Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-299

Proposal Title: Critical Destruction of PFAS in Landfill Leachate Waste

Project Manager Information

Name: Jonna Spanier

Organization: Bay West LLC

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Project Basic Information

Project Summary: Onsite demonstration of PFAS destruction in MN leachate via supercritical water oxidation advances MN Water Resources (RFP Priority B.2 & C) through PFAS removal from critical waste management infrastructure.

ENRTF Funds Requested: $1,782,000

Proposed Project Completion: December 31, 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.

PFAS, widespread contaminants harmful to human and ecological health, impact at least 45% of the Nation's tap water (USGS). In MN, up to 2.9 million Minnesotans have detectable concentrations in their water systems. States and federal government are building a regulatory framework to address known PFAS impacts. In Minnesota, past PFAS manufacturing and disposal resulted in significant impacts to groundwater, wastewater treatment plants, and landfills. The Twin Cities generates ~70 million gallons of leachate a year, potentially 95% percent (EPA) is impacted by PFAS. Landfill leachate is difficult to treat due to concentrated levels of contaminants including solvents, metals, pesticides and PFAS, among others. Currently, most leachate is transported to municipal water treatment facilities for treatment. The EPA proposes to designate 9 PFAS as hazardous substances, and some states already adopted legislation to prevent off-site transport/discharge, requiring on-site treatment. These changes impact how landfills manage leachate, creating a need for leachate pretreatment on site.

Current treatment technology concentrates PFAS and/or shifts PFAS media from liquid to solid and may not destroy PFAS compounds' bonds. Current treatment technologies are inadequate to treat dominant types of PFAS found in leachate and do not treat PFAS below regulatory action levels.

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.

SCWO destroys bonds in organic and inorganic wastes and is a proven destruction technology, effectively treating waste streams containing a myriad of contaminants. Through a partnership with General Atomics (GA) Bay West successfully works with GA and their iSCWO technology. The iSCWO system differs from other SCWO units in that it focuses on higher temperatures as the key factor in effective destruction of PFAS, has a reactor design eliminating the formation of "hot spots" (a common issue in SCWO designs) and has more research and development backing its performance than any competitor, with over 30 years of operation and demonstrated destruction of over 200 compounds. Results from application of the iSCWO system demonstrate that it effectively destroys PFAS compounds in leachate and is not inhibited by compounding of contaminants in a waste stream.

Bay West will focus on PFAS destruction in the leachate waste stream itself subsequently destroying PFAS prior to accumulation in biosolids (one of the final waste outputs generated during treatment of leachate).

Bay West is uniquely positioned to apply iSCWO technology at the pre-field optimization stage, followed by full field-scale demonstration of PFAS treatment of landfill leachate waste streams, displaying 99.99% or greater rates of destruction.

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?

iSCWO will demonstrate effective PFAS destruction, particularly in leachate comingled with a variety of contaminants. This destruction capability is a leap forward in how we view the PFAS lifespan, no longer a "forever chemical", with impacts resonating not just locally in Minnesota but nationally and globally.

The project will culminate in a comprehensive assessment of iSCWO, integrating demonstration results with a feasible blueprint for iSCWO deployment in Minnesota, providing a long term PFAS destruction solution. Successful destruction of PFAS actively protects and improves the environment and significantly contributes to the protection of one of Minnesota's most precious natural resources, water.

Activities and Milestones

Activity 1: Phase I: Optimization of iSCWO Process

Activity Budget: $255,000

Activity Description:
Phase I will optimize the iSCWO system specific to MN leachate waste streams and focus on efficient PFAS and comingled contaminant destruction. Preplanning includes test conditions design and coordination, transportation of MN leachate to the treatment facility for GA to complete pre-field optimization of the iSCWO field system. Optimization data collected will serve to modify the demonstration system operational parameters at the production facility prior to shipping and installation. This ensures streamlined operation of the demonstration system on specific leachate compositions it will be treating in Minnesota.
Waste streams include bulk landfill leachate, fractionated foam leachate, and a third placeholder for an additional waste stream. Waste streams will be provided in partnership with Minnesota Pollution Control Agency and SKB Landfill. Analytical confirmation sampling will be completed to determine PFAS destruction efficiencies (specific to a subset of PFAS analytes), NTA destruction efficiencies (PFAS non-targeted analysis – looking at the larger group of total PFAS compounds), leachate specific contaminant destruction efficiencies (VOCs, metals, etc.), along with mass balance calculations of total fluorine to account for critical PFAS destruction and illustrate that media transfer of PFAS is not occurring. A Phase I report will be developed summarizing data and analytical collected during this activity.

