Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)

Project Title: **ENRTF ID: 168-F**

Agricultural Runoff Water Quality Treatment Analysis - Phase II

Category: F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Total Project Budget: $ 295,010

Proposed Project Time Period for the Funding Requested: 4.5 years, July 2016 to August 2020

Summary:

Building on successes from LCCMR funded conservation practices, Phase II will validate agency requests to refine results. Phase I was more successful than anticipated, showing significant water quality benefits.

Name: Craig Austinson

Sponsoring Organization: Blue Earth County Drainage Authority

Address: 204 South Fifth Street

Mankato MN 56002-3567

Telephone Number: (507)304-4253

Email craig.austinson@blueearthcountymn.gov

Web Address www.blueearthcountymn.gov

Location

Region: SW

County Name: Blue Earth

City / Township: Mapleton

Alternate Text for Visual:

Bar chart shows significant water quality improvements as a result of original project.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

I. PROJECT STATEMENT

A 2010 LCCMR ENTRF grant was awarded to Blue Earth County project, *Mapleton Area Agricultural and Urban Runoff Water Quality Treatment Analysis*. This innovative conservation drainage improvement on Blue Earth County Ditch 57 (CD 57) is now a model project in the Le Sueur River Watershed. This project in a watershed comprised of agricultural land and the City of Mapleton, shows how combining Best Management Practices (BMPs) significantly improves water quality. Initial water quality monitoring results were much more successful than anticipated. **Landowners, agencies and nonprofits are requesting more detailed data to further validate original results and to promote ongoing benefits of the BMPs.**

A successful conservation drainage project for CD 57 was designed and constructed in 2011. BMPs installed include a two-stage ditch, a surge pond (Klein Pond), and a rate control weir, all of which were only included as part of the improvement due to a LCCMR grant. Three years of monitoring from 2012 – 2014, included water chemistry and stage (depth) data. Water chemistry was collected in storm events greater than one inch. Flow data was interpreted by data loggers that recorded stage every five minutes. The data indicated that this method of treatment was much more effective than anticipated. The Klein Pond was the most effective at removing Total Suspended Solids (TSS) Total Phosphorus (TP) and Total Nitrates (TN) at nearly 60% reductions. The Rate Control Weir was effective at reducing sediment and nutrient loading at 21-27%. These rates were much higher than expected to the point they were questioned by agencies. Phase II monitoring would incorporate real-time flow velocity meters and multiple water chemistry samples to further validate, measure potential backflow effects, and possibly reflect greater reductions than the Phase 1 results.

Based on the results from the initial monitoring, more than ten projects—using similar BMPs—have or will be installed in these counties: Blue Earth, Martin, Faribault, Jackson.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: ***Monitoring of Installed Best Management Practices*** **Budget: $200,010**

Outcome	Completion Date
1. Measure effectiveness of BMPs including the sediment removal, nutrient reduction, and decreased peak flow rates from the system. Using original equipment, along with better positioned, higher quality equipment (e.g. flow velocity meters) will confirm assumptions made during Phase I when data loggers were used.	*7/1/18*
2. Long Term Viability of BMPs: Determine the long-term effectiveness, required maintenance, and associated costs to keep the system functioning. The monitoring will help determine when the ditches need to be cleaned. Review repair costs since construction, and physically measure sediment in the BMPs to determine lifetime repair costs. Develop a maintenance schedule for BMPs based on real data (e.g. cleaning out sediment from a storage pond and maintenance on a two-stage ditch).	*7/1/18*

Activity 2: ***Develop a Final Report and Analysis for BMPs*** **Budget: $75,000**

Outcome	Completion Date
1. Analyze water chemistry and flow data for each BMP throughout the system.	*12/1/19*
2. Determine effectiveness of each BMP and compare it to previous monitoring results.	*12/1/19*
3. Develop a report for Drainage Authorities, Watersheds, State Agencies and Landowners to educate them on how these practices can be effectively incorporated into a drainage system including maintenance schedules, costs and practices.	*1/1/20*

