

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

Buffer Gap Analysis

ENRTF ID: 045-B

Category: B. Water Resources

Total Project Budget: \$ 1,390,656

Proposed Project Time Period for the Funding Requested: 5 years, July 2017 - July 2022

Summary:

We will determine the water-quality effects of Minnesota's 50-foot buffer initiative including gaps in continuity, such as tile drains, alternate practices, and width differences.

Name: Eric Mohring

Sponsoring Organization: Board of Water and Soil Resources

Address: 520 Lafayette Rd N
St. Paul MN 55155

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Email eric.mohring@state.mn.us

Web Address _____

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

The illustration shows: A stream flowing through adequately buffered reaches (buffer strips and RIM/CRP land) as well as gaps (inadequately buffered reaches); Sampling points for determining the water-quality and biological effects of buffers; and Project highlights: builds on previous research, multi-agency support Federal matching funds, third-party objective science

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



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: Buffer Gap Analysis

PROJECT TITLE: Buffer Gap Analysis

I. PROJECT STATEMENT

The new buffer law passed in 2015 offers a unique opportunity to answer scientific questions on water quality and quantity. BWSR proposes to collaborate with the U.S. Geological Survey in order to obtain a long-term, third party, objective and scientific analysis of the effects of statewide buffers. New buffers, alternative practices such as grassed waterways, different requirements for private and public ditches, exempt areas, and other conditions such as tile drains will mean that buffers will not be continuous across the state. We do not know the statewide effects of continuous buffers and we do not know how breaks in continuity will affect water quality.

Therefore, using the requirements outlined in the buffer law, this project will determine the water-quality and biological effects of buffers, as well as the effects of buffer gaps or discontinuities. We will evaluate water quantity and water quality (streamflow, sediment, nutrients, biological health and other water-quality measures) as they relate to the continuity of buffers and consider:

- Alternate practices (such as grass waterways, conservation cover, etc.)
- Vegetation effectiveness in terms of root depth
- Length of time for buffers to show improvement in water quality
- Bypassing buffers with tile outlets
- Variability of buffer width
- Saturated buffers

Time is critical for starting this work now to capture the effects of both the buffers and the alternate practices as they are installed and how they mature. Waiting until after buffers are established will lead to an incomplete and patchwork approach to data collection and we risk losing valuable data.

We propose to enhance data collection in three agricultural watersheds of the Minnesota River Basin where pre-buffer data exists. This analysis will be scaled up to approximately 80 MPCA/WRAPs sites in the Minnesota River Basin, using existing data. At the end of the study we will scale up to extend the analysis across the state, to cover 4-5 ecoregions.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: COMPARE PRE AND POST BUFFER AND WATER-QUALITY CONDITIONS **Budget: \$495,848**

We will determine objective methodology and gather the existing water-quantity, quality, and buffer data. Water and sediment-quality data collection will be augmented at sites where additional long-term data is needed. We will use advanced water-quality sensors and state-of-the-art sediment oxygen demand chambers, which are important to understand nitrate cycling.

Outcome	Completion Date
<i>1. Compile, Evaluate, and Quality Assure Baseline Data set</i>	<i>12-31-2017</i>
<i>2. Site instrumentation (only sites with pre-buffer data will be considered)</i>	<i>3-31-2018</i>
<i>3. Enhanced water quantity, quality, and biological data collection</i>	<i>9-31-2021</i>



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Activity 2: GAP ANALYSIS

Budget: \$670,448

We will compare alternative practices, root depth, and perform a continuity analysis of the buffer data. We will monitor vegetation and/or other related measures of buffer establishment. We will use Unmanned Aircraft Systems (UAS) to combine infrared and visible technology in order to map tile drains at established USGS study sites. A digital surface model of water features will be produced to provide additional tile drain data to combine with other agricultural management practices. With infrared cameras, we will be able to determine connectivity of tile drains to wetlands and ditches. We will provide a validation set that can be extended to satellite imagery to refine maps of tile-drained landscapes.

Outcome	Completion Date
1. Evaluate breaks in continuity and existing alternate practices	9-30-2018
2. Report on UAS data model	9-31-2021
3. Provide evaluation of vegetative effectiveness and root depth	9-31-2021

Activity 3: SCALE UP THE ANALYSIS TO BASIN AND STATE LEVEL

Budget: \$224,360

We will determine the effectiveness of buffers across the Minnesota River Basin and 4-6 regions of the state. This analysis will be dependent on the availability of a map of current buffer conditions. Acquiring additional UAS imagery from select field sites will help transition hydrologic investigations from these individual field sites to a regional and state-wide representation of how tile drains affect hydrologic budgets, streamflow, and water quality on a seasonal to a decadal time scale.