Activity Milestones:

Description	Approximate Completion Date
Work Plan and test conditions design and expected results planning. Identify leachate for optimization testing.	July 31, 2025
Ship samples of bulk leachate, foam fractionated leachate, and TBD waste stream to test facility	October 31, 2025
Complete optimization iSCWO testing & analytical confirmation sampling	January 31, 2026
Review and summarize optimization results and modify iSCWO demonstration system for Phase II	June 30, 2026
Phase I Results Report completion	July 31, 2026

Activity 2: Phase II: Full Scale Critical PFAS Destruction Demonstration

Activity Budget: $1,450,000

Activity Description:
Phase II will demonstrate full scale operation of the iSCWO system at a selected Minnesota site. The iSCWO demonstration system being deployed by GA will be modified based on data collected during Phase I, ensuring efficient and effective operation on MN leachate waste streams. The iSCWO system will be installed subsequent to a temporary utility buildout offering adequate weather protection, infrastructure, and input resources for system operation. Upon start up, parallel testing will be completed to repeat one set of optimization tests from Phase I to confirm in field success. Once confirmed, system operation will begin for 6 months to demonstrate successful full-scale operation. Analytical testing will mirror Phase I for parallel testing, and subsequent testing will be completed monthly, focusing on documentation of PFAS destruction efficiencies (specific to a subset of PFAS analytes). In addition, the iSCWO will demonstrate full scale operation on real world treatment flow rates and provide invaluable data supporting treatment capacity including operational inputs (fuel, electricity, etc.), efficacy, and efficiency. Specific test sites being considered include various active landfill and closed landfill sites in the public and private sectors. A Phase II report will be developed summarizing data and analytical collected during this activity.

Activity Milestones:

Description	Approximate Completion Date
Select Minnesota demonstration location and build out required system infrastructure	October 31, 2026
Implement Phase I necessary adjustments to iSCWO demonstration system for MN PFAS impacted leachate waste	March 31, 2027
Ship and Install demonstration iSCWO system	April 30, 2027
Complete iSCWO parallel testing, 6-month operational cycle, analytical and data collection	December 31, 2027
Remove iSCWO unit from site	January 31, 2028
Complete data evaluation and reporting	March 31, 2028

Activity 3: Minnesota iSCWO Deployment Feasibility Evaluation

Activity Budget: $18,000

Activity Description:

Develop a Minnesota iSCWO Deployment Feasibility Evaluation (DFE). Operational iSCWO data, collected in Phase II, will be used in conjunction with Minnesota treatment needs to evaluate the most effective operation and application of iSCWO in Minnesota, likely the development of regional destruction centers. Of particular interest, will be the evaluation of total generated leachate requiring iSCWO treatment, anticipated operational costs, consideration of regional generation rates and concentrations to identify a strategic location or locations to deploy iSCWO system(s) and the anticipated long term quantity of PFAS being removed from the environment. Offsets to these costs include reduction of PFAS mass to wastewater management systems and reduction in PFAS concentrate storage and transportation. The evaluation will include environmental justice (EJ) considerations. With this data, Minnesota will account for a continued issue of significant importance: the disproportionate impacts of pollution across the state.

iSCWO systems have been demonstrated and are already operational across the country. A timetable will be created considering infrastructure buildout, system deployment, and installation. Given the widespread impacts of PFAS across the State, creating a blueprint for iSCWO deployment to destroy PFAS waste steams will be economically efficient and a socially equitable way to address Minnesota PFAS contamination.

Activity Milestones:

Description	Approximate Completion Date
Desktop data collection and evaluation (State landfill data gathering and EJ data)	October 31, 2027
Incorporate and review Phase II data and reporting	March 31, 2028
Create Minnesota iSCWO Deployment Feasibility Study	June 30, 2028

Activity 4: Getting to Zero PFAS - Communication and Outreach

Activity Budget: $59,000

Activity Description:

Completed concurrently with Activities 1-3, communication and outreach will provide learning opportunities for those in academia and the general public. Bay West will participate in the University of Minnesota Capstone Design course. For Activity 1, students will assist in summarizing and reporting Phase I data. For Activity 2, students will have the opportunity to see the iSCWO technology, assist in destruction efficiency analysis, and full-scale operation reporting. For Activity 3, students will gather State landfill leachate data and help develop the iSCWO DFE.

