Environment and Natural Resources Trust Fund
2009 Phase 2 Request for Proposals (RFP)

LCCMR ID: 081-C1

Project Title: Controlling Invasive Macrophytes and Phosphorus using Iron

Total Project Budget: $ $462,950

Proposed Project Time Period for the Funding Requested: 3.5 Years-July 2009 to December 2012

Other Non-State Funds: $ $0.00

Priority: C1. Aquatic and Terrestrial Invasive Species

First Name: Brian **Last Name:** Huser

Sponsoring Organization: Barr Engineering

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Region:	County Name:	City / Township:
Metro	Anoka, Carver, Chisago, Dakota, Hennepin, Isanti,	

Summary: This project will determine the effectiveness of using sediment iron augmentation to control Curly-leaf pondweed and internal phosphorus loading in Minnesota lakes.

Main Proposal: 1008-2-014-proposal-Iron Augmentation Main Proposal.doc

Project Budget: 1008-2-014-budget-Iron Augmentation Project Budget.xls

Qualifications: 1008-2-014-qualifications-Iron Augmentation PM and Org Description.doc

Map: 1008-2-014-maps-Iron Augmentation Map.doc

Letter of Resolution:

MAIN PROPOSAL

PROJECT TITLE: Controlling Invasive Macrophytes and Phosphorus using Iron

I. PROJECT STATEMENT

Curly-leaf pondweed adversely impacts many lakes in Minnesota. These lakes also tend to exhibit high nutrients and phosphorus-rich sediments that contribute to noxious algal blooms after Curly-leaf pondweed dieback in summer. Research has linked high dissolved iron in sediment to suppression of macrophyte growth and preliminary data has shown reduced Curly-leaf pondweed abundance in lakes where iron augmentation has occurred. Furthermore, iron salts have been used successfully as a tool to reduce phosphorus flux from sediment. We hypothesize that iron filings (readily available in Minnesota) added to sediment will react over time to limit Curly-leaf pondweed growth and reduce internal sediment phosphorus loading. Our objectives are to determine the effectiveness of iron augmentation to control both Curly-leaf pondweed growth and internal phosphorus loading from sediment. This research is innovative because the results could lead to an ecologically sound tool that effectively addresses two major water quality issues in Minnesota lakes without using herbicides or other chemicals.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Effects of iron augmentation on sediments: Chemistry, phosphorus-retention capacity, and rates of internal phosphorus loading. **Budget:** $150,000

This result will determine the optimal iron product type and dosing needed to sequester phosphorus in the sediment of lakes infested with Curly-leaf pondweed. In the lab, iron product types and doses will be added to sediment under a range of conditions typically found in lake water and sediment. Changes in sediment iron and phosphorus chemistry will be analyzed. These results will serve as a guide for further refinement of iron augmentation for Results 2 and 3.

Deliverables	Completion Date
1. Changes in sediment iron and phosphorus chemistry due to iron augmentation	12/30/2010

Result 2: Effects of sediment iron augmentation on Curly-leaf pondweed growth and propagation **Budget: $** 71,500

The ability of iron augmentation to suppress Curly-leaf pondweed growth will be tested. Effects on a native species, wild celery, will also be examined to determine if iron augmentation is selective for Curly-leaf pondweed. Both plants will be grown in an outdoor mesocosm facility under controlled conditions. The effect of iron augmentation on plant growth, turion germination, turion production, as well as on phosphorus and iron in the sediment and plant tissue will be examined.

Deliverables	Completion Date
1. An assessment of Curly-leaf pondweed growth control vs. response of a native species	12/30/2011

Result 3: Test effects of sediment iron augmentation in real lake environments. **Budget: $**241,450

Experimental enclosures will be deployed in representative shallow lakes infested with Curly-leaf pondweed to test the findings from Results 1 and 2 under in-lake conditions. Sediment in the enclosures will be augmented with iron and changes in Curly-leaf pondweed growth and sediment iron and phosphorus will be measured. Enclosures will be deployed and treated in spring of 2010 and sampled in 2010, 2011, and 2012. Minnesota lake sediments that have been historically treated with iron will also be evaluated for control of internal phosphorus loading and Curly-leaf pondweed growth.