Activity 3: ***Engagement/Promotion of Practices*** **Budget: $20,000**

Outcome	Completion Date
1. Inform landowners, producers, and agencies through a workshop on the effectiveness of installing these BMPs in an agricultural watershed	*8/1/20*
2. Share monitoring methods and results via print materials, electronic documents, and presentations	*8/1/20*
3. Hold a Field Day event at the site with a tour of the BMPs throughout the watershed focusing on long-term maintenance.	*8/1/20*

III. PROJECT STRATEGY

A. Project Team/Partners

Blue Earth County Drainage Authority (Craig Austinson, Drainage Manager): Project management, project administration, review and approval of project, act as funding mechanism for drainage improvements. In-kind contributor and will receive funding.

B. Minnesota Department of Agriculture: Assist with monitoring, technical memorandum, and presentations.

C. **Landowners in Blue Earth County Ditch 57 (Various):** Allowing access to drainage system for monitoring. Recipient of monitoring outcomes and project goals. Pay for repairs done to the system and no funding received from this grant.

D. **ISG (Chuck Brandel, PE):** Acting as engineer for the Blue Earth County Drainage Authority – Assistance with Project Administration, Monitoring, and Technical Memorandum, and Presentations (Not a contributor and will not receive grant funding. Will serve as a contract service provider).

E. **Blue Earth Soil and Water Conservation District (Jerad Bach and John Billings)**. Assist with Monitoring, Technical Memorandum, and Presentations (In-Kind Contributor with staff time and will not receive grant funding).

B. Project Impact and Long-Term Strategy

The initial BMP implementation and monitoring have had significant impacts on water quality in southern Minnesota. The strategy for this phase of the project is to show the long-term effectiveness of the BMPs installed in this watershed and how they can be incorporated across the state to improve water quality. By incorporating more innovative monitoring practices to quantify flow, nutrient, and sediment loads at locations upstream and downstream of each BMP, the overall effectiveness of the project will be further confirmed and promoted. Long term maintenance of BMPs will be documented.

C. Timeline Requirements

Three and one half years of monitoring and analysis will begin in July 2016, with monitoring completed in fall 2019. Since the grant funding will begin partway through the growing season, additional time will be needed to effectively monitor for three years. A final report and workshop will be complete in the summer 2020, including the monitoring data and analysis.

The implementation of the BMPs was funded through the first phase of this LCCMR project. It was anticipated that additional monitoring following the original project would be necessary to refine the proposed original monitoring methods. This system has been and continues to be duplicated in other portions of the Minnesota River Basin. If this phase is funded and monitoring results are widely accepted, it will serve as a model for other projects in terms of design and monitoring.

2016 Detailed Project Budget

Project Title: Agricultural Runoff Water Quality Treatment Analysis - Phase II

IV. TOTAL ENRTF REQUEST BUDGET *4* years

BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**AMOUNT**
Personnel:	N/A
Professional/Technical/Service Contracts: *The Blue Earth County appointed engineer is Chuck Brandel, ISG. ISG will conduct all monitoring. This will include environmental scientists who will set up monitoring stations, check stations, collect samples and transport them to the laboratory. Laboratory costs for testing 8 sample sites at a third party facility. Approximately 2 samples per month per site for the duration of the monitoring.Civil Engineer, Level 4 (100 hours x $150); Civil Engineer Level 2 (300 hours x $100); Laboratory Analysis (200 tests x $100) x 3 years.*	$195,000
Equipment/Tools/Supplies: *Monitoring and testing equipment for eight monitoring sites: equipment shelters (4x$550), Jobox (2x$1000), 100W solar panels (8x$500), marine battaries (16x$150), 2 ISCO probes (2x$4,000), ISCO 6712 samplers (8x$3,500), ISCO 2105C (2x$4,000), ISCO 2105C1 w/Modem (1x$3,500), 750 Module & AV Probe (5x$2,500),ISCO Bottles (28x$35); ISCO Scissor Ring (3x$650); 3 various ISCO Scissor Rings($2,300); 4 Bottle Configuration (7x$500), ISCO Rain Gauge (2x$2000), Sample Y Cable (1x$100), ISCO Spring Clamp (1x$100), 1 Gallon ISCO bottles (28x$35)*	$ 85,010
Acquisition (Fee Title or Permanent Easements): *N/A*	N/A
Travel: *Travel to CD 57: Set up monitoring equipment, check monitoring equipment, collect samples, transport samples to laboratory. 3 years (50 meeting/site visits x $100)*	$ 15,000
Additional Budget Items:	N/A
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 295,010

