

**Time:**

(2) 45 minute class periods  
10 minutes of class for 3 days

**Level:**

Secondary Science – Earth  
Science

**Goals:**

Students will participate in a hands-on exploration activity to help them learn why watersheds are so important, the effects of human activity on watersheds, and how a watershed's health can be improved.

**Objectives:**

Students will be able to

1. Define the term 'watershed' with 100% accuracy.
2. Explain the effects that humans have on watersheds in 2-3 complete sentences.
3. Define and explain factors of a healthy watershed with 100% accuracy.

*Materials listed with each individual activity.*

# Building a Watershed

*by Gavin Hawkley, Neicca Butts, and Mark Larese-Casanova*

**Correlations to Core Curriculum:**

Secondary Science -- Earth Science

- Standard 5: Students will understand how Earth science interacts with society.
  - Objective 3: Indicate how natural hazards pose risks to humans.
    - Indicator c: Evaluate and give examples of human activities that can contribute to the frequency and intensity of some natural hazards (e.g., construction that may increase erosion, human causes of wildfires, climate change).

**Background Information:**Watersheds

A watershed is an area of land that drains to a common point. All land, from the wildest preserve to the most densely developed urban neighborhood, is part of a watershed. When watersheds are healthy and functioning well, they provide habitat and water for plants and animals. Healthy watersheds work hard. They move sediment from the mountains to the beaches and bays, sorting it along the way to create diverse landscapes and habitats. They cycle nutrients and convert them into forms that living organisms can use. They purify and store water, and then meter its release into streams to reduce flooding and damaging erosion in the winter and to sustain flows and cool temperatures during the dry season. They even affect air quality by absorbing pollutants and greenhouse gases. Well-functioning watersheds are more resilient to natural and human-induced disturbances than highly-impacted watersheds.

[http://www.marinwatersheds.org/healthy\\_watershed.html](http://www.marinwatersheds.org/healthy_watershed.html)

How to improve a watershed's health

- Plant native plants that fit your specific location and conditions. When you can, plant a variety of species and

types of plants from grasses for erosion control and wildflowers for bees and butterflies, to shrubs and trees for birds and healthy streams.

- Keep water clean. Prevent soil erosion, use non-toxic household and garden products, keep oil and animal waste out of streams and storm drains.
- Repair erosion wherever possible with biotechnical techniques that incorporate native plants. These methods allow for natural watershed functions to continue.

[http://www.marinwatersheds.org/healthy\\_watershed.html](http://www.marinwatersheds.org/healthy_watershed.html)

### Human Impact

Human activity causes 10 times more erosion of continental surfaces than all natural processes combined, an analysis by a University of Michigan geologist shows. "If you ask how fast erosion takes place over geologic time---say over the last 500 million years---on average, you get about 60 feet every million years," Wilkinson said. In those parts of the United States where soil is being eroded by human agricultural activity, however, the rate averages around 1,500 feet per million years, and rates are even higher in other parts of the world. Natural processes operate over areas larger than those affected by agriculture and construction, but even taking that into account, "the bottom line is, we move about 10 times as much sediment as all natural processes put together," he said.

<http://www.sciencedaily.com/releases/2004/11/041103234736.htm>

### **Lessons and Activities:**

#### **Day 1 (Classroom) --**

**Engage (15 minutes)** – Introduce the topic of watersheds by introducing the following questions and leading a short classroom discussion on them. Where do you get your water from? How does the water get to these storage areas? What could be some issues you would have to deal with to keep the water clean?

Have each student read the encyclopedia article on watersheds written by National Geographic, found [here](#). Ask students to write down at least 3 things they learn about watersheds in their science notebook as they read. *(Note to teachers: As a variation from this activity, you may choose to use available technology and have students do their own research on watersheds. Remind them to look for reliable sources in their research, and have them cite the*

#### **Materials:**

#### **Supplies –**

- Science journals and pencils for each student
- Water

#### **Equipment--**

- Map of local watershed (or Great Salt Lake watershed)
- Aquariums or Medium-sized clear containers (1 for every 4 people in the

- class)
- Sand
  - Soil
  - Rocks/pebbles
  - Beakers or measuring cups (1 for every 4 students)
  - Bean sprout seeds or bag of sphagnum moss

### Did you know?

In the continental US, there are 2,110 watersheds; including Hawaii Alaska, and Puerto Rico, there are 2,267 watersheds.

<http://water.epa.gov/type/watersheds/whatis.cfm>

*websites they got their information from.)*

Direct a pair-and-share, in which each student can turn to a partner and discuss what they have learned about watersheds. If time permits, allow students to then share out with the entire class what they learned about watersheds. *(This may be particularly applicable when students are doing their own research, and are all reading different articles.)*

Pull up a map of a local watershed (or the Great Salt Lake watershed). Explain in detail how watersheds work, and the connectivity throughout the watershed.

**Explore (20 minutes)** -- In small groups (no more than 4 people per group), do the following activities:

- Inform the students that they will be designing their own watersheds in small groups using sand as the land. Make sure the students understand that their watershed should be formed in a way that represents real watersheds – mountains and a place for the water to collect. Let them be creative and design their watersheds using sand, soil, rocks, etc...
- Have each group pour a certain amount of water into their watersheds using a watering can to simulate rainfall. (You will want to test how much water will be necessary for the containers you are using beforehand.) Ensure that all groups have a similar amount of materials and water, thus bringing about similar results throughout the classroom. Have the students write down some observations of how the water affects the land formations of their watershed. (They should notice large amounts of erosion.)
- Have students write and draw scientific observations in their science journals.