A University of Minnesota intern will support Phase II efforts. This partnership will provide hands on experience in iSCWO operation, data collection, interpretation, and reporting.

Phase I, Phase II, and iSCWO DFE Reports will be shared with LCCMR, partners and the general public. Project outcome reporting will be considered for peer reviewed journal article submissions, distribution to public facing newspaper/journal platforms, summarized, and presented at relevant lectures, symposiums, and/or seminars. The Bay

West marketing team will develop informational materials, including general public non-technical information, to disseminate. Bay West will communicate to the general public via an open house showing the iSCWO system in Minnesota and/or reach out to local news agencies to be featured.

Activity Milestones:

Description	Approximate Completion Date
Activity 1 Capstone Design	April 30, 2026
Activity 2 Capstone Design	April 30, 2027
iSCWO Public Open House/News Feature	June 30, 2027
University of Minnesota Intern	December 31, 2027
Disseminate Project Outcomes of Activity 1 through Activity 3	March 31, 2028
Activity 3 Capstone Design	October 31, 2028
ONGOING: Update LCCMR, MPCA, partners and general public (as applicable) with general findings	December 31, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
John Follin	General Atomics (GA)	Teaming Partner – GA and Bay West have partnered together since 2023 demonstrating iSCWO destruction capabilities.	Yes
Rebecca Higgins & Andri Dahlmeier	Minnesota Pollution Control Agency	Teaming Partner – The MPCA is partnering with Bay West to provide PFAS impacted waste streams for destruction optimization and is working to identify a potential iSCWO deployment site in Minnesota.	No
Geoff Strack	SKB	Teaming Partner – SKB is partnering with Bay West to provide PFAS impacted waste streams for destruction optimization and is working to identify a potential iSCWO deployment site in Minnesota.	No
Merry Rendahl	University of Minnesota - Capstone	Learning Partner – Capstone student lead project work supporting Activities 1 through 3 project outcomes.	No
Peter Kang	University of Minnesota	Learning Partner – Data sharing and 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?

Phase I and Phase II results will be utilized in the development of the iSCWO DFE. The iSCWO DFE will provide the blueprint for iSCWO deployment in Minnesota. This report will be distributed as described in Activity 4. This project will be instrumental in furthering the use of the iSCWO system, will provide a case study of successful PFAS remediation in leachate waste, paving the way for continued destruction of PFAS at sites both nationally and worldwide. Bay West will implement the iSCWO DFE report findings by installing a permanent iSCWO system in Minnesota through state-sponsored grants and public-private partnerships.

Project Manager and Organization Qualifications

Project Manager Name: Jonna Spanier

Job Title: Project Manager

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

Ms. Spanier received her graduate degree in Civil Engineering, specializing in Environmental Engineering from the University of Minnesota. She has over 13 years of experience as an environmental engineer and 9 years of experience as a Project Manager. She has worked at Minnesota based firms throughout her career, having been born and raised in St. Paul, MN. She is passionate about remediation, focusing on water resources. Relevant project experience including water and wastewater management and compliance, groundwater remediation design and implementation, groundwater treatment system operation and management, system optimization, landfill design and permitting, and general compliance and water quality projects. Ms. Spanier has acted as both the technical lead and project manager on a variety of these projects over the years. Project contaminants of concern include PFAS, VOCS, metals, pesticides, and nitrates. Site work has been both local, here in Minnesota and national for federal, state, and private commercial clients.

Organization: Bay West LLC

Organization Description:

Headquartered in St. Paul, Bay West has 50 years of experience as a nationally recognized environmental consulting and remediation company. With over 100 personnel in the Twin Cities and surrounding areas, we are proud to help the State, city, and its community members solve some of their greatest environmental challenges.

