Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-169

Proposal Title: PFAS in Precipitation: Assessing a Critical Statewide Threat

Project Manager Information

Name: Alexander Frie

Organization: U of MN - Duluth - Sea Grant

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Project Basic Information

Project Summary: PFAS contaminates Minnesota's natural resources through rainfall and snowfall. This project will support statewide, multi-year, measurements of PFAS in rain and snow and investigate associated sources.

ENRTF Funds Requested: $1,095,000

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.

Per- and Polyfluoroalkyl substances (PFAS), known as forever chemicals, can be toxic to humans and wildlife, persistent in the environment, and present in rain and snow. PFAS in rain and snow contaminate even the planet's most remote regions, including Minnesota's lakes, fields, forests, and prairies. Precipitation can represent the dominant pathway for the introduction of PFAS to these resources. Data from previous studies found common PFAS with concentrations in Minnesota's rain and snow above Minnesota's drinking water guidance levels.

A multi-year, multi-site, high-quality dataset is needed to assess the impact of PFAS in rain and snow on Minnesota's water resources and ecosystems. This dataset will help Minnesotans understand seasonal and yearly changes in PFAS levels and establish a foundation for estimating risks to wildlife and natural resources. It will also serve as a baseline to gauge the impact of PFAS remediation efforts.

The National Atmospheric Deposition Program (NADP) is a nationwide network of sites operated by collaborating agencies that collect weekly integrated rain and snow samples in the National Trends Network (NTN) and measure their chemistry. Originally established to monitor acid rain and nutrients, the NADP recently developed processes for PFAS analysis, providing an opportunity for Minnesota.

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 propose three years of comprehensive monitoring of 30+ PFAS in rain and snow at up to eight NADP-NTN sites across Minnesota. This sampling effort would leverage the existing physical, analytical, and digital infrastructure and investments of the NADP to provide weekly resolved measurements of PFAS in rain and snow. These measurements would be made publicly available through the NADP's website, creating a foundational dataset for use by all Minnesotans, scientists, and regulators.

In addition to producing this dataset, we will apply atmospheric modeling and investigate changes in PFAS amounts and types to understand how PFAS gets into Minnesota's rain and snow, information critical to solving MN's PFAS challenges. To better understand PFAS not measured in standard analysis techniques, we will also measure total organic fluorine and use non-targeted PFAS analysis to investigate PFAS for which standard techniques have not been established, known as "unknown unknowns."

The value of this dataset and analysis would be immense. Multi-year datasets for other chemicals in precipitation helped solve acid rain, understand harmful algae blooms in lakes, and establish risks to sensitive plant and animal species. This dataset will support similar efforts to understand and remediate the impact of PFAS on Minnesota's resources.

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 core outcome of the project will be a publically available, 3-year, weekly, 30+ PFAS dataset for up to 8 Minnesota NADP-NTN sites. This dataset will be foundational to understanding the impact of PFAS on Minnesota's natural resources and will be useful for identifying at-risk animal and plant species, targeting remediation activities, and strategically reducing pollution sources. This dataset will support estimates of atmospheric loadings of PFAS to Minnesota's ecosystems. The atmospheric modeling and statistical analysis of these data will provide insight into how PFAS moves and what sources and processes are most important in Minnesota.

Activities and Milestones

Activity 1: PFAS Data Collection at National Atmospheric Depostion Program Sites Across Minnesota

Activity Budget: $640,000

Activity Description:
Weekly precipitation samples will be collected by NADP site operators for three years at up to eight NADP-NTN sites within Minnesota in Anoka, Cook, Itasca, Lake (2 sites), Morrison, Redwood, and St. Louis counties. Samples will be collected and shipped to the Wisconsin State Lab of Hygiene (WSLH) following NADP's validated PFAS collection protocols.

Samples will then be extracted and analyzed for 30+ PFAS using state-of-the-art coupled Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) following validated methods approved by the National Atmospheric Deposition Program. Additionally, monthly composites will be collected and reserved for non-target analysis at the University of Minnesota's Natural Resource Research Institute and total organic fluorine analysis at the WSLH. Non-target analysis will allow for the investigation of "unknown unknown" species that will provide additional insight into the provenance of the PFAS. Up to 100 samples of interest will be investigated using non-target analysis.

