

**Environment and Natural Resources Trust Fund  
2019 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 092-B**

Mobilizing Minnesota Communities to Fight Proliferating Toxic Harmful Algal Blooms (HABs)

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**Category:** B. Water Resources

**Sub-Category:**

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**Total Project Budget:** \$ 513,179

**Proposed Project Time Period for the Funding Requested:** June 30, 2022 (3 yrs)

**Summary:**

This project will create seven tools to mobilize Minnesota communities to fight, detect and mitigate the impending toxic harmful algal blooms using drones and assisted by citizen science volunteers.

**Name:** Shahram Missaghi

**Sponsoring Organization:** U of MN

**Title:** Extension Educator

**Department:** Extension

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Eden Prairie MN 55346

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:** many

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**Alternate Text for Visual:**

We have used a self-explanatory graphics symbols, figures, arrows, and times to show the 3 main activities of project's design experiments, field work, and harmful algal bloom assessment tools development.

<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"/>	%
<input type="checkbox"/>	If under \$200,000, waive presentation?						



PROJECT TITLE: Mobilizing Minnesota communities to fight proliferating toxic harmful algal blooms (HABs)

I. PROJECT STATEMENT

We will create 7 tools to help mobilize Minnesota communities to detect, mitigate, and fight toxic HABs. Trained citizen science volunteers will use protocols, generated through research, for measuring and quantifying potential HABs. The project outcomes will make Minnesota communities resilient to the negative environmental, health, and economic consequences of toxic HABs that can turn water green, kill fish, and produce toxins with serious health risks - particularly for communities depending on surface water for drinking water (25% of MN population). Recent funding has helped us increase our understanding of HABs, develop an automated continuous water quality station (buoy) and initiate the annual MN HAB Workshop training with over 100 water resources professionals and practitioners attending. However, what is needed and missing is the application of the research findings at the community level to fight impending and increasing toxic HABs.

Our collaborative team, Minnesota Pollution Control Agency (MPCA), Minnesota Department of Health (MDH), Minnesota State University Mankato (MNSU), and University of Minnesota St. Anthony Falls Laboratory (SAFL) and Extension (Extension), proposes to:

- monitor HABs using the buoy and drones to develop HAB detection protocols and prediction models
• Establish a citizen science network to assist in monitoring the 6 lakes, implementing the protocols, and
• Incorporate past and current research creating tools for communities to assess risk and mitigate HABs.

Our approach is unparalleled in forming a committed team of experts to conduct necessary research and generate the set of tools and the framework for developing real-world solutions to HABs in Minnesota.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Lake selection, obtain equipment, establish monitoring procedures, and form citizen science.

Select 6 lakes for HABs monitoring by drones, buoy, toxin (ELISA) testing kits, and real-time RGB imaging. Develop site-specific sampling regimes, tasks, field training, and safety practices. Purchase, manufacture, test, and make all equipment field ready, including: drones (DJI Matrice 100) with HAB detecting (spectral- Tetracam Micro-MCA 6) and water temperature (NEC thermal) cameras; set up model. Identify and enlist about 60 volunteers, write field protocols, communication, and bring about a functioning citizen science group. Hire a postdoctoral researcher to manage drones' field operations and to train citizen science volunteers (3 flight-days / week).

ENRTF BUDGET: \$ 223,337

Table with 2 columns: Outcome, Completion Date. Rows include: 1. On boarding of the new citizen science coordinator and drone manager-postdoc (10/1/19), 2. Selection of 6 lakes, establishing tailored HAB sampling specification and templates (12/1/2019), 3. Equipment, materials procurement, configurations, and field preparation (2/1/2020)

Activity 2: Water quality and HAB toxin sampling, drone monitoring, and citizen science

We will use the buoy developed under LCCMR grant (2017-2019) to intensely monitor two lakes (1 deep & 1 shallow)and simultaneously with drone mapping the lake surface, to validate a 3D HAB prediction model and protocols for citizen science to detect the onset, measure growth, and track HABs distribution. The newly developed protocols will be tested and verified on another 4 lakes. All 6 selected lakes will be part of the MPCA's monitoring program and complement the MDH's investigation of HAB toxin in drinking water reservoirs.

