

Environment and Natural Resources Trust Fund

Research Addendum for Peer Review

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Project Title: Potential Benefits of Perpetual Easements on Phosphorus Reduction

Project number: 035-B

1. Abstract

This study will examine limited-duration and perpetual easements and their effectiveness at reducing phosphorus transport to streams. The U.S. Geological Survey (USGS), Minnesota Board of Water and Soil Resources (BWSR), and the Hawk Creek Watershed Project (HCWP) will work collaboratively to examine West Fork Beaver Creek watershed in Renville County, which has the largest number of Re-Invest In Minnesota (RIM) land retirement contracts in the state. The project builds on previous Environmental and Natural Resources Trust Fund (ENTRF) projects that demonstrated numerous benefits related to land retirement, including reductions in nitrogen concentrations and improvements in fish quality.

2. Background

Most studies of management practices are not long enough to evaluate reductions in phosphorus. Failure to show phosphorus reductions may reduce support for land retirement programs. It is up to scientists and resource managers to demonstrate that immediate reductions in phosphorus are not always expected. Recent ENTRTF projects (ML 2005 Subd. 7(c) and ML 2007 Subd. 5(c)) studied the impacts of agricultural land retirement programs on stream water quality and biotic integrity at sites in the Minnesota River Basin. The projects demonstrated that land retirement programs are a positive influence on stream quality, resulting in lower nitrogen concentrations and better fish quality. However, these studies did not demonstrate a relationship between **phosphorus** and **amount** of land retirement.

West Fork Beaver Creek is an important local resource and has a high profile among recreational users, especially kayakers. (The high resource quality, visibility to Minnesota recreationists, and on-going data collection at this site, make it ideal for this investigation. As it is part of the HCWP work area, this effort will have cost-sharing assistance for Best Management Practices (BMPs) available. Hawk Creek Watershed Project has noted that phosphorus concentrations have decreased in West Fork Beaver Creek over the past 10 years, coinciding with the increase in land retirement through the Reinvest in Minnesota (RIM) program and Conservation Reserve Enhancement Program (CREP). Renville County, which includes most of the West Fork Beaver Basin, has the greatest number of acres enrolled in the RIM program in the State of Minnesota, for the longest duration (most of the easements are perpetual in duration).

3. Hypothesis

The hypothesis of this research is that reductions in stream phosphorus concentrations are related to the **length of time** that the surrounding land has been in retirement. In other words, a comparison of the average age of land retirement contracts in the West Fork Beaver Creek watershed will be inversely related to phosphorus concentration in the West Fork Beaver Creek watershed.

Confirming this hypothesis would be important to BWSR management decisions and policy of prioritizing perpetual easements over limited duration easements, and may encourage more participation. This also will be useful to BWSR management for setting priorities and providing for responsible use of taxpayer dollars.

4. Methodology

Activity 1: Collect water samples to evaluate existing data from multiple sources and time periods.

The Hawk Creek Watershed Project will assist the U.S. Geological Survey in the collection of environmental samples during 2011-12. In addition, quality-assurance samples will be collected by U.S. Geological Survey personnel. Field values for water temperature, specific conductance, pH, and dissolved oxygen will be recorded at the time of sampling. Samples will be sent to the Minnesota Valley Testing Lab and the U.S. Geological Survey National Water Quality Laboratory for nutrient analyses.

The West Fork Beaver Creek has been the site of several recent research studies and monitoring efforts. An aspect in studies that use existing data that is often overlooked is an evaluation of the field and laboratory techniques and methods used. To provide sound results and address the hypothesis effectively, an evaluation of the differences in techniques is critical. Without this type of quality-control data, the water-quality of West Fork Beaver Creek cannot be interpreted adequately because errors associated with the sample data are unknown. Field and laboratory replicates will be collected to ensure that current field and laboratory techniques are comparable to previous methods and techniques. Results from Minnesota Valley Testing Lab will be compared in order to verify performance standards. Replicate samples will be sent the U.S. Geological Survey National Water-Quality Laboratory. Replicate error for the study period will be calculated using relative percentage differences (see Christensen and others, 2009). The environmental samples will provide a longer data set in which to assess the effects of land retirement and the quality-control samples will offer continued assurance that the data sets are comparable. The relative percentage difference (error) will be used to evaluate approximately 10 years of existing data.

Activity 2: Perform geographic spatial analysis of historical RIM participation, summarize documentation and statistical analysis of landscape patterns of RIM participation, and write a final report

Land retirement history will be compared to existing U.S. Geological Survey and Hawk Creek Watershed Project phosphorus data from West Fork Beaver Creek. The phosphorus data will be compared to existing RIM and CREP contract data to determine length of time acres have been enrolled in the program. The West Fork Beaver Creek watershed provides a unique opportunity to do this type of evaluation because very few acres have been taken out of land retirement and many of the contracts are perpetual easements. A geographic information system (GIS)

coverage will be used to complete statistical analyses and to relate length of time to potential phosphorus reduction.

Stream conditions, including total phosphorus concentrations, are influenced by interactions among many physical and chemical factors. Therefore, in addition to comparing phosphorus to the length of time land has been in retirement, other watershed, riparian, and in-stream factors will be summarized and considered. A recently approved U.S. Geological Survey report (Christensen and others, in press) examined 82 watersheds in the Minnesota River Basin and the relation of phosphorus and other stream conditions to environmental factors. A similar approach, using multivariate statistical analysis, will be used for this study. This will allow the researchers to identify other factors that influence total phosphorus. This also will allow agencies and land managers to put land retirement into perspective with regard to the broader picture of interdependent systems.

