M.L. 2016 Project Abstract
For the Period Ending June 30, 2018

PROJECT TITLE: Roseau Lake Watershed Targeted Water Quality Improvement
Project Manager: Henry Van Offelen
Affiliation: Minnesota Board of Water and Soil Resources – formerly Department of Natural Resources
Mailing Address: 26224 N. Tower Road
City/State/Zip Code: Detroit Lakes, MN 56501
Telephone Number: (218) 846-8406
Email Address: henry.van.offelen@state.mn.us
Web Address: NA

FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2016, Chp. 186, Sec. 2, Subd. 04w

APPROPRIATION AMOUNT: $65,000
AMOUNT SPENT: $65,000
**AMOUNT REMAINING: $0**

<u>**Overall Project Outcome and Results**</u>
The Roseau River Watershed District in collaboration with MN state agencies, local governments, and citizens is working to rehabilitate the Roseau Lake basin, which was substantially drained over 50 years ago. The outcomes and results of this project will be essential to strategically invest in water quality improvement projects that will ensure the long-term viability of the lake rehabilitation restoration project. This project resulted in development of a level 3 hydrologically conditioned digital elevation model (hDEM) for the U.S. portion of the watershed, a LiDAR-derived restorable wetland inventory, and complete set of Roseau River Watershed PTMApp data which is available on the Minnesota Board of Water and Soil Resource's PTMApp website and for PTMApp desktop use. The project identified and mapped the top 100 field scale best management and conservation practices to benefit water quality in the Roseau Lake. Output data from the PTMApp and the drained basin inventory has been provided to the Roseau County Soil and Water Conservation District and the Roseau River Watershed District in addition to a series of project implementation and effectiveness map. A Roseau River watershed PTMApp data-training workshop was held for project partners on May 30, 2018. Project partners are now using the data and maps to refine a targeted implementation plan for the Roseau Lake and the Roseau River watersheds. This foundational work has been essential for the Roseau River Watershed District to work with additional partners in Canada and expand the scope of this work to include the entire Roseau River watershed in the U.S. and Canada.

<u>**Project Results Use and Dissemination**</u>
This project resulted in the development of a level 3 hydrologically conditioned digital elevation model (hDEM) for the U.S. portion of the watershed, a LiDAR-derived restorable wetland inventory, a complete set of Roseau River Watershed PTMApp data, and a variety of maps to identify the Top 100 conservation and best management practices for water quality protection and improvement. The Roseau River watershed district has copies of all data, maps, and presentation associated with this work. The PTMApp data is also available on the Minnesota Board of Water and Soil Resource's PTMApp website. GIS tools needed to derive a restorable wetland inventory from LiDAR data were refined for this project and are also available from the Board of Water and Soil Resources.

A Roseau River watershed PTMApp data-training workshop was held for project partners on May 30, 2018. This foundational work has been essential for the Roseau River Watershed District to work with additional partners in Canada and expand the scope of the project to include the entire Roseau River watershed in the U.S. and Canada. These partners are now working with these data to further develop and refine and implementation strategy for the Roseau Lake Basin and for the entire watershed.
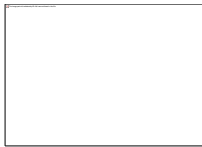
Date of Report: June 30, 2018

Date of Next Status Update Report: Final Report

Date of Work Plan Approval: June 7, 2016

Project Completion Date: June 30, 2018

Does this submission include an amendment request? _No_

PROJECT TITLE: Roseau Lake Watershed Targeted Water Quality Improvement

Project Manager: Henry Van Offelen

Organization: Minnesota Board of Water and Soil Resources – formerly Department of Natural Resources

Mailing Address: 26224 N. Tower Road

City/State/Zip Code: Detroit Lakes, MN 56501

Telephone Number: (218) 846-8406

Email Address: henry.van.offelen@state.mn.us

Web Address: NA

Location: Roseau Lake Watershed, Roseau County.

