



Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-046

Proposal Title: Scaling A Market-Driven Water-Quality Solution for Row-Crop Farming

Project Manager Information

Name: Nicholas Jordan

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: Adding a year of grain/winter camelina production to Minnesota crop rotations provides a highly scalable market-driven clean-water solution; our pilot supply chains will accelerate wide adoption of this solution.

Funds Requested: \$835,000

Proposed Project Completion: June 30 2025

LCCMR Funding Category: Water Resources (B)

Project Location

What is the best scale for describing where your work will take place?

Region(s): SE, Central,

What is the best scale to describe the area impacted by your work?

Region(s): SW, SE, NW, Central,

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.

A new option is emerging for improving water conservation in Minnesota row-crop agriculture: production of cool-season and winter grains (such as hybrid winter rye, oat, or pea), followed by the winter-hardy crop camelina. These pairs of crops (a grain, and camelina) can be grown between corn and soybean years of the common corn/soybean crop rotation, enabling farmers to grow three crops in two years while significantly enhancing stewardship of soil, water, and wildlife. The grain-camelina system safeguards water by providing continuous living cover of soil for most of the year, thereby substantially reducing soil erosion, runoff of rainfall, and losses of nutrients. In addition to safeguarding water, grain-camelina systems produce abundant yields of high-value commodities, for which large markets are beginning to emerge. Therefore, enabling Minnesota farmers to add a grain-camelina rotation year to row-crop crop production systems will create a highly scalable market-driven pathway to clean water. The grain-camelina system also provides habitat for pollinators and wildlife, and produces additional value for farmers by improving soil health and management of crop pests (including herbicide-resistant weeds). There is high potential to realize many environmental benefits from Minnesota agriculture by wide adoption of the grain-camelina system.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

To realize the potential of grain-camelina production as a market-driven water-conservation strategy for row-crop farms, we must eliminate remaining barriers to wide deployment across Minnesota. The crucial next step is extensive watershed-scale pilot-testing of grain-camelina systems in three Minnesota watersheds with highly-valued water resources, including source water protection areas and trout streams. This work will build on promising results from a current LCCMR project that is testing camelina in much smaller plots, and on other successful proof-of-concept efforts. This extensive pilot-scale implementation is critically needed to activate market forces that can drive wide adoption of grain-camelina systems. Specifically, our piloting work will engage many farmers in building experience in growing the grain-camelina system across Minnesota. Our piloting work will also produce large quantities of camelina seed that are critically needed to develop storage, processing, and manufacturing methods that are key to creating strong markets for camelina. In addition, emerging markets for environmental benefits produced on farms can pay farmers for benefits produced by the grain/camelina system. Pilot implementation will help advance these payment systems. Together, environmental-benefit payments and end-use markets will support wide adoption of the grain/camelina system, providing major conservation benefits of value to all Minnesotans.

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 key outcome is scaling up a market-driven water-quality solution for row-crop farming by piloting supply chains for the grain-camelina production system, through pilot implementation in three watersheds. Supply chains link farmers to markets for new crops, such as camelina, that can deliver major environmental benefits from row-crop farms. To achieve these benefits for the public, farmers must have markets, and markets cannot develop without supply chains. Specifically, our project will engage many farmers in piloting grain/camelina production, and produce large quantities of camelina grain that are critically needed to pilot storage, transport, and processing links in supply chains.

Activities and Milestones

Activity 1: Pilot Extended Rotation on Watershed Scale: Planning and Implementation.

Activity Budget: \$596,063

Activity Description:

Support core groups of farmers in three significant watersheds to test an extended crop rotation that adds a grain/camelina year to corn/soybean crop rotations. Working in a source-water protection area for the City of St. Peter (Rogers Creek), a trout stream in Rice County (Rice Creek), and in source-water protection areas in Stearns County, we will engage farmers to explore options for adding this rotation to their farming operation, planning and implementing pilot testing of the rotation on their farms, evaluating results of pilot grain/camelina plantings, and planning and implementing additional pilot plantings as warranted. In all watersheds, farmers are strongly interested in working together for clean water, as a result of previous efforts, creating ideal settings for our ambitious project. The project watershed coordinators will organize these activities; technical assistance will be provided by UMN personnel. Coordinator staff will hold group meetings and individual meetings with each farmer, to explore and discuss options for implementing the rotation. Interested farmers will collaborate to plan and execute strategically-placed implementation of the rotation in each watershed, to efficiently protect water while also enhancing crop production. We aim to plant and harvest 750 acres of grain/camelina during the project.

