# Open Channel Flow using the Float Method

## You need:

1) Tape measure
2) Stop-watch (cell phones often have a timer)
3) Yard or meter stick to measure depth (tape measures are more difficult to use)
4) Three highly visible buoyant objects such as a sticks or logs, pine cone, or oranges (objects heavy enough not to be effected by the wind)
5) Stakes or rocks for anchoring tape measure to channel banks (can act as markers)
6) Optional waders (you will usually get wet if doing this correctly)

**Float method** - The basic idea is to measure the time that it takes a floating object to travel a specified distance downstream.

We recommend doing these calculations in Feet and Seconds for convenience in converting to CFS (Cubic Feet Per/Second flow rate).

CFS = AxV (area multiplied by velocity)
A (Area) = Width of Channel (feet) x Depth of Water (feet)
V (Velocity) = Distance Traveled/Time to travel (feet traveled divided by seconds)

Step 1. Choose a suitable channel section with minimum turbulence
(ideally at least 3 channel widths long).

Step 2. Mark the beginning and end of the distance your floating object will travel. We recommend 20 feet as a minimum, but a travel time of around 20 seconds is best. The faster the velocity the harder it is to time the travel over short distances.

Step 3. Throw your floating object into the stream upstream of your upstream marker.

Step 4. Start the timer when the object crosses the upstream marker and stop the timer when it crosses the downstream marker.

Step 5. You should repeat the measurement at least 3 times and use the average feet per second by adding the three measurements and dividing that number by 3.

Step 6. Measure stream's width and depth across the downstream marker section. Be sure it is safe to wade, before getting in the channel. Use a yard stick or staff gauge to measure the depth at regular intervals across the channel. Taking ten depth measurements is the recommended minimum required but more will be better, especially in larger channels (about every foot across).

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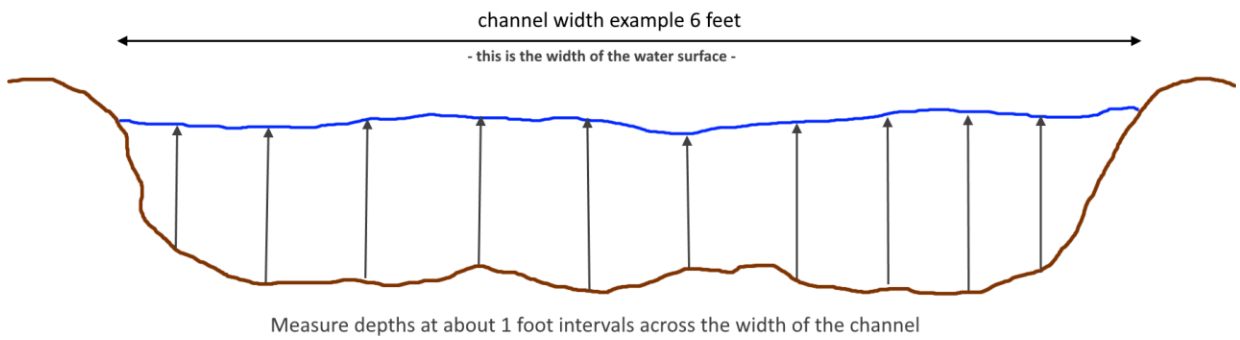
**Calculating the Area: (see image below)**
To get an overall channel area measurement, simply measure the width of the channel and then take 10 or more depth readings across the width. Try to take these depth readings about every 1 foot across (depending on the width and uniformity of the channel).




After taking the depth readings you simply add up the depths and divide that number by how many depth readings you measured. See example below:

| Depth 1 | Depth 2 | Depth 3 | Depth 4 | Depth 5 | Depth 6 | Depth 7 | Depth 8 | Depth 9 | Depth 10 |
|---|---|---|---|---|---|---|---|---|---|
| .6 | .9 | 1 | 1.1 | 1.2 | .9 | .7 | .7 | .6 | .4 |

Add up the depth values to get 8.1 and divide that by the number 10 (10 is how many measurements were made) the value you get is .81 – this is the average depth across the channel.

Now you can take the channel width (let's say 6 feet) and multiply that by the average depth.

Area = 6 x .81
Area = 4.86 square feet

If my float measurements gave me an average surface velocity of 2.2 ft/s (feet per second), then I can calculate the CFS discharge by using the discharge formula below.

CFS = Area x Velocity
CFS = 4.86 x 2.2
CFS = 10.69

Adjusted CFS (see note below) = 4.86 x (2.2 x .85) = 9.088 CFS

**NOTE:** Surface velocities are typically higher than average overall channel velocity. To account for this, we take the surface velocity measured, and multiply it by .85, to adjust the overall velocity to be more representative of the slower velocities under the surface. For example, if your surface velocity measurement is 2 ft/s (feet per second) and you multiply that by .85 you will get 1.7 ft/s, this will most likely be a better value to use in your flow calculation for the overall discharge rate.

**Tip:** To improve accuracy in wide channels you can take more velocity readings by dropping the float in different locations across the width of the channel, as long as all of your readings are away from the bank. Take a few measurements, and then average those measurements.

More Tools and How to Videos can be found on our web site at http://www.inmtn.com
Feel free to call us at (435) 755-0774 if you have questions.

# Float Technique Discharge Worksheet – ________________________________

Site Name / Date

Measure the average surface velocity of the flowing water using the float technique described in the first pages of this document.

Velocity 1 _______ft/s (feet per second)

Velocity 2 _______ft/s

Velocity 3 _______ft/s

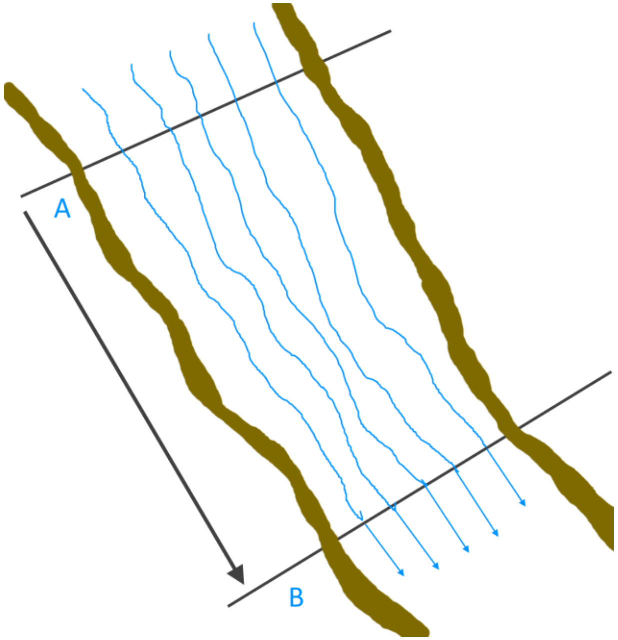
Add the three float timed velocity values together then divide that number by 3 = Average Velocity

AVG Velocity _________ ft/s

Multiply the AVG Velocity by 0.85 to get the adjusted velocity

Adjusted Velocity __________ ft/s

The Area is calculated using the table below:




CFS = AREA x AVG VELOCITY

CFS = $\boxed{\phantom{xxxx}}$

**Measure in feet**

| Depth 1 | Depth 2 | Depth 3 | Depth 4 | Depth 5 | Depth 6 | Depth 7 | Depth 8 | Depth 9 | Depth 10 | Depth 11 | Depth 12 | Depth 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |

Use as many of the boxes above as needed to record the depths you measure across the channel.
Add the depths together than divide them by how many depth readings you measured.
Width of water in channel (feet) multiplied by the Average Depth as calculated above.

AREA = ____________ square feet

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