



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-314

Proposal Title: Agricultural Technologies for Nutrient Efficiency and Water Protection

Project Manager Information

Name: Brad Matuska

Organization: Agricultural Utilization Research Institute

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Project Basic Information

Project Summary: Identification and validation of technologies to optimize nutrient recovery in agri-food systems focused on targeting sustainable economic and environmental solutions that prevent nutrients from entering ground and surface water resources.

ENRTF Funds Requested: \$561,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Water Resources (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.

Nutrients play a crucial role in boosting agricultural output, encompassing both crop and livestock farming. Nonetheless, these same nutrients can pose environmental risks if not properly managed. Municipal wastewater management entities possess extensive knowledge and skills in nutrient recovery technologies and practices aimed at achieving specific goals. This proposal seeks to explore the feasibility of applying such expertise and technologies on a smaller scale to farms and agri-food processing facilities. The core issue we intend to investigate is whether current or new technologies can effectively separate excess nutrients, such as nitrogen and phosphorus, from agricultural by-products. The goal is to repurpose these nutrients for beneficial uses in fertilizers or animal feed, mitigating the potential for loss into the environment. Achieving this would not only alleviate environmental impacts by reducing nitrate and phosphate levels, but also offer economic benefits to rural enterprises. Presently, Minnesota relies heavily on imported synthetic fertilizers for its nutrient needs. This initiative aims also to lower the carbon footprint associated with nutrient sourcing by adopting a local, circular approach to nutrient management and utilization, thus presenting both environmental and economic advantages.

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.

AURI would thoroughly review existing nutrient recovery technologies and management systems utilized by municipal wastewater management sites to understand the scale and potential applicability to various agri-food processing and production applications. Additionally, we would explore emerging technologies in this field to understand the technology and scale at which it could be applied as a solution. Dialogue with agricultural entities would further inform their challenges and opportunities for technologies uncovered during this process to be a solution in implementing a more circular nutrient management approach. This evaluation considers agriculture's unique constraints, such as nutrient specificity, stream physicochemical characteristics, and constraints like scale and infrastructure.

An important component of the work will also be the economic levers. Understanding the costs of separating nutrients from byproduct streams against the market value for the recovered nitrogen and phosphorous compounds in feed or fertilizer applications will be critical to the success of implementing circular nutrient recovery management systems. The research quantifies the economic and environmental aspects of nutrient recovery, assesses the potential market value of recovered nutrients, and analyzes the cost-benefit of the solutions along with its life-cycle assessment. The result is the identification of deployable technologies assessing their systemic impact.

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?

This project will help create a more proactive nutrient management approach for agri-food businesses to improve their environmental footprint while also providing new business opportunities for rural areas. The reduction of nitrogen and phosphorus in waste streams will be the key environmental benefit but will also reduce the need for synthetic fertilizer use or imports of feed nutrient supplements. This will have environmental benefits for ground and surface water and create circular approaches amongst Minnesota businesses and users that can increase local economic activity and help support the state's economy.

Activities and Milestones

Activity 1: Inventory of technology and processes for nutrient management

Activity Budget: \$122,200

Activity Description:

We will inventory existing suitable nutrient management and recovery technologies. The focus is on technologies that are either commercial or close to commercialization that can reduce nitrogen (i.e. nitrates) and phosphorus (i.e. phosphates). Leveraging the experience of wastewater facilities operators is essential for effective technology transfer. We will review the current state of the art and elect to research technology at an earlier stage of development if deemed exceptionally meritorious and with a high potential impact.

Activity Milestones:

Description	Approximate Completion Date
Identify processes used for nutrient management in industry	December 31, 2027
Create an inventory of nutrient management technologies	December 31, 2027

Activity 2: Technical and economic analysis of key nutrient recovery technologies

Activity Budget: \$146,000

Activity Description:

AURI will conduct a technical and economic analysis of the key nutrient recovery technologies identified in Activity 1. This review will consider economics, compatibility of recovered nutrients with the existing fertilizer supply chain, commercial readiness, and expected performance at the intended scale. We will leverage the experience of the City of St Cloud's Nutrient, Energy and Water Recovery Facility and other external experts in this assessment. A critical outcome of this activity is a gap analysis identifying obstacles and challenges in the adoption of these technologies at the farm or small and medium agri-food business scale. Essential outcomes are the realistic assessments of nutrient recovery efficiency under different conditions, the economic value of nutrients, the impact of policy incentives, and operating costs and complexity. Finally, as appropriate, the project team will test the most promising approaches at the laboratory and/or pilot scale, using real effluents and not modeled ones. The result of these tests will inform a detailed techno-economic analysis of the proposed processes.

