



Post-festival Lesson 4 – It All Adds Up Lesson Plan

Investigative Question:

- How do contaminants/pollutants travel downstream?
- What are the ways that pollution in a watershed is reduced or prevented?

Summary: Students develop a plot of waterfront property then learn how everyone can prevent pollution entering a river by identifying the pollution emitted from each property. Students recognize that everyone contributes to and is responsible for good water quality and learn how to differentiate between point and nonpoint source pollution.

Reference: adapted from “Sum of the Parts,” Part 1, *Foundations of Water Education*, 2024, pg. 95-104.

Time Frame: 50 minutes

Cross Cutting Concepts Demonstrated:

- cause and effect
- systems and system models

Science and Engineering Practices Integrated:

- develop and use models
- construct explanations
- ask questions and define problems

Materials Needed:

- Piece of flip chart paper or poster board prepared as instructed for each group
- Colored markers, pencils, or crayons
- Items representing pollution (see suggested pollution items table below)
- Lesson 4 Best Management Practices Example Sheet

SUGGESTED POLLUTION ITEMS TABLE	
Potential Pollutants	Items to Represent Pollution
Sediment from construction	Little pebbles/stones
Dog poop	Hershey kisses, beans, beads
Litter/trash	Small pieces crumpled of paper
Oil/gas from vehicles and roadways	Paper clips, rubber bands
Manure from livestock	Coins
Fertilizer from yards/farms	Legos
Something unique to one or two properties (could be one of the above or something else)	Pink eraser(s)



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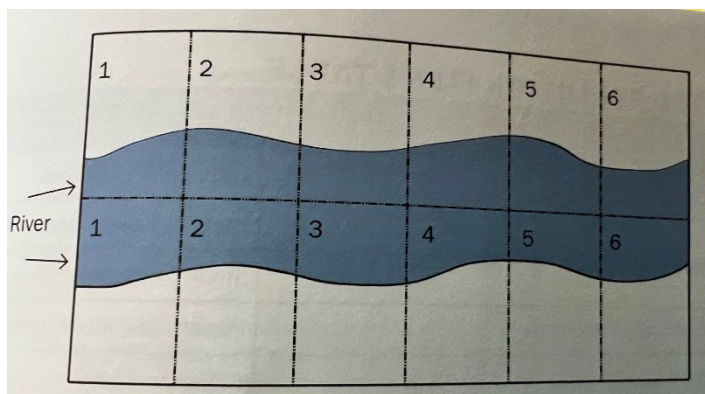
Warm Up:

- Ask students to **name waterways, streams or rivers near them**. Where do they think these rivers go? (Colorado River, Salta and Verde River, Santa Cruz River)
 - <https://azdot.gov/sites/default/files/2019/07/major-rivers-and-streams.pdf>
 - [Arizona's Water Story](#)
- Show the rivers on Google Maps or other mapping websites. Where do these rivers originate (where are the headwaters) and outlets? How many states does each cross or touch?
- Discuss some of the predominant types of land usage along a river. Could these practices affect the river?
- Use the **slides above to introduce this lesson**.
 - Have students define what **point pollution** is and list some examples in their notebooks.
 - Have students define what **non-point pollution** is and list some examples in their notebooks.

Lesson Sequence:

Preparation:

Using a blue marker, draw and color a river on the bottom of the flip chart papers, as shown here. Each section should include a portion of the river (10-20%) and mostly blank space to allow room for student drawings. The number of sections should correspond with the number of groups of students working together. Number the sections **on the back** of the paper so groups won't notice. For repeated use, sections could be laminated.





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Activity - Exploration:

1. Divide students into small groups and congratulate them. They just inherited a piece of river front property and money to develop it!
2. **Pass out the prepared pieces of property** and markers or crayons. Explain that the blue is water and the blank space is land they own. They can develop their land however they want with the amount of money you decide.
3. Give students time to draw their development ideas on their properties.
4. When finished, students present to the class how they developed their land and how they used water. They should **identify and of their actions that polluted or added contaminants to the waterway**.
 - a. For each pollutant, groups must take items that represent the pollution using items suggested in the table provided above, and hold on to them while the other groups go.
5. When the presentations are done, **reveal that each property has a number and that they are neighbors on a waterway**. Make a river by placing the properties next to each other by number.
6. Once the river is laid out, **ask which way the water flows?** In this case, the water flows from the highest numbered property toward the lowest number.
7. Tell students to **take their pollution item and line up in the same order as their pieces of riverfront property**. They are going to **pass their pollution pieces downstream**. Have them announce what kind of pollutant they are holding before they pass it on. They will pass their pollution downstream (from highest number to lowest), until the **students at properties one and two are holding all the items**.
8. Students at properties one and two may place all the pollution items on the ground at the end of the river.
 - a. How do the students downstream at properties one and two **feel about the quality of water they received from their upstream neighbors?**
9. Discuss the following questions:
 - a. Would they have designed their property differently had they known what pollution was coming from upstream?
 - b. **In what ways were the downstream properties impacted by the upstream properties?**



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10. Ask students if they can reclaim their pollution items from the pile of pollution downstream?

- a. Can they tell which pollutants came from their property? If not, what were these pollutants and what other properties could they have come from? These represent **non-point source pollution**. (These pollutants are more difficult to source because they originated from multiple sources).
- b. Can they identify the source of any unique pollutants? These represent **point source pollution**.

11. Discuss and review the difference between non-point source and point source pollution.

12. Pass out copies of the Lesson 4 Best Management Practices Example Sheet. **Discuss how to reduce pollution and/or prevent pollutants from entering waterways.**

13. You can also review other [Green Stormwater Infrastructure here](#) (scroll down towards bottom of the page) that communities can implement to help with reducing pollution, runoff and heat.

Wrap-up:

Have students write a few sentences or paragraph detailing ways they might reduce the amount of pollution they contributed. How can BMPs designed for organizations be adapted for individual and family use?

- Discuss as a class:
 - **How do the actions of those upstream impact those downstream?**
 - **Can you contribute to good water quality?**
 - **Are you responsible for helping to keep our water clean?**

*Students should complete the Lesson 4 section of their AWF Water Notes handout to record evidence and construct explanations based on that evidence. Students will also look at the lesson from the perspective of cause and effect – Cause is why something happened. Effect is what happened because of it.