



Title: Authorization to Submit proposal to LCCMR for development of 2D watershed model and dam optimization

Resolution number: 20-030

Prepared by: Name: Brian Beck
Phone: 952-471-8306
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Reviewed by: Name/Title: James Wisker: District Administrator

Recommended action: Authorize staff to submit a proposal to the Legislative-Citizen Commission on Minnesota Resources (LCCMR), for developing an updated watershed wide hydrologic and hydrology model and tools to continue optimizing Gray's Bay Dam

Schedule: April 9, 2020 – Board considers authorization proposal to LCCMR
April 15, 2020 – Submission deadline for 2021 LCCMR proposals
May 20, 2020 – Submittals distributed to LCCMR members for review, and evaluation
June 17, 2020 – High ranking proposals selected for further consideration
July 7-9, 2020 – Presentation of LCCMR
Aug 6-7, 2020 – Proposals selected for recommendation to the Legislature for funding
Jan-May 2021 – LCCMR recommendations introduced as an appropriations bill
July 1, 2021 – Money from Environment Resources Trust Fund becomes available

Budget considerations: Fund name and code: Research and Monitoring, 5001
Fund budget: Research and Monitoring 2020 Budget \$1,017,049.
Expenditures to date: \$47,213.61
Requested amount of funding: \$88,000 in 2021 budgeted expenditures as grant match

Summary:

Purpose:

At the April 9, 2020 Meeting the Board of Managers will be asked to consider authorizing staff to submit a \$883,000 proposal to the Legislative-Citizen Commission on Minnesota Resources (LCCMR), to develop innovative 21st century planning tools that more effectively forecast the impact of changing precipitation patterns on the watershed, and target public investments to protect water, homes, businesses, and infrastructure.

Problem/Opportunity:

Climate change is measurably changing the distribution, frequency and intensity of rainfall in Minnesota. The Minnehaha Creek Watershed has experienced the wettest six years ever recorded. These changes are stressing our natural and built environments, impacting pollutant loading, stream erosion, wetland function, surface and groundwater interactions, habitat, homes, public infrastructure, and businesses.

Watershed managers must accelerate monitoring, evaluating, and adapting to these changes. However, the ability to do so is hampered by sparse and static historic data sets. This makes it challenging to predict how specific areas will be impacted, and quantitatively compare potential solutions. Around the state, we are beginning to see the consequences of systems designed for stable climate patterns that no longer exist.

Fortunately, advances in data science have made it affordable to collect exponentially more data and analyze it in more sophisticated ways. These are allowing 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 data. 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.

Proposed Solution:

MCWD is proposing a pioneering program to integrate and maximize the value of recent public investments in data collection to better predict the impacts of changing precipitation across the watershed, and to pinpoint, quantify and evaluate solutions.

The proposal will draw on existing investments made by MCWD, U.S. Geological Survey and Hennepin County in monitoring precipitation and watershed response across the District, which will collect more than 1 million real-time data points per year for precipitation, surface and shallow ground water levels, and pollutant loading. It will integrate this local understanding with state investments in producing detailed topography of Minnesota, along with local municipal investments in digitizing storm sewer information.

The tools being proposed for development include:

Machine Learning: Drawing deep insights and revealing trends from the vast quantity of newly available remote sensing data about how shifting precipitation is changing the mass balance of water and pollution.

2 Dimensional (2D) Watershed Model: Integrating patterns revealed by machine learning with state topographic and municipal infrastructure data will provide a high resolution planning tool to pinpoint, quantitatively evaluate, and drive decisions on climate adaptation projects and policies.

Outcomes:

Combined these tools will provide an ability to predict the short-term impact of weather systems on the watershed, reducing flood impact and damages, through optimization of Gray's Bay Dam and increasing the lead-time for communities to respond. They will support policy development and long range planning with communities, by simulating the impact of future climate forecasts on the watershed, which will drive project identification and design – enhancing MCWD's ability to pinpoint, quantify and evaluate the costs and relative benefits of gray and green by infrastructure investments on the landscape.

