

NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Satellite-Based Fertigation Scheduling for Irrigated Acres

SPONSOR'S PRIMARY CONTACT INFORMATION (Not Consultant's)

Sponsor Business Name: Lower Elkhorn Natural Resources District

Sponsor Contact's Name: Julie Wragge

Sponsor Contact's Address: 1508 Square Turn Boulevard, Norfolk, NE 68701

Sponsor Contact's Phone: 402-371-7313

Sponsor Contact's Email: jwragge@lenrd.org

1. **Funding** amount requested from the Water Sustainability Fund:

Grant amount requested. \$ 176,736.00

- If requesting less than 60% cost share, what %? [Click here to enter text.](#)

If a loan is requested amount requested. \$ N/A

- How many years repayment period? N/A
- Supply a complete year-by-year repayment schedule. N/A

2. **Neb. Rev. Stat. § 2-1507 (2)**

Are you applying for a **combined sewer overflow project**? YES NO

If yes:

- Do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality? **YES** **NO**
- Attach a copy to your application. N/A
- What is the population served by your project? N/A
- Provide a demonstration of need. N/A
- **Do not complete the remainder of the application.**

3. **Permits Required/Obtained** Attach a copy of each that has been obtained. For those needed, but not yet obtained (box “**NO**” checked), 1.) State when you will apply for the permit, 2.) When you anticipate receiving the permit, and 3.) Your estimated cost to obtain the permit.

(N/A = Not applicable/not asking for cost share to obtain)
 (Yes = See attached)
 (No = Might need, don't have & are asking for 60% cost share to obtain)

G&P - T&E consultation (required)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
DNR Surface Water Right	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
USACE (e.g., 404/other Permit)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
FEMA (CLOMR)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Local Zoning/Construction	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Cultural Resources Evaluation	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Other (provide explanation below)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:

Sentinel Fertigation - Partner

Identify the roles and responsibilities of each Partner / Co-sponsor involved in the proposed project regardless of whether each is an additional funding source.

Sentinel Fertigation - Equipment and systems provider and installer.

5. **Other Sources of Funding**

Identify the costs of the entire project, what costs each other source of funding will be applied to, and whether each of these other sources of funding is confirmed. If not, please identify those entities and list the date when confirmation is expected. Explain how you will implement the project if these sources are not obtained.

LENRD's budget comes from a mill levy assessed to property values. The budget is set on a yearly basis and has remained steady for several years. A portion of the budget has been allocated to ensure there is sufficient funding to cover LENRD's 40% match for this project. The LENRD's operating budget for Fiscal Year 2023 was approved by the Board of Directors at their September meeting with a tax request of \$4,522,473. The estimated levy, based on the property tax request, is 2.2968 cents per \$100 of valuation, which is a decrease of 1.15% from the fiscal year 2022 levy of 2.3236 cents per \$100 of valuation.

6. **Overview**

In 1,000 words or less, provide a brief description of your project including the nature/purpose of the project and its objectives. Do not exceed one page!

This project is meant as an incentive of cost share to Producers for the adoption of image-based fertigation scheduling on current fertigated acres. The purpose is to provide the lowest cost per impact for the advanced usage of fertigation practices already in place to leverage satellite real time data for scheduling and further implementation of fertigation practices on irrigated acres. By upgrading to a satellite imagery system, the equipment monitors fields with real time data and makes timely recommendations of sustainable and necessary nitrogen fertilizer applications based on real nutrient needs of the monitored crops. The objective is to implement with a minimum of 40 producers who are currently fertigating to an extent, cost share on the upgrade, and educate them on the new technology for controlling nutrient application timing and rates. These implementations will evolve over a 2-year period, allowing producers adequate time experiencing the technology, and to utilize as a showcase/ training to introduce other area producers to the fertigation process.

7. **Project Tasks and Timeline**

Identify what activities will be conducted to complete the project, and the anticipated completion date.

Activity / Tasks	Year 1 \$	Year 2 \$	Totals
Assess producers and issue contracts	\$ 2,150.00	\$ 2,150.00	\$ 4,300.00
Equipment (as needed) / Installation / Education (includes installer travel)	\$ 35,290.00	\$ 35,290.00	\$ 70,580.00
Monitoring Subscription Cost and Support Services (includes installer travel)	\$ 107,690.00	\$ 107,690.00	\$ 215,380.00
Review of performance with Producers	\$ 2,150.00	\$ 2,150.00	\$ 4,300.00
		TOTAL	\$294,560.00

8. **IMP**

Do you have an **Integrated Management Plan** in place, or have you initiated one? YES NO Sponsor is not an NRD

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 004)

1. Does your project include physical construction (defined as moving dirt, directing water, physically constructing something, or installing equipment)?

YES NO

If you answered "YES" you must answer all questions in section 1.A.
If you answer "NO" you must answer all questions in section 1.B.

