



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-183

Proposal Title: Watershed Watchers: Empowering Educators to Expand Water Monitoring

Project Manager Information

Name: Kelsey Prihoda

Organization: U of MN - Duluth - Sea Grant

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Project Basic Information

Project Summary: We will expand Minnesota's real-time water-quality monitoring capacity by training 60 educators across the state, equipping them with build-a-buoy kits, and engaging 1,500 students in water resource protection.

ENRTF Funds Requested: \$496,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Water (B)

Project Location

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

Statewide

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

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

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

Minnesota's lakes are a vital asset, supporting a \$1.1 billion recreation economy (MNDNR, 2024). However, water quality is a concern, with 25% of the state's lakes currently failing to meet established standards (MPCA, 2026). Implementing continuous water-quality monitoring presents an opportunity to enhance the protection and improvement of Minnesota's water resources (Egge et al., 2021).

Water quality sampling has relied on collecting physical water samples at one point in time. This method fails to capture important changes in water quality caused by storms and runoff. Recent advances in low-cost communication networks, buoy-based sensor technologies, and machine learning provide new opportunities for continuous, water-quality monitoring and actionable data for lake managers that will support more effective protection and restoration efforts.

Making the most of these new tools will require a workforce trained to use monitoring technology for science-based decision making. Minnesota's K-12 educators have limited time, funding, and local data to keep pace with rapid advances in marine technology or integrate it into their classrooms (Ferris et al., 2025). Our project will link Minnesota's surface water monitoring needs, availability of low-cost monitoring platforms, and marine technology experts to engage educators and their students in water resource protection.

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

We will use an engineering design process to implement Watershed Watchers (Figure 1), a three-year program to deploy affordable, high-tech monitoring platforms statewide. We will create partnerships between engineering experts at the University of Minnesota and K-12 educators to develop age-appropriate build-a-buoy kits for classrooms to deploy in local lakes.

Water quality data complexity will increase by learner level. Elementary kits include location, communication, and a temperature sensor. Middle and high school students will use commercial probes to verify buoy data. High school kits will include pH, ORP, dissolved oxygen, and specific conductivity, with the option for computer-aided design, three-dimensional rapid prototyping, and manufacturing of buoy parts.

Minnesota Sea Grant (MNSG) will establish a vital pipeline for marine technology literacy by engaging two cohorts of 30 educators each. These educators will co-design kits with experts and receive professional development, stipends, and direct access to guest scientists. This hands-on approach extends beyond the classroom as students collaborate with lake associations and watershed districts to deploy their buoys. The resulting water quality data will be made public through a commercial platform and shared with lake managers, ultimately preparing Minnesota students to manage and protect our state's water resources into the future.

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?

The Watershed Watchers program will link Minnesota's water quality needs with emerging marine technology and begin building the workforce Minnesota needs to protect, conserve, preserve, and enhance our natural resources in the future. Outcomes of this project include: 1) increasing real-time water monitoring capacity in Minnesota, 2) training 60 educators who will engage an estimated 1,500 students in generating publicly available data to fill surface water quality data gaps, and 3) building a scalable model for a participatory science and education program that can support science-based decision making and future targeted sampling operations.

Activities and Milestones

Activity 1: Project Kickoff: Understanding Educators’ Needs to Inform Design, Recruiting Participants, and Building Relationships

Activity Budget: \$178,024

Activity Description:

Our first activity focuses on 1) ensuring our buoy project design meets the needs of Minnesota educators and classrooms of a variety of ages, 2) recruiting project team and program participants, and 3) hosting our kickoff event.

To ensure Watershed Watchers meets the needs of Minnesota classrooms, we will conduct three virtual, educator focus groups that will inform the design requirements for the build-a-buoy kit prototype. Focus groups will be virtual to reduce barriers to educator participation and ensure we include diverse perspectives from educators across the state.

