

M.L. 2016, Chp. 186, Sec. 2, Subd. 04s Project Abstract
For the Period Ending June 30, 2021

PROJECT TITLE: Agricultural and Urban Runoff Water Quality Treatment Analysis – Phase II

PROJECT MANAGER: Craig Austinson, Blue Earth County Ditch Manager

AFFILIATION: Blue Earth County Drainage Authority

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FUNDING SOURCE: Environment and Natural Resources Trust Fund

LEGAL CITATION: M.L. 2016, Chp. 186, Sec. 2, Subd. 04s

APPROPRIATION AMOUNT: \$ 105,000

AMOUNT SPENT: \$105,000

AMOUNT REMAINING: \$0

Sound bite of Project Outcomes and Results

The results will be used to implement the most cost effective BMPs and guide future maintenance to maximize the benefits and lifespan of the associated BMPs implemented on public drainage systems. The data can be used to inform larger watershed plans to meet local and state water quality goals.

Overall Project Outcome and Results

Phase I Agricultural and Urban Water Quality Treatment Analysis data shows how combining agricultural best management practices (BMPs) on a public drainage system can significantly improve water quality in an agricultural landscape. Upon the completion of the Phase I report and analysis, the need for continued, and more detailed, monitoring was identified as well as a gap in available information on maintenance recommendations for the BMPs and associated costs.

Phase II analysis refined methodology and findings from targeted site location including Klein Pond, the two-stage ditch, and rate control weir. Monitoring samples were collected during 2016-2017 by graduate students at Minnesota State University – Mankato (MSU) and added to previously collected data in Phase I to develop long-term trends.

A formal report compiled the findings from Phase II. The report outlined the long-term effectiveness of BMPs, maintenance recommendations to ensure functionality and effectiveness of BMPs, and review of BMPs lifetime costs to determine the most cost-effective water quality practices for drainage systems.

The report was published on the ISG website [here](#). The findings were presented at multiple virtual conferences reaching over 125 people. In addition, the report was sent in an email blast to 650+ individuals and was posted to social media to engage a larger audience and direct them to the website for more detailed information on findings.

The long-term study on CD 57 collected 10-years of monitoring data that provides decision makers and professionals with data to make informed decisions on having the greatest success with implementing and maintaining BMPs. Particularly in south-central Minnesota where drained agricultural lands dominate the landscape, a watershed approach to utilizing multi-purpose drainage management will play an integral role in meeting water quality goals. CD 57 can be used as a model for drainage systems and watersheds for implementing multiple BMPs with collaborative efforts from landowners, drainage authorities, county staff, and

agencies. This project highlights the importance of long-term sustainable funding for water quality and resiliency programs targeting implementation of practices on agricultural lands.

Project Results Use and Dissemination

A formal report was developed supplementing the finding created in the Phase I report which summarized the monitoring data, long-term maintenance recommendation, and lifetime cost analysis. The report is posted to the ISG website [here](#). The findings were presented in workshops, conferences, virtual water storage tours, email blasts, posts to ISG's website, and social media threads for drainage staff, county commissioners, watershed district managers, watershed management organizations, landowners, agency staff, non-profit organizations, academics, water resources engineers, and others from Minnesota and Iowa.



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2016 Work Plan – Final Report

Date of Report: August 16, 2021

Final Report

Date of Work Plan Approval:

Project Completion Date: June 30, 2021

PROJECT TITLE: Agricultural and Urban Runoff Water Quality Treatment Analysis – Phase II

Project Manager: Craig Austinson, Blue Earth County Ditch Manager

Organization: Blue Earth County Drainage Authority

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Location:

Blue Earth County Ditch No. 57 (CD 57) within Mapleton and Beauford Townships. This drainage system is within the Le Sueur River Major Watershed (HUC 07020011).

Total ENRTF Project Budget:

ENRTF Appropriation: \$105,000

Amount Spent: \$105,000

Balance: \$0

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 04s

Appropriation Language:

\$105,000 the second year is from the trust fund to the Board of Water and Soil Resources for an agreement with the Blue Earth County Drainage Authority to continue monitoring a model demonstration for storage and treatment options in drainage systems designed to improve agricultural and urban water quality by reducing soil erosion, peak water flows, and nutrient loading. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Agricultural Runoff Water Quality Treatment Analysis- Phase II

II. 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 No. 57 (CD 57) is now a model project in the Le Sueur River Watershed. Phase I showed how combining Agricultural Best Management Practices (BMPs) on a county drainage system can significantly improve water quality in an agricultural landscape. Initial water quality monitoring included collecting real time stage (depth) measurements throughout the ditch system. Initial water quality monitoring results were more successful than anticipated because of the reductions in Total Suspended Solids, Total Nitrogen and Total Phosphorus. Landowners, agencies and nonprofits are requesting more detailed data to further validate original results and to promote ongoing benefits of the BMPs. Table 1 summarizes the initial monitoring of the installed BMPs on the CD 57 System.

BMP	TSS % Reduction	TN % Reduction	TP % Reduction
Surge Pond	25	23	19
Two-Stage Ditch	5	4	10
Rate Control Weir	6	0	6

Phase II monitoring would incorporate the analysis of real-time flow velocity meters and multiple water quality samples taken during each rain event by Minnesota State University – Mankato (MSU). The majority of the monitoring equipment that will be utilized in Phase II will be provided by the Minnesota Department of Agriculture (MDA) and MSU. This equipment has been used in similar monitoring projects for water quality and will provide more data for analysis than the equipment used for Phase I. The same parameters will be analyzed for each BMP as done in Phase I and as shown in Table 1. Table 2 compares the Phase I and Phase II monitoring equipment.

