Lesson number	2.2
Title of activity	Measuring water velocity and building a stream profile to calculate stream discharge
Time	45 minutes at stream site to gather data
Student group size	3-4
Resources required	For each group: • Hard copy of instructions for each student • Floating object • Timer (could be personal phone) • Meter stick or long tape measure • Waders/wading shoes for students entering water • Personal flotation devices (if required by risk assessment)
Venue	Stream site with safe access– stream should be of wadable depth all the way across.

Instructions:

1. Preview the concepts of stream velocity, cross-sectional area and volume (can use accompanying slides).
2. Brief students on safety guidelines prior to departure and at field site. Safety is paramount. Make sure you choose a section of stream that is safe. Follow all relevant safety procedures from your school for field trips.
3. Choose a suitable range of sample sections of the stream (one per group) where the cross-sections would have different features including riffles, rapids, or slow pools.

4. Measuring water velocity
    a. Have one student stand 5 meters downstream from another student in a straight section of the stream.

b. As a student starts a timer, the upstream student drops a floating object into the fastest area of flow.

c. The student stops the timer when the object reaches the student 5 meters downstream and records the number of seconds. You can give the students the format of the example table below or have them construct their own table.

d. Student teams repeat the process five times and find an average water velocity (units are meters/seconds so the number of seconds must be divided by 5).

Table 1.1 Stream velocity measurements

Observation	**Distance travelled (m)**	**Time elapsed (sec)**	**Water velocity (m/sec)**
1	5		
2	5		
3	5		
4	5		
5	5		
		Average water velocity (m/sec):	

5. Building a stream profile

a. Using a measuring tape, the student team measures the width of the stream at the sample section. Have students record the width.

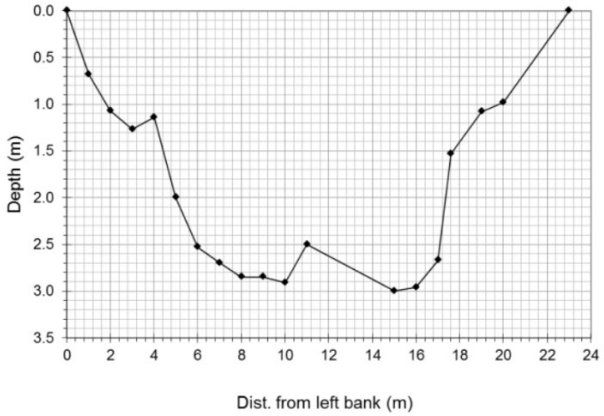
b. Using a measuring tape to measure increments and a meter stick to measure depth, the student team measures the depth of the stream at 50 cm (or 1 m) increments from bank to bank. Choose your interval to make sure the teams have at least 10 measurements across the river. At each increment, student teams should record depth and bottom description (sand, rock, gravel, woody debris, leaves, etc) including size of rocks (marble-sized? tennis balls? boulders?) or other debris. You can give the students the format of the example table below or have them construct their own table.

Table 1.2 Stream depth measurements and observations

Observation	Bottom description	Depth (m)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
	Average depth (m):	

c. Have students calculate the cross-sectional area of the stream (average depth * width). Result will be in m^2.

d. Have the students use the depth measurements to draw a profile of the stream using graph paper. Stream profile might look something like this:



6. Have students calculate the stream discharge by multiplying the velocity times the cross-sectional area. Result will be in m^3/sec. Can have students convert to ft^3/sec (cfs) to match USGS data by multiplying result by conversion factor of 35.3 ft^3/m^3 (1 m^3 = 35.3 ft^3).