Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-155

Staff Lead: Mike Campana

Date this document submitted to LCCMR: August 2, 2022

Project Title: Catch and Reveal: Discovering Unknown Fish Contamination Threats

Project Budget: $246,000

Project Manager Information

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Project Reporting

Date Work Plan Approved by LCCMR:

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2026

Final Report Due Date: August 14, 2026

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Sec. 2, Subd. 04g

Appropriation Language: $246,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to identify contaminants present in Minnesota water bodies using passive sampling and discovery-based chemical analysis and rank the contaminants' potential threat to Minnesota's fisheries. This appropriation is available until June 30, 2026, by which time the project must be completed and final products delivered.

Appropriation End Date: June 30, 2026

Narrative

Project Summary: Harmful “forever chemicals” were recently discovered in rainbow smelt- what else are we missing? We seek to protect anglers and their families by uncovering unknown contamination threats to Minnesota fish.

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

Recent reports of perfluoroalkyl substances (PFAS) in rainbow smelt have troubled Minnesota's anglers and their families. PFAS are widely present in consumer products, and they don’t break down once they enter the environment. Instead, they can accumulate in fish and end up on our dinner tables. The implications span generations: PFAS have been linked with developmental health effects in children, and may compromise immune activity and impact COVID-19 vaccine efficacy in adults. As Minnesota seeks to lead the nation to reduce PFAS contamination, innumerable other contaminants are present in the environment– and we may not even realize they exist. For example, 6PPD-quinone, a mysterious chemical that caused mass Coho salmon deaths on the West Coast, eluded detection because it’s not directly produced by humans. Rather, it’s a “transformation product” formed from tire rubber left on road surfaces. Further, the Minnesota Department of Agriculture recently reported detection of cyanazine transformation products in Minnesota waterbodies. Cyanazine is an herbicide no longer used in the US, and its transformation products were likely missed by monitoring programs for years. Therefore, as Minnesota seeks to reduce known contamination, we also have the opportunity to “catch and reveal” unknown fish contamination threats.

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.

To protect Minnesota’s families and fisheries, water quality monitoring efforts must cast a wide net to both track down sources of known contaminants and uncover potentially hazardous unknown contaminants. We seek to identify chemical fingerprints across waterbodies impacted by different land uses that indicate potential threats to Minnesota’s fisheries. We will go beyond current and planned monitoring efforts by coupling innovative field techniques with state-of-the-art chemical analysis methods. Specifically, we will use passive samplers (small vessels that take up contaminants over time when submerged in water) to capture contaminants that are likely to accumulate in fish while avoiding time-consuming and costly efforts to measure contaminants in fish tissue directly. Passive samplers will be deployed at sites across MN representative of waterbodies impacted by urban, industrial, and agricultural activities, as well as pristine waterbodies representing reference conditions. Contaminants collected on samplers will be measured using novel discovery-based chemical analysis techniques, enabling simultaneous measurement of known contaminants while acquiring a “snapshot” of all contaminants present in a sample- known or unknown. Finally, identified contaminants will be ranked according to potential threats to aquatic life by using databases and risk assessment tools to compile known or predicted bioaccumulation and toxicity potential.

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?

Our findings will provide a knowledge base for more comprehensive statewide contaminant monitoring and mitigation plans. Specifically, we will take a nontargeted approach to broadly observe contaminants lurking in MN waterbodies, in complement to conventional monitoring activities. Further, by ranking identified contaminants according to known or estimated hazards, our results will inform the prioritization of new contaminants to be included in existing monitoring and mitigation programs. These efforts will protect Minnesota’s natural resources and lead to cleaner water and healthier fisheries. Moreover, protecting Minnesota’s fisheries also means protecting our families, freshwater recreational opportunities, regional economies, and cultural identity.

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

Activities and Milestones

Activity 1: Development of passive sampling methods and field monitoring plans

Activity Budget: $68,100

Activity Description:
Preliminary work will be required to develop data collection methods that are comparable across varying field conditions, as described below:

Task 1a: Development of passive sampling methods. Several types of commercially available passive samplers with varying modes of contaminant capture will be evaluated in laboratory experiments under a range of flow conditions with realistic natural waters. The sampler (or combination of samplers) that most comprehensively captures contaminants will be selected for deployment. Sampler collection frequencies that optimize contaminant capture and time resolution will be determined according to experimental data.

