

DEQ in the Classroom: The Rain Takes Pollution Mainly Down the Drain



IDAHO
DEPARTMENT OF
ENVIRONMENTAL
QUALITY

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Grade Level:

4 – 7

Time Required:

About 2 – 2 ½ hours, total, spread over 2 days.

Day 1: Approximately 1 ½ hours

Day 2: Approximately 1 hour

Objective:

To develop an awareness of what stormwater is, where it goes, how it can become polluted, and how polluted stormwater can affect our rivers, streams, lakes, and ground water.

Meets State Standards:

Grade 4: 4.S.1.2.1, 4.2.1.2.3, 4.H.1.1.10

Grade 5: 5.S.1.2.3, 5.S.5.1.1, 5.S.1.2.1, 5.H.1.1.8

Grade 6: 6-9.GWH.2.5.2, 6-9.GEH.2.5.2, 6.S.1.2.2, 6.S.1.2.3, 6.S.5.1.1, 6.H.1.1.10

Grade 7: 6-9.GWH.2.5.2, 6-9.GEH.2.5.2, 7.S.1.2.2, 7.S.1.2.3, 7-8.H.1.1.9

Meets standards in Social Studies, Science, and Health.

Focus:

Stormwater, water pollution.

Materials¹:

Sturdy cardboard about 6" x 6" (1 per group or student)

Wax paper (enough to cover each piece of cardboard; 1 roll should be sufficient unless cardboard pieces are quite large and/or each student does his/her own)

Clay (non-hardening modeling clay works well; about 3 oz per maze)²

Masking tape

Green food coloring

Yellow food coloring

Water

Black ground pepper in a pepper shaker (½ cup) (for an entire class)

Cooking oil (about ½ cup) (for an entire class)

Salt (about ¼ cup) (for an entire class)

Powdered hot chocolate mix in a salt/pepper-type shaker (½ cup) (for an entire class)

Droppers or drinking straws (1 per student/group, plus 4 more)

Clear plastic cups (one per student/group, plus 4 more)

Half-gallon milk jug, juice pitcher, or other, similar-sized, container

Paper towels (for spills and clean-up)

¹ This activity can be done by each student individually or in small groups. Materials and instructions are listed per stormwater maze created, unless otherwise noted.

² Check local craft stores. The clay needs to stick to the wax paper.

Background:

Stormwater is water from rain or melting snow that does not immediately soak into the ground. Stormwater runs off land and hard surfaces such as streets, parking lots, and rooftops, and picks up pollutants, such as fertilizers, dirt (sediment), pesticides, and oil and grease. Eventually, stormwater soaks into the ground or enters rivers, lakes, and streams, bringing pollutants with it.

A storm drain is a drain (usually a grate) along the side of a road or in a parking lot that funnels water from a street, parking lot, or other hard surface into a stormwater pipe. Stormwater pipes channel stormwater to nearby bodies of water, such as rivers and lakes, or to ground water.

In Idaho, stormwater is channeled directly to rivers, streams, or lakes, or underground to ground water (it is also sometimes channeled to the ocean in coastal areas of the U.S.). It is *not* cleaned at a wastewater treatment plant. This means all of the pollutants carried by stormwater are also channeled to these water bodies. If you pour something down a storm drain or in a gutter, it is just as though you poured it into your favorite swimming hole or fishing spot, or even into the source of your drinking water.

There are many things individuals can do to help prevent stormwater pollution.

- Never pour anything other than pure water into a gutter or down a storm drain.
- Only use as much pesticide and fertilizer as necessary (read package instructions). Extra product (and your money!) goes down storm drains.
- Position sprinklers so you only water your lawn (not the driveway, sidewalk, etc.), and only use as much water as necessary. Extra goes down storm drains and takes pollutants with it.
- Use a commercial car wash. Commercial car washes recycle their wastewater and some also treat it before it is sent into the sewer system. If you do wash your car at home, use a bucket or a nozzle that you can turn off so the hose isn't running the entire time and wash your car on the lawn so the extra water soaks into the ground. Use cleaners sparingly.
- Pick up after your pet. Pet waste on the ground adds bacteria and nutrients to the stormwater, and eventually to local water bodies.
- Recycle, trade, or properly dispose of household products that contain chemicals. Do not pour them onto the ground or into gutters or storm drains.
- Participate in a program to educate your neighbors about stormwater pollution by marking storm drains with special "Dump No Waste" markers. Contact your local city public works department or the Department of Environmental Quality (208/373-0502) for more information on marking programs.