5. Results and Deliverables

Activity 1: Collect water samples to evaluate existing data from multiple sources and time periods

The Hawk Creek Watershed Project, with the help of USGS personnel, will collect and analyze 12 samples over 2 years to increase the length of the water-quality record and for quality-assurance purposes. The outcome of Activity 1 will be a quality-assured data set for use in Activity 2.

Activity 2: Perform geographic spatial analysis of historical RIM participation, summarize documentation and statistical analysis of landscape patterns of RIM participation, and write a final report

A student will be hired by the USGS to complete a geographic analysis of the RIM. The USGS will complete statistical analyses. A peer-reviewed report documenting results benefits of easements will be completed. A report will document phosphorus reduction in the West Fork Beaver Creek and the history of land retirement in the RIM programs in the basin. The report will be the basis for outreach activities including presentations to BWSR and local governments, fact sheets, and workshops in order to explain results of participation the RIM program.

6. Timetable

| Outcomes – Activity 1 | Completion Date |
|--|------------------------|
| 1. <i>Evaluate Minnesota Valley Testing Lab performance standards</i> | 9-30-2011 |
| 2. <i>Collect samples and analyze for phosphorus and other nutrients</i> | 9-30-2012 |
| Outcomes – Activity 2 | Completion Date |
| 1. <i>Database of RIM acres and analysis of years in program</i> | 6-30-2012 |
| 2. <i>Statistical interpretation of RIM and phosphorus concentrations</i> | 12-30-2012 |
| 3. <i>Draft report provided to the LCCMR quantifying benefits of easements</i> | 3-30-2013 |

7. Budget

2011-2013 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET 3 years

| BUDGET ITEM | AMOUNT |
|---|------------------|
| Contracts: USGS - Hydrologist, 20%FTE, 30% fringe, 3 years | \$64,896 |
| USGS - GIS Student, 30%FTE, 30% fringe, 3 years | \$39,424 |
| USGS - Hydrologic Technician, 5%FTE, 30% fringe, 2 years | \$8,112 |
| USGS - GIS specialist & water-quality specialist, 5%FTE, 30% fringe, 1 year | \$6,354 |
| Contracts: Minnesota Valley Testing, Nutrient analysis and sample shipping costs (contract through Hawk Creek Watershed Project) | \$1,000 |
| Contracts: USGS National Water-Quality Lab | \$ 494 |
| Contracts: USGS publishing network, editing, printing, illustrations | \$4,000 |
| Equipment/Tools/Supplies: Sample bottles, analytical blank water, filters, preservatives, ice | \$400 |
| Travel: Travel to sampling site. \$0.55 per mile, no per diem | \$220 |
| Additional Budget Items: Fedex of samples to National Water Quality Laboratory | \$100 |
| TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST | \$125,000 |

V. OTHER FUNDS

| SOURCE OF FUNDS | AMOUNT | Status |
|---|---------------|---------------|
| Other Non-State \$ USGS 40/60 matching funds | \$84,000 | Pending |
| Other State \$ Being Applied to Project During Project Period: | 0.00 | |
| In-kind Services During Project Period: BWSR hydrologist, project oversight, communications, presentations, report writing | \$20,000 | |
| Remaining \$ from previous ENRTF Appropriation | 0.00 | |
| Funding history: ML 2005, First Special Session, [Chap.1], Art. 2, Sec. [10], Subd. 7(c) and ML 2007, [Chap. HF 293], Sec.[2]. Subd. 5(c). | \$575,000 | |

8. Credentials

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

Experience:

Eric Mohring has a BS in geology from Princeton University and an MS in hydrogeology from the University of Minnesota. He is a Licensed Professional Geologist in Minnesota and has 23 years 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, 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 will include project over-sight, technical assistance, report review, and outreach.

Victoria Christensen, Hydrologist, United States Geological Survey

Experience:

Victoria Christensen has a BA in management from Hamline University and a BS in geology and MS in water resources from the University of Kansas. She is currently a project chief for the U.S. Geological Survey, Minnesota Water Science Center. She has 18 years of work experience in the fields of ground water and water quality. Her experience includes managing several research projects monitoring agricultural basins. She has served as project chief on 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 this proposal will include sampling design, statistical analysis, data review and compilation, report preparation, and outreach.

Cory H. Netland, Coordinator, Hawk Creek Watershed Project

Experience:

Cory Netland has a BS in biology from the University of Minnesota-Duluth and is currently the Coordinator of the Hawk Creek Watershed Project. He has 7 years of work experience in the field of surface water-quality improvement. His experience includes enrollment and maintenance of Conservation Reserve Program (CRP) and Reinvest in Minnesota (RIM) lands while working for two Soil and Water Conservation Districts. Current duties include the management of 10 grants that the Watershed Project currently has open. Also, all grant reporting, reimbursement requests, modifications, and applications are performed by Mr. Netland. Responsibilities for this proposal will include oversight of physical collection of water samples, assistance with data collection, and outreach.

Dissemination and Use

The findings of this research will be disseminated widely through a report in the form of a U.S. Geological Survey or a journal article. The results will also be shared with watersheds and counties that may benefit from an understanding of how land retirement affects phosphorus concentrations.