If "YES", it is considered mostly structural, so answer the following:

- 1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; N/A
- 1.A.2 Describe the plan of development (004.01 A); N/A
- 1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); N/A
- 1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C); N/A
- 1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information (004.01 D); N/A
- 1.A.6 Discuss each component of the final plan (004.01 E); N/A
- 1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1); N/A
- 1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2); N/A
- 1.A.9 When applicable include the criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3). N/A

If "NO", it is considered mostly non-structural, so answer the following:

- 1.B.1 Insert data necessary to establish technical feasibility (004.02);

This project is technically feasible in that it is designed to eliminate over-irrigation of our water sources and over-application of commercial nitrogen on crops by allowing real time data on the conditions of crop nitrogen needs and nitrogen contributions from non-synthetic sources to dictate when and how much nitrogen is applied. This adoption of satellite imagery and software (N-Time™) to automate the monitoring, analysis, and recommendation for fertigated fields with safety equipment have been tested and proved with on-farm research to simplify nitrogen management through data-driven insights. N-Time™ is a commercial product on the market today that can execute this approach.

1.B.2 Discuss the plan of development (004.02 A);

Beginning in the weeks immediately following the grant award, a search for at least 40 producers would commence for the 1st year implementation. Once the producer's system was inspected and qualified for the program, then contract for the cost share would be initiated, and the following items would commence:

1. Any equipment that was required for the upgrade would be procured and installed,
2. Information for field configuration would be submitted (field boundary, past irrigation & chemigation system information, agronomic information, insight settings, indicator block Rx)
3. Producers would need to furnish historical baseline production information to partners
4. Establish indicator blocks through base fertilizer applications
5. N-Time monitors fields with satellite imagery and makes recommendations, Producers follow recommendations for when to apply nitrogen via the irrigation system.
6. Service partners review performance, educate and train on system, and provide support system for next year, along with monitoring fees.

1.B.3 Describe field or research investigations utilized to substantiate the project conception (004.02 B);

The imagery technology was developed through UNL On-Farm Research, which currently has nearly 20 published trials, and has cooperators across the State of Nebraska. Extending from that research, Sentinel Fertigation was formed in 2021 and, continuing from the on-farm trials, currently has practical applications of their N-Time™ (experimental design from comparing this technology versus early-adopting grower practices). The research partners became customers – with 23 Producers utilizing this imagery system on over 8,000 acres. Here is a link to their website: <https://www.sentinel fertigation.com/> and a link to the 2022 On-Farm Research Results <https://on-farm-research.unl.edu/results-pdfs/2022research-results.pdf>

1.B.4 Describe any necessary water and/or land rights (004.02 C);

The land rights are retained by the Landowner. Water rights, as recognized for the usage of ground /surface water, is the right to use the water for its intended and purposeful use of irrigating and will comply with all necessary regulations as developed and implemented for irrigated acres per the Lower Elkhorn NRD's Integrated Management Plan (IMP).

- 1.B.5 Discuss the anticipated effects, if any, of the project upon the development and/or operation of existing or envisioned structural measures including a brief description of any such measure (004.02 D).

Fertigation and Chemigation practices are on the rise for all irrigated acres. These practices reduce the amount of Nitrogen and other agricultural chemicals at risk of leaching into the groundwater. As more companies are formed with standardized platforms for Producers to use, these practices will become economically substantiated in more use on more irrigated acres – thus reducing the amount of irrigated water and reduce the use of commercial fertilizer.

Prove Economic Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 005)

2. Provide evidence that there are no known means of accomplishing the same purpose or purposes more economically, by describing the next best alternative.

The Agricultural Nitrogen Cycle is complex, hard to predict, and highly impacted by a lot of variables. For fertigation scheduling, there is no other technology for broad acre row crops on the market. Models and tissue sampling are the next best alternative. Crop models are a way to present accumulative knowledge about how a crop grows in interaction with its environment. Each process in the Nitrogen cycle must be modelled to analyze and predict the nutrient and water needs of the crop. For models, sparse weather data, regional calibration requirements, and excessive data inputs are all hinderances, on top of inconsistent performance. For tissue sampling, results vary by lab used and often arrive too late for the producers to proactively eliminate the threat of nitrogen deficiencies and preserve yield potential for the crop. With the adoption of the image-based / sensor-based solution as part of the model for recommendations, this is updated a week in advance and is derived from real time data for the current crop need and is calibrated throughout the growing season.

3. Document all sources and report all **costs** and **benefit data** using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies is the project life. (Title 261, CH 2 - 005).

This project is economically feasible since we have proven research data, along with practical applications on real fields. The costs of the utilization of this satellite imagery-based nitrogen management system at \$7.50/acre are minimal compared to the benefits. The benefits per acre from implementing this project will be an estimated 23% increase in yield per field, 42 lbs. /acre average less of Nitrogen applied, increase in Nitrogen Use Efficiency, and a cost savings of approximately \$40.00 / acre realized by the Producer. Here is a link to the 2022 results of the analyzed data for the 8,000 acres utilizing the N-Time™ Nitrogen Management System <https://www.sentinel fertigation.com/2022-season-data>.

