**NEBRASKA NATURAL RESOURCES COMMISSION**

**Water Sustainability Fund**

Application for Funding

Section A.

**ADMINISTRATIVE**

**PROJECT NAME:** Water Resources Technology & Conservation

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

Sponsor Business Name: Lewis & Clark Natural Resources District

Sponsor Contact's Name: Cole Fiedler & Dustin Weinandt

Sponsor Contact's Address: 608 N Robinson Ave., PO Box 518, Hartington, NE 68739

Sponsor Contact's Phone: 402-254-6758

Sponsor Contact's Email: Cole Fiedler <cfiedler@lcnrd.org>, Dustin Weinandt <dweinandt@lcnrd.org>

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

**Grant** amount requested. $ 439,069

- If requesting less than 60% cost share, what %? N/A

**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.
- What is the population served by your project?
- Provide a demonstration of need.
- **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☒ | Obtained: YES☐ | NO☐ |
| DNR Surface Water Right | N/A☒ | Obtained: YES☐ | NO☐ |
| USACE (e.g., 404/other Permit) | N/A☒ | Obtained: YES☐ | NO☐ |
| FEMA (CLOMR) | N/A☒ | Obtained: YES☐ | NO☐ |
| Local Zoning/Construction | N/A☒ | Obtained: YES☐ | NO☐ |
| Cultural Resources Evaluation | N/A☒ | Obtained: YES☐ | NO☐ |
| Other (provide explanation below) | N/A☒ | Obtained: YES☐ | NO☐ |

No permits are required for the activities planned in this application.

4. **Partnerships**

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

Lewis & Clark Natural Resources District (LCNRD)

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

LCNRD will supply 40% of the funding for the project. LCNRD will develop, educate producers about, administer, regulate, and monitor this project.

A cost-share program will be designed to promote and select: effective soil, groundwater, and surface water practices; educate local producers; and create and utilize reliable data.

## 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.

The total cost of this proposed project is $731,783 with 60% from the WSF grant, 40% from the LCNRD special water projects budget, and additional cost above offered cost-share will be covered by participating producers. LCNRD will continue applying for additional funding throughout the next year. Applications are anticipated for the Regional Conservation Partnership Program (RCPP) through the USDA-NRCS and Water SMART Funds through the Bureau of Reclamation subsequent to the submittal of this proposal. Consequently, this project will have the potential for leveraging federal funds for additional progress within the state.

## 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!

The primary purpose of this project is to conserve water resources and improve water quality of groundwater and surface water and increase confidence in water data in the Lewis & Clark Natural Resources District (LCNRD).

LCNRD's responsibility of stewarding water resources is a high priority. LCNRD has been implementing a Groundwater Management Plan since 1986 and groundwater rules and regulations for quality since 2004 and for quantity since 2014. The district has both a Water Quality Management Plan (adopted in 2019) and a Voluntary Integrated Management Plan (adopted in 2016 and updated in 2019).

LCNRD has several wellhead protection areas (WHPAs) for public water supply systems (PWS) where groundwater is the source, including 16 communities (Map 1 in Sections B and C: District Nitrates, Wellhead Protection Areas and Project Areas – 2024). Many rural residents also rely on groundwater sourced drinking water provided through private domestic wells. Other residents of the district obtain drinking water from the Cedar Knox Rural Water Project (CKRWP) that treats surface water in a treatment plant. CKRWP meets drinking water needs in an area where groundwater resources are highly variable and complex due to the way geologic units were laid down and subsequently eroded by glaciers (Map 2 in Sections B and C: LCNRD Generalized

Geologic Block Diagram). Fewer irrigation and domestic wells exist in this area due to geological conditions. CKRWP serves 940 rural connections, 4 communities, several SIDs, and campgrounds.

Nitrate-nitrogen concentration in groundwater varies widely across the district, with trends indicating high levels in some aquifers/areas, and some indicating lower levels, appearing to be dependent upon many variables including land use, depth to groundwater, nitrogen containing fertilizer use, and manure application. It is generally accepted that the source of nitrate-nitrogen is in large part a result of nitrate leaching from organic and inorganic sources of nitrogen fertilizer that were not utilized by crops. Recent nitrate assessments in the district indicate nitrate levels average from 15.3 ppm in the Bazile Groundwater Management Area (BGMA) and 8.5 ppm across the district (Map 3 in Sections B and C: District Nitrate Levels - 2024).

The City of Creighton, located within the Bazile Groundwater Management Area (BGMA), a Phase III nitrogen management area, installed a reverse osmosis (RO) system in the 1990s at a cost over $1.1 million, to address nitrate levels in drinking water. RO systems are costly to install and maintain. The cost for private landowners to manage nitrate in their drinking water is also costly. Options for management in the private sector include purchasing drinking water or maintaining a private RO or distillation systems.

In addition to groundwater quality concerns, LCNRD has five streams and three recreational lakes currently on the 303d list of impaired waterbodies. Bow Creek is in Phase II of Project Implementation Plans with NDEE and the Environmental Protection Area (EPA) to educate producers and adopt practices. The practices that benefit surface water quality are also beneficial in addressing groundwater quality and/or quantity concerns.

Conservation practices have been the focus to reduce nitrate leaving the root zone of growing crops, to reduce runoff from fields and pastures that enters surface water, to increase irrigation efficiency, and conserve water. Cost-share programs are available to producers in LCNRD through contracts offered by the Natural Resources Conservation Service (NRCS) and the Nebraska Soil and Water Conservation Program (NSWCP). These programs have been successful in expanding the number of acres enrolled in programs that benefit ground and surface water quantity and quality. However, there are practices the district would like to prioritize that are not routinely contracted through NRCS programming due to limited funding. These practices include implementing technology-based irrigation and nutrient management systems, including a third crop in rotation and establishing a test field using rotating grasslands grazing. Increasing conservation practice adoption rates has been successful with other district programs using a model of; providing cost share, providing access to educational resources, and providing opportunities to get involved in a producer led producer group and will be applied to the practices proposed here.

The direct objectives of this project are to:

- Refine an outreach/education program to increase producer knowledge of water quality and quantity concerns and available programs that support adopting irrigation technology and other BMPs.

- Increase adoption of water quality and quantity improving BMPs including but not limited to: installing soil moisture sensors and flow meters with telemetry, pivot VRI upgrades, and fertigation/chemigation system upgrades.

- Increase confidence in groundwater data used by LCNRD board of directors for decision-making by increasing the number of irrigation systems with flow meters and telemetry.

- Promote real-time data utilization for irrigators while simplifying resource tracking for the district through the Producer Connect App. developed by Nebraska's NRDs.

- Support the inclusion of a third cash crop in corn-soy rotations and alternative cash crops to improve soil conditions and reduce irrigation water and fertilizer use.

- Create one Demo Farm that will convert irrigated cropland to a perennial system on 30-40 acres. This trial will track nitrate in the soil and vadose zone providing an opportunity to evaluate the benefit of offering incentives to landowners in high impact areas of wellhead protection areas to mitigate nitrate-nitrogen leaching.

LCNRD believes that a combination of increased irrigation technology adoption and land management practices have the potential to reduce nitrate leaching to the groundwater table. Similar projects with other NRDs in Nebraska where meters and soil moisture probes with telemetry have shown positive results to conserve irrigation water which in this case will also benefit groundwater quality.

Providing producers the ability to control the amount of water and inputs applied to specific areas of a field using VRI technology will reduce runoff and leaching. A third cash crop in rotation can decrease nutrients applied and improve soil health. Planting grass for rotational grazing allows for reduced nutrient application over longer periods and would serve as a field trial in high impact areas of the watershed.

## 7. Project Tasks and Timeline

Identify what activities will be conducted to complete the project, and the anticipated completion date.
**For multiyear projects** please list (using the following example):

| Tasks | Year 1$ | Year 2$ | Year 3$ | Remaining | Total $ Amt. |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Permits | $18,000 | | | | $18,000 |
| Engineering | | $96,000 | | | $96,000 |
| Construction | | $87,000 | $96,000 | | $183,000 |
| Close-out | | | | $8,000 | $8,000 |
| TOTAL | $305,000 | | | | |

- What activities (Tasks) are to be completed.
- An estimate of each Tasks expenditures/cost per year.
- Activities in years 4 through project completion under a single column.

Chart 1: Project Tasks & Timeline:

| Tasks | 2025 | | 2026 | | | | 2027 | | | | 2028 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 |
| Create cost-share guidelines | 1 | | | | | | | | | | | |
| Promote Cost-share Program | x | x | x | x | x | x | x | x | x | x | x | x |
| Install Moisture Senstors | | | | 8 | | | | 8 | | | | 8 |
| Install flowmeters with telemetry | | | | 10 | | | | 20 | | | | 20 |
| Contract for telemetry data service ($180 per year x 3 yr) | | | | 10 | | | | 20 | | | | 20 |
| Install Chemigation/Fertigation Systems | | | | 2 | | | | 3 | | | | 3 |
| Install VRI technology on Pivots | | | | 2 | | | | 3 | | | | 3 |
| Contract for Conseravtion Crop Rotation ( small grain) | | | | 80 acres | | | | 80 acres | | | | 80 acres |
| Alternative Cash Crop -3rd in Rotation | | | | 80 acres | | | | 80 acres | | | | 80 acres |
| Demo Farm - Perennial Conversion | | | | 40 | | | | | | | | |
| Annual Reporting | | | | x | | | | x | | | | x |
| Final Reporting | | | | | | | | | | | | x |

Chart 2: Project Costs

| Activities | 2025 | | 2026 | | | | 2027 | | | | 2028 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Total |
| Promote Cost-share Program | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 9,000 |
| Install Moisture Senstors | | | | $ 10,830 | | | | $ 10,830 | | | | $ 10,830 | $ 32,490 |
| Install flowmeters with telemetry | | | | $ 22,500 | | | | $ 45,000 | | | | $ 45,000 | $ 112,500 |
| Contract for telemetry data service | | | | $ 4,050 | | | | $ 8,100 | | | | $ 8,100 | $ 20,250 |
| Install Chemigation/Fertigation Systems | | | | $ 2,700 | | | | $ 4,050 | | | | $ 4,050 | $ 10,800 |
| Install VRI technology on Pivots | | | | $105,000 | | | | $157,500 | | | | $ 157,500 | $ 420,000 |
| Contract for Conseravtion Crop Rotation ( small grain) | | | | $ 3,247 | | | | $ 3,247 | | | | $ 3,247 | $ 9,742 |
| Alternative Cash Crop -3rd in Rotation | | | | $ 9,000 | | | | $ 9,000 | | | | $ 9,000 | $ 27,000 |
| Demo Farm - Perennial Conversion | | | | $ 30,000 | | | | $ 30,000 | | | | $ 30,000 | $ 90,000 |
| | | | | **$190,327** | | | | **$270,727** | | | | **$ 270,727** | **$ 731,782** |

## 8. IMP

Do you have an **Integrated Management Plan** in place, or have you initiated one?

YES☒ NO☐ Sponsor is not an NRD☐

LCNRD has a Voluntary Integrated Management Plan that was adopted in 2016 with NeDNR and LCNRD reports completed biannually.

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;

1.A.2 Describe the plan of development (004.01 A);
1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B);

1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C);

1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information (004.01 D);

1.A.6 Discuss each component of the final plan (004.01 E);

1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1);

1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2);

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).

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

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

In 2019 LCNRD worked with FYRA Engineering, NDEE, and local stakeholders to develop a Water Quality Management Plan. Development of this plan included modeling for groundwater nitrate and surface water *E. coli* reduction from BMP implementation

and feedback from local farmers and ranchers indicating which water quality improving BMPs they were likely to implement.

