

2005 Project Abstract

For the Period Ending June 30, 2008

PROJECT TITLE: Effects of Land Retirement on the Minnesota River

PROJECT MANAGER: Victoria Christensen

AFFILIATION: U.S. Geological Survey

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FUNDING SOURCE: Minnesota Environment and Natural Resources Trust Fund

LEGAL CITATION: ML 2005, First Special Session, [Chap.1], Art. 2, Sec.[10], Subd. 7(c).

APPROPRIATION AMOUNT: \$ 300,000

Overall Project Outcome and Results

Three watersheds in the Minnesota River basin were selected to study effects of agricultural land retirement on stream quality. Site selections were based on similarities in hydrology, land use, soil type, and other characteristics and differences in land retirement percentages. Water samples were collected from 2005-2007 and analyzed for field measurements, nutrients, and sediment. Streamflow and continuous water-quality data were collected and disseminated (<http://waterdata.usgs.gov/nwis/mn/rt>). Biological sampling was conducted in August 2006 and 2007. The South Branch Rush River (representing little to no land retirement) had substantially higher nitrogen concentrations (mean=14.3 mg/L) than Chetomba Creek (mean= 11.3 mg/L) and West Fork Beaver Creek (mean=8.5 mg/L), watersheds with more riparian land retirement. Total phosphorus was highest (mean=0.26 mg/L) in West Fork Beaver Creek and lower in Chetomba Creek (mean=0.15 mg/L) and South Branch Rush River (mean=0.16 mg/L). A second monitoring site was established in Chetomba basin, downstream from substantial riparian land retirement. Nitrite plus nitrate, total nitrogen, and total phosphorus were lower for the downstream monitoring site, which may indicate that water-quality improved due to land retirement. Fish data indicate better resource quality for West Fork Beaver Creek than other streams likely due to several factors including habitat quality, food resources, and dissolved oxygen characteristics. Index of biotic integrity scores increased as local land-retirement percentages (50-and 100-ft buffers) increased. Information from this study can be used to evaluate land retirement programs for improving water quality.

Additional work will continue at these sites under another USGS/BWSR project funded through LCCMR and USGS (ML2007, [Chap. HF 293], Sec. [2], Subd. 5(c)). Biological data collected from these watersheds will be compared to existing data collected across the Minnesota River basin and GIS coverages of land retirement, allowing the results from this study to extend to other sites in the Minnesota River basin and address the relation of retired land characteristics and biological integrity.

Project Results Use and Dissemination

The streamflow and continuous, in-stream water-quality data for Chetomba Creek, West Fork Beaver Creek, and South Branch Rush River was disseminated to the public in real-time through the USGS National Water Information Website at <http://waterdata.usgs.gov/nwis/mn/rt>. In addition, the following products or presentations were given:

1. A poster presentation, *Effects of Land Retirement on Three Streams in the Minnesota River Basin*, was given to attendees of the Minnesota Water 2006 and Annual Water Resources Joint Conference at the Earl Brown Center, Brooklyn Center, Minn. On October 24-25, 2006 by Chad R. Anderson, Victoria G. Christensen, and Kathy E. Lee.
2. An informal presentation was held on July 11, 2007 at the Muetzel Farm in the Minnesota River basin to discuss the project with LCCMR, BWSR, local agencies and land owners. Jim Stark,

USGS, provided to attendees a hand-out on how we are collecting the data, preliminary results, and analysis.

3. The presentation, *Effects of Agricultural Land Retirement on Quality of Streams of the Minnesota River Basin*, was given and an abstract published for the Soil and Water Conservation Society, Rocky Mountain Rendezvous II on July 25, 2007 by V.G.Christensen and K.E. Lee.
4. A presentation was given at the 2008 AWRA Summer Specialty Conference in Virginia Beach, Virginia on July 1, 2008. A proceedings paper also was published and provided to LCCMR (Christensen, V.G., and Lee, K.E., 2008, *Effects of Agricultural Land Retirement in the Minnesota River Basin*, in proceedings of the American Water Resources Summer Specialty Conference, June 30-July 2, 2008, Virginia Beach, VA, 6 p.).

