Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)

LCCMR ID: 029-A3

Project Title:

Optimizing Side Inlet Design to Improve Water Quality

LCCMR 2010 Funding Priority:

A. Water Resources

Total Project Budget: $ $465,000

Proposed Project Time Period for the Funding Requested: 3 years, 2010 - 2013

Other Non-State Funds: $ $0

Summary:

This project will opimize design, estimate cumulative benefits, develop technical guidance, develop a LiDAR-based method for identification, and provide demonstration and outreach of side inlet controls at geographically diverse locations.

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Sponsoring Organization: Board of Water and Soil Resources

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Location:

Region: NW, Central, SW, SE

County Name: Chippewa, Kandiyohi, Mahnomen, Mower, Nicollet, Norman, Polk, Redwood, Renville

City / Township:

_____ Knowledge Base _____ Broad App. _____ Innovation

_____ Leverage _____ Outcomes

_____ Partnerships _____ Urgency _____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: Optimizing Side Inlet Design to Improve Water Quality

I. PROJECT STATEMENT

In artificially drained agricultural land, an estimated 21,000 miles of drainage ditches (BWSR, 2006) convey runoff and tile drainage to receiving bodies of water. It is increasingly important to understand the role of agricultural drainage and its potential contribution to lake and river impairments and to develop Best Management Practices (BMPs) that mitigate negative effects while minimizing impacts to crops. Side inlets serve as surface runoff outlets from agricultural land into drainage ditches and are very common wherever surface drainage ditches are present (see map). We estimate that there are about 70,000 side inlet locations in the drained agricultural areas of the state, extrapolating inventory information from Seven Mile Creek watershed in Nicollet Co. These side inlets may contribute about 70 thousand tons/yr of sediment and concomitant nutrients and pesticides to MN's waters. As a comparison, the Mn River at Jordan transports about 675 thousand tons/yr (PCA, 2003). Side inlet controls such as culverts and drop pipes can prevent gully erosion, control the rate of flow to ditches, and create sedimentation areas to improve water quality. Side inlet controls were identified as a key BMP in the LCMR-funded MN River Assessment Project (LCMR, 1994) and are eligible for federal and state cost share (mechanism for widespread implementation). Research and demonstration are needed to quantify the benefits of this BMP on sediment, nutrient, and pesticide loading to receiving waters. Ancillary benefits include runoff volume and rate reduction – keeping water on the land - and streambank erosion reduction. The goals of this project are to: 1) evaluate the effectiveness of side inlet controls at **improving surface water quality, reducing runoff rate and volume**, and **reducing streambank erosion** in drainage ditches through assessment and testing; 2) demonstrate the effectiveness and provide design guidance for side inlet controls through **implementation and monitoring of demonstration projects**; and 3) provide targeted **outreach and education**. Understanding the effects of emerging BMPs and providing design guidance are crucial to meeting water quality goals.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Inventory and assess impacts of side inlets **Budget:** $ **220,000**

The first component of this proposed project is to: a) conduct an inventory of side inlet locations and condition in four different watersheds by using LiDAR in 3 of 4 watersheds and ground-truthing; b) better understand the cumulative effects of controlled and uncontrolled inlets at small and watershed scales on sediment, nutrient, and pesticide delivery as well as reducing runoff rate and volume. The University of Minnesota will conduct the LiDAR assessment and small-scale and watershed modeling. Small scale modeling will involve testing and development of models to evaluate individual side inlets, requiring one graduate student. Small-scale results would be used to evaluate side inlet controls on a watershed scale, which will require an additional graduate student. Developing a methodology to identify side inlet locations using LiDAR will be extremely valuable to help identify and prioritize water quality management strategies. ($212,500 to U of M, $7,500 to local partners).

Deliverable	**Completion Date**
1. Inventory number and condition of side inlets in select watersheds (see map)	April, 2011
2. Assess the water quality and quantity effects of **controlled versus uncontrolled** side inlets via modeling	May, 2012

Result 2: Optimize Side Inlet Design and Develop Guidance Material **Budget:** $ **150,000**

Current understanding of different side inlet control design is poor and the effectiveness of those designs has not been studied. We propose to construct experimental side inlet controls at the University of Minnesota Southwest Research and Outreach Center at Lamberton, MN.

