**Stream Quality Stations Lesson Plan Overview**

**Alignment to Ohio Content Standards:**

[**Ohio Learning Standards for Science**](http://education.ohio.gov/Topics/Learning-in-Ohio/Science)**:**

**Grade 7 Life Sciences:** Pg. 84 7.LS.1: Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments.

**Environmental Science:** Pg. 107 ENV.ES.1: Biosphere-Biodiversity, Ecosystems (equilibrium, species interactions, stability)

**Environmental Science:** Pg. 107 ENV.ES.5: Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere. Biogeochemical cycles, Ecosystems, Climate

**Environmental Science:** Pg. 108 ENV.ER.3 Water and Water Pollution. Hypoxia, eutrophication

**Environmental Science:** Pg. 108 ENV.ER.5: Wildlife and wilderness. Wildlife and wilderness management

**Environmental Science:** Pg. 108 ENV.GP.2: Potable water quality, use and availability

**Physical Geology:** Pg. 110 PG.IMS.4: Ocean. Streams (channels, streambeds, floodplains, cross-bedding, alluvial fans, deltas)

**Physical Geology:** Pg. 111 PG.ER.3: Water. Water quality, Hypoxia, eutrophication.

**Science Inquiry and Application**

* Identify questions and concepts that guide scientific investigations
* Design and conduct scientific investigations
* Formulate and revise explanations and models using logic and evidence (critical thinking);
* Recognize and analyze explanations and models; and
* Communicate and support a scientific argument

**Lesson Length:**

60 minutes classes

**Lesson Overview:**

Students will rotate through three stations exploring three aspects of stream quality: chemistry, habitat and biology. At each station students will evaluate that aspect to compare the characteristics of healthy or impacted stream. Additionally, students will connect these concepts to explore how they are related.

**Lesson Objectives**

The student will:

* Analyze pictures of habitat, chemical data, and biology of streams
* Compare characteristics of healthy and impacted streams
* Summarize and compare findings

**Online Materials needed:**

* [PowerPoint slides](http://watersheddata.com/Education/Document/Stream%20Quality%20Powerpoint.pptx)
* [Student Handouts](http://watersheddata.com/Education/Document/Stream%20Quality%20Stations%20Student%20Handout.docx)
* [Example Student Answer Sheet](http://watersheddata.com/Education/Document/Stream%20Quality%20Stations%20Student%20Handout%20Answers.docx)
* 360 virtual reality stream photos for virtual reality googles
	+ Device used to view virtual reality 360 photos must have downloaded Google Street View app
		- Virtual Reality Photo A
			1. Search “Carbondale, Ohio” in Google Street View app
			2. Correct photo is DCIM\100GOPRO by Watershed Ohio
		- Virtual Reality Photo B
			1. Search “Waterloo Aquatic Education Center
			2. Correct photo is DCIM\100GOPRO by Watershed Ohio
	+ If no virtual reality googles 360 photos can be accessed on Watershed Education, [Virtual Field Trips](http://watersheddata.com/Education/Stream1.html)
		- Carbondale is Stream A
		- Waterloo is Stream B
* Indicator Species Information (Helpful link)
	+ [http://www.nswwaterwatch.org.au/files/19/Water%20Bug%20ID%20Charts%20&Posters/30/Water%20Bug%20Dectective%20Guide%20-%20Freshwater.pdf](http://www.nswwaterwatch.org.au/files/19/Water%20Bug%20ID%20Charts%20%26Posters/30/Water%20Bug%20Dectective%20Guide%20-%20Freshwater.pdf)

**Technology Needed:**

* Water Chemistry Meter
* Microscopes
* Preserved macroinvertebrates
* Virtual reality googles

1. Engage the Learner

* 1. minutes)

**Teacher (T):** Pass out student handout. Then ask students what a healthy stream looks like. (Slide 2)

**Student (S):** Record 5 things that they would expect to observe in a healthy stream on their handout under the Engage section.

