DEQ in the Classroom:

Where's Your Watershed?

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

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March 2008

Grade Level:

4 - 7

Time Required:

About 1.5 hours, including extension.

Objective:

To develop an awareness of watersheds and their function.

Meets Idaho State Standards:

Grade 4: 4.SS.2.1.1, 4.S.1.2.1, 4.S.1.2.3, 4.H.1.1.10*
Grade 5: 5.SS.2.1.1, 5.S.1.2.1, 5.S.5.1.1, 5.H.1.1.8*
Grade 6: 6-9.GWH.2.5.6*, 6-9.GEH.2.5.6*, 6.S.1.2.3, 6.S.5.1.1, 6.S.1.6.4, 6.H.1.1.10*
Grade 7: 6-9.GWH.2.5.6*, 6-9.GEH.2.5.6*, 7.S.1.2.3, 7.S.1.6.3
* With extension activity

Focus:

Surface water/watersheds. Students will learn what a watershed is, discover what watershed they live in, understand how a watershed functions, and discuss ways they can protect water quality by taking care of watersheds. If the extension is used, students will also learn about nonpoint source pollution.

Materials:

Maps of Idaho (highway maps can be ordered from www.itd.idaho.gov/maps) (one set per group or per student, if doing individually)

Large map of U.S. that shows rivers (e.g., classroom map, road map)

Large pieces of newspaper (at least one per group or per student, if doing individually)

Roll of aluminum foil

Markers: red, brown, green, blue (one set per group or per student, if doing individually)

Water droppers and cups of water (one per group or student, if doing individually)

9" x 13" baking pans (one per group or student, if doing individually)

Balls (1 per student is best; fewer is OK) ***OR*** Large, hard-covered 3-ring binder (empty binder with spine less than 2" wide is best) *and* 2 rolls of tape (not in a dispenser)

Maps on pages 10 and 11 of this activity. These maps are for teacher's reference only. See Step 10.

Additional Materials to Complete the Extension Activity:

1 clear container of water (a clear 2-liter soda bottle works well; take the label off)

Food coloring in a container that allows you to meter it out drop by drop

Background:

The water cycle (hydrologic cycle) is the journey water takes as it circulates from land to sky and back again. Within the water cycle, water falls to the earth from clouds as rain, snow, sleet, or hail (precipitation); seeps into the ground or runs across the top of the ground to reach a lake, river, creek, or ocean (or falls directly into a body of water); is used by plants and is transpired back into the atmosphere or travels within a body of water until it either evaporates or reaches the ocean (from where it evaporates).

As water falls to the earth as precipitation, it lands within a watershed, which is the area of land that all drains to one river, lake, stream, or ocean. Because all water must drain somewhere, if you are standing on land, you are standing in one or more watersheds. Some watersheds, such as the Columbia River watershed, are large and drain water from several states. Other watersheds, such as the Paradise Creek watershed near Moscow, are fairly small and only drain a small area. Bigger watersheds contain many smaller watersheds. For example, the Paradise Creek watershed is within the Columbia River watershed, as are the Boise River watershed, the Snake River watershed, and the Salmon River watershed.

Since watersheds are interconnected, we all live "upstream" and "downstream" of someone else in a watershed. This means that everything we do affects the people, animals, and other life downstream of us, and that everything others do above us affects us. For example, if someone throws a piece of litter in a creek, that litter not only affects that creek and the life in and near it, but also the other creeks, rivers, and eventually the ocean where that litter will travel. By the time the piece of litter reaches the ocean, it would also be joined by other pieces of litter left by other people. (See "Extension," page 7 to follow up on this concept.)