Method Obtained	Phase I (2012-2014)	Phase II (2016-2020)
Flow	Depth Measurements every 5 minutes, flow data interpolated based on hydrologic model and topographic survey (MSU & ISG collected and analyzed)	Real time flow measurements from Area-Velocity Meter (MSU and MDA collection, ISG analyze similar to Phase I), depth measurements will also be taken as done in Phase I by ISG
Water Quality	1 water quality grab sample taken at peak flow after rain event (MSU sampled, MSU & ISG analyzed)	Multiple grab samples taken throughout a rain event with auto sampler (MSU and MDA collection, ISG analyze similar to Phase I)

A similar analysis that was utilized in Phase I is needed to further validate, measure potential backwater effects, and possibly reflect greater reductions than the Phase I results. Based on the results from Phase I, multiple projects, using similar BMPs, have or will be installed in Blue Earth, Martin, Faribault, Watonwan, Nicollet and

Jackson Counties. Continued monitoring to further analyze, validate, and to determine long term effectiveness is needed for the design of future projects. Further monitoring of these systems is also needed to determine a maintenance schedule and budget for these BMPs so they can be as effective as possible.

Phase II monitoring is not a part of regular ditch maintenance, as it solely focuses on the BMPs installed on CD 57. These results are important because they will help maximize the life of each BMP. It will also aid in planning for future projects. Phase I has been used for the following drainage projects:

- Blue Earth CD 28 – Rate Control Weir – to be constructed in 2016
- Blue Earth County CD 34 – Rate Control Weir – to be constructed in 2016
- Blue Earth County JD 38 – Rate Control Weir – Built in 2014
- Martin and Watonwan JD 2 – surge pond and rate control weir – built 2015
- Martin County JD 367 – 30 acre pond – to be built in 2016
- Jackson County JD 46 – Surge Pond – Constructed in 2015
- Jackson County JD 35 – Two Stage Ditch – to be constructed in 2016
- Jackson County JD 30 – Rate Control Weir and Surge Pond – to be constructed in 2016
- Watonwan County JD 13 – Surge Pond – Constructed in 2014 and 2015

Phase II results will be used to plan for future BMP's on county ditch projects throughout Minnesota.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of December 31, 2016:

Monitoring year 2016 focused on the set up and calibration of water quality monitoring equipment. MSU and MDA spent the entire monitoring season setting up equipment, establishing baselines and calibrating so multiple samples would be taken from the flow after a rain event. The calibration of the equipment prevented consistent samples to be obtained after rain events, but a set of baseline flow and water quality samples was established for the next four years of monitoring. This is a common practice performed with the level of equipment that is being utilized for monitoring. Therefore, no monitoring data was collected or provided to ISG for analysis. Blue Earth County anticipates invoicing for monitoring equipment set-up and analysis of data in June 2017.

Project Status as of June 30, 2017:

Similar to the process used during 2016, ISG, MSU and MDA have installed and calibrated the water quality and flow monitoring equipment, measuring both real-time flow velocity and collecting multiple water quality samples during rain events. Additionally, ISG purchased new solar panels, cameras, staff gauges, data loggers, and trail cameras which are being used to collect and interpret the data as well as ensure that the equipment is consistently working effectively. To date in 2017, the team has collected two months of monitoring data. Data collection and analysis will continue through the fall as well long-term through 2020, as outlined in the proposal, during all precipitation events. This monitoring data will then be interpreted and shared with landowners, agencies, and decision makers to evaluate and promote the most cost effective and environmentally beneficial BMPs.

Project Status as of December 31, 2017:

In 2017, the first full year of monitoring and data collection concluded, with equipment being removed at the beginning of November to avoid damage from below freezing temperatures. Throughout the monitoring season, equipment was checked and recalibrated monthly to ensure accuracy of results. During this time, several large (greater than 1 inch) rain events were recorded, providing real-time flow data on the effectiveness of the outlined BMPs during times of more significant precipitation. A mid-season meeting was held with project stakeholders, including MPCA, MDA, MSU, ISG, and Blue Earth County, to review the initial results. However,

final data for the first year is still being analyzed by MSU and has not yet been released. This information should be available in early 2018.

Project Status as of June 30, 2018:

Since the last reporting period, the project team of ISG, MSU, and MDA have installed and calibrated the water quality and flow monitoring equipment, similar to the methods utilized during the 2017 monitoring season. Two site visits have been completed to install equipment, including cameras, staff gauges, and data loggers, with the first month of data collection complete as of June 30. In addition, three new data loggers were purchased to replace three whose batteries were no longer functioning. Site visits and data collection will continue through the fall. MSU is currently in the process of compiling the findings from 2017 data collection, which will then be uploaded to the database on MSU's website and disseminated more broadly upon project completion.

Project Status as of December 31, 2018:

2018 monitoring was completed in October, with results uploaded to the database for inclusion in the final report. Data collection this year was successful, however there were challenges due to large weather events and a beaver dam near one of the gauges that will need to be considered in analyzing water level data for Site 4. Again this year, the project team joined MSU and agency staff for its annual meeting to discuss monitoring efforts and BMP effectiveness. These meetings are extremely helpful in efforts to assess and refine approach and share data. The project is on schedule and will continue in 2019, with the final report finalized in 2020.

Project Status as of June 30, 2019:

Monitoring for this project has concluded, with data from both MSU and ISG being compiled to include in the final report. In addition, MSU's graduate student has finished their thesis and data analysis, combining results from all three years of monitoring. ISG has also begun its analysis of the data and is using it to develop construction best management practices, better understand the long-term effectiveness of BMPs, create maintenance schedules, and conduct a cost/benefit analysis for these practices, which will include construction and maintenance costs as well as water quality benefit.