Yields exceeded expectations by 10% on average. Additionally, growers were able to achieve an average of approximately \$166.00/acre more in profit. Additional benefits can be recognized in the savings from not having to install infrastructure to treat nitrate contaminated water, reduced medical needs, etc. that are all externalities associated with nitrogen mismanagement.

- 3.A Describe any relevant cost information including, but not limited to the engineering and inspection costs, capital construction costs, annual operation and maintenance costs, and replacement costs. Cost information shall also include the estimated construction period as well as the estimated project life (005.01).

The estimated project life is 2 years. The N-Time monitors through a subscription of satellite imagery and is budgeted for a total of 13,920 acres. The services provided by Sentinel Fertigation are budgeted for 160 hours per year. Please refer to the attached budgets for both years. The costs are as follows:

1. N-Time Subscription for satellite imagery is \$7.50/acre in 2023 (potentially higher in 2024)
2. Sentinel Fertigation services are at a rate of \$43.00/hour, with a lump sum forecasted for travel related expenses at \$4,000.00 each year.
3. Cost of possible Equipment needed for existing systems may include: Panel upgrade at \$3,000.00 each, AgSense Control Unit Lease at \$900.00/yr, and VR Control at Ground Rig at \$2,500.00

- 3.B Only primary tangible benefits may be counted in providing the monetary benefit information and shall be displayed by year for the project life. In a multi-purpose project, estimate benefits for each purpose, by year, for the life of the project. Describe intangible or secondary benefits (if any) separately. In a case where there is no generally accepted method for calculation of primary tangible benefits describe how the project will increase water sustainability, in a way that justifies economic feasibility of the project such that the finding can be approved by the Director and the Commission (005.02).

Utilizing the results of the extended research and applications on existing fields, the tangible benefits for the estimated 13,920 acres to be treated with this

imagery system during this project will be:

1. Saving 42 lbs.-N/ac results in a 21 ppm NO3/ac environmental load reduction on average.

2. Water usage will be reduced.

Intangible / secondary benefits will include:

3. An average yield rise marginally or remains as expected.

4. An average cost savings in reduced nitrogen use of \$40.00 / acre can be realized by the Producer

Intangible / secondary benefits will include:

1. Less Nitrogen lost to leaching risk

3.C Present all cost and benefit data in a table to indicate the annual cash flow for the life of the project (005.03).

Funding Sources	Year 1 \$	Year 2 \$	Totals
Lower Elkhorn NRD (LENRD)	\$ 58,912.00	\$ 58,912.00	\$ 117,824.00
Nebraska DNR (NDNR)	\$ 88,368.00	\$ 88,368.00	\$ 176,736.00
		TOTAL	\$294,560.00

The total project costs of \$294,560.00 will be split between the LENRD and the NDNR at a 40/60 match of \$117,824.00 from the LENRD in the form of cash and in-kind funds, while the remaining 60% will come from the NDNR in the amount of \$176,736.00. These costs are expected to be distributed evenly across two years of the proposed project.

3.D In the case of projects for which there is no generally accepted method for calculation of primary tangible benefits and if the project will increase water sustainability, demonstrate the economic feasibility of such proposal by such method as the Director and the Commission deem appropriate (005.04). (For example, show costs of and describe the next best alternative.)