Vocabulary:

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| Contaminant | Something that makes something else unclean (e.g., mold on your food). |
| Drinking Water | Water that is used for drinking and other household functions. |
| Ground Water | Water beneath the earth's surface. |
| Gutter | A channel at the edge of a street or road for carrying off surface water. |
| Pollutant | Any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems. Something that pollutes the environment. |
| Pollution | The result of polluting or the state of being polluted, especially the contamination of soil, water, or air by the discharge of harmful substances. |
| Sediment | Fine materials from weathered rocks and organic material that are suspended in, transported by, and eventually deposited by water or air. Dirt. |
| Storm Drain | A drain (often a hole with a metal grate over it) found in a parking lot and along the side of a road used to capture stormwater and funnel it to a stormwater pipe, which then carries stormwater to a discharge point, such as a river. |
| Stormwater | Water from rain or melting snow that does not immediately soak into the ground. |
| Surface Water | Bodies of water, such as streams, lakes, rivers, and wetlands, which are on the surface of the land. |
| Wastewater | Used water, such as from a home, that contains enough harmful material to damage the water's quality. Every building with running water generates some sort of wastewater. |
| Wastewater Treatment Plant | A facility that removes pollutants from wastewater, then releases the treated wastewater back into the environment. Wastewater from homes and other buildings is often cleaned ("treated") at wastewater treatment plants. |

Procedure:

Ahead of time:

Scout out the location of the storm drain nearest your school³. Look in your school parking lot and/or on the edge of road in front of your school. Call your local city public works department and ask what body of water your local storm drains discharge into (e.g., the Clearwater River, the Boise River, ground water, etc.).

Prepare the “pollution”:

- Fill a plastic cup half full of water and add 3 drops of green food coloring (will represent fertilizer)
- Fill a plastic cup half full of water and add 3 drops of yellow food coloring (will represent antifreeze)
- Fill a plastic cup half full of cooking oil (will represent motor oil)
- Fill a plastic cup half full of water and add enough salt so that the water is saturated (no more salt will dissolve) (will represent pesticides)
- Fill a salt/pepper-type shaker with powdered hot chocolate mix (will represent sediment [dirt])
- Fill a pepper shaker with ground black pepper (if it did not come in its own shaker) (will represent litter)
- Write each pollutant (e.g., “fertilizer,” “litter”) on a piece of paper (or print from page 9 and cut out).

Day 1

Step 1. Have a student fill a clean half-gallon milk jug (or other container) with tap water.

Step 2. Have the class walk to the nearest storm drain. Bring the milk jug filled with water with you.

Step 3. Walk a few feet up-gradient of the drain and have one of the students pour the water in the gutter or on the parking lot. (Distance can vary depending on the gradient – the lower the gradient, the closer to the drain you will need to pour. You want students to be able to see the water run down the gutter/parking lot and enter the drain without having to wait a long time.)

Step 4. Have the students observe the water. Watch as it goes down the drain. Note if it ran over/through any contaminants, such as motor oil or litter.

Step 5. Return to the classroom.

Step 6. Discuss storm drains and stormwater (see background). Ask students if they know where their local storm drains discharge (both generally, e.g., “a river,” and specifically, e.g., “the Blue River”). If no one knows, provide that information to them.

Step 7. Have students brainstorm a list (write on the board) of what types of things could be carried by stormwater into storm drains. Students can use their observations from Step 4 to help with the list. Items on the list might include litter, soil/dirt (sediment), fertilizer, pesticides, soap (e.g., from washing cars), antifreeze, motor oil, gasoline, soda, coffee, chewing gum, etc.

Step 8. Tell students they are going to build their own “streets” and observe how water collects pollutants on its way to a storm drain. If students will do the activity in groups, divide into groups now.

³ Some older Idaho towns may not have storm drains or stormwater systems. Stormwater in these towns soaks into ground water or runs into surface water on its own, without being funneled through storm drains or storm pipes.

Step 9. (Each group/student) Cover a piece of cardboard with wax paper. Fold the wax paper over the edges of the cardboard and tape underneath.

Step 10. Using clay, create a maze on the cardboard (see photo, page 10). Be sure the clay sticks to the wax paper at all points, so that water cannot escape through a gap. The maze should have an exit point (off of the edge of the cardboard). The maze represents streets and parking lots. The exit point represents the storm drain.

Step 11. Place the cups and shakers of pollution in front of the class with the papers identifying what the pollutants are (what they represent; print from page 9). Put a dropper or straw⁴ with each of the four liquid pollutants.

Step 12. Using the droppers/straws and shakers, have students each put a few drops/shakes of the pollutants in various places in their mazes (on the “streets”). Students can pick which pollutants they use (best if not everyone uses all pollutants) and how much of each pollutant they use (best to limit to 6 - 8 drops or shakes of any one pollutant per maze). Have students record which pollutants they used and how many drops/shakes of each they used.

Step 13. Allow one day for the water to evaporate.

Day 2

Step 14. Tape a clear plastic cup at/under the maze exit so that when water exits the maze it will be caught in the cup. (Because the cups will hang down, mazes will need to be set at the edges of tables, etc.) The exit point/plastic cup represents the storm drain.

Step 15. With a dropper/straw, have each student/group put 12 drops of water at the beginning of their maze, then “help” the water move through the maze, and pass over the “pollutants” by tilting the maze in different directions. End with the water exiting the maze and into the cup.

Step 16. Observe as the water picks up contaminants as it moves through the maze.

Step 17. Have students observe and record what their water looks like after it has left the maze (do not taste). Does it look different? In what ways? Can you see things in the water? Is it colored? If so, what color? Does it smell? Does it feel oily? Does it feel gritty? What other things do you notice? What do your observations tell you about what happened to the water as it passed through the maze?