Future presentations scheduled include a field tour in Olivia, Minn. hosted by the Board of Water and Soil Resources and the Renville Soil and Water Conservation District on August 27, 2008. A hand-out will be prepared and an informal presentation will be prepared. Additionally, an abstract has been accepted for a presentation at the Minnesota Water 2008 and Annual Water Resources Joint Conference in October 2008. The focus of this presentation will be the benefits of continuous water-quality monitoring.

LCMR 2005 Work Program Final Report

Date of Report: August 15, 2008

LCCMR 2005 Work Program Final Report

Date of Work program Approval: June 14, 2005

Project Completion Date: June 30, 2008

I. PROJECT TITLE: Effects of Land Retirement on the Minnesota River

Project Manager: Victoria Christensen

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Location: Minnesota River Basin

Total Biennial LCMR Project Budget:	LCMR Appropriation:	\$ 300,000
	Minus Amount Spent:	\$ 300,000
	Equal Balance:	\$ 0
	Matching Funds	\$ 281,711

Legal Citation: ML 2005, First Special Session, [Chap.1], Art. 2, Sec.[10], Subd. 7(c).

Appropriation Language: 7(c) Effects of Land Retirements on the Minnesota River \$300,000. \$150,000 the first year and \$150,000 the second year are from the trust fund to the Board of Water and Soil Resources for a cooperative agreement with the U.S. Geological Survey to evaluate effects of retired or set-aside agricultural lands on the water quality and aquatic habitat of streams in the Minnesota River Basin in order to enhance prioritization of future land retirements. This appropriation must be matched by an equal amount of non-state money. This appropriation is available until June 30, 2008, at which time the project must be completed and final products delivered, unless an earlier date is specified in the work program.

II. and III FINAL PROJECT SUMMARY: Three watersheds in the Minnesota River basin were selected to study effects of agricultural land retirement on stream quality. Site selections were based on similarities in hydrology, land use, soil type, and other characteristics; and differences in land retirement percentages. Water samples were collected from 2005-2007 and analyzed for field measurements, nutrients, and sediment. Streamflow and continuous water-quality data were collected and disseminated (<http://waterdata.usgs.gov/nwis/mn/rt>). Biological sampling was conducted in August 2006 and 2007. The South Branch Rush River (representing little to no land retirement) had substantially higher nitrogen concentrations

(mean=14.3 mg/L) than Chetomba Creek (mean= 11.3 mg/L) and West Fork Beaver Creek (mean=8.5 mg/L), watersheds with more riparian land retirement. Total phosphorus was highest (mean=0.26 mg/L) in West Fork Beaver Creek and lower in Chetomba Creek (mean=0.15 mg/L) and South Branch Rush River (mean=0.16 mg/L). A second monitoring site was established in Chetomba basin, downstream from substantial riparian land retirement. Nitrite plus nitrate, total nitrogen, and total phosphorus were lower for the downstream monitoring site, which may indicate that water-quality improved due to land retirement. Fish data indicate better resource quality for West Fork Beaver Creek than other streams likely due to several factors including habitat quality, food resources, and dissolved oxygen characteristics. Index of biotic integrity scores increased as local land-retirement percentages (50- and 100-ft buffers) increased. Information from this study can be used to evaluate land retirement programs for improving water quality.

Additional work will continue at these sites under another USGS/BWSR project funded through LCCMR and USGS (ML2007, [Chap. HF 293], Sec. [2], Subd. 5(c)). Biological data collected from these watersheds will be compared to existing data collected across the Minnesota River basin and GIS coverages of land retirement, allowing the results from this study to extend to other sites in the Minnesota River basin and address the relation of retired land characteristics and biotic integrity.

IV. OUTLINE OF PROJECT RESULTS: Minnesota Governor Tim Pawlenty has requested funds for retiring an additional 100,000 acres of agricultural lands (currently 200,000 acres are included) to improve water quality and aquatic biology in Minnesota's streams and rivers. There are no existing state or federal programs to evaluate the effects of land retirement (for example, the Conservation Reserve Enhancement Program, CREP), or large-scale best-management practices (BMPs), on water quality and aquatic biology. Furthermore, the efficacy of prioritizing retired lands near streams is unknown. There have been several previous analyses of the effects of small-scale agricultural BMPs, such as crop-residue management and conservation tillage. Whereas field-scale agricultural BMPs and agricultural practice changes have shown promise in reducing non-point sources, a basin-scale analysis of current land-use practices was needed. This effort complements existing small-scale studies and provides a holistic evaluation on a watershed scale. This cohesive analysis, which addresses the effects of land retirement and effective locations for retired lands in a watershed, complements studies of small-scale agricultural practices and provides the basis for evaluating the combined effects of large and small-scale programs intended to improve environmental water quality.

