rain landing on the roof of your school. SPLAT! Where do you think that raindrop came from? Pretend that you are that raindrop and tell a story about where you came from.

- Do you ever have to do the dishes at home? As you are washing the dishes, think about the water coming out of the faucet. Where does that water come from? If you know, write one paragraph describing where your community get its drinking water. If you don't know, how could you find out?

- Everyone needs and uses water. Imagine you woke up one day and had no water. Tell a story about a day without water.

- Do you know someone who takes REALLY long showers? Can you think of any reason for that person to take shorter showers? In on or two paragraphs, try to convince that person to take shorter showers.

- If a raindrop fell on the roof of your school or your house, where would it go? Imagine that you are that raindrop. Where would you go?

SUBMIT YOUR WORK

The Healthy Waters Institute would like to invite you to write the story of your water drop. Submit a piece of writing for publication consideration in our journal, healthy waters.

Editorial Guidelines:

- Submissions must be all original work.
- Form can be editorial, narrative, descriptive, persuasive, or even poetic. The rain clouds are the limit!
- Content must include the story of your drop of water. (Please see "A Story of My Raindrop" by Governor Ted Kulongoski from the second edition of *healthy waters,* a copy is provided for you on page vii.)
- Length can vary—anywhere from an 11 word haiku to a 500-word story about your drop of water.

Please call your Regional Education Coordinator from the Healthy Waters Insititute (listing on page v) for more information regarding content, deadlines, format, etc., or email the healthy waters editor at editor@ortrout.org.

Submissions may be sent to:

Healthy Waters Editor
65 SW Yamhill Street
Suite 300
Portland, OR 97204

OR

editor@healthywatersinstitute.org

FAX 503-222-9187

Appendix

Benchmarks List

WATER & YOUR WATERSHED

Why is Water Important?

Science Inquiry

Benchmark SC.05.SI.01
Benchmark SC.05.SI.03
Benchmark SC.05.SI.04

Geography

Benchmark SS.05.GE.03.03
Benchmark SS.05.GE.04.01
Benchmark SS.05.GE.04.02
Benchmark SS.05.GE.07
Benchmark SS.05.GE.07.02
Benchmark SS.05.GE.08.02

Earth & Space Science

Benchmark SC. 05.ES.01.03

Physical Science

Benchmark SC. 05.PS.01

Social Science

Benchmark SS.05.GE.07
Benchmark SS.05.GE.07.01
Benchmark SS.05.GE.07.02

Mathematical Problem Solving

Benchmark MA.05.PS.01

We All Live in a Watershed

Science Inquiry

Benchmark SC.05.SI.01
Benchmark SC.05.SI.03
Benchmark SC.05.SI.04

English Language Arts

Benchmark EL.05.RE.18
Benchmark EL.05.RE.09

Physical Science

Benchmark SC. 05.PS.01

Geography

Benchmark SS.05.GE.02.01
Benchmark SS.05.GE.02.02
Benchmark SS.05.GE.03.03
Benchmark SS.05.GE.04.01
Benchmark SS.05.GE.04.02
Benchmark SS.05.GE.07
Benchmark SS.05.GE.07.02
Benchmark SS.05.GE.08.02

MAPS & MAPPING

Geography

Benchmark SS.05.GE.01
Benchmark SS.05.GE.01.01
Benchmark SS.05.GE.02.01
Benchmark SS.05.GE. 02.02
Benchmark SS.05.GE.03.03

NON-POINT SOURCE POLLUTION

Science Inquiry

Benchmark SC.05.SI.03
Benchmark SC.05.SI.04

Social Science

Benchmark SS.05.GE.07
Benchmark SS.05.GE.07.01
Benchmark SS.05.GE.07.02

AREA & VOLUME

Science Inquiry

Benchmark SC.05.SI.01
Benchmark SC.05.SI.03
Benchmark SC.05.SI.04

Earth & Space Science

Benchmark SC. 05.ES.01.03

Physical Science

Benchmark SC. 05.PS.01

Social Science

Benchmark SS.05.GE.07
Benchmark SS.05.GE.07.01
Benchmark SS.05.GE.07.02

Measurement

Benchmark MA.05.ME.04
Benchmark MA. 05.ME.08

Mathematics

Benchmark MA. 05.CE.12
Benchmark MA.05.PS.01

SOILS, SLOPES & SEDIMENT

Compacted and Uncompacted Soils Activity

Science Inquiry

Benchmark SC.05.SI.01
Benchmark SC.05.SI.03

Earth & Space Science

Benchmark SC.05.ES.01.02

Life Science

Benchmark SC.05.LS.05
Benchmark SC.05.LS.01

Erosion Boards Activity

Science Inquiry

Benchmark SC.05.SI.01
Benchmark SC.05.SI.03

Earth & Space Science

Benchmark SC.05.ES.03.01
Benchmark SC.08.ES.02
Benchmark SC.08.ES.02.01
Benchmark SC.08.ES.03.03

Sediment Jar Activity

Science Inquiry

Benchmark SC.05.SI.01

Earth & Space Science

Benchmark SC.05.ES.03.01
Benchmark SC.08.ES.02
Benchmark SC.08.ES.03.03

Benchmarks Table

	WATER & YOUR WATERSHED	Why is Water Important?	We All Live in a Watershed	MAPS & MAPPING	NON-POINT SOURCE POLLUTION	AREA & VOLUME	SOILS, SLOPES & SEDIMENT	Compacted and Uncompacted Soils Activity	Erosion Boards Activity	Sediment Jar Activity
Science Inquiry		✓	✓		✓	✓		✓	✓	✓
English Language Arts			✓							
Geography		✓	✓	✓						
Science & Technology					✓					
Earth & Space Science		✓				✓		✓	✓	✓
Life Science								✓		
Physical Science		✓	✓			✓				
Social Science		✓			✓	✓				
Measurement						✓				
Mathematical Problem Solving		✓				✓				
Science in Personal and Social Perspectives		✓			✓	✓				

Benchmarks

WATER & YOUR WATERSHED

Common Curriculum Goals (CCG) and Benchmarks for Science

This activity, Why is Water Important?, may be used to meet the following common curriculum goals and benchmarks for Science Inquiry:

CCG—Forming the question/hypothesis—Formulate and express scientific questions or hypotheses to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.

CCG—Collecting and presenting data—conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize and summarize data from investigations.

CCG—Analyzing and interpreting results—analyze scientific information to develop and present conclusions.

Benchmark SC.05.SI.04—Summarize, analyze and interpret data from investigations.

Additional Common Curriculum Goals and Benchmarks

Physical Science: Understand structures and properties of matter and changes that occur in the physical world.

CCG—Understand structure and properties of matter.

Benchmark SC. 05.PS.01—Identify substances as they exist in different states of matter.

Earth & Space Science: Understand physical properties of the Earth and how those properties change.

CCG—Understand the properties and limited availability of the materials which make up the Earth.

Benchmark SC. 05.ES.01.03—Recognize that the supply of resources is limited, and that resources can be extended through the use of recycling and decreased use.

Mathematics:

CCG—Mathematical Problem Solving—select, apply, and translate among mathematical representations to solve problems.

Benchmark MA.05.PS.01—Interpret the concepts of a problem-solving task and translate them into mathematics.

Science in Personal and Social Perspectives: Understand that science provides a basis for understanding and acting on personal and social issues.

Example: Reclaimed Rainwater Project

Social Science: The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between thee past present and future.

CCG—Understand how people and the environment are interrelated.

Benchmark SS.05.GE.07—Understand how physical environments are affected by human activities.

Benchmark SS.05.GE.07.01—Understand how and why people alter the physical environment.

Benchmark SS.05.GE.07.02—Describe how human activity can impact the environment.

Geography: Understand and use geographic skills and concepts to interpret contemporary and historical issues.

CCG—Locate major physical and human (cultural) features of the Earth.

Benchmark SS.05.GE.03.03—Locate, identify, and know the significance of major mountains, rivers, and land regions of Oregon.

CCG—Compare and analyze physical (e.g., landforms, vegetation, wildlife, climate, and natural hazards), and human (population, land use, language, and religion) characteristics of places and regions.

Benchmark SS.05.GE.04.01—Identify and locate major landforms, bodies of water, vegetation, and climate found in regions of the United States.

Benchmark SS.05.GE.04.02—Identify the type of economic activity, population distribution, and cities found in regions of the United States.

CCG—Understand how people and the environment are related

Benchmark SS.05.GE.07—Understand how physical environments are affected by human activities.

Benchmark SS.05.GE.07.02—Describe how human activity can impact the environment.

Benchmark SS.05.GE.08.02—Understand how the physical environment presents opportunities for economic and recreational activity.

This activity, We All Live in a Watershed, may be used to meet the following common curriculum goals and benchmarks for Science Inquiry:

CCG—Forming the question/hypothesis—formulate and express scientific questions or hypotheses to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.

CCG—Collecting and presenting data—conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize and summarize data from investigations.

CCG—Analyzing and interpreting results—analyze scientific information to develop and present conclusions.

Benchmark SC.05.SI.04—Summarize, analyze and interpret data from investigations.

Additional Common Curriculum Goals and Benchmarks

Physical Science: Understand structures and properties of matter and changes that occur in the physical world.

CCG—Understand structure and properties of matter.

Benchmark SC. 05.PS.01—Identify substances as they exist in different states of matter.

Geography: Understand and use geographic skills and concepts to interpret contemporary and historical issues.

CCG—Use maps and other geographic tools and technologies to acquire, process, and report information from a spatial perspective.

Benchmark SS.05.GE.02.01—Use maps and charts to interpret geographic information.

Benchmark SS.05.GE.02.02—Use other visual representations to locate, identify, and distinguish physical and human features of places and regions.

CCG—Locate major physical and human (cultural) features of the Earth.

Benchmark SS.05.GE.03.03—Locate, identify, and know the significance of major mountains, rivers, and land regions of Oregon.

CCG—Compare and analyze physical (e.g., landforms, vegetation, wildlife, climate, and natural hazards), and human (population, land use, language, and religion) characteristics of places and regions.

Benchmark SS.05.GE.04.01—Identify and locate major landforms, bodies of water, vegetation, and climate found in regions of the United States.

Benchmark SS.05.GE.04.02—Identify the type of economic activity, population distribution, and cities found in regions of the United States.

CCG—Understand how people and the environment are related.

Benchmark SS.05.GE.07—Understand how physical environments are affected by human activities.

Benchmark SS.05.GE.07.02—Describe how human activity can impact the environment.

Benchmark SS.05.GE.08.02—Understand how the physical environment presents opportunities for economic and recreational activity.

English Language Arts—Reading:

CCG—Reading—find, understand, and use specific information in a variety of texts across the subject areas to perform a task.

Benchmark EL.05.RE.18—Use the features of informational texts, such as formats, graphics, diagrams, illustrations, charts, maps, and organizational devices to find information and support understanding.

CCG—Reading—increase word knowledge through systematic vocabulary development; determine the meaning of new words by applying knowledge of word origins, word relationships, and context clues; verify the meaning of new words; and use those new words accurately across the subject areas.

Benchmark EL.05.RE.09—Understand, learn, and use new vocabulary that is introduced and taught directly through informational text, literary text, and instruction across the subject areas.

MAPS & MAPPING

Common Curriculum Goals (CCG) and Benchmarks for Social Science

Social Sciences:
The study of the social sciences (civics, economics, geography, and history) prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between the past present and future.

Geography:
Understand and use geographic skills and concepts to interpret contemporary and historical issues.

CCG—Understand the spatial concepts of location, distance, direction, scale, movement, and region.

Benchmark SS.05.GE.01—Define basic geography vocabulary such as concepts of location, direction, distance, scale, movement, and region using appropriate words and diagrams.

Benchmark SS.05.GE.01.01—Know and use basic map elements to answer geographic questions or display geographic information.

CCG—Use maps and other geographic tools and technologies to acquire, process, and report information from a spatial perspective

Benchmark SS.05.GE.02.01—Use maps and charts to interpret geographic information.

Benchmark SS.05.GE. 02.02—Use other visual representations to locate, identify, and distinguish physical and human features of places and regions.

CCG—Locate major physical and human (cultural) features of the Earth.

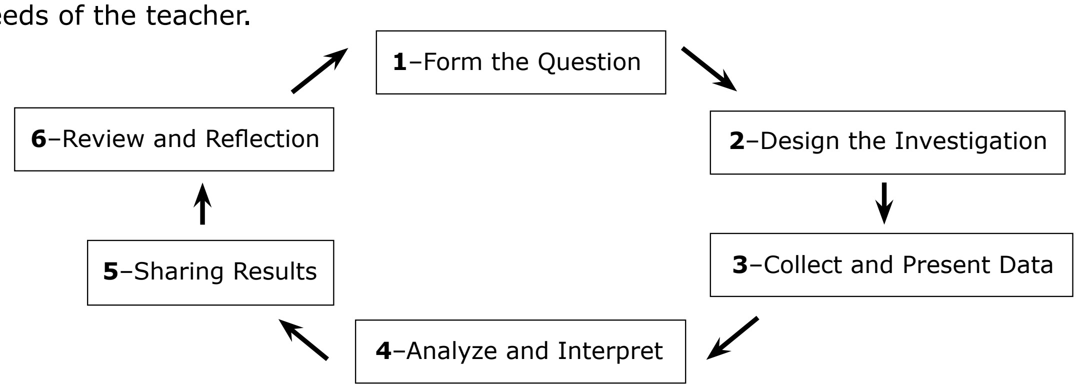
Benchmark SS.05.GE.03.03—Locate identify, and know the significance of major mountains, rivers, and land regions of Oregon.

NON-POINT SOURCE POLLUTION

Common Curriculum Goals (CCG) and Benchmarks for Science

Science Inquiry:
Use interrelated processes to pose questions and investigate the physical and living world

The Circular Process:
This method adapts the common inquiry approach with its familiar beginning and end, by looping it into a circular process, inviting entry into the loop at multiple points, depending on the program and/or needs of the teacher.



This Non-Point Source Pollution activity may be used to meet the following common curriculum goals and benchmarks for Science Inquiry:

CCG—Collecting and presenting data—Conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize and summarize data from investigations.

CCG—Analyzing and interpreting results—Analyze scientific information to develop and present conclusions.

Benchmark SC.05.SI.04—Summarize, analyze and interpret data from investigations.

Other CCG and Benchmarks that may apply:

Physical Science:
Understand structures and properties of matter and changes that occur in the physical world.

CCG—Understand chemical and physical changes.

Additional Common Curriculum Goals for Science

Science in Personal and Social Perspectives:
Understand that science provides a basis for understanding and acting on personal and social issues.

Example: Storm Drain Stenciling Project

Science and Technology:
Understand the interconnections among science, technology, and society.

CCG—Understand and relationship that exists between science and technology.

CCG—Understand the process of technological design to solve problems and meet needs.

Example: Using technology to manage stormwater—bioswales, green streets, ecoroofs, bio filters, etc.

Social Science:
The study of the social sciences (civics, economics, geography, and history) prepares students

for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between thee past present and future.

CCG—Understand how people and the environment are interrelated.

Benchmark SS.05.GE.07—Understand how physical environments are affected by human activities.

Benchmark SS.05.GE.07.01—Understand how and why people alter the physical environment.

Benchmark SS.05.GE.07.02—Describe how human activity can impact the environment.

AREA & VOLUME

Common Curriculum Goals (CCG) and Benchmarks for Science

Science Inquiry:
Use interrelated processes to pose questions and investigate the physical and living world.

The Circular Process:
This method adapts the common inquiry approach with its familiar beginning and end, by looping it into a circular process, inviting entry into the loop at multiple points, depending on the program and/or needs of the teacher.

Using this approach, the teacher has the option of encouraging the student to enter the cycle at any point and follow it for a full rotation or more.

This Area & Volume activity may be used to meet the following common curriculum goals and benchmarks for Science Inquiry:

CCG—Forming the question/hypothesis—Formulate and express scientific questions or hypotheses to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.

CCG—Collecting and presenting data—Conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize and summarize data from investigations.

CCG—Analyzing and interpreting results—analyze scientific information to develop and present conclusions.

Benchmark SC.05.SI.04—Summarize, analyze and interpret data from investigations.

Additional Common Curriculum Goals and Benchmarks

Physical Science:
Understand structures and properties of matter and changes that occur in the physical world.

CCG—Understand structure and properties of matter.

Benchmark SC. 05.PS.01—Identify substances as they exist in different states of matter.

Earth and Space Science:
Understand physical properties of the Earth and how those properties change.

CCG—Understand the properties and limited availability of the materials which make up the Earth.

Benchmark SC. 05.ES.01.03—Recognize that the supply of resources is limited, and that resources can be extended through the use of recycling and decreased use.

Mathematics:

CCG—Calculations and Estimations—compute fluently and make reasonable estimates.

Benchmark MA. 05.CE.12—Determine the order of operations for multiple-step calculations involving addition, subtraction, multiplication, and division.