Cost:

The proposal requests \$883,000 in funds from the LCCMR for work in the following areas:

*See attached grant application for additional detail

1. Identifying model inputs and data resources
 - a. Defining data input needs for the 2D model
 - b. Developing GIS stormwater infrastructure data format based on model requirements
 - c. Processing soil, land use, LIDAR and other data required by selected model
 - d. Developing scripts to routinely pull meteorological data
 - e. Develop documentation on data structure and processing for model inputs

2. Building the external data information processing system
 - a. Meet with municipal, regional and state partners that have infrastructure data
 - b. Develop consensus and adopt plan for GIS processing system based on findings from Task 1
 - c. Implement the GIS infrastructure plan

3. Building the 2D Model and Machine Learning
 - a. Select and build watershed 2D model
 - b. Calibrate model with stream flow and lake level data and developing the 2D model report
 - c. Purchase workstation/hardware for machine learning
 - d. Develop long-short term memory (LSTM) neural network model
 - e. Develop automated system to pull meteorological, surface water and groundwater data
 - f. Develop optimizing model for LSTM hydrological model
 - g. Finalize report for dam optimization and LSTM hydrologic model

The proposal will leverage an estimated \$365,930 of in-kind match from MCWD, in the form of staff time. This is the equivalent of 8,084 hours or 3.9 existing full-time employees, over the three year period of the grant. This represents time spread across a multi-disciplinary team of research and monitoring, planning, GIS and outreach staff. No new staff are proposed under this grant application.

Further, the proposal will leverage approximately \$125,500 in cash match from MCWD, in the form of equipment. \$37,500 of this match comes from existing 2020 budgeted expenditures on building out the District’s real-time remote sensing network (RESNET). These expenditures are proposed to be shifted into 2021 to support the phasing of project implementation, which make them eligible as grant match. The remaining \$88,000 in cash match represents proposed 2021 expenditures for the acquisition and installation of 16 groundwater sensors across the watershed. This represents a forward facing 2021 budget consideration for the Board of Managers. It is likely that these costs could be integrated into the Research and Monitoring budget for 2021 without increasing over 2020.

LCCMR Category	Task Description	Grant Request	In-Kind Match	Grant Match (equipment)
1) Identifying model inputs and data resources	Data Processing	\$83,500	\$111,180	\$125,500
	Data Collection			
	Municipal Stormwater Infrastructure Data Intake/Partner Convening			
2) Build External Data Information Processing System	Data Processing Planning	\$286,000	\$153,640	\$0
	Implementation of Data Processing			
3) 2D and Machine learning model build	Build and Calibrate 2D model	\$338,500	\$46,790	\$0
	Build Machine Learning Model for Flood Forecasting and Dam Optimization	\$95,000	\$54,320	\$0
	Equipment and Infrastructure of Models	\$80,000	\$0	\$0
Subtotals		\$883,000	\$365,930	\$125,500
Total Cost		\$1,374,430		

Proposal Development Process:

To develop this proposal a multi-disciplinary team of staff have worked with external partners to:

- Evaluate the technical feasibility of the proposal, and identify risk points
- Triangulate cost estimates
- Develop a grant narrative for LCCMR
- Cultivate and document written support from partners

A technical team including three independent consulting firms, the Department of Natural Resources, U.S. Geological Survey, St. Croix Watershed Research Station, and the University of Minnesota participated in a panel to evaluate the technical feasibility and then develop preliminary cost estimates.

Outreach staff worked with Himle LLC, Horner Strategies, Joel Carlson and Bill Becker to develop a grant narrative.

Planning staff worked with the District Administrator to outline the proposal and develop support from District partners. At the time of drafting this RBA, written support has been provided by Hennepin County, Edina, Orono, and Mound. District staff anticipate additional support from Victoria, Minnetonka, St. Louis Park, U.S. Geological Survey, and Hennepin County Emergency Management.

Conclusion and Next Steps:

On April 9, 2020 MCWD Staff will be seeking Board authorization to submit an \$883,000 proposal to the LCCMR.

Pending Board consideration, following the meeting staff would continue to refine the grant proposal (narrative, costs and letters of support) for submittal to the LCCMR on April 15.

Supporting documents (list attachments):

1. Grant Application
2. Letters of Support



RESOLUTION

Resolution number: 20-030

Title: Authorization to submit proposal to LCCMR for development of 2D watershed model and dam optimization