**S:** Share answers with class and briefly discuss their thoughts.

**T:** Present slides 3-9 to students.

* Discuss that there are 3 ways scientists typically measure stream quality. (Slide 3)
* Share and explain the vocabulary that scientists use to describe stream habitat. (Slides 4-6)
* Show normal water chemistry values, ask students to write down for later (Slide 7)
* Explain macroinvertebrates as bioindicators for stream quality, basic identification (Slide 8)
* Introduce the activity for the day and split students into 3 groups. (Slide 9)

2. Explore the Concept

(30 minutes)

**T:** Divide students into 3 groups.

**S:** Students will rotate to three stations spending 10 minutes at each station. At each station, students will record their observations on their handouts in the corresponding areas.

**T:** Before students begin work, demonstrate how to use the Google Boxes, Water Meters, and Microscopes. Be ready to help students with these items during the activity.

|  |  |  |
| --- | --- | --- |
| **Station 1 Habitat (Virtual Reality Photo)** | **Station 2 Water Chemistry** | **Station 3 Biology (Microscopes)** |
| **Explore the Concept** **T:** Explain how to use Google Boxes. There will be two pictures (one labeled “A” and one labeled “B”)**S:** Use Google Boxes to explore pictures of healthy and impacted streams. | **Explore the Concept** **T:** Explain how to use Water Quality Meter. Show Calibration and how to test.**S:** Use Water Quality Meter to test “A” and “B” samples. | **Explore the Concept** **T:** Explain how to use microscopes and indicator species sheets.**S:** Use bug boxes and indicator species sheets to classify “A” and “B” samples. |
| **Explore the Concept** **T:** Direct students to record findings on worksheet and guide students to look deeper into the pictures as in “engage section”. Guide discussion of why we collect these observations.**S:** Record observations on worksheet in corresponding box on the worksheet | **Explore the Concept** **T:** Guide discussion of why water chemistry might be collected.**S:** Record observations on worksheet in corresponding box on the worksheet | **Explore the Concept** **T:** Guide discussion of why this biology data might be collected.**S:** Record observations on worksheet in corresponding box on the worksheet |

3. Explain the Concept and Define Terms.

(10 to 15 minutes)

**S:** Share out their observations of the different activities.

**T:** Lead a class discussion about the activities. Ask students what they can infer about the health of the streams observed and how they came to their conclusions.

* Discuss the importance of measuring stream quality
	+ Why is it important to observe stream habitat (Station 1)?
	+ Why is it important to measure water chemistry (Station 2)?
	+ Why is it important to observe stream biology (Station 3)?

4. Elaboration/Expansion of the Concept (remediation if needed)

(5 minutes)

**S:** Write a short paragraph on their handout, describing which stream, A or B, has better water quality and why. Be sure to include data from each water quality

5. Evaluate Students’ Understanding of the Concept

* Teacher should make observations of student understanding during their exploration of the material (Explore) and during class discussion (Explain).
* Teacher should collect Handout (Engage/Explore/Extend) for additional proof of learning.

Additional Extension Ideas:

* Have students work in groups to measure water quality of local waterways. Either through a field trip to a river to do macroinvertebrate measurements and water chemistry measurements, or have students bring in their own samples from creeks and streams near their home to do in-class water chemistry measurements. (See My Backyard Stream on Watersheddata.com for more information).
* Have students research what happens to the water in their homes when it goes down the drain and what happens to rainwater. After discussing how some water is treated and some is not, work with the community to have the students do a Storm Drain Stenciling activity to help bring awareness to the pollution potential of dumping in storm drains.
* Have students research common sources of water pollution (agricultural runoff, industrial waste, acid mine drainage…) and have them make predictions on how these different types of runoff would affect a river. For example, would agricultural runoff affect the river’s habitat (perhaps causing more plant growth, or adding sediment to the river)? Would industrial waste affect the pH?

Additional Resources:

**Contact Jen Bowman (****bowmanj2@ohio.edu****) to borrow a preserved macroinvertebrate sample set.**

*Special thanks to the Ohio University Voinovich School and to AEP Foundation for their support in the creation of this educational materials.*