Activity Milestones:

Description	Approximate Completion Date
Identify key technology providers and external experts	February 28, 2027
Conduct technical and economic analyses of key technologies	October 31, 2027
Provide samples to identified technology providers for demonstration and validation	October 31, 2027
Test promising approaches at laboratory and/or pilot scale	February 28, 2028
Identify and meet with key stakeholders to establish supply chain connections while identifying obstacles	June 30, 2028

Activity 3: Inventory and characterization of critical waste streams of interest

Activity Budget: \$139,060

Activity Description:

This activity will identify the likely candidates for treatment with the technologies from Activity 2. These will include, but

not be limited to, manures, digester effluents, and waste streams from farms and agri-food processing facilities. The critical waste streams of interest will be identified, assessed, and inventoried to provide an estimate of nutrients available for recovery and a preliminary assessment of the possible environmental impacts. This activity will include analytical and life cycle analysis of the nutrients under the status quo compared to various mitigation implementation scenarios based on the technologies identified in activities 1 and 2. The characterization will quantify the waste streams, the amount of nutrients (i.e. nitrogen and phosphorus compounds), their type (organic vs. inorganic), other relevant physio-chemical characteristics, availability, and geographical dispersion.

Activity Milestones:

Description	Approximate Completion Date
Create an inventory and assessment of critical waste streams	June 30, 2027
Characterization of the critical waste streams	December 31, 2027

Activity 4: Definition of implementation strategies and the analysis of their systemic impact

Activity Budget: \$110,090

Activity Description:

Individual techno-economic and feasibility analyses of the process technologies identified in Activity 2 will be matched with critical waste streams from Activity 3. Work will be focused on summarization of the optimal opportunities, resource requirements, possible deployment timelines and identification of critical gaps or obstacles, technical or otherwise, to deployment. The primary outcome of this activity is to provide an overview the economic and environmental impact of widespread adoption of nutrient recovery and reuse technology in the Minnesota farm and agri-food sectors and provide insight into possible approaches to promote the deployment of recovery technologies, their feasibility, and the leading technical, economic, and policy enablers.

Activity Milestones:

Description	Approximate Completion Date
Capital and operating cost estimates for selected technologies with selected waste streams	October 31, 2027
Identification of fertilizer value of recovered nutrients	December 31, 2027
Completed technical and economic analysis of key technologies	March 31, 2028
Final analysis of systemic impacts of implementation strategy	May 31, 2028

Activity 5: Outreach, Engagement, and Dissemination

Activity Budget: \$43,650

Activity Description:

AURI plans to engage with both public and private stakeholders to identify potential challenges and pinpoint essential factors for the creation of a nutrient management industry in Minnesota. This industry's development could significantly reduce the state's reliance on synthetic fertilizers, showcasing a tangible impact on environmental sustainability and agricultural efficiency.

In support of this focus, AURI will collaborate with its partners to disseminate research outcomes and encourage further investment and adoption by leveraging networks and organizing events with various industry groups. Reports and informational materials featuring project findings will be developed and made accessible to interested stakeholders and the public to provide a roadmap for wider adoption and future deployment efforts.

Dissemination efforts will also include one-to-one meetings with key stakeholders, and may make use of webinars, podcasts, videos, and fact sheets to share information about the project's objectives and findings. Programs and materials will be focused on providing relevant parties with critical techno-economic information for implementation and deployment of technologies identified during this project. A final "implementation roadmap" report will also be designed and published online to share project findings and guide future action.

