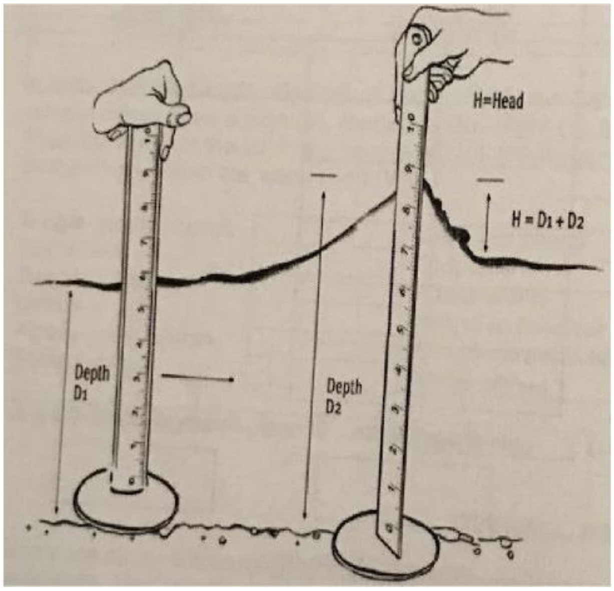

The velocity head rod (VHR) method takes advantage of the water buildup, or head, that develops when an object impedes the path of flowing water. The velocity of the free-flowing water and the shape of the rod drive the height of this head. The velocity head rod method measures the integrated velocity over a portion of the stream depth, though it remains a question whether the full depth-averaged velocity or the average velocity of some shallower portion of the water column is measured.

For the velocity head rod method, a $1^{1/8}$ x $1^{1/8}$ x 4 inch clear plastic corner guard (Trimaco®) was used as a velocity head rod and a separate, clear 12-inch ruler was used to measure the height of water buildup. While not as wide as other velocity head rods described in the literature, the corner guard has a few advantages. It is a commercial product with a standardized shape, allowing others to acquire the exact same product or another product of the same dimensions and to thus apply the calibrated velocity formula developed in the laboratory. Other advantages of the corner guard are that is transparent to allow for easier viewing of the head buildup, it is lightweight for easy transport, and that it has a small surface area and bracketed shape to reduce deformation caused by fast currents.

Note: A metal straight-edge from your local hardware store is an inexpensive and adequate substitute for the Trimaco® devise.

To make a measurement, the velocity head rod is placed vertically into the stream with one end placed on the streambed and the other end above the water surface. The rod is oriented so that the open 90-degree angle of its bracketed length is facing upstream, with the user standing downstream of the rod. At sufficient velocity (about 15 cm/sec), water will build up on the upstream side of the rod. The difference in water level, or head, between the upstream and downstream side is visible through the rod and measured using the clear ruler. It is assumed that the kinetic energy of the free-flowing water is transferred entirely to potential energy when it is stopped behind the rod.

Use this table to determine **VHR velocity** from rises. Note: rises are in inches.

Rise (R)	Velocity ^{cfs}	Rise (R)	Velocity ^{cfs}
$^1/_4$	1.2	3 $^1/_4$	4.2
$^1/_2$	1.6	3 $^1/_2$	4.3
$^3/_4$	2.0	3 $^3/_4$	4.5
1	2.3	4	4.6
1$^1/_4$	2.6	4 $^1/_4$	4.8
1$^1/_2$	2.8	4 $^1/_2$	4.9
1$^3/_4$	3.1	4 $^3/_4$	5.0
2	3.3	5	5.2
2 $^1/_4$	3.5	5 $^1/_4$	5.3
2 $^1/_2$	3.7	5 $^1/_2$	5.4
2 $^3/_4$	3.8	5 $^3/_4$	5.5
3	4.0	6	5.7

VHR = 8 x √R, where R is rise.

The NPS Coordinator demonstrates the VHR method to CRG's watershed specialist.

VHR is the WV Save Our Streams recommended method for measuring stream velocity/flow, especially in small streams (1st and 2nd order). The method is not as effective in larger streams 3rd order and higher primarily due the much larger volume of water causing erratic jumps of the rise making it difficult to determine. These size streams are also too deep to safely wade much of the time.

In some cases, measurements can still be effective on larger streams if the water is shallow/low enough, and if the channel condition is appropriate.

References and additional resources

1. https://www.blm.gov/sites/blm.gov/files/documents/files/Library_Alaska_TechnicalReport05.pdf
2. https://www.researchgate.net/publication/226704633_Head_Tube_A_Simple_Device_for_Estim_ating_Velocity_in_Running_Water
3. https://www.lowes.com/pd/Swanson-Tool-Company-Straight-Edges-3-ft-Metal-Ruler/1007805
4. https://www.fastenal.com/products/details/0268565