After data has been produced and the quality verified, all targeted PFAS data will be made publicly available on the NADP website, which already hosts nearly 50 years of rain and snow chemistry data from NTN sites across the country.

Activity Milestones:

Description	Approximate Completion Date
Begin PFAS sampling at National Atmospheric Deposition Program Sites	July 31, 2026
Begin non-target analysis of monthly composites	December 31, 2026
Complete PFAS sampling at National Atmospheric Deposition Program Sites	June 30, 2029
Complete targeted, non-target, and total organic fluorine, analyses	December 31, 2029
Project results and reports available on NADP website	June 30, 2030

Activity 2: Data Analysis, Atmospheric Modeling, and Community Engagement

Activity Budget: $455,000

Activity Description:
After the collection of the targeted data, data will be analyzed to understand the processes and sources that influence the PFAS levels and "fingerprints" observed in rain and snow. First, targeted PFAS data will be analyzed for significant seasonal, spatial, and meteorological (i.e., temperature, precipitation type, storm type) controls and trends. Next, the data set will be analyzed using a factor analysis approach, such as Positive Matrix Factorization, which uses the variability in composition between samples to identify signatures of different sources and processes. Next, back trajectory analysis will be coupled with the previous analysis to investigate how the history of an airmass, or "where it came from," contributes to the PFAS observed in rain and snow.

Finally, we will share the results not only with the scientific community and regulators at venues such as the Minnesota Water Resources Conference but also with communities that depend on Minnesota's resources. We will do this through a series of workshops over years 2 - 4 of the project aimed at bringing this science to local communities and resource managers. These workshops will be held across Minnesota and near NADP sampling sites to emphasize the local impact of this work.

Activity Milestones:

Description	Approximate Completion Date
Complete the final the community workshops	June 30, 2026
Begin Analysis of Targeted PFAS Data	December 31, 2026
Begin Back Trajectory Analysis	December 31, 2026
Complete non-targeted and targeted data analysis	March 31, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Bridget Ulirch	University of Minnesota Duluth - Natural Resource Research Institute	Co-Unvestigator	Yes
Matin Schafer	University of Wisconsin State Lab of Hygiene - National Atmospheric Deposition Program	Co-Investigator - NADP PFAS Subnetwork Contact	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, analysis, reports, and publications produced through this project will be publicly accessible through the NADP website. The project timeline has been structured to not only allow for data collection, but for analysis and finalization of data projects before project completion.

We anticipate that the three years of data, coupled with previous, more sporadic, federally funded, and non-Minnesota collections, will provide a comprehensive, self-contained, and interpretable dataset. If the dataset reveals a continued need for monitoring to, for example, understand the impact of PFAS solutions, a more appropriate state or federal resource will be pursued.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Catch and Reveal: Discovering Unknown Fish Contamination Threats	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04g	$246,000
Water Science and Policy Fellowships for Minnesota	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 05f	$407,000

Project Manager and Organization Qualifications

Project Manager Name: Alexander Frie

Job Title: Research and Fellowship Coordinator

Provide description of the project manager's qualifications to manage the proposed project.
Alexander L. Frie, Ph.D., is the Research and Fellowship Coordinator for the Minnesota Sea Grant College Program at the University of Minnesota. He earned his Ph.D. in Environmental Science with a focus on Environmental Chemistry from the University of California Riverside and a B.A. in Chemistry with an Environmental Chemistry concentration from Saint John's University and College of Saint Benedict. Dr. Frie's research spans atmospheric deposition, water quality, and

emerging contaminants, with a recent emphasis on PFAS transport and environmental impacts. He has significant experience managing scientific teams, project budgets, and partnerships. In addition to his research, he is actively involved in workforce development programs, including supporting the John A. Knauss Marine Policy Fellowships and leading Minnesota Sea Grant's Science and Policy Fellowship program.

