Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)

Project Title: **ENRTF ID: 036-B**

Rural Industrial Water Efficiency Impact on Drinking Water

Category: B. Water Resources

Total Project Budget: $ 282,000

Proposed Project Time Period for the Funding Requested: 2 years, July 2017 – June 2019

Summary:

We will assess regions in greater Minnesota where groundwater pumping likely affects water quality and work with industrial groundwater users to reduce their water footprint, thereby improving local groundwater resources.

Name: Kate Brauman

Sponsoring Organization: U of MN

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Location

Region: Central, Northwest, Northeast, Southwest, Southeast

County Name: Statewide

City / Township:

Alternate Text for Visual:

Existing groundwater data for Minnesota, including aquifer characteristic and land use data, water use data, and water quality data, will be collected. These data will be used to create a simplified groundwater model that shows interaction between water quantity and quality. In areas highlighted as high risk for groundwater use and quality interactions, MnTAP will work with local businesses to reduce their water withdrawals.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: Rural Industrial Water Efficiency Impact on Drinking Water

I. PROJECT STATEMENT

Clean, safe water is critical for both household drinking supply and economic development across Minnesota. Rising levels of nutrients and other contaminants of concern, particularly in conjunction with increased competition for water resources, can threaten both of these important uses. A majority of households and businesses in Greater Minnesota depend on ground water resources to meet water supply needs. Issues of water quality for these groundwater resources may be exacerbated if heavy pumping alters flow patterns or concentrates contaminants of concern. MPARS data shows that from 2010 to 2014, 60% of groundwater withdrawals statewide occurred outside of the Metro area. Of withdrawals in greater Minnesota, 8% were for industrial use, a total of 13,353 million gallons. For these industrial processors, 54% of withdrawals are categorized as agricultural/food processors. The other large category (24%) is petroleum-chemical processing/ethanol

This project will focus on land in Minnesota designed as Drinking Water Supply Management Areas (DWSMA) with investments in three activities: 1) identifying target areas where drinking water supply is threatened by both contamination and availability ; 2) developing a model to define the benefits of reduced water withdrawals on water quality; and 3) conducting an industrial water use pilot study in high impact regions to define the water availability and economic impact of more efficient water withdrawals. The proposed work supports state agencies such as the Minnesota Department of Health to improve drinking water quality, and it encourages replication by demonstrating the economic benefits of improved industrial water use efficiency

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Targeting areas of concern for both groundwater quantity and quality **Budget: $50,000**

We will identify drinking water supply management areas (DWMSA) in Minnesota at risk of suffering negative effects on water quality due to pressure from water withdrawals. For each DWSMA, we will catalogue which are facing water quality issues. We will integrate information developed in a related proposal ("What are the public benefits of protecting sourcewater?") on future water quality concerns. We will complement this by identifying DWMSAs where there is substantial pressure on water resources from groundwater withdrawals for industrial use. The Minnesota Department of Natural Resources dataset of water withdrawals in the state (MPARS) will be put into a spatial format to overlay with water quality information. By integrating these two data sources, we will identify areas in which issues of water quality are likely to be exacerbated by water withdrawals.

Outcome	Completion Date
1. Integrated dataset and maps of DWSMA and household wells with water quality issues	September 2017
2. Maps highlighting regions of high industrial groundwater withdrawal	November 2017
3. Map and short report about regions at risk of groundwater quality impact from pumping	January 2018

Activity 2: Evaluating the benefits of reducing water withdrawals for water quality **Budget: $142,000**

We will develop a simplified groundwater flow model to evaluate where there is likely to be substantial interaction between water quantity and quality in DWSMAs. This project will link groundwater quantity from sources such as the Minnesota Pollution Control Agency's map of Groundwater Contamination Susceptibility and pumping information from the Minnesota Department of Natural Resources. By integrating this information, we will develop a tool to evaluate where and at what scale industrial water use is likely to be impacting water quality in household wells. Several simplified groundwater quality models exist for Minnesota, as well as more in-depth products like the Metropolitan Area Groundwater Model. We will provide a simplified model applied at higher resolution to the regions in Greater Minnesota identified in Activity 1.

