



Water pollution: The dirty details

Background:

Protecting and restoring water quality is a core mission of the St. Johns River Water Management District. A key component of this work is water quality monitoring and reporting. Monitoring provides a wealth of information that enables the District to make resource decisions based on accurate and timely information.

The water quality monitoring network at the District was initially designed and implemented in the early 1980s and has since been improved and expanded. The current network is comprised of nearly 400 surface water sampling stations located on rivers, streams, lakes, canals and estuaries, 23 spring stations, and more than 450 groundwater stations throughout the District's 18-county service area. Stations are sampled for a variety of water quality parameters, including nutrients, major ions and physical measurements, and water quality samples are analyzed using U.S. Environmental Protection Agency (EPA) methods at the District's laboratory or at various contract labs.

Many of people's activities unintentionally add nitrogen and phosphorus or other pollutants to waterways. Over many decades, urban development, farming, industry and man-made pollutants have been pumped into waterways for disposal.

Find out more about the St. Johns River Water Management District and water pollution at www.sjrwmd.com/education/water-pollution.



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Vocabulary words:

Bacteria	Contamination
Nonpoint source pollution	Pesticide
Point source pollution	Sediments
Toxic	Water pollution
Water quality	

Pre-assessment: (5 minutes)

Have students fill in the boxes on the student page for “what you already know about this word” for each vocabulary word.

Engage: (3–5 minutes)

Tell the students they are going to learn more about water pollution. Ask them the following questions:

- When you hear the words “water pollution” describe what your mind sees: what colors, what objects, what motions?
- Is pollution something you can always see, smell or touch?
- What is pollution?
- How does it affect our ecosystems?

Explore/Explain: (20 minutes)

Watch the video “Water pollution: The Dirty Details” and instruct students to write down what they hear and learn about the vocabulary words. Students should write in their own words as this will help them learn how to use these words.

Warn them that the video goes fast, so they need to pay close attention. Pause the video every few minutes to allow students time to write.

See attached teacher page for the answer key. After viewing the video, discuss what the students found out about each word. It is important to clarify and specify the meaning of the word in the context of the video.

Next Generation Sunshine State Standards

SC912.L.17.16: Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

Extend:

Watch “Monitoring and collection team ensures highest-quality data” <https://youtu.be/sDdi0umhwB0>

Watch “The What, Why and How of Groundwater Modeling at SJRWMD” <https://youtu.be/KZ83iiKDGvK>

Explore the “What’s wrong with this picture?” activity sheet www.sjrwmd.com/static/education/Whats-wrong-activity-sheet.pdf

Extensions:

- Complete the water treatment demonstration activity (in this packet).

Evaluate/Post-assessment: (5 minutes)

Instruct students to choose three or four of the vocabulary words and write down all the new things they learned about the word.

Water treatment demonstration

It is necessary to make our water clean, because our drinking water comes from both surface water and groundwater that can easily pick up all types of contaminants. Water that might look clean to drink may contain harmful bacteria or chemicals, which is not safe for drinking.

Water treatment plants purify and maintain the quality of our drinking water by taking it through a five-step process. This demonstration will allow students to explore the water treatment process and the changes that occur with our drinking water during each step of the process.

Materials

- Diagram of water treatment plant
- Two clear, 2-liter plastic soda bottles
- Water (half gallon)
- Dirt (1 cup)
- Two large clear jars with lids (quart size)
- Cotton balls (several)
- Sand
- Small rocks
- Crushed charcoal
- Alum (2 tablespoons, may be obtained from grocery store)
- Bleach (2 tablespoons)



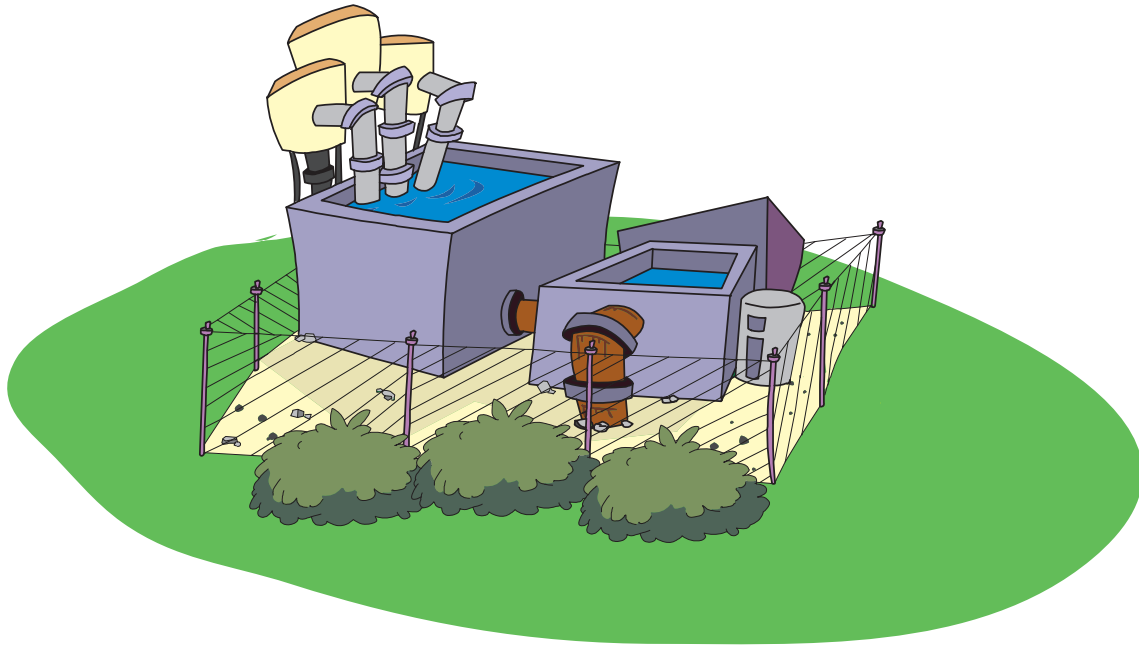
Advanced preparation

1. Cut off the tops of the 2-liter bottles about 3 inches from the neck.
2. Prepare the “dirty” water by mixing the dirt into the half gallon of water.
3. Create the filter by turning one of the bottle tops upside down. Put a cotton ball snugly in the neck of the bottle. Pour a layer of sand over the cotton, followed by the charcoal, more sand, and small rocks.
4. Clean the filter by pouring 1–2 gallons of tap water through the filter.

