Environment and Natural Resources Trust Fund

M.L. 2023 Approved Work Plan

General Information

ID Number: 2023-238

Staff Lead: Michael Varien

Date this document submitted to LCCMR: June 15, 2023

Project Title: Leveraging Innovations in Data Analytics for Project Implementation

Project Budget: $738,000

Project Manager Information

Name: Brian Beck

Organization: Minnehaha Creek Watershed District

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Project Reporting

Date Work Plan Approved by LCCMR: June 22, 2023

Reporting Schedule: April 1 / October 1 of each year.

Project Completion: July 31, 2025

Final Report Due Date: September 14, 2025

Legal Information

Legal Citation: M.L. 2023, Chp. 60, Art. 2, Sec. 2, Subd. 04l

Appropriation Language: $738,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Minnehaha Creek Watershed District to integrate local and statewide data sets into a high-resolution planning tool that forecasts the impacts of changing precipitation patterns and quantitatively compares cost effectiveness and outcomes for water quality, ecological integrity, and flood prevention projects in the district. Minnehaha Creek Watershed District may license third parties to use products developed with this appropriation without further approval from the legislature or the Legislative-Citizen Commission on Minnesota Resources, provided the licensing does not generate income. This appropriation is subject to Minnesota Statutes, section 116P.10.

Appropriation End Date: June 30, 2026

Narrative

Project Summary: Integrating local and statewide datasets into a 21st-century planning tool, widely called for by our communities, that forecasts the impacts of changing precipitation patterns and quantitatively compares cost-effective solutions.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Water systems throughout Minnesota were built for stable climate patterns that no longer exist. Extreme swings in precipitation are stressing our natural and built environments, impacting pollutant loading, stream erosion, wetland function, surface and groundwater interactions, habitat, and the safety of homes, public infrastructure, and businesses.

Watershed managers must help communities understand and adapt to these changes. However, the ability to do so is hampered by sparse and static historic data sets, which make it difficult to predict how specific areas will be impacted and quantitatively compare potential solutions.

Fortunately, advances in data science have made it affordable to collect exponentially more data and analyze it in more sophisticated ways. These advances allow water planners around the world to understand and predict changes with unprecedented accuracy and detail, allowing for more effective use of scarce public investment to address these issues. In Minnesota, data collection has outpaced the tools used to make sense of the information. Realizing the full potential of these advances requires new systems to integrate this data to identify existing issues, forecast future ones, and guide local decisions.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

In partnership with the DNR, USGS, and Hennepin County, and with formal support from 14 federal, state, and regional agencies and local communities, the Minnehaha Creek Watershed District (MCWD) is proposing a pioneering program to maximize the value of recent public investments in data collection.

For example, MCWD has created a remote sensing network that collects more than 1 million data points per year about surface water levels, shallow groundwater levels, and pollutant loading. State leaders have invested in mapping the detailed topography of the state. Municipal partners have digitized data about their storm sewer systems.

MCWD will use funding from LCCMR to develop a reproducible process that brings these disparate data sets together into a quantitative planning tool. Using advances in 2-dimensional modeling, these tools will be able to pinpoint, quantitatively evaluate and drive decisions on climate adaptation projects and policies.

Such a tool will be critical to the climate adaptation planning efforts as watershed managers and communities begin to understand the impact of changing precipitation patterns on our built and natural systems. The result will be more effective green and gray infrastructure solutions that protect and conserve the watershed's iconic water resources.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

- A single, continuously-updated tool that integrates previously-siloed public data sets to quantitatively compare proposed natural resource projects

- A high-resolution understanding of the balance of all surface and groundwater inputs and outputs in the system, to identify natural resources and public assets in need of protection

- Improved ability to predict the impact of changes in precipitation and land use, to enhance infrastructure

planning

- Improved ability to quantify and compare the cost-effectiveness of potential conservation projects needed to address predicted impacts

Project Location

What is the best scale for describing where your work will take place?

Watershed(s): Mississippi River - Twin Cities

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Building the External Data Information Processing System

Activity Budget: $361,000

Activity Description:
Because land use and stormwater infrastructure are constantly changing, watershed managers face the recurring challenge of using tools that are not based on up-to-date information. Historically, the process of updating watershed models has been a time-intensive endeavor because all data collection and processing has been done manually.