Activity Milestones:

Description	Approximate Completion Date
Engage supply chain participants and stakeholders through in-person and virtual events and meetings	June 30, 2028
Disseminate and communicate research findings through in-person events, online platforms, and one-on-one meetings	June 30, 2028
Develop and publish "implementation roadmap" report including project findings	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Emma Larson	City of St. Cloud - Public Utilities Department (Nutrient, Energy, and Water Recovery Facility)	Emma will oversee the St. Cloud Public Utilities Department's work on this project. St. Cloud Public Utilities will coordinate with AURI to provide technical guidance, review project reports and documents, and conduct industry research as requested in support of project objectives. The City of St. Cloud is committing in-kind support	No

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?

The main goals of this project are to quantify the opportunity, provide a realistic assessment of potential technologies and nutrient streams, and identify a framework for implementation that accounts for the reality of the farm and agri-food sectors.

If these goals are satisfied and the results indicate a realistic opportunity for implementation, AURI and its partners will identify and support further work to develop the market and justify future project funding. Findings from the project will also be shared with public and private stakeholders for evaluation and potential future investment.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Reducing Plastic Pollution With Biodegradable Erosion Control Products	M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 08i	\$200,000

Project Manager and Organization Qualifications

Project Manager Name: Brad Matuska

Job Title: Business Development Director of Biomass Feedstocks

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

Brad Matuska is AURI's Business Development Director of Biomass Feedstocks with a focus on producers and industry to develop and execute projects and initiatives resulting in the commercialization of new value-added products benefitting Minnesota agricultural biomass feedstocks, including manure, crop residues, food waste and other coproducts. He is currently working on multiple nutrient recovery projects involving anaerobic digestion, composting, and other technologies. This proposed project fits well into his roles and skillset.

In addition, Brad co-founded an organics recycling business, Mississippi Topsoils in 1998, that commercialized value-added products made from the wastewater treatment biosolids of a poultry producer. Over the 25-year history of the company, he gained a wide breadth of experiences that ignited his passion for sustainably creating valuable products from by-products and developed a strong foundation of entrepreneurship, business development, growth, and sustainability.

Brad carried that first-hand business experience into the classroom as well. He was an adjunct instructor at the College of St. Benedict and St. John's University. As an adjunct, Brad taught entrepreneurship and cultivated an enriching learning environment built on relationships and community building. He is also nonprofit advocate, having served on several nonprofit boards and helped manage aquatic invasive species, sustainable shoreline development, and water quality projects.

Finally, Brad has an undergraduate degree in biology and a masters of business administration. He has served as a consultant on multiple solid waste management projects as well as economic impact studies for various industries.

Organization: Agricultural Utilization Research Institute

Organization Description:

The Agricultural Utilization Research Institute (AURI) helps foster long-term economic benefit for Minnesota through value-added agricultural products. It accomplishes this mission by helping develop new uses for agricultural products through science and technology, while collaborating with businesses and entrepreneurs to bring ideas to reality. AURI provides a broad range of services including hands-on scientific technical assistance and technology transfer, a network of resources, and the applied research necessary to generate ideas for new ag-based products and processes and to help move them to market. With labs specific to analytical chemistry, coproducts, food, meat, and microbiology, as well as staff experienced in science, technology, and innovation processes, AURI is a one-of-a-kind resource that aids Minnesota businesses looking to create more value for the state's agricultural products.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
AURI Technical Team (Coproduct Scientist, Lab Technician, Chemist, Associate Scientist)		AURI's technical team will conduct research, perform technology assessment, and coordinate collaboration with external research partners. Activities will include sourcing samples for analysis and pilot scale trials, coordination and performance of analytical work, technical analysis, participation in events, and reporting research findings.			27.27%	0.96		\$101,640
AURI Commercialization Team (Principal Investigator, Business Development Directors)		Lead supply chain and market development activities and collaborate with industry and other key stakeholders. Coordinate with AURI technical and outreach teams, contractors, and other external partners to pursue and complete project objectives.			27.27%	1.11		\$126,225
AURI Outreach and Communications Team (Communications Director, Communications Coordinator)		Coordinate events and other outreach and dissemination activities to identify and engage key stakeholders and share information about project findings. Coordinate development and delivery of informational materials and final "implementation roadmap" report.			27.27%	0.12		\$14,850
AURI Project Manager		Manage AURI project activities, contracts, budgets, timelines, and ensure project follows grant rules and meets reporting requirements.			27.27%	0.48		\$9,900
							Sub Total	\$252,615
Contracts and Services								
TBD	Professional or Technical Service Contract	Conducting a life cycle analysis (LCA) to evaluate the environmental impacts of technologies being assessed for use in farm and agri-food settings. This contracted work will collect data on energy use, emissions, and resource consumption, compare assessed technologies to				0.48		\$55,000