Information from the WQMP has been used to update the Bazile Groundwater Management Project Implementation Plan, a joint project between LCNRD and three other NRDs, and create the Bow Creek Project Implementation Plan. Both PIPs have been accepted by NDEE and EPA and are currently being implemented. This project will be complementary to both projects.

The LCNRD WQMP indicated that irrigation management and cropping techniques both impact groundwater nutrients and *E. coli*. The plan also suggests because of the large amount of privately-owned ground in the WQMP Area used for agricultural purposes, one-on-one assistance to landowners/producers will be essential for successful implementation of this WQMP.

Table 7-7 from the WQMP indicates irrigation management and cropping techniques impact groundwater quality. Table 7-3 from the WQMP shows irrigation management and cropping techniques including perennial systems that improve surface water quality.

**LCNRD WQMP (Table 7-7) Groundwater Conservation Practice ACT/ Pollutants Addressed**

| Practice | Practice Mode of Action | | | Pollutants Addressed | | | |
|---|---|---|---|---|---|---|---|
| | Avoid | Control | Trap | *E. coli* | Atrazine | Sediment | Nutrients |
| **Groundwater** | | | | | | | |
| Irrigation management | x | x | | x | x | | x |
| Cropping techniques* | x | x | | x | x | | x |
| Nutrient management | x | x | | | | | x |
| Waste storage facility* | x | | | x | | | x |
| Covered feedlot* | x | | | x | | | x |
| *Source: ACT criteria not reported in Nebraska State Nonpoint Source Management Plan | | | | | | | |

**LCNRD WQMP: (Table 7.3) Upland Non-Structural ACT/Pollutants**

| Practice | Practice Mode of Action | | | Pollutants Addressed | | | |
|---|---|---|---|---|---|---|---|
| | Avoid | Control | Trap | *E. coli* | Atrazine | Sediment | Nutrients |
| **Cropland** | | | | | | | |
| Crop to grass/CRP | x | | | | x | x | x |
| Cover crop | x | x | | | | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Small grains rotation* | x | x | | x | | x | x |
| Irrigation management | x | x | | | | x | x |
| No-till farming | | x | x | | | x | x |
| Nutrient management | x | x | | | | | x |
| Soil sampling* | x | | | | | | x |
| Contour farming* | | x | x | | | x | x |
| **Livestock** | | | | | | | |
| Manure application management | x | x | | x | | | x |
| Reduced nutrients in feed* | x | | | | | | x |
| Grazing management - rotational grazing | x | x | | x | | x | x |
| Onsite waste water/runoff management system* | x | x | x | x | | x | x |
| Livestock Exclusion | x | | | x | | x | x |
| Waste storage facility* | x | | | x | | | x |
| Composting facility* | x | | | x | | | x |
| **Other** | | | | | | | |
| Riparian buffer | | x | x | x | x | x | x |
| Saturated buffers | | x | x | x | x | x | x |
| Soil Health Management | x | | | x | | x | x |

*Source: ACT criteria not reported in Nebraska State Nonpoint Source Management Plan

LCNRD also participated in the vadose zone monitoring project (http://nebraskavadose.unl.edu/ ). The Bazile WHP Vadose Zone Final Report (2023) compared samples taken in the Creighton WHPAs and observed an increase. The report demonstrated that nitrates have a unique isotopes that identify origins. Most nitrates in groundwater are associated with organic and inorganic fertilizers. Total nitrate in the vadose zone was highest under irrigated corn and irrigated corn/soybean fields. The report also stated water and nitrate transport rates may be up to 7 feet/year in some wellhead protection areas with sand-rich soils and vadose zone sediments. Nitrate changes in the district are variable. Some wells have had a decrease in nitrate levels showing there is a path to positively impact groundwater nitrate levels with management practices.

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

This project allows for the cost-share of conservation technology and land practices identified in the Water Quality Management Plan and Bazile Groundwater Management Area & Bow Creek PIPs.

Conservation technology will be focused on irrigation management with practices such as variable rate irrigation, soil moisture sensors, fertigation, flow meters with telemetry. Conservation land management practices will be focused on adding a third crop in rotation, alternative cash crops, and converting irrigated cropland to a perennial system with optional grazing.

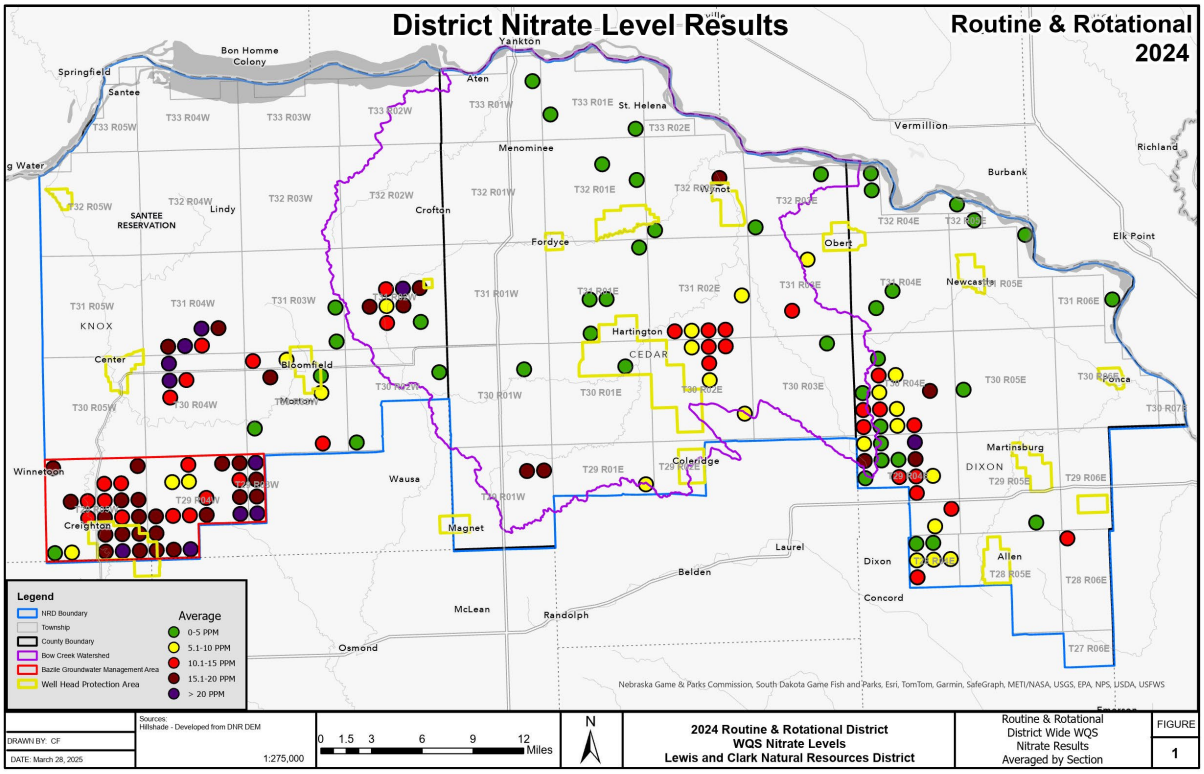
Priority focus areas for this project are the designated Phase III Groundwater Management Area, the Bazile Groundwater Management Area (BGMA); surface water priority area, the Bow Creek Watershed Project (BCWP) area; and the district Wellhead Protection Areas (WHPAs). See Map 1 of LCNRD, including boundaries for the BGMA, BCWP, and district WHPAs along with nitrate concentrations from irrigation wells. The focus areas are designated for two reasons, to facilitate impact to groundwater and surface water resources in the areas where there is established priority due to current uses and or conditions, and to allow for continued work with producers who are familiar with the conservation areas.

Producers across the state have different needs and have different experience levels when adopting/changing conservation practices. NRCS funding does not meet all local and priority area demand/need for high priority practices. NSWCP funding will be used to fill some of that gap, however a large number of practices will remain unfunded. In addition to limited NRCS funding there are some practices that are daunting to complete with NRCS funding and we are also looking to minimize that impact by providing an alternative funding source. Regardless of funding all practices will be implemented to NRCS conservation standards.

LCNRD anticipates the following practices will be implemented: twenty-four moisture sensor systems, fifty flow meters with telemetry, eight fertigation system installations, eight pivot technology upgrades, conservation crop rotations and the addition of a third cash crop on 240 acres, and the establishment of a perennial system on one 40-acre field for a 5-year duration.

Phase II and III areas will be prioritized for education and outreach as those have been identified as high nitrate areas within the district. This includes all or parts of two townships within the Bazille GMA that lie within the LCNRD. Producers in the Bow Creek Watershed Project and WHPA will also be prioritized for outreach and education.

Map 1: 2024 District Nitrate Level Results (routine and rotational), BGMA Boundary, BCWP Boundary, and WHPA Boundaries.




Data will be collected (whenever possible) using the Producer Connect reporting program that was developed with the software company Longitude 103 as part of a WSF grant sponsored by the Nebraska Association of Resource District in 2023. Summary data will be shared based on our Integrated Management Plan (IMP) ensuring information can be used across the district and the state. This allows us to create and implement effective data collection, reporting and management.

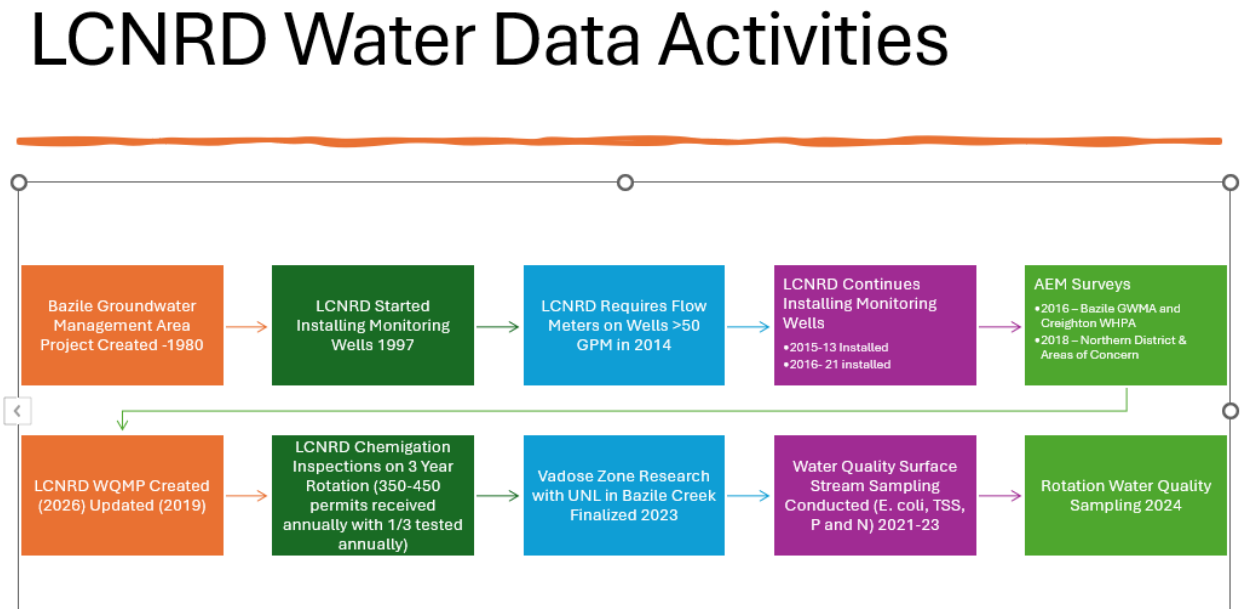
The chart below outlines the anticipated expenses for the cost-share program. Anything beyond the total cost-share will be covered by the producer representing an in-kind contribution not reflected in the project budget. Once installation is complete, the producer will be required to report yearly ground water pumped at the end of the growing season.

