GEO 144 Field Trip: Silver Falls State Park

Name: _____ Date: _____

Your company has been hired to evaluate the impact of some land management decisions made upon one fork of a two forked creek system, the Silver Creek system. The North Fork Silver Creek and the South Fork of the Silver Creek. Both creek watersheds have the same area (km^2) and have very similar discharges (m^3/s). Your team needs to determine whether one of the forks has been impacted.

Meet at the North Falls Parking Lot. Head east and cross the bridge. Turn right at the bottom of the hill and we will gather under the bridge along the metal pipe hand rail. This will be our first Discharge Measurement for the day. Recall that the Stream Discharge (Q) can be calculated by multiplying Area X Velocity.

$$Q = V \times A$$

There are many ways to measure both Velocity and Area. We will use several of these methods at cross-sections up/downstream from each other on the same Creek and on different creeks. The first Q measurement will be done with the simplest method and we will increase the complexity at the other locations.

Part I. North Falls Discharge Measurement

For this calculation, we are given the cross sectional area (3.5 m^2). We only need to make some estimates of the velocity. To do this we will place something in the river at an upstream location and measure the time it takes to travel a certain distance downstream.

Step 1. Measure the distance between the upstream and downstream locations. _____

Step 2. Measure the Velocity

Place a floating object (like a leaf or a twig, something that is naturally in the area that would typically be found in the creek) in the creek at the upstream location. Use a watch or phone to measure the time it takes to travel the distance to the downstream location. Do this 5 times and calculate the Mean Velocity. Recall that Velocity is distance/time. The distance measurement is the same for each of your Velocity calculations. Use the table below:

Measurement #	Distance	Time	Velocity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
		Sum:	_____

Calculate the Average (Mean) Velocity for these first five measurements. Mean Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Average Velocity First Five =

Do this again, for 5 more calculations:

Measurement #	Distance	Time	Velocity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
		Sum:	_____

Calculate the Average (Mean) Velocity for these second five measurements. Average Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Mean Velocity Second Five =

Calculate the Average (Mean) Velocity for all ten measurements. Mean Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Mean Velocity All Ten =

Step 3: Calculate the Mean Discharge:

Calculate the Discharge, in cubic meters per second, using the Mean Velocity from all ten measurements. Use the formula Q = V x A.

North Fork Silver Creek Mean Q = _____

Part II. South Falls Discharge Measurement: Upstream A

Drive to the South Falls Parking area and park in the easternmost part of the parking lot. Head to the bridge just downstream of the part of the river that is bounded by concrete. Upstream of the bridge are three spillways that are remnants of when this part of the river was dammed up to create a recreational lake.

For this Discharge Measurement, we will first measure the cross-sectional area, then we will make some velocity measurements, and finally calculate a Mean Discharge.

Step 1: Measure Cross-Sectional Area

Each spillway has the same dimensions and the same cross-sectional area. First determine the cross-sectional area of one spillway and then multiply it by three. Use a measuring tape to determine the depth of the water in one part of the spillway. Then, use a tape measure to estimate the width of the spillway. Have several people take measurements and use the mean of all these measurements.

Depth (m):

Mean Width (m):

Area (m^2) = Depth (m) x Width (m):

Step 2: Make 5 Velocity Measurements like you did for Part I, the North Falls Discharge Measurement.

Measurement #	Distance	Time	Velocity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
		Sum:	_____

Calculate the Average (Mean) Velocity for these first five measurements. Average Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Mean Velocity =

Step 3: Calculate the Mean Discharge:

Calculate the Discharge, in cubic meters per second, using the Mean Velocity from all ten measurements. Use the formula Q = V x A.

Q = _____

Part III. South Falls Discharge Measurement: Upstream B

We will now go to the next bridge that is downstream of this first bridge. Here, we will take a second discharge measurement on the South Fork of Silver Creek. We will compare this measurement of the Upstream A Discharge Measurement.

Step 1: Cross Sectional Area Measurements:

We will use a long board with a tape measure to take depth measurements. We will use a long tape measure to measure the width at each depth measurement. Each pair of measurements will comprise a measurement for a single rectangular area determination. After all measurements have been made, we will sum them all to determine the total cross-sectional area of the creek. We will take about ten measurements across the bridge, starting at one end and proceeding to the other end. Place the long tape measure along the footpath of the bridge near the handrail. Place the beginning of the tape measure at the edge of the creek below. Runt the tape to the other side of the creek and note the width of the river: _____. Divide this length by 10 to determine the area measurement spacing (also the width of each area measurements): _____. This will be the distance between each vertical measurement. Take your first measurement at 1X this distance, the second measurement at 2X this distance, and so on.