CCG—Mathematical Problem Solving—select, apply, and translate among mathematical representations to solve problems.

Benchmark MA.05.PS.01—Interpret the concepts of a problem-solving task and translate them into mathematics.

CCG—Measurement—apply appropriate techniques, tools, and formulas to determine measurements.

Benchmark MA.05.ME.04—Determine measurements of length and perimeter.

Benchmark MA. 05.ME.08—Analyze the effects on area and perimeter by combining two simple geometric figures.

Science in Personal and Social Perspectives:
Understand that science provides a basis for understanding and acting on personal and social issues.

Example: Reclaimed Rainwater Project

Social Science:
The study of the social sciences prepares students for responsible citizenship. It enables students to evaluate historical and contemporary issues, understand global relationships, and make connections between the past, present and future.

CCG—Understand how people and the environment are interrelated.

Benchmark SS.05.GE.07—Understand how physical environments are affected by human activities.

Benchmark SS.05.GE.07.01—Understand how and why people alter the physical environment.

Benchmark SS.05.GE.07.02—Describe how human activity can impact the environment.

English Language Arts:

CCG—Writing—pre-write, draft, revise, and publish across the subject areas.

SOILS, SLOPES & SEDIMENT

Common Curriculum Goals (CCG) and Benchmarks for Science

Compacted and Uncompacted Soils Activity

Earth & Space Science:

CCG—Understand the properties and limited availability of the materials which make up the Earth.

Benchmark SC.05.ES.01.02—Recognize that soils vary in color, texture, components, reaction to water, and ability to support the growth of plants.

Life Science:

CCG—Understand the relationships amoung living things and between living things and their environments.

Benchmark SC.05.LS.05—Describe the relationship between characteristics of specific habitats and the organisms that live there.

CCG—Understand the characteristics, structure, and functions of organisms.

Benchmark SC.05.LS.01—Group or classify organisms based on a variety of characteristics.

Science Inquiry:

CCG—Formulate and express scientific questions to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions based on those observations which can be explored through scientific investigations.

CCG—Conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize, and summarize data from investigations.

Erosion Boards Activity

Earth & Space Science:

CCG—Understand changes occurring within the lithosphere, hydrosphere, and atmosphere of the Earth.

Benchmark SC.05.ES.03.01—Identify affects of wind and water on Earth materials using models.

Benchmark SC.08.ES.02—Explain the water cycle and its relationship to weather.

Benchmark SC.08.ES.02.01—Explain the water cycle.

Benchmark SC.08.ES.03.03—Identify factors affecting water flow, soil erosion, and deposition.

Science Inquiry:

CCG—Formulate and express scientific questions to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions based on those observations which can be explored through scientific investigations.

CCG—Conduct procedures to collect, organize, and display scientific data.

Benchmark SC.05.SI.03—Collect, organize, and summarize data from investigations.

Sediment Jar Activity

Earth & Space Science:

CCG—Understand changes occurring within the lithosphere, hydrosphere, and atmosphere of the Earth.

Benchmark SC.05.ES.03.01—Identify affects of wind and water on Earth materials using models.

Benchmark SC.08.ES.02—Explain the water cycle and its relationship to weather.

Benchmark SC.08.ES.03.03—Identify factors affecting water flow, soil erosion, and deposition.

Science Inquiry:

CCG—Formulate and express scientific questions to be investigated.

Benchmark SC.05.SI.01—Make observations. Ask questions based on those observations which can be explored through scientific investigations.

Sustainable Stormwater Management
Green Streets

TECHNOLOGY USED: **Stormwater Curb Extensions**

working for clean rivers, healthy watersheds, and a livable, sustainable community

Urban stormwater runoff pollutes rivers and streams and contributes to combined sewer overflows (CSOs) to the Willamette River. Portland is building sustainable street projects around the City to reduce the negative impacts of stormwater runoff. Green Streets mimic natural conditions by managing runoff on the surface and at its source.

Landscaped Stormwater Curb Extensions: Historically Portland has built curb extensions to improve pedestrian safety. A new variation called a stormwater curb extension is landscaped with plants that help filter pollutants from stormwater runoff. They have similar benefits to the conventional curb extension but they also improve water quality, reduce stormwater flow, and look good.

NE Siskiyou Green Street stormwater curb extension

A Case Study: The NE Siskiyou Green Street Project is a good example of how landscaped stormwater curb extensions are integrated into the street system. Environmental Services built the landscaped extensions in the parking zone on each side of Siskiyou just above the storm drain inlets. Stormwater flows into the landscaped area, slows down and soaks into the ground while wetland plants filter pollutants. Any water that overflows the landscaped areas enters the storm drain inlets. The curb extensions reduce the amount of stormwater that flows off Siskiyou Street into the combined sewer system.

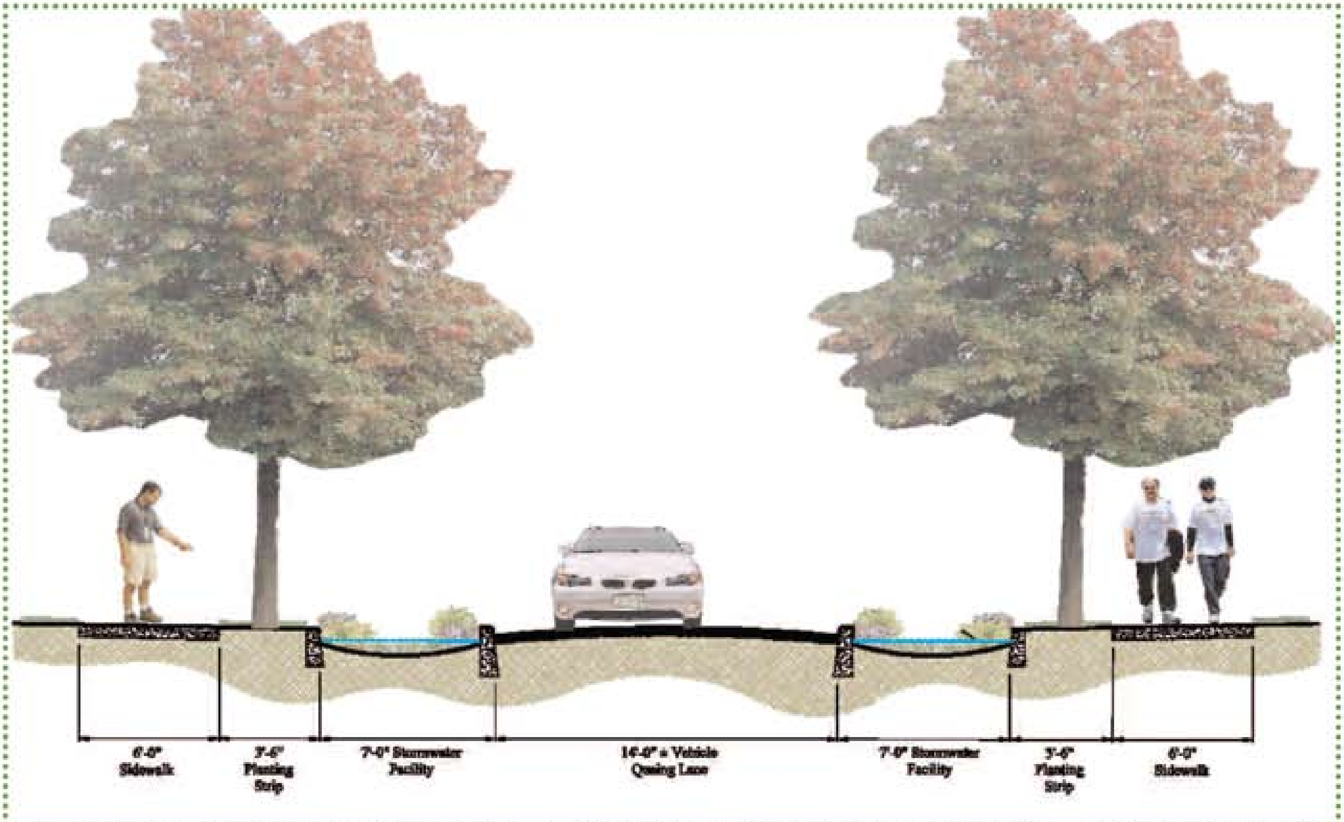
Environmental Services worked closely with residents during design and construction. Construction took two weeks and cost $15,000. The project is located on NE Siskiyou between 35th Place and 36th Avenue.

For design information see the back of this sheet.

For More Information:
Contact Emily Hauth at 503-823-7378
or email emilyh@bes.ci.portland.or.us.