**Explain (10 minutes)** – Talk about why there was so much erosion. What could reduce this? Have students list ideas, and then inform students on what makes a healthy watershed. Remind them that having natural plants can help support a healthy watershed. Tell the students they will get to experiment to see if plants really can support their watersheds. Hand out bean sprout seeds (about 5-6 per group) and have the students plant them in their watersheds. Alternatively, dry sphagnum moss may be used on Day 2 instead of sprouts. Ask students to predict what effect the bean sprouts will have on their watersheds. Have them write their predictions in their science journals.

**Materials:****Supplies –**

- Science journals and pencils for each student

**Equipment--**

- Watershed models

**Materials:****Supplies –**

- Science journals and pencils for each student

**Equipment--**

- Watershed models
- Sphagnum moss (optional)
- Water
- Cups to pour water with

**Day Two, Three, and Four (10 minute observation periods) --**

Each day, allow students 10 minutes to observe their bean sprouts. Give them time to make scientific notes and drawings in their science journal. Give time for students to share their observations with a partner, or with the class. Encourage students to focus on how they believe the bean sprouts are supporting their watershed system. If you choose to use sphagnum moss instead of bean sprouts, skip this step of the lesson.

**Day Five (Classroom) –**

Using the same small groups as on day one, have the students repeat the water pouring activity. If bean sprouts are not used, have the students apply thin layers of sphagnum moss to areas of their watershed prior to pouring water. Have the students take observations again, and make note if their conclusions supported their hypotheses. Give time for the students to share and discuss their results. Among other discussion points, you might discuss how the bean sprouts or moss affected the watershed? Help students understand and discuss why healthy vegetation is such an important part of a watershed system.

Discussion: Help students understand their impact on watersheds. Discuss how erosion affects watersheds and how humans play a role in this. Also talk about how pollutants are transported through watersheds. What can we do to preserve these natural water collection and purification areas?

**Assessment:**

Students should be assessed by completing one of the following activities (of their choice). They should have access to the rubric (attached below) before beginning their project.

- Have students write a paragraph showing at least 3 effects that humans have on watersheds, and why healthy watersheds are so critical. This presentation should also include what a healthy watershed is comprised of and how we can make watersheds healthier.
- Have students create a presentation (a poster, PowerPoint, etc.) showing at least 3 effects that humans have on watersheds, and why healthy watersheds are so critical. This presentation should also include what a healthy watershed is comprised of and how we can make watersheds healthier.
- Basic assessment consists of visual monitoring of the students' progress in creating a small watershed, as well as

## Did you know?

The Amazon River watershed is the largest in the world, draining more than a third of the entire South American continent. The Amazon River officially begins at the confluence of the Solimoes and Rio Negro, above, in northwestern Brazil.



[http://education.nationalgeographic.com/education/encyclopedia/watershed/?ar\\_a=1](http://education.nationalgeographic.com/education/encyclopedia/watershed/?ar_a=1)

in demonstrating the effect of adding vegetation in reducing soil erosion.

### Extensions:

- Visit areas of a local watershed. Evaluate the overall health of the watershed. Have students write down their observations in their science notebook. In small groups, have students come up with a plan for how to improve the health of the watershed.
  - Have students create a plan and take it to local representatives. The students should explain to the representatives (either in a letter or in speaking) why the health of our watersheds is so critical, and why the students feel that time and money should be spent on increasing the health of the local watershed.
- Have students make a short book for early elementary school students about watersheds. The book should include why watersheds are important and how to keep them healthy. These books, when written and illustrated, can be donated to a local elementary school for a unit on water.
- Reserve the Stream Trailer from Utah State University Water Quality Extension to teach watershed and erosion concepts on a larger scale.

<https://extension.usu.edu/waterquality/htm/educator-resources/lessonplans/stream-trailer/>

### Resources:

#### Books

- *Utah Master Naturalist Watersheds Textbook*  
[http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP\\_Watersheds\\_Text.pdf](http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Watersheds_Text.pdf)

#### Websites

- Utah State University Water Quality Extension  
<https://extension.usu.edu/waterquality/htm/educator-resources/lessonplans/stream-trailer/>

## Watershed Assessment Rubric

The presentation or paragraph discusses at least 3 effects humans have on watersheds <i>(15 points)</i>	The presentation or paragraph discusses at least 2 effects humans have on watersheds <i>(10 points)</i>	The presentation or paragraph discusses at least 1 effect humans have on watersheds <i>(5 points)</i>	No effects of humans on watersheds are presented or discussed <i>(0 points)</i>
The presentation or paragraph talks about why healthy watersheds are so critical in detail <i>(15 points)</i>	The presentation or paragraph briefly mentions why healthy watersheds are so important <i>(7 points)</i>	The presentation or paragraph does not discuss why healthy watersheds are so important <i>(0 points)</i>	
The presentation or paragraph discusses the elements of a healthy watershed <i>and</i> how we can make watersheds healthier <i>(15 points)</i>	The presentation or paragraph discusses the elements of a healthy watershed <i>or</i> how we can make watersheds healthier <i>(10 points)</i>	The presentation or paragraph briefly mentions the importance of healthy watersheds <i>(10 points)</i>	The presentation or paragraph does not talk about elements/contributions to healthy watersheds <i>(0 points)</i>

Name:

Score:        /45