Outcome	Completion Date
1. Provide report on basin and regional buffer gap analysis and water-quality comparison	6-30-2022

III. PROJECT STRATEGY

A. Project Team/Partners

- BWSR (Eric Mohring) will provide the project manager, managing distribution of funds to BWSR, USGS and U of M, guidance on buffer requirements, and status of buffer implementation
- USGS (Victoria Christensen) will provide science direction, and serve as the principal investigator to provide equipment, field personnel, and quality assurance. The USGS will provide matching funds (approximately 10%) and will seek other Federal funds annually for collaboration and provide assistance from the USGS National Research Program
- U of M (Dr. Chris Lenhart and Dr. Joe Magner) will provide research recommendations, a graduate student, and advisor
- MN DNR (Steve Kloiber) will provide existing buffer maps
- MPCA (Scott Niemela) will provide data on biological indices
- Renville County and the Natural Resources Conservation Service (Ben Trochlil) will provide information on site specific implementation of buffers

B. Project Impact and Long-Term Strategy

This proposal builds off previous work by BWSR, USGS, and MPCA. Two previous research projects were funded by LCCMR. This seed money led to six additional, primarily federally funded research projects on land retirement in Minnesota. With a commitment from LCCMR to fund this proposal it will likely lead to additional funding and support from other sources as in the past.

C. Timeline Requirements

We are proposing 5 years for this phase of the project. An additional 5 years may be needed to capture the full establishment of buffers in the state and account for weather conditions.

2017 Detailed Project Budget

Project Title: BUFFER GAP ANALYSIS

IV. TOTAL ENRTF REQUEST BUDGET 5 years

BUDGET ITEM	AMOUNT
Personnel:	\$ -
Principal Investigator, Victoria Christensen, (75 % salary, 25 % benefits), .20 FTE for 5 years	112,320
Hydrologist, TBD, (75 % salary, 25 % benefits), .25 FTE for 5 years	93,600
Water-Quality Specialist, Dr. Richard Kiesling, (70 % salary, 30 % benefits), .10 FTE for 5 years	68,640
GIS Specialist, TBD, (70 % salary, 30 % benefits), .25 FTE for 5 years	161,200
Administrative Staff, TBD, (70 % salary, 30 % benefits), .10 FTE for 1 years	43,680
Hydrologic Technician, TBD, (70 % salary, 30 % benefits), .25 FTE for 4 years	65,000
Graduate Student, TBD, (80 % salary, 20 % benefits), .50 FTE for 4 years	104,000
Professional/Technical/Service Contracts:	\$ -
Laboratory Analysis, NWQL and other contract labs	150,000
UAV flights and model analysis, USGS, Renville Co., and contract pilot	78,000
U of M, Graduate Student and Advising	120,000
Equipment/Tools/Supplies:	\$ -
Hydrologic Instrumentation and Gaging Stations	300,000
Supplies, bottles, reagents, calibration standards, gloves, preservatives, etc.	15,000
Equipment rental from Hydrologic Instrumentation Facility (water-quality monitors, cables)	27,216
Travel:	\$ -
Travel within the state of MN to field sites and meetings (\$4000/yr)	20,000
Additional Budget Items:	\$ -
Shipping samples, telecommunications	11,000
Training, conference presentations, printing	21,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 1,390,656

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period:	\$ -	
USGS matching funds	130,000	<i>Pending</i>
USGS GAP program (funding for one year has been secured)	30,000	<i>Secured</i>
USGS GAP program (up to \$30K annually)	30,000	<i>Pending</i>
USGS UAV Program	15,000	<i>Secured</i>
Other State \$ To Be Applied To Project During Project Period:	\$ -	
In-kind Services To Be Applied To Project During Project Period:	\$ 110,000	
New Ulm Gage (all Federal funds)		<i>Pending</i>
Funding History:	\$ 1,590,040	
\$300,000 - ENTRF for ML2005-7c "Effects of Land Retirement" + \$300,000 USGS MATCH		<i>Expended</i>
\$275,000 - ENTRF for ML2007-5c "Effects of Land Retirement" + \$275,000 USGS MATCH		<i>Expended</i>
\$100,000 - BWSR for "Phosphorus Effects of Riparian Buffers" + \$71,280 USGS MATCH		<i>Expended</i>
\$268,760 - USGS Federal Funds for Effects of Ag Conservation Practices		<i>Expended</i>
Remaining \$ From Current ENRTF Appropriation: N/A	\$ -	

Buffer Gap Analysis

Highlights:

- Builds on previous research
- Multi-agency support
- Federal matching funds
- Third-party objective science