Vocabulary:

Aquatic Life	Plants or animals occurring, growing, or living in water.
Conserving Water	Using water wisely (not wasting it).
Continental Divide	The line of summits of the Rocky Mountains, separating streams flowing toward the Gulf of California and the Pacific Ocean from those flowing toward the Gulf of Mexico, Hudson Bay, and the Arctic Ocean.
Erosion	The process by which the surface of the earth (dirt, soil) is worn away by the action of water, wind, etc. In Idaho, erosion often occurs when soil is carried by water from precipitation or snowmelt.
Evaporation	When water changes into vapor (water vapor).
Headwater	Where a river or stream starts; its source.
Nonpoint Source Pollution	Pollution originating over a wide geographical area (such as from a road or field), and not discharged from a specific location or "point."
Outflow	Something that flows out. The water that flows out of a lake is the lake's "outflow."
Precipitation	Any form of water, such as rain, snow, or sleet, that falls to the earth's surface.
Protecting Water	Keeping water clean.

Vocabulary, Continued:

Sediment	Fine particles of soil or dirt.
Terminus	The place where something ends.
Transpiration	The emission of water vapor from the leaves of plants.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Cycle	The journey water takes as it circulates from land to sky and back again. It includes processes such as precipitation, evaporation, and transpiration. (Also called the "hydrologic cycle.")
Watershed	An area of land that all drains to one water body, such as a lake, stream, or ocean.

Procedure:

This activity has three parts. Part I has two options.

Part I, Option 1. Choose a small hill or incline on your school grounds. A hill with a "peak" (where the hill slopes away in more than one direction) is ideal.

Part I, Option 2. If you do not have access to a small hill, or if the weather does not permit going outside, create a small "hill" in the classroom by opening a three-ring binder and standing it on its edges, so it creates a triangle with the spine at the top.

Part I, Option 1. Outside on a hill.

Step 1. Give a ball to each student. Have all students stand at the top of the hill, holding their balls.

Step 2. Ask the students what happens when it rains. Discuss how some of the water falls on the ground and runs across the surface; other water falls on the ground and seeps into the ground.

Step 3. Tell the students they are going to pretend their balls are rain drops and that their rain drops are going to run across the surface. Tell them that when you give the signal ("Rain!"), they should all drop their balls/raindrops at once and watch where they go.

Step 4. Say "1, 2, 3, Rain!" and have the students drop their balls. (Be sure the students are standing where the balls will roll downhill – not on a flat plateau at the top of the hill.)

Step 5. Have students observe where their balls went. Did they all roll down the same side of the hill? Did they all go to the same place? Discuss with students how their balls all rolled downhill. Water travels downhill, too. If the balls were water, what do they think would be at the bottom of the hill? *A river, stream, or lake.*

Part I, Option 2. Inside with a binder, on a table or on the floor.

Step 1. Have a student open a three-ring binder and stand it face down to form a triangle, with the spine at the top.

Step 2. Ask the students what happens when it rains. Discuss how some of the water falls on the ground and runs across the surface; other water falls on the ground and seeps into the ground.

Step 3. Tell the students they are going to pretend two rolls of tape are rain drops and that the rain drops are going to run across the surface. Tell them that when you give the signal ("Rain!"), someone will place two rolls of tape on the top of the binder and the students should watch where the rolls of tape go.

Step 4. Give rolls of tape to two students and have them place the tape on the spine of the binder. Say "1, 2, 3, Rain!" and have the students let go, so that the rolls of tape roll down the side of the binder.

Step 5. Have students observe where the rolls of tape went. Did they both roll down the same side of the binder? Did they end up in the same place? Discuss with students how the tape rolled downhill. Water travels downhill, too. If the tape were water, what do they think would be at the bottom of the binder/hill? *A river, stream, or lake.*

End Part I. Everyone continue with Step 6 (Part II).

Part II.

Step 6. Explain the concept of a watershed. *A watershed is a land area that all drains to one water body. Small watersheds drain to small streams, creeks, or lakes, which drain into larger watersheds (rivers or lakes), which drain to even larger watersheds (bigger rivers or lakes), which drain to oceans. Explain that everyplace on land is part of a watershed.*

Some of Idaho's watersheds are unique in that they do not drain to a lake or ocean. These watersheds instead drain or "sink" to ground water. Water seeps into the porous stream bed or spreads out in grassy areas and the water body eventually disappears. Four watersheds in Idaho are "sinks" watersheds: the Big Lost River, the Little Lost River, Birch Creek, and Medicine Lodge Creek. All of these are found in eastern Idaho. (If you do not live in eastern Idaho, you may choose to skip the discussion of "sinks" for sake of clarity.)