		the status quo, and identify opportunities to improve sustainability.						
TBD	Professional or Technical Service Contract	AURI will contract for engineering services providing specialized technical assistance focused on assessment and inventory of technology and processes for nutrient management and identification and implementation of strategies for nutrient recovery and reuse.				0.78		\$90,000
TBD	Professional or Technical Service Contract	AURI will contract with external labs as needed to perform additional analysis and provide services not available utilizing AURI's in-house analytical tools.				0.12		\$15,000
AURI	Internal services or fees (uncommon)	AURI lab use fees. Up to 1000 hours at \$70/hour. If use of AURI labs exceeds 1000 hours, additional fees will be covered by AURI as an in-kind project contribution.				0.6		\$70,000
							Sub Total	\$230,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Consumable lab supplies	Purchase of consumable supplies for AURI analytical research, chemistry lab work, and procurement of small, non-capital lab equipment for use in project activities.					\$37,885
							Sub Total	\$37,885
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Number of trips, miles, and people to be determined as technology partners and research sites are identified during project. Estimate total of 60 trips within Minnesota at average	Travel by AURI technical, commercialization, and outreach staff to meet with businesses, research partners, technology					\$15,000

		cost of \$250. Mileage, lodging, and per diem rates to be set as provided for by Minnesota Management and Budget under the applicable "Commissioner's Plan."	providers, and attend outreach and dissemination events.					
							Sub Total	\$15,000
Travel Outside Minnesota								
	Miles/ Meals/ Lodging	Travel (up to 4 trips) by two AURI staff to coordinate and conduct research and assess potential technologies. Cost to include lodging, meals, incidentals, airfare and mileage.	Travel to out-of-state labs and facilities to examine and assess technologies for nutrient capture and separation in lab and operational settings, and coordinate research and technology assessment with key partners.	X				\$8,000
							Sub Total	\$8,000
Printing and Publication								
	Publication	Report design and development	Design, development, and publishing of a digital "implementation roadmap" report					\$7,500
							Sub Total	\$7,500
Other Expenses								
		Event and dissemination expenses	Expenses to stage events focused on stakeholder engagement and dissemination of project findings including in-person events and development of webinars, podcasts, and informational videos.					\$10,000
							Sub Total	\$10,000
							Grand Total	\$561,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Miles/Meals/Lodging	Travel (up to 4 trips) by two AURI staff to coordinate and conduct research and assess potential technologies. Cost to include lodging, meals, incidentals, airfare and mileage.	Potential research partners and deployed technologies of key value to the project may be located outside of Minnesota. This funding will be used to allow AURI staff to assess key technologies, access technical information, and coordinate research at facilities possessing capabilities not available in Minnesota in support of the project.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
In-Kind	City of St. Cloud (Public Utilities)	The City of St. Cloud Public Utilities Department will provide in-kind hours for technical guidance, review of project reports and documents, and to conduct research as requested in support of project objectives.	Secured	\$15,000
			Non State Sub Total	\$15,000
			Funds Total	\$15,000

Total Project Cost: \$576,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [aaae943e-7de.pdf](#)

Alternate Text for Visual Component

An image with the project overview and a graphic showing sectors involved in the nutrient cycle in Minnesota and how the project will work in collaboration with industry and experts to identify nutrient capture technologies that will provide economic and environmental benefits to the state....

Financial Capacity

Title	File
AURI - FY23 Form 990	401ab6b3-e69.pdf
AURI - FY23 Audited FS-Full	22992f9f-4ac.pdf
AURI Certificate of Good Standing	bf71e4a2-b1d.pdf

Board Resolution or Letter

Title	File
AURI Letter of Authorization	ee9d81d9-0d4.pdf

Supplemental Attachments

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

Title	File
City of St. Cloud Letter of Support	f8541776-554.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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:

Brad Matuska, Matthew Leiphon, Dr. Luca Zullo, Jen Wagner-Lahr, and Dr. Michael Stutelberg all of AURI