Outcome	Completion Date
1. Short report evaluating existing models of groundwater quantity/quality in Minnesota	December 2017
2. A simplified groundwater model addressing water quantity and quality interactions for at least 3 regions of high importance	December 2018
3. Report assessing the value of reduced groundwater withdrawals based on the model	June 2019

Activity 3: Pilot study to implement industrial water savings in high-value regions **Budget: $90,000**

We will build on the analysis in Activity 1 to define industrial facilities that are situated in the most vulnerable and valuable regions. This work will establish a pilot program to confirm high volume, high value water efficiency measures suitable to the food processing and biofuels industries. These industries are critical to economic growth in rural areas of Minnesota and constitute 8% of regional groundwater use. The Minnesota Technical Assistance Program (MnTAP) has significant experience working with industry to develop compelling business cases for implementing water efficiency operations. The pilot program will utilize MnTAP site assessment experience to confirm industrial water conservation opportunities in the most vulnerable regions of the state. Selected facilities will be offered a MnTAP intern to conduct deeper evaluations of water use, identify efficiency opportunities, and begin the process of implementing water efficiency recommendations. Past experience in other industry sectors in the metro area indicates MnTAP interns identify and assist with implementation projects resulting in millions of gallons of water conservation per site.

Outcome	Completion Date
1. Profile of industrial activities in target DWSMA areas	December 2017
2. Water use assessments at 2-4 businesses within the target region	April 2018
3. Plan for implementing water efficiency recommendations at 2 industrial facilities in target regions done by 2 MnTAP Interns	November 2018
4. Report assessing cost impacts of water quality and availability on regional industrial facilities including food production facilities.	April 2019

III. PROJECT STRATEGY

A. Project Team/Partners

The project will be led by Dr. Kate Brauman at the University of Minnesota's Institute on the Environment and Dr. Laura Babcock, the Director of MnTAP. The project will be supported by a full-time post-doc (new hire) focused on data integration and groundwater modeling as well as MnTAP staff and 2 summer MnTAP interns.

B. Project Impact and Long-Term Strategy

This project is a stand-alone effort and not part of a longer-term funding request, although it builds and expands on work on a current LCCMR project led by Drs. Keeler, Brauman, and Twine entitled "Assessing Water Scarcity and Threats" and a LCCMR project proposed in this cycle lead by Dr. Keeler entitled "What are the public benefits of protecting sourcewater?" This project leverages agency data and land use and hydrologic modeling completed by the University of Minnesota and the Natural Capital Project. The project outcomes include detailed assessments of regions in Minnesota where interactions between groundwater pumping and water quality likely put drinking water at risk. The information we provide as well as the simplified groundwater quantity and quality model we create will provide a benefit to local communities similar to that provided by the Metropolitan Area Groundwater Model. Finally, the project sponsors actual interventions with industrial groundwater users to reduce their water footprint, thereby improving groundwater resources in their neighborhood. All data generated as part of the project will be shared with agencies and MnTAP and made publicly available through publication in a peer-reviewed open access journal. We will also work with the Minnesota Geospatial Information Office to make spatial data publically available.

C. Timeline Requirements

The proposed work will begin July 2017 and continue for 24 months.

2017 Detailed Project Budget

Project Title: *Rural Industrial Water Efficiency Impact on Drinking Water*

IV. TOTAL ENRTF REQUEST BUDGET 2 years

BUDGET ITEM	AMOUNT
Personnel:	
Kate Brauman, Project Manager (75% salary, 25% benefits); 17% FTE for each of 2 years	$ 38,000
Postdoctoral researcher (one), groundwater modeling and data assimilation (82% salary, 18% benefits); 100% FTE in years 1 and 2	$ 149,000
William Toscano, MnTAP Contributing Faculty, all years (75% salary, 25% benefits), 1% FTE years 1 and 2	$ 7,000
Laura Babcock, MnTAP Director and Sr. Engineer, project management and technical assistance (75% salary, 25% benefits), 12% FTE years 1 and 2	$ 25,000
Technical assistance, Civil Service (78.5% salary, 21.5% benefits), 22% FTE in year 1, 27% FTE in year 2	$ 35,000
Undergraduate Student Interns (92.7% salary, 7.3% benefits), 2.0 FTE in year 2	$ 17,000
Professional/Technical/Service Contracts:	N/A
Equipment/Tools/Supplies:	
Supplies: Printing/mailing of project notification materials and results to locations that do not routinely use electronic communications. Safety equipment for MnTAP Interns.	$ 1,000
Fees to publish a peer-reviewed analysis from this work in an open-access format	$ 2,000
Acquisition (Fee Title or Permanent Easements):	N/A
Travel: Mileage, lodging, and meals for travel to and between Drinking Water Supply Management Areas (DWSMA) in greater Minnesota for the post-doctoral research to gather field data and identify specific areas for modeling. Mileage, lodging and meals for MnTAP staff to conduct site visit activities at industrial facilities in DWSMA and mileage for student interns to travel from assigned intern locations back to Minneapolis campus for training and program support activities.	$ 8,000
Additional Budget Items:	N/A
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST	$ 282,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