During 2006-2007, streamflow was collected continuously in the Chetomba Creek basin, West Fork Beaver Creek basin, and South Branch Rush River basin. Streamflow during 2006 was higher for all sites than in 2007, which was a very low-flow year. Continuous in-stream water-quality data also were collected during 2006-2007. In-stream parameters included temperature, dissolved oxygen, pH, specific conductance, and turbidity. Fifty-five samples were collected and analyzed for nitrite plus nitrate, total nitrogen, total phosphorus, and other nutrients. Generally, nitrogen concentrations decreased with increasing land retirement percentages. Additional results of these chemical analyses are given in the attached progress report. Twenty-three samples were collected and analyzed for chlorophyll-a. Chlorophyll-a

was substantially higher at West Fork Beaver Creek than at other sites. Fish and aquatic biological samples were collected in the three basins. IBI scores were calculated from this data and results indicate that IBI scores increase with increasing local (50- and 100-ft buffers) land retirement percentages.

There were some changes in project expenditures from the original budget detail (attachment A). The most substantial difference was that more funds were spent on the collection of in-stream water-quality parameters, whereas fewer funds were spent on manual sample collection and analysis. There is a rich data set available from the continuous water-quality monitors, resulting in substantial dissolved oxygen data that will be used for metabolism analysis. A paper including stream metabolism will be published at a later date, using the remaining matching funds provided by the USGS.

A progress report was prepared (attached) that quantifies the effects of agricultural land-retirement programs on reductions in non-point nutrient and sediment inputs and changes in aquatic ecosystem integrity. Data from this analysis can be used by others to calibrate and verify current water-quality models. Data also can be used to verify information provided by local agencies, through the interagency *eLINK* Program, to estimate the success of non-point pollution control programs. In addition, the establishment of sampling sites with automated samplers and stream-flow gages can provide the infrastructure for future evaluations of BMPs in these watersheds.

Result 1: Selection of sites and streamgaging

Description: The effectiveness of land-retirement in improving stream-water quality and aquatic biological conditions is expected to be significantly related to how close retired lands are to streams and by the erodibility of soils in a watershed. As originally proposed, this study involved selection, study, and instrumentation of six watersheds from combinations of three levels of land-retirement acreages and two soil-runoff conditions. Watersheds were to be classified into three groups: 1) those with large proportions of the lands in retirement adjacent to streams, 2) those with a large proportion of upland lands in land retirement, and 3) those with little or no retirement acreage. The influence of soil runoff, on inputs to nutrients and sediment delivered to streams was to be tested in areas with both high and low runoff potential.

The revised study design required a reduction in scope as a result of lower funding. The revised design focused on three watersheds with fine-grained (heavy) soils that make up most of the Minnesota River watershed. A follow-up study, in subsequent years, could focus on watersheds with soils of different texture and therefore runoff characteristics. In addition, this revised study design places additional emphasis on assessing and understanding the significance of biological conditions and physical characteristics of the stream channels in the watersheds being studied. Results from previous studies were used to co-locate the selected basins in areas where historical data exist. These previous studies include the Minnesota River Assessment Project (MRAP) and biological reconnaissance studies conducted by the USGS and MPCA. By using data from previous studies in the historical evaluations of conditions in the

watersheds, investigators were able to gain insight on changes in historical stream quality and aquatic biological conditions.

Watersheds were monitored for suspended sediment, nutrients, aquatic biological conditions, and habitat conditions. Some samples were collected during runoff events when the majority of sediment is being transported and to more accurately determine loads of nutrients and sediment. The ecosystem approach of this study includes detailed water chemistry along with physical, hydrologic, and biological (invertebrates and fish) components. The results can be linked to eLINK (Board of Water and Soil Resources) calculations. The project was leveraged with a current USGS project that analyzes landscapes data in the Midwest by providing ancillary information needed to select appropriate watersheds.

