Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 055-B**

Working Farmlands: Targeting Alfalfa Production for Water Protection

Category: B. Water Resources

Total Project Budget: $ 752,913

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

We will develop a farmer-led, market-based working lands approach for protecting water by targeted expansion of alfalfa production, and enable farmers to take this approach by expanding markets for alfalfa.

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Location

Region: Southwest, Southeast

County Name: Nicollet

City / Township:

Alternate Text for Visual:

The visual describes the project watershed and the focal area (an "alfalfa-shed") where additional alfalfa production will be targeted to efficiently protect water and improve farm revenue. It also shows the alfalfa plant in full growth, and summarizes market-expanding activities that will create demand for expanded alfalfa production across Minnesota.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

I. PROJECT STATEMENT

We are developing a novel prevention-based strategy for protecting water resources, based on a farmer-led, market-based working lands approach to enhancing protection of water in agricultural regions. Our project is based on targeted integration of the perennial crop alfalfa into corn/soybean-based farming operations. If carefully targeted, adding alfalfa to these operations will provide multiple benefits: protecting water resources by reducing soil erosion and loss of nutrients from farms, reducing need for pesticides, improving soil health, supporting wildlife (such as pollinators), and enhancing production and profit for farmers and the agricultural industry. Our project results will help enable application of this prevention-based strategy across most agricultural regions of Minnesota. Therefore, our project will advance a highly feasible, widely applicable, and sustainable solution to major water resource conservation challenges that have resisted solution for decades. Our specific objectives are 1) to test a farmer-led, market-based working lands approach for using alfalfa to reduce agricultural effects on water, and 2) to do focused research & development work to open new markets for alfalfa. Under 1), we will develop a replicable working lands implementation approach, doing pilot work in the Seven Mile Creek watershed near St. Peter, MN, where there is substantial and growing demand for alfalfa. Our project will innovate by developing new methods for farmer-led protection of water resources, and by helping to develop extensive new markets for alfalfa. Under 2), we will advance emerging technologies for utilizing alfalfa that are opening up new large markets for the crop; these markets include sustainably-produced aquaculture feed for farming high-value fish and shellfish in Minnesota, and other high-value bio-products from alfalfa. Our project uses new scientific capabilities to target alfalfa in places where it will provide large improvements in water resources, and to produce high-value bio-products from alfalfa. Our project is supported by a wide range of preparatory efforts, an experienced project team, and leverages multiple collaborative partnerships, each of which will contribute additional efforts, resources, and substantial cost-share funds to the project.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Budget: $186,460

Support a core group of watershed farmers (initially organized by Nicollet County Soil and Water Conservation District), to design a farmer-led working lands plan by which these farmers take charge of preventive protection of water resources. The plan will be based on targeted expansion of alfalfa production in the Seven Mile Creek watershed within the 3-mile radius area surrounding Northern Plains dairy. The UMN Collaborative Geodesign process will be used to identify specific on-farm locations for alfalfa cultivation that are economically advantageous for farmers while efficiently protecting water. This watershed-scale plan provides an overall scheme for water protection but is not sufficiently detailed to guide farm-scale implementation. Therefore, an expert consultant will assist individual farming operations in identifying on-farm locations for producing alfalfa to enhance crop production, profit, and water protection. These two scales of planning (watershed-scale and farm-scale) are both essential to our farmer-led working lands implementation approach to efficiently enhance crop production, profit, and water protection through targeted expansion of alfalfa production.

Outcome	Completion Date
1. Develop and implement watershed-scale protection plan.	*June 30, 2021*
2. Develop on-farm implementation plans for 15 farm operations.	*March 31, 2020*

Activity 2: Implementation Support for Alfalfa Integration in Corn/Soybean Production Systems. Budget: $261,893

Compile and and communicate available information to support targeted integration of alfalfa into the prevalent corn/soybean production systems in this region, so that farmers can profitably produce abundant yields of quality alfalfa while maximizing water-quality and other resource protection benefits of alfalfa production. Monitor water quality impacts (including nutrients, soil sediments, and pesticide residues, among other parameters) by a flexible, adaptive strategy, and determine economics of alfalfa production when integrated into corn/soybean production systems for production and resource protection.