Bay West has been working on PFAS-impacted media for the past decade as the awareness of PFAS contamination has grown locally and nationwide. Our engineering work with General Atomics to evaluate and establish destruction efficiencies and costs to destroy PFAS wastes leads the way to rapid deployment of PFAS management solutions. With our experience in various site environmental work and remediation system design and operation, we have readily incorporated how best to address and remediate PFAS within our scope of overall expertise and services. Our ability to navigate an ever-changing regulatory climate, coupled with the recent work in PFAS destruction technology research, makes us uniquely suited to spearhead PFAS remediation work in Minnesota.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project Manger		Project management and coordination. Manage project and support project work, budget tracking and outcomes. Communication with partners.			70%	2.37		$224,400
Senior Engineer and Engineer Support		Provide engineering design, permitting, guidance and mentoring, data evaluation and review. System operation and sampling, data evaluation, and reporting.			70%	0.84		$97,000
Staff Professional Technical Support		Marketing and outreach resources. Communication with academia, partners, and local community. Disposal and coordination of any generated system waste. Site safety plan creation and implementation. Quality control. Supporting figure and map creation for reporting/cutsheets. Data management.			70%	1.74		$233,600
Intern		Assist in field operation, sampling, and data evaluation and reporting.			70%	0.57		$28,200
							Sub Total	**$583,200**
Contracts and Services								
Shipping Contractor	Sub award	Ship leachate waste to test facility (MN to San Diego, CA)				0		$10,000
Totes & Roll Off	Sub award	Totes to collect and ship leachate waste. Roll offs will be used to store generated wastewater during 6 month operation.				0		$15,000
Analytical	Professional or Technical Service Contract	Laboratory testing for liquid media including PFAS, PFAS non-targeted analysis, leachate characterization, and fluorine analysis. Air sampling for PFAS, VOCs, and fluorine. Generated condensate and wastewater will be tested for disposal characterization.				0		$130,700
Disposal	Sub award	Generated wastewater for disposal at local wastewater treatment facility (MN)				0		$35,000
Air Pump	Sub award	Air pump for air sampling				0		$600
Filters	Sub award	Filters to filter leachate waste				0		$2,000

Operation Costs for 6 Months	Sub award	Electric, propane (plus tank rental), diesel (plus tank rental), water, wastewater, internet		X		0		$110,500
Temporary Infrastructure	Sub award	Temporary infrastructure support to operate iSCWO (Concrete pad, enclosure and secondary containment, utility connections, security).		X		0		$250,000
General Atomic	Professional or Technical Service Contract	Costs to optimize iSCWO field system in San Diego		X		0		$86,000
General Atomics	Professional or Technical Service Contract	Ship, install and use iSCWO demo system for 6 months at Minnesota location				0		$512,000
							Sub Total	**$1,151,800**
Equipment, Tools, and Supplies								
	Equipment	Vehicle	Transpiration to landfills, partner meetings, and for system operation					$9,600
	Equipment	Vacuum Truck	Haul generated condensate for disposal					$5,500
	Equipment	Pump	Pump for leachate					$15,400
	Tools and Supplies	4-Gas/PID	Air monitoring					$9,100
	Tools and Supplies	PPE and disposable equipment	Protective equipment and sampling gear					$500
							Sub Total	**$40,100**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								

	Miles/ Meals/ Lodging	System Operation at Site - Amount includes mileage for round trip from Bay West offices in the Twin Cities to TBD site and laboratories. Day trips only.	During 6 months of operation system oversight will occur at regular frequency including system operation, sampling and trouble shooting. Site is anticipated to be in the twin cities area (within 40 miles round trip)					$4,500
							Sub Total	**$4,500**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Publication of one open access peer-reviewed journal article	Publication of an open access peer-reviewed journal article will allow results to be made available and accessible to citizens, stakeholders, and a broad community interested in PFAS destruction technologies					$2,400
							Sub Total	**$2,400**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,782,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Contracts and Services - Operation Costs for 6 Months	Sub award	Electric, propane (plus tank rental), diesel (plus tank rental), water, wastewater, internet	Integral support components to operate iSCWO system.
Contracts and Services - Temporary Infrastructure	Sub award	Temporary infrastructure support to operate iSCWO (Concrete pad, enclosure and secondary containment, utility connections, security).	Temporary infrastructure is necessary to support iSCWO system operation at selected facility. Facility selection will seek to identify a location not requiring significant temporary infrastructure additions.
Contracts and Services - General Atomic	Professional or Technical Service Contract	Costs to optimize iSCWO field system in San Diego	The GA field system is in San Diego, pre-testing to optimize mobile system prior to deployment is required to ensure system functionality and efficiency once deployed.

Non ENRTF Funds

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

Total Project Cost: $1,782,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: f456dfab-7b8.pdf

Alternate Text for Visual Component

NA...

Financial Capacity

Title	File
Financial Capacity Note	d00a515d-a11.pdf

Supplemental Attachments

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

Title	File
Letter of Support - MPCA	4f4090c7-8b6.pdf
Letter of Support - Capstone	be7cb692-e18.pdf
Letter of Support - GA	f64aee5b-892.pdf
Letter of Support - SKB	099788dd-47c.pdf
Letter of Support - U of M	24e235c7-799.pdf
Letter of Commitment	bb27f85e-b0b.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:

Kaitlin Larson