- WHEREAS, climate change is measurably changing the distribution, frequency and intensity of rainfall in Minnesota;
- WHEREAS, these shifting precipitation patterns are stressing our natural and built environments, impacting pollutant loading, stream channel erosion, wetland functions, surface and surficial groundwater interactions, habitat, and homes, businesses and public infrastructure;
- WHEREAS, watershed managers, in partnership with local communities, must accelerate efforts to monitor, evaluate and adapt to these changes;
- WHEREAS, the Minnehaha Creek Watershed District, in partnership with Hennepin County and the U.S. Geological Survey, has developed a real-time remote sensing network (RESNET) to monitor precipitation and watershed response in high resolution;
- WHEREAS, that RESNET data, if combined with local stormsewer and state topographic data sets and developed into appropriate tools, provides the potential to (1) Predict the short-term impact of weather systems on the watershed, reducing flood impact and damages, through optimization of Gray’s Bay Dam and increasing the lead-time for communities to respond; (2) Support policy development and long range planning with communities, by simulating the impact of future climate forecasts on the watershed; (3) Drive project identification and design – enhancing MCWD’s ability to pinpoint, quantify and evaluate the costs and relative benefits of gray and green by infrastructure investments on the landscape;
- WHEREAS, District staff have developed a project proposal to the Legislative-Citizen Commission on Minnesota Resources (LCCMR) for the development machine learning and 2D modeling tools to produce these outputs;
- WHEREAS, the technical feasibility, cost, and narrative surrounding the proposal has been developed in coordination with a team of technical experts and communications advisors, resulting in support being expressed from a cross-section of local and regional agencies;
- WHEREAS, the Board of Managers has reviewed the proposal and associated costs to develop machine learning and 2D modeling tools, and finds the potential outputs to be strategically aligned with the District’s mission to collaborate with public and private partners to protect an improve land and water for current and future generations.

NOW, THEREFORE, BE IT RESOLVED that the Minnehaha Creek Watershed District Board of Managers hereby authorizes District staff to finalize and submit a proposal for 2021 funding to the Legislative-Citizen Commission on Minnesota Resources in an amount of \$883,000, for the development of machine learning an 2D modeling tools

Resolution Number 20-030 was moved by Manager _____, seconded by Manager _____. Motion to adopt the resolution ___ ayes, ___ nays, ___ abstentions. Date: 4/9/2020

_____ Date: _____ Secretary



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-090

Proposal Title: Minnehaha Creek Watershed District 2D Watershed Model and Machine Learning Model Development

Project Manager Information

Name: Brian Beck

Organization: Minnehaha Creek Watershed District

Office Telephone: (952) 471-0590

Email: bbeck@minnehahacreek.org

Project Basic Information

Project Summary: Develop innovative 21st century planning tools that more effectively forecast the impact of changing precipitation patterns on the watershed, and target public investments to protect water, homes, businesses, and infrastructure.

Funds Requested: \$883,000

Proposed Project Completion: 2024-06-30

LCCMR Funding Category: Water Resources (B)

Project Location

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

Region(s): Metro

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

Statewide

When will the work impact occur?

During the Project

Narrative

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

Climate change is measurably changing the distribution, frequency, and intensity of rainfall in Minnesota. These changes 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 accelerate monitoring, evaluating, and adapting 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. Around the state, we are beginning to see the consequences of systems designed for stable climate patterns that no longer exist.

Fortunately, advances in data science have made it affordable to collect exponentially more data and analyze it in more sophisticated ways. These are allowing 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 data. 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? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

MCWD is proposing a pioneering program to maximize the value of recent public investments in data collection. For example, MCWD, U.S.G.S, and Hennepin County are investing \$x in a remote sensing network that will collect more than 1 million real-time data points per year for precipitation, surface and shallow groundwater levels, and pollutant loading. State leaders have invested in mapping the detailed topography of the state, while municipal partners have digitized data about storm sewer systems.

MCWD wants to partner with LCCMR to:

- 1) Integrate and maximize the value of these disparate data sets
- 2) Identify, evaluate, and drive local investment in green and gray infrastructure solutions that protect and conserve the watershed's iconic resources

We will do so by harnessing two advances in data science:

- 1) Machine learning: Drawing deep insights and revealing trends from the vast quantity of newly available remote sensing data about how shifting precipitation is changing the mass balance of water and pollution.
- 2) 2-dimensional modeling: Integrating patterns revealed by machine learning with state topographic and municipal infrastructure data will provide a high-resolution planning tool to pinpoint, quantitatively evaluate, and drive decisions on climate adaptation projects and policies.

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?

- Model for maximizing the value of public investments in data collection, for climate adaptation project and policy development.
- High-resolution understanding of the delicate balance of all surface and groundwater inputs and outputs in the system, identifying critical areas of need for protection of environmental and public assets
- Improved quantification of potential conservation projects to reduce the environmental impact of changing precipitation
- Systems-scale assessment of future impacts from changes in precipitation and landscape, enhancing infrastructure planning.
- Improved flood forecasting and optimization of existing resource-related infrastructure – e.g. dams, weirs, levees – reducing flood damage and enhancing emergency management.

