



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-095

Proposal Title: Evaluation, Management and Education of Septage from SSTS

Project Manager Information

Name: Sara Heger

Organization: U of MN - Water Resources Center

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Project Basic Information

Project Summary: This project will evaluate a range of septage sources for common and emerging contaminants, evaluate nitrogen availability when land applied, and educate regarding the options for proper septage treatment.

ENRTF Funds Requested: \$494,000

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

Narrative

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

There are over 636,000 subsurface sewage treatment systems (SSTS) in Minnesota. These SSTS primarily serve residences, although over 25,000 serve commercial properties. Typically, the treatment process starts with a septic tank cleaned approximately every three years due to solids buildup. Some SSTS on small lots only contain a holding tank that must be emptied every time it fills up. Conservatively, this produces 212,000,000 gallons of septage every year. Improperly treated septage can contaminate ground or surface water, therefore the septage must be either taken to a wastewater treatment plant (WWTP) or land applied to fields to provide nutrients for crop production. Many WWTPs do not accept septage due to a lack of capacity, unknown characteristics, and variability. The data referenced regarding septage characteristics is from the 1980s and 1990s. Since this time, septage characteristics have changed due to increased maintenance frequencies, increased tank capacity, and household practices. Land application of septage faces increasing scrutiny due to safety concerns. The amount of septage produced each year is increasing, and the number of options for proper treatment is decreasing. This is raising concerns as there must be valid treatment options for protection of Minnesota's ground and surface waters.

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 will gather data and samples regarding the characteristics of septage to assist WWTP and those applying it to fields with current information on loading rates of nitrogen, phosphorus, organics, and solids. It will also provide up-to-date information on the number of metals, contaminants of emerging concern (CEC), and PFAS in septage. Septage from three different sources will be evaluated: residential septic tanks, residential holding tanks, and commercial septic tanks. This data is needed for WWTP to accept septage into their facilities and set rates appropriately based on the source. Data will also be gathered regarding how the required liming process for septage land application reduces septage pathogens. The data will also be utilized to run incubation studies to determine the availability of nitrogen from septage for the growth of crops. The incubation study will evaluate four types of septage (two residential and two commercial) in three soil types commonly found in Minnesota. An education program will be implemented to inform citizens, WWTP, farmers, regulators, and local elected officials regarding the options for effective treatment of septage from SSTS and the benefits of land application for recycling nutrients essential for crop production.

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?

An improved understanding of septage characteristics will protect Minnesota's resources by providing increased acceptance at WWTP. The septage analysis and the incubation study will inform regulations regarding the application to fields to ensure the septage is properly land-applied to provide adequate nutrients and protect ground and surface waters. As maintenance costs rise due to increased disposal costs at WWTP and trucking distances, the risk of improper disposal of septage increases, negatively impacting water resources. Education efforts will inform citizens, WWTP, farmers, regulators, and elected officials of the management options for proper septage treatment.

Activities and Milestones

Activity 1: Collect and analyze septage from residential and commercial systems at WWTP and prior to land application.

Activity Budget: \$255,698

Activity Description:

This activity's objective is to gain an in-depth understanding of septage characteristics from residential and commercial SSTS from modern use and maintenance frequencies. Existing data will be obtained and a minimum of 500 additional samples will be collected at WWTP receiving stations and in the field before land application by SSTS Maintainers. All samples will be analyzed for organics (biochemical oxygen demand and total suspended solids), nitrogen (ammonia and total Kjeldahl), and phosphorus. This is the most needed data for WWTP, regulators, and farmers to increase the options for proper septage treatment. Ten percent of the samples will be analyzed for fat, oil, and grease (FOG), focusing on sources with high FOG generation (restaurants). Ten percent of the samples will be analyzed for metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc) and PFAS to screen for potential sources. Five percent of samples will be analyzed for the reduction in pathogens due to liming. Liming is the most common allowable pathogen reduction method SSTS maintainers utilize to reduce pathogen loads, but data regarding the reduction achieved is needed. A land application site will also be monitored for CEC in the septage, soil, and a shallow monitoring well.

Activity Milestones:

Description	Approximate Completion Date
Collect and analyze septage samples from WWTP receiving stations	June 30, 2026
Collect and analyze septage samples from SSTS Maintainers during tank cleaning	June 30, 2026
Summarize data in a report	December 31, 2026
Collect soil samples to be uses in Activity 2	December 31, 2026

Activity 2: Perform study on nitrogen minerilzation from two residential and two commercial sources on three different common soil types in Minnesota.

