

# Flow measurement procedures (using an electromagnetic velocity (current) meter)

## Safety Procedures:

- As a general rule, unsafe wading conditions exist if the maximum velocity (in cfs) multiplied by the maximum depth (in feet) exceeds 10. The velocity can be estimated prior to actual measurement by extending the top-setting rod into the channel while standing on the bank.
- A personal flotation device (perhaps a “mustang jacket” in cold weather) and a safety line (20’ rope attached to the tree and waist) will be used in marginal/high flows.
- A buddy system will always be used when working in the water. This means that at least one person will always be on shore. We will have a cell phone with the team as well.
- Volunteers will be given information to identify poison ivy and told to wear protective clothing.

## Standard Operating Procedure:

[1] Use of the current meter: Assemble the current meter by loosening the thumbscrew on the sensor bulb, sliding it (completely) onto the rod and tightening. Avoid handling the bulbous end, since oils and grease can occlude it. Using the up/down arrow key, set the meter to average readings over a period of at least 15 seconds unless the measurement needs to be faster because the water level is changing. Be sure the meter is reading in ft/sec and not meters/sec by pressing both the on and off buttons simultaneously.

### [2] Measuring velocity:

Secure a measuring tape stretched across the stream at the selected site.

Set the meter on FPA to average the readings every 15 seconds. Record the gauge level and the time on the data sheet (see sample, appended) immediately before, and again immediately after, taking the velocity readings.

When taking a velocity measurement it is necessary to be oriented upstream, with the current -meter rod held vertical, the current meter sensor pointed directly upstream parallel and into the flow, then stand at arm’s length to the side in order not to interfere with the movement of water. If there is a noticeable difference in flow on either side of the wading rod, stand on the side of the rod that has the slower flow. Currents created around the meter need to settle down before measuring the flow. Negative readings are recorded as the negative value, not as zero.

The first measurement is the location on the tape of the edge of the water, right or left (REW or LEW), looking downstream. Then, move to the first distance in the water and measure the depth with the top-setting rod, which will then be used to position the current meter sensor to the appropriate depth. Flow is measured 0.6 of the depth of water (from the water surface) for depths less than 2.5 feet. For stream depths greater than 2.5 feet, flow is measured at 0.2 and also at 0.8 of the stream depth.

Be sure that the rod is completely vertical and the sensor oriented upstream and directly into the current before pressing the on button to restart the measurements and take the reading.

Generally, it is easiest to measure along the tape at constant distance intervals. However, the intervals must be shorter wherever the velocity changes very much. If there are portions of the stream in which the majority of flow appears to be occurring then it is necessary to have more measurements in those sections. The number of measurements will be 15 – 20, with the lower number of measurements only when the flow is changing rapidly or in a very narrow stream. Make the distances at least 0.4 foot apart.

Volunteers will take measurements while wading, using a Marsh-McBirney “Flo-Mate” current meter and working with at least one other person. For swift water measurements, they will attach a safety line (with a secure but easily releasable connector) firmly to an appropriate anchor and to the in-stream worker. When the force of the water is too strong and/or the footing too uncertain, we will use a cable-way system with a weighted current meter. (See instruction manual, appended.)

#### Equipment for measuring flow:

1. Top-Setting Wading Rod graded to tenths of feet
2. Pencils (soft when it is raining)
3. Fiberglass Measuring Tape graded to tenths of feet
4. Marsh-McBirney current meter (“Flo-Mate”) with extra batteries (2 D size) & screwdriver
5. Data sheets on a clipboard
6. Maps ([1] of the sites & [2] a road map)
7. A watch (could be on your cell phone)
8. Your cell phone (turned on)
9. Study Sign (nice, but optional)
10. Waders

In high water (Could be after the storm):

11. Life Vest for measurements in deep water
12. Safety ropes to attach the wader to a tree

#### How the Marsh-McBirney Flow Meter Works:

The sensor end of the meter is producing a magnetic field.

Stream water can conduct electricity since it contains dissolved ions.

Therefore, a voltage is induced into the water as it flows past the magnetic field.

The variation in velocity of the water changes the voltage in a direct relationship to the flow.

Three little carbon electrodes in the upstream end of the sensor sense the induced voltage and translate that into the velocity reading.

#### BATTERIES:

Three captive screws in the bottom of the meter hold the cover on the batteries.