PACIFIC SALMON FOUNDATION

DISCHARGE MONITORING

VELOCITY METERING: SONTEK FLOWTRACKER2

Velocity metering is a method used to measure stream discharge (flow rate) that utilizes the velocity-area approach. It relies on the principle that discharge is the product of the average velocity of stream flow and the cross-sectional area of the flow. Velocity metering is generally intuitive and can be used in a variety of stream conditions. A current meter is used to determine the average velocity. The SonTek FlowTracker2 is considered the most advanced current meter available for stream flow monitoring. It is portable, does not require calibration, provides results in real-time, and is highly accurate in many stream conditions. The OTT MF Pro (see related summary) is a good alternative to the FlowTracker2, with each having specific advantages.

SUMMARY OF METHOD

There are four main steps involved with discharge measurement using the SonTek FlowTracker2:

1. **Site selection:** Identify suitable stream cross-section for metering. This step is critical to obtaining accurate and representative flow measurements. The ideal cross-section is on a straight section of stream with adequate flow depth and width, has steady and unobstructed flow, has a uniform flow profile across the stream, and can be accessed safely. Typically, a survey pin is installed on each side of the stream for establishing a permanent cross-section.

2. **Set-up:** Divide the cross-section into smaller panels (i.e., water columns) (typically 20, depending on desired data grade) for measuring velocity in each panel. Ideally, individual panels should account for no more than 10% of the total flow.

3. **Measurement:** Use the current meter to measure velocity mid-way across each panel and at a specific depth below the water surface (depends on the total flow depth; 60% below surface in a 1-point measurement when depth <0.75 m; 20% and 80% in a 2-point measurement when depth >0.75 m).

4. **Data processing:** Calculate the average velocity for each panel, multiply by the cross-sectional area of the panel (width x mean depth), then sum these values for all panels to obtain the total discharge. SonTek FlowTracker2 executes this step internally.

Photo credit: WaterSmith Research Inc.

IMPORTANT CONSIDERATIONS

The FlowTracker2 measures water velocity using Acoustic Doppler Velocimeter (ADV) technology, which determines velocity based on the Doppler shift of sound waves reflected from particles in the water. Clear water conditions can be problematic because particulate matter is required for the sensor to receive a signal. Aquatic vegetation can interfere with instrument measurement. Additionally, highly turbulent flow often generates errors on the console that can be challenging to reconcile, requiring field judgement.

For safety, it is recommended to avoid wading across a stream wherever the product of depth (m) and velocity (m/s) exceeds 0.8 (USGS 2008, WSC 1981). Additionally, safe stream access may be impeded by a muddy bed.

The method can be used for measuring discharge under ice cover, requiring holes to be cored through the ice. Complete removal of the ice across the stream should be considered where contact between the ice and the water surface is discontinuous.

STREAM CHARACTERISTICS

- Can measure velocities from 0.001 to 4.0 m/s
- Requires minimum flow depth of 0.02 m (~0.05 m when mounted to top-setting rod)
- Works well in high sediment conditions
- May not be suitable for low flow with coarse substrates (boulders, large cobbles)
- Performance can be impacted in highly turbulent flow and clear water conditions, and near aquatic vegetation
- Can be implemented under ice cover

MEASUREMENT CHARACTERISTICS

- Manual data acquisition
- Summation of multiple point measurements across stream
- Point measurement along stream network

SITE ACCESSIBILITY FACTORS

- Suitable for remote foot access
- Limited by safety of wading across stream
- Minimal equipment for initial set up
- Ongoing monitoring involves medium-sized equipment (e.g., 1.2-1.8 m wading rod)

SCALE OF EFFORT: INITIAL SET UP

Equipment cost: moderate-high
Field time: low; <2 hrs
Field expertise: moderate

SCALE OF EFFORT: ONGOING MONITORING

Equipment cost: negligible
Field time: low; ~1 hr
Field expertise: moderate
Analysis time: negligible
Analysis expertise: negligible

PRODUCTS TO CONSIDER

Current meter: SonTek FlowTracker2

ADDITIONAL RESOURCES

Community Flow Monitoring Network, 2023
Dobriyal et al., 2017
Lapp, 2023
Resources Information Standards Committee, 2018
SonTek, 2019
Water Survey of Canada, 2015a,b,c
World Meteorological Organization, 2010