Bio-Engineered Stream Bank Stabilization on the Teton River

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Introduction

WETLAND plants have unique characteristics that enhance their ability to stabilize eroding stream banks compared to upland species. These characteristics include: dense rooting properties that reinforce eroding soils; a high associated roughness that can result in decreased velocities and sediment deposition; and a high tolerance of fluctuating hydrologic conditions (Manning et al 1989; Micheli and Kirchner 2002). Although the presence of wetland vegetation has been identified as a significant component to stream bank stability, little has been published on how to effectively establish wetland species in the potentially high shear stress environments of river systems (Thorne 1982; Gregory 1992; Smith 1976). Many techniques have been developed to establish woody vegetation on eroding stream banks, however, there are few available techniques to establish wetland, herbaceous vegetation in these zones (Hoag 1994).

Wetland Sod installation.

Wetland Sod was developed and tested to rapidly establish key wetland species on wetland restoration and mitigation sites. It is a pre-planted erosion control mat grown with native plants to produce maximum root growth.

In 1999 and 2000, we tested Wetland Sod against traditional wetland planting techniques including: seeding, salvage marsh surface, wild transplants, containerized plugs and bare-root plugs. The pre-planted erosion control mats instantly established the desired plant community; was resistant to invasion by exotic species; and spread the greatest amount outside of the initial planted area (Klausmann and Hook 2001). These characteristics prompted us to try the product in high velocity, high shear stress environments such as erosion prone shorelines and eroding stream banks. From 2002 – 2004, we used it in combination with erosion control fabric and willows to stabilize six individual sites on the Teton River comprising over one mile of eroding stream bank. The goal of each project was to stabilize the eroding section using a bio-engineered method that:

1. Incorporated geo-textiles and native vegetation and did not require any hard structures.
2. Mimicked the conditions on natural, stable reference banks throughout the river system.
3. Resulted in stable, functional stream banks dominated by native wetland and riparian vegetation that would promote natural river interactions and flood plain connectivity.

Site Characteristics

The Teton River is located in southeast Idaho approximately 4.2 miles from the Idaho-Wyoming border. It is a free flowing system with a moderate spring runoff (1500-2000 cubic feet per second (cfs)) and an average base flow of 200-400 cfs. The dominant riparian plant community is comprised of sedges, rushes, willows, and introduced pasture grasses including reed canary grasss. Conditions at the study sites included an average eroding bank height of 3 – 4 feet, an average bank slope ranging from 1:1 to 2:1 and dominant bank vegetation consisting of upland grasses.

The majority of the sites were located on the outside bend of a meander and ranged from 250 feet – 750 feet in length. Eroding bank conditions were caused by the removal of the native wetland plant community under historic agricultural operations and subsequent bank erosion caused by scouring forces in the river environment. Many of the sites were observed to be eroding in 1988 by the local Soil Conservation Service. As a result, fences were installed, however, each project site failed to naturally stabilize itself over a period of 10 – 12 years.

Methods

Each eroding bank was reconstructed by first excavating the bank down to the base-flow water line to a width of 15 feet.