Activity Milestones:

Description	Completion Date
Develop on-farm implementation plans for grain/camelina in up to 30 farm operations in watersheds	February 28 2023
Implement production plans for up to 30 farm operations, supported by cost- and risk-share payments	June 30 2024

Activity 2: Supply-chain Co-Design with Supply-chain and End-use Partners

Activity Budget: \$58,190

Activity Description:

Building on current work, form and facilitate a network of end-use and intermediary firms, water-management agencies, watershed groups, the Forever Green Partnership, and others. Our private-sector partners will participate in this network. Participants will identify opportunities for production of the grain/camelina system in crop rotations in the project region, considering production opportunities, potential markets, and potential environmental and social benefits. Similarly, opportunities and requirements for establishing supply chains for these crops will be systematically explored, using structured supply-chain assessment tools developed by the Forever Green Partnership. Participants will share information and perspectives and explore market-driven scenarios for extensive production of these crops in the project region (Southeast, South Central, and Central Minnesota). These discussions will enable interested private-sector partners to advance feasibility assessments and planning for supply-chain infrastructure for these crops. Similarly, public and private clients for environmental benefits and public agencies can advance planning of programs to target public resources to support these crops. Finally, the network will collaborate produce a plan for scaling up production of these crops in the project region, projecting crop production and environmental benefits and explore terms (e.g., crop prices, and payments for environmental benefits) needed to implement production at scale.

Activity Milestones:

Description	Completion Date
Feasibility assessments for private- and public-sector development and support for grain/camelina and supply chains	January 31 2024
Identify terms needed to implement grain/camelina production at scale in regional row-crop farms	June 30 2025

Activity 3: Develop Crop Protocols for Ecosystem Service Market Development

Activity Budget: \$30,000

Activity Description:

The project will collaborate with the Ecosystem Service Market Consortium (ESMC) to its current pilot project in the Sauk River Watershed. The ESMC (represented by Minnesota by project partner The Nature Conservancy in Minnesota) is a major national project prototyping scalable methods for paying farmers for producing environmental benefits (i.e., ecosystem services). The ESMC protocols for establishing marketable water-quality and flow credits for farmers will be adapted for cool-season grains and camelina in the cropping system, and then administered on a pilot scale on acreage in the grain/camelina system in the Sauk River watershed. If the ESMC protocols are accurate, the ESMC marketplace will provide a scalable pathway for farmers to capitalize on the increase in ecosystem services provided by their cropping systems.

Activity Milestones:

Description	Completion Date
Adapt ESMC protocols for establishing marketable water-quality and flow credits for the grain-camelina system	December 31 2023
Complete verification test of ESMC protocols for grain/camelina system in row-crop rotations	January 31 2025

Activity 4: Support End-Use Entrepreneurs

Activity Budget: \$150,747

Activity Description:

Work on this activity will support the development of sustainable supply chains for winter camelina through technical assistance, commercialization, and stakeholder engagement. Milestones include a focus on expanding uses and markets for camelina, including the advancement of ecosystems services models that will improve the economic viability of camelina production and provide an additional return to growers. Technical work will focus on assessment of camelina for use in bioproducts and support for businesses in development of camelina-based food, feed, and biobased products. Results from this work will guide the development of pilot scale projects with private businesses to commercialize winter camelina-based products. AURI's outreach component will include working with project partners to organize an annual field day and inclusion of camelina at annual AURI "Fields of Innovation" events to further awareness, knowledge-sharing, and action planning and build stronger commercialization and supply chain networks for camelina. Outreach efforts will leverage previous efforts in the project region, which is one of three implementation clusters of the Forever Green initiative, creating an increasing level of awareness in regional private, public, and non-profit groups about opportunities to protect water and increase agricultural opportunities by implementing continuous living cover agriculture at scale.