Part of this research will focus on optimizing the design for the different variants. Impacts of buffers in concert with side inlet controls will be evaluated. Results from the plot-scale experiments will be critical to the modeling component for calibration and watershed scale evaluation. A key deliverable is design guidance to SWCD and WD staff and others. ($100,000 to U of M, $50,000 for construction/equipment)

Deliverable	Completion Date
1. Optimized design of side inlets through plot scale testing	September, 2011
2. Develop design guidance material for SWCDs, WDs, and others	April, 2012

Result 3: Implement Demonstration Projects & Conduct Outreach **Budget:** $ **95,000**

The third component of this project is to implement several side inlet controls at various sites in different agricultural areas around the state. We have identified partners in the Hawk Creek Watershed Project, Mower County SWCD, Brown-Nicollet-Cottonwood Water Quality Board, and Sand Hill River Watershed District as partners representing a diverse geographic area. Three demonstration sites in each partner's geographical area are proposed. Workshops will be conducted at the sites to educate SWCD and WD staff, drainage authorities, engineers, and other professionals interested in innovative BMPs. ($30,000 to local partners, $42,500 construction/instrumentation, $22,500 U of M)

Deliverable	Completion Date
1. Identify project locations	March, 2011
2. Construct Demonstration Projects	Spring or Fall, 2011
3. Conduct Outreach and Demonstration Projects	Fall 2011 / Spring 2012

III. PROJECT STRATEGY

A. Project Team/Partners

1) **University of Minnesota, Department of Biosystems and Bioproducts Engineering -** The University of Minnesota will be responsible for conducting the modeling and experimental research at Lamberton (key personnel: Dr. Bruce Wilson and Dr. Jeff Strock).
2) **Hawk Creek Watershed Project -** The Hawk Creek Watershed Project will be involved in selection, implementation, and monitoring of demonstration projects (Cory Netland, Dean Dambroten)
3) **Brown-Nicollet-Cottonwood Water Quality Board (BNCWQB) -** BNCWQB will assist with monitoring and landowner contacts (Ed Hohenstein)
4) **Sand Hill River Watershed District -** WD staff will assist with monitoring and landowner contacts (Dan Wilkens)
5) **Mower County SWCD -** SWCD staff will assist with monitoring and landowner contacts (Justin Hanson)
6) **MN Department of Agriculture -** MDA will provide guidance on terrain analysis using LiDAR as they have a terrain analysis clean water legacy project with the University of Minnesota and monitoring design (Adam Birr).

B. Timeline Requirements - This will be a three (3) year project. Year 1 will be spent conducting part of the modeling component and planning experiments. We will conduct the field experiments, find suitable demonstration sites, implement demonstrations, monitoring, and analyze data in Year 2. Year 3 will be spent constructing the demonstration and outreach projects, monitoring and finishing the modeling component of the project.

C. Long-Term Strategy - BWSR's long-term strategy is to promote this practice to landowners, through the SWCDs, WDs, and interagency Drainage Management Team. It is anticipated that conservation programs and clean water efforts will enable ongoing implementation of this BMP.