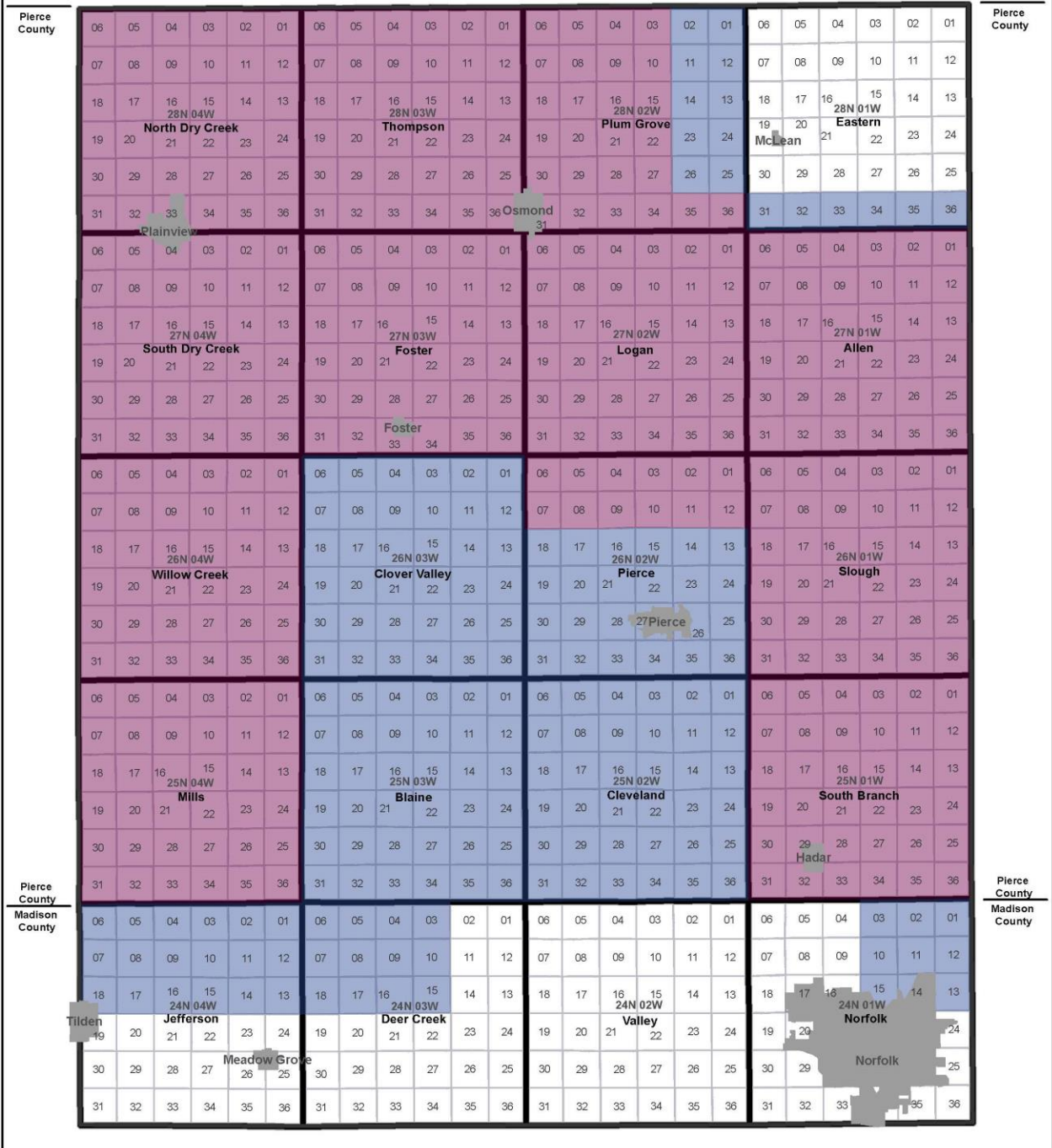
Primary tangible benefits for this project as listed above in item 3.B. will be essential to the support of the sustainability of groundwater resources in the LENRD Phase 2 and Phase 3 areas as shown on the phase area map. With the saving of 42 lbs-N/ac resulting in a 21 ppm NO3/ac environmental load reduction on average for the proposed goal of 13,920 acres, the impact should be measurable (in time) for our phased areas.

Phase 2 Areas in Madison & Pierce County Phase 3 Areas in Pierce County Effective October 15, 2018

Source: Lower Elkhorn NRD
Nebraska Department of
Natural Resources
Processed: October 15, 2018
Mike Murphy, GIS Specialist
Lower Elkhorn Natural Resources District



Pierce County Phase 3
 Madison and Pierce County Phase 2



Prove Financial Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 006)

4. Provide evidence that sufficient funds are available to complete the proposal.

LENRD has budgeted funds to cover the 40% contribution to the project. These funds will be used as necessary and be available for the duration of the grant.

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace).

LENRD's budget comes from a mill levy assessed to property values. The budget is set on a yearly basis and has remained steady for several years. A portion of the budget has been allocated to ensure there is sufficient funding to cover the LENRD's 40% match for this project.

The LENRD's operating budget for Fiscal Year 2023 was approved by the Board of Directors at their September meeting with a tax request of \$4,522,473. The estimated levy, based on the property tax request, is 2.2968 cents per \$100 of valuation, which is a decrease of 1.15% from the fiscal year 2022 levy of 2.3236 cents per \$100 of valuation.

6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal.

N/A

7. Describe how the plan of development minimizes impacts on the natural environment (i.e. timing vs nesting/migration, etc.).

The saving of 42 lb.-N/ac on the estimated 13,920 acres for this project results in a 21 ppm NO₃/ac environmental load reduction on average and promotes less leaching of nitrogen into our groundwater. Additionally, the system integrates very well with regenerative ag practices that help sustain more habitat for native species and mitigate environmental risk generally.

8. Explain how you are qualified, responsible and legally capable of carrying out the project for which you are seeking funds.

In 1972, the Nebraska Legislature created and declared that NRDs are essential to the health and welfare of the people and the State of Nebraska. NRDs were tasked by the legislature to conserve, protect, develop, and manage the state's natural resources. LENRD employs a professional staff upon whose shoulders

this responsibility falls. LENRD staff are trained and well qualified in these assistance programs as outlined in the grant application. LENRD staff have experience with all the project areas proposed and are fully capable of executing the vision of our locally elected Board of Directors. Staff have the expertise to assist producers, and both analyze and utilize any data collected during the project.