ENRTF BUDGET: \$ 177,724

Table with 2 columns: Outcome, Completion Date. Row includes: 1. 1st-year field sampling: Buoy and drone operation (SAFL), HAB toxin testing (Extension); plankton sampling & analysis; real-time video (MNSU); coordination with (11/1/2020)



**Environment and Natural Resources Trust Fund (ENRTF)  
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MPCA bi-weekly water quality sampling and MDH post water treatment HAB toxin testing.	
2. <i>Citizen science recruitment, training (coordinator), demonstration of drone technology and training others (Grad. Student), collecting and compiling of field data (all parties).</i>	10/1/2020
3. <i>2nd-year field sampling: similar and addition to outcomes of season 1.</i>	11/1/2021
4. <i>continuous training, equipment maintenance, and supply inventory management.</i>	12/1/21

**Activity 3: Creating HAB assessment tools and the frame work for real-world solutions.**

A unique feature of this project is that the research generated data will be made available to all Minnesota communities and Tribal governments through the following seven (7) HAB assessment tools:

1. Citizen science-Drones HAB detection & tracking protocol: A detailed volunteered protocol on how to detect HAB onset, measure growth, and track HABs distribution using drone technology. This will boost, strengthen, and complement existing and new collaborations with multiple statewide citizen science programs.
2. Lake algae and toxin monitoring website: MNSU will create a web base HAB reporting system of the 6 studied lakes for area communities. The system can be scaled up as additional citizen science data become available.
3. HAB exposure maps: Extension, MNSU, and MDH will create 6 dynamic HAB and toxin exposure maps to estimate the potential HAB seasonal and accumulative exposure time for a variety of lake users on each lake.
4. HAB Prediction model: SAFL, MPCA, and Extension will apply a fine-scale spatial and temporal 3D HAB predication model to develop various “what if” scenarios for testing different management schemes.
5. Training for Professional: Extension and the team will develop regionally tailored training workshops for water resources practitioners on HABs identification, detection, mitigation, and management.
6. Drinking water intake designs: SAFL and MDH will provide a set of preliminary design guidelines for water treatment facility intakes that would minimize HAB contaminations.
7. Project outreach and extension: All findings, results, and reports will be posted on [z.umn.edu/algae](http://z.umn.edu/algae) webpage to support the advancement of our understanding of detecting and mitigating HABs in Minnesota.

**ENRTF BUDGET: \$ 112,118**

Outcome	Completion Date
1. <i>data analysis, compiling reports, and write publications</i>	12/30/2021
2. Create the 7 HAB assessment and management tools for the Minnesota communities.	12/30/2021

**III. PROJECT PARTNERS:**

**A. Partners receiving ENRTF funding:**

Name	Title	Affiliation	Role
Ben Von Korff & Bryce Hoppie	Specialist & Prof.	Mankato State University	Co- Investigators

**B. Partners NOT receiving ENRTF funding:**

Steve Robertson & Todd Johnson	Supervisor	MDH	Collaborator & support
Pam Anderson	Supervisor	MPCA	Collaborator & support

**Please note that we have formal endorsement and letters of support from MPCA, MDH, and Mankato SU.**

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:**

This project will aid Minnesota communities to become stronger and more resilient to HABs occurrence. The project’s strategy is to nurture collaboration among all stakeholders, promote original discoveries, and develop research supported educational materials, and train water resources’ professionals and citizen science groups.

**V. TIME LINE REQUIREMENTS:**

The project is for 3 years: starting on July 1, 2019, and ending on June 30, 2022. Periodic project status update will be submitted January 1 and July 1 of each year with a final report submitted by June 30, 2022.