However, recent advances in data science have resulted in frameworks that automate complex data processing, which will dramatically reduce the cost of future model updates for MCWD and other public agencies throughout the state that could use this process as a template for enhancing and automating their own watershed model development.

MCWD will develop a reproducible data processing system that can incorporate publicly available datasets into a watershed modeling framework that can be used as a template for other local or regional agencies to efficiently build water resource models. Then, MCWD will work with technical experts to plan and build a GIS system that automatically updates based on changing landuse and infrastructure datasets to ensure the watershed model used for natural resource project identification is using the most current landscape and infrastructure information. The goal of this activity is to build a template that makes modeling much more efficient for all public agencies.

Activity Milestones:

Description	Approximate Completion Date
Develop Request for Proposals	April 30, 2023
Request Authorization to Release Project Request for Proposals	July 31, 2023
Request MCWD Board of Manager Authorization to Select Vendor for Model Input Refinement System	September 30, 2023
Meet with Municipalities and Partner Agencies to Provide Project Overview and Coordinate Stormwater Infrastructure Data	October 31, 2023
Develop Automated Process to Convert Regional Datasets into Standardized Geodatabase	November 30, 2023
Collect Initial Wetland, Stream Channel, and Bridge Data	November 30, 2023
Develop Automated Process that Converts the Standardized Geodatabase into Model Ready Format	January 31, 2024
Develop Documentation for Automated Geospatial Processing Steps	April 30, 2024

Activity 2: Building the 2D Watershed Model for Natural Resource Climate Adaptation Planning

Activity Budget: $377,000

Activity Description:
MCWD will incorporate the data produced from the automated processing system developed in activity 1 into a high-resolution watershed model that can predict, in unprecedented detail, how water and pollutants will move through the system under current and predicted scenarios. The outcome from building the watershed model will be a tool that can help watershed managers meet their water quality, water quantity, and ecologic improvement goals.

Building this model will involve an iterative process to ensure that the automated processes developed in activity 1 can be incorporated into a high-resolution watershed planning tool. In addition, the consultant will use streamflow data collected by MCWD staff to calibrate the model to ensure it can accurately predict how water moves through the built and natural environment.

MCWD and the consultant will meet with local municipalities and engineers to communicate the use cases for the model to ensure it can be used by other entities to identify water quality, natural resource, and flood reduction projects.

Activity Milestones:

Description	Approximate Completion Date
Request Authorization to Release Project Request for Proposals	September 30, 2023
Request MCWD Board of Manager Authorization to Select Vendor to Build Watershed Model	December 31, 2023
Load Model Ready Datasets from Automated Processes into Watershed Model to Test Completeness of Datasets	February 28, 2024
Refine Automated Processes to Incorporate Fixes and Issues Based on Model Testing	May 31, 2024
Load Updated Datasets Based on Refined Automated Process into Model	July 31, 2024
Collect Missing Field Data Identified During Model Testing	August 31, 2024
Calibrate and Validate 2D Watershed Model Upstream of Grays Bay Dam and Create Documentation	December 31, 2024
Calibrate and Validate 2D Watershed Model Upstream of Grays Bay Dam and Create Documentation	February 28, 2025
Develop Final Documentation of Model Based on Calibrated Model and Automated Process	May 31, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Tim Cowdery	U.S. Geological Survey	Assist with identifying groundwater well monitoring locations, conducting groundwater data analysis, suggesting methods for incorporating groundwater data into the 2D model, and providing oversight on 2D model build.	No
Dan Lais	Minnesota Department of Natural Resources	Collect and analyze additional groundwater and surface water interactions to integrate this data, along with other datasets, into the development of a high-resolution two-dimensional (2D) watershed model.	No
John Evans	Hennepin County	Hennepin County will assist with data collection, assessing climate impacts, and providing input on the tools needed to effectively plan and adapt to changing hydrology, in partnership with our communities.	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
There are multiple ways that the Minnehaha Creek Watershed District (District or MCWD) will disseminate the results from this project. Those dissemination efforts include:
1) Frequent communication with cities, townships, counties, regional agencies, and state agencies within MCWD to ensure that the model scenarios inform how each entity can improve its ability to manage water resources at a system scale.
2) Publishing a technical report on the Minnehaha Creek Watershed District website.
3) The MCWD staff will present at conferences about the model development process and the outputs from the model scenario analysis to increase awareness of the project.
5) The MCWD will provide acknowledgment of ENRTF, and include the ENRTF logo on reports and data submitted to the public and partner agencies.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?
This project will yield a sophisticated tool, drawing on state of the art data analytics, to enhance MCWD's organizational ability to partner with its member communities to identify, evaluate, and implement natural resource capital improvement projects that improve water quality, control water quantity, improve ecological integrity, and reduce flooding in the face of a changing climate. The products of LCCMR's investment are expected to help MCWD and its partners populate, focus, and prioritize capital improvement plans that will be funded locally. The long-term sustainment costs for maintaining the watershed tools will be borne by MCWD.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
							Sub Total	**-**
Contracts and Services								
TBD through competitive bid	Professional or Technical Service Contract	The consultant will be responsible for developing computer programming that will convert municipal and regional agency geospatial data into a standardized format and model development, and report writing. They will also be responsible for collecting stream channel data, wetland data, and bridge data in cooperation with MCWD.				2.44		$738,000
							Sub Total	**$738,000**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
							Sub Total	**-**
Travel Outside Minnesota								
							Sub Total	**-**

Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$738,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	Minnehaha Creek Watershed District Tax Levy	Minnehaha Creek Watershed District staff will be contributing a total of 3790 hours of in-kind support for the project. This work will include coordinating with cities to obtain data, communicating model need and purpose with cities, collecting field data, installing groundwater and surface water well sensors, reviewing automated computer code, and reviewing model develop. MCWD will also develop portions of the automated data intake code for automatically pulling weather data from the National Weather Service to calibrate the watershed model.	Secured	$203,100
Cash	Minnehaha Creek Watershed District Tax Levy	MCWD will contract with the USGS to oversee the selection of groundwater sensor monitoring locations and the development of the 2D watershed model	Secured	$10,000
			Non State Sub Total	**$213,100**
			Funds Total	**$213,100**

Attachments

Required Attachments

Visual Component

File: 61f1f181-ad1.pdf

Alternate Text for Visual Component

The attached graphic demonstrates how the proposed tools will convert a variety of disparate data sources into usable information to inform natural resource management decisions. It demonstrates how data sources about our built and natural environment – soils, topography, wetlands, hydrology, groundwater, precipitation, land cover, future land use, and storm sewer — will be integrated into a 2-dimensional model that will predict how water moves through the landscape under a variety of scenari...

Board Resolution or Letter

Title	File
MCWD Board Resolution Placeholder for LCCMR Application	14569b43-45c.pdf

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
USGS Letter of Support	de56a77b-280.pdf
MN DNR Letter of Support	2f72934d-205.pdf
Met Council Letter of Support	b0553570-10b.pdf
Minnesota Cities Stormwater Coalition Letter of Support	69c682c6-fb2.pdf
Hennepin County Letter of Support	306c750a-ab4.pdf
EQB Letter of Support	da7c900a-a25.pdf
Minneapolis Park and Recreation Board Letter of Support	0d2f38c5-2d0.pdf
City of Edina Letter of Support	c31c2f7f-880.pdf
City of Minneapolis Letter of Support	b03378ab-d1d.pdf
City of Minnetonka Letter of Support	08497ccb-20c.pdf
City of Mound Letter of Support	667fb967-295.pdf
City of St. Louis Park Letter of Support	35e72525-f56.pdf
City of Victoria Letter of Support	8164d10e-d55.pdf
City of Wayzata Letter of Support	10977cbe-a91.pdf
Background Check Certification Form	d5791bba-c6a.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

I updated the proposal based on the comments provided by LCCMR staff. I want to add a clarifying comment about the primary purpose of our proposal. The major advancement is developing a reproducible system that converts publically available data into a model-ready format to make watershed model development more efficient and higher resolution. All datasets for model development are currently available, however, they are all in unique formats, which makes model development a very labor-intensive process. However, the steps tend to be very repetitive and logical, which means that data conversion could be facilitated by developing computer scripts that automate the data conversion process. Furthermore, manual data incorporation results in lower resolution models, which is why most models at a watershed or regional scale are built at a low resolution which makes them difficult to use for planning purposes. Other agencies have already expressed interest and support for this system since they can use our process to build more efficiently

build models for their cities or regional agencies.

Please let me know if that doesn't come through in the work plan. The low word count limit makes it difficult to explain the purpose and the methods.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

N/A

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

Yes

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

Yes

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

No

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No