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period: *Indicate any additional non-state cash dollars secured or applied for to 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.*	N/A	*Indicate: Secured or Pending*
Other State $ To Be Applied To Project During Project Period: *Indicate any additional state cash dollars (e.g., bonding, other grants) secured or applied for to 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.*	N/A	*Indicate: Secured or Pending*
In-kind Services To Be Applied To Project During Project Period: *Blue Earth County Ditch Manager, Craig Austinson will provide oversight of the entire project. Four years:*	$14,000	*Secured*
Funding History: *ENTRF Funding: This funding was for implementing BMPs and initial monitoring. This monitoring is now complete and final report will be submitted in June 2015.*	$ 485,000	
Remaining $ From Current ENRTF Appropriation: *2010 . To be finalized in June 2015. It is anticipated that there will be no unspent money.*	$ -	*0 Unspent*

BLUE EARTH COUNTY DITCH 57

BACKGROUND: Blue Earth County Ditch (CD 57) is a 6,040 acre drainage system that was deteriorating and in need of improvements due to severe flood damage to farmland and roadways. ISG was selected to conduct a feasibility study based on their agricultural and environmental expertise. In 2007, landowners petitioned to make improvements to the system to increase drainage capacity on this public drainage system. Budget allocations required landowner contributions as well as outside funding sources.

PARTNERS:
- Blue Earth County
- Minnesota Department of Natural Resources (MN DNR)
- U.S. Department of Agriculture
- Soil and Water Conservation District

LCCMR FUNDING: After ISG determined cost and capacities, several grant applications were submitted, and a grant was awarded by the LCCMR for $485,000 to be utilized for the water quality portion of the project. Multiple storage options were reviewed with the landowners and they selected the improvements in collaboration with ISG and the other agencies. The following options were considered:

•In-channel sotrage • Two-stage ditch •Wetland restoration • Surge ponds • Enhanced buffers

Based on cost and capacities for the system, the following improvement projects were implemented: Enhanced Buffers, Two-Stage Ditch, a Outlet Control Weir, Klein Pond and a City Pond. Due to cooperation with landowners and Blue Earth County, no easements were taken without full support from landowners.

METHODOLOGY AND IMPLEMENTATION: Data was collected prior to construction of BMPs in order to compare the changes in water quality due these practices. Implementation of the plan included expanding native grass buffers along the sides of the original ditch. The installation of two large storage ponds were designed to capture and hold runoff to reduce peak flows and improve water quality. A two-stage ditch and a rate control weir were built at the outlet of the system.

ISG collaborated with private and public sector stakeholders and coordinated monitoring assistance from Minnesota State University, Mankato students and faculty. Involving students in the process allows them to broaden their experiences and further develop their skills and knowledge as future environmental professionals.

MONITORING: Water quality monitoring allowed ISG to analyze results of the improvements. Three seasons of water quality monitoring were completed following the construction of the improvements. Flow data loggers recorded depth of water in five-minute increments continuously. Twelve monitoring locations and seven water quality sample stations were designed throughout the system to record flow and water quality data. Minnesota State University, Mankato Laboratory analyzed all samples.