Project Budget

IV. TOTAL PROJECT REQUEST BUDGET (3 years)

BUDGET ITEM	AMOUNT
Contracts:	
University of Minnesota, Department of Biosystems and Bioproducts Engineering, includes for (1) a research associate to provide coordination of project activities, to collect and analyze data, and to assist in interpreting model results, (2) a graduate student to perform the modeling activities of different side inlets, (3) a graduate student to perform the modeling activities of a system of different side inlets as part of watershed response, (4) senior scientist to design, install and maintain data collection instrumentation and (5) undergraduate workers to assist in data collection and analysis.	$ 335,000
Hawk Creek Watershed Project, includes staff time to perform ground-truthing of side inlet locations, landowner contacts to find demonstration sites, help with contractor selection and construction, and monitoring.	$ 10,000
Brown Nicollet Cottonwood Water Quality Board, landowner contacts to find demonstration sites, help with contractor selection and construction, and monitoring.	$ 7,500
Sand Hill River Watershed District - includes staff time to perform ground-truthing of side inlet locations, landowner contacts to find demonstration sites, help with contractor selection and construction, and monitoring.	$ 10,000
Mower County SWCD, includes staff time to perform ground-truthing of side inlet locations, landowner contacts to find demonstration sites, help with contractor selection and construction, and monitoring.	$ 10,000
Contracts to construct demonstration projects (general construction contracts)	$ 32,500
Contract to construct experiment facility at Lamberton	$ 15,000
Equipment/Tools: Pump(s) for water supply and sediment feeder at University of Minnesota Research Center	$ 10,000
Instrumentation for University of Minnesota Research Center	$ 25,000
Instrumentation at demonstration projects	$ 10,000
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 465,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Leveraged During Project Period: *What additional non-state cash $ will be spent on the project during the funding period? For each individual sum, list out the source of the funds, the amount, and indicate whether the funds are secured or pending approval.*		*Secured or Pending*
Other State $ Being Spent During Project Period: *What additional state cash $ (e.g. bonding, other grants) will be spent on the project during the funding period? For each individual sum, list out the source of the funds, the amount, and indicate whether the funds are secured or pending approval.*	$ -	*Secured or Pending*
In-kind Services During Project Period: Hawk Creek Watershed Project, 1:1 labor match to LCCMR funding	$ 10,000	
Brown-Nicollet-Cottonwood Water Quality Board labor match	$ 7,500	
Sand Hill River Watershed District	$ 10,000	
Mower County SWCD	$ 10,000	
University of Minnesota faculty time	$ 40,000	
BWSR personnel time (Joel Peterson, 15% FTE, Al Kean 2% FTE)	$ 68,600	
MDA personnel time (Adam Birr, 5% FTE)	$ 10,000	
TOTAL	$ 156,100	

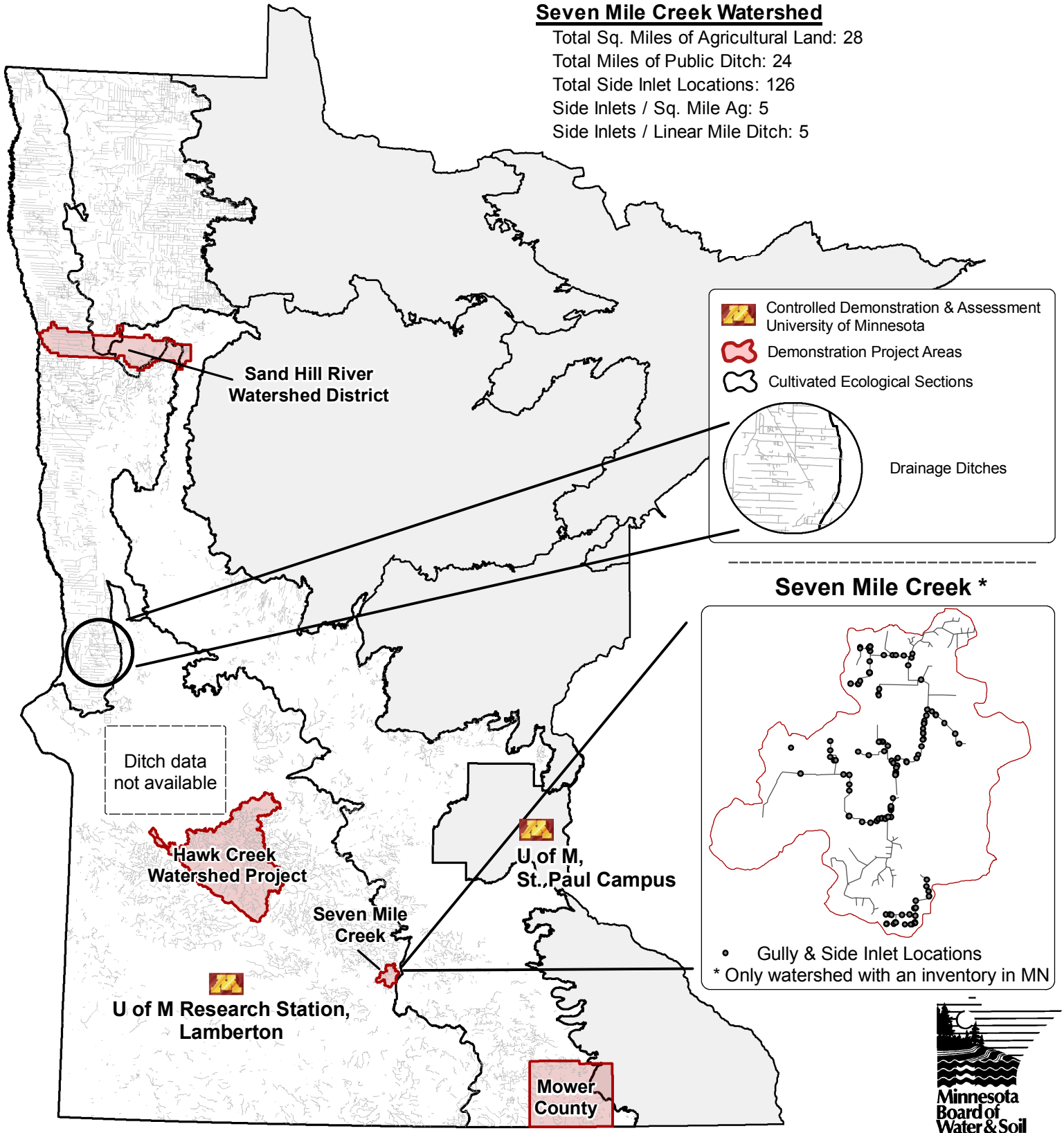
Side Inlet Project Locations & Estimated Frequency

