Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-164

Proposal Title: Visitor Perceptions of Lake Water Quality

Project Manager Information

Name: Bonnie Keeler

Organization: U of MN - Humphrey School of Public Affairs

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Project Basic Information

Project Summary: Use mobile AI-assisted technologies to survey lake visitors. Assess perceptions of water quality and perceived threats. Combine survey data with water quality trend monitoring to inform lake management.

Funds Requested: $411,000

Proposed Project Completion: January 31, 2027

LCCMR Funding Category: Water Resources (B)

Project Location

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

Region(s): Metro, Central, SE,

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.

Lakes are the most visited and valued of Minnesota's recreational amenities. However, land use change, warmer temperatures, nutrient runoff and invasive species pose threats to lake water quality with impacts for recreation, property values, and wildlife. To address degraded water quality in lakes, managers can treat lakes with alum or iron, install aeration pumps, combat invasive species, and invest in stormwater management and habitat restoration. These investments are expensive, especially for local municipalities, lake associations, and watershed management groups with limited resources and many competing objectives.

Managers continue to invest in best management practices and expensive treatments without information about how residents and lake users perceive resulting water quality improvements. Are changes in water quality actually noticed by lake visitors? Are management changes that increase water clarity but increase aquatic plant abundance viewed negatively? Very little is known about how measurable changes in water quality are perceived and valued by lake visitors, making it difficult to assess the return on investment in lake management activities.

Our proposal combines analysis of long-term datasets on water quality with cutting-edge mobile technologies that can survey lake visitors faster, cheaper, and at broader scales than using traditional methods.

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.

Our proposal leverages advancements in AI, mobile technologies, and community science to collect real-time information on lake visitors' perceptions and preferences. We will identify a set of 15 lakes across the 15 county region representing the greater Twin Cities Metropolitan Area, that include a range of lake size and depth, land-cover, water quality, amenities and management investments including in in-lake treatments (e.g. chemicals, invasive species management) and watershed management (e.g. BMP installations).

Signs installed at each lake will direct lake visitors to send a text message to a phone number where they will respond to a short survey administered by a conversational AI- powered chatbot. The survey will ask visitors about their perceptions of water quality and other questions relevant to park managers.

Working in collaboration with lake managers, we will construct management history for the past 20+ years. We will analyze water quality trends and quantify changes in lake ecosystems, such as water clarity, aquatic plant and algal abundance, that are most relevant to lake users. By combining water quality data with elicited data on visitor perceptions of water quality we can better understand where (and if) measured water quality improvements are translating into improved visitor experience.

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?

Results will identify if investments in improving lakes are perceived and valued by lake visitors, helping managers make more informed decisions about where to invest in improving lake water quality. We will co-develop the survey with lake managers, park officials, and watershed districts so that they can collect information about the aspects of the visitor experience that are most relevant to management. Combining water quality data with surveyed perceptions of water quality will address a notable gap in our understanding of the return on investment in water quality and inform more strategic and effective urban watershed management.

Activities and Milestones

Activity 1: Distributed surveys of lake visitors using AI-powered conversational chatbots

Activity Budget: $272,383

Activity Description:
We will contract with a firm that provides the back-end technical capabilities needed to program an SMS-based conversational chatbot. A chatbot is a computer program that simulates and processes human conversation, allowing humans to interact with digital devices as if they were communicating with a real person. AI language models can then process the information received by respondents and efficiently parse and synthesize responses. The surveys are optional, will be designed to protect user data privacy so no personally identifying information will be collected, and the survey design will comply with best practices for survey research. Respondents will have the opportunity to opt-in to future data collection via phone or text, allowing the team to follow-up with specific users for more in-depth interviews.

We will collect data during the open water season (April - October) for two years (2024 and 2025). We will select lakes to survey based on coordination with lake managers and state agencies to identify recent and planned water quality treatments that are likely to visibly change water clarity, algal and aquatic plant abundance. Agencies and lake managers will have the opportunity to add questions to the survey based on specific management needs at each site.

Activity Milestones:

Description	Approximate Completion Date
Outreach with municipalities and watershed districts to identify lakes, survey locations, and co-design survey instrument	May 31, 2025
Design and program the chatbot survey, print and install signage, and monitor signs	October 31, 2026
Analyze survey data, communicate and visualize findings, draft final report	December 31, 2026

Activity 2: Analysis of trends in lake water quality and lake management history

Activity Budget: $138,617

Activity Description:
Through our established partnerships with government entities responsible for lake management (watershed districts, counties, cities, MPCA), we will document the history of significant management activities over the past 20 years at each of the study lakes through interviews and reviews of public documents. We will analyze available water quality data, examining long-term changes in metrics commonly associated with water quality (chlorophyll a, total phosphorus, secchi depth), as well as compiling available data on aquatic vegetation (from surveys and areal imagery). We will also collect supplementary measurements on measurements associated with harmful algal blooms (phycocyanin concentration and cyanobacteria abundance), to examine how these metrics are related to visitors' perceptions of water quality. By combining water quality data with elicited data on visitor perceptions of water quality we can better understand where (and if) measured water quality improvements are translating into improved visitor experience. We can also investigate if the water quality in different types of lakes (e.g. lakes used for swimming, boating, or fishing) is perceived and valued differently.

Activity Milestones:

Description	Approximate Completion Date
Lake water quality data acquisition and trend analyses	October 31, 2025
Lake management and outreach database development	December 31, 2025
Management and water quality response analysis	March 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Jacques Finlay	University of Minnesota	Finlay will develop management histories and assess lake water quality trends in collaboration with partners. Finlay will support site selection and implementation of data collection interfaces. He will supervise an early career scientist who will manage project operations and will facilitate leveraged partnerships around long term monitoring.	Yes
Gaston Small	University of St. Thomas	Small will work with Finlay to compile information about management histories and water quality data trends for selected study lakes. He will supervise an undergraduate research student who will support project operations and supplemental data collection.	Yes

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?

All data will be shared with project partners via reports and visuals. Using the results of this project, we will seek state and federal funding to deploy chatbots at additional sites statewide in consultation with state agencies and management organizations. Given current trends in AI technologies, we see distributed chatbots as an option to replace more expensive engagement and outreach methods, especially in remote areas. Leveraging robust long-term data on lake water quality, this research can be used to inform future statewide water plans, watershed planning processes, and local decision making on the return on investment in lake management.

Project Manager and Organization Qualifications

Project Manager Name: Bonnie Keeler

Job Title: Associate Professor, Co-Director Center for Science, Technology, and Environmental Policy

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

Professor Bonnie Keeler is a faculty member in the Science, Technology, and Environmental Policy area at the University of Minnesota's Humphrey School of Public Affairs. Professor Keeler is an experienced project manager and principal investigator overseeing over $3 million in external funding over the past 10 years at the University. Keeler's expertise is in water policy and the economic and social values of clean water. Her work has been published and cited broadly and she is a frequent speaker and advisor on state and federal water policy.

Keeler will hire and supervise a postdoctoral researcher who will take primary responsibility for day-to-day project management, submission of required project reports, and coordination of the research team. Keeler is a qualified supervisor, with experience supervising numerous project managers, postdoctoral researchers, and graduate students.

Organization: U of MN - Humphrey School of Public Affairs

Organization Description:

The mission of the Humphrey School of Public Affairs is to inspire, educate, and support innovative leaders to advance the common good in a diverse world. Within the Humphrey School, the Center for Science, Technology, and Environmental Policy fosters interdisciplinary and community-engaged research on human well-being, environmental sustainability, and social justice in a complex and diverse world. The Center conducts public engagement with external partners, develops environmental leadership, and facilitates solutions-oriented projects at the nexus of science, technology, and environmental policy.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Bonnie Keeler		PI			36.8%	0.08		$17,483
Jaques Finlay		CO-PI			36.8%	0.06		$15,300
TBD		Research Associate			36.8%	1.02		$74,142
TBD		Postdoc			25.7%	2		$150,840
TBD		Undergraduate student			0%	0.36		$11,520
TBD		Grad Student -RA			24%	0.5		$17,532
							Sub Total	**$286,817**
Contracts and Services								
Earth Lab	Professional or Technical Service Contract	The Firm will provide back-end technical capabilities needed to program an SMS-based conversational chatbot.				0		$70,000
University of St. Thomas	Professional or Technical Service Contract	Gatson Small is a faculty member at University of St. Thomas. Salary a for Small for summer and academic year and undergraduate students, plus their fringe benefit supplies and travel costs =$41,208.They will compile information about management histories and water quality data trends for selected study lakes.				0		$41,427
							Sub Total	**$111,427**
Equipment, Tools, and Supplies								
	Tools and Supplies	Hardware supplies and installation materials for signage (20@$30/eac)	Hardware to mount signs at area lakes					$600
							Sub Total	**$600**
Capital Expenditures								
							Sub Total	-

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Other	20 sites requiring 6 visits to each site per year or 120 trips per year. Each trip is 40 miles total. Total # of miles for the trips are 4800 miles and the mileage reimbursement rate is $.585/ml. Total is $2,808. This will repeat itself for a second year and the grant total will be $5,616	Trips are needed to the lakes to conduct surveys					$5,616
	Other	Per-diem meal reimbursement for the 20 site visits by two Researchers (20*2*2 = 44.25) with $44.25/visit, equals to $1,770						$3,540
							Sub Total	**$9,156**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	Printing of 150 signs for 20 lakes at $150/sign. $3,000	The signs will notify lake vistors of the survey being conducted					$3,000
							Sub Total	**$3,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$411,000**

Classified Staff or Generally Ineligible Expenses

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

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Attachments

Required Attachments

Visual Component

File: 812f06ff-4d9.pdf

Alternate Text for Visual Component

Visual shows examples of signage used last summer at Como Lake Park to invite visitors to respond to a chatbot survey. Also included is a figure showing results of the survey data collection....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
UMN Sponsored Projects Letter of Intent	4028d19c-c49.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

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?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?

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?

No