Activity Milestones:

Description	Completion Date
Identify and assess potential uses of camelina in bioproducts including composites and plastics	December 31 2024
Build network connections to advance markets and support continued development of supply chains for camelina	March 31 2025
Provide technical assistance to Minnesota businesses in the development of camelina-based products	June 30 2025
Collaborate in development of ecosystem services models that enhance market-viability for Minnesota camelina producers	June 30 2025
Disseminate information developed during project through forums, publications, and other targeted outreach activities	June 30 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Brad Gordon, Program Manager – Southern MN	Great River Greening	Watershed planning and coordination in Rogers Creek, via individual and group meetings with interested farmers, and support for watershed planning in Rogers Creek and Rice Creek, by modeling agricultural practice impacts in the target watersheds with PTMApp and ACPF.	Yes
Kristi Pursell, Executive Director	Cannon River Watershed Partnership	Watershed planning and coordination in Rice Creek, via individual and group meetings with interested farmers, and water-quality and flow monitoring in Rice Creek.	Yes
Tom Raymond, Director of Environmental Sustainability	Hormel Foods Corporation	Participate in supply/value chain co-design for grain/camelina systems.	No
Erin Heitkamp, Senior Vice President – Agriculture and Public Affairs	Pipeline Foods, LLC	Participate in supply/value chain co-design for grain/camelina systems.	No
Jack Brodshaug, Sustainability Field Manager	Nutrien Ag Solutions	Participate in supply/value chain co-design for grain/camelina systems.	No
Tai Ullmann, Sustainability Manager, Global Edible Oilseeds	Cargill, Inc.	Participate in supply/value chain co-design for grain/camelina systems.	No
Leif Fixen, Agriculture Strategy Manager	The Nature Conservancy	Watershed planning and coordination in Sauk River Ecosystem Service Market Consortium Minnesota pilot project, via individual and group meetings with interested farmers; other integrate grain/camelina into the Sauk River Ecosystem Service Market Consortium pilot project.	Yes
Michael Stutelberg, Scientist, Chemistry	Agricultural Research and Utilization Institute	Support end-use entrepreneurs developing products from grain/camelina system, through a range of activities as detailed in Activity 4	Yes
Stefani Millie Grant, Senior Manager, External Affairs & Sustainability	Unilever North America	Participate in supply/value chain co-design for grain/camelina systems.	No
M. Scott Wells, Associate Professor, Agronomy & Plant Genetics, University of Minnesota	University of Minnesota	Technical advice and support for pilot experiments with the grain-camelina system	Yes
Jack Grushcow,	Smart Earth Camelina Corp.	Participate in supply/value chain co-design for grain/camelina systems.	No

President and CEO			
Dennis J. Fuchs, Administrator	Stearns County Soil and Water Conservation District	Watershed planning and coordination in Sauk River Ecosystem Service Market Consortium Minnesota pilot project, via individual and group meetings with interested farmers.	Yes
JoAnne Berkenkamp, Managing Director	MBOLD	Participate in supply/value chain co-design for grain/camelina systems, provide cost-share contribution to support pilot production of grain/camelina systems	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 be funded?

If we are successful, our key outcome—a grain-camelina option for Minnesota row-crop farms—will be rapidly adopted in row-crop farming across Minnesota. There is very strong market interest in sustainably-sourced grains, oils, and protein produced from the grain-camelina system, as reflected by our many private-sector partners. By building prototype supply/value chains, project partners—from farmers to corporations such as Cargill, Unilever, and Hormel—will “work out the kinks” in their systems, setting the stage for wide adoption of this market-driven water-quality solution, resulting in major benefits for water, soil, and wildlife, and for all Minnesotans.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Farmer-Led Expansion of Alfalfa Production to Increase Water Protection	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 04i	\$500,000

