

## Lesson Plan – Week 5 – July 30 – August 1

### What is Pollution? Point and Non-Point Sources. How does Pollution Affect Water Quality and the Neighborhood?

#### Two and One-Half Hours

#### Goals

- Students will learn how water becomes polluted
- Students will understand that by using water they are polluting it
- Students will learn the difference between point and non-point sources of pollution
- Students will understand how sewers function
- Students will recognize the main characteristics of wastewater when it enters a treatment plant

#### Objectives

- Students will name ways in which they use – and pollute – water
- Students will trace the path of water from their house to the wastewater treatment plant
- Students will make up stories about how various products enter the sewer system
- Students will perform a hands-on exercise to observe what happens to various products in water

#### Related Activities for the Lesson

Activity #2 – Collection and tagging of urban artifacts at vacant lot – Students will uncover buried bottles, bricks and other debris at the site and discuss their probable origin. Artifacts will be tagged and placed in a container for cataloguing.

Activity #5 - Stenciling project – students will install “No Dumping – Drains to River” plastic decals on storm drains in the neighborhood.

Activity #12 – Visit to the Southeast Wastewater Treatment Plant (August 1)

#### Glossary of Watershed Project Terms

Refer to previous lessons

**Combined Sewer**

**Inorganic pollutant**

**Organic pollutant**

**Non-point source pollution**

**Pollution**

**Point source pollution**

**Storm sewer**

## Lesson Narrative

### **Point Source Pollution**

All water used is polluted. In a big city, large amounts of wastewater are produced each day, which presents a real health hazard to the people that live there. Historically, cities built sewers to collect polluted water and carry it away – usually to a river, which in turn carried it to the ocean. In historic Philadelphia, sewers carried wastewater to the Delaware and Schuylkill rivers. In time, the fish died because pollution robbed the water of dissolved oxygen which fish need to live. People who worked along the rivers also became sick from the gases generated by the polluted water.

Not only Philadelphia, but communities upstream emptied their wastewater into the rivers. Industrial neighborhoods and cities such as Manayunk, Pottstown and Reading are upstream along the Schuylkill River; and Trenton, Easton and Bristol are upstream along the Delaware. Since the rivers were also the cities' sources of drinking water, this meant that people were drinking polluted water. People who drank the river water became sick and many died because of waterborne diseases such as typhoid and cholera. Back then, we did not fully understand the connections between our health and that of our natural resources.

Sewers and other pipes that empty directly into rivers and streams are known as point sources, as the end of their pipes, known as outfalls, are located in one spot and the source of the wastewater can be identified. Sewer plans will show all of the connecting sewer pipes which ultimately feed into the pipe that is seen emptying into the river. Because the source of this wastewater is known --- discharging from a wastewater treatment plant or a storm sewer system in a neighborhood, it can be more easily tested for pollutants and better managed.

Today, thanks to wastewater treatment plants such as Philadelphia's, we are able to clean and disinfect our polluted water and return it to the rivers cleaner than when we took it out. Also, laws such as the Safe Drinking Water Act and the Clean Water Act make it illegal for industries and communities to dump their wastewater directly into the rivers. Since point source pollution is coming from a specific source, it must be cleaned according to the standards set by these laws to protect our water resources.

### **Non-Point Source Pollution**

However, pollution in our rivers and streams is still a problem because of stormwater runoff. Every time it rains, water runs over the land and into a waterway. It carries with it trash and pollutants which drain directly into rivers and streams, or into storm drains which carry the polluted water to our waterways. This type of pollution is called non-point source pollution because the pollution is not coming from a specific source, but from many sources which are difficult to pinpoint. Motor oil, soda cans, cigarette butts, fertilizers, and dog wastes are all examples of non-point source pollution because they are

often lying all over the watershed, just waiting to be swept away with the next rain storm. We are all responsible for non-point source pollution and we must all do our share in making sure we take care of the land.

When we keep the land clean and throw trash in its proper place, we help keep the water clean. When we pick up after our dogs, or place a tray under our car when we change the oil, we are helping to keep our water ---- and our neighborhood clean. The cleaner the stormwater that enters our sewer system, the cleaner our rivers and streams will be, and the more inviting our waterways will be to the many plants and animals that rely on our rivers and streams for homes and food.

### **Water Quality in the Neighborhood**

Sewers that collect wastewater from our houses are called sanitary sewers. Sewers that carry rainwater and other items that wash off the streets are called storm sewers. In neighborhoods with a combined sewer system, like Mill Creek, one sewer performs the duty of two, collecting in one pipe both wastewater from properties and businesses and stormwater runoff from the storm drains in the streets. Sanitary sewers and combined sewers carry the wastewater to a wastewater treatment plant. Because sewers are built to follow the natural topography of the watershed, gravity carries the wastewater to the plant.

During a rain storm, the sewer can become so full of water that it cannot carry any more water. In order to prevent sewers from backing up into people's houses and into the street, there are outfalls that act as release valves on the combined sewers which allow the excess wastewater to overflow into the Schuylkill River. This also protects the wastewater treatment plant from flooding and enables the plant to still clean the majority of the wastewater it receives.

Because of these overflows, it is important to keep your neighborhood as free from pollutants as you can. The wastewater from homes and businesses is already polluted, so the easiest improvements to the quality of the water entering our sewers can be made by reducing the amount of non-point source pollutants.

### **Class Exercise**

We will use an aquarium tank and pretend it is a sewer. Since all sewers have some water in them all of the time (from rain and household uses), we will pour two to three gallons of water as "rain" and another two to three gallons of water as "household use" into the aquarium.

We have a collection of household products and typical trash items found on the street. These include: toothpaste, soap, toilet paper, oil, candy wrappers, mouthwash, juice, leaves, seeds, chips, baby powder, Windex.

Each student will individually pick a product and show it to the class and tell a brief story about how this product could wind up in the sewer. After each student tells a story, he/she will pour a small amount of the product into our “sewer.” If necessary, we will use a large spoon to mix the water. Each student will then explain what happened to their product. Did it float? Sink? Dissolve?

What does the sewer look like once everything has been added? Think of how other forms of pollution may have entered the sewer in using the products. For example, mouthwash could also bring germs and pathogens, shampoo and soaps can bring dirt and body oils, and we all know what comes with using toilet paper.

At the end of the lesson, put as much of the trash into the trash can or recycle. The rest of the wastewater can go to the treatment plant, i.e., pour into a sink.

### Discussion Questions

What is pollution?

What is the difference between point and non-point source pollution?

How does pollution get into our rivers and streams?

How many ways do you use water?

What happens to water when you use it?

Where does it go?

How does a sewer work?

How can you reduce pollution?

How can your family reduce pollution?

How can your neighborhood reduce pollution?

### Materials Needed

- Glossary
- Household Plumbing Connections (poster and handouts)
- Urban Water Cycle (poster and handouts)
- 10 gallon aquarium
- 4-6 gallons of water (in pitchers)
- Household products (ex. Soap, detergent, foods, candy wrappers, shampoo, powder, etc.)
- Large spoon

### Student Assessment

I know that.....

I want to know....

I learned that.....

Have students share with one another (orally) during last half hour of class.