Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 056-B**

Water Quality through Capture/Use of Agricultural Runoff

Category: B. Water Resources

Total Project Budget: $ 600,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

More water storage in agricultural landscapes is essential for protecting water, but expensive. We will develop a cost-effective approach benefiting water and wildlife by capturing runoff for use in irrigation.

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Sponsoring Organization: U of MN

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Location

Region: Central, Northwest, Southwest, Southeast

County Name: Statewide

City / Township:

Alternate Text for Visual:

A pond is shown at the edge of two cornfields and is disconnected from the nearby river. The pond captures excess water from subsurface tile and surface runoff, preventing the water, sediment and nutrients from reaching the river. The pond water can be used to provide supplemental irrigation during short term droughts that otherwise would substantially reduce yields. The pond serves additional functions including waterfowl habitat.

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

PROJECT TITLE: Water quality through capture/use of agricultural runoff

I. PROJECT STATEMENT

The Minnesota Nutrient Reduction Strategy lists water storage in tile-drained landscapes as an important strategy for improving water quality. "Water storage" takes many forms. This project will stimulate use of a particularly cost-effective approach to water storage: capturing excess water from agricultural runoff/drainage and using it for multiple functions including reducing sediment and nutrient loading in streams, providing wildlife/waterfowl habitat, and irrigating crops. Coupling water capture with supplemental irrigation makes the practice economically feasible in those landscapes that most need greater water storage capacity.

We will implement on-farm demonstrations plus field and model-based research to achieve these outcomes:

1. **Estimate the water quantity and quality impacts** of water capture for multiple uses to determine whether these systems can have real benefits at the watershed scale.
2. **Assess the potential for negative impacts** of concentrating agricultural chemicals in storage ponds.
3. **Develop preliminary guidance for design and management** of water capture systems so they effectively perform the multiple functions of reducing streamflow, reducing nutrient and sediment delivery, providing wildlife/waterfowl habitat, and providing supplemental irrigation.
4. **Determine the realistic potential to implement** water capture systems in tile-drained areas of the state.
5. **Estimate farm-level costs and benefits** of water capture for supplemental irrigation.

Water retention coupled with supplemental irrigation is becoming increasingly urgent given Minnesota's climate trends in recent decades. More intense precipitation has resulted in greater incidence of high stream flow and greater export of sediment, nutrients and agricultural chemicals from Minnesota's agricultural landscapes. At the same time, occurrences of severe heat and drought have resulted in crop water deficits that can be ameliorated with supplemental irrigation. Preliminary work in Minnesota and other states (see TransformingDrainage.org) has shown water capture for supplemental irrigation is a promising conservation practice, but more work is needed to give landowners the information needed to implement at a broad scale.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Engage producers and establish on-farm demos of water capture Budget: $160,000

Engage and invest landowners from the beginning by conducting outreach meetings to exchange current knowledge and economic analyses of ag water capture/irrigation systems. Install water capture/irrigation systems on 2 farms in contrasting regions of the state. The systems will be designed for multiple functions: runoff water storage, sedimentation basins, natural vegetation, habitat for migratory waterfowl, and supplemental irrigation. Monitor the systems for performance, water quality, and impact on water flow and habitat under different environmental conditions. Share observations with landowners and conservationists.

Outcomes	Completion
1.1. Three farmer informational meetings ($2,000)	Dec 2018
1.2. Two on-farm water capture/use systems installed, plus monitoring ($98,000)	Dec 2020
1.3. Report of monitoring data, written for general audience, describing system performance and water and habitat impacts ($57,000)	Jun 2021
1.4. Three field days at the research and demonstration sites ($3,000)	Jun 2021

Activity 2: Research feasibility and impact of capturing ag water for multi-use Budget: $440,000

Conduct an initial cost-benefit analysis and review of similar systems around the country to present at farmer meetings. Continue field research at a water storage for supplemental irrigation site at the Southwest Research and Outreach Center near Lamberton. (Site establishment and initial operation is underway with $437,000 of federal funding. ENRTF would support an additional 18 mo. of operation.) While the on-farm demonstration sites provide context-rich information, the research site will generate statistically robust data on impacts on water quality/quantity and productivity under a range of irrigation and nitrogen scenarios.