Write a definition of a watershed (or draw a picture) to leave on the board for the class to see during the remainder of the exercise. Tie your discussion back to what the students observed in Part I.

The next parts of the activity can be done by students individually or in small groups. If doing in groups, divide students now.

Step 7. Give each student or group a map of Idaho and a set of colored markers. Ask the students to find their town on the map, then look at the area near their town and identify nearby lakes and rivers. Have students trace the course of the largest nearby river or stream with their fingers…start in/near your town and have them trace both upstream to see where the river begins (headwaters) and downstream to see where the river ends, drains into a lake or another river, or leaves Idaho. Students will notice that most rivers will flow into other, larger, rivers before leaving the state.

Have students answer the following questions individually or in their groups…

In which direction does your river flow?

Where does it start (the "headwaters")? Look for the general area.

Where does it leave Idaho? (Or, where does the river it flows into leave Idaho?)

After students are confident they have found the river, headwaters, etc., have students trace the river course in blue, circle the headwater area of their river in red, and circle where it leaves Idaho in brown.

Step 8. As a class, discuss what the students observed in Step 7. Did all groups find the same river or stream? If not, discuss what different groups picked and why there were differences. Together, decide which watershed(s) your town lies in. *Since watersheds are nested within one another, your community will lie within more than one watershed (see Step 10).* At this point, pick the smallest watershed that encompasses your town.

Step 9. Look at a map of the U.S. With the class's help, have a student trace the route of your local water body (the one you picked in Step 8) from its headwaters (start) to its terminus (end)*. Most water bodies in Idaho will feed into other, larger water bodies, and eventually into the Pacific Ocean. However, some will end in "sinks" (see Step 6) and some will eventually flow into the Great Salt Lake in Utah. The Great Salt Lake is unique in that it has no outflow; that is, water does not flow out of the lake. Therefore, the Great Salt Lake is the terminus for any water body that flows into it. **(*Students should trace the route of the water body all the way to the ocean, sinks, or Great Salt Lake; continue to trace the route as it flows into other, larger rivers and out of Idaho.)**

Observe how smaller watersheds feed into larger watersheds, which demonstrates that we all live in several watersheds at once.
For example, Boise is in the Boise River watershed, but also the Snake River watershed (because the Boise River flows into the Snake River) and the Columbia River watershed (because the Snake River flows into the Columbia River), and the Pacific Ocean watershed (because the Columbia River flows into the Pacific Ocean).

Count how many different watersheds you live in. Can you name all of them?

Step 10. On a map of the entire U.S., show your students the extent of the Columbia River watershed in the west and the extent of the Mississippi River watershed in the Midwest. Point out the many small and large streams and rivers (and therefore other watersheds) that feed into these large watersheds. Point out the Continental Divide and discuss how it separates watersheds in the West from watersheds in the Midwest and East. (*Teacher: See maps, pages 10 and 11 ahead of time to see the extent of these watersheds to help you show them on your classroom map. These maps are for your reference only.*)

Step 11. Ask students to look back at their maps and look at the land surrounding their rivers. Ask where they think the water in their rivers comes from. *Rain, snow, springs, irrigation, other streams.*

Step 12. Have your students look at their maps and see what types of land use surround their rivers (e.g., agriculture, urban, forest, etc.). Discuss how those types of land use could impact the rivers/ watersheds.

Part III.

Step 13.

Step 13. Give each group one large piece of newspaper. Have them crumple their paper into a loose ball, then spread it partially out (not flat) in a 9" x 13" pan to create a landscape that is full of dips and peaks. Students may need to tape the newspaper onto the pan.

Step 14. Give each group a large piece of aluminum foil and have them loosely cover their newspaper with the foil (following the contours). Students may need to tape the foil onto the pan.

Step 14.