Project Status as of December 31, 2019:

The project team is working on analyzing and interpreting the four years of monitoring data that was collected. In addition, research is being compiled on other relevant studies focused long-term maintenance, BMP effectiveness, and cost effectiveness. This information has been compiled and a draft report has been circulated for peer review. The final report will be complete this spring.

Project Status as of June 30, 2019:

The final presentations and wrap up including site visits was scheduled for June 2020 as part of a watershed seminar. Due to Covid 19 the June meetings was postponed to August 2020. A majority of the final report had already been completed prior to the postponement.

AMENDMENT REQUEST August 31, 2020: Amendment Approved by LCCMR 10/09/2020

We are requesting an extension for Activity 3: Engagement/Promotion of Practices until June 30, 2021. Due to the current COVID-19 pandemic, plans for workshops and other presentations during the summer months were delayed to a later date, held virtually, or canceled. Our timeline and approach to accommodate social distancing requirements and health regulations. To date, we have presented this information at one virtual conference, ISG's Agricultural Drainage and the Future of Water Quality workshop, held on August 13 and 20. There were over 140 participants registered for the event from Minnesota and throughout the Midwest. In order to fulfill our obligation and fully and properly execute the deliverables outlined in this task, we are requesting an extension to June 30, 2021 to complete this work. Alternate outreach plans currently in place include socially distanced field day, virtually distributed quick fact sheet, blog post, and presenting at conference(s) virtually.

Project Update December 2020:

The analysis of the data collecting, analyzing, and compiling of results is complete. Final work on graphically enhancing the results is taking place to best convey the findings in an easily understandable and visual way. Upon review from the county, landowners, and additional stakeholders, the report will be disseminated and posted on the ISG and Blue Earth County websites for the public to access. The findings from the report were presented at two conferences, the Agricultural Drainage and Future of Water Quality Workshop and the annual Minnesota Association of Watershed Districts (MAWD) Conference. Due to the State's guidelines on COVID-19, both conferences were held virtually. A total of approximately 125 people were in attendance for both presentations.

Amendment Request: September 9, 2021:

Due to recommended safety protocols during the period of time we were planning to do a majority of our engagement and promotion of practices, we are not able to have an in person field day. We request to utilize the funds that were planning for bus rental, tent, chair, tables, etc. for promotion of practices in other ways that allowed us to best complete outcome of the task we outlined in a safe manner. The tasks include development of our website page, email blast creation and development of mailing list, and development of a handout summary.

Overall Project Outcomes and Results:

Phase I Agricultural and Urban Water Quality Treatment Analysis data shows how combining agricultural best management practices (BMPs) on a public drainage system can significantly improve water quality in an agricultural landscape. Upon the completion of the Phase I report and analysis, the need for continued, and more detailed, monitoring was identified as well as a gap in available information on maintenance recommendations for the BMPs and associated costs.

Phase II analysis refined methodology and findings from targeted site location including Klein Pond, the two-stage ditch, and rate control weir. Monitoring samples were collected during 2016-2017 by graduate students at Minnesota State University – Mankato (MSU) and added to previously collected data in Phase I to develop long-term trends.

A formal report compiled the findings from Phase II. The report outlined the long-term effectiveness of BMPs, maintenance recommendations to ensure functionality and effectiveness of BMPs, and review of BMPs lifetime costs to determine the most cost-effective water quality practices for drainage systems.

The report was published on the ISG website [here](#). The findings were presented at multiple virtual conferences reaching of over 125 people. In addition, the report was sent in an email blast to 650+ individuals and was posted to social media to engage a larger audience and direct them to the website for more detailed information on findings.

The long-term study on CD 57 collected 10-years of monitoring data that provides decision makers and professionals with data to make informed decisions on having the greatest success with implementing and maintaining BMPs. Particularly in south-central Minnesota where drained agricultural lands dominate the landscape, a watershed approach to utilizing multi-purpose drainage management will play an integral role in meeting water quality goals. CD 57 can be used as a model for drainage systems and watersheds for implementing multiple BMPs with collaborative efforts from landowners, drainage authorities, county staff, and agencies. This project highlights the importance of long-term sustainable funding for water quality and resiliency programs targeting implementation of practices on agricultural lands.

IV. PROJECT ACTIVITIES AND OUTCOMES:**ACTIVITY 1: *Monitoring of Installed Best Management Practices***

Description: Monitoring of Installed BMPs includes installation of stage data logging equipment and in channel staff gauges as used in the previous years of monitoring. Monthly maintenance is needed for this equipment to ensure its accuracy. Maintenance includes monthly data collection, inspection of monitoring equipment, debris removal from in channel monitoring equipment, and replacement of damaged equipment.

Also included in the monitoring is yearly topographic survey of the BMPs for analysis of their effectiveness and to create a maintenance schedule for the installed BMPs. The topographic survey includes using conventional survey methods to obtain horizontal and vertical locations of all installed BMPs, sediment accumulations, damages or repair areas of each BMP, and identifying exact locations of all monitoring equipment for future analysis.

In addition to the monitoring outlined above, flow and water quality data will be collected by MSU and will be provided to Blue Earth County for additional analysis to determine BMP effectiveness and maintenance needs. This information will be compared to the previous 3 years of monitoring completed in Phase I. Monitoring equipment for this portion was purchased and provided in kind by MDA and MSU and is separate from Activity 1.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 26,500
Amount Spent: \$ 26,500
Balance: \$ 0

Outcome	Completion Date
<p><i>1. 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 maintenance is required for installed BMPs. 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).</i></p>	<p>8/31/2020</p>

Project Status as of December 31, 2016:

Periodic site visits were made to analyze the function of the BMPs and required maintenance. After a large storm event in the fall of 2015, erosion occurred on the rate control weir and required maintenance of the ditch bank and rip-rap. The weir was repaired as part of the warranty period of the CD57 project by the contractor. No topographic survey was conducted on any of the BMPs, as there was no water quality obtained.

