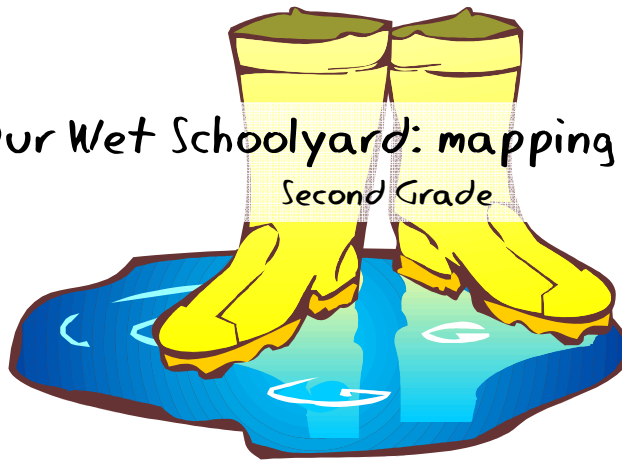


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## Our Wet Schoolyard: mapping puddles

Second Grade



This lesson arose from students' observation about the large puddles in their schoolyard. These puddles often made certain places inaccessible and caused them to reroute their path between the schoolyard and school building. In this lesson, students answer: *Why are the puddles in our schoolyard where they are?* and *What can we do to get rid of them?*

### Enduring Understandings:

- Water moves between different parts of the environment.

**NYS Standards:** Elementary standards for math, science and technology:

Standard 1 (Analysis, inquiry and design):

- S2.3b Record observations accurately and concisely.
- Analyze, construct, and operate models in order to discover attributes of the real thing

Standard 6 (Interconnectedness)

- Identify common things that can be considered to be systems

Standard 4 (Science)

- 2.1c Water is recycled by natural processes on Earth.
- 5.1c The force of gravity pulls objects toward the center of Earth.
- 5.1d The amount of change in the motion of an object is affected by friction.

**Setting:** School and Schoolyard

**Duration:** Two 45 minute - 1 hour sessions in mid to late spring

### Materials you will need:

Maps of various sorts (trail maps, road maps, a river map, subway map, etc)

Three water bottles

Sand

Soil

1 foot by 6 inch (approximately) piece of hard plastic, metal or wood

Bucket or basin

Medium size measuring cup or an empty bottle or cup

3 clear plastic cups of any size

Clipboards and colored pencils

After studying puddles in the schoolyard in Kindergarten and first grade, students now build their mapping skills to determine why puddles are where they are, and how they might be drained in order to keep the schoolyard dry. This lesson is a building block to understand the Watershed concept.

Blank map of school

Transparencies printed from Google Earth showing several spatial levels (globe, hemisphere, country, region, county, town, schoolyard) *optional*


### Setting up the lesson

1. *Optional* Gather various maps: road maps, hiking maps, maps of a river, subway maps, touristic maps, etc.
2. *Optional* Go to Google Earth and print (on transparencies) aerial photos that zoom into your school, starting with the globe and ending with the school. If a computer with internet and projector are available, you can go to Google Earth during the lesson and zoom into the schoolyard.
3. The introduction of this lesson involves 3 demonstrations which the teacher should prepare in advance.
  - a. Infiltration. Students will need to build their knowledge about why water seeps down into the ground in some places and not in others. Find 3 clear plastic bottles, cut the bottom off and stuff the mouth with cotton and/or some sort of screen or filter.
    - i. Bottle 1: soil. Fill one bottle densely with dry, rich soil.
    - ii. Bottle 2: soil with a lid. Fill one bottle densely with dry rich soil and then cover it with some impermeable material that you can put a small hole in. Make sure that the edges of the material fit tightly into the bottom of the bottle.
    - iii. Bottle 3: sand. Fill one bottle with dry sand.
  - b. Runoff . While it is intuitively obvious that water runs downhill, it is important to remind students that the slope of their schoolyard contributes to puddle formation. Place the plastic, metal or wood board, the basin or bucket and the measuring cup or bottle (filled with water) together.
  - c. Evaporation. Set 3 cups of water in three different places in the classroom. Be sure to add the same amount of water in each cup and mark the water level with a marker. Put one cup in the sunniest place and one cup in a dark place. Let the students choose where to set the last cup. You should set this up in several hours, or even one day, before conducting starting this lesson.
4. Using Google earth or an aerial photo of the schoolyard, trace a simple outline map of the school building and schoolyard boundary (see sample on following page). Photocopy a map for each student.