We will partner with educators and school district STEM coordinators (see letters of support) and launch a statewide campaign to recruit the first cohort of 30 educators. In addition, we will initiate a national search to recruit a graduate student to lead the technical component of buoy development.

Finally, once our year-one teachers and the graduate student are recruited, we will hold our virtual “Watershed Watchers Kick-Off Event” to begin building relationships among the project team and educators. During this event, we will present the results of the initial focus group research, solidify the prototype design requirements, and brainstorm solutions for classroom implementation at all levels (elementary, middle school, and high school).

Activity Milestones:

Description	Approximate Completion Date
Host three, virtual educator focus groups and develop design requirements for the build-a-buoy kit prototype.	January 31, 2028
Recruit and hire a graduate student to lead project technical development.	February 28, 2028
Recruit 30, K-12 educators to the first cohort of the Watershed Watchers program.	March 31, 2028
Host a virtual Watershed Watchers program kick-off event and solidify prototype design requirements.	April 30, 2028
Design the first prototype build-a-buoy kit according to educator requirements.	June 30, 2028

Activity 2: Build-a-Buoy Prototype Development, Testing, and Evaluation

Activity Budget: \$158,714

Activity Description:

In summer 2028, co-PI Hill and the graduate student will design the first prototype build-a-buoy kit, adaptable for elementary, middle, and high school levels. This design will be presented at an August 2028 in-person professional learning workshop for year-one educators focused on water quality monitoring. Educators will provide feedback on the kit design and suggest stewardship activities and curriculum integration for the guidance document. A post-workshop evaluation will inform future professional learning.

MNSG, with assistance from the Minnesota Coalition of Lake Associations (MN COLA, see letter of support), will connect educators to community partners and identify buoy deployment sites. MNSG will assist with securing the necessary buoy permits and permissions.

Subsequently, the graduate student will build the prototype kit, and MNSG extension staff will finalize the classroom

guidance document for assembly. The prototype will ship to educators in January 2029, and educators and their students will assemble the kit. Assembled buoys will deploy at local sites in spring 2029, initiating water quality monitoring.

In spring 2029, we will recruit the second cohort of 30, K-12 educators to join the 2029-2030 Watershed Watchers. A virtual workshop will be hosted in June 2029 for year-one educators to provide program feedback.

Activity Milestones:

Description	Approximate Completion Date
Host an in-person workshop focused on water quality monitoring in Minnesota for 30, year-one educators.	August 31, 2028
Build the first prototype build-a-buoy kits and finalize classroom guidance documents.	December 31, 2028
Recruit 30, K-12 educators to the second cohort of the Watershed Watchers program.	March 31, 2029
Year-one educators test the prototype build-a-buoy kit, including assembly, deployment, and data collection.	June 30, 2029
Year-one educators evaluate the prototype kit via an online survey and virtual workshop.	July 31, 2029

Activity 3: Final Build-a-Buoy Kit Development, Testing, Evaluation, and Communication of Results

Activity Budget: \$159,262

Activity Description:

Based on evaluation data from year-one educators, the project team will make needed design changes to the build-a-buoy kit and improve the classroom guidance document. We will kick-off the second educator cohort of the Watershed Watchers program in August 2029 by hosting an in-person professional learning opportunity. We will use evaluation data from the previous year’s event to improve the impact of this event for the educators in the program.

We will ship the redesigned build-a-buoy kit and classroom guidance document to educators in January 2030. Educators will assemble the kits in their classrooms with their learners and then deploy the buoys in a local body of water to monitor water quality over the remainder of the school year.

We will use a survey-based approach to collect evaluation data on the educators’ experiences using the kit in their classrooms and working with local community partners to monitor water quality conditions.

In June 2030, we will host a Watershed Watchers program celebration event with educators from both years, students, community partners, and the project team to present water quality monitoring results.