## 2019 Proposal Budget Spreadsheet

**Project Title: Harmful Algal Blooms in Minnesota Lakes**

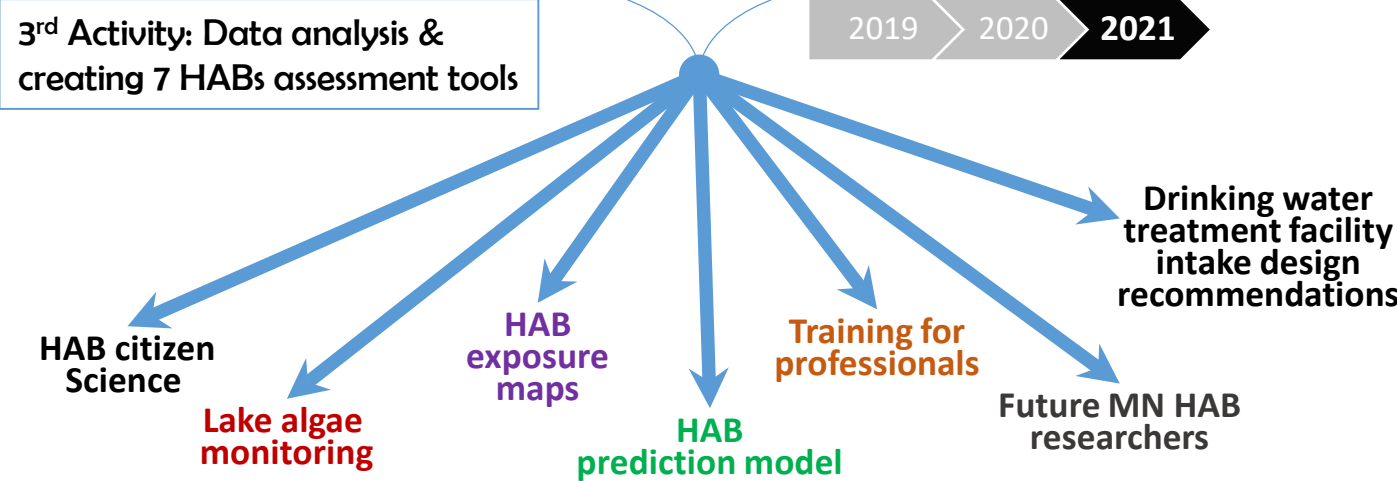
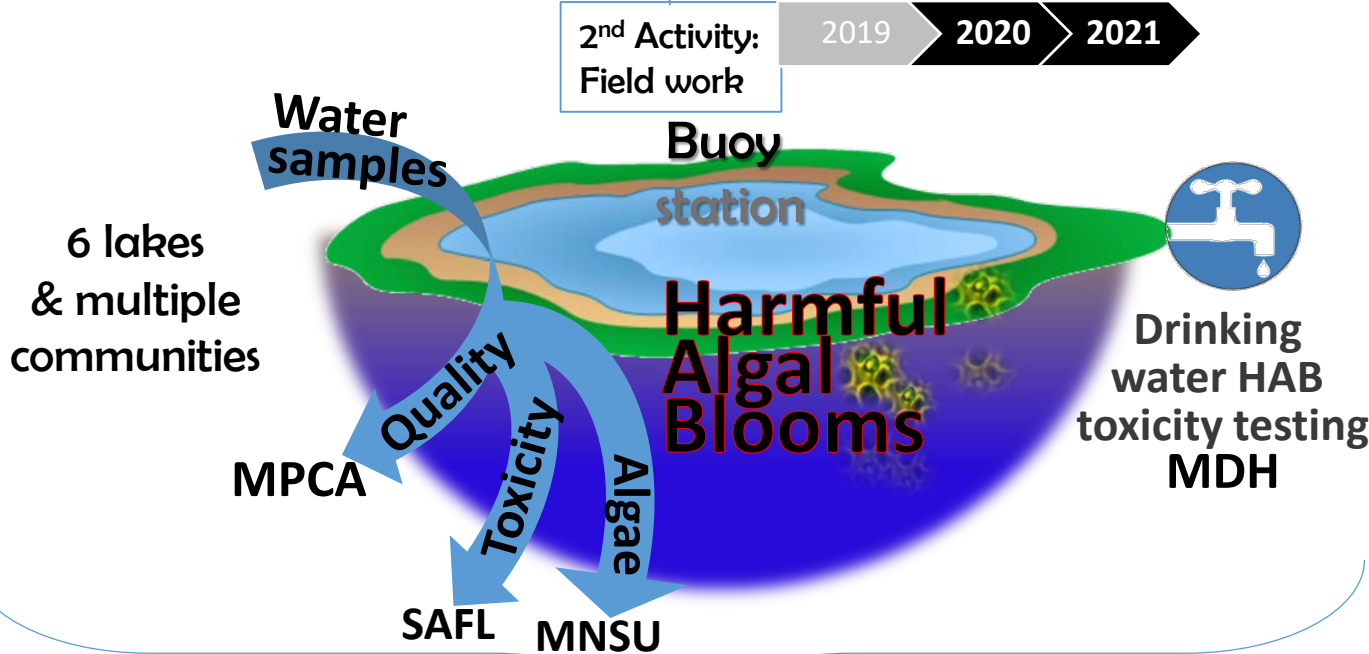
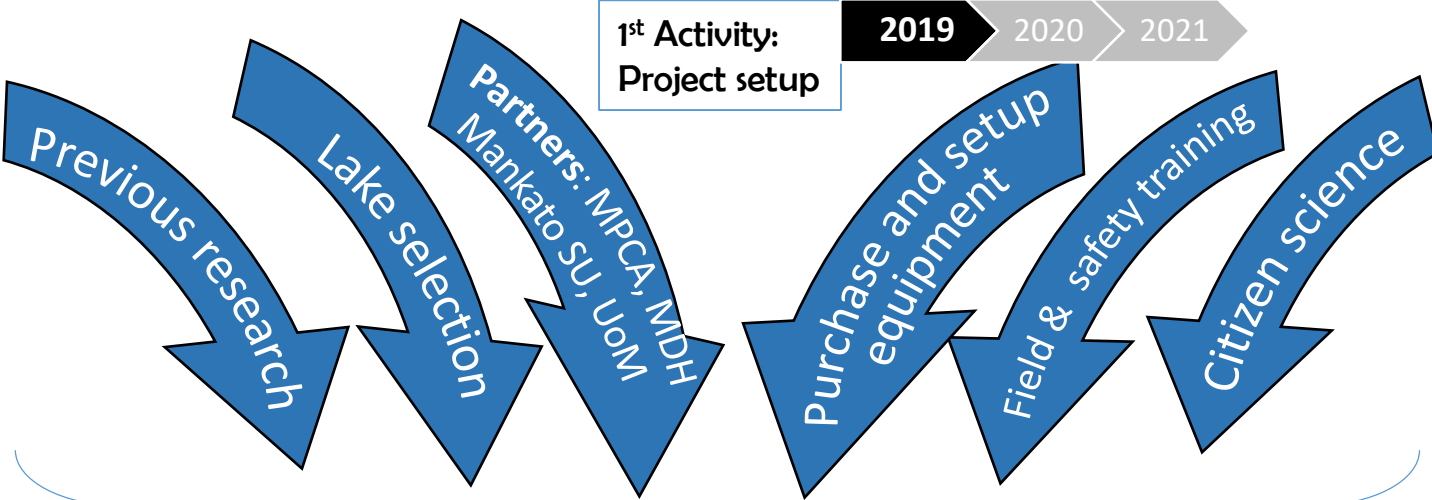
**IV. TOTAL ENRTF REQUEST BUDGET for 2.5 years**