Conduct model-based analysis assessing the feasibility and potential sites of water storage for selected tributaries within the Minnesota River Basin. The model will help define water storage needs and irrigation rates sufficient to meet crop demands and improve water quality. The model will also characterize impacts under variable weather scenarios, because water quality and yield impact of water capture for irrigation will vary tremendously year to year. Assess risk of concentrating pollutants by sampling storage pond inputs (surface runoff, tile drainage) and storage pond water at multiple time points from March through August. Measure concentrations of pesticides and select metabolites in water samples. Compare results to published toxicological data to assess potential risk.

Outcomes	Completion
2.1 Report of potential impact on water quality if these water capture systems were implemented across a watershed ($50,000)	Jun 2021
2.2 Report of the practical potential for implementing water capture in MN ($30,000)	Jun 2021
2.3 Submit for publication, report of the research data on water quality impacts of water capture/use systems under various management strategies ($190,000)	Jun 2021
2.4 Report for general audience on guidelines for design/management of water capture	Jun 2021
2.5 Submit for publication a report of occurrence and sources of ag contaminants in water capture ponds and extrapolate potential risks to vegetation and wildlife ($127,000)	Jun 2021
2.6 Report of farm-level cost estimates for water storage and distribution for use at farmer meetings ($40,000)	Dec 2018

III. PROJECT STRATEGY

A. Project Team/Partners

Ann Lewandowski, UM Water Resources Center -- project manager. *(ENRTF supported)*
Dr. Jeffrey Strock, UM Southwest Research and Outreach Center
Dr. Brent Dalzell, UM Dept of Soil Water and Climate *(ENRTF supported)*
Dr. Jeffrey Apland, UM Dept of Applied Economics *(ENRTF supported)*
Dr. William Lazarus, UM Dept of Applied Economics *(ENRTF supported)*
Dr. Pamela Rice, USDA-Agricultural Research Service and UM Dept of Soil Water and Climate (adjunct)
Alan Peterson, Irrigators Association of Minnesota

B. Project Impact and Long-Term Strategy

Water capture for supplemental irrigation is a conservation practice that eventually will be sustained and multiply through market incentives. This project will lay groundwork needed to make the practice feasible and effective for protecting water quality. The next stage of research will help optimize operation of supplemental irrigation on heavy soils and develop decision support tools for farmers.

C. Timeline Requirements

The project requires 3 years to allow time to implement the on-farm demonstrations.

2018 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET for 3 years

BUDGET ITEM	AMOUNT
Personnel: Faculty and Professional (75% salary, 25% fringe) Brent Dalzell (model feasibility and water quality impacts), 33%FTE for 3yrs = $75,000 Jeffrey Apland (advise on whole farm economic analysis): 5%FTE for 3yrs = $17,000 William Lazarus (calculate farm-scale costs/benefits): 5%FTE for 3yrs = $18,000 Ann Lewandowski (project coordination and outreach lead): 20% FTE for 3yrs = $49,000	$ 159,235
Personnel: Technicians and Civil Service (79% salary, 21% finge) Demo manager (set up and manage demonstrations) 100%FTE for 2 yrs Research site manager (management and operations) 100%FTE for yr1, 50%FTE yrs2-3 Student hourly (assist in pesticide extraction): 50%FTE for yr2 & yr 3)	$ 236,069
Professional/Technical/Service Contracts: Contract with design-build firm to design and construct pond-irrigation system, including permits or mitigation costs	$ 29,500
Equipment/Tools/Supplies: Flumes and samplers to measure flow and sample inflow to 3 ponds ($8,000 for 2 demos, $22,000 for research site) Glass bottles and sampling equipment for pesticide sampling ($31,000)	$ 61,333
Travel: In-state Apland and Lazarus to visit fields sites and farmer meetings (6 trips @ $150 = $900) Demo manager to visit two fields sites several times each year ($3,500) Pesticide research to collect pond samples 6X/year ($3,000) Project manager to attend farmer meetings and field days (6 trips @ $150 = $900)	$ 8,300
Additional Budget Items: Meeting expenses Meeting expenses ($500 for each of 3 informational meetings, $1,000 for each of 3 field days)	$ 4,500
Additional Budget Items: Lab analysis for water quality Nutrient analysis ($30,000) Pesticide analysis ($65,000)	$ 95,000
Additional Budget Items: Publication or conference costs (4 presentations or publications at $1,500)	$ 6,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 600,000