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

Dan Saltzman, Commissioner
Dean Marriott, Director



Typical Section of NE Siskiyou Street

Plan view of NE Siskiyou Street

Stormwater slows as it enters the landscape area, water soaks into the ground, and wetland plants filter pollutants.

Printed on recycled paper. PL 0508 revised Jan 2005

Glencoe Swale
Glencoe Elementary school in southeast Portland is treating stormwater from their parking lots by having it flow through planted areas to be filtered and stored as ground water rather than entering the storm drains directly. Bioswales help reduce the amount of stormwater entering the sewer system and helps improve the water quality of the runoff from the parking areas.

Erosion Control Bags
Erosion control bags are used to control soil erosion and sedimentation resulting from highway, and other construction projects by helping to trap these materials before they enter storm drains.

Eco Roof

Hamilton West Apartments in downtown Portland

Part of Portland's efforts to reduce the negative impact of stormwater runoff on rivers and streams. New developments are required to treat all stormwater on site, and an ecoroof is an approved treatment facility.

Co-Op Eco Roof

Co-op in southeast Portland near 21st and SE Clinton

The Deschutes River
This is an orthophoto of the Deschutes River as it runs through the City of Bend. The lines you see are topographic lines overlain. This can be used with students to represent gradients and the path that water flows through the city and into the river.

Tumalo Falls
The area where the city of Bend, Oregon gets its drinking water.

Join a Stream Team!

Dive into a clean water project

Clean your room! And take out the trash and the recycling! For many teens, these are among the most annoying sentences they hear. *Why can't you do it yourself? Buffy is on!* For many parents, these are among the most annoying sentences they hear.

Why don't parents do it themselves? Well, when everyone lends a hand, chores get done faster and *everyone* can spend more time relaxing in a cleaner, tidier home. *Clean* beats *filthy* and *relaxing* beats *working* just about every time.

Streams, lakes, ponds, and wetlands need a break, too. Do you enjoy going to the beach, whitewater rafting, or fishing in your favorite lake? You and your friends can lend a hand to help keep the water resources we use and enjoy running clean and clear by volunteering your time and talents in a water project. *Will I really help the environment?* You bet! *Will it be fun?* Definitely! *Will this make the most popular kid at school?* Um...we'll get back to you on that one (but we know you'll be popular with some very cool fish).

Are There Many Programs to Get Involved In?

The answer is a definite yes! Every year new volunteer programs are formed across the country. Some have thousands of volunteers; many, however, are small and often are linked with neighborhood associations, schools, or local environmental organizations. There are many different ways to get involved.

Become a Volunteer Monitor!

Volunteer monitors are people who measure the water quality of lakes, streams, rivers, estuaries, and other bodies of water. In most programs they take water samples and either send them to a laboratory or analyze the water themselves using portable water quality test kits.

People who monitor streams also sometimes examine insect life living on the stream bottom. Using special nets, they count and sort the specimens they collect. Some aquatic insects cannot tolerate pollution. They will leave the area as fast as they can (or croak) when things turn bad. So, if stream monitors find an abundant amount of "clean water" insects, they feel pretty good about the water quality of their stream.

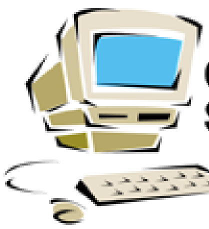
Today nearly 2,800 ponds, lakes, and wetlands and about 1,000 streams and rivers in the United States are monitored by volunteers. Most monitoring programs welcome middle and high school students. Instructors show you how to use monitoring equipment and provide reporting forms and other supplies. Getting your feet wet is easy and fun, and the information you collect helps people understand water resources and what needs to be done to keep them clean.

Join a Beach, Stream, or Lake Clean-up Campaign!

Another activity that can use the help of you and your friends is cleanup campaigns. Typically, teams are organized to pick up and remove trash and debris from a section of stream, beach, wetland, or lakeshore. The cleanup can be a onetime activity or, better yet, an ongoing project where the team "adopts" an area and visits it regularly.

PHOTO COURTESY USDA NRCS.

These volunteer monitors are collecting water samples from a small stream.



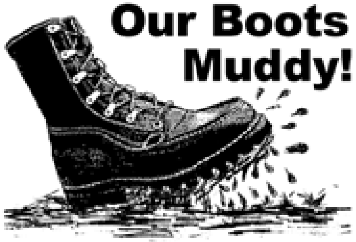
Let's Go Surfing Now!

Learn what you can do for your watershed

www.epa.gov/students/surf_your_watershed.htm

EPA has developed a list of 15 things you can do to make a difference in your watershed. Check out the information on:

- *Adopting your watershed*
- *Volunteer monitoring*
- *Clean-up campaigns*
- *Building backyard habitat*



Let's Get Our Boots Muddy!

Give water a hand

The University of Wisconsin can help you choose a great water project for you and your classmates. Download the **Action Guide** from their web site: www.uwex.edu/erc/index.html. It will give you tips on how to

* *Investigate water problems*
* *Choose a great project*
* *Plan your activities*
* *Put your plans into action*
* *Celebrate your success*

Several national organizations can help students build a "dream team" of clean-up volunteers. Coordinating your efforts with recognized campaigns like the International Coastal Cleanup (sponsored by the Center for Marine Conservation on the third Saturday in September) or the National River Cleanup Week (sponsored by American Outdoors the second or third week in May) can help generate and maintain enthusiasm and team spirit. The first thing to do is to learn about the groups already active in your watershed and join in!

Set Up Your Own Backyard Conservation Area!

You can do environmental wonders with just a little land and some imagination. A small neglected wetland can become a bird and butterfly paradise. A backyard corner can be transformed into a mulch factory. A muddy, trampled bare patch can be turned into a canvas of wildflowers. It's easy, and your efforts will help nature control soil erosion, reduce sediment in streams, conserve water, and improve water quality.

Career Corner

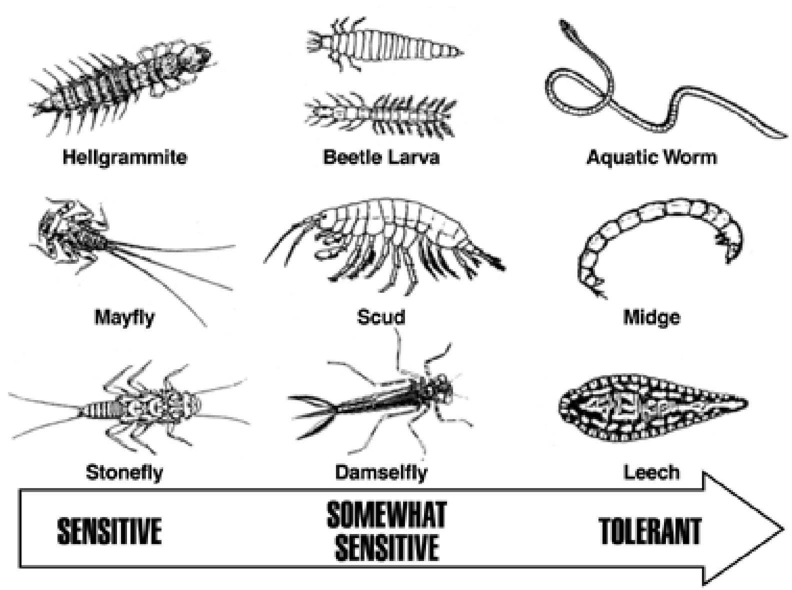
A *volunteer monitoring coordinator* develops a monitoring program, gathers volunteers, and helps to monitor the health of streams.

A *biochemist* studies the chemistry of living organisms.

An *entomologist* studies insects and their environment.

In 1998, 300,000 volunteers picked up more than 40,000 cigarette butts in coastal waterways (nearly 20 percent of all the trash picked up) in the annual International Coastal Cleanup.

What's Buggin' You?



List of Local Partners and Project Opportunities

The following service-learning project resource lists were compiled to assist teachers and students in designing projects. Included are names of organizations and agencies in need of volunteer assistance organized by region: Central Oregon, Corvallis area, Eugene area, Medford area, and Portland area. Schools are encouraged to partner with one or more of these organizations for projects in the local watershed to help with technical and material support. A partner may also be able to enhance the learning component of their projects to meet your needs. It's a good idea to alert your local watershed council coordinator of the project you and your students are planning. To find out which watershed your school belongs or if you have any questions, please contact the *Healthy Waters Insititute* and assistance will be provided.