Demonstration procedure

1. Use the diagram of the water treatment plant and review the five steps of the water treatment process (aeration, coagulation, sedimentation, filtration, and disinfection).
2. Pour “dirty water” into one of the jars until it is about three-quarters full. Ask the students to describe the water.

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3. Place the lid tightly on the jar and shake for 30 seconds. Then use both jars to pour the “dirty water” back and forth 10 times. (Have students determine that this is step one of the process — aeration.) Ask students to note any changes they observe in the water from this process.
4. Next, pour the aerated water into the bottom section of a cut bottle and add 2 tablespoons of alum. Stir the mixture slowly for three minutes. (Note that this is step two of the process — coagulation). Ask students to predict what they think might happen during this process.
5. Allow the coagulated mixture to stand undisturbed about 20 minutes. (Discuss what will happen during step three of the process — sedimentation.)
6. Set the filter (made earlier) inside the bottom of the second cut bottle so that it will drain into the container.
7. After the sediments are allowed to settle to the bottom (step four), carefully pour the top two-thirds of the water (without disturbing the sediment) through the filter and collect the filtered water in the container. (Note step five of the process — filtration.)
8. After you have collected most of the water poured through the filter, add 2 tablespoons of bleach to the filtered water. (Safety glasses should be used when pouring the bleach.) The bleach represents the disinfection process.
9. Ask the students if all of the water they started with was recovered. Discuss that a certain loss of usable water does occur during the treatment process.
10. Compare the treated and untreated water. What changes have taken place? **IT IS IMPORTANT THAT STUDENTS UNDERSTAND THAT THIS IS A SIMULATION OF THE TREATMENT PROCESS AND THE WATER IS NOT SAFE TO DRINK.**

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Vocabulary words with definitions:

Vocabulary Word	What new things/ideas you learned about this word?
Bacteria	<p>Possible answers: (1) Microscopic living things in water (and most other living things and places) that can be helpful (decomposing sewage and oil) or harmful (using up most of the oxygen in water so water plants and animals suffer or die; also causing diseases spread through water). (2) Sources of bacteria: sewage, runoff from animal wastes, slaughter houses, paper processing plants, landfills.</p> <p>Common misconception: Bacteria are germs so they are always bad.</p>
Contamination	<p>Possible answers: Adding something to another substance that makes the original substance unhealthy, or it doesn't work correctly; contaminants are often hazardous.</p>
Fertilizer	<p>Possible answers: (1) plant food, (2) nutrients</p> <p>Common misconception: Fertilizers can cause aquatic ecosystems to become out of balance causing plants and algae to grow too rapidly.</p>
Nonpoint source pollution	<p>Possible answers: Used to identify pollution that doesn't come from one source.</p>
Nutrients	<p>Possible answers: (1) Means food, also the things needed in food for growth. (2) Too many nutrients in water cause plants and other things in the water to grow too fast, clogging waterways, and making them unmanageable.</p> <p>Sources of nutrients: Sewage, animal wastes, detergents, industrial wastes, fertilizers</p> <p>Common misconception: Since nutrients give you the energy and materials needed to grow, they are always good.</p>
Pesticide	<p>Possible answers: Used to kill either plants, fungus, animals, or insects that are not wanted.</p> <p>Consequences: Can kill organisms that are desired.</p> <p>Possible answers: herbicide — specifically for plants — and insecticide — specifically for insects. Fungicide — specifically for fungus.</p>
Point source pollution	<p>Possible answers: pollution that comes from a single pipe and is easily traced to a single source of pollution.</p>

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Vocabulary Word	What new things/ideas you learned about this word?
Sediments	<p>Possible answers: Bits of soils, leaves, other solids that are washed or blown into water bodies.</p> <p>Consequences: Blocks sewers and storm drains causing flooding; makes lakes and streams shallow; blocks gills of water animals and covers eggs so they don't hatch.</p> <p>Common misconception: Sediments are natural so they cannot be a pollutant.</p>
Water pollution	<p>Possible answers: Harmful chemicals or waste materials that contaminate the water; source can be natural, or by people.</p> <p>Two types of pollution: (1) Point source: easy to identify, from one source, regulated by state and federal laws. (2) Nonpoint source pollution: comes from many sources or a wide area, often carried by rain.</p> <p>Synonym: Contaminated, unclean</p>
Water quality	<p>Possible answers: (1) Enough clean, usable water for the plants, animals, and people. (2) Means different things to different users — fishermen want water that has lots of healthy fish with places to spawn; boaters want open water that isn't clogged with plants or debris; homeowners want water that is safe to drink and plentiful enough for their homes and yards.</p>

WATER POLLUTION: The dirty details

Name: _____

Date: _____

Vocabulary word	What you already know about this word	What new things/ideas you found out
Bacteria		
Contamination		
Fertilizer		
Nonpoint source pollution		
Nutrients		
Pesticide		
Point source pollution		
Sediments		
Water pollution		
Water quality		