Cultivated Ecological Sections

Total Sq. Miles of Agricultural Land: 23,967
Total Miles of Public Ditch: 15,636
(Does not account for all public and no private ditches)
Estimated Side Inlet Locations: 70,300
(Based on Seven Mile Creek data)

Seven Mile Creek Watershed

Total Sq. Miles of Agricultural Land: 28
Total Miles of Public Ditch: 24
Total Side Inlet Locations: 126
Side Inlets / Sq. Mile Ag: 5
Side Inlets / Linear Mile Ditch: 5



Minnesota Board of Water & Soil Resources
WWW.BWSR.STATE.MN.US
April 2009

MANAGER QUALIFICATIONS AND ORGANIZATION

Manager Qualifications:

Dr. Joel Peterson is a registered professional engineer in the State of Minnesota and has worked in academia, private consulting and in the public sector for over 10 years. At the BWSR he is the lead technical and administrative engineer in the drainage area. His areas of responsibility include leading the interagency Drainage Management Team, providing technical assistance to drainage authorities, leading the writing of the update of the update of the Minnesota Public Drainage Manual. Dr. Peterson is also an Adjunct Assistant Professor at the University of Minnesota in the Department of Biosystems and Bioproducts Engineering.

As a consulting engineer, Dr. Peterson served as a project engineer and project manager on water resources projects. These projects included rain garden design, regional infiltration basin design, stream restoration design, channel embankment protection, and modeling studies. Construction costs of these projects ranged from $10,000 to multi-million dollar projects. Dr. Peterson also worked for the US Army Corps of Engineers on ecosystem restoration projects and served as Water and Sanitation project manager for the Corps in Baghdad, Iraq from August through December 2003.

During graduate school and as a Visiting Assistant Professor focused on hydrologic modeling and erosion mechanics and taught junior level water resources engineering.

Dr. Peterson received his BS, MS, and PhD degrees from the University of Minnesota, The Pennsylvania State University, and Purdue University, respectively, in Agricultural Engineering with emphasis in Water Resources Engineering.

Organization Description:

The mission of the Board of Water and Soil Resources is to assist local governments to manage and conserve their irreplaceable water and soil resources.

Minnesota Statutes 103B.101 directs the BWSR to facilitate communication and coordination among state agencies and between state and local units of government to make the expertise and resources of the state agencies involved in water and soil resources management available to local units of government. This includes engineering assistance for conservation on private lands.

The BWSR facilitates the stakeholder Drainage Work Group and interagency Drainage Management Team and thus is acutely aware of drainage policy and research in Minnesota. The BWSR is leading the update of the Minnesota Public Drainage Manual, which will include chapters on engineering and Best Management Practices (BMPs).