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Activities and Milestones

Activity 1: Identifying model inputs and data resources

Activity Budget: \$83,500

Activity Description:

One of the most common ways watershed districts synthesize data is the development computer models that can predict how water flows through our streams, lakes, and landscapes. The majority of commercially available watershed software use similar datasets that include landuse, soils, stormwater infrastructure, and topography. In recent years, the State of Minnesota, local municipalities, counties, and other local units of government have worked tirelessly to develop a series of high quality standardized digital datasets. However, the true value of data cannot be realized until it is transformed into a format that allows scientists, engineers, planners, and policymakers to make actionable decisions. Minnehaha Creek will identify watershed models that are capable of seamlessly incorporate datasets that have been collected by local, regional, and state entities.

Activity 2: Building the external data information processing system

Activity Budget: \$286,000

Activity Description:

MCWD will develop a reproducible data processing system that is able to incorporate publically available datasets into a watershed modeling framework. Historically, the process of building watershed models has been incredibly time intensive since all data collection and processing has been done manually. However, recent advances in data science have resulted in frameworks that automate complex data processing that will dramatically reduce the cost of future model builds for watershed districts throughout the state.

Activity 3: Building the 2D Watershed and Machine Learning Model

Activity Budget: \$513,500

Activity Description:

Minnehaha Creek will incorporate data and the data processing system into a living watershed model that is able to be automatically updated based on a changing landscape and technological improvements. One of the greatest problems facing watershed districts today is ensuring that the tools being used for decision making are based on the most up-to-date information available. Incorporating an automated data processing system that combines the data collected by municipal, county, and state partners ensure that Minnehaha Creek Watershed District, and its partners, can make informed decisions.

The final process of building any type of model is validation and calibration. Minnehaha Creek Watershed District has spent the past two years building a state of the art watershed monitoring network that provides an unprecedented level of detail to calibrate the watershed model. The calibration and validation step will ensure that the model can accurately predict stream and lake water level responses to precipitation based on real-world data.

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 be funded?