Chart 2: Project Expenses

| Activities | 2025 | | 2026 | | | | 2027 | | | | 2028 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Total |
| Promote Cost-share Program | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 9,000 |
| Install Moisture Senstors | | | | $ 10,830 | | | | $ 10,830 | | | | $ 10,830 | $ 32,490 |
| Install flowmeters with telemetry | | | | $ 22,500 | | | | $ 45,000 | | | | $ 45,000 | $ 112,500 |
| Contract for telemetry data service | | | | $ 4,050 | | | | $ 8,100 | | | | $ 8,100 | $ 20,250 |
| Install Chemigation/Fertigation Systems | | | | $ 2,700 | | | | $ 4,050 | | | | $ 4,050 | $ 10,800 |
| Install VRI technology on Pivots | | | | $105,000 | | | | $157,500 | | | | $ 157,500 | $ 420,000 |
| Contract for Conseravtion Crop Rotation ( small grain) | | | | $ 3,247 | | | | $ 3,247 | | | | $ 3,247 | $ 9,742 |
| Alternative Cash Crop -3rd in Rotation | | | | $ 9,000 | | | | $ 9,000 | | | | $ 9,000 | $ 27,000 |
| Demo Farm - Perennial Conversion | | | | $ 30,000 | | | | $ 30,000 | | | | $ 30,000 | $ 90,000 |
| | | | | $190,327 | | | | $270,727 | | | | $ 270,727 | $ 731,782 |

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

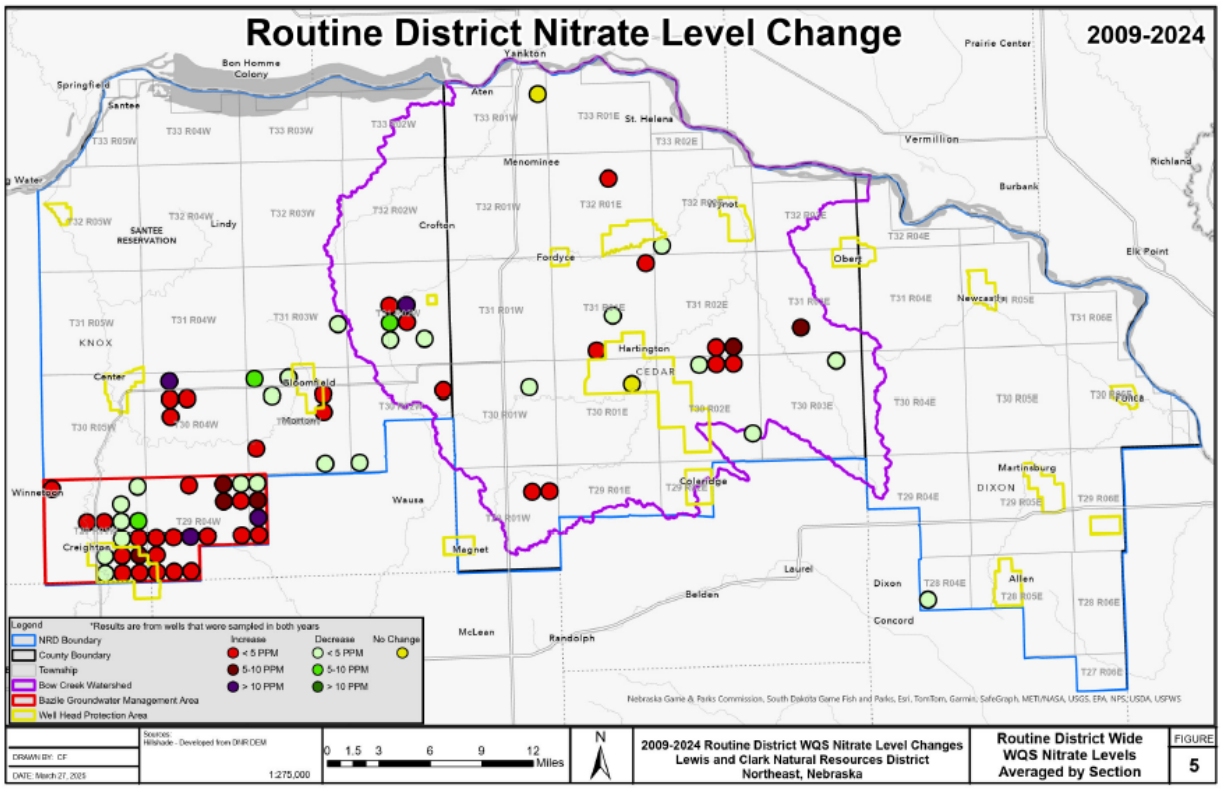
LCNRD has been actively managing for both water quality and quantity since it's inception in 1972. Many activities have provided water quality data within the district.




Local water quality data along with the WQMP and NDEE/EPA Project Implementation Plans from Bazile Groundwater Management Area Project and Bow Creek Watershed Project were used to substantiate this plan.

As seen in the Map 4 below, the groundwater quality monitoring program in LCNRD has detected an overall increase in concentrations of nitrate-nitrogen in areas of the local aquifer. This is in close proximity to a number of WHPAs including Creighton, Hartington and Bloomfield as well as many private drinking water wells. This project will put in place the Best Management Practices identified in the WQMP that will help to slow or reverse these trends of increasing concentrations of nitrate-nitrogen in the drinking water supply and determine which practices are the most effective.

Map 4: Routine District Nitrate Level Change 2009-2024 by Section Average

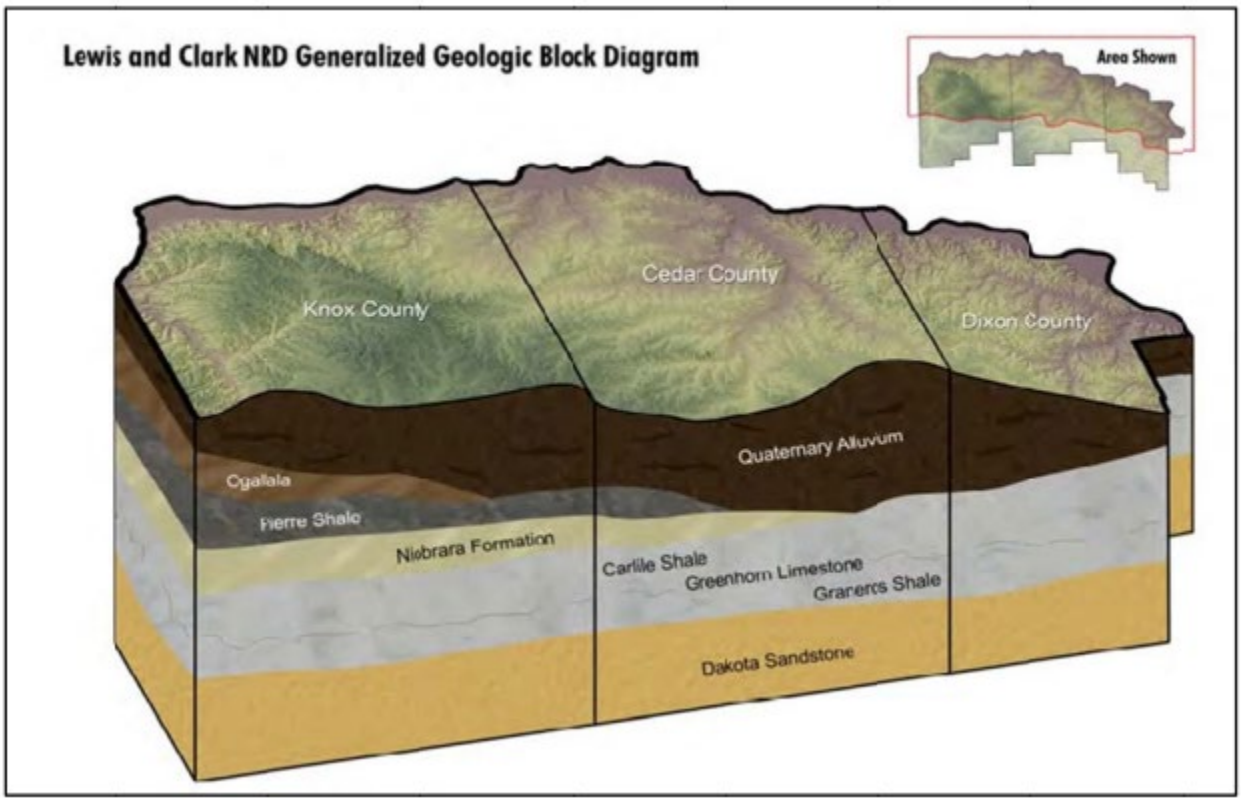



During the development of the [LCNRD Water Quality Management Plan,](#) FYRA Engineering used modeling to identify target areas and best management practices most applicable to groundwater and surface water concerns. A detailed explanation of the process can be found in Chapter 5 of the LCNRD WQMP. The model is spreadsheet-based, utilizing concepts of the Simple Method (Schueler, 1987) and the Spreadsheet Tool for Estimating Pollutant Load (STEPL) (Tetra Tech, 2011). The model predicts annual average runoff and groundwater/baseflow volumes, and the associated pollutant loads are estimated from predicted flow volumes and land use based runoff and groundwater pollutant concentrations. Erosion and sediment-associated pollutant concentrations are also simulated and included in the pollutant load predictions. Bacteria predictions consider travel time and die-off variables to account for natural reductions in concentrations that occur during transport.

The LCNRD 2014 Groundwater Management Plan has six designated sub-areas that are considered geologically/hydrogeologically different. The sub-areas necessitate different methods of management and permitting to effectively monitor and manage groundwater resources in an area that is highly variable and complex due to the way geologic units were laid down and subsequently eroded by glaciers (Map 2 LCNRD Generalized Geologic Block Diagram). A different class of water well permit is issued

based on the sub-area of the intended well. The six designated sub-areas are: Niobrara Chalk Bedrock Reservoir, Dakota Sandstone Bedrock Reservoir, Area of Limited Aquifer Development Potential, Remaining Areas, Missouri River Groundwater Reservoir, and Community Water System Protest Areas.