9. Explain how your project considers plans and programs of the state and resources development plans of the political subdivisions of the state.

The Lower Elkhorn Natural Resources District (LENRD) is a member of the Lower Platte River Basin Coalition, which includes seven NRD's and the Nebraska Department of Natural Resources. This coalition was formed to initiate the process of developing a basin plan, which includes an inventory of current water uses (both groundwater and surface water) and projects the amount of available depletions (by sub-basin and NRD) allowable for the term of the accounting period. In 2017, the LENRD adopted Conditions for Approval that would be imposed on any new irrigation well constructed within the district. The conditions include an annual groundwater allocation of 9 inches/acre for irrigation of a primary crop, and an additional 2 inches/acre to be used post-harvest for establishing a conservation cover crop. The logic behind this policy is to allow for the addition of new uses of groundwater for irrigation purposes, while providing protection for existing groundwater users. This concept will also provide protection for hydrologically connected rivers and streams, since it would effectively "cap" the amount of groundwater withdrawal; a portion of which would otherwise reach the connected river or stream. If funded, this project would target Phase 2 and 3 management areas as a means of providing enhanced ability to monitor pumping and nitrogen use for both the well owner and the district.

10. Are land rights necessary to complete your project? YES NO

If yes:

- 10.A Provide a complete listing of all lands involved in the project. N/A
- 10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. N/A
- 10.C Provide assurance that you can hold or can acquire title to all lands not currently held. N/A
11. Identify how you possess all necessary authority to undertake or participate in the project.

On July 1st, 1972, the Nebraska Legislature created the Natural Resources Districts pursuant to Chapter 2, Article 32, 2-3201. The Legislature tasked NRDs with the management of groundwater and hydrologically connected groundwater and surface water. Chapter 46, Article 7, 46-702 of the Groundwater Management and Protection Act states, “The Legislature also finds that natural resources districts have the legal authority to regulate certain activities and, except as otherwise specifically provided by statute, as local entities are the preferred regulators of activities which may contribute to groundwater depletion.”

12. Identify the probable consequences (environmental and ecological) that may result if the project is or is not completed.

Over-irrigation and nitrate leaching go hand in hand – by not utilizing real time data provided by a satellite linked program to show the Producer exactly when the crop needs water or nutrient – can result in the same practices utilized for decades. These practices of broadcasting nutrient and running irrigators 24 hours – 7 days a week – are what has caused the nitrate leaching to continue through the top 10 feet of the vadose zone.

Section C.

NRC SCORING

In the NRC's scoring process, points will be given to each project in ranking the projects, with the total number of points determining the final project ranking list.

The following 15 criteria constitute the items for which points will be assigned. Point assignments will be 0, 2, 4, or 6 for items 1 through 8; and 0, 1, 2, or 3 for items 9 through 15. Two additional points will be awarded to projects which address issues determined by the NRC to be the result of a federal mandate.

Notes:

- The responses to one criterion *will not* be considered in the scoring of other criteria. Repeat references as needed to support documentation in each criterion as appropriate. The 15 categories are specified by statute and will be used to create scoring matrixes which will ultimately determine which projects receive funding.
- There is a total of 69 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted above. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.
- The Commission recommends providing the requested information and the requests are not intended to limit the information an applicant may provide. An applicant should include additional information that is believed will assist the Commission in understanding a proposal so that it can be awarded the points to which it is entitled.

Complete any of the following (15) criteria which apply to your project. Your response will be reviewed and scored by the NRC. Place an N/A (not applicable) in any that do not apply, an N/A will automatically be placed in any response fields left blank.

1. Remediates or mitigates threats to drinking water;
 - Describe the specific threats to drinking water the project will address.
 - Identify whose drinking water, how many people are affected, how will project remediate or mitigate.
 - Provide a history of issues and tried solutions.
 - Provide detail regarding long-range impacts if issues are not resolved.

The practices proposed by this project will support and protect the long-term sustainability of groundwater quality and quantity for drinking water for both individual domestic users as well as municipalities. The adoption of satellite imagery

in a fertigation system for irrigation water management will have the benefit of reducing overall water pumped for irrigation uses in LENRD thereby retaining water in the local aquifer for future uses. This will limit the non-beneficial uses of groundwater in the district including runoff or off-site evapotranspiration by weeds or other phreatophytes that serve no beneficial purposes. Retaining water in the local aquifer is the optimal storage space for the conserved water resources since they will not be diminished by evaporation or non-beneficial transpiration. The proposed practices will also be beneficial to drinking water quality since irrigation water management will become more efficient because of this project. Near real-time water use data will have the effect of improving the seasonal application efficiency of irrigation water having the effect of limiting or reducing the leaching of nitrogen fertilizers or other agricultural chemicals out of the plant root zone into the local aquifer where it can be intercepted by drinking water wells. This will be to the benefit of numerous municipalities in the LENRD as well as hundreds of private well owners.