Project Status as of June 30, 2017:

In May 2017, new equipment, including staff gauges, data loggers (for measuring water depth), cameras, and solar panels/batteries were installed. Since installation and calibration, the team has conducted two months of monitoring during storm events and information collected has been stored in the computer database. In addition, two site visits have been completed to ensure proper function of the monitoring equipment and address any maintenance needs. Maintenance needs to date have included re-adjusting cameras and staff gauges, clearing debris from staff gauges, and adjustments to the data loggers and control structure mounts. This monthly maintenance is critical to ensuring the data collected is accurate. Monitoring and maintenance will continue throughout the summer and fall.

Project Status as of December 31, 2017:

As outlined in the June 2017 update, monthly monitoring and maintenance continued through October, with field adjustments required for some of the equipment. Water quality data was recorded and uploaded to the computer database by MSU students. However, that data has not been publicly released and is still being

compiled and analyzed. A preliminary report detailing initial results is expected in early 2018. In addition, a sedimentation analysis is planned for Klein Pond to determine the effectiveness of the installed sediment trap, with a topographic survey to be conducted during the winter of 2018, as conditions allow.

**Note: Budget allocation to date has been revised for Activity 1 since the June 2017 report.*

Project Status as of June 30, 2018:

In May 2018, monitoring equipment was installed, using the same monitoring equipment from 2017 except for the three data loggers noted above and replacing staff gauges that were damaged in the previous year. Subsequently, two site visits have been conducted, during which cameras and solar panels were installed as well as some of the staff gauges and data loggers. The water levels were too high during the first visit to install the rest of the equipment. During the second visit, all of the remaining equipment was set up and the project team ensured that all components were working correctly. As of June 30, one month of data has been collected. In addition, a sedimentation analysis for Klein Pond is planned for this year using topographic survey and will be completed by the next reporting period.

Project Status as of December 31, 2018:

The project team has completed the second year of monitoring, with monitoring occurring from May through October. Soil borings were done in the sediment trap on the storage pond to assess long-term sediment collection abilities, with the goal of creating an accurate maintenance schedule for CD 57 and other similar systems.

During a site visit, beaver dams were found on a stretch of open ditch near Site 4. Blue Earth County staff were contacted and the issue was resolved. However, this will need to be taken into account when analyzing water level data for this location.

Monitoring equipment was removed in October for the winter and will be assessed and replaced, as needed, before installation next spring. Of note, large rain events during the monitoring season caused damage to cameras and may need to be replaced for next year.

Project Status as of June 30, 2019:

All monitoring has been complete, as of December 2018. The project team of ISG and MSU are working to compile and analyze the data for the final report. The last field component needed for this phase will be survey work to analyze the accumulation of sediment in Klein Pond. The survey will also analyze the geomorphology of the two-stage ditch. We plan to compare this to the survey completed by Minnesota DNR. These results will then be included as part of the final report. Staff from ISG met with Brooke Hacker, who led MN DNR's study of the effectiveness of two-stage ditches. The survey for both of these sites will be completed late summer/early fall 2019.

Project Status as of December 31, 2019:

In September 2019 survey work was completed for Klein pond and the two-stage ditch. For Klein pond, this information will be used to compare the survey results from Phase 1 of this project and the results will be used to help determine sediment accumulation since construction in order to assess the effectiveness of the pond in reducing sediment loads to downstream waterways. For the two-stage ditch cross-section, the results will be compared to MN DNR's survey results that were conducted periodically throughout the project's four year timeframe. This data will help in assessing changes to the cross-section and will be used to determine construction best practices and ongoing maintenance needs moving forward. In addition, the project team is analyzing the water quality data to find trends and patterns and gain insight into the effectiveness of the outlined BMPs.

Project Status as of June 30, 2020:

Once Covid Restrictions are relaxed, the final portion of the postponed topographic surveying will be completed. This will be done before the presentation of the findings in August.

Project Update December 2020:

All work for Activity 1 is complete as of December 2020.

Final Report Summary: June 2021:

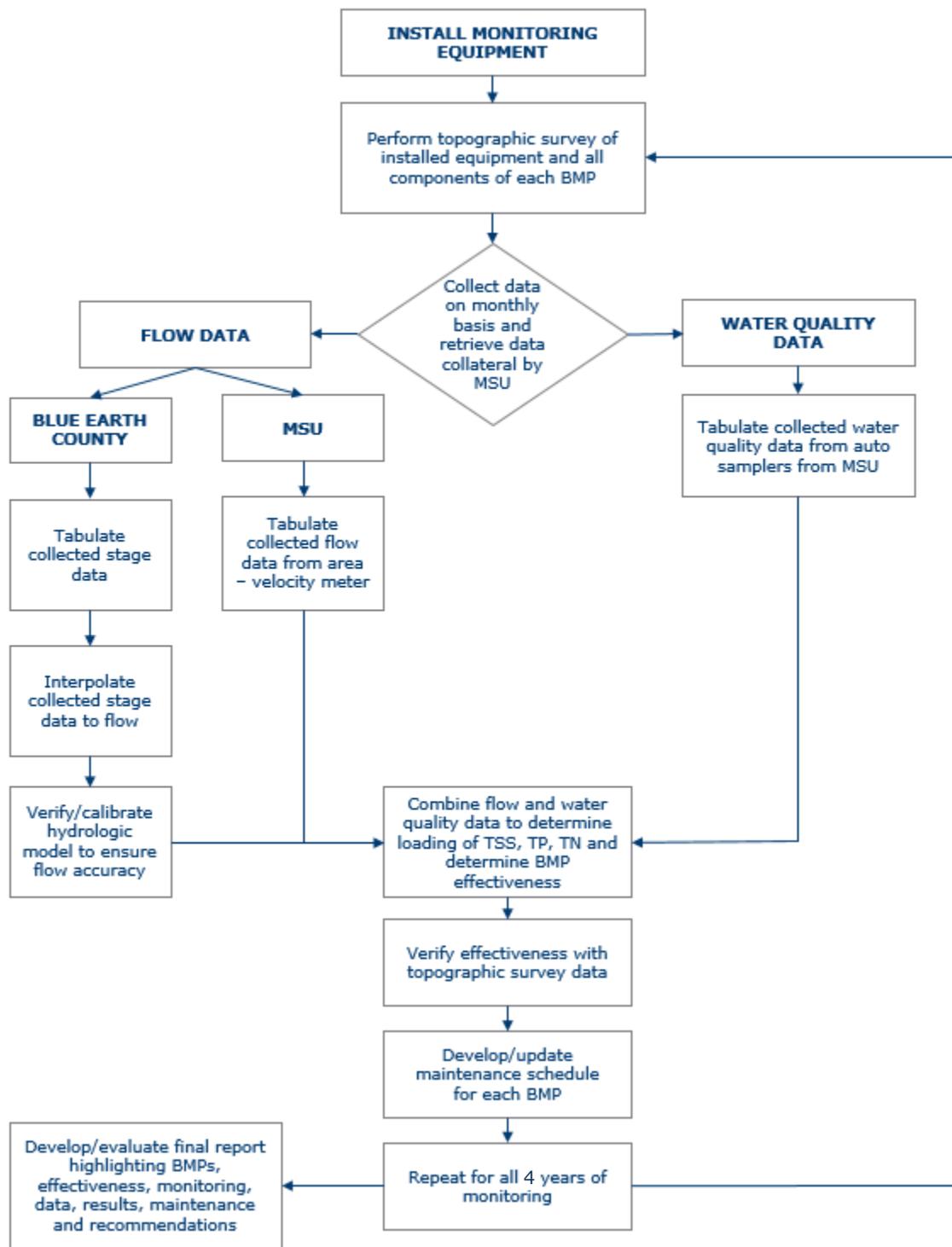
Monitoring of the BMPs on the system took place during the growing months of 2016 and 2017. In March, the monitoring equipment was serviced, batteries replaced, and prepared for installation. Monitoring stations included a Hoboware stage data logger and automated camera with solar panels. The monitoring stations were installed in the same locations each year as well as the same locations from Phase I monitoring in order to more accurately compare the data collected from each phase. The locations correlated with the location of the BMPs. Staff conducted monthly site visits to each monitoring station to download data, inspect monitoring equipment, replace damaged equipment, and ensure the data collection is operating correctly. In October, the monitoring equipment was removed, serviced, and cleaned. Monitoring equipment was purchased and provided in kind by MDA and MSU.

Additional site data was collected through surveys. Klein Pond was surveyed to assess the amount of sediment buildup in the sediment trap and other areas of the pond. Soil borings were also taken and recorded in the sediment trap. Cross-sections of the two-stage ditch were also surveyed to analyze the change in the channel's dimension over time. Data from multiple years was shared by the DNR that allowed time series evaluation of the change in cross-section of the two-stage ditch.

The monitoring of CD 57 filled data and research gaps of long-term monitoring of BMPs on a public drainage system. The monitoring data proved to landowners and agencies that conditions for agricultural production were enhanced, peak flow rates reduced, and water quality was improved. The monitoring data was used to inform BMP maintenance recommendations. The results will be used to aid in planning for future implementation of the most cost effective BMPs and give guidance on maintenance to maximize the benefits and lifespan of each BMP implemented on public drainage systems throughout Minnesota.

ACTIVITY 2: *Develop a Final Report and Analysis for BMPs*

Description: The analysis for Phase II of the monitoring will be completed similarly to the analysis done in Phase I in order to ensure accuracy of the results. The analysis will supplement the development of a final report for Phase II which includes determining the effectiveness of each installed BMP and comparing those results to Phase I. The analysis and final report is described in the following flowchart.



Summary Budget Information for Activity 2:

ENRTF Budget:	\$ 58,500
Amount Spent:	\$ 58,500
Balance:	\$ 0

Outcome	Completion Date
1. Collect and analyze annual data to <i>determine effectiveness of each BMP and compare it to previous monitoring results.</i>	August 2020
2. Develop a final report highlighting the data collection and analysis of Phase II and a comparison to results of Phase I. Also include the developed maintenance schedule for each BMP and recommendations moving forward for BMP installation.	August 2020
3. Provide the report to 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.	August 2020

Project Status as of December 31, 2016:

No action was taken was taken on Activity 2.

Project Status as of June 30, 2017:

No action was taken on Activity 2.

Project Status as of December 31, 2017:

During the reporting period, several meetings and planning sessions were held, including one regional meeting with stakeholders to discuss initial results from this year’s monitoring, review processes and past reports, and outline next steps for the coming year. The meeting was well attended by agency staff, with representation from Minnesota DNR, MPCA, Blue Earth County, MDA, MSU, and ISG. In addition to this larger meeting, several smaller sessions were held amongst partners prior to monitoring season to ensure proper set-up and calibration of equipment and to conduct a watershed analysis that will be included in the final report. In addition, the project team participated in several site visits throughout the past year.

Project Status as of June 30, 2018:

No action was taken on Activity 2 this reporting period.