The approach depended on our ability to identify retired lands within individual watersheds that fit the design criteria outlined in the preceding paragraph. The original sampling design was altered in 2006, by adding a secondary site in Chetomba Creek basin (Judicial Ditch No. 1), co-located with a sampling and streamgaging site operated by the Hawk Creek Watershed Project. In addition, it was difficult to find basins with substantial upland land retirement that fit the design criteria. Therefore, analyses of watersheds were based on a range of the total amount of retired land in a watershed, in addition to proximity of retired land to streams.

The design was based on existing GIS data as well as Minnesota Board of Water and Soil Resources data, STATSGO data (U.S. Department of Agriculture, 1991), consultation with the U.S. Fish and Wildlife Service, the USDA Natural Resources Conservation Service, Minnesota Department of Agriculture, local soil and water districts and direct observation. Each watershed had a gaging station with automated water samplers. A total of three watersheds were studied.

Summary Budget Information for Result 1:	LCMR Budget	\$ 105,943
	Minus Amount Spent	\$ 104,826
	Balance	\$ 1,117
	Matching Funds	\$ 113,858

Completion Date: September, 2007

Final Report Summary: Sites were selected and streamgaging equipment was installed at 3 sites. A problem that was encountered during the site selection process was that current CRP data was not available in a GIS coverage. Additionally, there was not a site to represent primarily upland set-aside conditions because only two basins had substantial amounts (Hawk, LeSueur) and these two basins do not have similar hydrologic conditions (i.e. many upland lakes in Hawk) and have other complicating factors (i.e. wastewater discharge into Hawk Creek). Sites selected for this project are: Chetomba Creek near Renville (05314510); West Fork Beaver Creek at 320 St. near Bechyn (053165290); and South Branch Rush River at Co. Rd. 63 near Norseland (05326189). In addition, streamflow is being monitored by Hawk Creek Watershed Project at a fourth site (Judicial Ditch 1 at County Road 17 near Maynard, site 05313930).

Current CRP data was acquired from the FSA in 2007. This data has been used to calculate the percentage of land in CRP and other set-aside programs for each basin. In addition, GIS coverages were created which quantify the amount of land retired within 50-, 100-, 200-, and 300-ft of the stream—identified as critical buffer distances (Emmons and Olivier, 2001).

Streamflow was variable during 2006 and 2007. Several storm events occurred in the 3 basins during the study period; however, 2007 was a very low flow year. Streamflow can have a significant effect on water-quality (discussed under Result 2). Dissemination of data from the USGS sites is available to the public at <http://waterdata.usgs.gov/mn/nwis/rt> by clicking on the streamflow table and selecting one of the three sites. Additional flow data will be collected during 2008 (partially funded under ML2007, [Chap. HF 293], Sec. [2], Subd. 5(c)).

Result 2: Water quality and aquatic biological monitoring

Description: During the major runoff months of April through August (2006 and 2007), two types of water-quality samples and habitat, invertebrate and fish information were collected at each site. Water-quality data consisted of routine samples and samples collected during high-flow runoff. Water-quality measurements included in-stream continuous parameters, such as dissolved oxygen and manually collected water-quality samples. Water quality samples were analyzed for nutrients, chlorophyll-a, and suspended sediment. During storm runoff events, some of the samples were collected with automatic samplers.

Summary Budget Information for Result 2:	LCMR Budget	\$ 126,225
	Minus Amount Spent	\$ 133,783
	Balance	\$ - 7,558
	Matching Funds	\$ 122,074

Completion Date: September, 2007

Final Report Summary: The first set of water-quality samples were collected in October 2005 (Water Year 2006) at the 3 USGS sites and the Hawk Creek Watershed Project site. The water samples were analyzed for major ions, nutrients, wastewater compounds, organic carbon, chlorophyll, suspended solids, suspended sediment concentration, and field parameters (dissolved oxygen, turbidity, pH, temperature, and specific conductance). All results from the National Water Quality Laboratory have been released and are on file at the USGS office. Results of the nutrient sampling are described here briefly. The South Branch Rush River (representing little to no land retirement) had substantially higher nitrogen concentrations (mean=14.3 mg/L) than Chetomba Creek (mean= 11.3 mg/L) and West Fork Beaver Creek (mean=8.5 mg/L), watersheds with more riparian land retirement. Total phosphorus was highest (mean=0.26 mg/L) in West Fork Beaver Creek and lower in Chetomba Creek (mean=0.15 mg/L) and South Branch Rush River (mean=0.16 mg/L).

