USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Computational Methods in River Engineering

Focus Category: SW, MET (Surface Water,. Methods)

Duration: March 1, 1999 - April 30, 2000

Keywords: Rivers, Engineering, Methods

Federal Request: $7,750

Non-Federal Match: $18,598

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Congressional District: 1

Statement of Critical Regional or State Water Problems

The Yellowstone river has been called the last wild river in America. You would believe this if you approached the river from the perpendicular, walking across the fertile flood plain to step into the bed where water meets cobble-lined channel. But don't look upstream or downstream! A quick glance in either direction is likely to catch sight of man's intervention - an irrigation diversion, rip-rap for erosion control, structures protruding into the stream to protect property, roads and bridges, or even channel alterations to maintain fisheries. Many of these structures have served their purpose well over the years, delivering irrigation water, deflecting erosive currents away from sensitive overbanks, or providing temporal fisheries habitat. Other structures have not met expectations, leaving behind the evidence of undercutting, overtopping, or transported debris. The disparity of success rates for river engineering projects stems from a lack of comprehensive and methodical design procedures. Common sense, experience and a practical working knowledge of a river system are necessary tools for the designers kit, but alone do not ensure that the design goals of a project will be met over the long haul.

Statement of Results or Benefits

Trial-and-error design approaches have given river engineering an undeserved black eye. The tools for sound approaches to river engineering exist, but have yet to be packaged to fit the evolving expectations of river works. This is a seed project, and as such will have the following results and benefits:

1. Dr. Cahoon is changing his research focus from applied soil physics to river engineering. This transition fills a void in the Montana University System - there are no other engineers working in this area. Dr. Cahoon is well suited for this work with his background in the study of surface irrigation system hydrodynamics. Dr. Cahoon has trained one unfunded graduate student in this area and that student's professional paper has been published in a refereed journal. Dr. Cahoon currently has three additional unfunded graduate students working in this area. Dr. Cahoon teaches the senior-level open channel hydraulics course at MSU - the highest enrollment elective in the civil engineering department. Montana offers the perfect natural laboratory for river engineering research. This seed project will help launch this research transition for Dr. Cahoon.

2. This seed project will train one graduate student. The student will perform an assessment of the design methods used at a bendway weir (barb) rehabilitation site that has failed. The student is on-board and is enrolled in river engineering course work.

3. The design assessment at the study site will generate sufficient material to allow Dr. Cahoon and his students to host a workshop at the state AWRA meeting in fall 1999. This workshop should be interactive both ways - participants learning from the research experience at the study site and then directing the research team on future research needs and directions.

4. Follow-up proposals (Army Corps of Engineers, USDA, USGS…) to this seed project will make possible the funding required to address the gamut of emerging design needs in river engineering - bendway weirs, barbs, veins, diversions, etc. and to overlay the incorporation of plants and natural features (bioengineering) on those structures.

5. The Yellowstone river will likely play host to several large-scale investigations concerning the effectiveness of river works of all scales and intents. This seed project adds an engineer to the Montana University System's team of biology and geology expertise in this area.

Nature, Scope and Objectives of the Research

The Natural Resources Conservation Service (NRCS) has oversight obligations for river engineering projects that qualify to receive financial cost-share from the federal government. As such, the NRCS maintains design and as-built information for a number of river engineering projects. NRCS engineers in Bozeman have provided design and as-built information for a stream bank restoration project on the Highwood Creek near Great Falls, Montana (see photos, next page). The bendway weirs installed at this site have partially failed. Post failure (current) surveys and measurements will be used to assess the design methods that were used and to arrive at a design that, in theory at least, would have sufficed. Much of the interest in river works is focused on the Yellowstone river, but the design and as-built detail available from the NRCS for the Highwood Creek site presents a unique opportunity. The objectives of this project are to train a graduate

student, assess the design of a failed revetment at the research site, and develop the framework for overcoming that failure in future designs.