Activity Budget: \$192,606

Activity Description:

This activity's objective is to determine the nitrogen availability from various septage sources identified in Activity 1 to estimate appropriate land application rates for crop production. To accomplish this task, a 128-day incubation study will be established with four septage types, three application rates (0, 1X, and 2X based on total Kjeldahl N analysis), and three soils replicated three times. Soils with three different textures will be collected from fields representative of those used for land application. Before the incubation, the soil samples will be analyzed for selected physical and chemical properties. Septage samples mixed with soil at appropriate rates will be incubated at 80% of field capacity in quart Mason jars. Over the course of the incubation, samples will be collected on days 0, 2, 4, 8, 16, 32, 64 and 128. Nitrate and ammonium will be determined in each sample following extraction. An exponential regression model initially developed by Stanford and Smith (1972) will be used to estimate potentially mineralizable nitrogen and calculate availability from organic N in the septage samples. The outcome will be to provide applicators and regulators with appropriate rates of septage that can be safely land-applied based on available nitrogen content.

Activity Milestones:

Description	Approximate Completion Date
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Set up experimental design with septage and soil	July 31, 2026
Collect and then analyze samples from incubation study	December 31, 2026
Summarize data in a report	June 30, 2027

Activity 3: Education program regarding septage characteristics and utualization for citizens, WWTP, farmers, applicators, regulators, and local elected officials.

Activity Budget: \$45,696

Activity Description:

The objective of this activity is to inform citizens, WWTP, farmers, applicators, regulators, and local elected officials regarding septage characteristics to increase acceptance at WWTP and allowance of treatment via land application. The results of Activity 1 and 2 will be summarized in factsheets for non-technical audiences. The results will be published in a journal for scientific-based audiences. The results will be presented at the Minnesota Onsite Wastewater Association (MOWA) annual conference, the MPCA Operators Conference, and ten University of Minnesota Onsite Sewage Treatment Program (OSTP) continuing education training events. The results will be published on the OSTP website and via newsletters published by the UMN, MOWA, and the MPCA. These educational resources will be provided to the public via the social media platforms of the listed organizations. The information will be formatted to ensure the public's ease of understanding. The outcome will be a better understanding of septage characteristics and acceptance of disposal at WWTP and land application. As more septage is applied to land, there will be a reduction in commercial fertilizer use, lower treatment costs compared to WWTP, decreased maintenance costs, and reduced carbon emissions due to decreased hauling distances.

Activity Milestones:

Description	Approximate Completion Date
Create summary factsheets and journal articles for the range of audiences	December 31, 2027
Present the results at state conferences and training events	June 30, 2028
Disseminate the data electronically	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Carl Rosen	Department of Soil, Water and Climate	Co-PI overseeing the incubation study	Yes
Aaron Jensen	Minnesota Pollution Control Agency, Subsurface Sewage Treatment Program	Assist with research design and dissemination	No
Tammy Trantham	Minnesota Onsite Wastewater Association	Assist with research design, finding of septic Maintainers, dissemination of results	No
Wastewater Treatment Plants across Minnesota	East Gull Lake, Grand Rapids, Metropolitan Council, Moorhead, New Ulm, Owatonna, Rochester, St. Cloud, Western Lake Superior Sanitary District, Worthington	All the listed plants have agreed to share data and collect samples for the project.	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 result of this project will be integrated into the OSTP curriculum and manual used to train all septic system professionals in Minnesota, a required training program in Minnesota for certification of all SSTS professionals. The OSTP website will host the results of the research long term for the public to access. MOWA will make the resources available to professionals and the public through its website for further public awareness. MOWA will also partner with local governmental units to provide this data locally to increase the understanding of land application's available options and benefits.

Project Manager and Organization Qualifications

Project Manager Name: Sara Heger

Job Title: Research Manager and Instructor

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

Dr. Sara Heger is a researcher and instructor in the Onsite Sewage Treatment Program (OSTP) in the Water Resources Center (WRC) at the University of Minnesota (U of MN) and is an Adjunct Assistant Professor in the Bioproducts and

Biosystems Engineering Department. Since 1998, she has been conducting research and providing education and technical assistance to homeowners, small communities, onsite professionals, and local units of government regarding onsite wastewater treatment. Sara coordinates the OSTP research program at the U of MN and is currently serving as the principal investigator on septic system related grants to evaluate water tables and groundwater mounding, septage from rest areas, bioaugmentation, contaminants of emerging concern, and the use of biochar and iron enhanced sand. Past research evaluated chloride impacts from water softeners on water quality (LCCMR funded), reuse of wastewater, milkhouse wastewater, and various related topics. Sara serves on the NSF International Committee on Wastewater Treatment Systems. She chairs the MPCA State Advisory Committee on Subsurface Sewage Treatment Systems. She serves as an instructor in the UMN Onsite Sewage Treatment Program providing training in Minnesota and across the country integrating research results into septic system design, installation, inspection, and maintenance. Her recent work collecting samples from rest areas well positions her to oversee septage collection, analysis, and related educational activities. She has a B.S. in Biosystems & Agricultural Engineering and an M.S. and a PhD in Water Resource Science. Dr. Heger is an expert in septic system performance and related research.

