

## CFWEP Lesson Plan: World Water Monitoring Day Lesson 2: Field Trip

**Duration:** 2 - 3 hours

**Grade Level:** 9-12

**I. Lesson Topic** In this lesson, students travel to two different local sites to engage in water quality monitoring. The sites could be two separate locations on the same river, stream or other water body (suggested), or sites on two separate water bodies. Over 2-4 hours, the class will travel by bus (or walk, if possible) to the two sites, where they will review quality assurance protocol, then conduct water monitoring procedures, collect and record data, and complete general site assessment forms.

### **II. Montana Standards and Benchmarks**

Science Standard 1: Grade 12 Benchmarks: 1, 2

Science Standard 2: Grade 12 Benchmarks: 2

Science Standard 3

Science Standard 4: Grade 12 Benchmarks: 4

For support, equipment and additional information, contact the **Clark Fork Watershed Education Program (CFWEP)** (406) 496-4124  
[www.cfwep.org](http://www.cfwep.org)

### **III. Objectives**

- Students will learn about standard water monitoring quality assurance protocol.
- Students will collect and record water quality data.
- Students will complete general environmental site assessments.
- Students will learn to use technology applied to water quality monitoring.

### **IV. Materials/Equipment/Resources Needed:**

- Copies of the Data Sheets and Watershed Survey Forms for each student.
- Clipboards, pens/pencils for each student.
- Proper outdoor clothing.
- *Optional:* GPS Unit(s).
- WWMD Test Kits, GLX Multimeters, or water test strips (available from the CFWEP).
- Copies of Site Assessment Forms for each student.
- Prearranged bus for transportation to field sites.
- Two previously selected monitoring sites (note: the CFWEP can offer suggestions and guidance in choosing appropriate sites for water monitoring activities).
- Water Monitoring Quality Assurance Protocol copies for each student.

### **V. Vocabulary**

Same as Lesson 1

### **VI. Assessment**

A Pre/Post Test will assess students' content knowledge. Data Sheets and Site Assessment Forms will assess students' ability to observe and record data. A post Stewardship Survey will assess student attitudes.

### **VII. Procedure**

#### **Teacher Input**

1. Before class: Arrange transportation and select two monitoring sites to visit.
2. Before class: Prepare Data Sheets, Watershed Survey Forms and Quality Assurance Protocol for each student. Ensure that clipboards and pens/pencils will be available to students in the field.
3. Before class: Prepare monitoring equipment. In the case of GLX Multimeters, ensure that Multimeters are charged. To borrow equipment, or for any other equipment or technical support, contact the CFWEP.
4. Distribute Data Sheets and Site Assessment Forms to each student.
5. Travel to site 1. Use travel time to review the Water Monitoring Quality Assurance Protocol with students.

6. Divide students into 3-4 groups. Each group will need to complete a Master Watershed Survey and Data Sheet. At each site, each group should walk the site and complete a Site Assessment Form (30-40 min.) and use Multimeters or Test Kits to measure the main water quality parameters (water temperature, dissolved oxygen, turbidity, pH) (20-30 min.).
  - a. General Site Assessment: Independently, students should walk the site and fill out the 3-page Watershed Survey Form (15-20 min.). Then they should join with the other members of their group to compare and discuss their results. Each student group will need to reach consensus and record their consensus observations on a master Watershed Survey Form (15-25 min.). This form is self-explanatory; it is a qualitative assessment of the site.
  - b. Water Quality Monitoring: Working with their group, students should take 4-5 separate readings of the 4 basic water quality indicators (temperature, dissolved oxygen, turbidity, pH), recording their data each time (15-20 min.). They should then average their data and record on their Master Data Sheet (5-10 min.).
7. Travel to site 2 and repeat.
8. *Optional*: Measuring Additional Parameters
  - a. Conductivity: If students are using Multimeters or other instruments capable of measuring Conductivity, then it should be added to the list of water quality indicators for students to measure described above (note: allow for an additional 5 min.).
  - b. Dissolved Copper: If students have access to copper test strips, a colorimeter, or other instrument capable of measuring dissolved copper, then it should be added to the list of water quality indicators for students to measure described above (note: allow for an additional 10 min.).
9. *Optional*: Photodocumentation: If students have access to a digital camera, then each group should also take 5-10 digital photos in order to document conditions at the site.
10. Reflection Activity: At site 2, after students have completed all other tasks, they should independently take 10-15 minutes to write a paragraph on the back of their Data Sheet reflecting on what they have observed, and potential implications for or problems at the site.
11. Return to class.