Step 15. Have each group look at their landscape. Have students find the highest peak on their landscape. Mark this with a red circle. Have them find where a major river or lake would be and then trace the course of the river/lake with blue. Have them find where they think the borders of the watershed would be that "feeds" that river/lake. To help them think through this, use the example of a bathtub – any water that falls on the sides of the bathtub would drain down into the tub and down the drain. The watershed is anyplace that is part of a "bathtub" – anyplace where, if it rained, the water would drain to the river they drew. The top edges of the bathtub would be the outline of the watershed. Have them trace the outline of their watershed with green. **The green line will likely be a jagged semi-circle around the river/lake, connecting the peaks that surround the it.**

Step 16. Discuss with students what else might be in their watersheds – e.g., lakes in large basins, perhaps towns along the river or near a lake, smaller rivers or streams, trees or farms (depending on your local land uses), etc. Using a brown marker, have students draw in appropriate landscape features, based on the topography of their watershed and typical land uses in your area.

Step 17. Have students show their classmates their watersheds and explain why they put what they put where.

Step 18. Using a dropper, have students drip water around the edges of their watershed (where they drew the green line), then observe to see if the drops follow the contours of their watersheds as they predicted. Use one dropper-full of water at each of several locations along the edge of the watershed. If the water does not follow the contours as they predicted, have students consider why not and change the outline of their watershed, if necessary. Remind students that if the water flows down the "back" of a peak, that is OK. That water is just flowing into a different watershed.

Step 19. Have students record their observations and conclusions as to why the water did or did not drain into their river as expected.

Follow up with the Extension Activity, page 7, and/or wrap up with Questions for Discussion, page 8.

Extension:

This extension activity demonstrates the concepts of nonpoint source pollution and that "we all live downstream/upstream." That is, it shows how even if each person makes only a small impact to the watershed (nonpoint source pollution), it can cause a large cumulative effect "downstream." See page 1 for materials.

Procedure:

Show the students the container of water and tell them it represents a river or lake. Take the food coloring and add 1 drop to the water. Allow the class to observe what it looks like. It should be slightly colored.

Pass the water and the food coloring around the class and have each student add one drop of "pollution." While the class is passing the water around and "polluting" it…

Discuss nonpoint source pollution. *Nonpoint source pollution is pollution that does not come from a single source (point), such as a ditch or a pipe. Most water pollution in Idaho comes from a lot of small sources (nonpoint sources), as opposed to a few big sources such as factories. Nonpoint source pollution can come from yards, roads, fields, etc.*

In our everyday actions, each of us contributes a little to water pollution, often without even realizing it. We can contribute to nonpoint source pollution when we don't pick up after our pet, when we pour things in the street or down storm drains, or if we use too much fertilizer on our lawns. Bacteria and nutrients from pet waste, chemicals dumped down storm drains (such as motor oil or even soda), and excess fertilizer can all make their way into water bodies as pollution. While each of our contributions is small, it all adds up and can become significant amounts of pollution. This activity will demonstrate this.

Once the water has been "polluted" by everyone in the class (aka everyone in the watershed), look at it again. It should be colored very dark.

Discuss that each person added just one drop, but it all added up to make the water very polluted. Then have students think what it would be like if another class did this before them (represents people above them in the watershed) and what it would be like if they passed their polluted water on to yet another class (represents people below them in a watershed). Talk about the concept that "we all live downstream/upstream" of someplace/someone. What we do to our water travels downstream and impacts everyone further down the watershed.

Discuss what types of things and what actions contribute to nonpoint source pollution.

Pet waste. *This contains bacteria and nutrients that can get into surface water or ground water.*
Fertilizer, pesticides, herbicides. *If more is used than necessary, these can get into surface water and ground water. They contain nutrients and chemicals that can harm water quality and aquatic life.*
Chemicals in the street. *Liquids (e.g., motor oil or antifreeze) poured or litter placed in the gutter, on the street, on driveways, etc. can get washed down storm drains and carried to ground water or a nearby river or lake. (Storm drains are the grates along the sides of roads where water drains. This water [and the pollutants it carries] is not treated; it goes directly into rivers, streams, ground water, etc.)*
Sediment. *Sediment (soil/dirt) from erosion is the most common nonpoint source pollutant in Idaho.*

Discuss what students can do to prevent nonpoint source pollution. (See Question #4 under Questions for Discussion.)