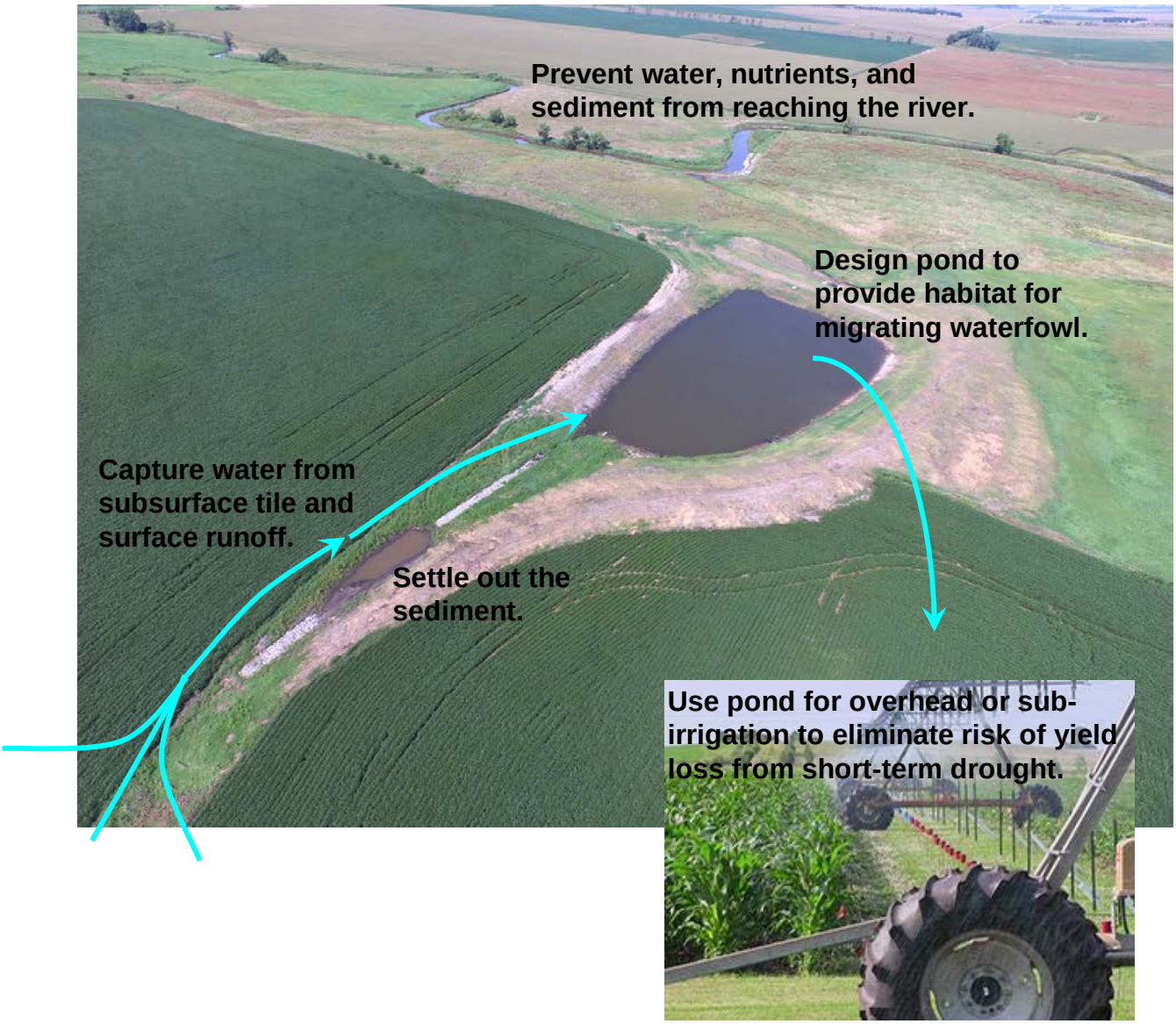
V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not*

