



# Lesson 7

## NONPOINT SOURCE POLLUTION

### Lesson Focus

In this lesson, students will learn the difference between nonpoint source pollution and point source pollution.

### Lesson Objective

- Students will be able to correctly define nonpoint source pollution.
- Students will be able to correctly distinguish nonpoint source pollution from point source pollution.
- Students will be able to correctly list examples and causes of nonpoint source pollution.
- Students will be able to explain the function of a storm drain.

<b>Grade Level</b> 5	<b>Duration</b> 50 Minutes	<b>Subject Area</b> Science	<b>Vocabulary</b> runoff, nonpoint source pollution, point source pollution, stormwater drain
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### Louisiana Student Standards for Science

#### 5-ESS3-1

Generate and compare multiple solutions about ways individual communities can use science to protect the Earth's resources and environments.

### Materials List

#### Per Class

- Clear plastic tub with lid about 5-7" tall x 7" wide x 10-12" long. A plastic shoe box will work.
- Water
- Food coloring
- Spray bottle
- ¼ cup soil, sand, gravel (mix is fine)
- ¼ cup vegetable oil
- Grass clippings or leaves (small handful)
- Shredded paper (small handful)
- Small wads of paper
- A few small sticks

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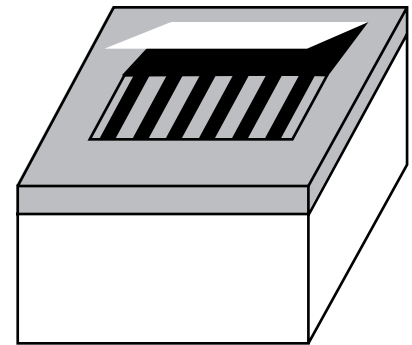
# NONPOINT SOURCE POLLUTION

### Activity Sheets

- A Storm Water Drain
- Water Pollution Water Drops
- Nonpoint Source Pollution

### Advance Preparation

1. Cut the lid of the clear plastic container so that it resembles a storm drain. This can be as simple as cutting a slot in one end to as elaborate as cutting a grill in front of the “drain slot” (see diagram).
2. Make copies of **Activity Sheet #2** and cut out the water droplets for the Explore Activity.
3. Make copies of **Activity Sheet #3**



### Background Information

There are many forms of water pollution, from sediment to chemical discharges to litter. In understanding these many forms of water pollution, environmental scientists distinguish two groups, point source and nonpoint source pollution, based on how the pollution enters a water body.

**Point source pollution** is any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship, or factory smokestack. Examples of point sources can include industrial plants, oil refineries, pulp and paper mills, chemical manufacturers, sewage treatment plants, food processors, and livestock operations. Pollutants from these sources can include oil, thermal pollution, toxic chemicals, heavy metal, nutrients, and bacteria. Point source pollution is subject to environmental regulations and remediation efforts.

**Nonpoint source pollution** results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources which makes it challenging to regulate. Nonpoint source pollution is caused when stormwater **runoff** is generated from rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into bayous, streams, rivers, wetlands, coastal waters, and ground waters. (United States Environmental Protection Agency - EPA, 2023)

Nonpoint source pollution is the opposite of point source pollution, with pollutants released in a wide area. As an example, picture a city street during a thunderstorm. As rainwater flows over asphalt, it washes away drops of oil that leaked from car engines, particles of tire rubber, dog waste, and trash. The runoff goes into a **stormwater drain** and ends up in a nearby river. Runoff is a major cause of nonpoint source pollution. It is a big problem in cities because of all the hard surfaces, including streets and roofs. The amount of pollutants

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washed from a single city block might be small, but when you add up the miles and miles of pavement in a big city, you get a big problem.

In rural areas, runoff can wash sediment from the roads in a logged-over forest tract. It can also carry acid from abandoned mines and flush pesticides and fertilizer from farm fields. All this pollution is likely to wind up in streams, rivers, and lakes.

