

Stormwater Runoff and Nonpoint Source Pollution in Watersheds

ESTIMATED TIME: 45 minutes

OBJECTIVES:

Students will be able to:

- Understand what a watershed is and how we all live in a watershed
- Understand how the land is connected to the sea
- Understand stormwater runoff and how it transports nonpoint source pollution to waterways
- Understand nonpoint source pollution and identify solutions to nonpoint source pollution
- Increase their environmental awareness

MATERIALS:

- Stormwater Management in Your Schoolyard journal for each student
- Spray bottle filled with water
- Laminated aerial map of the schoolyard watershed made into 3D model (also known as the Schoolyard Watershed Model) and associated materials
- Optional: Google Earth™ watershed tour on computer and associated projector and screen

PROCEDURE:

Part 1: Pre-Test

Estimated Time: 10 minutes

Preparation:

1. Prepare the Stormwater Management in Your Schoolyard journal for each student to complete for this module (Before Lesson and After Lesson).

Directions:

1. Distribute a pencil and a Stormwater Management in Your Schoolyard journal to each student.
2. Read the questions on the "Before Lesson" page and have the students complete.
3. Have the students hold onto their pencil and Stormwater Management in Your Schoolyard journal until the end of the module.

Part 2: Messy Town

Estimated Time: 15 minutes

Preparation:

1. Place the Schoolyard Watershed Model on a desk centered for the students to either view from their seats or sit around the desk.
2. If any pieces (i.e., housing, felt, etc.) fell off, please tape them back onto their designated spaces.
3. In a small bottle, mix cocoa and water to make a "sludge" mixture. This will be used to illustrate oil leaks from the vehicles (highway and construction site).
4. Use multi-colored sprinkles for litter, brown sprinkles for fertilizer/fecal pollution, red/pink sprinkles for pesticides, and green sprinkles for herbicides.

Directions:

1. Ask the students to share with the class what they think water pollution is.
2. Tell the story of "Messy Town" using the Schoolyard Watershed Model, following these guidelines:
 - Introduce Messy Town – TOWN NAME (school's town i.e., Camden, Haddonfield, Lindenwold) New Jersey that consists of your school, homes, factories, open spaces, and highways. Let's pretend this was ten years ago!



River

- Here is a part of Cooper River which already has water (i.e., Cooper River, Delaware River, etc.). *Add water to your model by either pouring or spraying some water onto the model where the river is located to represent the existing water.*



- Highway/Parking Lots
The people of Messy Town do not take very good care of their cars and they often leak what liquids? *Motor oil. Use cocoa and water mixture in "sludge bottle" and squirt on the highway/roads/bridges, driveways, parking lots – black felt.*
- Residential area
Here is where people live in Messy Town
 - Dog feces:
Does anyone have a dog?
What does the dog do when you walk him?
What is the right thing to do with the feces?
The people in Messy Town do not pick up after their pets and leave the feces on the ground. (*Sprinkle brown sprinkles near where the houses are located on the model as well as at the parks/open spaces – green felted areas*)



- Litter:
Does anyone eat while driving in the car?
Does anyone know what it is called when you throw garbage out the window? (*Sprinkle colored sprinkles around the residential area to illustrate litter as well as at the parks/open spaces, highways/parking lots*)
What could you do instead?



- Fertilizers and Herbicides/Pesticides:
What do your parents put on the grass to help it grow and stay green?
Your parents want their plants to grow well so they use fertilizers to give nutrients to the plants/grass/trees. (*Sprinkle green sprinkles on the residential areas*)



- Parks/Open Space:
Does anyone like to play at the park?
What do you play on at the park?
What type of chemicals do they use to help the plants, grass and trees to grow?
The park ranger wants his plants to grow well so he uses fertilizers to give nutrients to the plants/grass/trees. (*Sprinkle green sprinkles on the green felt*) and uses pesticides/ herbicides to get rid of all the bugs and weeds that make it harder for it to grow (*Sprinkle red/pink sprinkles on the green felt*).



- Construction site
More people want to move to Messy Town, so the forest is clear cut, and trees are removed.
What happens to the soil when the trees are removed? *Sprinkle cocoa powder on the forest to show soil erosion.*
The construction site does not take care of their trucks. What kind of liquids might leak out of their trucks? *Motor oil. Use cocoa and water mixture in "sludge bottle" and squirt on the construction site.*

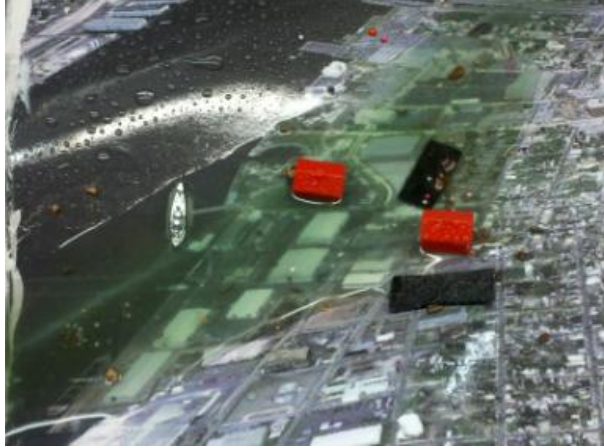


- Rain storm begins
Calling on two students, use two of the water bottles, make it "rain" over the areas where you have sprinkled.