Outcome	Completion Date
1. Advice and support for profitable production of alfalfa in corn-soybean systems while also efficiently producing environmental benefits.	*June 30, 2020*
2. Water quality monitoring report on effects of integrating alfalfa in corn-soybean production systems.	*June 30, 2021*
3. Economic report on alfalfa on integrating alfalfa in corn-soybean production systems.	*June 30, 2021*
4. Evaluate replicable implementation process model and identify needs for scaling-up.	*June 30, 2021*

Activity 3: Develop value-added processes and products for profitable alfalfa marketing. We will develop Innovations in post-harvest processing that will reduce risk and costs for alfalfa farmers, motivating increased alfalfa production, and leading to improved water resources. Technical tasks within this activity will focus on implementing advanced chopping and sealing mechanisms to reduce spoilage and nutrient leaching of alfalfa due to rain. We will also refine methods for extracting cellulosic sugars from alfalfa residue for further conversion into high-value bio-products such as nutraceuticals and biofuels. The leaf protein extract will be evaluated for inclusion in aquaculture feed. Our underlying goal is to establish a diverse portfolio of high-value products from the entire alfalfa plant. Also, we will develop supply chain connections and identify new market opportunities through exploration, development and management of pilot scale projects with private businesses to commercialize new products and technologies. The outreach component will include organizing 1-2 Innovation Network Program Forums to further awareness, knowledge-sharing and action planning related to innovative opportunities for products, markets and technologies from traditional and emerging alfalfa varieties.

Budget: $340,500

Outcome	Completion Date
1. Implement "rescue" strategies to protect alfalfa from moisture-related decay.	*June 2019*
2. Optimize process to extract cellulose sugars from alfalfa for conversion into high-value bio-products such as biochemicals and nutraceuticals. 3. Identify at least one market opportunity in nutraceutical and cellulosic sugars sectors by validating supply chain connections.	*June 2020*
4. Upgrade alfalfa leaf extract for aquaculture feeds and identify and capture value-added opportunities in aquaculture sector.	*June 2021*

III. PROJECT STRATEGY

A. Project Team/Partners: *University of Minnesota*: Project management, geodesign, implementation support; monitoring, evaluation, cost sharing. *Great River Greening/Nicollet Co SWCD*: implementation support, geodesign, cost sharing. *AURI*: value-added alfalfa processing research and outreach. *Gustavus Adolphus College*: water quality monitoring, cost sharing.

B. Project Impact and Long-Term Strategy: Project results will develop a replicable farmer-led working lands approach for expanding alfalfa production to improve wellhead protection and meet other water management needs, and accomplish critical research and outreach activities to expand markets for alfalfa beyond those available from dairies. Both results are essential to achieving benefits from expanded alfalfa production for water, farm and rural economies, and all Minnesotans. Ultimately, we aim to develop farmer-led, market-based working lands approaches for meeting critical water resource needs. Our project will strongly complement other efforts to develop working lands approaches in Minnesota.

C. Timeline Requirements: This research and demonstration project is designed to meet its goals in three years. We anticipate that our project will produce a workable farmer-led working lands implementation approach, and expand interest in new market opportunities for alfalfa, e.g., for Minnesota's emerging high-value aquaculture industry. If we are successful, then subsequent efforts—beyond the three-year period of this project—will focus on building capacity for widespread application of farmer-led, market-based approaches for meeting water resources needs, and further expansion of emerging alfalfa marketing opportunities.

2018 Detailed Project Budget

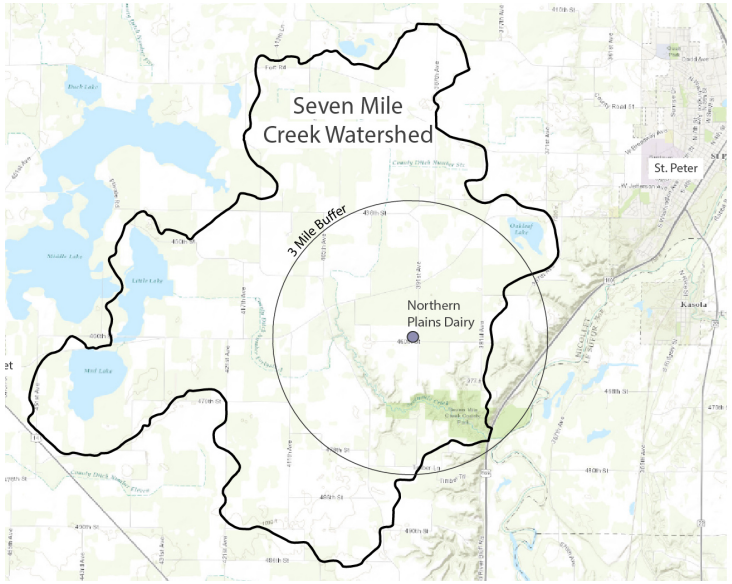
Project Title: *Working Farmlands: Targeting Alfalfa Production for Water Protection*