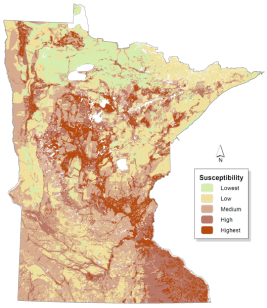
SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	N/A	
Other State $ To Be Applied To Project During Project Period: *Rent allocation for MnTAP staff work area at McNamara Alumni Center on the University of Minnesota Twin Cities camps. Funding from annual MPCA grant to the University of Minnesota for partial support of MnTAP activities.*	$ 6,348	*Secured*
In-kind Services To Be Applied To Project During Project Period: *The University will provide office space, IT services, and administrative / financial services in support of the project. The University of Minnesota's Facilities and Administrative rate is 53% and 54% of modified total direct costs during the duration of the project. The amount, if F&A expenses had been allowed on the project, would be $102,742. F&A expenses for MnTAP are calculated at an off campus rate of 26% or $23,400.*	$ 126,142	*Secured*
Funding History:	N/A	
Remaining $ From Current ENRTF Appropriation: *$234,936 - ENRTF for 2015-04a" Informed water management: Mapping scarcity, threats, and values." The proposed work leverages an existing LCCMR appropriation awarded July 2015 to PI's Keeler, Brauman, and Twine. The project has $190,000 remaining in the budget as of January 2016 and the project has an end date of June 30th 2018. The existing appropriation will generate statewide maps and data on future precipitation, temperature, and water scarcity that will inform the sourcewater risk assessments proposed in this study.*	$ 234,000	*Legally Obligated*

Rural Industrial Water Efficiency Impact on Drinking Water

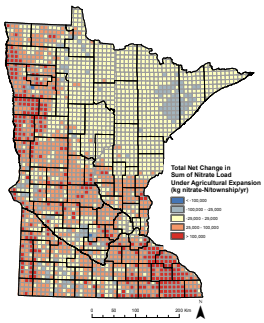
Activity 1:

Existing MN Water Data

Aquifer and Land Data

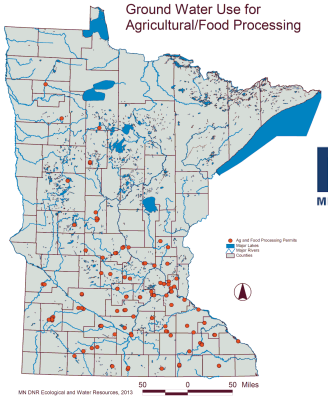


Groundwater Contamination Susceptibility from MnDNR based on model by the MnPCA (Porcher, 1989)



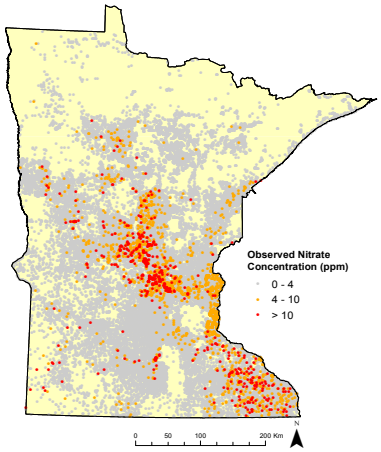
Change in N load from agricultural expansion from Keeler & Gourevitch, MCEA (2014)

Groundwater Use Data



Water Use Permits for Food Processing data from MPARS, map from MnDNR Draft Groundwater Management Program (2013)

