



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-323

Proposal Title: Assessing Actual and Perceived Watercraft Behavior and Safety

Project Manager Information

Name: Ingrid Schneider

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: Use novel technologies to analyze watercraft behaviors and lake conditions. Assess recreationist and lake-residents views of on-water recreational conditions. Compare and combine data to inform lake management and improve safety.

ENRTF Funds Requested: \$786,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Education and Outdoor Recreation (C)

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 waters attract millions of visitors, serve as a sense of state pride, and support a strong recreation and tourism industry. Minnesotans cherish high-quality water-based recreation and the majority participate in water-based recreation (Davenport et al. 2024). Advancing boat technologies provide exciting new experiences that simultaneously challenge safe and sustainable recreation and the resources upon which they depend. A 2020 survey of Minnesota boaters revealed at least one-fourth of them were concerned with high wakes, watercraft speeds, and specific activities as well as boat-to-shore distances (DNR). In high wakes or large wave situations, safety concerns emerge for both water and shoreline-based recreationists. Large waves also put lakebeds and shorelines at higher risk for erosion, vegetation loss and impaired water quality (Fracis et al. 2023, Ortiz et al. 2025).

Research on recreational use of lakes is scant yet vital to sustainable management and safe use. This information gap on watercraft behaviors such as speeds, boat-to-shore distance and watercraft interactions thwarts effective management and puts both Minnesotans and their lake resources at risk. Exacerbating the problem, the gap in perceived and actual watercraft behaviors remains unknown. While Minnesotans are concerned about watercraft behaviors, the actual situation remains unstudied.

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.

This project combines observed and reported watercraft behaviors (i.e. measurable characteristics of how a watercraft is used during the activity) to inform management decisions and efforts toward safe-watercraft behaviors. Our project integrates actual and reported behaviors to produce rich information into lake use and safety issues.

Actual behaviors will be observed using novel observation methods (drones, geographic position loggers) at four frequently used recreational lakes. Tethered drones will assess distance between watercrafts, watercraft-to-shore distances, watercraft speeds, and on-lake watercraft behaviors, calibrated by voluntary watercraft tracking among on-water recreationists.

Water-based recreationists and lake residents will report behaviors via questionnaires on lakes where boater behaviors are observed. Lake use, watercraft interactions, and perceptions of on-lake activities and experiences will be recorded as well as familiarity with safe-boating rules and guidelines.

Lake selection will be informed by our advisory committee, published data and activity records and location: two in greater Minnesota and two within the seven-county metro area. Data will be collected between Memorial Day and Labor Day over two open-water seasons (2028-2029).

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 immediately inform waterbody management and support future monitoring through a user-friendly guide on data collection and integration. Baseline behavioral gaps between recommended and actual watercraft behaviors will be collected to inform immediate management opportunities and future educational campaign enhancements, watercraft safety and shoreline and habitat health. Co-creating questionnaires with lake associations, resource managers, and other interested parties ensures they get information they are most interested in. A monitoring toolkit detailing how to collect, integrate and analyze the novel data will be developed and electronically distributed among lake associations and interested organizations.

Activities and Milestones

Activity 1: Boater and watercraft observations

Activity Budget: \$290,938

Activity Description:

The objective is to collect actual watercraft behavioral information for four well-known recreational lakes in Minnesota. Partners will inform site selection and provide on-lake support. Data collection approaches include aerial drones, watercraft mapping and human observers and will be validated on-site.

An aerial drone will be tethered to and deployed from a stationary work platform anchored near shore; personnel will remain on the platform. The tether allows long-duration flight (10-12 hours/mission) and continuous data transfer for the drone. Flight data includes continuous hi-res video of vessels on the lake to reveal routes, distance from shore and distance from other vessels. The platform will have a weather station where wind speed, direction, wave characteristics, and water temperature will be recorded. Personnel will record observations of watercraft activity and behaviors.

In addition to the drone, we will invite participatory mapping among watercraft owners using a GPS trackers unit or cell-phone tracking app to provide detailed position and behavior data. This data will provide ground truthing for the drone data and comparisons with reported behaviors collected in Activity 2.

Initial lake-specific behavior maps summarizing watercraft type, location patterns, and activity will be drafted and refined with an advisory committee and partners.

Activity Milestones:

Description	Approximate Completion Date
Develop and pilot aerial observation	October 31, 2027
Identify lakes for project development	February 28, 2028
Convene initial partners, expand contacts and continue engagement	April 30, 2028
Implement aerial observations OR Complete 20 full-day drone observation missions across 4 lakes	October 31, 2029

Activity 2: Watercraft and resident surveys

Activity Budget: \$240,000

Activity Description:

The objective of this activity is to obtain visitor and residential reports on watercraft behaviors and knowledge about safe watercraft behaviors. Multiple research methods will be employed. First, we will conduct a survey of Minnesota residents living on the study lakes (sample size depends on lake residences). Questionnaire topics will be informed by an advisory committee, past research, and include lake use, reported behaviors and safety knowledge. Multiple postal contacts will maximize response rates. Second, we will survey lake visitors using watercraft to identify lake experience, knowledge of watercraft safety information and report watercraft behavior concerns (seeking 400 per lake). Third, to calibrate aerial behavior data and compare stated and actual behavior, we will invite watercraft users to carry a geospatial logger for the duration of their visit, either returning to the surveyor upon return or depositing in a 'drop box' onsite where they would be collected (seeking 20 per watercraft type). Questionnaire and logger data will be combined where possible to compare reported and actual behaviors. Data will be collected across two open-water seasons. Deliverables include technical reports, information summaries for partners, presentations to key management agencies and interest groups, peer-reviewed publications.