When it rains, the rain water runs off the roof tops, down the streets, and carries pollutants with it. The rainwater travels either directly into a river/stream/lake or travels down the storm drains. Look how dirty the water got in town.

Would you want to swim in water that looks like that?
If you were a fish, would you want to live in this lake?



- Solutions to Nonpoint Source Pollution (NPS)
How can the park ranger help clean Messy Town?
 Reading the labels on the pesticides and herbicides
How can the people living in Messy Town help clean their watershed?
 1. By not littering.
 2. Keeping up with their cars - make sure it's not leaking any liquids.
 3. Picking up after their pets.
 4. Putting in rain gardens that are designed to manage stormwater runoff, mainly from rooftops, but also from driveways, lawns, roads, and parking lots.
 - a. Rain gardens are similar to a sponge; they soak up polluted/dirty water and clean it through filtration.
 - b. During a storm, a rain garden fills with water, and the water slowly goes into the ground rather than running into storm sewers.
 - c. By capturing stormwater, rain gardens help reduce nonpoint source pollution, like fertilizers, pesticides, or herbicides used by the farmer or the bacteria found in feces that might be left on the ground by the people in Messy Town after they walk their dogs.
 - d. Therefore, rain gardens help to protect our local waterways.
 5. Putting in rain barrels that collect rain water.
 - a. Collecting rain water helps save water and helps prevent basement flooding.
 - b. By collecting rain water, homeowners are also helping to reduce flooding and pollution in local waterways.
 - c. When rain water runs off of hard surfaces like rooftops, driveways, roadways, and parking lots, it carries with it pollution to our local waterways.

- d. Harvesting the rain water in a rain barrel is just one of the ways homeowners can reduce rain water from running off their property and possibly causing pollution and flooding problems in local waterways.

Part 3: Connect Messy Town to the Real World – Option A. Google Earth™ Tour (Optional)

Estimated Time: 10 minutes

Preparation:

1. Prepare the Google Earth™ Tour video focusing only on the Land Use from the “Connecting Watersheds to Land Use” module.
2. Connect the projection screen to a computer to play the video.
3. Keep the Schoolyard Watershed Model in the students view.

Directions:

1. Show a point in Google Earth™ of an open space, suburban, and urban area within the local area of the school (this can be the same points of interest as those within the Schoolyard Watershed Model).
2. Ask students to name possible point and nonpoint source pollution at the chosen locations and discuss solutions that can be used to help stop the pollution at that source.

Part 3: Connect Messy Town to the Real World – Option B. Watershed Map (from the “Connecting Watersheds to Land Use” module)

Estimated Time: 10 minutes

Preparation:

1. Keep the Schoolyard Watershed Model in the students view.
2. Print out pollutant pictures from the sources above OR print out the words of different types of pollutants.
3. Group students and assign each group a pollutant.
4. Set up a table on the board by writing the pollutants on the left and the types of land use going across (this can be used as a tally for how many groups say what pollutants are found where).

Directions:

1. Ask each group to identify their pollutant, where they are likely to find this pollutant (land use – open space, suburban, urban) and solutions for that pollutant.
2. Have groups present to the class what their pollutant is, where it can be found, and ways to prevent that pollution from occurring.
3. Have students tape onto the Land-Use Watershed Map from the “Connecting Watersheds to Land Use” module the pictures/words of their pollutants.

Part 4: Putting it All Together and Post-Test

Estimated Time: 10 minutes

Preparation:

1. Prepare the Stormwater Management in Your Schoolyard journal for each student to complete for this module (Before Lesson and After Lesson).

Directions:

1. Moderate a brief class discussion to help pull the module content together. Ask students the following questions:
 - a. What is nonpoint source pollution?
 - b. What is point source pollution?
 - c. Provide an example of nonpoint source pollution and a way that we can prevent it. Have students discuss the different types of nonpoint source pollution and the various solutions to these types of pollution.
 - d. Have you ever witnessed nonpoint source pollution? If so, provide an example.
 - e. How does nonpoint source pollution get into our waterways? *When it rains, the rain picks it up and washes it into the waterways as stormwater runoff.*
2. Ask the students to answer the prompt in their journal.