In the United States, the Clean Air Act and the Clean Water Act have helped to limit both point-source and nonpoint source pollution. Thanks to these two legislative initiatives, in effect for some 50 years now, America's air and water are cleaner today than they were for most of the 20th century. (National Geographic, 2023)

### **Examples Nonpoint Source Pollution**

#### **Litter**

Roadside trash, overflowing garbage cans and dumpsters, unkempt parking lots and alleys, illegally dumped tires, and "junk" as well as piles of leaves, sticks, and grass clippings piled along curbs or dumped into ditches, are all forms of litter. Time, wind, rain, and melting snow aid in "breaking down" or decomposing some of these materials and carrying the lighter ones into nearby ditches, storm drains, streams, and rivers. Trash and debris on our highways and streets can travel by wind or rain into ditches, storm drains, bayou, streams, and rivers.

#### **Sediment**

Sediment is tiny soil and rock particles carried by rain and snowmelt into streams, lakes, and estuaries. It can carry chemical pollutants with it into the water. Sedimentation can result from soil erosion, construction, and other types of land disturbances in rural, urban, and suburban areas.

#### **Excessive Nutrients**

All plants require nutrients to survive and reproduce. Two naturally occurring nutrients, nitrogen and phosphorus, are important components in fertilizers. When too much fertilizer is used, excess nutrients are picked up by stormwater runoff and washed into nearby waterways. This excess causes increased algae and aquatic plant growth, resulting in lower amount of dissolved oxygen in the water, which can result in fish kills. Excessive amounts of nitrogen and phosphorus in stormwater runoff comes from fertilizers, manure from farms, industrial waste, sewage, detergents, and grass clippings.

#### **Animal and Human Waste**

Pathogens are disease-causing microorganisms present in human and animal waste, also known as fecal matter. Diseases that can result from exposure to fecal matter include dysentery, hepatitis, food poisoning and parasitic infections. Bacterial contamination is caused when untreated waste of humans, pets, livestock, and animals are washed from the ground by stormwater runoff into local waterways. Contamination also occurs at marinas and by boaters discharging raw sewage overboard with poorly operated septic systems.

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### **Pesticides**

Pesticides, which include insecticides and herbicides, contain chemicals harmful to humans and animals. Improper application and usage lead to pesticide-laden runoff and ground water that can possibly kill aquatic vegetation, insects, and fish.

### **Toxic Metals**

Metals are considered toxic to humans because they can accumulate in our body and can impact our health over time. Toxic metals include copper, mercury, nickel, chromium, zinc, and lead. Metals originate from cars, industrial waste, and misused pesticides that are transported by rain and highway runoff.

### **Motor Oil**

Motor oil contains toxic substances, including lead and chemical additives, which seriously contaminate ground water and inland and coastal waterways. It stunts or kills algae and other vegetation, smothers aquatic animals, and contaminates shellfish beds and drinking water supplies. The presence of oil in groundwater is usually the result of used motor oil poured directly onto the ground or into storm drains and leakage from improperly maintained vehicles and equipment.

### **Household Hazardous Waste**

Household hazardous waste includes poisonous substances found in our homes and can include household cleaners, nail polish removers, antifreeze, paint, and gasoline. Improper disposal of these substances onto the ground or a storm drain means they can enter our bayous and streams without any treatment at a wastewater treatment plant. When dumped into a sink, toilet, or household drain, they can harm the bacteria used to treat the water, either in the septic system or at the wastewater treatment facility.

### **Road Salts**

Salt is used to de-ice highways every winter. Used in this way, however, it can contaminate ground water supplies and affect the lives of fish.

### **Acidic Deposition**

Acid rain is the most common form of acidic deposition and is caused primarily by car emissions. It is also associated with the burning of coal, wood, and other industrial emissions. It is defined as the settling of the aerial acid particles by means of precipitation. Acid rain not only removes certain nutrients from the soil and affects tree growth, but it also washes toxic metals from the soil into the waterways.