Be sure to point out to students that the concept demonstrated in this activity is the same with positive environmental actions too. That is, if each of us just takes one small action to clean up the environment (or not pollute in the first place), it can have a large cumulative effect.

Questions for Discussion:

1. Do you know what watershed you were born in?
Some students will likely have been born locally, so the watershed your class identified in Step 8 will be the watershed where they were born. For students who were born elsewhere, work with them to figure out the answer…either by looking at a map or (if they are familiar with the town where they were born) by asking questions about local bodies of water.

2. Why is it important to protect our watersheds and the water bodies (e.g., lakes, rivers) in them?
Look for answers such as "we all live downstream/upstream"; it helps keep fish, plants, and other living things healthy; we (and/or others downstream from us) may use the water for drinking, recreation, agriculture; etc.

3. What are some of the land uses in your watershed (e.g., forest, agriculture, urban) and how do they affect the watershed?

4. What can you, as a young person, do to protect the watershed where you live, and the water bodies it feeds?
Look for answers such as clean up after pets; don't pour things in the street or down storm drains; remind parents to only use as much fertilizer, herbicide, and pesticide as necessary; wash the car on the grass or at a car wash so pollutants on the car don't wash down storm drains; plant trees or other plants along rivers and don't destroy plants that are already there.

Follow-Up:

- Have students follow up on some of their ideas of how to protect watersheds (see Question for Discussion #4): planting trees, not littering/picking up litter, joining or creating a "Friends of the Watershed" group, picking up after pets, not dumping things down storm drains, etc., or encouraging others to do the same (e.g., make posters, give presentations, etc.). Contact your community to see if they have a storm drain marking program. Many communities are looking for volunteers to mark local storm drains with "dump no waste" markers. See www.deq.idaho.gov/water/prog_issues /storm_water/storm_drain_marking.cfm for more information on storm drain marking.
- Invite a guest speaker to discuss water quality (contact amy.luft@deq.idaho.gov for suggestions on DEQ speakers in your area), drinking water (contact your local water utility), or snowmelt/snowpack (contact the Natural Resources Conservation Service).
- Take a field trip to your local water treatment facility.
- Learn more about stormwater with *The Rain Takes Pollution Mainly Down the Drain* activity www.deq.idaho.gov/water/educ_tools/storm_drain_lp.pdf
- Learn more about the water cycle with Thurstin's Water Cycle Adventure (Interactive EPA Web site) www.epa.gov/safewater/kids/flash/flash_watercycle.html
- Have students create a watershed journal. Either individually or as a class, have students visit a spot within your local watershed on several occasions and reflect on what they observe, sense, and/or feel while there in a journal (in writing, by drawing pictures, or both).

Additional Resources:

After the Storm: A Citizen's Guide to Understanding Stormwater
www.epa.gov/npdes/pubs/after_the_storm.pdf

DEQ Kids: Water Does a Lot for Us…What Can We Do For Water?
www.deq.idaho.gov/water/educ_tools/water_quality_kids_brochure.pdf

DEQ Kids: Water Quality in Idaho
www.deq.idaho.gov/water/educ_tools/water_kids_tips_fs.pdf

Drinking Water Protection
www.deq.idaho.gov/water/prog_issues/source_water/protection.cfm