Task 1b: Development of deployment plan. We will work with regional managers to select field sites along MN streams that represent the following categories of expected land-use impacts: pristine, urban-impacted, industry-impacted, and agriculture-impacted. We will target locations with active stream gauges, expect sites to be distributed throughout Northeastern MN, Southern MN, and the Twin Cities Metro area. We will also develop a sensor deployment plan to continuously monitor other parameters important to fish and fish habitat health (temperature, dissolved oxygen, conductivity, pH, and turbidity).

The output of this activity will be a field monitoring plan to comprehensively collect water quality and contaminant data across Minnesota streams impacted by varying land uses.

Activity Milestones:

Description	Approximate Completion Date
Passive sampler and analysis methods verified in the laboratory	February 28, 2024
Field sites selected and sampling plan finalized	February 28, 2024
Sensors, samplers, and other field equipment acquired	March 31, 2024

Activity 2: Deployment and monitoring of passive samplers and sensors

Activity Budget: $132,700

Activity Description:
Passive samplers and in-stream, high-frequency sensors will be deployed and monitored over two field seasons as described below:

Task 2a: Deployment and maintenance of monitoring equipment. Sensors and samplers will be securely installed within streams at easily accessible locations, allowing field crews to maintain sensors and download data approximately every other week from April - October. The frequency of sampler collection will be determined during Activity 1 to optimize contaminant capture and time resolution. To inform contaminant load calculations, we will also measure water height and measure discharge to create rating curves for each stream.

Task 2b: Discovery-based analysis of captured contaminants. Contaminants extracted from samplers will be analyzed using discovery-based chemical analysis techniques, yielding “snapshots” of virtually all detectable compounds present. Briefly, candidate contaminant “peaks” will be deciphered from acquired data, and then established workflows will be

performed to link observed mass spectra (a chemical fingerprint) with potential contaminant identities. Confidence of identities will be ranked according to established methods, and concentrations will be measured if analytical standards are readily available.

The output of this activity will be a summary of measured water quality parameters and detected contaminants (known and newly identified) in streams across varying land uses.

Activity Milestones:

Description	Approximate Completion Date
Passive samplers and sensors deployed	April 30, 2024
Collection of samplers and sensor data completed	November 30, 2025
Measurement of known contaminants and identification of unknown contaminants completed	March 31, 2026

Activity 3: Assessment of potential fish contamination threats and dissemination of findings

Activity Budget: $45,200

Activity Description:
Task 3a: Compile a ranked list of potential fish contamination threats. The potential hazards of detected contaminants will be quantified according to known or predicted indicators of aquatic toxicity and bioaccumulation potential. Briefly, we will search the US EPA's ECOTOXicology Knowledgebase (ECOTOX) for toxicity data for detected contaminants, compile known aquatic toxicity indicators, and use data for structurally similar compounds to estimate indicators for cases where no toxicity data exists. Contaminant bioaccumulation potential (an indicator of the likelihood of contaminants to accumulate in fish) will be estimated using standardized software (e.g., EPA's Epi Suite). A weighted ranking system will be applied to create a prioritized list of detected contaminants according to aquatic toxicity and bioaccumulation potential, and trends in hazard potential and land-use impacts will be evaluated. The list will also be cross-checked with contaminant lists from current monitoring programs to identify potentially problematic gaps.

Task 3b: Disseminate findings. Our results and recommendations for expanded contaminant monitoring programs will be summarized in a final report. Findings will be disseminated to resource managers, stakeholders, and the public through state and regional agency presentations, community gatherings, media stories, NRRI and UMD communications, conference presentations, and peer-reviewed scientific articles.

Activity Milestones:

Description	Approximate Completion Date
Compilation of known or predicted bioaccumulation and toxicity potential for identified contaminants completed	May 31, 2026
Final report detailing findings and recommendations submitted	May 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Christopher Filstrup	Natural Resources Research Institute	Dr. Filstrup will be responsible for leading stream monitoring efforts and assisting with sampling design, data analysis and interpretation, and dissemination of findings. Filstrup supervises the operation of NRRI's Central Analytical Laboratory, a state-certified water quality laboratory, and has been studying lakes and streams for more than two decades.	Yes
Brian Barry	Natural Resources Research Institute	Dr. Barry will serve as a liaison between researchers and the recreational fishing community. Dr. Barry is a chemist and avid angler, and will connect researchers with members of the recreational fishing community to assist with dissemination of results.	No