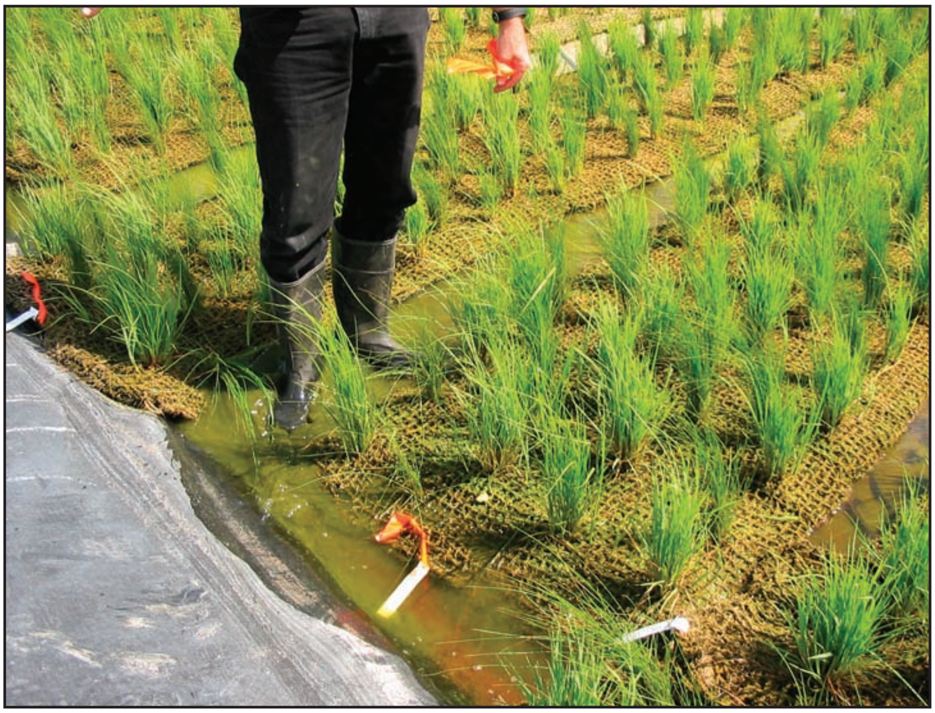
Two layers of erosion control fabric were staked onto the base of the excavated bank using 8-inch wire staples. Soil was compacted onto the erosion control fabric layers to a depth of 10 inches. Approximately 3 feet of the erosion control fabric was wrapped up onto the compacted soil to build the initial toe and first terrace of the reconstructed bank. On most sites, this technique was repeated to construct a second terrace, off-set by 3 feet from the lower one. The remaining soil was sloped back to create a bank with an average slope of 4:1. Disturbed areas were seeded with a xeric mix and 5 gallon, containerized willows and dormant willow cuttings were installed above the second soil terrace. This work was completed in the late fall of each year to insure that the terraces were constructed during base-flow conditions.

Because installation of the Wetland Sod during the fall would not allow the plants to root before the peak, run-off event; it was installed using 12-inch lath staking every 8 square feet after the spring run-off in July of the following year. A temporary irrigation system was used at each site to irrigate the projects through the first growing season.

Results & Conclusion

All of the project sites resulted in stable stream banks that were dominated by native, wetland species. The two-layers of erosion control fabric were effective at temporarily stabilizing the re-constructed banks through the first peak-flow event. Once the Wetland Sod was installed directly on top of the erosion control fabric, it took approximately 2- 4 weeks to fully root. During that establishment time, the sites experienced "real-world" conditions such as wildlife trampling, bovine herbivory, storm events, increased river stage, too much

Top: Construction of the first soil terrace. Lower: Site conditions during Wetland Sod installation.



The pre-planted erosion control mat is grown with native plants to produce maximum root growth.

water and too little water. In each case, the erosion control matting that provides the planting medium for the native plants in the Wetland Sod material protected the roots and allowed for the establishment of the desired plant community despite significant disturbances. At all sites, the pre-planted erosion control mat was effective at out competing reed canary grass and resulted in robust stands of sedges and rushes. During and after peak-flow events, decreased velocities and sedimentation were observed in the form of deposition of sediments directly onto the Wetland Sod. We concluded that this was an effective way to establish wetland vegetation in the high velocity, high shear stress zones of the Teton River and that each restoration site met the project goals. **L&W**

For more information regarding Wetland Sod, please contact Native Sod Solutions at 1-877-444-6996 or visit www.wetlandsod.com. Katie M. Salsbury is a Principal at Intermountain Aquatics, Inc and Native Sod Solutions.

Literature Cited

Gregory, K.J. 1992. The role of vegetation in river bank erosion. In Hydraulic Engineering, Proceedings of the ASCE Conference. ASCE: New York; 218-223.

Hoag, Chris 1994. Technical Notes: TN Plant Materials No. 6 The Stinger. USDA-Natural Resource Conservation Service; Boise.

Klausmann, J. and Hook, P. 2001. Comparison of Seven Methods for Revegetating Sedge-Dominated Rocky Mountain Wetlands. Project Completion Technical Report for research funded by USEPA Region 8 FY1999 104(b)(3).

Manning, M.E., Swanson, S.R., Svejcar, T. and Trent, J. 1989. Rooting characteristics of four intermountain meadow community types. Journal of Range Management. 42(4):309-312.

Micheli, E.R. and Kirchner, J.W. 2002. Effects of wet meadow riparian vegetation on streambank erosion. 2. Measurements of vegetated bank strength and consequences for failure mechanics. Earth Surface Processes and Landforms. 27:687-697.

Smith, G.G. 1976. Effect of vegetation on lateral migration of anastomosed channels of a glacier meltwater river. Geological Society of America Bulletein. 87:857-860.

Thorne, C.R. 1990. Effects of vegetation on riverbank erosion and stability. In Vegetation and Erosion, John Wiley & Sons: Chichester; 125-144.