Total ENRTF Project Budget:		**ENRTF Appropriation:**	**$65,000**
		Amount Spent:	**$65,000**
		Balance:	**$0**

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

Appropriation Language:

$65,000 the second year is from the trust fund to the commissioner of natural resources to develop targeted water quality improvements for the Roseau Lake watershed by coordinating with partner agencies to identify the top priority field scale best management and conservation practices to implement in the region.

I. PROJECT TITLE: Roseau Lake Watershed: Targeted Water Quality Improvement

II. PROJECT STATEMENT:
The MN Department of Natural Resources (DNR) and International Water Institute (IWI) will partner with other state agencies, the Roseau River Watershed District, and local partners to identify the top 100 field-scale best management practices in the Roseau Lake watershed based on their suitability, pollutant load reduction efficiency, and cost/unit load reduction. The project will directly complement the efforts of the MN Department of Natural Resources and the Roseau River Watershed District to implement the Roseau Lake Rehabilitation Project which will reduce flood damages and improve wildlife habitat. This project will result in a roadmap for implementing projects in the watershed to improve water quality and ensure long-term sustainability of the Roseau Lake rehabilitation.

The Roseau Lake Watershed: Targeted Water Quality Improvement project will build on existing technologies developed with Clean Water Legacy Funds to apply the Prioritize, Targeting and Measuring Application (PTMApp) http://www.rrbdin.org/prioritize-target-measure-applicationptmapp. The PTMApp will be used to identify and evaluate the suitability and effectiveness of best management and conservation practices in the watershed, provide estimates of sediment, nitrogen and phosphorous delivered (and subsequently treated after project implementation) to the lake and prepare a list of implementation projects that includes treatment train (BMP and CP) load reduction amounts to the Roseau Lake. Final project outcomes will include the 100 most effective projects to improve Roseau Lake water quality which local government partners and landowners will use to implement conservation practices.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of January 31, 2017: The project is on schedule. Staff from DNR, the International Water Institute (IWI), and the Roseau River watershed district have worked to update the existing hydrologically conditioned digital elevation model (DEM). Production of this data was foundational to moving the project forward. The DEM update included review and inclusion of 2016 culvert inventory data and field review of a number of areas to verify that the final DEM routed water across the landscape correctly. IWI staff is now assembling and deriving the additional data needed to run the Prioritize Target and Measure (PTMApp) model and drained basin inventory model to identify the top one hundred water quality improvement projects within the watershed.

Project Status as of July 1, 2017:
No update provided based on May 19, 2017 email from Diana Griffith titled "LCCMR Status Update is not needed for June / July 2017".

Project Status as of September 30, 2017:
As originally proposed, this project was only going to conduct an analysis of the U.S. portion of the Roseau Lake watershed. Discussions of this project earlier this year among members of the Roseau River International Watershed group resulted in Canadian partners being interested in conducting a similar analysis for their portion of the Roseau River watershed. Since May, they were able to secure separate funding and are in the process of developing and compiling the data needed to run the water quality models for the Canadian portions of the watershed. The U.S. data has been created and assembled. The Canadian data will undergo review to ensure the two datasets align so that the water quality model PTMApp can be run for the entire lake watershed and the remaining portion of the Roseau River watershed. The inclusion of the Canadian portion of the Roseau watershed has delayed this original expected date of completion but will result in completion of a more comprehensive project.

Amendment Request as of September 30, 2017:
Based on the September 2030, 2017 project status update we requested an amendment to this work plan so that the project final report is due June 30, 2018 and a project status update for March 30, 2018 is added.

Amendment Approved by LCCMR 10/18/17

Project Status as of March 30, 2018:
Canadian data was created, compiled, and input into the PTMApp model. The PTMApp model has been run and data outputs are complete. A meeting has been scheduled with LGUs.