Activity Milestones:

Description	Approximate Completion Date
Engagement with lake sites, municipalities and other partners to co-design questionnaire	February 28, 2028
Complete survey collection (two seasons: summer 2028 and 2029; 400 visitors per lake)	October 31, 2029
Data analyzed, report drafted and initial partner presentations implemented and publications drafted	June 30, 2030

Activity 3: Data integration & toolkit

Activity Budget: \$255,062

Activity Description:

Data sources will be combined to compare actual and reported watercraft behaviors to inform management and educational efforts. Drone visual data images will be rectified and then used to: identify watercraft type and location, measure distance from shoreline and other watercraft, speed and direction of travel. The project team will combine results from drone imagery with boat tracking positions and visitor survey data to identify common recreational lake use patterns and differences in observed and reported safe watercraft behaviors. Results will identify high-risk zones for shorelines and sensitive aquatic vegetation. Additional analysis includes safety and recreational concerns 1) within visitors reporting their own behaviors and actual incidents recorded with the geospatial data they collect, 2) among on-lake visitors of varying watercraft types, 3) between visitors and lake residents, 4) among residents using varying watercraft types.

Deliverables include technical reports, information summaries for partners, presentations to key management agencies and interest groups, and peer-reviewed publications, as well as a toolkit for managers and lake associations. The toolkit will document easy to follow processes for lake managers to instrument and collect similar lake usage and behavior data supporting localized decision making.

Activity Milestones:

Description	Approximate Completion Date
Data prepared for integration and analysis	October 31, 2029
Data analysis, share findings and draft report	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Jeffrey Marr	University of Minnesota, St. Anthony Falls Laboratory	Co-PI, design of drone data collection, mission flights and data processing.	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 research will directly inform lake management and boat practices in the state of Minnesota. We plan to develop a final project report that will be published to the UMN Digital Conservancy providing long-term free access to the information. We will also prepare at least one peer reviewed journal article. Additionally dissemination will include information summaries for partners and in-person and online presentations to key management agencies and interest groups. We will work with our advisory committee and follow communication best practices to disperse results. In addition, we will create and distribute a toolkit for managers and lake associations. The tool kit will document methods in plain language and visually appealing format on how to collect and integrate the data to inform management decisions. All materials will acknowledge the Environment and Natural Resources Trust Fund through use of the trust fund logo or attribution language.

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 baseline data, reports and presentations will be shared with project partners and others. Managers can integrate findings to assess and adapt educational and management efforts as necessary. A planned 2030 DNR boater survey can incorporate items of highest relevance to recreationists and residents alike to monitor watercraft safety behaviors, perceptions and knowledge. Thus, this research can inform future planning, statewide water plans and local decision making.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Wind Wave and Boating Impacts on Inland Lakes	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04c	\$415,000
Modeling the Future Mississippi River Gorge	M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 04n	\$427,000

Project Manager and Organization Qualifications

Project Manager Name: Ingrid Schneider

Job Title: Professor

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

Professor Schneider is a faculty member in the Forest Resources and Environmental Science, Policy & Planning programs at the University of Minnesota's Department of Forest Resources. Schneider has more than 25 years of successful