## References

- New Jersey Department of Environmental Protection. (1991). Beneath the Shell: A teacher's guide to nonpoint source pollution and its potential impact on New Jersey shellfish. <https://www.nj.gov/dep/seeds/docs/bts.pdf>  
*Lesson 7 has been modified from The Beneath the Shell, Storm drain watch lesson.*

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## Procedure

### Engage – 5 Minutes

1. Watch, **The Drainage System in Front of the School is Clogged Due to Debris.**  
<https://www.youtube.com/watch?v=PB7KyBLnEBk> (12:46)
2. Ask students:
  - **What is going on in this video?** *There has been a rainstorm, and the street is flooded because the drain is clogged.*
  - **What is the person doing?** *They are removing debris, leaves, sticks, and litter from the drain opening.*
  - **Is the water on the flooded road causing problems?** *Yes. At the beginning of the video, the cars and motorcycles were driving in the center of the road to stay out of the water.*
  - **Were leaves the only thing the person pulled out of the storm drain?** *No. There was also litter (a plastic cup and bottles, about 5:40 in the video).*
  - **Did the person remove the leaves on the sidewalk?** *Yes. They put the leaves and trash into a trash bin.*

*NOTE You can stop watching at around 6:00 if time is short.*

### Explore – 20 Minutes

1. Show a picture of a stormwater drain (**Activity Sheet #1**).
2. Ask students:
  - **Does anyone know what this is called?** *It is a stormwater drain.*
  - **Where are these found?** *Along our streets.*
  - **What does a storm drain do?** *It prevents flooding by diverting rainwater and melted snow off the streets and other paved surfaces and into a natural body of water.*
  - **What might enter a storm drain?** *Write the student's answers on the board. The answers are all the things listed in the Background section. Explain that the items listed are nonpoint source pollutants.*
  - **Where does the water go after it enters a storm drain?** *It usually is piped directly to the nearest stream, canal, or river.*
3. Bring the pre-made storm drain model and set it down on the front table where students can observe it. Explain that this is a model of a storm drain.
4. Fill the plastic container about ½ full of water. Explain that the water represents a stream in which the drain empties into.
5. Students will pretend there is a rainstorm. Students will read each water drop card (**Activity Sheet #2**), discuss the situation, and fill the storm drain model with the items indicated on the card.
6. For each water drop card scenario discuss:
  - **Does the action described on the water drop card harm the environment? If so, how?**
  - **Do you think the people in the story wanted to harm the environment?**
  - **What could they have done differently to not harm the environment?**

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### Explain – 25 Minutes

1. Observe the storm drain model and discuss:
  - **How did the water change from the beginning of the activity?** *The water changed color and became full of debris.*
  - **How did this make you feel?** *Angry and sad. Concerned for the environment.*
  - **Where will the water and pollutants travel?** *They will travel to larger water bodies like streams, canals, and rivers.*
  - **Students should work in groups to invent a method or mechanism to remove the pollutants from the stormwater.**
  - **Have the class create a list of ways to prevent people from littering and dumping into the storm drain.**
  - **Review examples of nonpoint source pollution.**

### Expand – 15 Minutes (Optional)

1. Watch, SciShow Kids (May 3, 2021). **Keeping Our Water Clean!**  
<https://www.youtube.com/watch?v=Npv47F3GK2w>
2. Ask students:
  - **What are two examples of impermeable surfaces?** *Roadways, parking lots, and buildings.*
  - **Why is rainwater pooling on roadways dangerous?** *Excessive rainwater on roadways is dangerous because it creates puddles of water. It could also cause street flooding which is a driving hazard.*
  - **What is runoff water?** *Runoff occurs when there is more water than land can absorb. The excess water flows across the land and into nearby creeks, streams, or ponds.*
  - **How is water going down a sink drain similar and different from water going down a storm drain?** *Water going down a sink and a storm drain are both being carried away from a particular spot. Water going down a sink is destined for a water treatment facility where it is cleaned of any harmful substances. Water going down a storm drain is carried off to a nearby stream or bayou. Storm drain water is not treated at a water treatment facility.*
  - **Why are storm drains important on roadways?** *Storm drains move water off the roads and keep them clear of flooding.*
  - **Why are clogged storm drains a problem?** *Clogged storm drains can no longer function as they were designed, causing water to accumulate on the street. Flooded streets are dangerous and can cause flooding of cars, homes, and businesses.*

### Take Action

1. **Adopt a Storm Drain.** <https://la.adopt-a-drain.org/suggested-drains/create?zoom=17&lat=30.43062842197942&lng=-91.1357727462799>  
Your class can help by adopting a storm drain and keeping it clean. Take a walk around your school campus to look for the storm drains. Then, go to the link listed above. When you enter your address, a map will pop up. Drag a red pin to mark the location to adopt a storm drain.
  - Sign up online to Adopt a Drain in your neighborhood or school.
  - Keep the drain clear of debris especially before rainfall. Rake leaves, trash, and other debris off the drain surface throughout the year.