CENTRAL OREGON

Local Watershed Councils

Upper Deschutes Watershed Council
Contact: Kolleen Yake
541-382-6103 x33
kyake@restorethedeschutes.org
Upper Deschutes Watershed Council
700 NW Hill St., Bend, OR 97701

At the Upper Deschutes Watershed Council we believe that a clean, healthy Deschutes River is at the heart of our community. Our projects in habitat restoration and education provide tangible changes on the landscape to create a future of healthy rivers, clean water and outstanding natural values. Contact the watershed council for available projects.

Area-Wide Resources

Deschutes Basin Land Trust
Contact: Amanda Egertson
541-330-0017
amanda@deschuteslandtrust.org
www.deschuteslandtrust.org
760 NW Harriman, Suite 100, Bend, OR 97701

The mission of the Deschutes Basin Land Trust is to protect special lands in the Deschutes basin for present and future generations by working cooperatively with landowners and communities. Contact Amanda for information on restoration opportunities in the Metolius basin.

ODFW—High Desert Region
Contact: Jennifer Bock
541-388-6363
jennifer.a.bock@state.or.us
61374 Parrell Rd., Bend, OR 97702

Contact Jennifer for information about restoration or monitoring projects in the Bend, Prineville, Redmond, and Sisters areas.

reSource
Contact: Tim Hester
541-388-3638
thester@resourceoregon.org
www.resourceoregon.org
740 NE 1st St., Bend, OR 97701

The mission of reSource is to create a sustainable future for Central Oregon by educating people about what sustainability means and how to put it into practice. Contact Tim for information on service learning projects.

USFS
Contact: Nate Dachtler
541-549-7725
ndachtler@fs.fed.us
P.O. Box 249, Sisters, OR 97759
Contact Nate for information about restoration or monitoring projects within the Metolius basin.

Wolftree
Contact: Jay Hopp (Education Director)
541-549-1459
www.beoutside.org
P.O. Box 204, Sisters, OR 97759
Contact Wolftree if you are interested in hearing more about local education opportunities or to participate in a hand-on service learning project.

City of Bend
Contact: Wendy Edde (Water Resource Education)
541-317-3000
wedde@ci.bend.or.us
575 NE 15th St., Bend, OR 97701
Contact the City of Bend for information on stormwater, stormdrains, stormdrain stenciling projects, wastewater management, or for a tour through the City of Bend's intake facility.

Deschutes River Conservancy
Contact: Kate Fitzpatrick (Program Manager)
541-382-4077
kate@deschutesrc.org
700 NW Hill St., Bend, OR 97702
Contact the Deschutes River Conservancy to learn more about water quantity issues and concerns in the Deschutes River and its tributaries.

CORVALLIS AREA

Local Watershed Councils

Calapooia WC
Contact: Denise Hoffert-Hey
541-367-6735
calapooia@centurytel.net
Restoration and monitoring projects. Call Denise for information.

Jackson Frasier Watershed Council
Contact: Jerry Davis
541-757-6871; FAX 541-757-6891
jerry.davis@co.benton.or.us
360 SW Avery, Corvallis, OR 97333
Project opportunities at Jackson Frasier Wetlands and other sites possibly further up stream. Monitoring and data collecting projects are available through the council.

Luckiamute WC
Contact: Erin McCabe
503-838-2794
mccabe.e@worldnet.att.net
Newly formed watershed council, but might have restoration and monitoring projects soon. Contact Erin for more information.

Marys River Watershed Council
Contact: Sandra Coveny
541-929-5768

sandrac@peak.org
www.scgis.org
330 N 13th St., Philomath, OR 97370

Many projects such as water quality monitoring and working on fish traps are possible in the Philomath area. Technical support and equipment is available for projects.

North Santiam Watershed Forum

Contact: Craig Luedeman
503-588-5333
3150 Lancaster Drive NE, Suite B, Salem, OR 97305

South Santiam Watershed Council

Contact: Greg Pendle (Council Coordinator, SWCD)
541-367-5564
sswc@centurytel.net
3225 Hwy 20, Sweet Home, OR 97386

Both middle and high schools can participate in water quality monitoring projects. Call for information on monitoring projects and other volunteer opportunities.

Area-Wide Resources

Benton County Soil and Water Conservation District

Contact: Teresa Matteson (Education and Outreach Director)
Heath Keirstead (Education Coordinator)
541-753-7208
office@benton-swcd.org
305 SW C Avenue, Suite 2, Corvallis, OR 97333

Educational support including a Stream stimulation table and curriculum notebook, Making Ripples: Community Building for Water Quality; and Conservation Poster Contest. Other opportunities include annual native tree and shrub sale and conservation mini-grants.

City of Corvallis, Public Works Department

Contact: 541-766-6916; FAX 541-766-6920
P.O. Box 1083, Corvallis, OR 97339
Mark Taratoot (Water Resources Specialist)
mark.taratoot@ci.corvallis.or.us
Diana Sharps (Water Resources Specialist)
diana.sharps@ci.corvallis.or.us

The Storm Drain Marking Program can be done by any age student and by any number of students. All of the needed materials are provided including the paint, stencils, safety vests and cones. The Public Works Department has just begun its outreach program and is in the process of developing other projects. Please call Sue to find out about these opportunities.

Corvallis Environmental Center

Contact: Connie Wiegers
541-753-9211
ecenter@peak.org
www.peak.org/~ecenter
254 SW Madison, P.O. Box 2189, Corvallis, OR 97339

Project opportunities include removing non-native plants, working on the Avery House (new nature center), working in collaboration with the Parks Department, and helping in the office. Call Connie to discuss other opportunities through the Environmental Center.

Corvallis Parks and Recreation

Contact: 541-766-6918
1310 SW Avery Park Drive, Corvallis, OR 97333
Becky Merja (City Forester)
541-754-1723
Steve DeGhetto (Parks Operations Specialist)
541-754-1738

The Corvallis Parks and Recreation Department offers a number of sites to the community as outdoor classrooms and laboratories. Some are urban parks and within walking distance of many schools. Others are open space areas that require transportation, but are within five miles of the city center.

Greenbelt Land Trust

Contact: Karlene McCabe
541-752-9609
P.O. Box 1721, Corvallis, OR 97339

Currently the Greenbelt Land Trust does not have projects underway. However, Karlene is a great resource regarding other possible projects in the area.

Oregon Department of Fish & Wildlife

Contact: Karen Hans
541-757-4186 x 251

Karen is very knowledgeable about the different projects and opportunities in this area. Potential projects include constructing and monitoring fish traps, streamside plantings and clean up projects. Projects are suitable for middle and high school students. The Salmon and Trout Enhancement Program provides opportunities for youth including hatching and rearing salmon and trout eggs, stream habitat restoration work, surveys, and other educational projects. The Stream Scene: Watersheds, Wildlife and People is a comprehensive watershed-based education curriculum package designed to bring schools and communities to the resource. Fish Eggs to Fry is a classroom guide for teachers to teach students how to raise fish eggs in their classroom.

US Fish and Wildlife Service-Finley Refuge, William L. Finley National Wildlife Refuge

Contact: 26208 Finley Refuge Road, Corvallis, OR 97333
541-757-7236

The refuge consists of oak and maple woodlands, Oregon ash thickets, second growth Douglas-fir, hedgerows, marshes, meandering creeks, open meadows, and cultivated fields. The refuge offers wildlife observation, including migratory birds, and self-guided interpretive trails. Information kiosks and comfort station are available.

Other Resources

Audubon Society

Contact: Kate Matthews
541-754-7364
mathewsk@ava.bcc.orst.edu
P.O. Box 148, Corvallis, OR 97339-0148

They could possibly use some help on a wetland project at Jackson Frasier Wetland. Individuals might also be able to help with office tasks as well. Please call and talk to Kate for more information.

Avery House Nature Center

Contact: Keri Pilgrim
541-758-6198
ahnc@peak.org
1200 SW Avery Park Road, Corvallis, OR 97333

Avery House a part of the Corvallis Environmental Center, provides nature education programs for youths and adults, which fosters knowledge and stewardship for our local ecosystems.

Benton County-OSU Extension-4H Program

Contact: Maggie Livesay (4-H Faculty)
541-766-3550
maggie.livesay@oregonstate.edu
Tammy Skubinna (4-H Youth Development Faculty)
541-766-3555
tammy.skubinna@oregonstate.edu
1849 NW 9th Street, Corvallis, OR 97330

Extension provides research-based information to the general public. Subject areas include Community Horticulture, Small Farms, Forestry, Family and Community and Development and 4-H Youth Development.