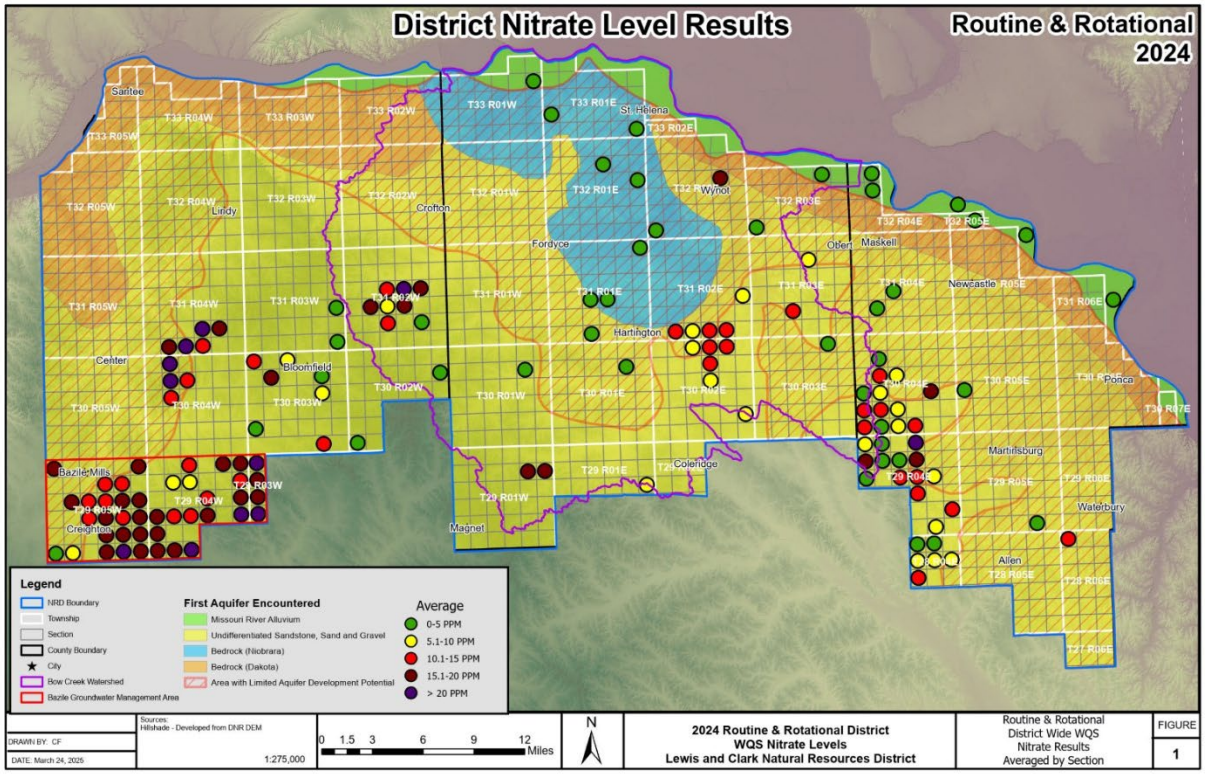
Map 2: LCNRD Generalized Geologic Block Diagram




Groundwater extraction data in LCNRD is currently limited. LCNRD is currently obtaining groundwater extraction data from only 200 metered irrigation wells out of a total of 1,674 active irrigation wells in the district. The majority of producers are using an outdated method of multiplying pumping capacity in gallons per minute by the time pumped. Data collected in LCNRD Phase III area has exhibited that over irrigation can increase nitrate leaching. Map 3 indicates current nitrate levels throughout the district.

Nitrate levels are highly variable ranging from 3 ppm to >20 PPM throughout the Phase III area. Map 3 shows the concentration of current irrigation wells throughout the LCNRD. With the variability of geology/hydrogeology and land management increasing data collection points will provide more date for sound decision making.

Map 3: District Nitrate Levels 2024




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

This project works only with landowners or operators who have control of the land, no water or land rights are required to implement this project.

### 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).

With 16 WHPAs and many private wells used for drinking water within LCNRD any practice that decrease nutrient leaching will have a beneficial effect. The town of Creighton located in the SW corner of LCNRD has already installed a reverse osmosis system at a cost of over $1 million dollars due to high concentrations of nitrate-nitrogen. Bloomfield and Hartington WHPAs show the potential for increased nitrate-nitrogen. This project will provide more water quality data to support better decision making in WHPAs that will protect public drinking water systems. Implementing and management practices that reduce nitrogen leaching will also positively impact public drinking water systems.

With increased adoption of a series of BMPs in the watershed and an increase in irrigation water management efficiency, it is anticipated that soil health measures will

increase. These measures include, but are not limited to, increased water infiltration rates, reduced water erosion rates, and increased water and nutrient holding capacity of the soil. Each one of these measurements will positively impact existing private dam and stock pond structures in the watershed. Although not structural, the sixteen wellhead protection areas will also benefit from the decreased risk of nitrate leaching. LCNRD has four community water systems and 920 rural customers. These water systems provide drinking water to 2500 full-time residents and 4000-6000 seasonal users.

Each acre that receives conservation treatments will increase stable soil aggregates. Stable soil aggregates retain the soil pore space needed for quick water infiltration which reduces the amount of water running off. Nutrients and bacteria attached to soil particles are transported to surface water bodies in water runoff causing nonpoint source pollution. While increasing stable soil aggregates, BMPs also increase soil organic matter. A one percent increase in soil organic matter can increase the water holding capacity of an acre by as much as 20,000 to 22,000 gallons. If a one percent increase in soil organic matter can be realized on 10,258 acres targeted for practice incentives it would total 225,676,000 gallons. Keeping this water from washing down the watershed decreases flooding, and reduces sedimentation in streams, dams, and terraces. It also decreases the likelihood of high nutrient levels in streams and livestock ponds that can be detrimental to aquatic life and livestock.

Increasing soil organic matter content of the soil also increases the soil's ability to hold nutrients, keeping them from leaching into groundwater. The ability to hold nutrients is referred to as a soil's cation exchange capacity (CEC). The CEC of a soil is expressed in cmol/kg (centimol positive charge per kg of soil). Sandy soils have low CEC, generally in the range of 3-5 $cmol_c$/kg, while clay soils have higher CEC in the range of 30-50 $cmol_c$/kg. Soil humus typically has a much greater CEC, ranging from 150-250 $cmol_c$/kg. When increasing the CEC of a soil the anion exchange capacity is also increased. Anions include nitrates (NO3-) that can negatively impact public drinking water when leached to the water table. This project may prevent small rural water systems from needing additional treatment options for nitrates such as Reverse Osmosis (RO) systems which can cost in the millions of dollars to install and operate.

## **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.

Chart 3: Total Project Costs

| Costs | | | | | |
|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total |
| Program Promotion | $ 9,000 | | | | 9000 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 |
| Flow Meter w telematry Equipment (75% of $3,000=$2250) | $ 3,000 | 0.75 | $ 2,250 | 50 | $ 112,500 |
| Telemetry Data Costs for Flow Meters (($180 per yearx3 yr) @75% is $405 | $ 540 | 0.75 | $ 405 | 50 | $ 20,250 |
| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 |
| Alternative Cash Crop - 3rd in rotation (80 acres x$150x75% | $ 150 | 0.75 | $ 113 | 240 | $ 27,000 |
| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 |
| | | | | Total | $ 731,782 |

Chart 4: Next Best Alternative Costs

| Next Best Alternative Costs | | | |
|---|---|---|---|
| Alternative Method | Number | Cost Each | Total Coat |
| Perennial Systems Conversion (in acres) (@ $250 per acre for 3 years) | 10,258 | $750 | $ 7,693,500 |
| Evapotransporation Eddy Covariance Method (each) | 50 | $50,000 | $ 2,500,000 |
| | | | $10,193,500 |

The next best alternative to reduce erosion and nitrate leaching would be to plant irrigated cropland into perennial grass or enroll it in the USDA Conservation Reserve Program (CRP). While this is currently an option it has low adoption rates. Idling crop ground in a large portion of the NRD would also have negative impacts on local communities. Allowing grazing on the perennial system would be needed to sustain rural vitality.

In Dixon County there are currently 317 active CRP contracts with acres totaling 10,949 acres, in Cedar County there are 10,747 acres enrolled, and in Knox County there are 237 CRP contracts enrolling 7,879 acres. According to a UNL Center for Ag Profitability 2025 survey (https://cap.unl.edu/realestate/) the average cash rental rates for northeast Nebraska were $365 per acre for center pivot irrigated cropland, $325 per acre for gravity irrigated cropland, $250 per acre for dryland cropland and $77 per acre for pasture. Land values for center pivot irrigated cropland was $11,970 per acre, for gravity irrigated cropland $9,810 per acre, dryland cropland with irrigation potential was $9,425 per acre, dryland cropland without irrigation potential was $7,740 per acre, and tillable grazing land was $4,385 per acre. To convert from center pivot irrigated cropland to tallageable grazing land results in a -$7,585 land value change. No farm can sustain that kind of decreased value. Likewise, USDA 2024 ([https://www.fsa.usda.gov/resources/programs/conservation-reserve-program/statistics/2024-county-average-ssrs](https://www.fsa.usda.gov/resources/programs/conservation-reserve-program/statistics/2024-county-average-ssrs) ) county average payments for CRP in Cedar County were $250 per acre, Knox County was $207 per acre and Dixon County was $233 per acre, all below the 2025 average rental rate for irrigated cropland. In order

to increase adoption rates of grass or CRP the incentive payment would need to be higher than the opportunity costs associated with pivot irrigated cropland.

With a goal of 10,258 acres treated with BMPs it would cost $7,693,5,00 to offer CRP/Perennial Grass payments to improve water quality based on Cedar County average payments. It is not reasonable to believe this payment rate would be enough to convince landowners to enroll their irrigated cropland into perennial systems so that per acre payment rate would need to be increased significantly or mandated. That would not solve the problem of limited and uncertain groundwater data.

Collecting accurate groundwater usage during a single growing season is difficult to estimate without a reliable form of measurement. The current forms of manual measurement are multiplying pumping compacity in gallons per minute by the total running time pumped within a growing season or estimating water use through electrical usage records. These methods can be highly inaccurate and unreliable forms of data collection since flow rates of irrigation wells can fluctuate significantly throughout the growing season resulting in inaccurate calculations. The LCNRD irrigation season demands are localized to specific areas of the district and accurate flow information is needed to fully understand the complex hydrogeologic factors that impact flow.

At this time LCNRD is only monitoring groundwater extraction at 16% of the total irrigation wells district wide leaving large data gaps across a very diverse hydrogeologic area. The priority area of the BGMA has a total of 150 active irrigation wells, but only 20 (or 13%) of them are metered at this time which provides limited extraction data to the district.  This proposal would add at least 25 flow meters with remote telemetry to the BGMA increasing the number of metered irrigation wells to 45 out of 150 (or 30%) that would be metered – more than half with telemetry.

Our current reported data measurements do not account for in-season fluctuations in pumping rates and result in inaccurate data. LCNRD currently only has flow meters on 16% of irrigation wells. Permanently installed totalizing flow meters with telemetry are the best method to quantify groundwater extraction and are the most affordable and reliable alternative for the district. Telemetry-enabled meters and soil moisture sensors will also provide real-time irrigation data to farmers on to allow them to match irrigation event to crop water use demands.

The next best option to estimate real time irrigation water use would be to use Eddy Covariance Systems. These systems can cost $50,000 –70,000 each. To install fifty of these systems would cost $2,500,000 compared to the cost of $165,240 for 50 flowmeters and 24 soil moisture sensors.

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).

LCNRD plans to implement conservation technology and land management practices with district producers. Some producers may choose to implement more than one practice with complimentary telemetry or computer based programming to improve management of their acres. A cost-share program will provide up to 75% of the costs for practice implementation, equipment, and/or technology costs. Any expenses over the 75% cost-share will be the responsibility of the producer and is not included in this application. A funding cap per producer will facilitate meaningful implementation for producers looking to address needs with interconnected technology while making funds available to a sizeable number of participants. The identified practices are as follows:

1. Soil Moisture Sensors – telemetry based if utilized as a single practice,
2. Flow Meters – telemetry based if utilized as a single practice,
3. Variable Rate Technology upgrades,
4. Chemigation/Fertigation equipment installation,
5. Conservation crop rotation with third crop in rotation,
6. Alternative cash crops, and
7. One demonstration farm under irrigation to be planted to a perennial system that is monitored for nitrate change. Must agree to utilize one other practice on field the same size as demonstration acres under that pivot.

Soil Moisture Sensors provide real time soil moisture evaluation to the total rooting depth allowing for irrigation management decisions to be made that utilize water when it is most efficient for crops and facilitates improved nitrogen management. Cost associated with soil moisture sensors include equipment at $1805 and it is anticipated 24 sensors will be installed. With a cost-share of 75% the project will pay $1,354 each for a total cost of $32,496. Other projects report soil moisture sensors paired with other practices can reduce close to 1 inch of water per acre. On the 240 acres targeted for soil moisture sensors, at a pumping cost of $10 per inch, it would save producers $2,400. Reducing the amount of irrigation water pumped will reduce aquifer depletion.