Project Manager and Organization

Project Manager Name: Brian Beck

Job Title: Research and Monitoring Program Manager

Organization: Minnehaha Creek Watershed District

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Budget Summary

LCMR Category	Task Description	Sub-task	Consultant	MCWD (In-Kind)	Equipment	Grant Request	In-Kind Match	Grant Match (equipment)	Narrative and Assumptions	Consultant		Beck \$60.00		Cermak \$50.00		Schauffer \$62.00		Steele \$45.00		Wisker \$80.00		Communication Manager \$60.00					
										Consultant Billing Rate	Consultant Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours						
1) Identifying model inputs and data resources	Data Processing	Task 1a. Define Data Input needs for 2D Model	\$7,500	\$8,400	\$0	\$83,500	\$111,180	\$125,500	Consultant will identify data or input requirements for the selected 2D model. This may include input layers such as stormwater infrastructure, LIDAR, and other common input datasets for model development.	\$151.32	38	\$4,800.00	80	\$0.00		\$0.00		\$3,600.00	80	\$0.00		\$0.00					
		Task 1b. Develop GIS Stormwater Infrastructure Data Format Based on Model Requirements	\$30,000	\$0	\$0				Consultant will work with MCWD and IT consultant to develop a single GIS stormwater infrastructure format based on the required inputs of the 2D model selected by MCWD.	\$175.00	20	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00					
		Task 1c. Process soil, landuse, LIDAR, and other data required by selected model	\$15,000	\$8,800	\$0				The consultant will process all input datasets required by the model. These will likely be a one time process since parameters such as soils will not need to be changed.	\$136.79	106	\$4,800.00	80	\$4,000.00	80	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00			
		Task 1d. Develop Scripts to routinely pull meteorological data	0	\$6,400	\$0				MCWD staff will develop a python script that will routinely pull meteorological data from partner agencies such as National Weather Service and Hennepin County.							\$2,400.00	40	\$4,000.00	80	\$0.00		\$0.00		\$0.00		\$0.00	
		Task 1e. Develop documentation on data structure and processing for model inputs	\$7,500	\$0	\$0				Consultant will develop documentation that will be published in the final report outlining the data used for the model and data preparation needed prior to model implementation.	\$147.73	44	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00	
	Data Collection	Task 1a. Install Surficial groundwater wells	\$0	\$0	\$88,000				Note: This cost assumes that MCWD will install 16 wells. Well installation will cost \$4k and equipment will cost \$1.5k. This cost may change if the technical panel decides fewer or more groundwater wells are required.				\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		
		Task 2b. Survey wetland volumes throughout MCWD	\$0						Consultant will work with MCWD to survey wells throughout the District. Assume that surveying will include 1 staff from consulting firm and 1 staff from MCWD.				\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		
		Task 2c. Install stream and lake water level sensors	\$0	\$0	\$37,500				MCWD staff will be purchasing and installing 3 acoustic doppler sensors in the upper watershed to improve model calibration. MCWD staff may also install several lake level sensors depending on recommendations on of the technical panel. This assumes that 4 additional lake level sensors will be installed at a cost of \$3.5k each.				\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		
		Task 2d. Update bridge/structure data on Minnehaha Creek		\$0					Confirm what, if any, data are available from municipalities				\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		
		Task 2e. Update Minnehaha Creek bathymetry/transects		\$0					Confirm what, if any, data are available from municipalities				\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		
Municipal Stormwater Infrastructure Data Intake/Partner Convening	Meet with Municipalities/Regional Agencies within MCWD that have stormwater infrastructure	\$43,500	\$87,580		MCWD staff will be reaching out to communities to obtain their GIS stormwater infrastructure or hydrologic models.				\$150.00	290	\$17,400.00	290	\$8,000.00	160	\$17,980.00	290	\$3,600.00	80	\$23,300.00	290	\$17,400.00	290					
2) Build External Data Information Processing System	Data Processing Planning	Task 2b. Develop and adopt plan for GIS processing system based on Task 1a findings	\$25,000	\$20,800	\$0				Consultant will develop a plan that outlines a GIS intake and processing system for municipal and regional entity (MnDOT, Hennepin County, etc).	\$150.00	167	\$9,600.00	160	\$4,000.00	80	\$0.00		\$7,200.00	160	\$0.00		\$0.00					
	Implementation of Data Processing		\$261,000	\$132,840	\$0		\$286,000	\$153,640	\$0	Implementation and development of GIS intake and processing system for municipal and regional entity stormwater GIS data into a format that can be directly imported to MCWD 2D model. This assumes that each of the municipality within MCWD will require approximately \$4k in consulting to sift through each dataset. This task assumes it will cost \$35k to develop a conversion tool for GIS stormwater infrastructure.	\$150.00	1740	\$34,800.00	580	\$26,000.00	520	\$19,840.00	320	\$52,200.00	1160	\$0.00	0	\$0.00				
		Task 2c. GIS Stormwater Infrastructure Plan Implementation for continually processing stormwater infrastructure data																									
3) 2D and Machine learning model build	Build and Calibrate 2D model	Task 4a. Meet with municipalities to discuss model build	\$43,500	\$37,990					Time that staff and consultant will need to spend working with external city staff and consulting engineers to identify what model makes the most sense for MCWD and partners	\$150.00	290	\$8,700.00	145	\$0.00		\$8,990.00	145	\$0.00		\$11,600.00	145	\$8,700.00	145				
		Task 4b. Select and build MCWD watershed 2D Model	\$225,000	\$0	\$0	Build watershed model using information and data developed in previous tasks. Assumes that LMCW model is built on a 1-D/2-D platform like XPSWMM or Mike Flood, and that UMCW model is 1-D SWMM like with groundwater.	\$338,500	\$46,790	\$0	Calibrate 2D model using stream level and lake level data collected by MCWD.	\$145.83	264	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00				
		Task 4c. Calibrate model with stream flow and lake level data	\$50,000	\$8,800	\$4,400	Assumes that MCWD verifies accuracy and reasonableness of data for calibration purposes.	\$147.57	432	\$4,800.00	80	\$4,000.00	80	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00				
		Task 4d. Develop 2D Model Report	\$30,000	\$0	\$0	Develop final report that describes data used, model build, assumptions, and calibration of the 2D model. Assumes 2 review cycles for final document.	\$145.83	156	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00				
		Task 4e. Develop 2D Model Report	\$25,000	\$21,920	\$80,000	MCWD will build the LSTM hydrologic model based on groundwater, meteorologic data, and stream flow. The primary cost associated with this task will be academic review and support for the model build.	\$150.00	167	\$12,000.00	200	\$0.00		\$9,920.00	160	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00				
	Build Machine Learning Model for Flood Forecasting and Dam Optimization	Task 5a. Develop Long-Short Term Memory (LSTM) Neural Network model	\$0	\$8,800		MCWD will develop a script to pull all necessary data identified in task 5a to continuously predict water levels at each monitoring location throughout the District.				\$4,800.00	80	\$4,000.00	80	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00					
		Task 5b. Develop automated system to pull meteorological, surface water level, and groundwater level for LSTM model flood forecasts	\$35,000	\$0	\$0	The consultant will develop a dam optimization model using the LSTM hydrology model. The optimization model will be developed to operate within the current dam operation plan.	\$95,000	\$54,320	\$0	Final report documenting the development of the optimization model using the LSTM model. This report will also document the development of the MCWD LSTM hydrologic model used for optimization and flood forecasting.	\$164.35	324	\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00				
		Task 5c. Develop optimization model using LSTM hydrologic model	\$35,000	\$9,680	\$0	Meeting with cities, DNR, FEMA, and other entities to market dam optimization	\$157.74	84	\$2,400.00	40	\$0.00		\$2,480.00	40	\$0.00		\$4,800.00	60	\$0.00		\$0.00		\$0.00				
		Task 5d. Final Report for Dam Optimization and LSTM hydrologic model	\$0	\$13,920		Cost to purchase workstation to run the 2D model and train the LSTM hydrology model.				\$6,960.00	116					\$116				\$116		\$6,960.00	116				
		Task 5e. Meeting with local and regional external stakeholders to market dam optimization	\$0																								
Equipment and Infrastructure of Model	Task 6a. Purchase Nvidia DGX Workstation								\$80,000	0	\$0																
Subtotals				\$883,000	\$365,930	\$125,500																					