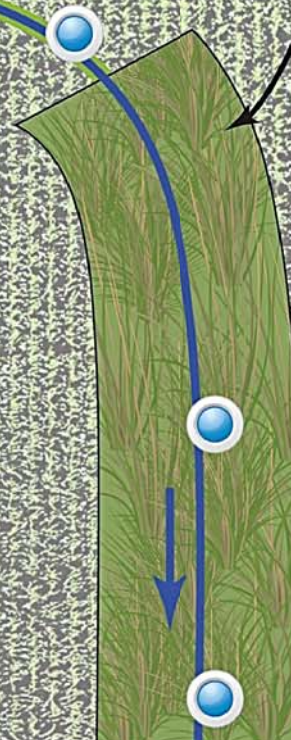
RIM/ CRP



GAP
(inadequate buffer)



BUFFER



 = sample point

Project Manager Qualifications and Organization Description

Eric Mohring, Hydrologist, Minnesota Board of Water and Soil Resources

Education: BS, Geology, Princeton University
MS, Hydrogeology, University of Minnesota

Experience:

Eric Mohring has 27 years of experience with state government including the Minnesota Board of Water and Soil Resources (BWSR) and the Department of Natural Resources (DNR). Duties have included: assisting local governments with hydrology and water management, data base management, conducting hydrology training, evaluating pollution reduction benefits, administering a well sealing cost-share grant program, hydrogeologic investigations and regional studies, technical assistance to state agencies, local units of government, and the public. He has 2 years experience in private consulting.

Responsibilities for this proposal include project over-sight, technical assistance, and report review.

Other: Licensed Professional Geologist in Minnesota

Organization Description:

The Minnesota Board of Water and Soil Resources (BWSR) is a state government agency.

Victoria Christensen, Hydrologist, United States Geological Survey

Education: BA, Management, Hamline University
BS, Geology, University of Kansas
MS, Water Resources Science, Dept. of Civil Engineering, University of Kansas

Experience:

Victoria Christensen is the Subject Matter Expert in Scientific Project Management for the U.S. Geological Survey. She is also a project chief and hydrologist for the USGS, Minnesota Water Science Center. She has 20 years of work experience in the fields of ground water and water quality. Her experience includes managing several research projects in the area of real-time water-quality monitoring of agricultural basins. She has served as project chief on large-scale studies of nutrient and pesticide occurrence and distribution, statistical modeling, and ammonia assimilative capacity. Her research history includes studies of water quality, sediment quality and ground-water recharge.

Responsibilities for the proposed project include sampling design, principal investigator, supervision of field scientists, supervision of data review and compilation, and report preparation.

Organization Description:

The United States Geological Survey is a federal government agency in the Department of Interior.

CHRISTIAN F. LENHART, Research Assistant Professor, Ecological Engineering Group, Department of BBE, University of Minnesota, St. Paul, MN

Education: Education: Ph.D., Water Resources Science, University of Minnesota, 2008;
M.S. in Water Resources Management and MSLA in Landscape Architecture, University of Wisconsin- Madison, 2000;
B.S. in Biology, University of Notre Dame, 1993

Experience:

Research Assistant Professor, 2010- present, University of Minnesota, BBE Department
Research project leadership: I have been the principal investigator or co P.I. on 9 research projects ranging from \$5,500 to \$312,000 since 2010. Some relevant projects include:

- Agricultural BMP Handbook update, a manual on the effectiveness of farmland management practices, Minnesota Dept. of Agriculture (MDA), 2015-16, \$65,000
- Treatment wetlands for water quality improvement in sub-surface tile drainage. Minnesota Department of Agriculture (MDA) (2013-2015), \$312,000.
- Developing approach for prioritizing stream restoration sites in the Minnesota River Basin for sediment reduction (2011-2013) (McKnight Foundation)(\$75,000)
- Researching tools for prioritizing channel restoration sites and investigating hydrologic drivers of channel erosion in different agro-ecoregions (2011-2015). MDA, \$280,000
Field hydrologic monitoring and wetland assessment experience from other work
- Led hydrologic monitoring and assessment to characterize the impact of EAB-on forest hydrology in LCCMR study, Forecasting the hydrologic impacts of emerald ash borer on northern Minnesota black ash forests (2010-2014).
- Developed an assessment tool for wetland buffers for the Minnesota Department of Transportation to benefit water quality and wildlife (2009)
- Managed hydrologic and water quality monitoring program of restored wetlands in Martin County Minnesota, 2004-2007. Assessed hydrologic and nutrient reduction in two restored wetlands for my PhD research
- At Coon Creek watershed 2002-2004 as a water resources specialist I coordinated hydrologic monitoring, wetland permit review and wetland mitigation monitoring.
- Coordinated wetland assessments in Illinois, Wisconsin, Minnesota and Montana

Organization Description:

The BBE Department team strives for the sustainable use of renewable resources and enhancement of the environment. The Ecological Engineering group focuses on research and development of ecological management and restoration practices such as buffers, wetlands and drainage water management particularly in rural settings.