Overall Project Outcomes and Results: The Roseau River Watershed District in collaboration with MN state agencies, local governments, and citizens is working to rehabilitate the Roseau Lake basin which was substantially drained over 50 years ago. The outcomes and results of this project will be essential to strategically invest in water quality improvement projects that will ensure the long term viability of the lake rehabilitation restoration project. This project resulted in development of a level 3 hydrologically conditioned digital elevation model (hDEM) for the U.S. portion of the watershed, a LiDAR-derived restorable wetland inventory, and complete set of Roseau River Watershed PTMApp data which is available on the Minnesota Boar dof Water and Soil Resource's PTMApp website and for PTMApp desktop use. The project identified and mapped the top 100 field scale best management and conservation practices to benefit water quality in the Roseau Lake. Output data from the PTMApp and the drained basin inventory has been provided to the Roseau County Soil and Water Conservation District and the Roseau River Watershed District in addition to a series of project implementation and effectiveness map. A Roseau River watershed PTMApp data training workshop was held for project partners on May 30, 2018. Project partners are now using the data and maps to refine a targeted implementation plan for the Roseau Lake and the Roseau River watersheds. This foundational work has been essential for the Roseau River Watershed District to work with additional partners in Canada and expand the scope of this work to include the entire Roseau River watershed in the U.S. and Canada.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Create advanced water quality data using the PTMApp toolbar, assemble model outputs for implementation planning, and derived drained wetland inventory with associated water quality related attributes.

Description:
The PTMApp is run through an ArcGIS toolbar to estimate sediment loads at the catchment level, identify highest ranking catchments, evaluate BMP suitability, and conduct benefits analysis. This project activity will include assembling and deriving the data for use by the PTMApp, creating advanced water quality data using the PTMApp, assembling PTMApp outputs into user friendly maps and tables, and completion of the drained wetland basin inventory. Tasks include:
1) Updating the hydrologic conditioning of the Roseau River Digital Elevation Model (DEM). Hydrologic conditioning refers to the modification of topographic data in a raw or "bare earth" DEM through a series of GIS processing steps to more accurately reflect the movement of water across the landscape. The process includes filling spurious sinks or pits, breeching digital dams (roadbeds and bridges which block the modeled flow of water across the DEM), and enforcing drainage connections such as culverts, storm sewers, and known tile drainage.
Hydrologic conditioning is an iterative process. Several iterations are generally needed to achieve the final conditioned DEM. The hydrologic conditioning process can be accomplished to a high level at the computer desktop; however, the practitioner can ensure a higher quality product by incorporating local knowledge of drainage patterns as well as bridge and culvert locations.

This project will use standard methods to integrate a recently created culvert inventory with local knowledge and a conditioned DEM originally used for hydrologic modeling into a new conditioned DEM suitable for use in the PTMApp.

2) Assemble and create base library data for the Roseau Lake watershed. In order to successfully run the PTMApp, a suite of data products must be assembled and derived (Table 1) from the conditioned DEM. The input products are used by the PTMApp to prioritize various catchments based on their BMP suitability and to estimate load contribution and reduction from one or more BMPs, and cost per unit load reduction.

3) Assemble PTMApp output and compile output data into user friendly maps and tables for public use. Once the application is run for the Roseau Lake watershed, a series of GIS processing will be completed to create a comprehensive set of user-friendly tables and map products for use in workshops with local conservation professionals. The maps will present basic PTMApp output loading grids, identify catchments which are most suitable for different categories of BMPs, the relative effectiveness of one or more land treatments, and their cost effectiveness.

4) Develop drained wetland basin inventory. The PTMApp will identify priority catchments for using water storage as a BMP that will improve water quality. Wetland restoration is one type of water storage BMP; however, no data is currently available in the Roseau Lake watershed to identify drained wetland basins. Previous efforts to map drained wetland basins were limited geographically to areas of the Prairie Pothole Region within Minnesota (i.e. Ducks Unlimited drained wetland inventory) and did not include this area of Minnesota. In addition, methods have recently been developed to use LiDAR data to identify the location of wetland basins which existed prior to drainage and to quantify their attributes (e.g., depth, volume, drainage area). A drained basin analysis will be conducted in the Roseau Lake watershed to identify drained basins. This data will be combined with outputs from the PTMApp to identify the most suitable locations for wetland restorations to improve water quality.