IV. TOTAL ENRTF REQUEST BUDGET Three years

BUDGET ITEM	AMOUNT
Personnel	
Activity 1 team will support farmer-lead design process for alfalfa-based working lands plan for watershed protection; Watershed coordinator, 600 hours/year (30% FTE); $60 hour, all years; Geodesign programmer, 250 hours (12.5%FTE), $80/hour; year one only.	$ 128,000
Activity 2 team will provide technical assistance on profitable alfalfa production to growers, provide economic assessment of alfalfa production, and monitor effects on water resources in collaboration with project partners. Team includes: agronomy & soil science technicians (900 hours/yr (45%FTE), $50/hr, all years), and applied economics personnel including faculty (3 weeks/year (12.5% FTE; $10,000/yr, all years) and graduate research assistants (1, year 3 only (50&FTE); $44,000). Team will work on alfalfa extension programming, economic analyses, and water quality monitoring and sample analysis.	$ 219,000
Activity 3 technical team (comprising of Process Engineer, Organic and analytical scientist and Food Scientist) will work on assessing alfalfa materials for conversion them into fishmeal supplements, protein-based food-based applications, and extracting cellulosic sugars and high-value nutraceuticals Total team effort is 50% FTE/year at $55/h, all years).	$ 171,600
Activity 3 supply chain team will establish supply chain connections and lay foundation for new market opportunities through exploration, development and management of pilot scale projects with private businesses to commercialize new products and technologies. Total team effort is 20% FTE/year at $55/h), all years.	$ 68,640
Activity 3 outreach team will organize 1-2 Innovation Network Program forums over the course of the grant period to further awareness, knowledge sharing and action planning related to innovative opportunities in alfalfa-based food, feed and fuel applications and products, markets and technologies. Total team effort is 10% of FTE/year at $55/h, all years).	$ 34,320
Professional/Technical/Service Contracts: We will contract with consultant to provide partial support for assistance to individual farming operations in identifying on-farm locations for producing alfalfa to efficiently enhance crop production, profit, and water protection. RFP will be issued according to University of Minnesota procedures.	$ 50,000
Equipment/Tools/Supplies	
Water-quality monitoring supplies and sample analysis.	$ 30,000
Process equipment (High temperature/pressure reactor) for processing alfalfa plant residue and conversion into cellulosic sugars.	$ 15,000
Travel	
Activity 1 travel for collaborative geodesign team (6 Minneapolis-St. Peter round trips x $1,272/trip for vehicle rental, fuel, per diem) and project director (9 Minneapolis-St. Peter round trips x $92 trip for mileage, per diem) to support working lands design process.	$ 8,460
Activity 2 travel for collection of water samples (34 9 Minneapolis-St. Peter round trips/yr x $92/trip for mileage, per diem, and extension educator (9 Minneapolis-St. Peter round trips x $92 trip for mileage, per diem).	$ 12,893
Activity 3 Travel by the technical team, supply chain team, and outreach team. Travel by Technical team to collect samples and conferences, to partner labs, various locations = $4,000; Travel by Innovation and Commercialization Team to private businesses and investors, various MN locations = $7,500; Travel by the Outreach and Communications team to Forums (various MN locations) ,costs of hosting Forum speakers = $3,500.	$ 15,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 752,913

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period: Funds from Federal Clean Water Act Section 319 Project Seven Mile Creek Assessment and Implementation (Gustavus Adolphus College) and cash match from Gustavus Adolpus to support Activity 2 water quality monitoring during all project years. NB that this 319 project has been approved for funding but funds are not yet available; therefore we describe match as "pending".	$ 389,137	Pending
Other State $ To Be Applied To Project During Project Period:	N/A	N/A
In-kind Services To Be Applied To Project During Project Period: University of Minnesota personnel Jordan and Mulla will contribute in-kind support through their efforts on Activities 1 and 2, which are not included in above budget.	$ 25,340	Secured
Great River Greening personnel will contribute in-kind support ($10,000 per year, all years) though additional effort on Activity 1, beyond effort budgeted above, in all project years. NB that these funds are from 319 project Seven Mile Creek Assessment and Implementation; this project has been approved for funding but funds are not yet available; therefore we describe match as "pending".	$ 30,000	Pending
Past and Current ENRTF Appropriation:	N/A	N/A



Farmer-led, market-based working lands approach for protecting water by expanding alfalfa production

- Use geodesign to target new alfalfa production in "alfalfa-shed" w/in 3 miles of Northern Plains Dairy, to meet increasing alfalfa demand from dairy.
- Assist individual operations in integrating alfalfa in corn-soybean farming and producing high yields while protecting water.

Expanding markets for alfalfa

- Establish end-use applications for the entire alfalfa plant.
- Promote pilot enterprises using alfalfa for high-value applications.
- Innovation Network Forum events on emerging alfalfa opportunities.

The Project Manager is Dr. Nicholas Jordan. He is an agricultural scientist specializing in agronomy. He is highly experienced with project management, including complex, large-budget projects. He will provide project direction, management, and fiscal oversight. The University of Minnesota is the project organization; it is capably of fulfilling all project activities through its research and outreach capacities.