

Exercise: Stream Discharge Analysis

Name _____ Name _____

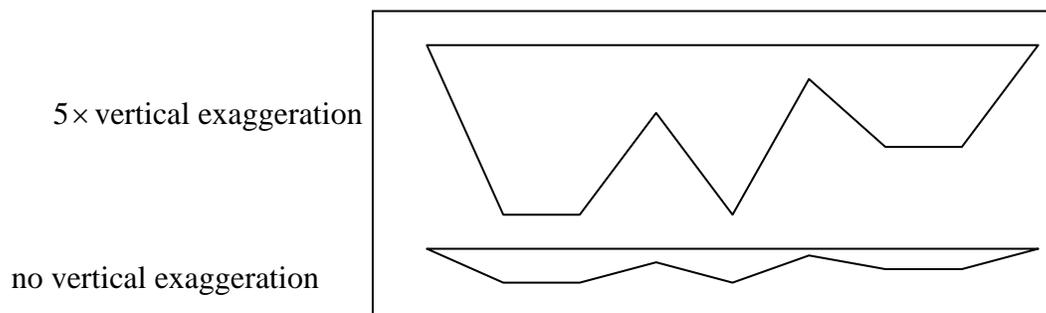
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Deep Creek Analysis

1: Cross sectional profile

On one side of the 11 x 17 graph paper, draw two versions of a cross section through Deep Creek, using your width = x, depth = y measurements. Both versions will be **looking upstream** when you look at the piece of paper.

The first version of the cross section through Deep Creek will have the same horizontal and vertical scales; no vertical exaggeration. Put this version at the bottom of the graph paper. The second version of the cross section, plotted on the SAME side of the page as the first, will have the same HORIZONTAL scale as the first, but will have an exaggerated vertical scale, to see the creek more easily. Plot this second cross section right above the first (they should not overlap!).



2. Cross sectional Area

Calculate the **cross sectional area** of Deep Creek (width times mean depth). Show work, show units. Use an appropriate number of decimal places.

3. Wetted Perimeter of Deep Creek

Using your ruler, measure the length of the **wetted perimeter** for Deep Creek. The wetted perimeter is the length of the channel in contact with the water. How does the wetted perimeter compare with the width of Deep Creek? Discuss your answer.

4. Velocity across the Deep Creek profile

On your exaggerated cross section, show your “30 second” velocity measurement locations with a small square, and write the velocity for each location (to **two** decimal point) next to the symbol.

Calculate the mean velocity for your entire profile:

5. Discharge of Deep Creek: Method 1

Using your width, mean depth and mean velocity, calculate discharge for Deep Creek. Show work, show units.

Raging River Analysis

7. Raging River Cross Sections

On the second sheet of graphing paper, draw two versions of a cross section through the Raging River, using your width = x , depth = y measurements. Remember: **looking upstream**. The first version has no vertical exaggeration, the second has $5\times$ vertical exaggeration. Plot the second cross section right above the first on the same graph paper. Label your velocities (where available) and construct polygons on the exaggerated cross section. Good labeling is required. If you didn't label properly on the Deep Creek cross sections, do so now.

You're missing some of the velocity measurements needed to complete your transect, the velocity meter couldn't reach all the way across. Describe your physically and mathematically sound approach for completing the velocity measurements on your transect. Attach extra work as needed.

Put these velocities on your exaggerated plot, with parentheses around the numbers, to show that these numbers are not measurements.

Calculate the mean velocity for your transect: _____

Calculate the mean depth for your transect: _____

What is the width of your transect? _____

What is the discharge, using method 1?: _____

What volume of water flowed past you in the 1.5 hours when you were working along the Raging River? Show calculation, include units.

Discharge was measured at a gaging station downstream from the Raging River transect. The Raging River discharge downstream was 60 cfs. How does your calculated discharge compare with the downstream discharge for your stream/river? Is your discharge too big, too small, or just right? Explain.

8. Flood Control

The Washington State Department of Transportation decides to build levees (vertical retaining walls, made of rock or concrete) near the bridge, to try and protect the bridge supports from erosion during flooding. The levees are 6 feet high and are built right on the banks of the river. Levees are built upstream from the bridge for several hundred yards.

Sketch a (simple) cross section across the Raging River below, showing the levees. What will be the discharge on the Raging River if the water rises to the top of the levees? Show work, and briefly justify your steps/choices.

Suppose the discharge at the bridge was 3000 cubic feet per second. Would a discharge this big exceed the capacity of the levees or not? If so, how high must the levees be built?

9. Volumetric analysis-“mean method”

Over a 24 hour period on November 5, 1998, the mean discharge of the Raging River was 100.1 cfs, measured at a nearby gaging station. Calculate the total volume of water that passed by the gaging station during the 24 hours. Show calculation and units.

10. Volumetric analysis-“graph area method”

A more detailed computation of the total volume can be accomplished using the **hydrograph** from this 24 hour period (see graph next page). The volume of water is the **area under the graph**, but above the x-axis. However, there's a problem with the graph. The time units are different along the x and y axis, and that would produce an incorrect area. **Reconfigure the discharge scale** so that the units are in cubic feet per **hour** (cfh). Label this new vertical scale along the right hand side of the graph.

Now draw vertical lines every 2 hours. The lines should start at the x-axis, and stop at the graph. When finished, you should have 12 regions under the graph.

Compute the area of the first (left-most) region using the new vertical scale. Show how the units work out so that the end result is a volume.

Now compute the volumes corresponding to the other 11 areas under the graph. You may need the polygon method used earlier for some of the areas. Organize your work for all 12 areas in a table below.

What is the total volume of water that passed the gaging station, as determined by the more detailed graphical analysis?

How close are your volume measurements from the 2 methods (mean method and areas method)? Which do you think is more accurate? Discuss.

Hydrograph (Nov. 5, 1998)