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period: USDA NIFA (see also "Funding History". This project has begun and will continue during the project period.)	$ 200,000	*Secured*
Other State $ To Be Applied To Project During Project Period:	NA	
In-kind Services To Be Applied To Project During Project Period: **Dr. Jeff Strock, UM (5% FTE to manage research site) --** *$15,000* Dr. Pam Rice (5% FTE for 3yrs) and technician (7% FTE for 2yrs), USDA-ARS, to manage and implement pesticide research -- *$23,400*	$ 38,400	*Secured*
Past and Current ENRTF Appropriation:	NA	
Other Funding History: USDA NIFA	$ 237,000	

To protect natural resources, we have to work in agricultural landscapes.

Slowing down and storing water in soil, ponds, and wetlands has been identified as an important way to protect water quality.

Capturing water for use in irrigation will be economically viable, making this a powerful means of getting water storage on the landscape. Before farmers and industry will invest, we need research and demonstration to prove and refine the practice.



Project Manager Qualifications and Organization Description

PROJECT MANAGER and PRINCIPAL INVESTIGATORS

Ann Lewandowski, Principal Investigator (PI) and Project Manager, is the Research and Outreach Coordinator for the University of Minnesota (UM) Water Resources Center, where she has been a researcher for 9 years. In the past six years, Ann has been the Principal Investigator or Project Manager for 5 grants totaling over $700,000, ensuring completion of all project deliverables and reporting requirements, including for the ENRTF-funded "Conservation Applications of LiDAR" project. She has 20 years' experience in implementing research and outreach related to soil and water quality management in agricultural landscapes, including helping develop the Phosphorus Index for assessing P loss risk, studying costs of nitrate contamination, training local water resource managers, and supporting the ACPF software for siting conservation practices. Ann's specialty is building partnerships across academic disciplines, government agencies, and the private sector.

Dr. Jeffrey Strock, Co-PI, Professor, UM Dept of Soil, Water, and Climate; and UM Southwest Research and Outreach Center. Dr. Strock's research program focuses on providing practical solutions to soil and water management issues in drained agricultural landscapes. Field-based research and outreach education focuses on water and nutrient management to support resilient agricultural production in support of food and water security for crop and livestock producers. Research includes investigating and improving water and nutrient management practices for crop production (e.g. soil water storage, water use efficiency, crop water use, drainage water management and nutrient use efficiency) and nitrogen mobility.

Dr. Pamela Rice, Co-PI, has a Ph.D. in toxicology and is a Research Chemist with United States Department of Agriculture – Agricultural Research Service (USDA-ARS). She is an adjunct professor in the University of Minnesota (UM) Department of Soil, Water and Climate and faculty advisor for the Water Resources Science Graduate Program. Her research has evaluated the environmental fate of chemicals in water and soil, the occurrence of contaminants in surface waters in relation to local land uses to better understand contaminant sources, the toxicological significance of chemical residues in the environment and the ecological impacts of agricultural and non-agricultural practices, and the design and assessment of mitigation strategies to reduce off-site chemical transport and remediate contaminated surface waters. In both her research and professional leadership roles Pamela has brought together multiple scientific disciplines for enhanced problem solving.

ORGANIZATION DESCRIPTION:

The **University of Minnesota Water Resources Center** (WRC) facilitates interdisciplinary research, education, and outreach on water resources. It hosts the Water Resources Science graduate program with faculty affiliates across many UM Departments. In collaboration with UM Extension as well as state and federal agency partners, it develops and delivers outreach and professional education programs on storm-water management, on-site sewage treatment, agricultural practices and other topics. The WRC manages 20-25 active grants, from federal, state, and private funders, totaling over $2 million at any one time, and working across disciplines and across institutions. The WRC maintains sufficient permanent staff to complete all grant reporting and data submittal requirements in the timeframe required.