### Lesson

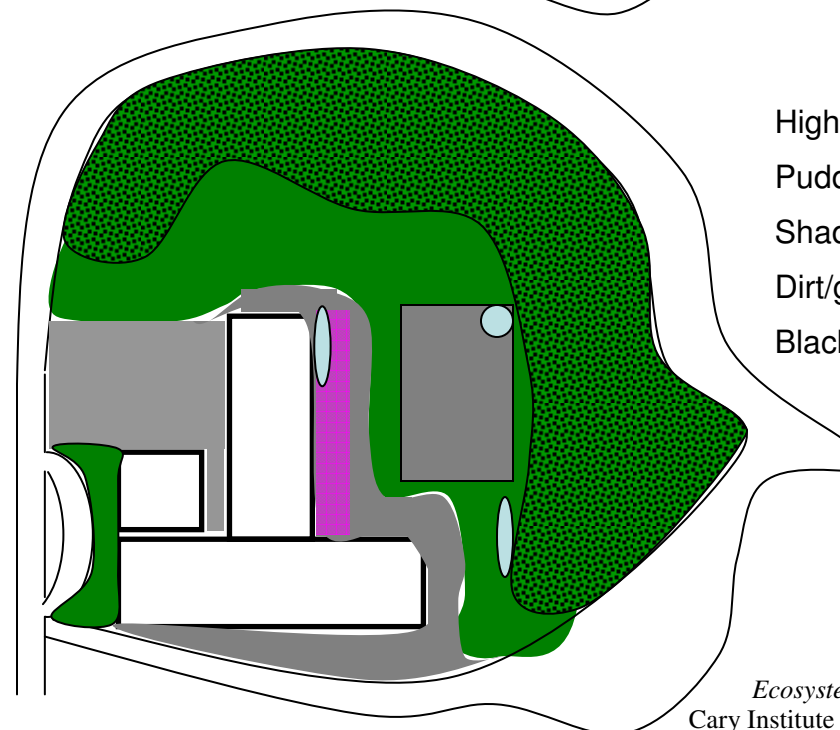
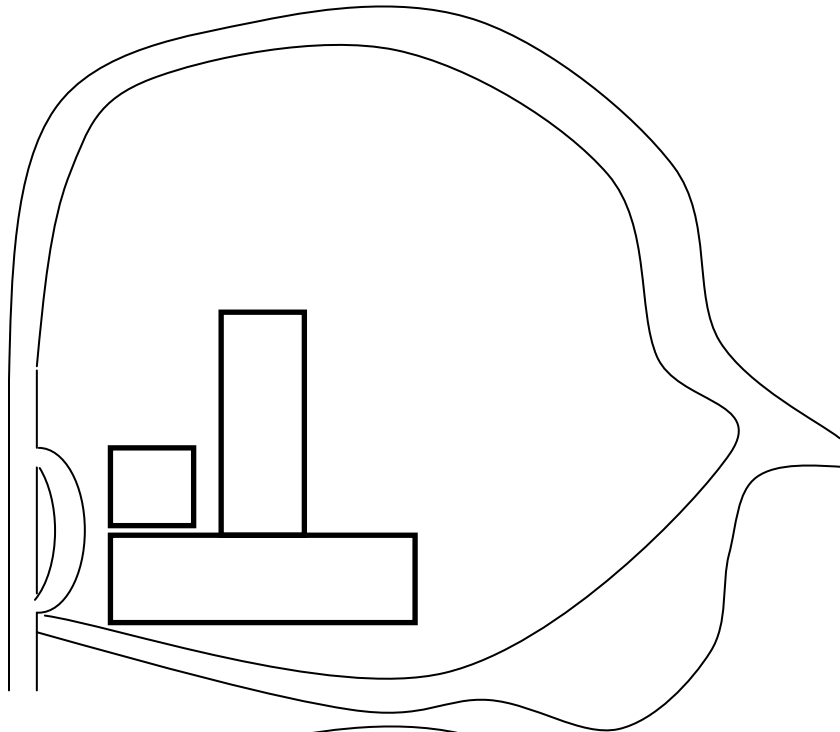
1. **30 second observation.** Ask the students to have some scrap paper and a pencil on their desk. Then, ask them to put their heads down while they listen to your instructions. Tell them that on your count you will ask them to take 30 seconds to look around the room. They will have 30 seconds to observe as many things as they can, and then after that time they will look only at their paper and write down as many things as they remember. Then, take a survey of the objects that they wrote down. This is a fun way to help the students realize that some things are more easily observable than others, but that ecologists are very good observers and learn to see the things that are not always obvious. Then, ask them how they could have made a picture or map of the classroom that would include everything. Help them see that a birds-eye view is the best of way of getting a large three dimensional place on a piece of paper.
2. **Introduce maps.** This optional engaging introduction gets students excited about mapping their schoolyard. Show them one map at a time as ask *What is this map for? What is it showing? When*