Table 1. List of inputs required to run PTMApp (for more information, see PTMApp Users Manual: http://gis.rrbdin.org/Lidar_data/RRBDIN_data/PTMApp/PTMApp_User_Guide.pdf.

	Data	PTMApp Name	Description	Format
1	Plan Boundary			
		bound_1w1p	Boundary for 1W1P planning area	polygon
2	Priority Locations			
		p_res_pts	Point locations of priority resources and/or plan regions, with WQ goals in attributes	points
3	DNR Travel Time*			
		tt_grid	Cell to cell travel time in seconds	raster
4	Curve Number*			
		curve_num	Curve number raster	raster
5	Elevation Products			
		raw_dem	Non-conditioned digital elevation model	raster
		fdr_total	Flow direction raster from fill all	raster
		fac_total	Flow accumulation from fill all	raster
		hyd_dem	Hydrologically conditioned digital elevation model	raster
		us_tt	Upstream travel time in hours	raster
		ds_tt	Downstream travel time in hours	raster
6	SSURGO*			
		ssurgo_cpi	SSURGO - Crop Productivity Index	raster
		ssurgo_hs	SSURGO – hydraulic rating	raster
		ssurgo_dtgw	SSURGO - Depth to groundwater	raster
7	RUSLE Inputs			
		rusle_kw	RUSLE - Soil erodibility factor	raster
		rusle_r	RUSLE - rainfall-runoff erosivity factor	raster
		rusle_c	RUSLE - Cover management factor	raster
		rusle_p	RUSLE - Support practice factor	raster
		rusle_m	RUSLE - m-weight factor	raster

Summary Budget Information for Activity 1:   **ENRTF Budget:** $ 45,000
                                                        Amount Spent: $ 45,000
                                                             Balance: $ 0

Outcome	Completion Date
1. Hydrologically Conditioned Digital Elevation Model with metadata	January, 2017
2. PTMApp base data library for the Roseau Lake watershed	December, 2017
3. PTMApp derived maps and tables of potential sediment, total nitrogen, and total phosphorus load reductions to Roseau Lake for categories of Best Management Practices (BMPs)	March, 2018
4. Drained basin inventory with quantitative attributes associated with water quality.	March, 2018

Activity Status as of January 31, 2017:

The existing Roseau Watershed conditioned digital elevation model (DEM) used for HEC-HMS modeling was reviewed by watershed district and IWI staff and it was determined that new information from a recent culvert inventory and additional review was needed for this project. Staff used standard methods to review 22 HUC-12 subwatersheds through 3-5 iterations each to update the DEM to best reflect water flow across the landscape. Site visits to several areas were needed to ensure proper placement of some burn and breach lines. A total of 9,300 burn lines and breach lines were used to correct the raw DEM to create a final hydro-conditioned DEM which accurately reflects the flow of water through the watershed. The resulting product will ensure reliable outputs from the Prioritize Target and Measure (PTMApp) model and drained basin inventory.

IWI staff is now assembling and deriving the additional data needed to run the Prioritize Target and Measure (PTMApp) model and drained basin inventory model to identify the top one hundred water quality improvement projects within the watershed.

Activity Status as of July 1, 2017:
No update provided based on May 19, 2017 email from Diana Griffith titled "LCCMR Status Update is not needed for June / July 2017".

Activity Status as of September 30, 2017:
All data for the U.S. portion of the Roseau Lake watershed has been prepared and assembled. Canadian data is being prepared. Once completed, this data will undergo quality control review to ensure consistency with U.S. data. Once quality control is complete the PTMApp model outputs will be derived. Drained wetland basin methods have been tested and refined in order to develop the data for the watershed.