This project will fund the purchase and installation of 50 irrigation flow meters for a total project cost of $125,000. Flow meters with telemetry will increase groundwater use data confidence and provide real-time data to farmers and LCNRD.

Fertigation systems could potentially save farmers $53,200 and reduce nitrogen applied by 53,200 pounds. This calculation is based on a USDA NRCS publication stating fertigation could reduce 50 pounds per acre. At $1 per pound

on 1064 acres that fertigation systems would be implemented on would equate to $53,200 in savings to farmers.

The benefit from VRI will come in the reduction of nitrate leaching into groundwater. This is hard to calculate. However if targeted VRI systems in sections with the highest nitrate PPM levels could prevent the need for our two most vulnerable communities from needing to install RO systems it would save over $5.7 million. If targeted practices could prevent one household in the sections with nitrate over 10 PPM from needing to install an RO system (at a cost of $750 each) that would save 75 homes from needing to install RO systems, saving over $56,000.

Conservation crop rotation, adding a third crop to the rotation, and converting to perennial systems helps build soil structure and soil organic matter. Again, the benefit comes from environmental impacts and is hard to put into dollars. Increasing SOM by 1% can increase water holding capacity by 20,000-22,000 gallons of water which can help to reduce erosion and flooding. Increasing small grains in the rotation can increase wildlife habitat and reduce nonpoint source pollution entering the streams.

| Costs | | | | | |
|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total |
| Program Promotion | $ 9,000 | | | | 9000 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 |
| Flow Meter w telematry Equipment (75% of $3,000=$2250) | $ 3,000 | 0.75 | $ 2,250 | 50 | $ 112,500 |
| Telemetry Data Costs for Flow Meters (($180 per yearx3 yr) @75% is $405 | $ 540 | 0.75 | $ 405 | 50 | $ 20,250 |
| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 |
| Alternative Cash Crop - 3rd in rotation (80 acres x$150x75% | $ 150 | 0.75 | $ 113 | 240 | $ 27,000 |
| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 |
| | | | | Total | $ 731,782 |

| Benefits Calculation | | | |
|---|---|---|---|
| Reduced Pumping Costs Due To Soil Moisture Sensors | 240 | $ 10 | $ 2,400 |
| Reduced need for RO systems for two Communities ($1.3 million x 2.2 for inflation = $2,860,000) | 2 | $ 2,860,000 | $ 5,720,000 |
| Reduced cost for Home RO Systems (based on 1 home per section with ppm test over 10 PPM) | 75 | $ 750 | $ 56,250 |
| Cost Saveings to farmer for reducing 50# Nitrogen applied at $1/# | 1064 | $ 50 | $ 53,200 |
| | | | $ 5,831,850 |

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)

This project will have no engineering, inspection, or construction costs.

The project will offer cost-share on conservation technologies and land management practices as outlined in the chart below. In addition to cost-share the program would support the program with a demo farm converting from irrigated cropland to a 5-year

perennial system. Education and outreach to producers to support their adoption of conservation practices is estimated at $3,000 per year. This will include workshops, field days, and in-person visit and other promotional activities.

Total program costs estimate is $731,782.

Chart 3: Total Project Costs

| Costs | | | | | |
|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total |
| Program Promotion | $ 9,000 | | | | 9000 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 |
| Flow Meter w telematry Equipment (75% of $3,000=$2250) | $ 3,000 | 0.75 | $ 2,250 | 50 | $ 112,500 |
| Telemetry Data Costs for Flow Meters (($180 per yearx3 yr) @75% is $405 | $ 540 | 0.75 | $ 405 | 50 | $ 20,250 |
| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 |
| Alternative Cash Crop - 3rd in rotation (80 acres x$150x75% | $ 150 | 0.75 | $ 113 | 240 | $ 27,000 |
| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 |
| | | | | Total | $ 731,782 |

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).

This project will increase water sustainability across the LCNRD and enhance data reliability and accuracy. Data will be shared to help ensure consistency with other NRD's and state agencies. Accurate groundwater extraction collection will improve groundwater management across our district. This will allow for accurate and manageable programs designed to reduce aquifer depletion and increased streamflow. Meters with telemetry are the most accurate method of data collection for groundwater extraction and the most efficient way to collect and deliver the data to irrigators for irrigation water management. When accurate irrigation water measurement is used for on-farm water management, irrigated producers will experience average cost-savings of due reduced pumping costs compared to historical pumping levels

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).

| Activities | 2025 | | 2026 | | | | 2027 | | | | 2028 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Total |
| Promote Cost-share Program | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 750 | $ 9,000 |
| Install Moisture Senstors | | | | $ 10,830 | | | | $ 10,830 | | | | $ 10,830 | $ 32,490 |
| Install flowmeters with telemetry | | | | $ 22,500 | | | | $ 45,000 | | | | $ 45,000 | $ 112,500 |
| Contract for telemetry data service | | | | $ 4,050 | | | | $ 8,100 | | | | $ 8,100 | $ 20,250 |
| Install Chemigation/Fertigation Systems | | | | $ 2,700 | | | | $ 4,050 | | | | $ 4,050 | $ 10,800 |
| Install VRI technology on Pivots | | | | $105,000 | | | | $157,500 | | | | $ 157,500 | $ 420,000 |
| Contract for Conseravtion Crop Rotation ( small grain) | | | | $ 3,247 | | | | $ 3,247 | | | | $ 3,247 | $ 9,742 |
| Alternative Cash Crop -3rd in Rotation | | | | $ 9,000 | | | | $ 9,000 | | | | $ 9,000 | $ 27,000 |
| Demo Farm - Perennial Conversion | | | | $ 30,000 | | | | $ 30,000 | | | | $ 30,000 | $ 90,000 |
| | | | | **$190,327** | | | | **$270,727** | | | | **$ 270,727** | **$ 731,782** |

| Benefits Calculation By Year | Year 1 | Year 3 | Year 3 | Total |
|---|---|---|---|---|
| Reduced Pumping Costs Due To Soil Moisture Sensors | $ 800 | $ 800 | $ 800 | $ 2,400 |
| Reduced need for RO systems for two Communities ($1.3 million x 2.2 for inflation = $2,860,000) | | | $ 5,720,000 | $ 5,720,000 |
| Reduced cost for Home RO Systems (based on 1 home per section with ppm test over 10 PPM) | | | $ 56,250 | $ 56,250 |
| Cost Saveings to farmer for reducing 50# Nitrogen applied at $1/# | $ 17,733 | $ 17,733 | $ 17,733 | $ 53,200 |
| | | | | **$ 11,663,700** |

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.)

With a goal of 10,258 acres treated with BMPs it would cost $7,693,500 to offer CRP/Perennial Grass payments to improve water quality based on Cedar County average payments of $250/acre. It is not reasonable to believe this payment rate would be enough to convince landowners to enroll their irrigated cropland into perennial systems so that per acre payment rate would need to be increased significantly or mandated. Mandating perennial systems would harm the relationships with farmers the LCNRD relies on and would not solve the problem of limited and uncertain groundwater data.

Our Phase III report data indicates that over-irrigation increases costs with no increase in yield or production. Estimating groundwater usage is common, but very inaccurate. Alternatives to directly measuring the actual water pumped would be directly measuring the evapotranspiration (ET) from various land cover types within the district. Measuring actual ET can be very costly using equipment that can apply the Eddy Covariance Method and is only +/- 20% accurate, at best. Such instruments and equipment can cost up to $50,000 apiece and measuring the various crop types and geography across our district would require many systems. By installing flow meters and soil moisture sensors with telemetry on irrigation wells, agricultural producers will become more aware of their water uses and become more efficient in their operations.

Additionally, in periods of drought, flow meters are a necessary tool for effective groundwater management through the implementation of groundwater allocations.

| Costs | | | | | |
|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total |
| Program Promotion | $ 9,000 | | | | 9000 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 |
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| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 |
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| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 |
| | | | | Total | $ 731,782 |

| Next Best Alternative Costs | | | |
|---|---|---|---|
| Alternative Method | Number | Cost Each | Total Coat |
| Perennial Systems Conversion (in acres) (@ $250 per acre for 3 years) | 10,258 | $750 | $ 7,693,500 |
| Evapotransporation Eddy Covariance Method (each) | 50 | $50,000 | $ 2,500,000 |
| | | | $10,193,500 |

## 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. Click here to enter text.

LCNRD has budgeted funds to cover the 40% cost share. 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). Click here to enter text.

LCNRD's budget comes from a mill levy assessed to property values. The budget is set on a yearly basis and has increased over the last couple of years. A portion of the budget has been allocated to ensure there is sufficient funding to cover LCNRD's 40%.

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.).

LCNRD works closely with NRCS and the Nebraska Game and Parks Commission to ensure environmental impacts are beneficial to the natural environment. As part of Best Management Practices (BMP) implementation producers are required to follow guidelines and recommendations from NRCS and NGPC.

Conservation crop rotation, perennial systems, and growing alternative crops, all help improve or expand habitat for upland gamebirds and other wildlife. Increasing plant diversity has a cascading effect on soil biology diversity as well as above ground biological diversity. Expanded crop rotations that include different flowering plant species attract and provide resources for different insects and pollinators. Migratory birds can find a plethora of seeds in perennial systems. Other wildlife benefits from stockpiled perennial grasses include increased cover, nesting and food resources.

Flow meters and other irrigation equipment updates will be installed at existing irrigation well locations. These areas are generally already disturbed as cropland. There will be no additional environmental disruption from the installation of flow meters.

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

NRDs were created to address natural resources issues such as flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues in 1972 by Legislative Bill (LB) 1357. LCNRD's responsibility of stewarding water resources is a high priority. LCNRD has been implementing a Groundwater Management Plan since 1986 and groundwater rules and regulations for quality since 2004 and for quantity since 2014. The district has both a Water Quality Management Plan (adopted in 2019) and a Voluntary Integrated Management Plan (adopted in 2016 and updated in 2019).

Nebraska's NRDs are involved in a wide variety of projects and programs to conserve and protect the state's natural resources. Water management responsibilities for NRDs are outlined under Nebraska State Law. These responsibilities pertain to human health and safety, resource protection, and enhancement and recreation. Specific NRD responsibilities related to water management and the WQMP are listed below:

1. Erosion Prevention and Control,
2. Prevention of Damages from Floodwater and Sediment,
3. Flood Prevention and Control,
4. Soil Conservation,
5. Water Supply for any Beneficial Use,
6. Development, Management, Utilization & Conservation of Ground & Surface Water,
7. Pollution Control,
8. Solid Waste Management,

9. Drainage Improvement and Channel Rectification,
10. Development and Management of Recreational and Park Facilities,
11. Forestry and Range Management,
12. Development and Management of Fish and Wildlife Habitat.

The Lewis and Clark Natural Resources District (LCNRD) includes the eastern half of Knox County and the northern three-fourths of Cedar and Dixon Counties.

NRDs are responsible for maintaining groundwater quality and quantity for municipal, domestic, and agricultural uses (Nebraska State Statute Chapter 2 Article 32 and Nebraska Groundwater Protection Act Chapter 46 Article 7). The NRD staff members have local knowledge of the area and groundwater resources. Annette Sudbeck, Myles Lammers, Dustin Weinandt, Cole Fiedler, Reed Trenhaile, and Becky Ravenkamp are all staff members of the LCNRD and many are licensed Natural Resources Groundwater Technicians. Lisa Lauver is the Bazile Groundwater Management Area Project Coordinator located in the LENRD Office in Norfolk.