Project Status as of December 31, 2018:

In early July, MSU hosted its annual meeting to present findings from the 2017 monitoring results, with chemistry data focusing on nitrates, total phosphorus, and total suspended solids (TSS). Attendees at the meeting included Minnesota Department of Agriculture, Minnesota Department of Natural Resources, Blue Earth County Soil and Water Conservation District, Blue Earth County drainage staff, and members of the technical consulting team. Participation at this meeting is important because it allows for data sharing across multiple project as stakeholders seek to better understand the effectiveness of conservation practices. We will continue to work with agency staff to ensure accurate data collection and dissemination of results.

Additionally, 2018 was the last year for MSU’s water chemistry monitoring. A MSU graduate student will now work to analyze the collected data as a thesis project for publication in a scientific journal. This information will then be shared with the project team to be incorporated into our final report findings.

Project Status as of June 30, 2019:

To date, all of MSU’s data has been shared with ISG and will be analyzed and included in the final report. Additionally, MSU graduate student, Zach Hilgendorf, has completed his thesis on the project, entitled “*The Efficacy of Best Management Practices on Peak Discharge and Contaminant Loads in Agricultural Drainage Systems, Blue Earth River Watershed, South-Central Minnesota, USA.*” The paper in its entirety can be found

online, [here](#). Preliminary data analysis is being conducted, synthesizing the information collected from both MSU and ISG. The results of which will form the basis for the recommendations outlined in the forthcoming final report, which will include a details on the long-term effectiveness of the outlined BMPs, a maintenance schedule, construction best practices for each, and a cost/benefit analysis of each BMP in terms of ongoing maintenance, water quality improvement and erosion reduction as well as cost and ease of construction. An outline that will guide development of the final report has been created and shared with the project team.

Project Status as of December 31, 2019:

Most of the work occurring since the last progress report has been analyzing the monitoring data that was collected and compiling the data for the final report. An outline was developed and shared with project partners to ensure all of the key content needs are accurately conveyed, including long-term BMP effectiveness, cost/benefit analysis, and maintenance recommendations. A first draft of the report is complete and is being reviewed. All edits will be submitted in January and February and feedback incorporated in March and April in order to finalize and be more widely disseminated late spring and summer.

Project Status as of June 30, 2020:

Most of the work analyzing the data was completed this spring before the Social Distancing slowed the progress of the report. The report should be completed prior to its completion in August.

Project Update December 2020:

The final report is drafted, and project partners are reviewing prior to finalizing ahead of June 2021.

Final Report Summary: June 2021

A report was completed to supplement the findings created in the Phase I report. The water quality and quantity data was analyzed utilizing MSU's and ISG's monitoring data with the findings highlighted in the report. The report outlines:

- 1) Long-term BMP effectiveness showing 10-years of water quality data and developed trends;
- 2) Identified long-term maintenance and associated costs to ensure functionality and effectiveness of BMPs;
- 3) Developed maintenance schedule recommendation; and
- 4) Reviewed lifetime costs of BMP including initial implementation costs and associated reoccurring maintenance needs.

The report utilizes images, charts, graphs, and other graphics to present complicated information in an easy to understand way. The report was reviewed by project partners before publishing. The final *Agricultural and Urban Water Quality Treatment Analysis: Phase II Report* is posted to the ISG website [here](#).

ACTIVITY 3: Engagement/Promotion of Practices

Description: Presentations/workshops and/or field days will be conducted to present the findings to the public and interested agencies. These events will provide an opportunity to educate the public on best management practices within drainage systems and to facilitate conversations on water quality in drainage systems and BMP implementation requirements.

Presentations will include an update to agricultural drainage and water quality, recommended BMPs, their effectiveness and most appropriate use, results and final report summary of Phase II, and any other appropriate presentations at that time. Also included will be a site visit to CD 57 showcasing the install BMPs, their function relating to the ditch system, what makes them effective, and a description of any necessary maintenance required. Also presented at the field day will be the monitoring equipment and a brief demonstration of how the data is collected.

Also included in Activity 3 is printing for handout materials during the presentations/workshop/field day as well as travel associated with the field day and site visit.

Similar field days and workshops have been held in the past during the summer of 2012, 2013, and 2015 with nearly 200 attendees per event. Attendees for the event will include producers, government agencies, county drainage authorities, conservationists, and soil and water conservation groups. These field days serve as a model for the future of agricultural drainage and water quality for all parties attending.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 20,000
Amount Spent: \$ 20,000
Balance: \$ 0

Outcome	Completion Date
<i>1. Inform landowners, producers, and agencies through a workshop on the effectiveness of installing these BMPs in an agricultural watershed</i>	6/30/2021
<i>2. Share monitoring methods and results via print materials, electronic documents, and presentations</i>	6/30/2021
<i>3. Hold a Field Day event at the site with a tour of the BMPs throughout the watershed focusing on long-term maintenance.</i>	6/30/2021

Project Status as of December 31, 2016:

No action was taken on Activity 3.

Project Status as of June 30, 2017:

No action was taken on Activity 3.

Project Status as of December 31, 2017:

No action was taken on Activity 3.

Project Status as of June 30, 2018:

No action was taken on Activity 3 this reporting period.

Project Status as of December 31, 2018:

No action was taken on Activity 3 during the reporting period.

Project Status as of June 30, 2019:

No action was taken on Activity 3 during the reporting period.

Project Status as of December 31, 2019:

No action was taken on Activity 3 during the reporting period. Future activities include presenting the final report findings at conferences and events such as ISG’s Agricultural Drainage and Future of Water Quality workshop in July, GBERBA meetings, regional water resources conferences, and an in-depth workshop with key stakeholders to review the findings. In addition, a field day will be held this summer with landowners and other stakeholders.