### **Student Activities**

1. Review Water Quality Testing Quality Assurance Protocol.
2. Complete Watershed Survey and record data at both sites.
3. Using the appropriate tools, complete Water Quality Monitoring and record data at both sites.
4. *Optional*: Measuring Additional Parameters.
5. *Optional*: Photodocumentation.
6. Reflection Activity.

**VIII. Homework** None.

### **IX. Resources**

WWMD Website: <http://www.worldwatermonitoringday.org/>

CFWEP Website: <http://www.cfwep.org>

**X. Extensions** This lesson is designed as part 2 of a 3-part module. Part 1 is an overview of water monitoring and an introduction into the module, and part 3 builds on the field activities of this lesson with in-class data analysis and assessment. Considerable options exist for further extension; refer to the resources listed above as a starting point for extended activities. Teachers interested in potential extensions can also contact the CFWEP (see contact info above) for additional suggestions and support.

**XI. Notes** Teachers may find it helpful to review Lesson 3 prior to the field trip. Lesson 3, which involves analysis and assessment of the data collected in the field, is closely tied to this lesson.

### **XII. Science Process Skills**

#### **1. Knowledge**

In this lesson, students observe 2 local water body sites, collect data, compute averages, and record data.

**2. Comprehension**

In this lesson, students will make generalizations about observed sites, summarize collected data, make inferences based on collected data, define observed problems, and identify cause and effect of site conditions.

**3. Application**

Using collected data, students classify and categorize watershed health.

**4. a. Analysis**

Students will identify relationships and patterns affecting watershed health, compare sites and data, formulate questions about watershed conditions, and discuss the procedures used and results obtained in data collection.

**b. Analysis and Synthesis**

Students will report data to their group, and debate and persuade within their group in recording master data.

**5. Evaluation and Synthesis**

Students, through data collection and field observation, test and verify hypotheses regarding watershed health.

**XIII. Montana Standards and Benchmarks** (Item II in full)

Note: Standards are bolded and Benchmarks are italicized, with connections to this lesson explained in plain text.

**Science – Standard 1:**

**Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.**

In the activity for this lesson, students conduct an inquiry investigation into water quality, evaluate results, and communicate results to their fellow students.

*Grade 12 Benchmarks:*

*1. Generate a question, identify dependent and independent variables, formulate testable, multiple hypotheses, plan an investigation, predict its outcome, safely conduct the scientific investigations, and collect and analyze data.*

In the activity for this lesson, students safely conduct a scientific investigation into water quality, including collecting and analyzing data.

*2. Select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations using appropriate mathematical analysis, error analysis, and graphical representation.*

In the activity for this lesson, students utilize technology in gathering water quality measurements, and process and analyze data using appropriate mathematical analysis.

**Science – Standard 2:**

**Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.**

In this lesson, students use the inquiry process to assess the properties, forms, changes and interactions of physical and chemical parameters of natural water systems.

*Grade 12 Benchmarks:*

*2. Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of (a) valence electrons on the chemical properties of elements and the resulting periodic trends in these properties, (b) chemical bonding, (c) molecular geometry and intermolecular forces, (d) kinetic molecular theory on phases of matter, and (e) carbon-carbon atom bonding on biomolecules.*

In this lesson, students will investigate how the particulate level structure and properties of water molecules affect the macroscopic properties of water, including the effect of (b) chemical bonding.

**Science – Standard 3:**

**Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.**

In this lesson, students use the inquiry process to study how living organisms interact with each other and their environment.

**Science – Standard 4:**

**Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth’s systems and other objects in space.**

In this lesson, students use the inquiry process to study the composition, structures, processes and interactions of Earth’s water cycle system.

*Grade 12 Benchmarks:*

*4. Collect and analyze local and regional weather data to make inferences and predictions about weather patterns; explain factors influencing global weather and climate; and describe the impact on earth of fluctuations in weather and climate (e.g., drought, surface and ground water, glacial instability).*

In this lesson, students collect and analyze local water data to make inferences and predictions about factors influencing weather and riparian climates and explore fluctuations in weather and riparian climate.