Activity Milestones:

Description	Approximate Completion Date
Host an in-person workshop focused on water quality monitoring in Minnesota for 30, year-two educators.	August 31, 2029
Finalize design changes to build-a-buoy kit and classroom guidance document based on evaluation data.	December 31, 2029
Year-two educators test the redesigned build-a-buoy kit, including assembly, deployment, and data collection.	May 31, 2030
Year-two educators evaluate the prototype kit via an online survey and virtual workshop.	June 30, 2030
Host a celebration event for educators to present water quality monitoring data to community partners.	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Craig Hill	University of Minnesota Duluth	Craig Hill is Associate Professor of the Mechanical and Industrial Engineering Department at the University of Minnesota Duluth. As Co-Principal Investigator, he will lead the development of the build-a-buoy kit, supervise and mentor the graduate student, and will assist with educator professional learning events and project reporting.	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

This project will culminate in a celebration event, which is an opportunity for Watershed Watchers program educators, local community partners (see letter of support from the Minnesota Coalition of Lake Associations), and the project team to share their experiences and water quality monitoring results. We will coordinate with the MNSG communications team to advertise this public event to ensure results are shared with natural resource managers, lake associations, and other entities that may be interested in using the results. In addition, we have commitments from Minnesota educators who will assist in the dissemination of water quality data to their local communities (see letter of support from L. Lindquist).

To share results with K-12 educators across the state and promote the longevity of the Minnesota Watershed Watchers program, we will present this work at the Minnesota Science Teachers Association Annual Conference on Science Education (tentatively held in November 2029). Throughout this project and following its completion, we will feature the Minnesota Watershed Watchers program in MNSG's Center for Great Lakes Literacy quarterly newsletter, which is delivered to over 250 subscribers. Finally, we will present the results of this research to educators, researchers, and local leaders at the International Association for Great Lakes Research Annual Conference on Great Lakes Research (tentatively held in May 2030).

The Watershed Watchers will be integrated into MNSG's Education and Workforce Development Program, and the build-a-buoy kits will be available for free to educators across the state through MNSG's education kit loan program. MNSG will maintain public access to student-built buoy data. Additionally, co-PI Dr. Craig Hill will incorporate elements of this project into a new maritime engineering curriculum in the Mechanical Engineering Department at the University of Minnesota Duluth (e.g. ME 4495 - Applied Maritime Engineering, among others).

A final, accessible report summarizing the project's methods and results will be distributed to educators, local community partners, and other project partners via electronic means, published on the University Digital Conservancy, and posted on the MNSG website (seagrant.umn.edu). Any additional final products generated from this project will also be accessible through these channels.

We will acknowledge the Environmental and Natural Resources Trust Fund (ENRTF) by using the trust fund logo or attribution language on all project print and electronic media, publications, signage, and other communications and outreach materials, in accordance with the ENRTF Acknowledgement Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If

additional work is needed, how will this work be funded?

This program will develop and widely implement build-a-buoy kits for classroom and freshwater use. Educators who pilot the materials provide essential input throughout the program, guaranteeing the kits' operational readiness.

The build-a-buoy kits and classroom guidance documents will be integrated into MNSG's free Education Kit Loan Program, making the materials accessible to K-12 educators and environmental learning centers for years to come.

MNSG will maintain public access to student-built buoy data, offering valuable, local information for statewide monitoring. MNSG's connections to emerging marine technology industries will provide ongoing support through technical advice, mentorship, or participation in future educator professional development.

Project Manager and Organization Qualifications

Project Manager Name: Kelsey Prihoda

Job Title: Great Lakes Transportation Extension Educator

Provide description of the project manager's qualifications to manage the proposed project.

Kelsey Prihoda has an M.S. in Toxicology from Iowa State University (2007), and over 15 years of experience managing grant-funded research and education programs. She has managed projects ranging from tracking the source of indicator bacteria at impaired beaches in the St. Louis River Area of Concern (Prihoda et al., 2017) to identifying naturally-occurring fluoride and selected metals in northwest Wisconsin groundwater (Prihoda et al., 2020). She spent nearly 15 years as part of a research team that examined the performance of ballast water management systems for commercial vessels, and was the research program manager for this effort from 2018 to 2021. In her role as Great Lakes Transportation Extension Educator for Minnesota Sea Grant, she is a member of the Center for Great Lakes Literacy, a collaborative effort led by Sea Grant educators throughout the Great Lakes region that fosters a community of freshwater stewards by engaging, inspiring and supporting educators, scientists, and youth. She has led workshops for educators to inform them about issues like weather forecasting, Great Lakes shipping, and current Lake Superior research.

Organization: U of MN - Duluth - Sea Grant

Organization Description:

Minnesota Sea Grant's mission is to engage with communities along Lake Superior and Minnesota's inland waters to understand water science needs, support scientific research to address those needs, and provide results to communities to help them apply science-based knowledge to solve problems, support and enhance local economies, and sustain ecosystem services for future generations.

We serve Minnesotans who need water science. We provide accessible research data to industry leaders, policymakers, educators, community organizations, municipal governments, university stakeholders, and Minnesotans of all ages. If the needed science doesn't exist, we seek to fund it and work to ensure it gets to those in need.

We are a systemwide program of the University of Minnesota. We are what makes UMN a Sea Grant Institution.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Kelsey Prihoda/Principal Investigator		Serve as the project manager to coordinate the development of the classroom guidance document for the build-a-buoy kit, host educator focus groups, recruit educator cohorts, identify local community partners, facilitate educator professional learning events, and conduct project evaluation and reporting.			27%	0.51		\$58,122
Craig Hill/Co-Investigator		Responsible for overseeing the development of the build-a-buoy kit, supervision and mentorship of the graduate student, and will assist with educator professional learning events and project reporting.			27%	0.6		\$114,565
Heidi Ferris/Environmental Literacy and Workforce Development Extension Educator		Assist with recruitment of educator cohorts and facilitation of professional learning events, provide review of the classroom guidance document for the kit, and provide educator mentorship.			27%	0.27		\$13,276
Hilarie Sorensen/Water Resources Extension Educator		Assist with facilitation of professional learning events, identification of local community partners and monitoring sites, and identification of guest scientists for classroom visits.			27%	0.27		\$25,574
Marine Technology Extension Associate		Responsible for collaborating with educators and private industry partners to provide Watershed Watchers program students with information and training pathways for marine technology careers.			27%	0.27		\$26,129
Graduate Research Assistant		Responsible for designing, developing, and overseeing testing and evaluation of the build-a-buoy kit. Benefits calculation includes tuition.			45%	4.5		\$174,981
							Sub Total	\$412,647
Contracts and Services								
							Sub Total	-

Equipment, Tools, and Supplies								
	Equipment	30 Build-a-Buoy Kits for educators, 20 with base kit supplies (GPS, data communications, and water temperature) and 10 with base kit supplies plus standard water quality sensors (pH, ORP, DO, and conductivity).	Year 1: Supplies to build 30 buoy kit prototypes for classroom use. Year 2: Supplies needed to improve, maintain, and deploy kits. Year 3: Supplies needed to maintain and deploy kits.					\$41,500
	Equipment	2 Bambu X1E with AMS 3D printer systems	Downloading and printing the necessary parts for the kits. Will be used by the graduate student to build kits, and will be used by educators during workshops. The high school version of the kit will allow students the option to design their own buoy parts.					\$7,000
	Equipment	2, Aqua Troll 400 Multiparameter Probes	Will be used for educator workshops, in-class demos, and validation for the buoy kits to determine accuracy of the installed water quality sensors.					\$8,000
	Tools and Supplies	Prototyping supplies	Extra wires, batteries, prototyping boards, and other consumables needed to build the prototype and improve after prototype testing.					\$1,617
	Tools and Supplies	Lab supplies	Replacement filament materials for 3D printers. Aqua Troll calibration and maintenance kits.					\$1,950
							Sub Total	\$60,067
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Travel for PI Kelsey Prihoda to attend the 2028 Minnesota Science Teachers Association Annual Conference. Conference registration estimated at \$500, UMD fleet vehicle rental (\$22/day x 2	Present Year 1 project results to educators at the Minnesota Science Teachers Association's annual					\$929

		days), mileage at 460 miles x \$0.30/mile, per diem for 1 individual at \$60/day x 2 days, lodging for 1 individual at \$127/night x 1 night.	Conference Education (tentatively held in November 2028).						
	Miles/ Meals/ Lodging	In-state travel for one graduate student in Years 2 and 3, estimated five trips per year, UMD fleet vehicle rental for 10 days at \$203 total, mileage at 1,485 miles x \$0.30/mile, per diem for 1 individual at \$80/day x 10 days, lodging for 1 individual at \$148/night x 8 nights.	Graduate student travel to Watershed Watchers educator classrooms.						\$2,632
								Sub Total	\$3,561
Travel Outside Minnesota									
								Sub Total	-
Printing and Publication									
	Printing	30, printing and binding Build-a-Buoy Kit classroom guidance documents	Provides written instructions on kit assembly, classroom use, options for stewardship activities, and incorporating the kit into existing STEM curriculum.						\$1,500
								Sub Total	\$1,500
Other Expenses									
		Shipping, 30 Build-a-Buoy Kits each in Years 2 and 3 (60 shipments total)	Courier/mailing services needed to ship build-a-buoy kits to 60 educators, including the cost of return shipping. Estimated \$50 shipping per kit x 60 shipments x 2 ways.						\$9,090
		Short-term equipment rental for two educator workshops	Research vessel (R/V Sadie Ann) time is needed during the educator workshop in Year 2 and Year 3 in order to train educators in a real-world setting on how to deploy and properly moor buoys, understand and interpret water quality data, and how to validate buoy data.						\$4,060
		24-Month subscription to commercially available data platform	Platform for online hosting of water quality data collected from buoys in						\$5,075

			Years 2 and 3, required to make the water quality data publicly available.					
							Sub Total	\$18,225
							Grand Total	\$496,000

Classified Staff or Generally Ineligible Expenses

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

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN federally negotiated rate for other sponsored activities of 37% modified total direct costs.	Indirect costs are those costs incurred for common or joint objectives that cannot be readily identified with a specific sponsored program or institutional activity. Examples include utilities, building maintenance, clerical salaries, and general supplies.	Secured	\$183,520
In-Kind	Sponsored funds	Out-of-state travel: PI Kelsey Pihoda travel to the International Association for Great Lakes Research Annual Conference to present project methods and results.	Potential	\$3,667
			Non State Sub Total	\$187,187
			Funds Total	\$187,187

Total Project Cost: \$683,187

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [ed8ac242-5b7.pdf](#)

Alternate Text for Visual Component

The visual has an outline of the State of Minnesota in the center with buoys dotted throughout the state. It is encircled by the engineering design process the proposed three-year project will follow with major steps highlighted. There are three photographs, a student and buoy, teachers, and students outside....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Letter of Support from Ted Christopher of Verterra Energy Inc.	cdd9014b-1b6.pdf
Letter of Support from Brian Kane of Anno.Ai	f059dd0c-871.pdf
UMN transmission authorization letter	658913fa-e2a.docx
Letter of Support from Deanne Trottier at Eagle View Elementary School	30982274-22a.pdf
Letter of Support from Brian Scott at Harbor City International School	753c5a0b-926.pdf
Letter of Support from Minnesota Coalition of Lake Associations	0049b9f9-a25.pdf
Letter of Support from Lisa Lindquist at Roseville Area Middle School	76a80eb3-e3c.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

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

No

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

N/A

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

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

UMD Sponsored Projects Administration

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

N/A