Activity Status as of March 30, 2018:
Data for the Canadian portion of the Roseau Lake watershed has been prepared and integrated with U.S data. The PTMApp run was completed and undergone third party quality control. The drained basin inventory is complete. Geodatabases of all data and tables have been assembled for use in developing products needed for Task 2.

Final Report Summary: All geospatial inputs have been created, processed using PTMApp Desktop, and undergone quality assurance review. All data PTMApp output data has been uploaded to the MN Board of Water and Soil Resources PTMApp Website and is available for public review. The full PTMApp geodatabase has been distributed to US and Canadian partners.

LiDAR-derived restorable wetland inventory data has been created and made available for use by local government staff in conjunction with PTMApp data.

Maps depicting catchments with the Top 100 best management practices have been created and shared with local partners in the US and Canada.

ACTIVITY 2: Conduct workshops to engage local resource professionals, share PTMApp results, and get input to develop a list of top 100 projects to improve water quality in the Roseau Lake watershed.

Description:
Two workshops (one face-to-face and a final recorded Webinar) will be held to engage watershed district, soil and water conservation district and other resource professionals (e.g. NRCS) responsible for delivering conservation to landowners so that they can understand and use PTMApp outputs and provide input into the development of the list of top 100 water quality improvement projects.

Participants will review maps and outputs generated from PTMApp depicting the top 100 field scale best management practices and gain understanding of underlying theory and methods used to rank the watershed catchments. Participants will also learn how to generate their own PTMApp maps and information using PTMApp Desktop application developed as part of the MN BWSR Clean Water fund project (scheduled for completion January 2016).

Incorporate PTMApp final products and workshop outcomes into a final report in collaboration with local implementers. Local partners will implement the marketing plan.

Summary Budget Information for Activity 2:   **ENRTF Budget:** $20,000
                                                             Amount Spent: $17,891
                                                                  Balance: $0

Outcome	Completion Date
1. Workshops for information exchange and strategy development	May, 2018
2. List of the top 100 strategies for local agencies to implement to achieve water quality improvement in the watershed.	June, 2018
3. Final Report	June, 2018

Activity Status as of January 31, 2017: No work completed.

Activity Status as of July 1, 2017: No update provided based on May 19, 2017 email from Diana Griffith titled "LCCMR Status Update is not needed for June / July 2017".

Activity Status as of September 30, 2017: No work completed.

Activity Status as of March 30, 2018:
A preliminary set of data and maps have been created to prioritize catchments within the watershed that contribute the highest combined sediment, nitrogen, and phosphorus loads to Roseau Lake. Supplemental data and maps have been created for the highest priority areas to identify the top 100 catchments for sediment, nitrogen, and phosphorus load reductions individually. These maps and additional data products will be used as a basis for local user workshops to identify top 100 strategies to improve water quality.

Final Report Summary: A workshop was held for project partners on May 30, 2018. The workshop demonstrated and reviewed the PTMApp data currently available on the PTMApp website and for desktop use. Maps of the watershed catchments where the top 100 strategies were located were demonstrated and reviewed. The data and maps are currently in use by project partners to develop a refined implementation plan for the Roseau Lake and Roseau River watersheds.

V. DISSEMINATION:
Description:
Water quality related maps, associated data, and the list of top 100 water quality improvement projects developed by this project will be disseminated locally to conservation and water resource professionals and made available for download on the Red River Basin Decision Information Network (www.rrbdin.org) The information produced will empower local conservation professionals to meet with landowners in order to implement priority conservation practices. Additional outreach for this effort will include presentations at county and watershed board meetings and professional conferences. Conference presentations are likely to include the Minnesota Association of Soil and Water Conservation Districts, Minnesota Association of Watershed Districts, the Red River Basin Commission, Board of Water and Soil Resources Academy, and the Red River Basin Flood Damage Reduction Work Group.