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

   This project is being implemented to ensure the requirements in the LCNRD Integrated Management Plan (IMP) and the Groundwater Management Plan (GMP) are being met. Interest in this monitoring project and data collection is a response to numerous objectives and actions in various management plans. We will be analyzing and sharing all data through other state agencies.

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

11. Identify how you possess all necessary authority to undertake or participate in the project. Click here to enter text.

    NRDs were created to address natural resources issues such as flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues in 1972 by Legislative Bill (LB) 1357.

    Nebraska's NRDs are involved in a wide variety of projects and programs to conserve and protect the state's natural resources. Water management responsibilities for NRDs are outlined under Nebraska State Law. These responsibilities pertain to human health and safety, resource protection,

and enhancement and recreation. Specific NRD responsibilities related to water management and the WQMP are listed below:

- Erosion Prevention and Control,
- Prevention of Damages from Floodwater and Sediment,
- Flood Prevention and Control,
- Soil Conservation,
- Water Supply for any Beneficial Use,
- Development, Management, Utilization & Conservation of Ground & Surface Water,
- Pollution Control,
- Solid Waste Management,
- Drainage Improvement and Channel Rectification,
- Development and Management of Recreational and Park Facilities,
- Forestry and Range Management,
- Development and Management of Fish and Wildlife Habitat.

The Lewis and Clark Natural Resources District (LCNRD) includes the eastern half of Knox County and the northern three-fourths of Cedar and Dixon Counties.

NRDs are responsible for maintaining groundwater quality and quantity for municipal, domestic, and agricultural uses (Nebraska State Statute Chapter 2 Article 32 and Nebraska Groundwater Protection Act Chapter 46 Article 7). The NRD staff members have local knowledge of the area and groundwater resources. Annette Sudbeck, Myles Lammer, Dustin Weinandt, Cole Fiedler, Reed Trenhaile, and Becky Ravenkamp are all staff members of the LCNRD and many are licensed Natural Resources Groundwater Technicians. Lisa Lauver is the Bazile Groundwater Management Area Project Coordinator located in the LENRD Office

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

Environmental and ecologic benefits of increased irrigation efficiency would reduce aquifer depletion and increase streamflow.

Through a substantial increase in reliable data and effective management, positive effects will include a reduction in over-irrigation and an increase in groundwater stored in the local aquifer. Additional improvements will be wetland and stream hydrology and their related habitats.

Through accurate water use across the district, the LCNRD will be able to manage groundwater use in an effective manner that achieves and sustains water quality and water quantity. This will provide environmental benefits throughout LCNRD, including but not limited to plant and animal habitat conservation and preservation, and increased quality for human consumption, and utilization.

Improved pivot technology and the adoption of best management practices will have environmental and ecological benefits. Producers will be able to more effectively irrigate crops to reduce both runoff and nitrate leaching. BMPs such as crop rotations and growing alternative cash crops will keep the soil covered reducing runoff potential, increase living roots in the soil to prevent nitrate leaching, increase soil organic matter that can hold more water and nutrients in the soil profile, and provide a diverse habitat for wildlife.

Ecosystem functioning, in the form of the water cycle, nutrient cycle, and biological communities, will improve as a result of this project.

The water cycle will benefit from conservation crop rotations, irrigation management, nutrient management and alternative cash crops. These practices allow the biological processes that build stable aggregates to take place. By increasing stable soil aggregates the pore space in the soil increases and allows more water to infiltrate. At the same time increasing crop plant diversity and plant growth patterns will protect the soil surface from raindrop impact that dislodges soil particles and washes them into waterbodies. Protecting the soil from the sun's rays will also decrease evaporation making water more available for crops or perennial grass growth. As soil aggregates increase, soil organic matter will also increase. A 1% increase in soil organic matter can increase water holding capacity of an acre by 20,000-22,000 gallons. An increase in water holding capacity can decrease the need for irrigation water, thus improving aquifer recharge.

The nutrient cycle is improved by the same practices as the water cycle. With an increase in soil organic matter, nutrient holding capacity also increases. Nutrient holding capacity is measured in cation exchange capacity. Sandy soils have an average cation exchange capacity of around 3-5 $cmol_c$/kg, clay soils have an average cation exchange capacity of around 30-50 $cmol_c$/kg, but soil humus can have cation exchange capacity of 150-250 $cmol_c$/kg. Increasing the soil's ability to hold cations and water (including water soluble nitrates) in the root zone will allow plants to use those nutrients before they have a chance to leach into the groundwater of the 16 wellhead protection areas within the project area.

Biological communities at many levels will benefit from this project. The increased carbon in soil feeds soil microbes that drive healthy water and nutrient cycles. Bacteria that associate with legume and grass plants to fix atmospheric nitrogen and fungal hyphae networks that extend the plant's root reach are often more populous in soils managed under BMPs. Diverse plant communities found in perennial systems provide different pollen and nectar sources for pollinators as well as food

and cover for upland gamebirds and a variety of other wildlife species. Increased water quality may have a positive impact on native fish species.

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 to 6 for items (1) - (9); and 0 to 3 for items (10) - (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 72 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.

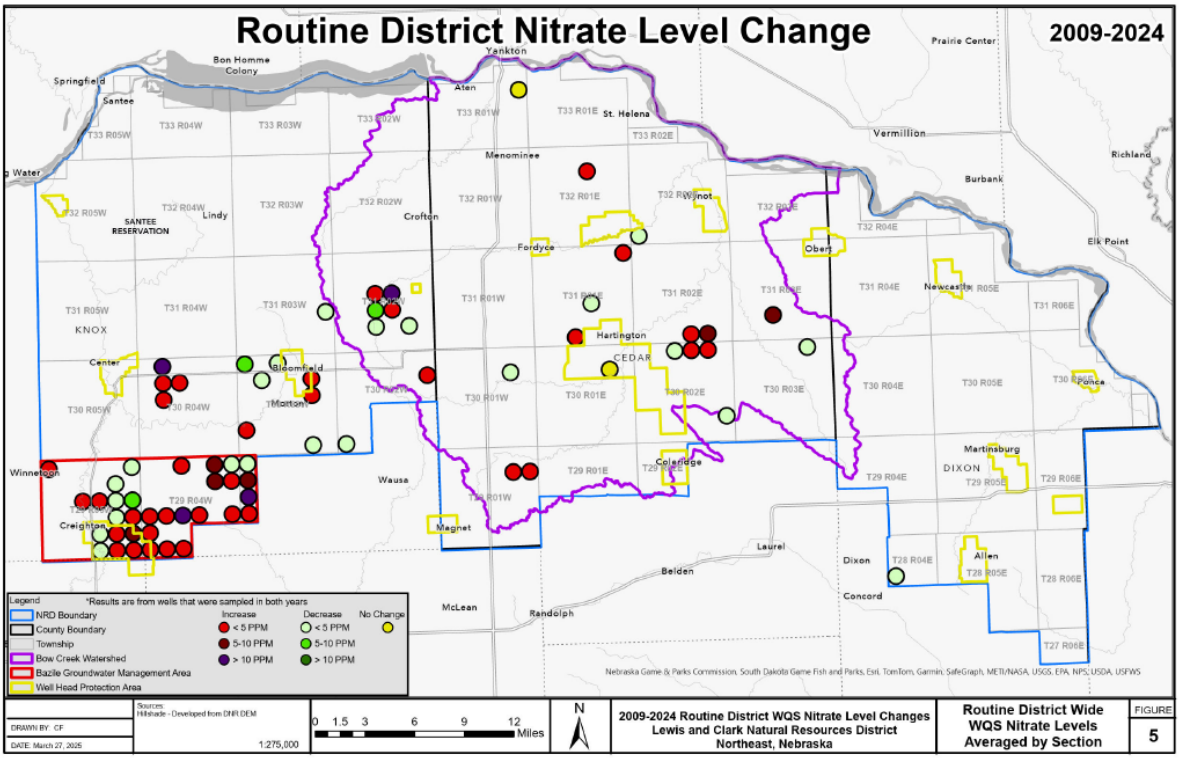
1. Remediates or mitigates threats to drinking water;

- 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.

Groundwater nitrate concentrations are a concern in Nebraska and have been a concern in areas of LCNRD. The southwestern portions of LCNRD have higher nitrate levels than have been observed in the remainder of the district. LCNRD has worked with other NRDs to establish the Bazile Groundwater Management Area (BGMA) to help address this concern which impacts public and private water supplies. LCNRD has been conducting routine nitrate sampling since the 1980s and has expanded sample locations throughout the district recently adopting a program to sample the majority of irrigation wells on a five (5) year rotation for the purpose of tracking nitrogen impacts in the district.

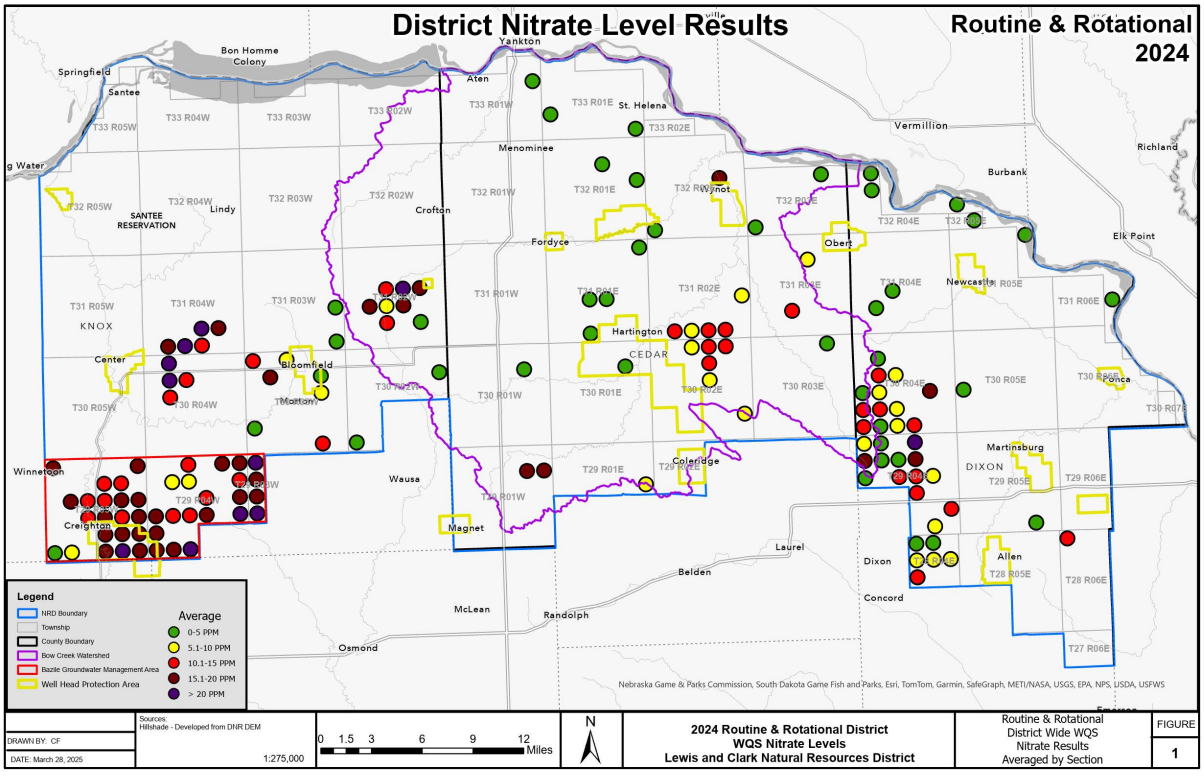
Nitrate sampling data for current WHPAs indicate levels are variable. In some areas nitrate levels are holding steady, other places there is a slight decline (Map 4). Bloomfield and Creighton WHPAs there are increasing. The Village of Allen is under an administrative order (AO) for exceeding the nitrate maximum contaminant level of 10 parts per million (ppm).

