

MNTU'S STREAM HABITAT WORK IN MINNESOTA

Part 2 - Effective Use of Log and Rock Vanes

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This is the second in a series of articles exploring how MNTU and its chapters go about designing and implementing trout and steelhead habitat projects around the state. In Part 1 we examined broadly our approach to design and the importance of flood flows and flood plains and accounting for each stream's need to transport its sediments. With those principles as background, we now examine a highly visible set of structures which anglers often ask about. I am referring to rock cross vanes, vortex weirs and J-hook vanes. No single method, structure or material is suitable for every project site, but on most projects it is appropriate to select these vane structures from the habitat work "toolbox" for use in some locations.

What are Rock and Log Vane Structures?

Cross vanes, vortex weirs and J-hook vanes are structures made of large rock, logs and root wads which are placed in the stream channel to both stabilize the stream channel and enhance fish habitat.

How do Vanes Work?

The shape and angles (elevations) of cross vanes and J-hook vanes combine to roll or direct water away from the stream banks and toward the center of the stream channel. The structures are built well into the stream banks (or one stream bank in the case of J-hooks) and angle upstream and downward into the center and bottom of the stream. A graphic below at the right illustrates how flow is shifted into the center of a weir or cross vane and scours a pool down the center of the stream. Note how the arrows turn into the center as they pass over the vane.

These structures act as grade control to prevent the stream from eroding downward and cutting deeper in to the landscape and help stabilize channel boundaries and width/depth ratios. They decrease water velocity, stream power and shear stress (erosive force) along the stream banks and thereby reduce stream bank erosion, and increase the energy to the center of the stream. This centralized flow maintains the channel capacity and ability to transport sediment, scouring and maintaining a pool below the structure. Note in the picture above how the cross vane on Rush Creek not only helps to prevent bank erosion, but also keeps a long, deep pool free of the heavy sand bedload in this stretch of river.

These structures also provide good fish habitat by creating and maintaining deep holding cover during low and high flows. The downwelling and upwelling forces in the center of the channel creates feeding lanes where the fast and slow water meets. Cross vanes also sort sediments, depositing gravel which trout and steelhead utilize for spawning. Cross vanes can also be built with a combination



THIS ROCK CROSS VANE ON RUSH CREEK IN SE MINNESOTA DIRECTS WATER FLOWS TO THE CENTER OF THE STREAM CHANNEL, SCOURING THE AREA AND MAINTAINING POOL DEPTH FOR A LONG REACH BELOW THE STRUCTURE.

of rock and logs or only logs as on the Kadunce River project.

Grade Control

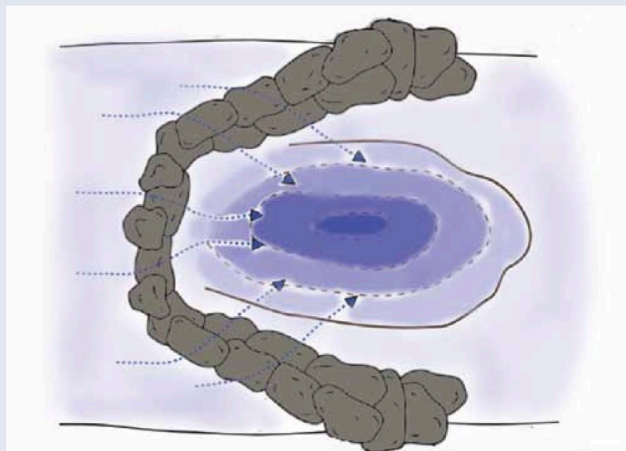
In high gradient reaches a series of vanes can be used to stabilize a longer reach of stream channel. In Minnesota this is most often found on our North Shore trout streams. This can appear as a series of "step pools" that maintain the stream gradient throughout the reach. Note that cross vanes hold back water upstream of the vane and deepen or maintain the depth of the stream immediately above them. In the picture at right observe how each cross vane holds back water, creating a series of short pools.



THIS SERIES OF ROCK VANES IN THE STEWART RIVER HELP MAINTAIN GRADE CONTROL WHILE KEEPING DEEP POOLS SCOURED. THESE POOLS ARE VITAL FOR SEDIMENT TRANSPORT IN ADDITION TO PROVIDING GREAT TROUT HABITAT.

J - Hook Vanes

J-hooks are similar structures pointing upstream with a gradually sloping rock or log arm along the outside bend of the stream. They can be made entirely of rock or a combination of rock "hook" and a log or root wad for the long "arm" extending out from the bank. These are used most often at the tops of pools to provide scour and configured to direct flow down the pool to keep it free of sediment. They are designed to reduce bank erosion by rolling water over the log and reducing velocity, stream power and shear stress along the banks. Note in the pictures on the following page how the J-hook scours a run leading into the pool and directs flow down the pool to keep it free of sediment.



A DIAGRAM OF A ROCK VANE, SHOWING FLOW MOVING FROM LEFT TO RIGHT AND SCOURING A POOL. GRAPHIC ADAPTED FROM UNIVERSITY OF MINNESOTA