Activity Status as of January 31, 2017: Regular updates on the project status have been provided to the Roseau Lake Rehabilitation Project Team, the Roseau River Watershed District Board, and the Red River Watershed Management Board.

Activity Status as of July 1, 2017: No update provided based on May 19, 2017 email from Diana Griffith titled "LCCMR Status Update is not needed for June / July 2017".

Activity Status as of September 30, 2017: Regular updates on the project status have been provided to the Roseau Lake Rehabilitation Project Team, the Roseau River Watershed District Board, and the Red River Watershed Management Board.

Activity Status as of March 30, 2018: Regular updates on the project status have been provided to the Roseau Lake Rehabilitation Project Team, the Roseau River Watershed District Board, and the Red River Watershed Management Board. A project overview was provided at the annual meeting of the Roseau Watershed Citizens' Advisory Committee.

Final Report Summary: Data and maps have been distributed to project partners and PTMApp data is available on the MN BWSR PTMApp website (https://ptmapp.bwsr.state.mn.us/).

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Personnel:	$ 0	DNR lead staff will manage this project and be engaged in every activity as part of in-kind work.
Professional/Technical/Service Contracts:	$ 65,000	1 contract with the International Water Institute to complete all activities in this project.
TOTAL ENRTF BUDGET:	**$65,000**	

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 0

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 0.5

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
In-kind match from the Roseau River Watershed District and Roseau County Soil and Water Conservation District	$15,000	$5,000	Assistance in completion of Activities 1 and 2.
State			
Anticipated Clean Water Fund Grant from the Board of Water and Soil Resources	$60,000	$17,600	Funding to supplement LCCMR funding for completion of Activities 1 and 2.
TOTAL OTHER FUNDS:	$75,000	**$22,600**	

VII. PROJECT STRATEGY:

A. Project Partners:

Project Partners Not Receiving Funds:
Roseau County Soil and Water Conservation District
Roseau River Watershed District
Minnesota Board of Water and Soil Resources

Project Partners Receiving Funds:

International Water Institute: $65,000 to complete project activities.

B. **Project Impact and Long-term Strategy:**

This project will help ensure the long term sustainability of the investments that the state and local governments make into the rehabilitation of Roseau Lake. The list of water quality projects focussed on improving the water quality in the Roseau Lake watershed will provide a template for project implementation. Upon completion, the project will serve as example with statewide application of how to engage multiple partners in development and implementaion of a watershed-based approach to improve habitat, reduce flood damages, and improve water quality.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
Board of Water and Soil Resources, Accelerated Implementation Grant	March, 2016 – December, 2018	$111,800

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than January 31, 2017, September 30, 2017 and March 30, 2018. A final report and associated products will be submitted by June 30, 2018.

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

Project Title: Roseau Lake Watershed: Targeted Water Quality Improvement
Legal Citation: *FM.L. 2016, Chp. 186, Sec. 2, Subd. 04w*
Project Manager: Henry Van Offelen
Organization: Minnesota Department of Natural Resources
M.L. 2016 ENRTF Appropriation: $ *65,000*
Project Length and Completion Date: *June 30, 2018*
Date of Report: June 30, 2018

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Run the PTMApp, assemble model outputs for implementation planning, and derived drained wetland inventory with associated water quality related attributes.			Conduct workshops to engage local resource professionals, share PTMApp results, and get input to develop a list of top 100 projects to improve water quality in the Roseau Lake watershed.				
Personnel (Wages and Benefits)								
N/A - DNR lead staff will manage this project and be engaged in every activity as part of in-kind work.								
Professional/Technical/Service Contracts								
1 contract with the International Water Institute to complete all activities associated with this project.	$45,000	$45,000	$0	$20,000	$20,000	$0	$65,000	$0
COLUMN TOTAL	**$45,000**	**$45,000**	**$0**	**$20,000**	**$20,000**	**$0**	**$65,000**	**$0**