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;
 - Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.
 - Provide the history of work completed to achieve the goals of this plan.
 - List which goals and objectives of the management plan the project provides benefits for and how the project provides those benefits.

This project will enhance the Lower Elkhorn Natural Resources District's (LENRD) ability to achieve the goals and objectives set forth in the district's Groundwater Management Plan, which was first approved by the Nebraska Department of Natural Resources in late 1984. This plan has undergone several revisions since that initial approval, the most recent occurring in January of 2018 to integrate a Drought Management component into the district's groundwater management strategy. The LENRD Groundwater Management Plan outlines the monitoring mechanisms that will be completed to evaluate the health and viability of aquifers in the district. The plan also identifies benchmarks, or triggers, that if met, provide a road-map for enhanced management schemes to sustain groundwater supplies well into the future. The triggers for establishing a groundwater management area for the protection of groundwater quality were met in a portion of Pierce County in 1997. In response, a Phase 2 Groundwater Management area was established and as conditions changed in other portions of the county those boundaries have been expanded, along with the controls, to now encompass most of Pierce and a portion of Madison County as a Phase 2 and 3 Area. If funded, this proposal would provide resources for the adoption of tools to assist in enhanced nutrient management for crop production.

3. Contributes to water sustainability goals by increasing aquifer recharge, reducing aquifer depletion, or increasing streamflow;

List the following information that is applicable:

- The location, area and amount of recharge;
- The location, area and amount that aquifer depletion will be reduced;
- The reach, amount and timing of increased streamflow. Describe how the project will meet these objectives and what the source of the water is;
- Provide a detailed listing of cross basin benefits, if any.

This project contributes to water sustainability goals by reducing aquifer depletion through the practices of reducing the irrigation water used by integrating the satellite imagery analysis in the recommendation issued for the crops need based upon current weather and environmental conditions.

4. Contributes to multiple water supply goals, including, but not limited to, flood control, agricultural use, municipal and industrial uses, recreational benefits, wildlife habitat, conservation of water resources, and preservation of water resources;

- List the goals the project provides benefits.
- Describe how the project will provide these benefits
- Provide a long range forecast of the expected benefits this project could have versus continuing on current path.

This project contributes to a more controlled agricultural use and conservation of water resources, while also contributing to the preservation of the water source with the proven reduction in applied commercial fertilizers over irrigated acres. The project provided benefits are from not having to install infrastructure to treat nitrate contaminated water, reduced medical needs, etc. that are all externalities associated with nitrogen mismanagement without precision irrigation.

5. Maximizes the beneficial use of Nebraska's water resources for the benefit of the state's residents;

- Describe how the project will maximize the increased beneficial use of Nebraska's water resources.
- Describe the beneficial uses that will be reduced, if any.
- Describe how the project provides a beneficial impact to the state's residents.

This project maximizes the beneficial use of Nebraska's water resources for irrigation. Sustainability of groundwater will be improved in LENRD by improving irrigation water use efficiency through limiting or reducing excessive or unnecessary pumping. The only way that a beneficial use will be reduced is by reducing the pumping of irrigation water that is currently being pumped, but not needed. In this manner, the beneficial use of irrigation water is not being curtailed or restricted beyond the reasonable allocation established by LENRD.

Instead, the beneficial use is becoming more efficient and sustainable where the resource is diminished. This project will provide an example for other districts in the state with similar water shortage issues for effective water conservation practices that will benefit the waters of the state. Other NRDs in the state including MRNRD and CPNRD have implemented programs utilizing automated meter reading and have experienced reductions in irrigation water applications. This project is another example that will perpetuate this practice within the State of Nebraska and possibly others.

6. Is cost-effective;

- List the estimated construction costs, O/M costs, land and water acquisition costs, alternative options, value of benefits gained.
- Compare these costs to other methods of achieving the same benefits.
- List the costs of the project.
- Describe how it is a cost effective project or alternative.

The costs of the utilization of this satellite imagery-based nitrogen management system at \$7.50/acre are minimal compared to the benefits. The benefits per acre from implementing this project will be an estimated 23% increase in yield per field, 42 lbs. /acre average less of Nitrogen applied, increase in Nitrogen Use Efficiency, and a cost savings of approximately \$40.00 / acre realized by the Producer. Yields exceeded expectations by 10% on average. Additionally, growers were able to achieve an average of \$166.59/ac more profit, marking an average 14% increase versus what was anticipated.

7. Helps the state meet its obligations under interstate compacts, decrees, or other state contracts or agreements or federal law;

- Identify the interstate compact, decree, state contract or agreement or federal law.
- Describe how the project will help the state meet its obligations under compacts, decrees, state contracts or agreements or federal law.
- Describe current deficiencies and document how the project will reduce deficiencies.