Routine samples also were collected at the Hawk Creek Watershed site in the Chetomba basin. Initial results show some nutrient concentrations are lower at the

downstream Chetomba site. The area between these two sites has a substantial amount of riparian CRP.

Autosamplers were installed at Chetomba, West Fork Beaver, and South Branch Rush sites in March 2006. Auto samples were collected during at least 3 precipitation events during spring 2006 and 2007. The autosampler occasionally malfunctioned; at these times a field crew collected manual samples. Precipitation events have been more significant at some sites than at others, making comparisons difficult.

Biological sampling at the 3 USGS sites was conducted in August of 2006 and 2007. Sampling included fish identification, physical habitat characterization, benthic macroinvertebrate and periphyton collections, measurements of dissolved oxygen, and phytoplankton chlorophyll *a*.

Some additional dissolved oxygen, nutrient, and biological data were collected from the West Fork Beaver and South Branch Rush River as part of a USEPA/USGS project. This additional data will be available for analysis at no cost to this USGS/BWSR/LCCMR project and may provide some insight into the relation between daily dissolved oxygen fluctuation and chlorophyll-*a* concentrations in a nutrient-rich environment. Water-quality monitors continue to be maintained and data from selected USGS sites are available on-line at <http://waterdata.usgs.gov/mn/nwis/rt>.

Result 3: Data analysis, synthesis, and report writing

Description: Data generated by this effort are available to be used by others for calibration and verification of simulations of changes in water quality resulting from changes in land-use activities. The data may also be used to verify the algorithms used by local units of government in reporting to document the success of individual non-point pollution control programs through eLINK. The establishment of fully instrumented sampling sites with automated samplers and streamflow gages also can provide the infrastructure for future evaluations of other BMPs in watersheds. This resulted in a progress report that identified the benefits of watershed-level land-use programs to reduce non-point source nutrient and sediment inputs and improve stream habitat. The final report (which will be published in September 2009, after another year of data is collected) will compare sediment and nutrients and aquatic biological conditions in small watersheds with differing set-aside lands.

Summary Budget Information for Result 3:	LCMR Budget	\$ 67,832
	Minus amount spent	\$ 61,391
	Balance	\$ 6,441
	Matching Funds	\$ 45,779

Completion Date: June 30, 2008

Final Report Summary: The streamflow and continuous water-quality data from the 3 selected sites is being disseminated through the USGS website (<http://waterdata.usgs.gov/nwis/mn/rt>). In addition, the following products were prepared or presentations given:

1. Presentation of results to date was provided to USGS cooperators and others interested in nutrient studies at the USGS Nutrient work group meeting in May 2006
2. A poster presentation, *Effects of Land Retirement on Three Streams in the Minnesota River Basin*, was given to attendees of the Minnesota Water 2006 and Annual Water Resources Joint Conference at the Earl Brown Center, Brooklyn Center, Minn. on October 24-25, 2006 by Chad R. Anderson, Victoria G. Christensen, and Kathy E. Lee.
3. An informal presentation was held on July 11, 2007 at the Muetzel Farm in the Minnesota River basin to discuss the project with LCCMR, BWSR, local agencies and land owners. Jim Stark, USGS, provided to attendees a hand-out on how data was collected, preliminary results, and analysis.
4. The presentation, *Effects of Agricultural Land Retirement on Quality of Streams of the Minnesota River Basin*, was given and an abstract published for the Soil and Water Conservation Society, Rocky Mountain Rendezvous II on July 25, 2007 by V.G.Christensen and K.E. Lee.
5. A presentation was given at the 2008 AWRA Summer Specialty Conference in Virginia Beach, Virginia on July 1, 2008. A proceedings paper also was published and provided to LCCMR (Christensen, V.G., and Lee, K.E., 2008, *Effects of Agricultural Land Retirement in the Minnesota River Basin*, in proceedings of the American Water Resources Summer Specialty Conference, June 30-July 2, 2008, Virginia Beach, VA, 6 p.).