Precipitation
- Rain gauge records every 0.01" of rainfall & barometric pressure
- Weather station records rainfall (total & intensity), temperature, wind speed & direction, relative humidity

Flow Monitoring
- Data logger records water depth every 5 minutes
- Staff gauge for manual readings taken by camera
- Camera takes pictures every 5 minutes to verify and calibrate the data logger

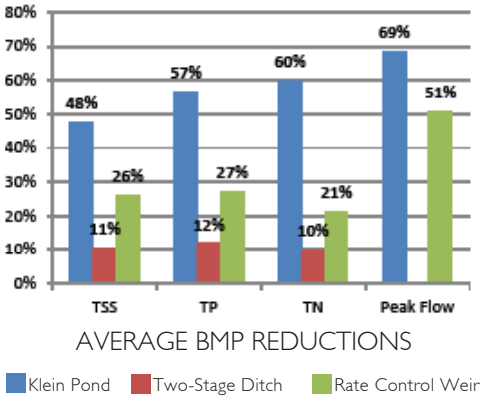
Parameters - Grab Samples
- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Total Phosphorous (TP)
- Ortho-Phosphorous
- Nitrate
- Nitrite

Parameters - Instrumental Readings
- Temperature
- pH
- Dissolved Oxygen
- Specific Conductivity
- Turbidity
- T-Tube

Frequency
- Data collection for 3 years post construction (2012, 2013, 2014)
- Monitoring begins in March or after ice out
- Monitoring continues through October
- At least one water quality sample and manual flow reading were taken during base flow conditions per month
- Water quality samples were taken after one-inch rain events

ACCOMPLISHMENTS AND RESULTS: Recognized as a model project, CD 57 is the result of an important collaboration with farmers, landowners, county authorities, engineers, surveyors, tiling contractors, DNR, and other state and county agencies. Together, this group developed several goals which included replacing a deteriorating tile system, increasing drainage capacity, improving water quality and reducing peak flows, and increasing diversified habitat all while protecting downstream landowners and natural features. From these goals, a multi-purpose drainage management plan was created.

Together, the enhancements are making an ongoing difference. In one particular significant rain event, 2.63 inches fell in two hours. Eighteen hours after the event occurred, the two storage ponds were still doing their job which allowed the farmland to drain down in time to save the crop. The two-stage ditch, storage ponds and rate control weir together reduce peak flows, Total Suspended Solids, Total Nitrogen and Total Phosphorus, all while providing adequate drainage to the system. The adjacent figure summarizes the average reduction for these parameters from 2012-2014.



AVERAGE BMP REDUCTIONS

Project Manager and Qualifications
Craig Austinson served as the Project Manager for Phase I of the *Mapleton Agricultural and Urban Runoff Water Quality Treatment Analysis project funded by a 2010 LCCMR Grant*. He has served as the Ditch Manager for over 16 years and has overseen hundreds of repair and improvement projects including many that incorporate water quality practices.

Craig Austinson, Agricultural Drainage Manager/Appraiser
Experienced agricultural drainage manager and county appraiser.

Agricultural Drainage-Ditch Manager
Duties include maintaining all county ditches, requiring thorough knowledge of current Minnesota ditch law, working with landowners, legislators and county commissioners, contracting professionals for ditch assessment and repair and working closely with the county attorney. Adept at producing reports and correspondence for interested parties. Responsible for maintaining, revising and updating ditch records and property assessments.

Communicate effectively with all affected parties. Accustomed to meeting very tight deadlines. Presents at statewide conferences, legislative meetings and to landowner groups. Reports directly to the County Board.

Organization Description
Ditch Management

Blue Earth County has over 100 ditches, with over 160 miles of open ditches and over 500 miles of tile systems. Approximately 50% of all the land in Blue Earth County drains to a county ditch. The remaining land drains to natural drainage systems such as rivers or streams.

Blue Earth County's Ditch Authority is the County Board of Commissioners. Others involved with ditch proceedings include:

- County Ditch Manager
- County Attorney
- Ditch owners' attorneys
- Engineers
- Interested landowners
- State and federal agencies

The County Board's Drainage Committee includes two county commissioners, the County Administrator and the county-employed ditch manager.

Annual activities related to the county's ditches include: Inspections of ditch systems; repair and improvement projects; and erosion control.