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the United States such that their incapacitation would have a debilitating effect on public security or public health and safety;

- Identify the property that the project is intended to reduce threats to.

- Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
- Identify the potential value of cost savings resulting from completion of the project.
- Describe the benefits for public security, public health and safety.

If funded, this project will not quantify benefits providing public safety. However, additional benefits may be recognized in the savings from not having to install infrastructure to treat nitrate contaminated water, reduced medical needs, etc. that are all externalities associated with nitrogen mismanagement.

9. Improves water quality;

- Describe what quality issue(s) is/are to be improved.
- Describe and quantify how the project improves water quality, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- Describe other possible solutions to remedy this issue.
- Describe the history of the water quality issue including previous attempts to remedy the problem and the results obtained.

LENRD does have areas where concentrations of high nitrates exist in the local aquifer. These groundwater nitrate concentrations are well-documented in the Phase 2 and 3 Management Areas of the LENRD as well as in the Bazile Groundwater Management Area (BGMA), a federally-recognized groundwater quality area. Previous demonstrations of other practices have not significantly reduced groundwater nitrate concentrations. This project may introduce practices that will have benefits of improving groundwater quality. The proposed practices will be beneficial to groundwater quality since irrigation water management will become more efficient because of this project. Near real-time recommendations from satellite imagery for water use data and nitrogen application will have the effect of improving the seasonal application efficiency of irrigation water having the effect of limiting or reducing the leaching of nitrogen fertilizers or other agricultural chemicals out of the plant root zone into the local aquifer where it can be intercepted by drinking water wells. The population within the LENRD phased areas will benefit because of this proposal. Once groundwater conservation is experienced on these acres, the practice will likely be transferred to other areas of the district with groundwater depletion concerns.

10. Has utilized all available funding resources of the local jurisdiction to support the program, project, or activity;

- Identify the local jurisdiction that supports the project.
- List current property tax levy, valuations, or other sources of revenue for the sponsoring entity.

- List other funding sources for the project.

The project is supported by the Lower Elkhorn Natural Resources District (LENRD). The operating budget for Fiscal Year 2023 was approved by the LENRD Board of Directors with a tax request of \$4,522,473. The levy, based on the property tax request, is 2.2968 cents per \$100 of valuation, which is a decrease of 1.15% from the fiscal year 2022 levy of 2.3236 cents per \$100 of valuation.

For example, if a person owns a \$300,000 house, the taxes owed to the LENRD would have been \$69.70 in 2022 and will be approximately \$68.90 in 2023. With major grant funding approved for the district, the LENRD's total operating budget for fiscal year 2023 was near \$13.8 million, with only \$4.5 million in revenue from the property tax levy.

If funded, the project will be supported by funding from the Nebraska Department of Natural Resources Water Sustainability Fund and the general revenues of the Lower Elkhorn NRD. No other sources of revenue are currently proposed for this project. LENRD will budget funds sufficient to cover 40% of the cost of this project to match funding from the State of Nebraska.

11. Has a local jurisdiction with plans in place that support sustainable water use;

- List the local jurisdiction and identify specific plans being referenced that are in place to support sustainable water use.
- Provide the history of work completed to achieve the goals of these plans.
- List which goals and objectives this project will provide benefits for and how this project supports or contributes to those plans.
- Describe and quantify how the project supports sustainable water use, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- List all stakeholders involved in project.
- Identify who benefits from this project.

The local jurisdiction is the Lower Elkhorn Natural Resources District (LENRD) which has a Groundwater Management Plan, and an Integrated Management Plan, in place to govern water use in the district.

The LENRD has engaged in efforts to monitor groundwater quantity and quality for decades, and activities include: annual static water level monitoring, irrigation and monitoring well network water sampling, periodic revisions to the Groundwater Management Plan and Rules and Regulations to integrate new management mechanisms as conditions require, development and adoption of mechanisms to facilitate the expansion of groundwater uses for beneficial purposes, while providing mechanisms to guarantee the protection of existing users.

As previously stated, the district supports the development of available groundwater supplies to their fullest potential and this project would provide real time information that can be utilized for enhanced monitoring of irrigation pumping for protection of the resource, and to help well owners maintain compliance with district requirements. This proposal is targeted to irrigation wells in the LENRD within the Phase 2 and 3 areas of the district's groundwater management plan.

12. Addresses a statewide problem or issue;

- List the issues or problems addressed by the project and why they should be considered statewide.
- Describe how the project will address each issue and/or problem.
- Describe the total number of people and/or total number of acres that would receive benefits.
- Identify the benefit, to the state, this project would provide.