Future presentations scheduled include a field tour in Olivia, Minn. hosted by the Board of Water and Soil Resources and the Renville Soil and Water Conservation District on August 27, 2008. A hand-out will be prepared and an informal presentation will be prepared. Additionally, an abstract has been accepted for a presentation at the Minnesota Water 2008 and Annual Water Resources Joint Conference in October 2008. The focus of this presentation will be the benefits of continuous water-quality monitoring. The final report, submitted with this Work Plan is an unpublished progress report. This report is for LCCMR review, not to be cited or released to the public. The information from this project will then be combined with the enhancement funded under the 2007 Trust Fund (Legal Citation: ML 2007, [Chap. HF 293], Sec. [2], Subd. 5(c)) into a published report. The report is scheduled for publication in September 2009.

V. TOTAL LCMR PROJECT BUDGET:

All Results: Personnel: \$	186,712
All Results: Equipment: \$	53,568
All Results: Development: \$	0
All Results: Acquisition: \$	0
All Results: Other: \$	59,720

TOTAL LCMR PROJECT BUDGET: \$ 300,000

Explanation of Capital Expenditures Greater Than \$3,500: No single capital expenditure over \$3,500. The cost of a stage sensor is \$3495 (model H350XL/355). One stage sensor will be purchased for each of the three sites.

VI. Past, Present, and Future Spending: Some data analysis and report writing will continue with USGS matching funds. A presentation and paper is being prepared for the Minnesota Water 2008 Conference. Future publications include a USGS Scientific Investigations Report, which includes the data collected through the LCCMR/USGS/BWSR project (ML 2007, [Chap. HF 293], Sec.[2], Subd. 5(c)).

VII. OTHER FUNDS & PARTNERS:

A. Project Partners: The USGS, Minnesota Board of Water and Soil Resources, and others, were partners in the effort. The USGS will provide project design, management and evaluation, equipment, personnel, and half of the costs (Federal matching funds) for this project, through a joint funding agreement with the Board of Soil and Water Resources (Board). The Board and other agencies will provide in-kind support and may provide supplemental funding. The Hawk Creek Watershed Project is providing data and assistance for the Judicial Ditch 1 and Chetomba Creek sites. The Rush River CWP Project has agreed to provide data and assistance in the collection of rainfall event samples.

B. Other Funds being Spent during the Project Period: Because this project is a good fit with local and national science priorities of the USGS, federal matching funds were available to be provided for this effort.

C. Required Match (if applicable): \$300,000 in Federal matching funds. These matching funds will provide for personnel expense for science support staff, administrative staff, facilities costs, cost center and bureau assessments and indirect costs.

Detail is provided in Attachment A.

D. Past Spending: none

E. Time: The project will required three years to complete. The first year was consumed with site selection and gage and sampling equipment installation.

Sampling commenced in fall of 2005. The sites were sampled through September of 2007.

- VIII. DISSEMINATION:** Products of this study will be publicly available. A USGS Scientific Investigations Report will be completed at the end of the project (combined with the results from the project enhancement and due September 30, 2009). Real-time streamflow and water-quality information are available on the World Wide Web at URL <http://waterdata.usgs.gov/nwis>.
- IX. LOCATION:** Minnesota River basin
- X. REPORTING REQUIREMENTS:** Periodic work program progress reports were submitted every six months beginning in December 2005, and ending with this final work program report.
- XI. RESEARCH PROJECTS:** A provisional report (unpublished) is attached. This report has not yet received approval for publication from the USGS. The report is subject to revision and should not be referenced or released.

Attachment A: Budget Detail for 2005 Projects

Proposal Title: Effect of Land Retirement on the Minnesota River Proposal # (A-01)

Project Manager Name: Jim Stark/Victoria Christensen

LCMR Requested Dollars: \$ 300,000 with an equivalent amount from Federal matching funds

- 1) See list of non-eligible expenses, do not include any of these items in your budget sheet
- 2) Remove any budget item lines not applicable