Step 18. Have students/groups get together with two other students/groups and compare results and compare pollutants and quantities of pollutants used. What similarities/differences were seen?

Step 19. Ask a few students/groups to describe to the class their results and the comparison of their results with other students/groups in Step 18.

⁴ If droppers are not available, use straws by placing one end of the straw in the liquid and covering the other end with a finger. Then release the finger to let the liquid out, drop by drop.

Questions for Discussion:

1. Which of the “pollutants” we used in our experiment (fertilizer, litter, pesticides, motor oil, antifreeze, sediment [dirt]), have you seen in gutters, streets, driveways, parking lots, etc.?
2. What would have happened to those pollutants you saw?
Would have gone down storm drains.
3. What did your observations tell you about what happened to the water as it passed through the maze? (Already discussed in groups, but now discuss as a class.) What results of your experiments surprised you? What didn’t surprise you?
4. Why do we care about stormwater?
Stormwater enters our lakes, rivers, streams, and/or ground water. If it carries pollutants with it, those pollutants enter these bodies of water as well and can hurt fish and other wildlife, make the water less desirable for recreation, make the water stink or look bad, and make the water more difficult and costly to clean if it is a source for drinking water.
(In Idaho, most of our drinking water comes from ground water. Public water systems are required to test their water regularly and treat [clean] the water when necessary. However, individuals with private wells are responsible for testing and treating their own water [if/when necessary].)
5. What can you do to help keep stormwater from becoming polluted?
 - Don’t pour anything other than pure water into a gutter or down a storm drain.
 - Remind your parents to only use as much pesticide and fertilizer as necessary (read package instructions). Extra product (and your family’s money!) goes down storm drains.
 - Position sprinklers so you only water your lawn (not the driveway, sidewalk, etc.), and only use as much water as necessary. Extra goes down storm drains and takes pollutants with it.
 - Ask your parents to use a commercial car wash. Commercial car washes recycle their water and some also treat it before it is sent down storm drains. If you do wash your car at home, use a bucket or a nozzle that you can turn off so the hose isn’t running the entire time and wash your car on the lawn so the extra water soaks into the ground. Use cleaners sparingly.
 - Pick up after your pet. Pet waste on the ground adds bacteria and nutrients to the stormwater, and eventually to local water bodies.
 - Remind your parents to recycle, trade, or properly dispose of household products that contain chemicals. Do not pour them onto the ground or into gutters or storm drains.
 - Educate your family, friends, and neighbors about stormwater pollution (Find ideas on how to do this under “Assessment/Follow-up Suggestions,” page 7).

Assessment/Follow-Up Suggestions:

After the Activity:

- Visit a storm drain outlet (a place where the stormwater leaves the stormwater pipe and enters a water body) and observe the quality and cleanliness of the water. Contact your local city public works department to learn the location of storm drain outlets in your community (if any).
- Trace on a map, or develop your own map, to show the path that water takes after leaving your town on its way to the ocean. The stormwater pollution from your town follows this same path and is added to the stormwater pollution from all the other communities (that use those water bodies for storm drain discharge) along the way.
- Research local laws and prepare a report on what you find. Does your community have laws to protect stormwater?
- Pick a different Idaho community, a community in a different part of the county, and/or a community in a different part of the world, and research what happens to its stormwater. Where does it go (a specific river? The ocean?)? What laws exist, if any, in that community (those communities) to protect stormwater? Compare and contrast with your community and among communities if you pick more than one.
- Show how each individual or each community can impact stormwater. Pick a part of the classroom that is relatively bare (“clean”). Have students take a close look and/or draw a picture of the area, or the teacher take a photo of the area. Then have each student walk by and throw one thing that they can identify as theirs (piece of paper, pencil, shoe, etc.) into the “clean” area. Have students watch the entire time, but specifically stop periodically to ask students what differences they see in the “clean” area (that is, it is no longer clean). Once done, have students take another look, draw another picture, or have the teacher take another photo. Discuss how each just contributed one item, but they ended up with a very dirty/polluted area. Then have the students do the same thing in reverse (one at a time, each student pick up what they threw in) and again discuss how each student just picked up one item, but that together they made the area clean again. The students could represent individuals affecting stormwater in your community or communities that affect water quality in a certain body of water by discharging stormwater to that water body. Discuss the collective impact (positive and negative) individuals can make. Discuss (again) actions individuals can take to protect stormwater.
- Educate others in your school, neighborhood, and community about storm drain pollution.
 - Make posters to hang around your school or on community bulletin boards in stores and community centers.
 - Write letters to the editor.
 - Participate in a storm drain marking program. Students and adults mark storm drains with special “Dump No Waste” markers. Contact your local city public works department or the Department of Environmental Quality (208/373-0502) for more information on marking programs in your area.

Additional Resources:

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

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

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

Make Your Home the Solution to Stormwater Pollution
www.epa.gov/npdes/pubs/solution_to_pollution.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
www.deq.idaho.gov/water/educ_tools.cfm

Fertilizer

Antifreeze

Sediment (dirt)

Litter

Pesticides

Motor Oil