Organization: U of MN - Water Resources Center

Organization Description:

The University of Minnesota (U of M) is a large, comprehensive, public land grant research university serving a state where both water resources and agriculture are hallmarks of the economy. The Water Resource Center (WRC) is the primary coordination unit for U of M research, outreach, and graduate education related to water resources. It manages 20-25 active grants, from federal, state, and private funders, totaling over \$3 million at any one time, and working across disciplines and institutions. The WRC maintains sufficient permanent staff to complete all grant reporting and data submittal requirements in the time required. The U of M Onsite Sewage Treatment Program (OSTP) has been providing education and performing research on septic systems since the mid-1970s. OSTP is a multi-disciplinary program with four distinct yet interrelated activities and programs: 1) Professional Training, 2) Research and Demonstration, 3) Small Community Wastewater Education, and 4) Homeowner Operation and Maintenance. The integration of the four programs has continued to be a priority for the overall program, both within the U of M and state of Minnesota and on a broader scale to partnering Universities' research, education, and outreach functions across the nation.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Dr. Sara Heger		Project Manager, Oversight of Septage Collection and Education			37.1%	0.6		\$91,300
Lab Technician		Perform incubation study			33.5%	1.11		\$98,515
Graduate student		Collect samples and assist with incubation study			25.1%	1.25		\$124,099
Undergraduate student		Assist with sample collection and incubation study			0%	0.06		\$3,035
							Sub Total	\$316,949
Contracts and Services								
Certified Laboratory (several locations based on sample collection location)	Professional or Technical Service Contract	Analysis of samples for organic material, nutrients, metals, PFAS and CECs				0		\$114,550
Septic Maintainers/Pumpers	Professional or Technical Service Contract	Collection of septage samples prior to land application and transportation to laboratory				-		\$25,000
UMN Soil's Lab	Internal services or fees (uncommon)	Lab costs to run incubation study laboratory analysis				0		\$19,503
							Sub Total	\$159,053
Equipment, Tools, and Supplies								
	Tools and Supplies	10 cartons of nitrile gloves	personal protective equipment for lab and field work					\$170
	Equipment	2 pH meters with calibration kits at \$150 per meter	for field testing of pH					\$300
	Tools and Supplies	35 - 5 gallon buckets at \$11.20 per bucket	for collection of soil and septage samples					\$392
	Tools and Supplies	5 funnels at \$10 per funnel	for septage sample collection in the field to transfer to bottles					\$50
	Tools and Supplies	Face masks, 5 cartons at \$23/carton	personal protective equipment for lab work					\$115

	Tools and Supplies	1000, 1 quart mason jars at \$3.285/jar	hold soil and septage during incubation study						\$3,285
	Tools and Supplies	1000 Clear straight side glass jars at \$1.25/jar	hold samples after incubation						\$1,250
	Equipment	Lab balance	weigh soil with septage addition						\$320
	Tools and Supplies	1 carton of plastic bags	storage of samples						\$49
	Tools and Supplies	sharpies - 1 package	labeling jars						\$28
	Tools and Supplies	Weighing dishes, 10 packs at \$19 pack	container used to place samples on scale for weighing						\$190
								Sub Total	\$6,149
Capital Expenditures									
								Sub Total	-
Acquisitions and Stewardship									
								Sub Total	-
Travel In Minnesota									
	Miles/ Meals/ Lodging	1 person mileage to collect soil samples 600 miles @ \$0.67/mile = \$402; 1 person traveling to wastewater treatment plants and field sites 5000 miles @ \$0.67/mile = \$3350 + 20 nights hotel @ \$115/night = \$2300 + 20 days per diem meals at travel day rate of \$59.25/day = \$1185.	Travel to collect wastewater and soil samples						\$7,237
	Conference Registration Miles/ Meals/ Lodging	Travel to MOWA conference, PI and graduate student, registration \$300/person x 2 = \$600, mileage 300 miles roundtrip at \$0.67/mile x 2 = \$402, hotel @ \$180/night x 2 nights x 2 = \$720, per diem travel day rate of \$59.25 per day x 2 = \$237.	Formal presentation of project findings						\$1,959
								Sub Total	\$9,196
Travel Outside Minnesota									
								Sub Total	-
Printing and Publication									

	Publication	Journal fee	Expense for publishing of results in research journal					\$2,653
							Sub Total	\$2,653
Other Expenses								
							Sub Total	-
							Grand Total	\$494,000

Classified Staff or Generally Ineligible Expenses

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

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

Total Project Cost: \$494,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [1a745f24-f9c.pdf](#)

Alternate Text for Visual Component

Project overview with septage samples collected at wastewater treatment plants or before land application from Minnesota's 600,000+ septic systems producing over 212,000,000 gallons per year. Analyzed for organics, nitrogen, phosphorous, metals, PFAS, and emerging contaminants, including an incubation study to determine nitrogen application rates....

Supplemental Attachments

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

Title	File
UMN SPA Approval	f121cd8e-a18.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?

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:

Carl Rosen, University of Minnesota