Attachments

Required Attachments

Optional Attachments

Support Letter or Other

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

No

DRAFT

HENNEPIN COUNTY

MINNESOTA

April 6, 2020

LCCMR

100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

Hennepin County Energy and Environment strongly supports the Minnehaha Creek Watershed District's (MCWD) application to the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Hennepin County has an abundance of natural resources, including 200 lakes, 640 miles of stream, and more than 45,000 acres of wetlands. Protecting these important recreational, aesthetic and ecological resources is a priority for the County, its residents and its partners – like MCWD. However, the County's natural resources are under increasing pressure from population growth, development and climate change.

More and more, Hennepin County residents are starting to notice the effects of climate change, from warming winter temperatures to more extreme precipitation events. This is one of the most pressing challenges the County's natural systems face, and the MCWD is a key partner in the County's efforts to address the resulting impacts to our water resources.

The MCWD and Hennepin County Emergency Management have already collaborated to monitor and evaluate the watershed's response to changing precipitation regimes, and the interaction between surface and groundwater within the Minnehaha Creek corridor. In 2020 additional investments will be made by our respective agencies to gather additional real-time water level and flow data from across the watershed.

The MCWD's proposal to the LCCMR would build off, and leverage, these investments. Specifically, the proposed tools will provide much more detailed insights into the changes in runoff volumes, surface and surficial groundwater interactions, and pollutant load distribution associated with actively changing precipitation regimes. They will provide a high-resolution ability to quantify and evaluate the impacts of future forecasts on the natural and built environments; and drive decision making, investment and public confidence in the various adaptation strategies being considered across the landscape. This innovative work will also serve as a model that may be replicated in the other 10 watershed management organizations across the County.

MCWD and Hennepin County have a long history of innovative partnership, and we look forward to carrying that work forward through the funding of this proposal. Thank you for your consideration.

Sincerely,



Rosemary Lavin
Director, Environment and Energy Department

Hennepin County Environment and Energy

701 Fourth Avenue South, Suite 700, Minneapolis, Minnesota 55415-1842
hennepin.us/environment





April 7, 2020

Legislative-Citizen Commission on Minnesota Resources (LCCMR)
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

The City of Edina wishes to express its support for the Minnehaha Creek Watershed District's (MCWD or District) funding proposal to the LCCMR.

Edina prides itself in being a model of a successful, mature, and progressive urban community, that strives to lead in a modern and evolving world. Given this, we recognize the need to be an innovator that seeks to implement creative solutions to local and regional issues.

In an effort to implement creative landscape solutions, the City of Edina and the District have a long history of innovative partnership. Collectively our agencies have agreed to collaborate on land use planning, stormwater management, economic development, flood mitigation, parks and public land management, greenway development, and water resources improvements. The current restoration of Edina's Arden Park meets the goals of both the City and the District by restoring over 2,000 feet Minnehaha Creek, connecting the creek to its floodplain to reduce flooding, treating 80 acres of stormwater and improving water quality, while also improving park facilities and recreational opportunities.

Restoring the capacity of our natural systems is important because we recognize that flooding issues within Edina will continue to increase in frequency and severity, and climate change is the lead driver of this increased flood risk. Climatologists indicate that large, intense rainfall events are occurring more frequently, and models predict that large rainfall events will become more intense in the future.