Chintimini Wildlife Rehabilitation Center

Contact: Jeffrey S. Picton (Executive Director)
541-745-5324
cwrc@peak.com
P.O. Box 1433, Corvallis, OR 97339

The mission of the Chintimini Wildlife Rehabilitation Center is to provide care for injured and orphaned wildlife, and to foster a connection between people and wildlife through education. Presentations including Birds of Prey, Wildlife Rehabilitation and Owls can be tailored to any kind of group. The length of the presentation depends on the group age.

Oregon Forestry Education Program, College of Forestry

Contact: 541-737-2128 or 800-554-6987
51 Peavy Hall, Oregon State University, Corvallis, OR 97331

The mission of Oregon Forestry Education Program (OFEP) is to provide resources to help teachers increase students' understanding of our environment; stimulate students' critical and creative thinking; develop students' ability to make informed decisions on environmental issues; and instill in students the commitment to take responsible action on behalf of the environment. Multi-day workshops and summer institutes offer educators an opportunity for in-depth explorations of natural resource topics through experiential field trips, discussions with forest landowners, interaction with researchers and classroom activities.

Rocky Mountain Elk Foundation

Contact: Bill Richardson
541-917-7636
wildlife@peak.org
24550 Ervin Road, Philomath, OR 97370

The local chapter of the Rocky Mountain Elk Foundation serves the greater Benton and Linn County area and offers tours, kits, presentations and hands-on learning about elk, other wildlife and their habitats.

Science Education Partnerships—SEPS

Contact: Kathy Blaustein (Outreach Coordinator)
541-754-7574
blaustek@science.oregonstate.edu

SEPS is a partnership between Oregon State University, Hewlett-Parckard and the Corvallis School District that is committed to using community scientists to help teachers provide a quality science education for all students in classroom settings. SEPS maintains a database of scientists who are eager to give presentations, arrange field trips, mentor individual students, and help teachers with classroom science activities.

Suislaw National Forest

Contact: Kathy Fletcher
4077 SW Research Way
P.O. Box 1148, Corvallis, OR 97339

Materials for grades K-12 and college available for check out include puppets, videos and books on forests, wildlife, insects, mammals and curriculum boxes.

Starker Forests

Contact: Dick Powell (Forester)
541-929-2477
dick@starkerforests.com
P.O. Box 809, Corvallis, OR 97339

Dick provides forestry education upon request. The Starker Forestry Trail near Blodgett can be tailored to teacher/class needs, and is a day-long field trip.

EUGENE AREA

Local Watershed Councils

McKenzie Watershed Council
Contact: Kate Ferschweiler
541-988-9904
kfersch@callatg.com
341 S. E Street, Springfield, OR 97477

The McKenzie Watershed Council can use students to help them with water monitoring along the McKenzie River. Since much of Eugene's drinking water comes from this watershed, Eugene students are encouraged to explore their problems with the council.

Middle Fork Willamette WC
Contact: Juan Welsh
541-937-9800
mfwwc@efn.org
P.O. Box 27, Lowell, OR 97452

Contact Juan for more information on possible restoration or monitoring projects.

Area-Wide Resources

Cascade Family Flyfishers
Contact: Jane Sageser
541-687-5957
msageser@earthlink.net
84499 Boods Road, Eugene, OR 97405

The Cascade Family Flyfishers are involved with the Adopt-A-River program each year. They do clean-ups twice a year and could use volunteers to help them. The flyfishers meetings are open to the public and students are welcome to attend.

East Lane Soil & Water Conservation District
Contact: 541-465-6648
55 D Oakway Center, Eugene, OR 97401

Depending on the time of year, projects such as tree planting and clean-ups may be done.

Eugene Stream Team
Contact: Lorna Baldwin
541-682-4850
1820 Roosevelt Blvd., Eugene, OR 97402

The Eugene Stream Team is the volunteer component of the City of Eugene's Water Management Plan. Students can help with storm drain stenciling and clean-ups. Call for information on these volunteer opportunities and others. Lorna can help classrooms set up individual projects as well.

Eugene Water & Electric Board
Contact: John Femal
541-484-2411
500 East 4th Avenue, P.O. Box 10148, Eugene, OR 97440-2148

Currently Eugene Water & Electric Board (EWEB) does not have projects available for students, but later this year and beginning in the fall there will be project opportunities, such as trail maintenance. Contact John to discuss these opportunities.

Oregon Department of Fish & Wildlife
Contact: STEP Biologist
541-726-3515
odfwspfd@efn.org
3150 East Main Street, Springfield, OR 97478

ODFW needs seasonal help with various projects such as clean-ups and restoration projects. These projects are best suited for high school students. The biologist can help design projects to fit location and resource limitations.

Other Resources

Nearby Nature

Contact: 541-687-9699
P.O. Box 3678, Eugene, OR 97403

Nearby Nature is an environmental education non-profit organization that teaches children the ecological importance of being environmentally conscientious. They use Alton Baker Park as their classroom and always welcome students to help with restoration efforts within the park. It's best to leave an evening phone number where you can be reached because they are out in the field during the work day.

Old McKenzie Fish Hatchery

Contact: Ken Engelman
541-822-3358
RivRef@aol.com
P.O. Box 1117, Leaburg, OR 97489

The Old McKenzie Fish Hatchery was closed in the 1950s and is now being restored. The Hatchery is on 46 acres of privately and publicly owned land. Stream enhancement projects, watershed analysis, and brochures for a self-guided tour of the Hatchery could be developed and produced by students. There are also monthly Hatchery meetings in which students could participate. Project partners include Mckenzie River Watershed Council.

MEDFORD AREA

Local Watershed Council

Bear Creek Watershed Council

Contact: Beth Franklin (Coordinator)
541-899-7361
P.O. Box 1548 Medford, OR 97501
coordinator@bearcreek-watershed.org

Other Local Watershed Councils

Applegate River Watershed Council

Contact: Zach Stevenson (Coordinator)
541-899-9982; FAX 541-899-1256
6941 Upper Applegate Road, Jacksonville, OR 97530
staff@arwc.org

Upper Rogue Watershed Association

Contact: Don Nelson (Coordinator)
541-878-3710; FAX 541-878-3710
P.O. Box 1128, Shady Cove, OR 97539
urwatershed@hotmail.com

Illinois Valley Watershed Council

Contact: Kevin O'Brien (Coordinator)
541-592-3731
102 S. Redwood Highway, P.O. Box 352, Cave Junction, OR 97523
ivwc@cavenet.com

Middle Rogue Watershed Council

Contact: Brad Carlson (Coordinator)
541-474-6799; FAX 541-955-9574
576 NE 'E' St., Grants Pass, OR 97526
mrwc@charterinternet.com

Seven Basins Watershed Council

Contact: P.O. Box 909, Gold Hill, OR 97525

541-261-7796; FAX 541-830-0261
contact@sevenbasins.org

Little Butte Creek Watershed Council

Contact: Lu Anthony (Coordinator)
541-826-2908; FAX 541-826-2908
1094 Stevens Road, Eagle Point, OR 97524
luanthony@earthlink.net

Other Resources

Rogue Valley Audubon Society

Contact: Stacey Faught (Education Committee Co-Chair)
541-535-5138 or 541-772-3575
P.O. Box 8597, Medford, OR 97504
montfaught@msn.com
www.roguevalleyaudubon.org

Priorities include habitat protection, preservation of environmental laws, and public education. Through school programs, field trips, monthly chapter programs, publications, and community events, RVAS motivates people to get to know the bird life in their area and become advocates for wildlife.

Bear Creek Watershed Education Partners

Contact: Heidi Buettner (Coordinator)
541-773-1039
112 East 6th Street, Suite A, Medford, OR 97501
bcwep1@yahoo.com
www.bcwep.org

Bear Creek Watershed Education Partners (BCWEP) provides watershed oriented service learning opportunities, a watershed education symposium, monitoring projects, restoration projects and educational experiences to youth in the Bear Creek watershed. BCWEP also provides teachers with classroom and field equipment, training and workshops, project funding and ideas, and a network and support system.

Bureau of Land Management
Butte Falls Resource Area Environmental Education Program

Contact: Leah Schrodt (Program Lead/Environmental Education Specialist)
541-618 2468
3040 Biddle Rd, Medford, OR 97504
lschrodt@or.blm.gov

The Butte Falls Resource Area Environmental Education Program provides the community with exposure to and a deepened understanding of the complicated tasks involved with managing our natural and cultural resources. We strive to increase public awareness, appreciation, and respect for the health, diversity, and productivity of our public lands for generations to come.