Deliverables	Completion Date
1. Assessment and recommendations on the effectiveness of iron augmentation on Curly-leaf pondweed growth and internal phosphorus loading control in Minnesota lakes.	12/30/2012

III. PROJECT STRATEGY AND TIMELINE

A. Project Partners

Dr. Brian J. Huser, Barr Engineering Company, Lab sediment iron augmentation and experimental enclosure studies
Mr. William F. James, US Army Corps of Engineers - Engineer Research and Development Center, Curly-leaf pondweed mesocosm studies and enclosure studies
Mr. Steve McComas, Blue Water Science, Lab sediment iron augmentation and experimental enclosure studies
Dr. Amy Myrbo, University of Minnesota, Lab sediment iron augmentation and experimental enclosure studies
Dr. Keith Pilgrim, Barr Engineering Company, Lab sediment iron augmentation studies
Dr. David Wright, Minnesota Department of Natural Resources, Technical reviewer and consultant
Mr. Dennis Wasley, Minnesota Pollution Control Agency, Technical reviewer and consultant
Mr. Chip Welling, Minnesota Department of Natural Resources, Technical reviewer and consultant

B. Project Impact

The outcome of this project will have direct impacts on management of shallow, phosphorus-rich aquatic habitats in Minnesota. If sediment iron augmentation has potential for reducing internal nutrient loading and the growth of invasive macrophyte species, its use would provide an integrative approach for improving water quality and aquatic habitat. Minnesota would benefit from this new knowledge because invasive macrophytes and high-phosphorus sediments contribute substantially to impaired water quality and recreation in lakes across the state (see map).

C. Time

This project is designed as a three-and-a-half year effort. Eighteen months will be required to determine appropriate dose rates to test and to evaluate the behavior of various iron products in lake sediments. Those results will guide further studies of how effectively Curly-leaf pondweed and internal phosphorus loading can be managed, both in laboratory and real lake settings.

D. Long-Term Strategy

This proposed research will provide foundational knowledge that is needed in order to develop future strategies for implementing iron augmentation technology as a tool for improving water quality in Minnesota Lakes. Another phase of research will be required after completion of this foundational work in order to assess the effects of iron augmentation on other aquatic plant species, invertebrates, and fish.

Project Budget (3.5 Years)

IV. TOTAL PROJECT REQUEST BUDGET

BUDGET ITEM	AMOUNT	% FTE
Personnel:		
Dr. Brian J. Huser (Salary & benefits between 7/2009 and 12/2012; 22% of total project cost)	$ 103,000	20%
Mr. William F. James (Salary & benefits between 7/2009 and 12/2012; 22% of total project cost)	$ 104,000	20%
Mr. Steve McComas (Salary & benefits between 7/2009 and 12/2012; 5% of total project cost)	$ 21,500	20%
Dr. Keith Pilgrim (Salary & benefits between 7/2009 and 12/2010; 4% of total project cost)	$ 20,200	7%
Eau Galle Aquatic Ecology Support Staff (3 laboratory and field technicians, salary & benefits between 7/2009 and 12/2012; 23% of total project cost)	$ 107,200	25%
University of Minnesota Limnological Research Center Support Staff (3 laboratory and field technicians, salary & benefits between 7/2009 and 12/2012; 12% of total project cost)	$ 53,750	10%
Equipment/Tools:		
Equipment rental, bottles, jars, tubes, and reagents for laboratory sediment iron augmentation research	$ 24,550	
Fiberglass enclosures, plant containers, reagents and chemicals, gases, and plant tubers for Curly-leaf pondweed mesocosm studies and enclosure studies	$ 26,500	
Other:		
Local field trips to study sites within Minnesota. Approximately 15 trips at 200 miles round trip and $0.75 per mile	$ 2,250	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 462,950	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT
In-kind Services During Project Period: Dr. Amy Myrbo, Limnological Research Center, Department of Geology and Geophysics, University of Minnesota. Salary and Benefits to oversee University of Minnesota students working on the project and chemical analyses of sediment.	$ 15,000
In-kind Services During Project Period: David Wright and Chip Welling, Minnesota Department of Natural Resources. Salary and benefits for technical review and consultation.	$ 10,000
In-kind Services During Project Period: Dennis Wasley, Minnesota Pollution Control Agency. Salary and benefits for technical review and consultation.	$ 5,000
In-kind Services During Project Period: Barr Engineering Company. Waiving of normal administrative fees for the project.	$ 29,000
Past Spending: Various MN Lake Associations and the Cities of Apple Valley, Burnsville, and Lakeville, Minnesota. Pilot sediment augmentation studies.	$ 20,000