Project Manager and Organization Qualifications

Project Manager Name: Nicholas Jordan

Job Title: Professor of Agronomy and Plant Genetics

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

The Project Manager is Dr. Nick Jordan. He is an agricultural scientist and is co-director of the Forever Green Initiative, a project based at the University of Minnesota. The Forever Green Project is developing a set of new crops that grow during times when summer crops do not grow, while also producing valuable agricultural commodities and marketable environmental benefits. Forever Green's goal is to provide crops that enable market-based solutions to conservation of soil, water and wildlife through agriculture. Dr. Jordan, as Forever Green co-director, has led development of Forever Green's strategy to implement this market-based strategy. This strategy is based on developing pilot supply/value chains that coordinate growth of both supply (crop production) and market demand for these crops, thus surmounting the "chicken or egg" problem that can block adoption of these crops by both farmers and end-use markets (the problem is: which comes first, supply or demand?). More broadly, he has many years of project management experience, including complex, large-budget projects. He will provide project direction, management, and fiscal oversight. The University of Minnesota is the project organization; it is capable of fulfilling all project activities through its research and outreach capacities.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The University of Minnesota's College of Food, Agricultural and Natural Resources Sciences (CFANS) works to provide comprehensive sustainability solutions by novel solutions to today's pressing challenges related to food, water, wildlife, and communities. We use science, education, and engage with communities, companies, and organizations to find answers to the world's grand challenges and solve tomorrow's problems. Every single day, our students, faculty and staff use science, education, and partnership to create a world that will feed our growing population while sustaining the natural resources upon which we depend. Few public universities come close to the breadth of our expertise, allowing us to tackle challenges in novel ways. Most importantly, we work with young people to develop leaders that see more possibilities and produce solutions that work for real people.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Technical assistance support for farmers		Develop, coordinate, and deliver custom learning opportunities for individual farmers, groups, and others engaged in integrated grain/camelina in pilot-project region.			32%	0.75		\$75,000
Supply-chain Organizer		Organize and facilitate planning and implementation of supply-chain development for grain-camelina production system			32%	0.42		\$50,000
							Sub Total	\$125,000
Contracts and Services								
Great River Greening	Sub award	Support farmers in Roger's Creek watershed (Nicollet Co.) to design and test an extended crop rotation using the grain/camelina system in watershed farms, engaging at least 10 watershed farms; outreach, connect growers/buyers.				0.9		\$124,200
Cannon River Watershed Partnership	Sub award	Support farmers in Rice Creek watershed (Rice Co.) to design and test an extended crop rotation using the grain/camelina system in watershed farms, engaging at least 10 watershed farms.				0.75		\$109,200
Agricultural Resources Utilization Institute	Sub award	Establish opportunities and investigate new camelina markets with private businesses; pilot-scale R&D projects for food and non-food uses (e.g. protein isolate, resins, margarine, etc); organize annual educational field days; organize AURI Connects: Fields of Innovation events for dissemination of market and supply-chain opportunities for grain/camelina system.				1.05		\$118,470
AURI-designated Contractor, TBD	Professional or Technical Service Contract	Contracted technical and analytical services supporting AURI R&D activities.				0.15		\$15,000
Rice County SWCD	Professional or Technical	Collaborate with Cannon River Watershed Partnership in outreach, engagement, and planning				0.24		\$15,000

	Service Contract	activities related to extended rotation with grain/camelina system in farms in the watershed.						
The Nature Conservancy	Sub award	Support farmers in Sauk River watershed (Stearns Co.) to test an extended crop rotation using the grain/camelina system, engaging at least 10 watershed farms; work with the Ecosystem Service Market Consortium (ESMC) to adjust ESMC protocols and algorithms for grain/camelina, integrate available validation data and evaluate results.				0.9		\$124,200
Stearns County SWCD	Professional or Technical Service Contract	Collaborate with The Nature Conservancy in outreach, engagement, and planning activities related to extended rotation with grain/camelina system in farms in the Sauk River watershed.				0.6		\$30,000
							Sub Total	\$536,070
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies required for Activity 4	Activity 4: Product R&D: Reagent and consumable supplies/chemicals for all years (\$6,000). Activity 4: Field Day budget for all years (e.g. food, flyers, etc) (\$3,000).	X				\$9,000
	Tools and Supplies	Expenses for meetings associated with Activities 1 and 4	Costs of printed materials (\$1000) and refreshments (\$377) at meetings for participating farmers	X				\$1,377
							Sub Total	\$10,377
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel for related to work in project watersheds.	Travel to project watersheds in Nicollet, Rice, and Stearns Counties, involving					\$2,173

