How Much Water Flows Through Our Local Stream?

Order of Magnitude Lesson

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**Pretest (think essential questions)**

Ask students to answer the following questions in their science notebooks or on a piece of paper:

1. What is stream flow?
2. Why is it important for us to know how much water flows in our streams and rivers?
3. \*How much water do you think will flow through \_\_\_\_(local creek or river)\_\_\_\_\_ today? How could you find out?

**Objective**

Students will determine approximately how much water flows through a local creek/ river.

**Catch**

Prepare materials: Enough cups and juice (or water can be used as a substitute) for the whole class. About ¼ of the juice should be put into an opaque container/pitcher while the rest should remain hidden.

Short Activity: Pass out a cup to every student and then ask who would like some juice. Start pouring juice into the cups of students who raise their hands. You should run out of juice after only approximately ¼ of the students have received some.

Tell/ ask students, *Sorry but we ran out of juice; is everyone else okay to not receive juice today?* (Likely response will be “No!”) *Why not?* (Likely response, “It’s not fair.”) *How could this problem been prevented?* (Don’t offer it to everyone if there is not enough; divvy up the juice more evenly, etc.)

Relate this to water we consume/use every day. Ask students, *hypothetically,* *what would it be like if only ¼ of the community received water every day and the rest didn’t?* (many would not be able to drink water, take showers, cook food, grow a garden, etc.)

Tell students, *well, it’s a good thing I counted my actual resources before providing juice to you today.* Pull out the remaining juice and pour it into the remaining cups.

**Activity**

Part 1: Building Background Knowledge on Stream Flow

Have studentsread the attached information entitled “Stream Flow” provided by Teton Science School and then answer the “Stream Flow” Reading Response Sheet” (below) when they are finished. The reading can also be found at: <http://www.tetonscience.org/data/contentfiles/File/downloads/pdf/TLC/streamteambackground/Stream%20Flow.pdf>

Part 2: Determining Stream Flow

Arrange for a trip to a local creak/river and prepare Materials: clothesline or long string/rope, hammers, stakes, stopwatches, calculators, tennis balls (or other small object that floats), tape measures, students willing to get their feet wet

Lesson:

1. Divide the class into groups of 4 or 5.
2. Spread the groups out over a length of a creek/river (be sure you can still see them for safety reasons)
3. Each group should string the clothesline across the stream using the hammer and stakes. Measure the depth of the stream at 1 foot intervals across the width of the stream. Calculate the area of the stream bed along your crosscut.
4. Using the tennis ball and stopwatch, calculate the velocity of the ball, and thus the velocity of the water near the surface. Take at least 3 measurements, trying to spread them out through the width of the stream. Average the velocities.
5. Calculate the flow of the stream in feet3/seconds.
6. Back in the classroom, create a class data table on the board.
7. In their groups, students should calculate how much water travels through the creek/river in a day.
8. Have students work in pairs or groups to answer the following OoM Extension Questions (focus on the process, not the answers):
	1. How many people do you think our creek/river could serve on a daily or yearly basis?
	2. What do you think the daily stream flow would be exactly three months from now? Why? Six months? Nine months? Students should defend their answers (they will hopefully include considerations for heaviest time for precipitation, runoff, summer heat & evaporation, gardening, etc.)
	3. How much water flows through other rivers in the U.S. in any given day? (Teacher should select other rivers students are familiar with)

**Review**

Have students share their solutions with the whole class though do not focus on who is right, rather focus on the process of how they got to their answers.

**Assessment**

Assess students formatively in multiple ways:

1. Collaboration with group members
2. Independent work
3. Journal/worksheet recordings

**Posttest**

Ask students to answer the following questions in their science notebooks or on a piece of paper:

1. What is stream flow?
2. Why is it important for us to know how much water flows in our streams and rivers?
3. \*How much water do you think will flow through \_\_\_\_(local creek or river)\_\_\_\_\_ today? How could you find out?

**Standards**

2016 Wyoming Science Content and Performance Standards (planned to be adopted soon)

3-5-ETS1-1 and 3-5-ETS1-2

\*Essential Order of Magnitude Question or Component

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Stream Flow Reading Response Sheet

Complete the sentences and answer the questions below:

1. Stream flow, or discharge, is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of water that flows past a specific point in a stream over a specific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. What are the two components of stream flow? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Define velocity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Define volume: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. List three things that we can learn about a specific water source by knowing it’s stream flow:
	1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. When do we see the heaviest (peak) stream flow in Wyoming? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Why are those the peak runoff months? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Local Flow Analysis

Name of creek/river: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Off the top of my head, I think \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (amount) of water flows through our local creek/river every day.

Determine the velocity and volume to the best of your groups’ ability. Record your work here:

After traveling to the creek with our group, we have projected that \_\_\_\_\_\_\_\_\_\_ (amount) of water flows through of local creek/river every day.