PROJECT MANAGER QUALIFICATIONS AND ORGANIZATION DESCRIPTION

Project Manager:	Dr. Brian J. Huser
Position:	Water Resources Engineer/Limnologist
Agency:	Barr Engineering Company
Mailing Address:	4700 West 77th Street Minneapolis, MN 55435
Phone Number:	952-832-2905
Fax Number:	952-832-2601
e-mail Address:	bhuser@barr.com
Web Site Address:	http://www.barr.com

Qualifications and responsibilities pertaining to this project proposal:

This project involves research over a broad range of focus areas (e.g., invasive macrophyte control, sediment chemistry, aquatic plant ecology, lake eutrophication and restoration) and will be executed by a multi-discipline research team using laboratory and field approaches. As a result, the project manager will be asked to handle a variety of responsibilities.

Brian Huser has been conducting research in the field of limnology for over 10 years. He has been responsible for managing scientific research and lake and wetland remediation projects to address issues that include lake and reservoir eutrophication and acidification, nutrient cycling, aquatic plant ecology and management, and sediment water interactions. His current position as a water resources engineer and limnologist for Barr Engineering includes directing and interpreting studies involving surface water resources for both private and governmental organizations. He is required to develop, execute and disseminate water quality studies, assemble and coordinate project teams, manage project budgets, and work with a variety of groups and agencies to complete projects.

Barr Engineering Company provides engineering and environmental services to clients in many industries and levels of government by developing sound scientific solutions to environmental and natural resource issues. Barr's work in water resources engineering and planning includes lake restoration, lake and wetland management, landscape architecture, stormwater management, landscape ecology, and groundwater protection.