Caterpillar (Pacifica¹s)
A MOBILE SCIENCE & NATURE CENTER

Contact: Linda Mullens
541-479-3243
lindamullens@starband.net
or Peg Prag
541-846-9230

The Caterpillar is a unique mobile science and nature center on a 24 foot trailer (with antennae and eyes added to the front!). It has been taking environmental science to local elementary schools for 4 years now, involving up to7,000 kids a year. It provides schools with changing displays, equipment that might not otherwise be available, and hands-on activity-curriculums fostering knowledge and joy of science, nature, and horticulture.

Jefferson Nature Center

Contact: Susan Cross (Director)
541-773-1039
112 East 6th Street, Suite A, Medford, OR 97501
scross@mind.net

Jefferson Nature Center is a non-profit located in Medford. JNC provides science inquiry and natural history education for youth in the Medford and Phoenix/Talent area with a focus on regional natural history.

Klamath Bird Observatory

Contact: Ashley Dayer (Outreach Coordinator)
Located at Willow Wind Community Learning Center, Ashland, OR
aad@klamathbird.org
www.klamathbird.org

The Klamath Bird Observatory works on educating the public about birds, their responses to restoration and conservation. Our specialty is field-based programs that teach about science and the scientific process.

Lomakatsi Restoration Project

Contact: Oshana Catranides (Executive Director)
541-488-0208
P.O. Box 3084, Ashland, OR 97520

Ecological restoration projects, riparian restoration projects, native plant nursery care, tree planting, fire ecology based on local indigenous ecological knowledge and modern restoration science, including discussions about aboriginal fire as it related to indigenous hunting, gathering, basketry, and survival; ecological fuels reduction for restoration of fire adapted ecosystems; current ecological needs in our area.

North Mountain Park Nature Center

Contact: Kari Gies
541-488-6606
620 North Mountain Ave., Ashland, OR 97520
giesk@ashland.or.us
www.ashland.or.us

We provide service-learning opportunities at North Mountain and Lithia Parks for students in grades 2-12. Topics for the learning component vary with the season. We also work with students in high school and college on a variety of special projects and internships.

OSU Extension Services, Jackson County

Contact: Megan Kleibacker
541.776.7371 x 209; FAX 541.776.7373; CELL 541.301.2935
Youth Natural Science Program
569 Hanley Road, Central Point, OR 97502
megan.kleibaker@oregonstate.edu
extension.oregonstate.edu/sorec/natsci/

or Erin Taylor
4-H Technology Extension
Erin.taylor@oregonstate.edu
extension.oregonstate.edu/sorec

Youth Natural Science Programs at OSU Extension Services are open to groups of youth outside of the normal classroom environment. For example, afterschool programs, field trips, summer camps, weekend trips, Boy or Girl Scout groups, teacher workshops, etc.

Rogue Valley Council of Governments (RVCOG)

Contact: Greg Stabach
541-664-6676 x 219
P.O. Box 3275. Central Point, OR 97502
gstabach@rvcog.org

ScienceWorks Hands-On Museum

Contact: Chris Wallace Hostetler (Executive Director)
541-482-6767 x 31
1500 East Main, Ashland, OR 97520

On site museum experience for students that involves science lab, demonstration and team investigation on exhibits. Outreach programs include Science Inquiry workshops for teachers and students, and assembly-style "ScienceLive!" programs.

SOU Youth Programs

Contact: Danya Hector
541-552-6916
hectord@sou.edu
www.sou.edu/youth

SOU Youth Programs delivers creative, dynamic, educational hands-on programs to curious minds in Southern Oregon.

PORTLAND AREA

Local Watershed Councils

Columbia Slough Watershed Council

Contact: Katie Meckes
volunteer@columbiaslough.org

The Columbia Slough Watershed Coordinator can help organize different projects within the area, including those at Whitaker Ponds. Schools within this area are encouraged to participate in these projects.

Johnson Creek Watershed Council

Contact: Christine Steele
503-652-7477
csteele@jcwc.org
1900 SE Milport Rd., Suite B, Milwaukie, OR 97222

The Johnson Creek Watershed runs from Milwaukie east to Gresham. The council is constantly doing watershed restoration projects. Projects are suitable for middle school and high school students. Call for a list of projects with names of the project coordinators

Tualatin Riverkeepers

Contact: Monica Smiley
503-620-7507
monica@tualatinriverkeepers.org
12360 SW Main St. Suite 100
Tigard 97223

The Tualatin Riverkeepers is the umbrella organization for all "Friends of" groups in the Tualatin River watershed. Projects for schools within this watershed can be found here. River clean-ups can be arranged for your group almost any time of the year. There is also an annual Clean-up Day on Earth Day in April in which everyone can participate.

Tryon Resource Management Partnership

Contact: Liz Callison
503-244-0641
callison@agora.rdrop.com
c/o West Multnomah County Soil & Water Conservation District
2115 SE Morrison St., Portland, OR 97214

Projects including stream bank restoration, water quality monitoring, and plant salvaging can be done in the Tryon Creek Watershed area. Projects are suitable for middle school or high school students.

Area-Wide Resources

Friends of Trees

503-284-TREE
fot@teleport.com
2730 NE Martin Luther King Blvd., Portland, OR 97212

"Seed the Future" campaign goes on annually. Students can participate in tree plantings in many neighborhoods in the greater Portland area. They partner with many different schools, public agencies and non-profit organizations. Call for a schedule of plantings.

Portland Parks and Recreation

Contact: 503-823-5121
Volunteer Services, Portland Parks and Recreation
1120 SW 5th Ave., Room 1302, Portland, OR 97204

Projects are done in wetland areas, parks and neighborhoods. Possible projects in the fall and spring include plantings and clean-ups. These projects can be done by all ages, each project is designed to best suit the students' ages and needs.

The Wetlands Conservancy

Contact: 503-691-1394
9675 SW Tualatin-Sherwood Rd., Portland, OR 97062

Small projects can be designed for each individual group on any one of their wetland preserves (located in Washington, Clackamas, and Multnomah Counties). These might include tree planting and blackberry removal. Call for information on the preserve closest to your school.

Other Resources

Community Energy Project

Contact: 503-284-6827
422 NE Alberta St., Portland, OR 97211

High school projects: Every Saturday they need help weatherizing senior citizens' homes. Weatherizing houses cuts the costs of electric bills which in turn reduces the amount of hydroelectric power needed directly affecting salmon.

Friends of Columbia Gorge

Contact: 503-241-3762
319 SW Washington #301, Portland, OR 97204

During May there is a Trail Restoration Week where students can help restore trails in the Columbia Gorge. Another option is to call Kristin about your individual group and she can find a trail that needs fixing. There is always work to be done!

Friends of Forest Park

Contact: Sandy Diedrich
503-223-2708
117 NW Trinity Place, Portland, OR 97209

Ivy Removal—In Forest Park ivy is a non-native plant species that is taking over areas that used to be inhabited by native plants. Project(s) could be after school or on a Saturday.

Hoyt Arboretum Friends Foundation

Contact: Sue Thomas
503-228-8733
4000 SW Fairview Blvd., Portland, OR 97221

Projects include ivy removal, tree planting, and/or trail work (depending on what is needed at the particular time a group wants to do service).

Jackson Bottom Wetlands

Contact: Pat Willis
503-681-6206
205 SE 3rd St., Hillsboro, OR 97123

Maintenance work on these Wetlands in Hillsboro can be done in the spring. Project(s) could entail dusting trails with wood chips, repairing bird boxes, planting native plants and removal of non-native plants. Tools will be provided as well as some education about the wetlands.

METRO Regional Parks and Greenspaces

Contact: Lupine Jones
503-797-1733
600 NE Grand Ave., Portland, OR 97232

Volunteer opportunities include restoration work at Metro greenspaces, Smith & Bybee Lakes or Oxbow Park. Juniors and seniors in high school can join METRO's Volunteer Naturalist Program and become certified to lead elementary school children on Salmon Field Trips next fall.

The Nature Conservancy

Contact: Volunteer Manager
503-230-1221
821 SE 14th, Portland, OR 97214

Projects at local Nature Conservancy preserves in West Linn, and along the Sandy River. Help with trail maintenance or non-native plant removal. Individual opportunities for older students—Every Wednesday night at the Nature Conservancy office volunteers are needed to do a variety of tasks, including stuffing envelopes, mapping local areas, etc. This is a great way to meet and talk with other people interested in the environment.

Portland Audubon Society

Contact: 503-292-6855
5151 NW Cornell Rd., Portland, OR 97210

One day projects are available for students age 13 and older in the sanctuary within Forest Park. Groups of 8-10 students are needed to help with a wide range of projects (i.e. sanctuary maintenance, pulling ivy, bark dusting, etc.). Supervision will be provided.