			individual and group meetings with participants in and near those watersheds. Projected travel: 1293.3 miles per year, x 3 years, at 0.56/mile					
	Miles/ Meals/ Lodging	Technical assistance to participating farmers.	Technical support (10 Minneapolis-St. Peter round trips/yr, all years x \$95 trip for mileage, per diem). (10 Minneapolis-Dundas round trips/yr, all years x \$69 trip for mileage, per diem). (10 Minneapolis-Freeport round trips/yr, all years x \$109 trip for mileage, per diem). 2850 + 2070 + 3270 \$8190 total					\$8,190
	Miles/ Meals/ Lodging	Travel related to supply-chain organization	Supply-chain organizing (10 Minneapolis-St. Peter round trips/yr, all years x \$95 trip for mileage, per diem). (10 Minneapolis-Dundas round trips/yr, all years x \$69 trip for mileage, per diem). (10 Minneapolis-Freeport round trips/yr, all years x \$109 trip for mileage, per diem). 2850 + 2070 + 3270 \$8190 total					\$8,190
	Miles/ Meals/ Lodging	Travel associated with Activity Four	Travel by technical team, business development team, and outreach team. Pilot scale project sites are unknown currently. Annual field day in Waseca (Mileage: 3 trips to Waseca from various locations @ \$0.56/mile. Travel by Business Development Team to private businesses and investors, various MN locations (\$0.56 per mile; M&IE@ \$71 per day in Minneapolis/St. Paul, outside metro area M&IE@ \$50/day); Travel by the Outreach and AURI Connects team to Field Days (@ \$0.56/mile; M&EI @ \$50 per day), \$2,500/year, \$7,500 all years.					\$7,500
							Sub Total	\$26,053

Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		Risk-share payments to growers for grain/camelina production	Cost- and risk-share payments to growers of grain/camelina (\$250/acre, projected scope 750 acres total, distributed approximately equally across all three target watersheds), in partial compensation for costs of camelina production, a reasonable mark-up for grain produced, and risk of lost income in participating in pilot project. Camelina seed produced will become property of University of Minnesota and used for a range of supply-chain development research purposes. NB \$50,000 cost share will be provided by project partner MBOLD.					\$137,500
							Sub Total	\$137,500
							Grand Total	\$835,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Equipment, Tools, and Supplies		Supplies required for Activity 4	Budget is requested to provide refreshments at educational events associated with Activity 4.
Equipment, Tools, and Supplies		Expenses for meetings associated with Activities 1 and 4	We request funding (\$377) for refreshments at meetings for participating farmers

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
Cash	Project partner MBOLD	Cost-share by project partner MBOLD of cost- and risk-share payments to growers of grain/camelina (\$250/acre, projected scope 750 acres total, distributed approximately equally across all three target watersheds), in partial compensation for costs of camelina production, a reasonable mark-up for grain produced, and risk of lost income in participating in pilot project. Camelina seed produced will become property of University of Minnesota and used for a range of supply-chain development research purposes.	Secured	\$50,000
			Non State Sub Total	\$50,000
			Funds Total	\$50,000

Attachments

Required Attachments

Visual Component

File: [3baf7254-111.pdf](#)

Alternate Text for Visual Component

Photograph of winter camelina crop and map illustrating the project region for watershed-scale pilot implementation of the grain/camelina system for safeguarding water in Minnesota row-crop farming, indicating that the project area contains many highly-valued water resources such as high-value trout fisheries, and vulnerable groundwater and drinking water source protection areas....

Optional Attachments

Support Letter or Other

Title	File
Letter of support from Cannon River Agricultural Collaborative	bd4fd2d5-009.pdf
Letter of support from Headwaters Agriculture Sustainability Partnership	8f59d17c-0b0.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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?