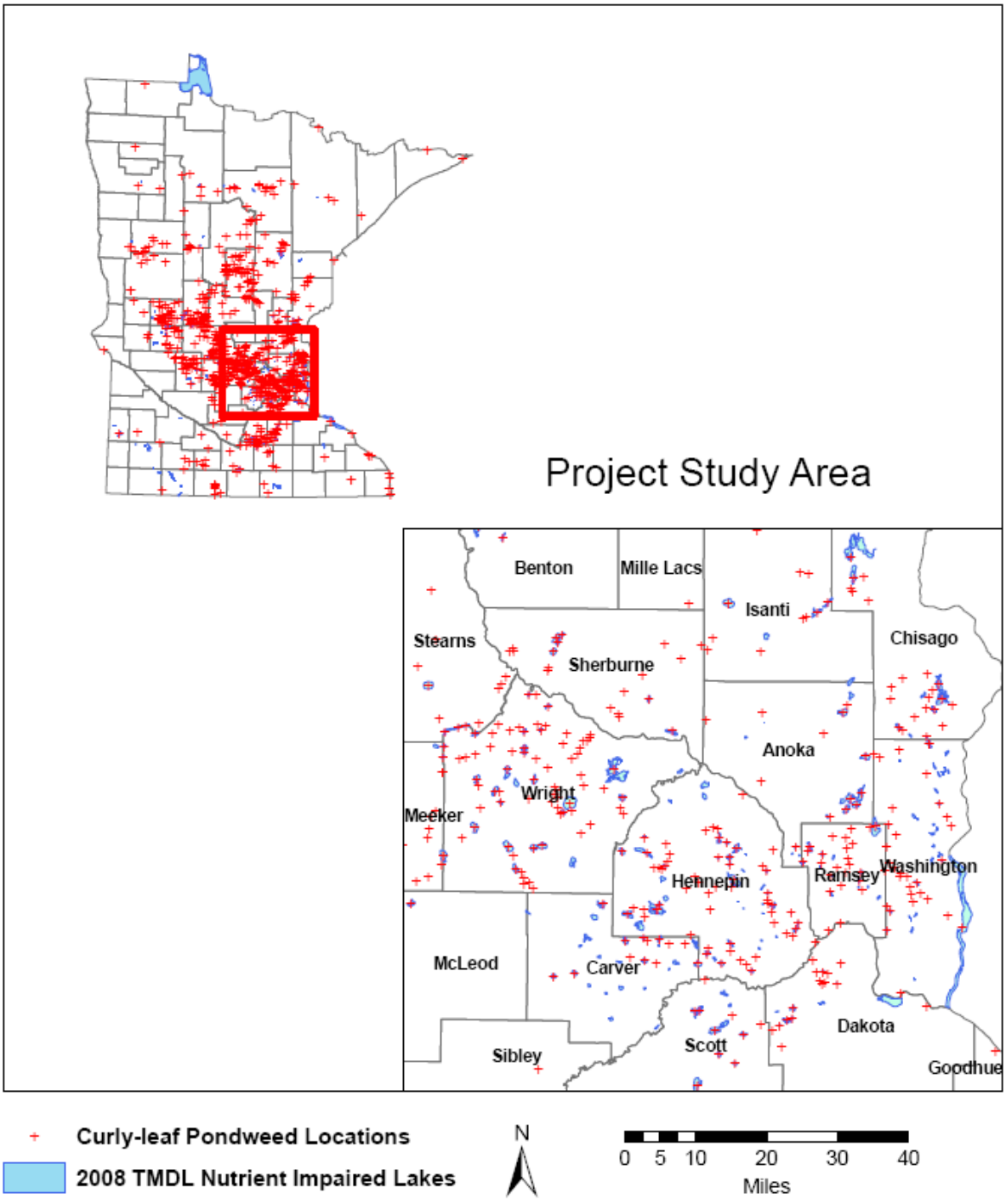
Brian Huser received a Ph.D. in Water Resources Science at the University of Minnesota in 2005 and a M.S. in Civil and Environmental Engineering at the University of Washington in 2000. He has been published in and reviews articles for international science journals. He is a Fulbright Scholar and recently received a Malmberg Scholarship to conduct research on nutrient dynamics in lakes.

Pilgrim, K.P., B.J. Huser, and P.L. Brezonik. 2007. A method for comparative evaluation of whole-lake and inflow alum treatment. Water Res. 41: 1215-1224.

Huser, B.J. and E. Rydin. 2005. Phosphorus inactivation by aluminum in Lakes Gårdsjön and Härsvatten during the industrial acidification period in Sweden. Can. J. Fish. Aquat. Sci. 62:1702-1709.

Huser, B.J. 2005. Sorption of phosphorus by sediments in eutrophic and acidic lakes. Dissertation thesis, University of MN, Minneapolis, MN.

Rydin, E., B.J. Huser, and E.B. Welch. 2000. Amount of phosphorus inactivated by alum treatments in Washington lakes. Limnol. and Oceanogr Vol. 45 (1): 226-230.



Project Map. Distribution of Curly-leaf pondweed and nutrient impaired lakes within the project study area (MNDNR 2007, MPCA 2008). A substantial portion of nutrient impaired lakes are infested with Curly-leaf pondweed. The negative effects Curly-leaf pondweed can have on water quality are a likely factor contributing to impairment status in these lakes.