Tryon Creek State Park (Friends of)

Contact: Stephanie Wagner
503-636-4398
tryonfrn@teleport.com
11321 SW Terwilliger Blvd., Portland , OR 97219

Tryon Creek State Park is located west of the Willamette River just north of Lake Oswego. Projects would have to be organized by the individual group in partnership with the State Park. Projects include ivy removal, trail maintenance, and stream restoration (in the late spring).

List of Grants

The grant opportunities listed below typically have 2-4 page applications and are not especially competitive. Please use this preliminary list as a reference for future planning if deadlines have passed for this year. All of these opportunities should be renewed for another cycle.

NATIONAL

NEA Foundation for the Improvement of Education Award

Contact: 203-822-7840
Goal: Grants seek to fund participation in high-quality professional development such as summer institutes or action research. Grants also fund lesson study or mentoring experiences to improve teaching, curriculum, or student achievement.
Award: $2000-$5000

National Science Teachers Association NSTA Sylvia Shugrue for Elementary School Teachers

Contact: awards@nsta.org
www.nsta.org/dcat
Goal: For an elementary school teacher who implements an interdisciplinary, inquiry-based lesson plan.
Award: $1000

Office of Education (OED) NOAA Environmental Literacy Grants for Free-Choice Learning

Contact: Sarah Schoedinger
704-370-3528
Sarah.Schoedinger@noaa.gov
www.oesd.noaa.gov/funding_opps.html
Goal: The priority is to create a more environmentally literate citizenry.
Deadline: see website for current deadline

Ecology and Environmental Science Teaching Award NABT and Vernier Software and Technology Foundation Award

Contact: www.nabt.org/sup/education/awards.asp
Goal: Award will be given to a teacher who has demonstrated an innovative approach in the teaching of ecology and environmental science.
Award: $1500

STATEWIDE

Diack Family Oregon Ecology Education Fund

Contact: 503-287-7974
www.diack-ecology.org
Goal: Assists in funding activities in Oregon which take children K-12 into the study of ecology in their fields, forests and waters to see personally what lives there and how it thrives. Funding primarily for long term field ecology studies program development, rather than one-day events. Does not cover substitute teachers or transportation.
Award: up to $1500

Learn & Serve America Youth In Action, Oregon Department of Education

Contact: 503-378-3584 x 369
Goal: This grant is designed specifically to remove barriers for service learning projects directly connected to the school curriculum. Barriers include transportation and plant materials. Projects must be student initiated, planned, and implemented and must provide opportunities to develop leadership and citizenship skills. Grants must be written by students and are reviewed by students. All applications that meet the grant criteria will be funded.
Award: up to $500
Deadline: usually mid-February and mid-March

Meyer Memorial Trust Teacher Initiatives Program

Contact: 503-228-5512
www.mmt.org/~mmt

Goal: Stimulating or facilitating more effective learning.

Award: up to $1500 for individual teachers, $5000 for teams

Deadline: February 1 each year

National Wildlife Federation Wild Seed Fund for Schoolyard Wildlife Habitats

Contact: Beth Stout
503-230-0421
stout@nwf.org

Goal: Creating or enhancing an existing schoolyard habitat

Award: one-time $150 plus $25 Fred Meyer gift certificate

The Oregon Parks Foundation

Contact: 503-297-6043

Goal: Land protection, community outdoor recreation and education programs, administrative expenses, publications, conferences and seminars, emergency funding, recognition and student internship in the context of providing for natural park settings and outdoor recreation and educational opportunities.

Award: $1500–5000

SOLV (Stop Oregon Litter & Vandalism) SOLV CUP projects

Contact: 1-800-322-3326
503-844-9571

Goal: Cleanups, prevention (recycling, signage), restoration (for those in need of social services), plantings, development (trail repair, brush removal)

Award: up to $250 plus free SOLV materials, does not cover transportation

PORTLAND AREA

METRO Waste Reduction Education Program

Contact: 503-797-1521
wred@metro.dst.or.us

Goal: Waste prevention and reduction strategies to increase awareness, create more space for recycling, increase efficiency, and decrease paper costs. Many ideas included. Projects must be within METRO boundary.

Award: $500

METRO Environmental Education & Restoration Grant Program

Contact: Lynn Wilson
503-797-1781
wilsonl@metro.dst.or.us

Goal: Provide funding from the US Fish & Wildlife Service to regional schools and programs with grant projects in environmental education or restoration. Projects must be in METRO area.

Award: range from $250–20,000.

Deadline: early fall—contact for dates.

Metro Nature in the Neighborhoods Grants Program

Contact: Janelle Geddes
503-797-1550
NINrestore@metro.dst.or.us

Goal: To link participants and citizens to their watershed through education and restoration. Projects could include efforts that educate and activate communities in their watershed.

Award: $2500-25,000+

Unified Sewerage Agency Community Best Management Practices Funding Project

Contact: Mark Jockers
503-693-4501
mjockers@usa-cleanwater.org

Goal: Funding for projects that improve water quality, emphasizes water quality as a community resource, and is the result of a partnership. Projects must be within Washington County.
Award: average funding level $500 with a maximum of $5000

Environmental Services City of Portland Clean River Works Community Stewardship Grant Program
Contact: Lynn Vanderkamp
503-823-5625
Goal: To provide direct and long term benefits to community and watershed. Projects must involve citizens in the watershed and other partners. Projects must be within the city of Portland.
Award: up to $5000
Deadline: April 1

GRANT APPLICATION FORM

Healthy Waters Institute

Students Connecting With Their Home Waters

The *Healthy Waters Institute* (*HWI*) seeks to connect every student with their home waters. Through meaningful outdoor educational experiences and commitment to local communities, we will cultivate citizens capable of maintaining the health of waters statewide. *HWI* is a provider of tools, programs and services that help teachers and students connect with their local waters through community-based projects.

HWI offers grants to help teachers engage students with their home waters. Grants up to $500 may be used to pay for field trip transportation costs, substitutes, equipment, rentals, or other relevant science education tools and/or services. *HWI* encourages teachers to submit grant requests following the guidelines below. One role of the local *HWI* Regional Education Coordinator is to assist teachers in the grant application process; *HWI* encourages teachers to contact their local REC for more information and for assistance in creating a project that helps connect students with their home waters.

Pilot Resource Pool Grants

Submissions:

- Individual grants up to $500
- Teachers may submit more than one request
- Open ended submission period

To Be Used For:

- Transportation
- Substitutes
- Equipment
- Rentals
- Other science education tools and services

Who Can Apply:

- Teachers within the pilot watersheds
- Salmon Watch teachers
- Other teachers with projects that further the *HWI* mission

How To Apply:

- Submit the completed Grant Application Form to your Regional Education Coordinator for consideration (see sidebar).

Additional Requirement:

- Successful applicants are required to submit a final report (with photos) for use on-line or in *HWI* journal

Traci Price
Director, Healthy Waters Institute
Oregon Trout
65 SW Yamhill St. Suite 300
Portland, OR 97204
503.222.9091 x 25
traci.price@ortrout.org
www.healthywatersinstitute.org

Information about HWI pilot watersheds:

Mary Ann Schmidt
Regional Education Coordinator
Oregon Trout
65 SW Yamhill St. Suite 300
Portland OR 97204
503.222.9091 x 20
maryann.schmidt@ortrout.org

Kim Carson
Regional Education Coordinator
Oregon Trout
230 S 3rd St, Suite 202
Corvallis OR 97333
541.753.4280
kim.carson@ortrout.org

Kolleen Yake
Regional Education Coordinator
Oregon Trout/Upper Deschutes Watershed Council
700 NW Hill Street
Bend OR 97709
541.382.6103 x 33
kyake@restorethedeschutes.org

Susan Cross
Regional Education Coordinator
Oregon Trout
112 E 6th, Suite A
Medford OR 97501
541.773.1039
susan.cross@ortrout.org

GRANT APPLICATION FORM

Healthy Waters Institute

Students Connecting With Their Home Waters

Date:

School:

Address:

Phone:

Fax:

Teacher:

E-mail Address:

List names of teachers/ leaders who will participate in project:

GRANT APPLICATION FORM

Healthy Waters Institute

Students Connecting With Their Home Waters

Project Description (maximum 250 words):

Explain, by dollar amount and item, how grant funds will be spent?

Who/ how many will benefit from the grant?

How does the project fit into the overall goals of *HWI*? (maximum 250 words)

If the project is on-going, how will it be funded in the future?

List other sources of funding for the project:

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Jared Jirschele (www.uwsp.edu/Education/pcook/unitplans/docs/ResourceFile.doc).