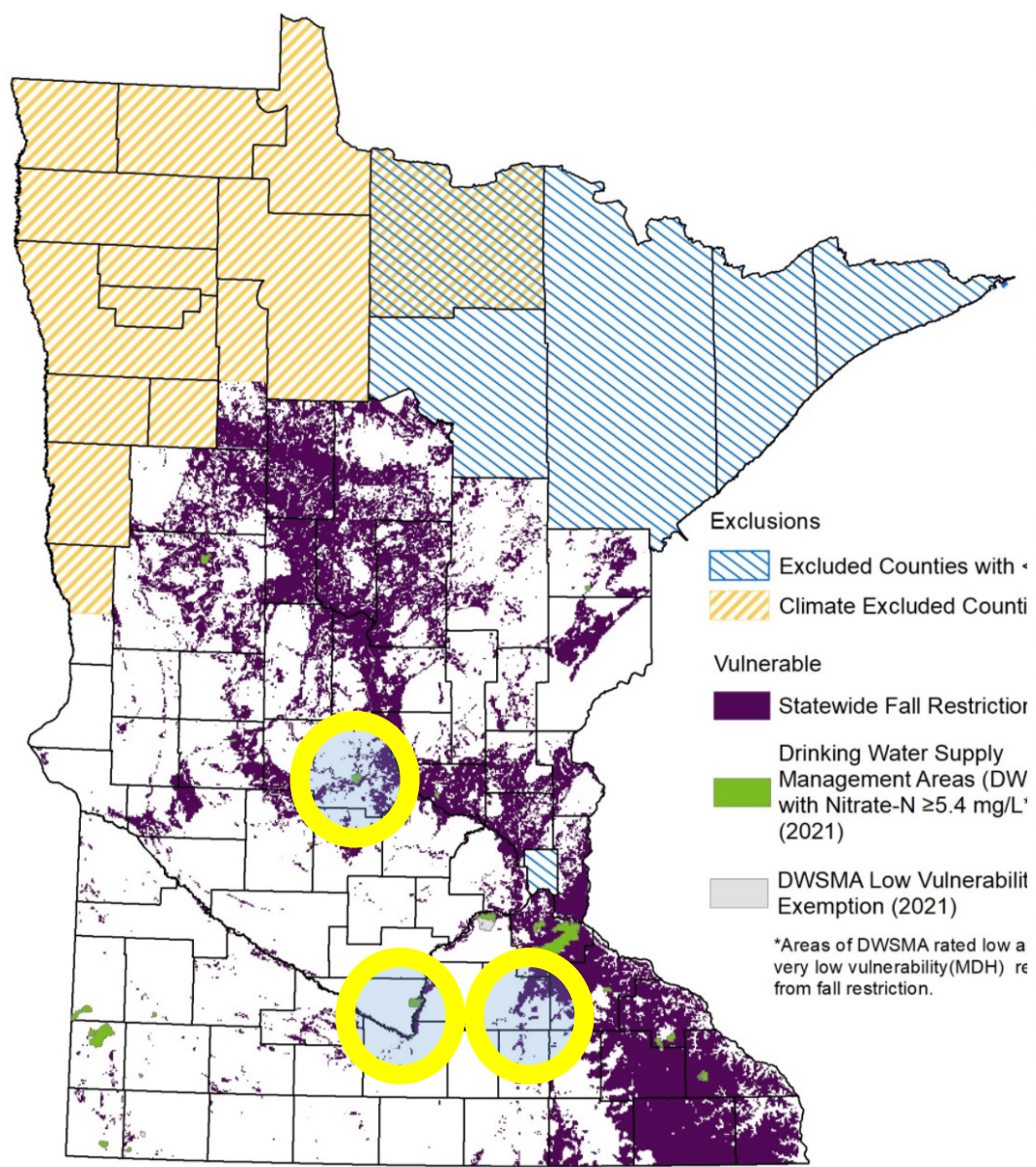
Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Project Pilot Regions & Winter Camelina Crop

Grain/Camelina pilot production area (yellow circles) are situated to protect water in areas with high-value trout fisheries and vulnerable groundwater and drinking water source protection areas. Purple areas are vulnerable groundwater areas as mapped by Minnesota Department of Agriculture.



Winter camelina in flower, and double cropped into silage corn.