2005 LCMR Proposal Budget	Result 1 Budget:	Amount Spent (6/30/08)	Balance (6/30/08)	Result 2 Budget:	Amount Spent (6/30/08)	Balance (6/30/08)	Result 3 Budget:	Amount Spent (6/30/08)	Balance (6/30/08)	TOTAL FOR BUDGET ITEM
Effects of Land Retirement on the Minnesota River	<i>Selection of sites and streamgaging</i>			<i>Water quality and aquatic biological monitoring</i>			<i>Data Analysis, Synthesis and Reporting</i>			
BUDGET ITEM										
PERSONNEL: Staff Expenses, wages, salaries – Project Chief	\$17,000	\$17,000	\$0	\$0	\$0	\$0	\$50,000	\$45,359	\$4,641	\$67,000
PERSONNEL: Staff Expenses, wages, salaries – Support Staff				\$0	\$0	\$0	\$4,267	\$4,267	\$0	\$4,267
PERSONNEL: Staff Expenses, wages, salaries – Geographer	\$18,275	\$18,275	\$0	\$0	\$0	\$0	\$1,175	\$1,175	\$0	\$19,450
PERSONNEL: Staff Expenses, wages, salaries – Support Hydrologist/Aquatic Biologist	\$2,000	\$2,000	\$0	\$24,080	\$24,080	\$0	\$6,500	\$6,500	\$0	\$32,580
PERSONNEL: Staff Expenses, wages, salaries – Hydrologic Technician/Student Help				\$16,425	\$16,425	\$0			\$0	\$16,425
PERSONNEL: Staff Expenses, wages, salaries – Hydrologic Technician	\$2,400	\$2,400	\$0	\$5,790	\$5,790	\$0	\$0		\$0	\$8,190
PERSONNEL: Staff Expenses, wages, salaries – Hydrologic Technician	\$32,500	\$31,383	\$1,117	\$6,300	\$6,300	\$0	\$0		\$0	\$38,800
Equipment / Tools:Gage house and equipment	\$10,215	\$10,215	\$0	\$0	\$0	\$0			\$0	\$10,215
Equipment/Tools: stage sensor and DCP	\$19,053	\$19,053	\$0			\$0			\$0	\$19,053
Equipment/Tools: WQ monitor rental				\$24,300	\$29,376	-\$5,076				\$24,300
Printing			\$0	\$0	\$0	\$0	\$1,800		\$1,800	\$1,800
WQ monitor supplies (standards, etc)				\$2,754	\$15,701	-\$12,947			\$0	\$2,754
Automated sampler rental				\$5,508	\$2,203	\$3,305			\$0	\$5,508
Lab supplies for integrated sampling				\$2,500	\$2,500	\$0			\$0	\$2,500
Supplies for automated sampling				\$982	\$982	\$0			\$0	\$982
Supplies for biological sampling				\$110	\$278	-\$168			\$0	\$110
Travel expenses in Minnesota	\$4,500	\$4,500	\$0	\$4,738	\$9,456	-\$4,718	\$3,090	\$3,090	\$0	\$12,328
Travel outside Minnesota	\$0		\$0	\$0		\$0	\$1,000	\$1,000	\$0	\$1,000
Analytical costs			\$0	\$32,738	\$17,973	\$14,765			\$0	\$32,738
Postage/Fedex/sample transport				\$0	\$2,719	-\$2,719				\$0
COLUMN TOTAL	\$105,943	\$104,826	\$1,117	\$126,225	\$133,783	-\$7,558	\$67,832	\$61,391	\$6,441	\$300,000

Other project costs to be covered by the USGS:

Personnel: Support Staff (Distributed Direct)	\$45,555	\$46,672	-\$1,117	\$40,199	\$53,892	-\$13,693	\$23,066	\$24,400	-\$1,334	\$108,820
Personnel: Project Chief							\$0	\$4,641	-\$4,641	
Facilities	\$10,594	\$10,594	\$0	\$9,349	\$10,571	-\$1,222	\$6,357	\$1,869	\$4,488	\$26,300
Cost Center Assessment	\$40,523	\$40,523	\$0	\$35,758	\$41,435	-\$5,677	\$24,314	\$12,128	\$12,186	\$100,595
Bureau Assessment	\$24,314	\$16,069	\$8,245	\$25,383	\$16,176	\$9,207	\$14,588	\$2,741	\$11,847	\$64,285
TOTAL USGS COSTS	\$120,986	\$113,858	\$7,128	\$110,689	\$122,074	-\$11,385	\$68,325	\$45,779	\$22,546	\$300,000
TOTAL PROJECT COST	\$226,929	\$218,684	\$8,245	\$236,914	\$255,857	-\$18,943	\$136,157	\$152,949	-\$16,792	\$600,000