BIO-ENGINEERED STREAMBANK STABILIZATION USING WETLAND SOD ON THE TETON RIVER: A CASE STUDY[1]

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Abstract. Wetland sod in combination with erosion control fabric was used to reconstruct and stabilize an eroding streambank on the Teton River in southeast Idaho. The river has an average base flow of 5.67 m^3/s and an average peak flow of 34 m^3/s. Above and throughout the study area the Teton River is a predominantly ground water fed, free flowing system with a moderate spring run-off. Conditions at the study site pre-construction included an average bank height of 1.07 m, an average bank slope of 2:1 and dominant bank vegetation consisting of introduced pasture grasses. The dominant soil type was a silty clay loam. The existing bank was reconstructed by first excavating the bank down to the base-flow water line to a width of 3.66 m. Two layers of long-term erosion control fabric were staked onto the base of the excavated bank using 20 cm wire staples. Soil was compacted onto the erosion control fabric layers to a depth of 0.30 m. Approximately 1 m of the erosion control fabric was wrapped up onto the compacted soil to build the initial toe of reconstructed bank. The remaining soil was sloped back to create a bank with an average slope of 3:1. Wetland sod, a pre-vegetated coir product planted with native sedges and rushes, was installed in two rows onto the constructed toe and remaining bank to a width of 1.83 m. A total of 77 m of eroding bank was reconstructed in 2 days at a cost of $195 per linear meter. In 1 month post construction the pre-vegetated coir material was fully rooted and could not be displaced by human or animal disturbance.

Additional Key Words: erosion, pre-vegetated coir, wetland revegetation

Introduction

Wetland plants have unique characteristics including high root mass quantities and root length densities that enhance their soil binding capacity compared to upland species. Manning (1989) found that *Carex nebracensis* communities had a root mass of 3,382 g/m^2 and a root length density of 95.6 cm/cm^3 compared to *Poa nevadensis* which had a root mass of 555 g/m^2 and a root length density of 8.8 cm/cm^3. Wetland vegetation can effectively increase the

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cohesion and strength of stream banks through root reinforcement of bank substrates (Micheli and Kirchner, 2002). These soil binding qualities have direct applications to stream bank restoration techniques. Smith (1976) concluded that plant roots can be critical in stabilizing stream banks and that vegetation can have an effect on the lateral migration of rivers. Although the presence of wetland vegetation has been identified as a significant component to bank stability (Thorne 1982; Gregory 1992), little has been published on how to effectively establish wetland vegetation in the potentially high shear stress environments along stream banks. Many techniques have been developed to establish woody, wetland vegetation on eroding stream banks (Hoag 1994), however, there are few available techniques to establish wetland herbaceous vegetation in these zones. We used a pre-vegetated coir product hydroponically grown with sedges and rushes known as wetland sod to establish wetland vegetation on an eroding bank on the Teton River in southeast Idaho.

Site Characteristics

The Teton River is located in southeast Idaho approximately 7 km from the Idaho-Wyoming border. It is a predominantly groundwater fed, free flowing system with a moderate spring run-off (34 m^3/s) and an average base flow of 5.67 m^3/s. The dominant riparian plant communities include sedges, rushes, willows, and introduced pasture grasses. Conditions at the study site included an average eroding bank height of 1.07 m, an average bank slope of 2:1 and dominant bank vegetation consisting of introduced grasses. The dominant soil type was a silty clay loam. The study site was located on the outside bend of a meander and totaled 77 meters. Eroding bank conditions were caused by removal of native riparian species and subsequent bank erosion caused by scouring forces at the outside bend of a meander.

Methods

The existing bank was reconstructed by first excavating the bank down to the base-flow water line to a width of 3.66 m. Two layers of long-term erosion control fabric were staked onto the base of the excavated bank using 20 cm wire staples. Soil was compacted onto the erosion control fabric layers to a depth of 30 cm. Approximately 1 m of the erosion control fabric was wrapped up onto the compacted soil to build the initial toe of reconstructed bank. The remaining soil was sloped back to create a bank with an average slope of 3:1. Wetland sod comprising of *Carex nebrascensis, Carex utriculata* and *Juncus balticus* was installed in two rows using 30 cm lath staking every 0.8 m^2. Wetland sod is a new restoration product developed to rapidly establish wetland vegetation. It is an integrated unit of erosion control matting (5m*(l)*x1m*(w)*x 0.08m*(d)*) and containerized nursery plugs (100 per unit) grown in a nursery setting for approximately 8 weeks to promote maximum root growth. A total of 32 wetland Sod units were installed over 141 m^2 (Figure 1). The entire project was constructed in 2 days at a cost of $195 per linear meter including design, permitting, excavation and revegetation. A temporary irrigation system was installed to irrigate the project daily through the first growing season.

Observations

The project was constructed in July of 2002. Four days post construction a herd of 15 calves and one bull swam across the river and climbed onto the newly constructed bank to graze for a few hours until caught. The cattle were herded off of the project and an electric fence was quickly installed to prevent future incidents. The wetland sod material was significantly browsed but remained in place with the roots of the material protected by the erosion control matting. One week post-construction a storm event resulted in an increased stage of the river by 30 cm. The entire project remained intact and thrived under the increased hydrology. Within 1 month, the wetland sod pieces could not be displaced and were fully rooted into the underlying soil and erosion control fabric (Figure 2).

Figure 1. Picture sequence from pre-construction through wetland sod installation.

Figure 2. Project pictures 1.5 months post-construction.

Conclusion

Wetland sod was an effective way to establish wetland plants on an outside meander on the Teton River in one growing season (Figure 2). Its unique attributes including mature roots and rhizomes, protective erosion matting and established top-growth combined to establish wetland vegetation quickly in a high velocity zone. This bank stabilization project will continue to be monitored for five years to evaluate the success of our techniques under natural stresses including: anchor ice, ice dams, spring-run off and livestock and wildlife depredation. The initial tolerance to high flows and livestock depredation, and the quick rooting capabilities of wetland sod indicate that this wetland revegetation technique may have a wide range of applications in the high shear stress environment along eroding stream banks. Future studies calculating the actual shear stress tolerances of wetland sod compared to rock and traditional erosion control fabric would help determine the maximum velocity zones where wetland sod is a suitable technique to establish wetland vegetation.

Literature Cited

Gegory, 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.

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. http://dx.doi.org/10.2307/3899500

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. 27:687-6 http://dx.doi.org/10.1002/esp.340

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. http://dx.doi.org/10.1130/0016-7606(1976)87<857:EOVOLM>2.0.CO;2

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