BUDGET ITEM (See "Guidance on Allowable Expenses")	AMOUNT
<b>Personnel:</b>	
Shahram Missaghi, Project Manager, Salary \$37,609 + fringe (33.5%) \$12,599; 15% FTE for year 1 year 2, 30% FTE year 3	\$ 50,208
Miki Hondzo, Salary \$48,609 + fringe (33.5%) \$16,284; 10% FTE for year 1, year 2 and year 3	\$ 64,893
Michele Guala, Salary \$27,822 + fringe (33.5%) \$9320; 8% FTE for year 1, 10% FTE year 2 and year 3	\$ 37,142
Citizen Science Coordinator - TBD, Salary \$29,905 + fringe (33.5%)\$10,018; 25% FTE for 1, year 2 and year 3	\$ 39,923
Post Doc - TBD, Salary \$133,316 + fringe (21.4%) \$28,530; 100% FTE all three years	\$ 161,846
<b>Professional/Technical/Service Contracts:</b>	
GreenWater Laboratories: 50 random samples @ \$120/sample; price includes testing + shipping costs	\$ 6,000
HAB laboratory testing for algal identifications	\$ 5,500
<b>Equipment/Tools/Supplies:</b>	
Drone	\$ 12,000
Camera	\$ 26,500
Drone maintenance & camera waterproofing kit	\$ 4,500
Buoy maintenance: wind cup, vane anemometer, thermistors, temperature & RH sensors, etc.	\$ 4,500
HABs & water quality 3D modeling: 1 time site registration + maintenance license	\$ 10,000
Toxic testing kit (Microcystin ELISA kit) @ \$471/ kit + \$45 shipping x 24 kits	\$ 12,000
Consumable supplies: field supplies, chemical & nutrient buffers, etc.	\$ 10,500
<b>Travel:</b>	
Car rental	\$ 5,000
Staff mileage @ 2500 miles/year	\$ 4,089
<b>Subaward/subcontract:</b>	
Mankato State University	\$ 54,078
<b>Additional Budget Items:</b>	
Publications	\$ 4,500
	\$ -
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 513,179</b>