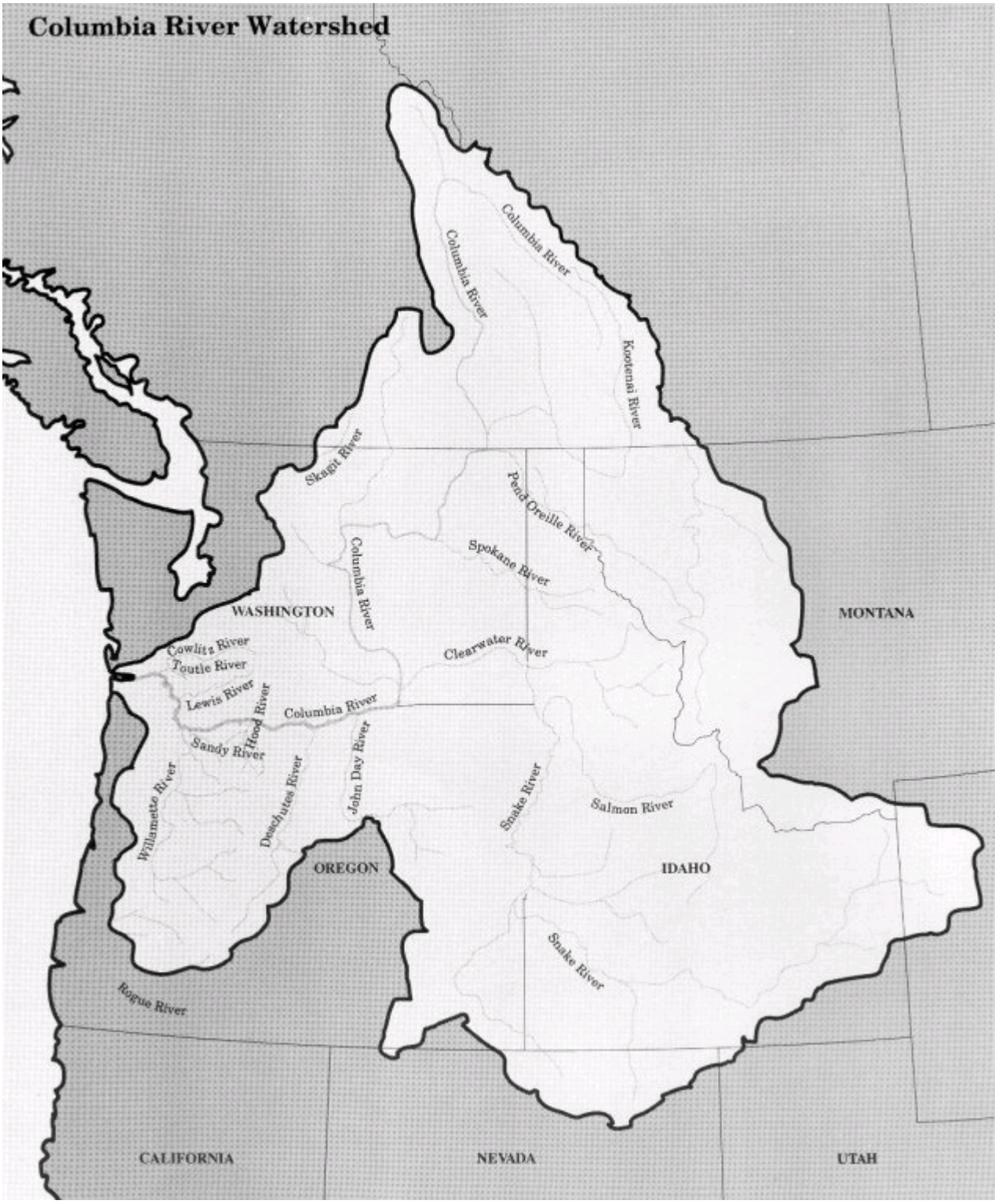
Down the Drain with Stormwater
www.deq.idaho.gov/water/assist_citizen_comm/stormwater_brochure_1007.pdf

Nonpoint Source Management
www.deq.idaho.gov/water/prog_issues/surface_water/nonpoint.cfm

Stormwater in Idaho: An Overview
www.deq.idaho.gov/water/prog_issues/storm_water/overview.cfm

Surface Water: Monitoring and Assessment
www.deq.idaho.gov/water/data_reports/surface_water/monitoring/overview.cfm

Water Quality: Educational Tools (DEQ Web site)
www.deq.idaho.gov/water/educ_tools.cfm



Source: www.bpa.gov/Power/pl/columbia/stories/jour001.jpg

Mississippi River Watershed

Source: www.lpb.org/education/classroom/ntti/cdpdf2003/6jmHyp1.pdf