Project Status as of June 30, 2020

The Agricultural Drainage and Future of Water Quality Workshop was postponed to August. The workshop will be virtual as well as the field day.

Project Update December 2020:

The findings compiled from data collection were presented at two conferences during the reporting period. The presentations promoted BMP practices, function on public drainage systems, effectiveness of water quality benefits, and recommended appropriate use. In addition, the presentation included the analysis of maintenance recommendations, lifetime cost analysis, and cost benefit ratio of the BMPs. Due to the State's guidelines and restrictions, both conferences presented at were held virtually. On August 13th, the findings were presented at the Agricultural Drainage and Future and Water Quality Workshop. Approximately 75 people were in attendance including drainage staff, county commissioners, watershed district managers, landowners, agency staff, non-profit organizations, academics, and others from Minnesota and Iowa. The findings were also presented at the annual Minnesota Association of Watershed Districts (MAWD) Conference on December 2nd. The audience of approximately 50 people included drainage staff, watershed district managers, watershed management organization staff, agency staff, water resources engineers, and others. COVID-19 has posed a challenge in outreach and promotion of practices, although continued efforts will be made to engage and promote practices.

Final Report Summary: June 2021:

The findings from the Phase II research was presented at a variety of events that included workshops, conferences, a virtual water storage tour as well as shared through email blasts, posts to ISG's website, and through numerous social media outlets. There were challenges to public engagement and promotion of practices on CD 57 with the timing of COVID-19 and recommended safety procedures that limited in-person interactions and large group gatherings. With the restrictions of COVID-19, a field visit did not take place, and our team pivoted to present the findings virtually at the Agricultural Drainage and Future of Water Quality Workshop and the at the annual Minnesota Association of Watershed Districts Conference. In total, approximately 125 people attended the virtual presentations, including watershed drainage staff, county commissioners, watershed district managers, watershed management organizations, landowners, agency staff, non-profit organizations, academics, water resources engineers, and others from Minnesota and Iowa. ISG was interviewed by MSU to be included in the Minnesota River Basin Virtual Water Storage Tour. Content was shared to provide insight on the findings from Phase II. The link to the report was shared and may be included on the developed story map.

The report is posted to the ISG website [here](#). A landing page was developed providing a summary of Phase I and Phase II with both reports available for download. An email blast to 650+ individuals and social media posts directed people to the website and report. In addition, a handout that summarizes the findings of the Phase II study was submitted with the final grant reporting (see attached).

V. DISSEMINATION:

Description:

- Final Report – Submitted to local agencies and posted on Blue Earth County and ISG websites. Final report to be published in January of 2021, as adequate time is needed to compile the data from 2020 and analyze and finalize the report.
- Workshop and/or presentation on findings of MSU water quality data collection/analysis and individual analysis by Blue Earth County to be completed by December 31, 2020.
- Coordination between MSU, Blue Earth County, ISG, and MDA will be ongoing during data collection, analysis and final report/presentation preparation.
- Data collected by MSU will be posted on Hydrostat. A M.S. thesis will be written and published (journal TBD) based on the data collected and general analysis of BMPs effect on water quality and quantity.

Websites include Blue Earth County (<http://www.blueearthcountymn.gov/>) and ISG (www.is-grp.com)

Project Status as of December 31, 2016:

Blue Earth County coordinated with MSU, ISG, and MDA in the preparation of monitoring equipment for 2017-2020. This included on-site meetings in June and July 2016, analyzing the equipment set-up and function after rain events.

Project Status as of June 30, 2017:

Monitoring by MSU, MDA, and ISG is ongoing with site visits, data collection, interpretation of information, and maintenance of all equipment. This information is being shared among project partners but will not be disseminated more broadly until the project team has completed the monitoring and associated analysis of findings.

Project Status as of December 31, 2017: Collection of monitoring data by MSU, MDA, and ISG is ongoing. This information is being shared among project partners but will not be disseminated more broadly until the project team has completed monitoring and associated analysis of findings.

Project Status as of June 30, 2018: Similarly to 2017, collection of monitoring data by MSU, MDA, and ISG is ongoing. This information is being shared among project partners but will not be disseminated more broadly until the project team has completed monitoring and associated analysis of findings, at which time it will be uploaded and made public on the project teams' websites.

Project Status as of December 31, 2018:

Monitoring and data collection is ongoing and is being uploaded to a database to be compiled for the final report, at which time it will be made publicly available. However, MSU has completed a portion of its monitoring work and will coordinate efforts to formalize its findings through a published thesis paper and inclusion in a scientific journal.

Project Status as of June 30, 2019:

As noted above, all monitoring has been completed and data shared amongst the project team. Additionally, the noted thesis paper has been published, with potential for inclusion in professional journals. There have also been information sharing meetings with MN DNR, comparing monitoring results. The project team is currently working on the final report, utilizing data collected from all of the project partners, with more broad dissemination of those results shared upon completion of the final report.

Project Status as of December 31, 2019:

As noted above, the first draft of the report is complete and is being reviewed by the project team, with plans to finalize and disseminate this spring and summer. Several outreach events and workshops are being planned to share this information with partners, landowners, agency staff, and others. A workshop will be planned to discuss the findings with the project team. In addition, the final report will be made publicly available on Blue Earth County's and ISG's websites.

Project Status as of June 30, 2019:

With the exception of the delays and changes to virtual presentations, the project is going well with few changes for the December statutes

Project Update December 2020:

The report content has been compiled with remaining items on finalizing graphic content. Prior to dissemination of report to public, Blue Earth County, landowners, and other stakeholders will review the report findings. The findings were presented on at two virtual conferences and reached approximately 125 people.