Fertigation has some specific advantages over broadcast and band fertilization: (1) a frequent supply of nutrients reduces fluctuation of nutrient concentration in soil; (2) there is efficient utilization and precise application of nutrients according to the nutritional requirements of the crop; (3) fertilizers are applied throughout the irrigated soil volume; (4) nutrients can be applied to the soil when soil or crop conditions would otherwise prohibit entry into the field with conventional equipment. If funded, the adoption of satellite-based imagery management system will provide an enhanced tool for area producers.

This project will benefit 40 producers to further manage 13,920 acres.

This project will have the ability to be replicated in any other portion of Nebraska or other state where there are declines in groundwater quality and quantity.

13. Contributes to the state's ability to leverage state dollars with local or federal government partners or other partners to maximize the use of its resources;

- List other funding sources or other partners, and the amount each will contribute, in a funding matrix.
- Describe how each source of funding is made available if the project is funded.
- Provide a copy or evidence of each commitment, for each separate source, of match dollars and funding partners.
- Describe how you will proceed if other funding sources do not come through.

LENRD will budget funds sufficient to cover 40% of the cost of this project to match funding from the State of Nebraska. LENRD obtains funding from a mill levy on property within the district. LENRD also intends to apply for federal funding most likely from the Bureau of Reclamation to further leverage state funds and expand these conservation activities in the district.

14. Contributes to watershed health and function;

- Describe how the project will contribute to watershed health and function in detail and list all of the watersheds affected.

Nothing is more important to the health and function of a watershed than an adequate water supply for wildlife, people, and plants for the natural landscape and food production. This project will implement water saving practices for agriculture that will support groundwater sustainability for all uses. Agriculture is the primary user of groundwater resources in the district and will consequently have the greatest impact on watershed health. These practices will be available throughout the Lower Elkhorn watershed.

15. Uses objectives described in the annual report and plan of work for the state water planning and review process issued by the department.

- Identify the date of the Annual Report utilized.
- List any and all objectives of the Annual Report intended to be met by the project
- Explain how the project meets each objective.

The development of this image-based management program to fertigate on irrigated acres is an opportunistic project for the NeDNR to collaborate with the LENRD and meets several of the goals identified by NeDNR to implement Neb. Rev. Stat. 2-1599 described below:

1. Maintain data, information, and analysis capabilities for water planning, including specific programs for collecting, maintaining, and distributing information on streamflows, as well as analyzing water uses and water supplies across the state;

This project clearly meets Objective 1 by developing the necessary tools to acquire water use data for irrigation management on the farm level as well as the watershed level. Additionally, the NeDNR will directly benefit as a collaborator with the LENRD when collecting and analyzing water use data and supplies across the district.

2. Provide staff and resources to support planning and implementation of water resources projects;

LENRD will partner to this project with the financial assistance of the NeDNR and has allocated staff to provide resources and support implementation of the project.

3. Support locally developed water management plans for managing hydrologically connected water supplies;

This project supports the basis for scientifically based decisions for irrigation water management which is in direct alignment with implementation of the LENRD Voluntary IMP.

4. Provide coordination of federal agencies, state agencies, local NRDs, and other water interests for the development of water resources programs and projects.

LENRD intends to utilize funding from the NeDNR to initiate this program in priority areas of the district and then expand upon this by leveraging federal funds with district and state dollars to support groundwater management in the LENRD.

5. Participate in interagency collaboration with federal agencies, state agencies, local natural resources districts (NRDs), and other water interest entities on various water resources programs and projects; and

This project is a joint venture between the LENRD and NeDNR which will also include the cooperation of private industry to implement technology.

6. Consolidate and present information in a form that is understandable and useful to the public and interagency collaborators.

This project will generate satellite-based nutrient management system that using real-time data that will be readily available for irrigators for water and nitrogen management decisions. This project will make advance the technology to make it available for water management as well.

16. Federal Mandate Bonus. If you believe that your project is designed to meet the requirements of a federal mandate which furthers the goals of the WSF, then:

- Describe the federal mandate.
- Provide documentary evidence of the federal mandate.
- Describe how the project meets the requirements of the federal mandate.
- Describe the relationship between the federal mandate and how the project furthers the goals of water sustainability.

Portions of the Phase 2 and 3 Groundwater Management Areas within the Lower Elkhorn Natural Resources District (LENRD) overlap into the Bazile Groundwater Management Area (BGMA). Elevated groundwater nitrate concentrations are

well-documented in the BGMA, a federally-recognized groundwater quality area. The BGMA was originally identified as the Bazile Triangle area of concern in the late 1980s because of nitrate contamination affecting municipal wells in the vicinity of the Villages of Brunswick, Creighton, Orchard, Osmond, Plainview, Royal, and Wausa, Nebraska. This was later expanded to the current BGMA, which covers 21 townships, or 756 square miles. Two thirds of the total land use, or about 324,000 acres, is used for row crop production. While no federal mandates currently exist for this federally-recognized groundwater quality area, this proposed project has the potential to be implemented by irrigators in the BGMA and present a possible solution to nitrate concerns in the BGMA.