*would you use it?* Explain that each map serves a purpose and that we can use maps to understand a place, to get somewhere, or to answer a question. Today, we will be making a map to answer the question: Why are the puddles in our schoolyard where they are? AND what can we do to get rid of them? Write these questions on the board.





3. **Introduce the schoolyard ecosystem as part of, or embedded in, larger ecosystems.** Explain that while we are exploring our schoolyard ecosystem, our school is one, small ecosystem that is in larger ecosystems, sort of like Russian nesting dolls. And many of the things that we will learn about water in our school are true for other ecosystems, even large ecosystems. Show them a picture of the planet and gradually zoom into the aerial picture of the schoolyard.
 
4. Using the aerial picture of the schoolyard, show them how you traced the aerial photo and arrived at the **simple map of the schoolyard** (see below for an example). With this simple map, students now need to collect information to answer the scientific questions. First, have them make hypotheses about why the puddles are where they are. Make a class list of why puddles form where they form. Ask enough questions, or give enough hints, so that the list includes something that pertains to evaporation, something that pertains to slope and something that pertains to soil or types of surfaces. Depending on your students' past experiences you may want to do the demonstrations before or after making this class list.
5. **Conduct the demonstrations.**
  - a. Write down the results (how far the water level of each cup dropped) of the evaporation demonstration and discuss why the cup in the warmest, sunniest spot evaporated more quickly. When water warms up, the molecules of water get energy from the heat and then, with that energy, escape the liquid and turn into gas. That water, of course, did not disappear it just turned into a gas and is now floating in the air.
  - b. Show the students the three bottles filled with soil, soil with a water-resistant surface, and sand. Tell them that you are going to pour water on each bottle, but first they should guess in which bottle will the water drain through the quickest and slowest. Have them count, in seconds, how long it takes for the same amount of water to begin dripping down each bottle. Then ask them what would happen if rain falls on soil, sand or blacktop?
  - c. Lastly, take the empty basin of bucket, the board and a bucket of water. Get the board wet and then show them how fast water runs down the board when you have the board flat, at a slight incline, a greater incline and then nearly perpendicular to the floor. Ask them if there are any hills or higher parts of the school where water might run down.
6. **Make a Legend.** Make a class list of the aspects of the schoolyard that they should map, which will answer their scientific questions. Remember that they could map anything that is there, but they only want to map what is useful for these questions. In other words, they could map every flower, or the types of plants, or color of the grass; but these might not tell them what is helpful in determining why puddles are where they are. The following aspects should be mapped, if they are applicable: high places and/or low places, puddles or very muddy places, dirt or grass, blacktop, shady and/or sunny places. Remind them that they should mark a place as shady or sunny only if it is shady or sunny for the bulk of the day.
7. Hand out the **blank map** and have them draw their legend, attributing one color for each item in the legend.
8. **Go outside!** Remind students that, while they may think they know the schoolyard like the back of their hand, they should only map what they SEE. Scientists only collect data on what they can observe with their senses. It may be best to have students do only an initial part (about 1/3 of the space) of the schoolyard, and then come back inside to refine and teach them how to

appropriately use their legend to make the map. Once everyone is on the same page, then go back outside to complete the map.

9. **Results and suggestions.** Either find a nice place outside, or head back in the classroom and ask each student to silently look at their map for 30 seconds. Then discuss why the puddles are where they are (you may want to write this down on the board for future reference). Knowing this, ask the students to suggest what, if anything, could be done to keep the schoolyard dry. They may decide that puddles are perfectly fine aspects of their schoolyard, and that is fine.
10. **Communicate the results.** If the students have a suggestion of how to improve the schoolyard, ask them to write a letter (either individually or as a group) to the principal or superintendent telling them what they have discovered and what they suggest. This letter can be used as an assessment of how well they have understood the concepts of evaporation, infiltration and runoff.



**Legend**

High Places	
Puddle/mud	
Shady places	
Dirt/grass	
Blacktop	