Knowing that flooding is increasing in our community means we need new strategies, skill sets, and tools. The District's proposal to utilize machine learning is an innovative technique that will optimize the operation of the Gray's Bay Dam to reduce flooding along Minnehaha Creek to the extent possible, while also significantly enhancing the accuracy and lead time of flood predictions for emergency services. Coupling this machine learning with a 2-dimensional model that will incorporate digital municipal stormsewer data, topographic and land cover data, and insights drawn from the large volume of District remote sensing data, will result in an innovative new tool that will help drive solutions for local and regional issues.

The ability of our city to lead and evolve requires forward-looking tools and strategies, and for that reason I am writing to ask that the LCCMR consider the City of Edina's support for MCWD's proposal.

Sincerely,

Chad Millner PE
Director of Engineering

ENGINEERING DEPARTMENT

7450 Metro Boulevard • Edina, Minnesota 55439
www.EdinaMN.gov • 952-826-0371 • Fax 952-826-0392

April 6, 2020

Legislative-Citizen Commission on Minnesota Resources (LCCMR)
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

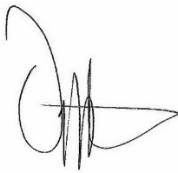
The City of St. Louis Park wishes to express its support for the Minnehaha Creek Watershed District's (MCWD or District) funding proposal to the LCCMR.

The City of St. Louis Park is a community that continually reinvents itself to best meet its future challenges and opportunities. In order to provide a livable community, we have committed to leading in environmental stewardship and have made it a priority to protect and improve the quality of our natural resources, parks, lakes, creek, and wetlands. St. Louis Park and MCWD have a strong history of partnership that has worked to fulfill this environmental stewardship and restore water resources across our city.

Since 2010, the city and MCWD have proactively coordinated public and private development to manage regional stormwater and expand and connect the riparian Minnehaha Creek Greenway to the St. Louis Park community. Through early coordination of land use planning and innovative public and private partnerships, efforts to date have resulted in hundreds of acres of regional stormwater management, two miles of restored stream, over ten acres of wetland restoration, public access to over 50 acres of previously inaccessible green space, and two miles of new trail network. Building on these shared endeavors, MCWD will continue to focus within this area of St. Louis Park – part of the Minnehaha Creek Greenway – to continue corridor restoration and stormwater management efforts while maximizing community goals of St. Louis Park.

As St. Louis Park looks to continue its work to protect and improve our city's natural resources, we recognize that climate change will continue to stress these systems. MCWD's proposal to implement machine learning is an innovative method that will allow MCWD to optimize the operation of the Gray's Bay Dam and reduce flooding along Minnehaha Creek, while also providing our emergency management staff more lead time to prepare for flooding events. The parallel component of the proposal to develop a 2D watershed model will provide our city a tool in which we can evaluate future green and gray infrastructure investments, which will enhance our ability to protect and improve our natural resources. MCWD is a critical partner to St. Louis Park as we work to provide a livable community, which is why we are asking the LCCMR to consider the City of St. Louis Park's support in its decision to fund this project.

Sincerely,



Tom Harmening
St. Louis Park City Manager

City of Victoria

April 6, 2020

LCCMR
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

The City of Victoria is writing in support of the Minnehaha Creek Watershed District's (MCWD or District) application to the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

The City of Victoria and the District have a strong history of partnership, and have worked closely to integrate plans and investments for the built and natural environments – to ensure the protection of our valuable water resources while sustainably guiding our community's growth.

As outlined in our 2040 Comprehensive Plan vision – Victoria actively preserves and enhances the natural features and environmental qualities that make it an attractive place to live, work and play. The District was an integral partner in that planning process and worked with the City to develop a "greenprint" for growth policy - promoting the intentional integration of natural systems into future planned development.

Meanwhile, over the course of our partnership, during the last six years record rain has stressed municipal infrastructure and waterbodies across our community and made it apparent that, as the City of Lakes and Parks, new tools and data driven approaches are needed to effectively plan for the future.

As we collectively look towards an uncertain future, we need to embrace next-level data driven approaches to community development and natural resource planning. MCWD's innovative proposal to stitch together digital municipal stormsewer data, with statewide topographic and land cover information made available through LIDAR, and insights drawn from the large volumes of District remote sensing data, will achieve that next level.