For the depth measurements, we will take two and difference them. First we will measure the vertical distance between the bridge and the top of the water. Second we will measure the vertical distance between the bridge and the bottom of the creek (the creek bed). When we subtract these measurements from each other, we will know the depth of the water at that location.

Horizontal Distance (m)	**Width (m)**	**Top of Water (m)**	**Bottom of Bed (m)**	**Difference (m)**	**Area (m^2)**
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Cross Sectional Area (m^2): _____

Step 2: Calculate Velocity like you did for Part I, the North Falls Discharge Measurement.

Measurement #	Distance	Time	Velocity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
		Sum:	_____

Calculate the Average (Mean) Velocity for these first five measurements. Average Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Mean Velocity =

Step 3: Calculate the Mean Discharge:

Calculate the Discharge, in cubic meters per second, using the Mean Velocity from all ten measurements. Use the formula Q = V x A.

Q = _____

Step 4: Compare Discharge Measurements from **Part II** and **Part III**.

Enter **Part II** Mean Discharge (Q = m^3/s): _____

Enter **Part III** Mean Discharge (Q = m^3/s): _____

Are these Mean Discharges the same (Y/N)? _____

Why do you think that these Mean Q values may be different?

Part IV. South Falls Discharge Measurement: Downstream

We will now walk down, past South Falls. Make sure to walk behind the water and take note of the different layers of rocks.

What kinds of rocks are layered here (igneous, sedimentary, and metamorphic)? _____

We will meet at the bridge downstream of the South Falls. We will make a discharge measurement like in **Part III**.

Step 1: Cross Sectional Area Measurements:

Place the beginning of the tape measure at the edge of the creek below. Runt the tape to the other side of the creek and note the width of the river: _____. Divide this length by 10 to determine the area measurement spacing (also the width of each area measurements): _____. This will be the distance between each vertical measurement. Take your first measurement at 1X this distance, the second measurement at 2X this distance, and so on.

For the depth measurements, we will take two and difference them. First we will measure the vertical distance between the bridge and the top of the water. Second we will measure the vertical distance between the bridge and the bottom of the creek (the creek bed). When we subtract these measurements from each other, we will know the depth of the water at that location.

Horizontal Distance (m)	**Width (m)**	**Top of Water (m)**	**Bottom of Bed (m)**	**Difference (m)**	**Area (m^2)**
_____	_____	_____	_____	_____	_____

_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Total Cross Sectional Area (m^2): _____

Step 2: Calculate Velocity like you did for Part I, the North Falls Discharge Measurement.

Measurement #	Distance	Time	Velocity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
		Sum:	_____

Calculate the Average (Mean) Velocity for these first five measurements. Average Velocity = Sum of all Velocity Measurements / The Number of Velocity Measurements

Mean Velocity =

Step 3: Calculate the Mean Discharge:

Calculate the Discharge, in cubic meters per second, using the Mean Velocity from all ten measurements. Use the formula Q = V x A.

Q = _____

Step 4: Compare Discharge Measurements from **Parts II, III, and IV** and calculate a mean Discharge Measurement for the South Fork of Silver Creek

Enter **Part II** Mean Discharge (Q = m^3/s): _____

Enter **Part III** Mean Discharge (Q = m^3/s): _____

Enter **Part IV** Mean Discharge (Q = m^3/s): _____

Sum (Q = m^3/s): _____

Mean (Q = m^3/s): _____

Are these 3 Mean Discharges the same (Y/N)? _____

Are these 3 Mean Discharges the very different from the Mean Q of all three? _____

Why do you think that these Mean Q values may be different (are any of them very different from the other two, or all they close in value to the Mean Q of all three)?

Part V. Compare your Mean Discharge measurements

Step 1. Compare Q Calculations:

We will now compare our Q measurements from the North Fork of Silver Creek and the South Fork of Silver Creek. We will then write a short paragraph to the person who signed our paycheck. This paragraph will summarize what you did to determine if there was an impact upon the creek discharge on either fork of Silver Creek. The North Fork Mean Discharge is from one cross section and the South Fork Mean Discharge is the Mean of three cross sections.

Part I/Step 3. North Fork Mean Discharge (Q = m3/s): _____

Part I/Step 4. South Fork Mean Discharge (Q = m3/s): _____

Step 2: Write your report here: