

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 104-B

Quantifying A New Urban Precipitation/Water Reality

Category: B. Water Resources

Sub-Category:

Total Project Budget: \$ 1,377,893

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

Better understanding of groundwater and surface water interactions will be used to improve future infrastructure planning, reducing damage to home basements and underground infrastructure resulting from recent high water tables.

Name: Joe Magner

Sponsoring Organization: U of MN

Job Title: Dr.

Department: Department of Bioproducts & and Biosystems Engineering

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Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Map titled "Cities Selected for Proposed Groundwater Analysis" shows State of Minnesota with county boundaries, and proposed seven study cities: Minneapolis, St. Paul, St. Cloud, Duluth, Moorhead, Worthington, and Rochester.

<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base	
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency	
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>		TOTAL	<input type="checkbox"/>	%



PROJECT TITLE: Quantifying A New Urban Precipitation/Water Reality

I. PROJECT STATEMENT: In recent years the Twin Cities Metro Area has been experiencing significant extremes in meteorological and hydrological events. One issue that has arisen recently has been the phenomenon of high-water tables leading to damaging of home basements and buried infrastructure in the Lake Nokomis Area, Highland Park Area, and North Minneapolis. High water tables can probably be attributed to significantly more precipitation than has occurred in the previous hundred years and a greater amount of impervious surface. Infrastructure, including water lines, sewer lines, and private residences, were built during a period of relatively dry conditions compared to the current climatic conditions. In response to the higher precipitation and resulting surface runoff, most municipalities have begun adopting stormwater best management practices that not only reduce downstream flooding but also reduce negative water quality impacts. The application of these practices also may be causing higher water tables resulting in damage to above ground and underground infrastructures, including basements, roadways, and pipelines. To address this issue, it is necessary to better understand the pathways of groundwater recharge not only within the Twin Cities Metro Area (TCMA) but in other cities such as Rochester, Moorhead, Duluth, St. Cloud, and Worthington to capture a statewide perspective.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Evaluate relations between precipitation, lake-levels, groundwater-levels, and factors controlling water-level responses to precipitation in the TCMA and greater Minnesota. Precipitation, lake-level, and groundwater data will be compiled, compared, and statistically analyzed with geologic, land-use, and other hydrologic data and information to identify areas with high water-level responds to precipitation and important factors controlling these high responses in the TCMA. This analysis will be used to select up to three study areas in the TCMA where assessment of groundwater and surface-water interactions will be done. Results from this analysis also will be used to assess high-water-table areas in greater Minnesota cities: Duluth, Rochester, St. Cloud, Worthington, and Moorhead, where high precipitation may result in possible damage to infrastructure.

ENRTF BUDGET: \$330,000 requested (USGS match TBD, based on \$250,000)

Outcome	Completion Date
<i>1. Precipitation, lake-level, and groundwater level datasets for the TCMA and greater Minnesota.</i>	<i>June, 2023</i>
<i>2. Maps and databases identifying areas with high lake levels and groundwater levels and any relations between precipitation, lake-level, and groundwater levels and geologic, land-use, and other hydrologic factors in the TCMA and greater Minnesota</i>	<i>June, 2023</i>
<i>3. Selection of three to five urban settings in the TCMA and greater Minnesota where lake-level responses are highest to precipitation to investigate in Activity 3.</i>	<i>April 2021</i>

Activity 2 Title: Quantify geologic and hydrogeologic features and constraints that influence groundwater elevation in the TCMA and possible outstate areas TBD based on known geologic data. Provide up-to-date information on the distribution and hydraulic properties of geologic materials from land surface to bedrock. Provide information on the physical container for water and subsurface infrastructure.

ENRTF BUDGET: \$199,602 requested

Outcome	Completion Date
<i>1. geologic datasets (maps and databases) of near-surface, unconsolidated and bedrock topography/geology compiled from recent or updated County Geologic Atlases – dependent on project spatial extent. Examples: Hennepin (2018); Washington (2016) Anoka (2013) CGAs.</i>	<i>September 2021</i>



**Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal Template**

2. geologic datasets (maps and databases) of near-surface, unconsolidated and bedrock topography/geology in site-specific areas created where existing geologic atlas is not up-to-date or missing unconsolidated stratigraphy: Examples: Highland Park in Ramsey County, Ramsey CGA (1992)	<i>December 2022</i>
3. Hydraulic properties of geologic materials – ranges of horizontal and vertical hydraulic conductivities compiled from existing data in TCMA and settings identified in Activity 1-3.	<i>December 2022</i>

Activity 3 Title: To protect and preserve future water resources, investigate reasons for high-water-levels in three to five representative areas in TCMA and greater Minnesota urban centers defined in Activity 1. Provide detailed evaluations of groundwater and surface water interactions and establish relations between precipitation and groundwater and surface water interactions in selected urban settings using water-quality metrics, geochemical and stable isotope samples. Evaluate the effects of urban hydrologic features on lake and groundwater-level responses to precipitation. These evaluations will be conducted using conventional hydrogeologic analysis techniques as well as applying sophisticated groundwater flow and hydrologic water balance models that include the detailed processes of infiltration and evapotranspiration, as well as snowmelt and soil freezing.

ENRTF BUDGET: \$848,291 requested (USGS portion of activity = \$387,000)

Outcome	Completion Date
1. Water-level datasets (maps and databases) of upper-most water table in the selected areas. Map would include polygons showing where Platteville Formation, Decorah Shale, peat deposits are present and other geologic features.	<i>June 2023</i>
2. Maps showing locations of stormwater connections, infiltration basins, rain gardens and stormwater detention ponds at selected study sites.	<i>June 2023</i>
3. Frameworks for future infrastructure planning in the outstate selected outstate cities, and the TCMA in concert with the Minnesota Departments of Natural Resources, Pollution Control, Metropolitan Council, MWMO, MCWD, CRWD , and local community members.	<i>June 2023</i>

III. PROJECT PARTNERS AND COLLABORATORS:

- Dr. Joe Magner, UMN, Dept. Bioproducts and Biosystems Engineering (ENRTF supported) Project Manager/Soil Scientist/Hydrogeologist.
- Dr. John Nieber, UMN, Dept. Bioproducts and Biosystems Engineering (no ENRTF support) Project Engineer/Modeler
- Dr. Tony Runkle, MGS, Chief Geologist (ENRTF supported) Project Geologist
- Dr. Bob Tipping, MGS, Hydrogeologist (ENRTF supported) Project Hydrogeologist
- Perry Jones, USGS, Hydrologist (ENRTF supported) Project Hydrologist
- Tim Cowdery, USGS, Hydrologist (ENRTF supported) Project Hydrologist/Modeler

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

Improving our understanding of the hydrologic flow pathways, in a changing climate, on the land surface and in the subsurface will be of key importance to providing guidance to municipalities. Given, more water there may be better ways to management stormwater as well as permitting of various land uses that construct vulnerable infrastructure. Work in the TCMA will be expanded to greater Minnesota cities to help adapt to changes in precipitation and water storage and the potential adverse environmental outcomes. This work will provide longer range recommendations to the State of Minnesota.

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet



Legal Citation:

Project Manager: Dr. Joe Magner

Project Title: Quantifying A New Urban Precipitation/Water Reality

Organization: Regents of the University of Minnesota

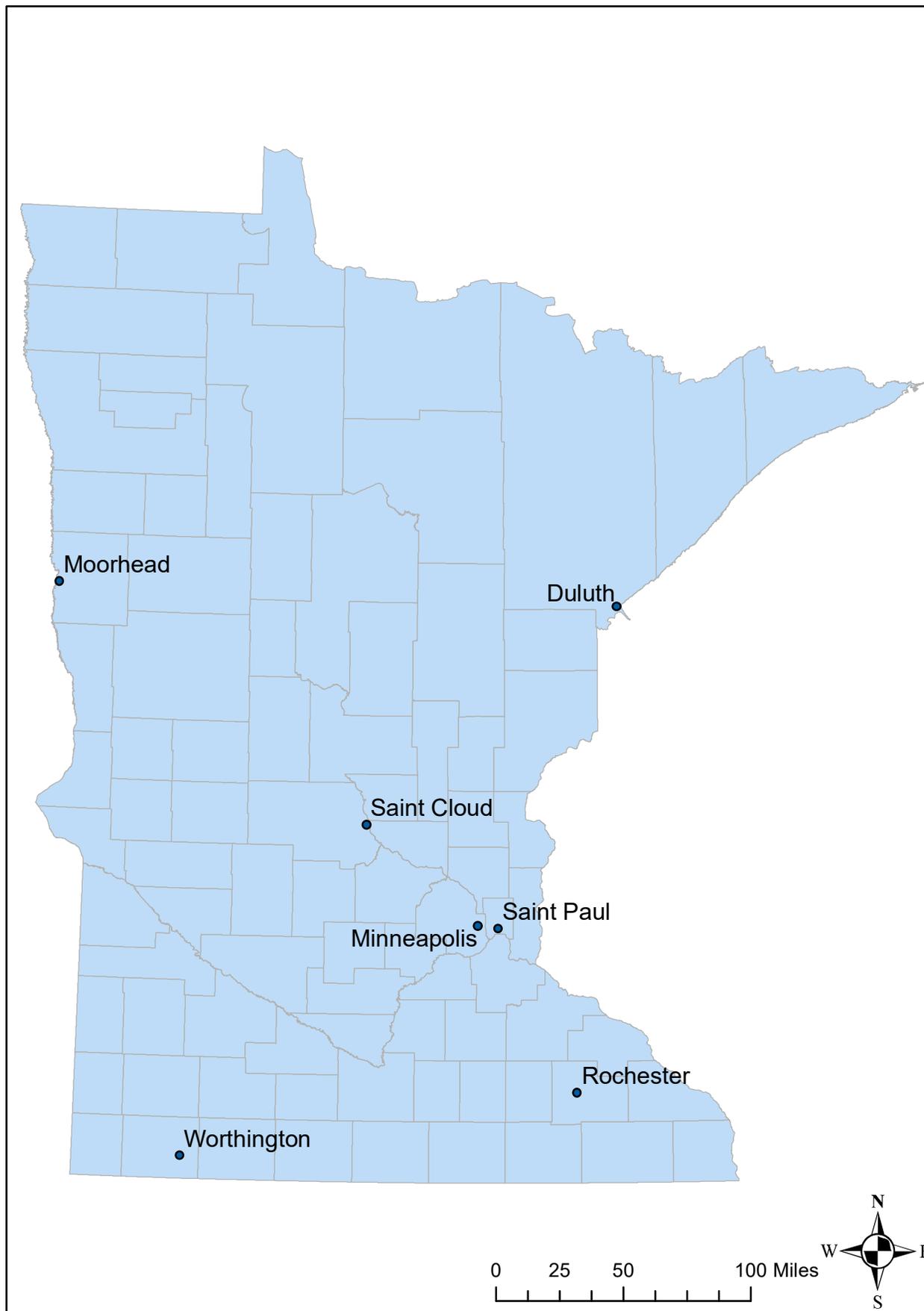
Project Budget: \$1,377,893

Project Length and Completion Date: Start: 7/1/20; Completion: 6/30/2023

Today's Date: April 10, 2017

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance	
BUDGET ITEM					
Personnel (Wages and Benefits)		\$ 356,488	\$ -	\$ 356,488	
Research Professor (PI), 10% FTE, \$51,889, 73.5% salary, 26.5% fringe					
Professor, Co PI, (Nieber is a fully funded faculty)					
Chief Geologist 16% FTE, \$53,637, 78% salary, 22% benefits					
Hydrogeologist 12% FTE, \$36,952 78% salary, 22% benefits					
Quaternary Geologist 25% FTE, \$61,293 78% salary, 22% benefits					
Grad student, 50% FTE, \$123,917 \$62,900 in salary and \$61,017 in fringe					
Undergrad student (3), .288 FTE, \$28,800 (\$16/hr x 1800 hours), 100% salary					
Professional/Technical/Service Contracts					
Sub contract with USGS		\$ 637,000	\$ -	\$ 637,000	
rotary-sonic drilling (4660 per 60 foot hole; boxes (\$10 per 2 foot box)		\$ 34,720	\$ -	\$ 34,720	
transducers, perisaltic pump, water sampling supplies		\$ 12,000	\$ -	\$ 12,000	
Major cation /anion and isotope analysis		\$ 42,350	\$ -	\$ 42,350	
Equipment/Tools/Supplies					
Batteries, enclosures, solar panels and wiring materials		\$ 78,355		\$ 78,355	
Laptop computer and software - 2		\$ 4,200		\$ 4,200	
OTT Bubble Level Sensors and data logger - 6		\$ 28,970		\$ 28,970	
Cellular Modem for wireless communication - 6		\$ 3,890		\$ 3,890	
Capital Expenditures Over \$5,000					
YSI multi-parameter probe - 6 @ \$12,000		\$ 72,000		\$ 72,000	
CSI Weather Station - 2 @ \$16,460 for North and South locations		\$ 32,920		\$ 32,920	
Fee Title Acquisition					
Easement Acquisition					
Professional Services for Acquisition					
Printing					
Report prep and graphic designer and Journal publication		\$ 60,000		\$ 60,000	
Travel expenses in Minnesota					
Travel to outstate cities		\$ 15,000		\$ 15,000	
Other					
COLUMN TOTAL		\$ 1,377,893	\$ -	\$ 1,377,893	
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT		Status (secured or pending)	Budget	Spent	Balance
Non-State: USGS		To be secured	\$ 273,000	\$ -	\$ 273,000
State:			\$ -	\$ -	\$ -
In kind: Unrecovered F&A		Secured	\$ 385,000	\$ -	\$ 385,000
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS		Amount legally obligated but not yet spent	Budget	Spent	Balance
			\$ -	\$ -	\$ -

Cities Selected for Proposed Groundwater Analysis



Magner 2019 Bio

Dr. Joe Magner is a licensed professional hydrologist (WI), a licensed professional soil scientist (MN) and an American Institute of Hydrology registered professional hydrogeologist. He received degrees from the University of Wisconsin-River Falls and the University of Minnesota and has served as an environmental scientist and educator in varying roles for over 40 years; primarily with the MN Pollution Control Agency but also advising US federal and local governments, and officials in China, India, Azerbaijan and South Africa.

Dr. Magner is a research professor in the Department of Bioproducts & and Biosystems Engineering at the University of Minnesota. He teaches classes and advises students in water quality, hydrology/soils, ecological engineering and watershed management. Joe has successfully advised over 40 graduate students along with 90+ publications. Joe is a co-author of the 4th edition of *Hydrology and the Management of Watersheds* published by Wiley-Blackwell (2013). Dr. Magner has a proven track record of managing large grants and directing studies with professional staff, postdocs, graduate students and undergrad students. He has advised clients such as David Letterman, the California Water Board, the Red River Basin Commission, private sector consultants, the Environmental Defense Fund and The Nature Conservancy.