project management and principal investigator experience working across disciplines and geographic boundaries. State-funded projects with multiple partners have been part of the successfully managed portfolio. Schneider's expertise is in outdoor recreation behavior and natural resource management; she has included water-based recreation and safety in her work since 1993 and she works with a variety of local, state and national partners to optimize experiences while protecting natural resources. Schneider will hire graduate students and undergraduate researchers to support research data collection and reporting. Schneider has experience supervising multiple projects, project managers and graduate students and, in addition, directed the University's Tourism Center for more than a decade.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The College of Food, Agricultural, and Natural Resource Sciences (CFANS) hosts twelve academic departments and ten research and outreach centers, the Minnesota Landscape Arboretum, the Bell Museum, and several interdisciplinary centers. Within CFANS, the Department of Forest Resources advances the science and management of forests and related natural resources by developing solutions to important problems affecting these resources; training the next generation of scholars and practitioners; and informing the broad public on the importance of forests and natural resources and how they enrich our quality of life. We will partner with the St. Anthony Falls Laboratory (SAFL), an active research center of the College of Science and Engineering at the University of Minnesota. SAFL research focuses on important problems in the areas of water and environmental fluid mechanics. Since 2020, SAFL has been leading efforts in research on recreation boating impacts on Minnesota Lakes, carefully documenting the energy and velocities produced by boats through their waves and propeller wash. SAFL has important collaboration with lake associations, lake managers and citizens interested in recreational access and lake management/protection.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Pi/Professor		Project leader and coordinator			36.6%	0.33		\$85,345
Graduate Research Asst		Research assistant for social science research			24.1%	150		\$255,296
Undergraduate research asst		Collect onsite data social science			0%	0.6		\$46,284
Marr/		Co investigator, drone deployment, data collection, analysis reporting			36.6%	0.36		\$69,226
Jenks/Senior Researcher		Supporting drone deployment, GPS tracking, App based tracking and analysis			8%	0.12		\$16,019
Ted Morris/		Support drone deployment, GPS tracking, app based track and analysis			36.6%	1.2		\$27,014
Andrew Riesgraf		Researcher leading drone deployment, environmental monitoring, field planning, coordination, data processing			36.6%	0.75		\$75,000
Chris Millren		Engineer supporting drone technology and monitoring, GPS and app based boat tracking analysis			36.6%	0.12		\$14,848
Madigan Rios		Engineer supporting activity 1 field data collection and data analysis			32.3%	0.78		\$61,965
Ben Erickson		Technician and safety officer supporting field gear preparation, safety training and field coordination for activity 1 field deployment			32.2%	0.12		\$11,417
GRA for Computer Science		Work with computer vision and large language models for watercraft distancing and density assessments			24%	0.15		\$15,000
							Sub Total	\$677,414
Contracts and Services								
TBD	Service Contract	Sample selection for lake resident surveys				0.05		\$5,000
							Sub Total	\$5,000
Equipment, Tools, and Supplies								

	Tools and Supplies	T shirts, self protective supplies ie bug spray and sun screen for onsite surveyers; 2 per surveyer	Identify onsite staff as UMN and protect from elements					\$840
	Tools and Supplies	Mailing	Mailing and printing of resident questionnaires					\$15,000
	Equipment	Generator 1	powering drone					\$2,500
	Equipment	Rental pontoon	For observing and confirming data collection					\$2,000
	Tools and Supplies	Onwater safety supplies(PFDs 4, flares 6, first aid kits 2)	Keep personnel safe					\$1,000
	Tools and Supplies	Safety for boats	Marker buoys boats ropes					\$500
	Equipment	Range fiender	estimate distance from shore of boats					\$200
	Equipment	GPS trackers (10 at 125)	For watercraft logging to validate data					\$1,250
	Tools and Supplies	Drone supplies (battery=3, rotors-for damaged, estimate 4) charger-1	Keep drone operating for data collection					\$2,000
	Tools and Supplies	Gen power supplies (power cords, zip ties)	Keep equipment together and powered					\$200
	Tools and Supplies	Wave mast measurement supplies	Keep wave mast in shape for data collection					\$2,000
	Equipment	Water temp and enverionmental monitoring buoy	To track environmental conditions and use as predictor variables					\$2,000
	Equipment	hard drive 1	Data back up					\$100
	Tools and Supplies	Fuel gallons	For boat fuel to deploy buoys.observe					\$535
	Equipment	Radios 2	For on-water communications and safety					\$250
							Sub Total	\$30,375
Capital Equipment								
		Drone tether system	Use this to monitor and map watercraft behavior on lakes	X				\$30,000
							Sub Total	\$30,000
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								

	Miles/ Meals/ Lodging	20 days month, 60 miles, 2 people; local site data collection	Travel to local lake sites for data collection, social science					\$7,920
	Conference Registration Miles/ Meals/ Lodging	2 trips, 1000 miles, 2 people/trip, registration \$450; 2 nights and 3 days following MN travel guides	Share research and recommendations at 2 different conferences					\$4,107
	Miles/ Meals/ Lodging	20 days, following standard MN per deim, estimate 1200 mile loop	Travel to greater MN lake sites for social science data collection;					\$15,840
	Miles/ Meals/ Lodging	Local travel for drone team : 20 days truck rental, 60 miles round trip, \$77 day rental; years 1 and 2	Set up and deploy tethered drone system in local metro lakes					\$6,544
	Miles/ Meals/ Lodging	20 days: RT 350 miles, \$77 truck rental/day; per deim and housing for 4 people; 2 years	Greater MN travel for drone deployment and data collection					\$8,800
							Sub Total	\$43,211
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$786,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Equipment		Drone tether system	This tethered drone system is essential for the project to collect objective, accurate data of actual watercraft behavior and document actual vs reported behaviors to address safety and enviornmental concerns Additional Explanation : We will share the drone system with communities interested in mapping lake behaviors throughout the lifespan of the technology

Non ENRTF Funds

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

Total Project Cost: \$786,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [a14b4c95-45c.pdf](#)

Alternate Text for Visual Component

Research process depicted in three boxes with data integration noted and then outcomes listed...

Supplemental Attachments

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

Title	File
Approval letter from UMN for Schneider et al.	65e5894d-811.pdf
Support Letter Three Rivers Parks District Schneider watercraft	87034c47-07b.pdf
Support letter from MNCOLA Schneider watercraft safety	7a209c5c-36e.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?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

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:

Jeff Marr, SAFL; Andrea Little, UMN; Ted Morris, UMN; Reier Erickson, UMN

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

Yes, I understand