Map 4 Routine District Nitrate Level Change 2009 -2024



The focus area for the project includes the Well Head Protection Areas of communities in the district, the Bazile Groundwater Management Area (BGMA) and the Bow Creek Watershed Project (BCWP) area although all district acres have the potential to impact ground water and surface water in their own setting and will be eligible for to participate in the program with priority given to producers with property in the areas indicated previously. There are 16 Wellhead Protection Areas (WHPAs) in the Lewis & Clark Natural Resources District (LCNRD) surrounding public drinking supplies (Map 1). The City of Creighton serves 1094 people and is the only community in the LCNRD portion of the BGMA. Communities in the BCWP include Hartington, which serves 1436 people, the Village of Wynot serves 220 people, and Bow Valley Water Works serves 120 people. Also in the BCWP boundaries are the Village of Fordyce which serves 135 people, and Crofton which serves 754 people, and presently receive drinking water from the Cedar-Knox Rural Water Project. The Village of Fordyce and City of Crofton maintain the WHPAs for the previously used public supply wells however the WHPA does not provide their primary source of drinking water.

Map 1: 2024 District Nitrate Level Results (routine and rotational), BGMA Boundary, BCWP Boundary, and WHPA Boundaries.




Acres in WHPAs qualify for increased cost-share rates through USDA NRCS. The Bazile Groundwater Management Area has provided extra cost-share on NRCS practices and education outreach to BGMA producers for the NRCS approved practices.

Even with the increase in cost-share rates and outreach, BMP adoption rates are not sufficient to remove nitrate threats to drinking water. This is in part to limited USDA NRCS funding that cannot cover all applications and because some of the practices payments are not high enough to entice producers to implement the practice. This project will provide cost share for irrigation technology and land practices that show potential in the BGMA and throughout the district. The education and outreach component of this project will increase producers' knowledge and confidence to implement new technology and BMPs successfully, and will increase adoption in WHPAs.

Implementing a combination of BMPs, such as crop rotations, alternative cash crops and perennial systems, in WHPAs can increase soil organic matter. A 1% increase in soil organic matter can increase the water holding capacity of an acre by 20,000 - 22,000 gallons. By increasing the water holding capacity of the soil leaching of nitrates into groundwater can be reduced. Organic matter also increases the nutrient holding capacity of soils. Sandy soils have an average cation exchange capacity of around 3-5 $cmol_c/kg$ (centimol positive charge per kg of soil), clay soils have an average cation exchange capacity of around 30-50 $cmol_c/kg$, but soil humus can have cation exchange capacity of 150-250$cmol_c/kg$. Increasing the soil's ability to hold cations and water in the root zone will allow plants to use those nutrients before they have a chance to leach into the groundwater of the sixteen wellhead protection areas within the project area.

The benefit from VRI will come in the reduction of nitrate leaching into groundwater. If targeted VRI systems in sections with the highest nitrate PPM levels could prevent the need for our two most vulnerable communities from needing to install RO systems it would save over $5.7 million. If targeted practices could prevent one household in the sections with nitrate over 10 PPM from needing to install an RO system (at a cost of $750 each) that would save 75 homes from needing to install RO systems, saving over $56,000.

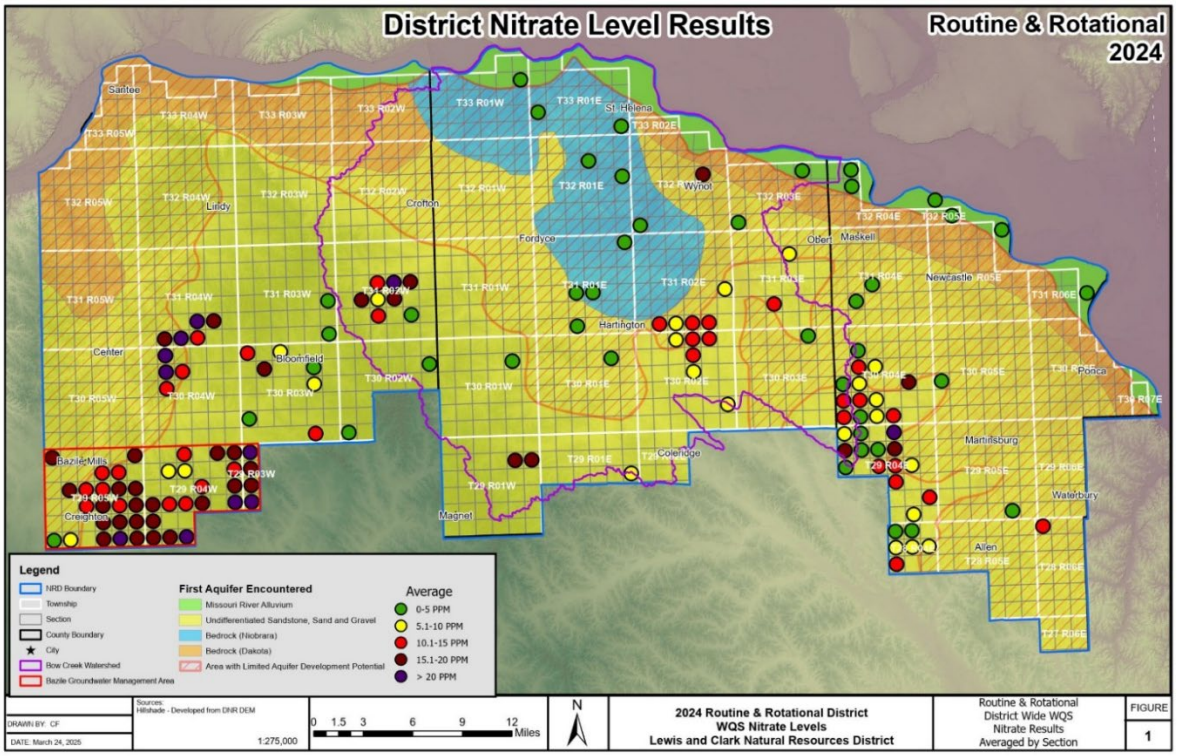
If nitrates continue to increase in WHPAs the small communities would be forced to relocate the supply wells, install a reverse osmosis system or connect to another Public Water Supply (PWS). The City of Creighton, which is located in the Bazile Groundwater Management Area (BGMA) of LCNRD, installed a reverse osmosis (RO) system to treat nitrates in 1993. At that time cost to install the RO system was $1.3 million. The small villages and towns in the LCNRD would have a difficult time covering the capital cost of installing and operating an RO system. Establishing new wells could also be cost prohibitive with cost of $250,000 or more for each well and this solution may just move the problem further into the future. Connecting on to another PWS or connecting to a rural water district may or may not be an option depending on location and ability of the other system to serve them in a cost efficient way. If nitrates are not addressed the

issue could potentially leave more than 1,700 residents without a safe water supply in LCNRD.

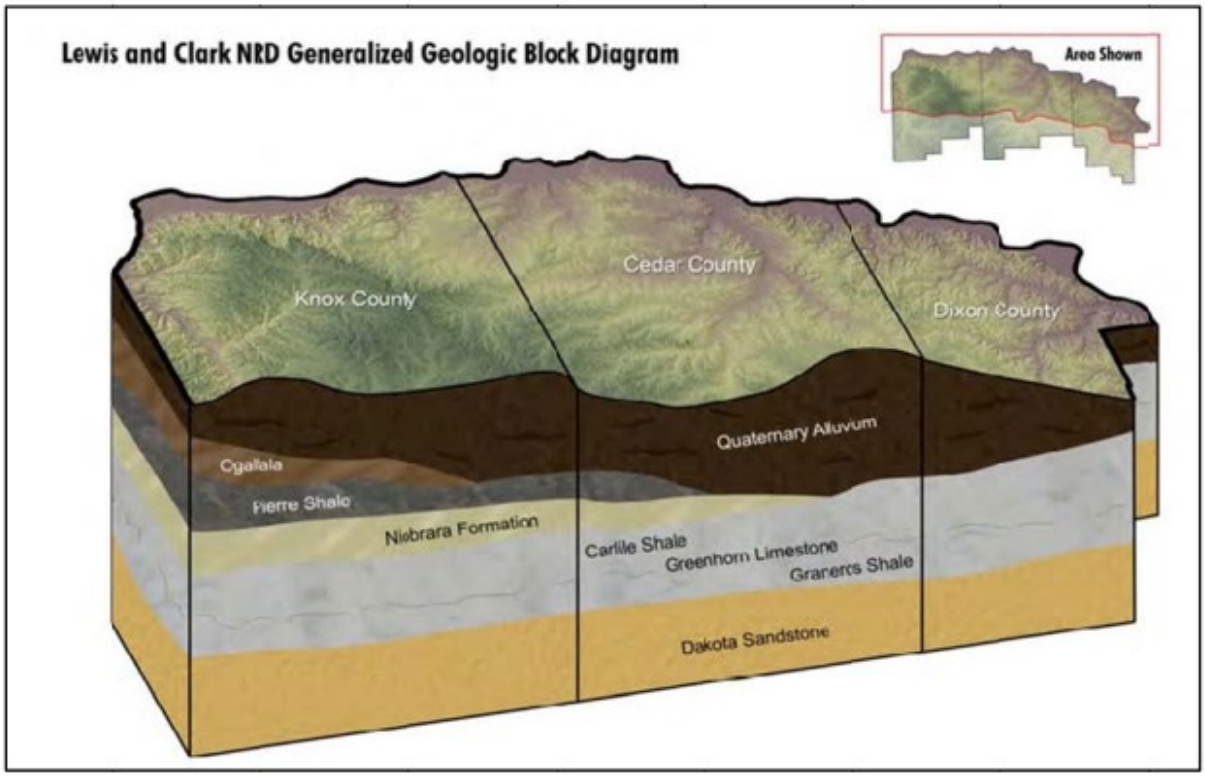
This project will improve water sustainability across LCNRD and enhance data reliability. Data will be shared to help ensure consistency with other NRD's and state agencies. Accurate water quantity and use data collection will improve groundwater management across LCNRD. Allowing for accurate and manageable programs designed to reduce nitrate-nitrogen leaching and aquifer depletion. Improved irrigation water management through effective reliable water measurement data helps mitigate over irrigation throughout the BGMA and WHP areas. Overuse of irrigation water has been identified as one factor in nitrate leaching. Currently the average nitrate level across the LCNRD's Phase III area of the BGMA is roughly 15 parts per million (ppm) (Map 3). The current EPA standard for nitrate in drinking water is 10 ppm. Other residents of the district obtain drinking water from the Cedar Knox Rural Water Project (CKRWP) that treats surface water in a treatment plant. CKRWP meets drinking water needs in an area where groundwater resources are highly variable and complex due to the way geologic units were laid down and subsequently eroded by glaciers (Map 2 LCNRD Generalized Geologic Block Diagram). KRWP serves water to four communities and 940 rural connections, providing drinking water to 2500 full-time residents and 4000-6000 seasonal users.

If the groundwater nitrate issues are not resolved, domestic water users and municipalities in the district will have greater difficulty in sourcing clean drinking water or will need to deploy expensive treatment systems that will require long-term maintenance at additional expense.

Map 3: District Nitrate Level 2024




Map 2: LCNRD Generalized Geologic Block Diagram



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.

The proposed LCNRD Project will help meet the groundwater quantity goals and objectives of the district IMP, established with NDNR in 2016, and quality goals in the LCNRD Groundwater Management Plan, established in 1986 and was last revised in 2015, in accordance to the Groundwater Management and Protection Act. The proposed project will help achieve groundwater quality and quantity goals stated in Chapter 7 of the LCNRD IMP to collect accurate groundwater extraction data. Current IMP and GMP require accurate groundwater usage data to ensure adequate and effective program regulations. The proposed project will address the current objective of the district's IMP.