Final Report Summary: June 2021

The final report *Agricultural and Urban Water Quality Treatment Analysis: Phase II Report* is posted to the ISG website. An email blast was sent to more than 650 people, including drainage authorities, watershed districts, SWCD staff, landowners, agency staff, and other water professionals. The report will remain on the website for

the foreseeable future. The project was highlighted on ISG’s Twitter, Facebook, and LinkedIn to direct people to the website and report. 20-paper copies of the report were printed and disseminated to key stakeholders and partners. As requested, ISG will continue to provide paper copies, upon request.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	\$85,000	ISG - Time required for: data analysis, report preparation, workshops/presentations
Presentations/Workshop/Field Day	\$20,000	Includes organizing event, renting space to hold event, printing of all invitations and materials handed out during the event, presenters/speakers expenses, and travel to field day/site visit
TOTAL ENRTF BUDGET:	\$105,000	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: None – In Kind by Blue Earth County

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds: Monitoring equipment provided by MDA and MSU includes area velocity meters, water quality auto sampling devices, electronic rain gauges, and all associated housing and electronic components. Also included is funding for analytical analysis of the water quality samples, labor and transportation for data collection by MSU. The total other funding for the project is \$119,161. It shall be noted that a majority of the equipment provided for the MSU monitoring was in kind from MDA and MSU and does not have attached funding with it.

VII. PROJECT STRATEGY:

A. Project 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.

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

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.

ISG (Chuck Brandel, PE and Team): Acting as engineer for the Blue Earth County Drainage Authority – Assistance with project administration, assist with monitoring, and technical memorandum, and presentations (Not a contributor and will not receive grant funding. Will serve as a contract service provider).

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).

Minnesota State University Biology Department (Bryce Hoppie) Received grant from MDA for completion of monitoring, purchase and use equipment, take samples and get samples analyzed at lab. The results from this monitoring will be shared with Blue Earth County and ISG for analysis.

B. Project Impact and Long-term Strategy:

This project will provide information on the effectiveness and long term maintenance requirements of BMPs established in a drainage system for water quality improvements. Information obtained from previous and ongoing monitoring on CD 57 will be evaluated and conclusions will be shared with the public and applicable agencies through presentations and a final report. This information can be used by those involved in drainage water management and organizations concerned with water quality to better plan the location and type of BMPs installed on other drainage systems.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
ENRTF – M.L. 2010, Chp. 362, Sec. 2, Subd. 5d	2010-2014	\$485,000

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List: N/A

B. Acquisition/Restoration Information: N/A

IX. VISUAL COMPONENT or MAP(S):

- **Exhibit:** *CD 57 Project Map*

X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than:

- Year 1: December 31, 2016; June 30, 2017;
- Year 2: December 31, 2017; June 30, 2018;
- Year 3: December 31, 2018; June 30, 2019.
- Year 4: December 31, 2019; June 30, 2020;
- Year 5: December 31, 2020; June 30, 2021-August 15, 2021

Environment and Natural Resources Trust Fund
Final M.L. 2016 Project Budget



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

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 04s

Project Manager: Craig Austinson

Organization: Blue Earth County Drainage Authority

M.L. 2016 ENRTF Appropriation: \$105,000

Project Length and Completion Date: 5 Years, June 30, 2021

Date of Report: August 16, 2021

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Activity 1: Monitoring of Installed Best Management Practices</i>			<i>ACTIVITY 2: Develop a Final Report and Analysis for BMPs</i>			<i>ACTIVITY 3: Engagement/Promotion of Practices</i>				
Professional/Technical/Service Contracts - ISG											
<i>Installation of Monitoring equipment - \$5,000 Estimate</i>	\$5,000	\$5,000	\$0			\$0			\$0	\$5,000	\$0
<i>Maintenance and Data Collection - \$5,000 Estimate</i>	\$5,000	\$5,000	\$0			\$0			\$0	\$5,000	\$0
<i>Topographic Survey - \$16,500 Estimate</i>	\$16,500	\$16,500	\$0			\$0			\$0	\$16,500	\$0
<i>Flow and water quality data tabulation, interpolation, hydrologic model calibration - \$15,000 Estimate</i>			\$0	\$15,000	\$15,000	\$0			\$0	\$15,000	\$0
<i>Quantify loading and effectiveness of BMPs with tabulated data from flow and water quality - \$13,500 Estimate</i>			\$0	\$13,500	\$13,500	\$0			\$0	\$13,500	\$0
<i>Develop and update BMP maintenance schedule for all BMPs included - \$10,000 Estimate</i>			\$0	\$10,000	\$10,000	\$0			\$0	\$10,000	\$0
<i>Develop and update final report with all analyzed data (effectiveness, monitoring, results, etc.)- \$20,000 Estimate</i>			\$0	\$20,000	\$20,000	\$0			\$0	\$20,000	\$0
<i>Workshop/presentations setup, coordination, location determination, scheduling, etc.- \$15,000 Estimate</i>			\$0			\$0	\$15,000	\$15,000	\$0	\$15,000	\$0
Printing <i>Invitations and postage, agendas, handout materials, presentations - \$3,500 Estimate</i>			\$0			\$0	\$3,500	\$3,500	\$0	\$3,500	\$0
<i>Virtual Field day expenses (development of our website page, email blast creation and development of mailing list, and development of handout summary- \$1,500 Estimate</i>			\$0			\$0	\$1,500	\$1,500	\$0		\$0
COLUMN TOTAL	\$26,500	\$26,500	\$0	\$58,500	\$58,500	\$0	\$20,000	\$20,000	\$0	\$105,000	\$0