Groundwater Quality Data

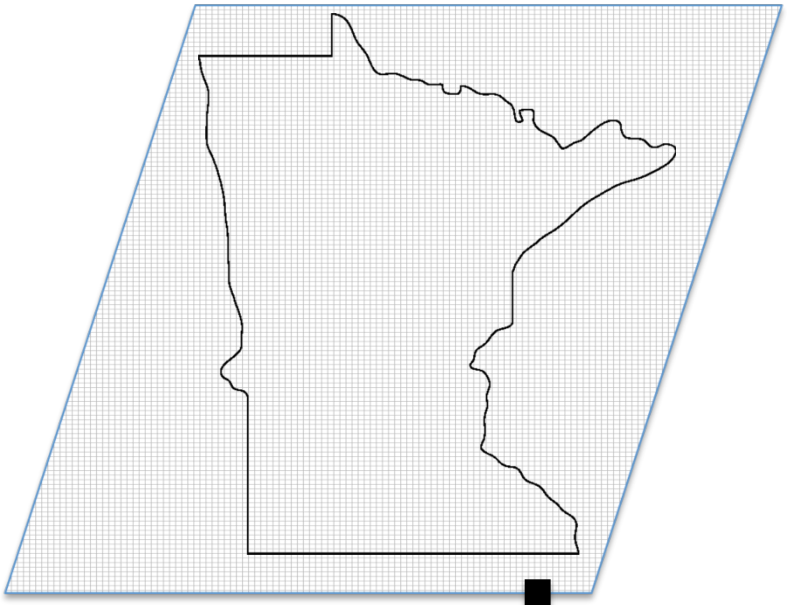


Observed Nitrate Concentration in drinking water wells from Keeler & Gourevitch, MCEA (2014)

Activity 2:

Simplified Groundwater Flow Model

Incorporating Quality and Quantity Information



Activity 3:

On site technical assistance

from MnTAP staff and interns to reduce water use

"The internship gave me hands-on experience in an industry, allowed me to be in charge of a project, work with all levels of employees and make a real difference in terms of water conservation and cost savings"
Civil Engineering Student, University of Minnesota Twin Cities

Case Study - Northern Star Co., Chaska, MN

Recommendation	Impact	Potential Savings	Status
Lower water level in potato washer	2.8 million gallons	N/A	Completed
Replace float in basket washer	6.7 million gallons	N/A	Completed
Reduce peeler exhaust spray time	93,000 gallons	N/A	Completed
Replace leaking solenoid	1.4 million gallons	N/A	Completed
Reuse RO reject water	5.25 million gallons	N/A	Completed
Reuse scrubber water	8.25 million gallons/ scrubber	N/A	Recommended
Install auto fill valves on pump tanks	4.2 million gallons	N/A	Recommended
Optimize surge bin water level	1.9 million gallons	N/A	Recommended
TOTAL	38,843,000 gallons	$166,300	

"The MnTAP intern allowed Northern Star Co. to focus specifically on water conservation opportunities without the typical day-to-dayu interruptions any internal resource would have encountered."
Corporate Environmental Director, Northern Star Co.

PROJECT TITLE: Rural Industrial Water Efficiency Impact on Drinking Water
2017 Project Manager Qualifications

Project Manager Qualifications: Kate Brauman
Kate Brauman is the Lead Scientist for the Global Water Initiative at the University of Minnesota's Institute on the Environment. In this role, she coordinates water-related activities at the University of Minnesota's Institute on the Environment. This entails organizing and leading grant propels, teaching and advising students, convening on- and off-campus groups interested in water resources, and public speaking engagements as well as doing research.

Dr. Brauman's research focuses on assessing patterns and drivers of water use in order to manage water wisely in an era of limited supply. This research addresses issues of water scarcity, water productivity, and land use effects on water resources, integrating hydrology and land use with economics and policy. Through projects as diverse as payments for watershed services, global variation in "crop per drop", and trends in water consumption and availability, Dr. Brauman researches sustainable solutions to pressing water issues. Her work includes field-based work, modeling, and analysis of existing large data sets. This methodological breadth provides insight on a global scale about pressing problems and solution levers while providing critical ground truth data and understanding from local interactions.

Dr. Brauman received her doctorate from Stanford University and her undergraduate degree from Columbia University. Prior to her graduate studies, Dr. Brauman worked in public education at the Natural Resources Defense Council.

Institutional information: Institute on the Environment, University of Minnesota
The mission of the University of Minnesota's Institute on the Environment is to lead the way toward a future in which people and the environment prosper together. The Institute on the Environment (IonE) exists to accelerate the transition toward a more hopeful and sustainable future, while also preparing leaders and scholars for uncertainties that arise along the way. IonE supports breakthrough research across disciplines, develops the next generation of global leaders, and builds transformative partnerships across the state, region and globe. Current IonE topical foci are:

- illuminating the value of nature, often for people but also in its own right;
- accelerating the transition to an economy based on renewable energy
- informing land use decisions so we can feed a growing global population without degrading planetary systems;
- collaborating with the private sector to develop sustainable solutions to production and consumption challenges;
- working with communities to build resilience and adapt to a changing climate; and
- reducing risk of water shortage in an increasingly resource-constrained world.