Organization: U of MN - Duluth - Sea Grant

Organization Description:
Minnesota Sea Grant is a systemwide program of the University of Minnesota and one of 34 federal-university Sea Grant partnerships across the country that bring applied water science to communities. Minnesota Sea Grant is supported through a partnership with the National Oceanographic and Atmospheric Administration and the University of Minnesota. Minnesota Sea Grant’s mission is to inform and facilitate interaction among the public and scientists to enhance the communities, the environment, and the economies along Lake Superior and across Minnesota's inland waters by identifying information needs, supporting scientific research to address those needs, translating the resulting science into actionable information, and communicating those results to the public.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Alexander Frie		Project PI			27%	0.64		$83,122
Graduate Student		50% GRA in AY and summer, years 1, 3-4. Data Analysis and Interpretation			45%	0.93		$206,976
Bridget Ulrich		Co-PI - Lead for non-target PFAS analysis			27%	0.28		$43,307
Devin Edge		Laboratory Technician			24%	0.16		$12,888
Analytical Chemist		Analytical Chemist - Non-target analysis and interpretation			27%	1.16		$124,929
Post Doctoral Associate		Support Non-target Analysis and interpretation			21%	0.04		$2,983
							Sub Total	**$474,205**
Contracts and Services								
Wisconsin State Lab of Hygiene - National Atmospheric Deposition Program	Service Contract	NADP annual PFAS analysis, and processing costs ($22,500 per site for 3 years) for 8 sites across Minnesota.				0		$540,000
Wisconsin State Lab of Hygiene - National Atmospheric Deposition Program	Service Contract	University of Wisconsin Lab of Hygiene Analysis of 100 samples x $145 per sample for total organic fluorine. ($14,500 total)				-		$14,500
University of Minnesota: Natural Resources Research Institute	Internal services or fees (uncommon)	Non-target PFAS Analysis Instrumentation Costs Analytical costs assume 40 samples per year at $100/sample. Note that while this total works out to 160 total samples, this includes 100 samples received as well as an additional 60 samples for blanks, quality control, and re-runs.				0		$16,000
Site Operator Time associated with PFAS Sample Collection and	Service Contract	Site Operator Costs to Collect Samples and Quality Controls - Estimated as 8 operators at 62.50 an hour for 8 hours a year.				0.09		$12,000

Quality Control/Assurance								
							Sub Total	**$582,500**
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies and consumables for PFAS analysis	Supplies to support non-target PFAS analysis. Supply costs assume 40 samples per year at $125/sample. Note that while this total works out to 160 total samples, this includes 100 samples for non-target analysis and 60 samples for blanks, quality control, and re-runs					$20,000
							Sub Total	**$20,000**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Once a year: Travel for two project members to present results at Minnesota based conference or meeting such as the Water Resources Conference. Calculated as one person traveling 314 miles (0.7*$314), 3 nights lodging in Minneapolis (3x$222), 3 days full per diem for meals (2x$79), 2 days travel per diem for meals (0.75x2x$79) and registration ($274.25)).	Travel to present and share results with minnesota scientists and resource managers,	X				$10,965
	Miles/ Meals/ Lodging	Four events a year in project years 2,3, and 4. Calculated as two people traveling 104.25 miles (0.7*$104.25), 1 nights lodging in Minnesota (1x$144), 2 day travel per diem for meals (0.75x2x$59). No inflation.	Travel to share results with Minnesota communities.					$7,330
							Sub Total	**$18,295**

Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,095,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel In Minnesota	Conference Registration Miles/Meals/Lodging	Once a year: Travel for two project members to present results at Minnesota based conference or meeting such as the Water Resources Conference. Calculated as one person traveling 314 miles (0.7*$314), 3 nights lodging in Minneapolis (3x$222), 3 days full per diem for meals (2x$79), 2 days travel per diem for meals (0.75x2x$79) and registration ($274.25)).	Sharing of the results with Minnesota Scientists and regulators will be critical to their being integrated into future science and resource management.

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 research of 54% 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. (https://research.umn.edu/units/oca/fa-costs/direct-indirect-costs)	Secured	$555,383
			Non State Sub Total	**$555,383**
			Funds Total	**$555,383**

Total Project Cost: $1,650,383

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 04eac503-4e7.pdf

Alternate Text for Visual Component

An outline of Minnesota with the text "PFAS" in the center. Above the text, icons of clouds with snowflakes and raindrops indicate precipitation. Below, a downward arrow points to icons representing people, fish, crops, and deer, illustrating potential environmental and human exposure. The color scheme is primarily blue....

Supplemental Attachments

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

Title	File
UMD Authorization Letter	2e6545a1-61d.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?

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:

Brady Rivers, Bridget Ulrich, Martin Schafer

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