**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:	NA	NA
Other State \$ To Be Applied To Project During Project Period:	NA	NA
In-kind Services To Be Applied To Project During Project Period:	NA	NA
Past and Current ENRTF Appropriation:	NA	NA
Other Funding History:	NA	AN

**Mobilizing Minnesota communities to fight proliferating toxic harmful algal blooms (HABs)**



**Environment and Natural Resources Trust Fund (ENRTF)**

**2018 Main Proposal**

**Title: Mobilizing Minnesota communities to fight proliferating toxic harmful algal blooms (HABs)**

**Project Manager Qualifications and Organization Description**

Dr. Shahram Missaghi is the U of MN Extension's Water Resources professor. He develops research supported water resources education and training for the current and the next generation water resources professionals and communities. Programs focus on innovative land and in-lake practices that reduce environmental impacts of excessive runoff. He conducts research around surface water quality and investigating the potential impacts of various factors on our local water resources using water quality modeling. Shahram leads a number of partnership teams and manages various outreach projects for major research projects. This current LCCMR proposal is in direct response to numerous requests from water resource's stakeholders, researchers, practitioners and communities in Minnesota.

**Selected grants:**

ENRTF ID: 038-B; as recommended by LCCMR; (Co-I); \$ 270,000; 2015-2018  
Watershed Specialist Training. Grant partner; EPA 319; (Co-I); \$193,000; 2012-2014  
Maintenance Training and Certification for Reduced Environmental Impacts. (Co-I); EPA Section 319; \$118,000; 2009-2011  
Adapting Minnesota Shoreland BMPs for Climate Change; EPA 319; (Co-I) \$208,000. 2011  
Development of Pollution Prevention Training for Municipal Separate Storm Sewer System Entities. Grant partner. Minnesota Pollution Control Agency; \$44,000. 2008

***University of Minnesota Extension***

The University of Minnesota Extension Water Resource team connects community needs and University resources to address Minnesota's critical water resource issues. We model effective education to ensure safe and sustainable water resources. And we provide expertise and collaborative support for watershed and water basin resources, stormwater education, shoreland education, and sewage treatment education for homeowners, communities, and professionals.

Our projects have stabilized the shoreline of Lake Superior, teach communities how to construct rain gardens, and work with counties to develop sustainable action plans to address local water quality concerns.

University of Minnesota Extension takes into account diverse views and multiple land uses by drawing on our expertise in agriculture, natural resources, and citizen leadership. Working with local communities, Extension employs a balanced, research-based, solution-focused approach, providing a trusted source of accurate information. Our goal is to coordinate diverse interest groups, engage citizens in watershed planning and education, and provide evaluation and technical expertise in areas of safe drinking water, aquatic invasive species, drainage, water valuation, nutrient management, and program evaluation.