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- Track your impact. Keep a log of what you collect and enter it into your online account to gauge the cumulative results of your work.
- Lead by example. Tell friends and neighbors about your commitment to keeping a storm drain clean and ask them to do the same. Share with them some easy things they can do at home to prevent water pollution.

### Evaluate

1. Have students complete **Activity Sheet #3** and discuss their answers.

### Online Resources

City of Garland Texas. (November 22, 2016). **Only Rain in the Storm Drain.**

<https://www.youtube.com/watch?v=LsBKpArM-v0>

*Did you know that only rain goes in the storm drains? This video discusses ways that you can limit water pollution.*

Contra Costa County Clean Water Program. (March 25, 2021). **How Does the Storm Drain System Work?**

(0:44) <https://www.youtube.com/watch?v=YJ5DOo3sAh4>

*Learn about the difference between the storm drain system and the sanitary sewer system.*

EPCOR. (October 8, 2019). **What is a catch basin?**

<https://www.youtube.com/watch?v=QB0vGXF70Jk> (1:00)

*A catch basin is often referred to as a storm drain, storm sewer, surface water drain or storm water drain. This video explains how important storm drains are in moving storm water into the drainage system. It also shares that only rain and melting snow should enter a catch basin.*

Louisiana Department of Environmental Quality (DEQ). **Nonpoint Source Pollution (NPS) Video Featuring Enviroscope.** <https://www.youtube.com/watch?v=2WHW3F5qG18> (4:41)

*The Enviroscope Model effectively communicates our shared responsibility for the environment, specifically water quality, to people of all ages. By being able to see “pollution” move around in real-time and discuss solutions, these complex issues seem simple to anyone who will listen. You can also contact a DEQ scientist and request an Enviroscope model demonstration for your classes.*

Contact India Ambeau at [india.ambeau@la.gov](mailto:india.ambeau@la.gov)

#### **Enviroscope Exam**

<https://www.deq.louisiana.gov/assets/docs/LDEQEnviroscopeVideoTest.pdf>

#### **Enviroscope Exam Answer Key**

<https://www.deq.louisiana.gov/assets/docs/LDEQEnviroscopeVideoTestKey.pdf>

The Watershed Institute. (June 18, 2018). **Explaining Stormwater Runoff.**

<https://www.youtube.com/watch?v=fn736F34QyQ> (1:35)

*Learn about stormwater runoff and how to reduce it.*

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### Children's Books

Beck, G. (2022). **Watersheds: A practical handbook for healthy water.**

Firefly Books. ISBN 0228103231.

*The book explains ecological principles and environmental challenges, introduces North America's major biological regions, outlines the complexities of water and nutrient cycles, and explains the ecology of wetlands and waterways. This book also explains some of the major environmental issues facing North America, including air pollution, water pollution, invasive exotic species, and habitat loss and destruction. Ages 8 years to Adult.*

Canavan, R. (2014). **You Wouldn't Want to Live Without Clean Water!**

Franklin Watts Publishing. ISBN-13: 978-0531213100

*This book familiarizes the readers with fascinating facts about water. Ages 8 - 12 years.*

Fossey, S. (2020). **The Life of a Little Plastic Bottle.**

Autumn Publishing, Igloo Books. ISBN-13: 978-1839032455

*Children are introduced to reusing and recycling through this story about the journey of a little water bottle. Ages 1 - 5 years. Read aloud at <https://www.youtube.com/watch?v=fclaNkzrRQU>*

Lindstrom, C. (2020). **We are Water Protectors.**

Roaring Brook Press. ISBN-13: 978-1250203557

*This book issues an urgent call to protect the Earth's waters. Winner of the 2021 Caldecott Medal. Read aloud at <https://www.youtube.com/watch?v=FLZVQFhFeqE>. Ages 3 - 7 years.*