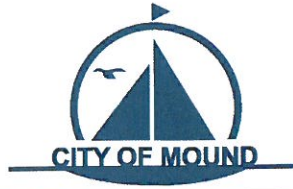
This work will strengthen our partnership and support the City's strategic goals to protect our natural systems in balance with our planned growth and economic development. These investments will provide us with high resolution tools to quantitatively evaluate when, where and how to most cost effectively manage increasing runoff volumes to reduce pollutant loading, manage stream channel erosion, reduce impacts to wetlands, better understand surface and groundwater interactions, and mitigate the impacts of high water to homes and businesses.

MCWD is a valued partner in sustainably planning for our community's future, and we would like the LCCMR to consider the City of Victoria's support in its decision to fund this project.

Sincerely,



Dana Hardie
City Manager



2415 WILSHIRE BOULEVARD • MOUND, MN 55364-1668 • PH: 952-472-0600 • FAX: 952-472-0620 • WWW.CITYOFMOUND.COM

April 7, 2020

LCCMR
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

The City of Mound wishes to express its support for the Minnehaha Creek Watershed District's (MCWD or District) application to the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Located on the western shores of Lake Minnetonka, Mound is a full service community that recognizes and appreciates its unique setting. Our commitment to preserving the natural environment ensures everyone can enjoy the community's four lakes, numerous wetlands, open space and parks.

With goals of creating land development patterns that fulfill social and economic needs, while enhancing and preserving natural resources, we have a long history of partnership with MCWD to implement low impact development practices to address water quantity and quality issues.

To continue to strike balance in the future between the built and natural environments, land use and water planning decisions must be integrated and based on best available information. The District's proposal to integrate watershed, city storm sewer and state topographic and land cover into a 2 dimensional watershed model will provide a detailed understanding of the patterns of water, and the tools needed to help us collectively evaluate the need, opportunity, and benefits of investing in gray and green infrastructure.

Having such a detailed understanding of the function and constraints of our local watershed systems, under changing precipitation patterns, will support the ability to make wise decisions related to the need for increased volume storage on the landscape, where to locate water quality improvement projects, assess upstream and downstream considerations, and guide policy planning to support sustainable growth.

Please consider the City of Mound's support for this proposal as you make decisions related to 2021 funding.

Sincerely,

Eric Hoversten
City Manager and Director of Public Works
erichoversten@cityofmound.com
952-472-0609



CITY OF ORONO

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2750 Kelley Parkway
Orono, MN 55356

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Crystal Bay, MN 55323

Telephone (952) 249-4600
Fax (952) 249-4616
www.ci.orono.mn.us

April 6, 2020

LCCMR
100 Rev. Dr. Martin Luther King Jr. Blvd.
State Office Building, Room 65
St. Paul, MN 55155

Dear LCCMR Members,

The City of Orono wishes to express its support for the Minnehaha Creek Watershed District's (MCWD or District) application to the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

No other city bordering Lake Minnetonka has as much water area, as much shoreline, or as much watershed land area as Orono. As such, we remain committed to effective land use planning and permanent environmental protection in an effort to preserve the natural systems that support Lake Minnetonka, for the benefit of all regional residents.

To achieve this commitment to the environment, the City of Orono works closely with the MCWD. Together we have restored 170-feet of shoreline on Lake Minnetonka; permanently protected the 63-acre Big Island Nature Park providing recreation opportunities and valuable habitat on an island situated in Lake Minnetonka; worked to preserve 26 acres of upland habitat and 63 acres of wetland resources through conservation development; and implemented stormwater management practices providing volume control and phosphorus reduction within the Painter Creek watershed.

Balancing our future growth and infrastructure needs while preserving the environmental qualities that make Orono an attractive residential community will require ongoing, careful and thoughtful analysis of how the built and natural environments interact. Communities must be able to quantify and evaluate landscape interventions and infrastructure adaptations in order to make wise decisions and investments - that support growth while achieving environmental goals of protecting surface and groundwater storage systems, correcting flooding and water quality problems, and enhancing wildlife habitats and water recreational facilities.

The District's proposal will be of significant value in accomplishing these goals, by leveraging all available local, regional and state data to develop a detailed and comprehensive planning tool. This work will serve to strengthen our history of partnership, and support the City's goals of growing sustainably into the future - by supporting detailed analysis of stream, wetland and shoreline restoration projects, and localized storage, volume reduction and water quality improvement sites.



CITY OF ORONO

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We look forward to continued partnership with the MCWD as we pursue our vision for the City of Orono, and want the LCCMR Members to consider our support when making its 2021 funding decisions.

Sincerely,

Dustin Rief
Orono City Administrator