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.
Our results and recommendations for expanded contaminant monitoring programs will be summarized in a final report, to be made publically available. Findings will be disseminated to resource managers, stakeholders, and the public through state and regional agency presentations, media stories, NRRI and UMD communications (i.e., the NRRI newsletter), conference presentations, and peer-reviewed scientific articles. Results from the year prior will be presented each year at the Minnesota WRC, which reaches hundreds of students, academics, and practitioners across MN. Appropriate attribution language will be included in all dissemination materials (including reports, publications, posters, and PowerPoint presentations) 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?
In reflection of NRRI's commitment to sustaining Minnesota's natural resources, we will continue to disseminate our findings and advise resource managers beyond the project duration. This will lead to future implementation of evidence-based, statewide contaminant monitoring programs that more effectively target potential threats to fisheries and families alike. Development of discovery-based chemical analysis methods are ongoing at NRRI, and are funded as a part of the US EPA's Great Lakes Restoration Initiative (GLRI). Beyond project completion, we intend to seek funding opportunities for solutions-oriented research to mitigate contamination threats uncovered as a part of our findings.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project manager and analytical lead		Overall project management, oversight of chemical analysis and data acquisition.			26.9%	0.2		$29,052
Field work coordinator		Oversight of planning and implementation of field work.			26.9%	0.06		$6,420
Environmental chemist		Analytical assistance and QA/QC oversight			24.2%	0.03		$2,142
Postdoctoral researcher		Assistance with data analysis, contaminant threat assessment, and report preparation			20.4%	0.01		$647
Undergraduate research assistants		Undergraduate research assistants to visit field sites, download data, and collect and ship samplers.			0%	0.3		$4,681
Ph.D. Researcher		Coordination of day-to-day laboratory, field, and data analysis activities			45.2%	1.32		$132,022
Temp/Casual Technician		Hourly assistance with field and laboratory activities			7.6%	0.12		$6,341
							Sub Total	**$181,305**
Contracts and Services								
University of Minnesota Duluth	Internal services or fees (uncommon)	Nutrient analyses at NRRI analytical lab				0.02		$8,450
Entity TBD	Professional or Technical Service Contract	LCMS analysis for approximately 95 samples per year at $38 per sample				0.08		$14,400
							Sub Total	**$22,850**
Equipment, Tools, and Supplies								
	Equipment	Hydrolab sonde data logger: 2 @ $4500 = $9,000; Sensors: 2 @ $3,500 = $7,000	Data loggers and sensors will be deployed at field sites to continuously monitor water quality parameters					$16,000

	Tools and Supplies	Passive samplers and analytical supplies required for analysis of approximately 350 samples (120 per sampling year)	Passive samplers are needed to collect contaminants, and solvents, analytical standards, and laboratory consumables required to perform chemical analyses.					$15,595
	Tools and Supplies	Field supplies required to perform approximately 20 site visits	Supplies required to collect and transport passive samplers and maintain and monitor sensors					$8,000
							Sub Total	**$39,595**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Mileage for 40 total out-and-back trips (20 trips, 2 sampling teams) with an average distance of 89.7 miles at a rate of $0.585/mile.	Frequent travel to field sites by multiple sampling teams will be required to carry out proposed field activities.					$2,100
							Sub Total	**$2,100**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Overnight shipping for approximately 20 shipments from the Twin Cities Metro area to Duluth at approximately $25/shipment.	Overnight shipping of samplers to NRRI for chemical analysis will be required to prevent contaminant degradation during storage					$150

							Sub Total	**$150**
							Grand Total	**$246,000**

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				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN negotiated rate for research of 55% 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	$112,038
			Non State Sub Total	**$112,038**
			Funds Total	**$112,038**

Attachments

Required Attachments

Visual Component

File: 0c344c87-ab3.pdf

Alternate Text for Visual Component

A young child on a lake in Minnesota, proudly displaying his catch and asking "Is this fish safe to eat?"....

Optional Attachments

Support Letter or Other

Title	File
UMD SPA Transmittal Letter	230e607a-77e.pdf
Background check form	0f133e60-09d.pdf
Research Addendum: Catch and Reveal	a2ace03e-241.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

The scope of Activity 1 was reduced significantly to account for the budget reduction. The milestone dates were also extended by a year to account for delays in recruiting a graduate student that are associated with the uncertainty in the award status of the funds during the student recruitment period. The appropriation language was also adjusted accordingly to allow an end date in June 2026.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must 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 agree to the UMN Policy.

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

Catch and Reveal: Discovering Unknown Fish Contamination Threats