LCNRD has a Groundwater Management Plan and an Integrated Management Plan in place to govern water use in the district. Rules and Regulations adopted in 2014 required flowmeters on all new and replacement wells. The district currently collects groundwater use data at approximately 200 wells across the district and monitors water levels from 70 dedicated observation wells and 34 irrigation wells.

LCNRD has a Groundwater Management Plan and an Integrated Management Plan in place to govern water use in the district. Rules and Regulations adopted in 2014 require well permits, expanded irrigation permits, and flowmeters on all new and replacement wells. The rules also establish triggers that would be actuated with groundwater decline. Better irrigation decision tools made available to producers can help avoid over watering and help to maintain healthy water levels in district aquifers, especially in those with in season pumping impacts and during drought. Although conservation is beneficial at all times for the resource and to maintain financial integrity.

LCNRD's Phase III requirements went into effect in October of 2004 when the Bazile Groundwater Management area was established after excessive nitrate levels were identified. Currently all Phase III producers are required to attend certification trainings on nitrogen management, take water samples of irrigation wells for nitrogen

credits, take soil samples for nitrogen residual to a depth of 3 feet, submit nitrogen management reports using these credits, and nitrogen applications are prohibited in the fall and winter. Groundwater quality monitoring consists of roughly 300 irrigation wells being tested annually to track nitrate nitrogen levels and in 70 dedicated observation wells.

LCNRD IMP Goal 1: Develop and Maintain a District-Wide water inventory.

- Objective1: Create and maintain a comprehensive database of ground and surface water information.
- Objective 1.2: Address data gaps in the surface and groundwater monitoring network.
    - This project provides for the IMP identified needs by accounting for groundwater use through monitoring for both the district and producers. Current groundwater use data is reported by most producers using well pumping capacity multiplied by the number of hours pumped. Many of these wells were constructed in the 1960's and 1970's and are not pumping at their registered rates. In addition, flow rates from irrigation wells can fluctuate greatly throughout the season making this method of estimating groundwater extraction inaccurate. This data is highly unreliable and in many cases is reported with up to +/-20% accuracy. This data is inadequate to make effective water management decisions within the LCNRD. Flowmeters are currently required on new wells but producers are not required to upgrade all wells and the use of irrigation management technologies are not widespread. The installation of permanently totalizing flowmeters is the most accurate method of quantifying groundwater extraction from irrigation wells.
        - The use of soil moisture sensors enables the use of irrigation water to be tailored to meet crop needs. Fertigation/chemigation equipment allows for spoon feeding of nitrogen containing fertilizers to match crop need throughout the growing season instead of applying one or two applications early in the growing season that is susceptible to leaching reducing with rain or irrigation events. The data collected by the use of these technologies will be reported in the Producer Connect App. Producer Connect enables producers to track current use and facilitate future decision making with the data from their crops in one on-line application. Producers can review and update as needed based on crop activities. The summarized data provides the district opportunities to work with producers when completing crop reports required with district rules and regulations

and to summarize data for evaluation of impacts to groundwater resources.

LCNRD IMP Goal 2: Protect existing water uses while allowing for future water development.

- Objective 2.3: Improve water resource sustainability through innovative management strategies
  - This project provides cost-share for innovative irrigation technology and land management practices modeled to improve water resource quality and quantity within LCNRD but not commonly funded through USDA NRCS programs in LCNRD. By supporting adoption of these practices n the district LCNRD can quantify their contribution to water quality and quantity goals and share that data throughout the state. Local producers will have the opportunity to evaluate technology and land management practices suitability for adoption on their farms without leaving the local area. LCNRD staff and LCNRD directors will have the opportunity to evaluate the impact of the technology land management practices for water management and future funding support.

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 LCNRD Project will create accurate water usage data that when paired with the current Nebraska Mesonet details will create reliable producer information that can reduce over-application of irrigation water in the Well Head Protection Areas (WHPAs), BGMA Phase III area, and Bow Creek Watershed (BCW) in the district. The WHPAs, BGMA Phase III area, and BCW are delineated on Map 1 (the map also indicates nitrogen concentration representing 2024 results which is not pertinent to this questions). This map represents the areas where depletion will be reduced and recharge will therefore be enhanced. Long-term, this project will effectively reduce aquifer depletion and increase stream flow. Utilization of both accurate water usage and

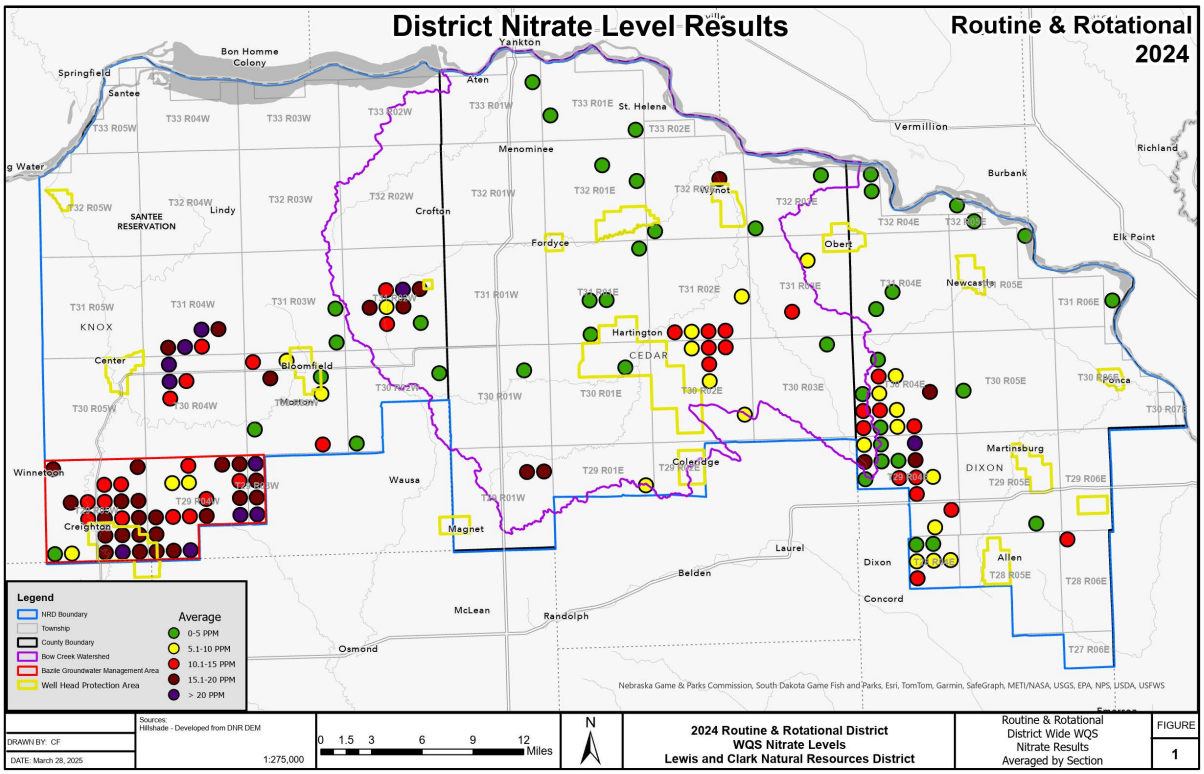
natural precipitation will reduce over-application of irrigation water, decrease nitrogen leaching through the root zone, and improve overall water quality and quantity.

Other NRDs in Nebraska have experienced water savings from the addition of remote telemetry and best management practices including the installation of flow meters as well as soil moisture probes. In 2016 the MRNRD received funding from the Nebraska Department of Natural Resources (NDNR) Water Sustainability Fund to implement their "High-Tech Irrigation Project". This highly successful project deployed remote telemetry on flow meters and soil moisture probes in forty-nine irrigated fields within the MRNRD for improved irrigation water management. Based on actual metered pumping records in 2019, the MRNRD estimates that **0.94 inches of water were saved per acre per year** on these fields due to improved management utilizing automated meter reading and soil moisture monitoring with telemetry.

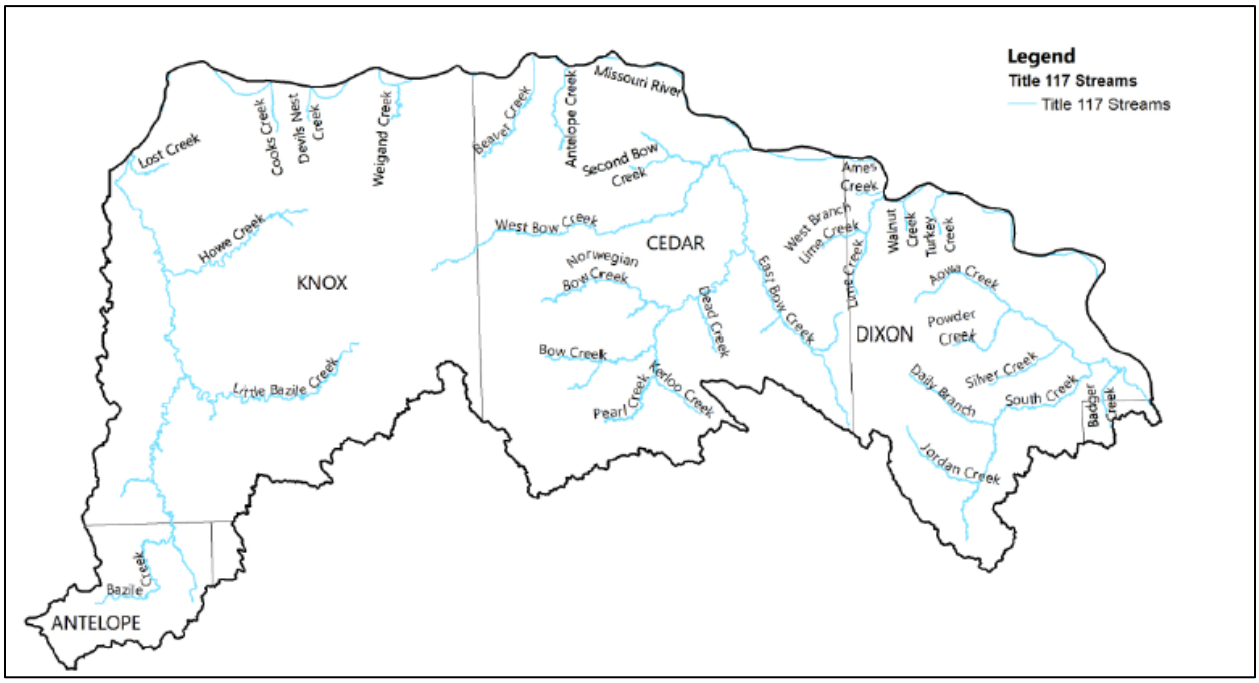
Within the LCNRD boundaries there are 117 surface water right permits irrigating 11,380 acres (Surface Water Data | Department of Natural Resources) with the acres coming from the following watersheds: Antelope Creek and tributaries 348 ac., Aowa Creek 187 ac., Bazile Creek and tributaries 881 ac., Beaver Creek and tributaries 1,188 ac., Bow Creek and tributaries 2948 ac., Missouri River 3,038 ac., Pearl creek 472 ac., South Creek 742 ac., and Weigand Creek and tributaries 149 ac., (Map 6 Title 117 Streams in LCNRD) the remainder comes from lakes and reservoirs. If each of those acres reduced irrigation by 0.94 inches a year it would save 10,697 inches of water per acre per year from leaving the stream systems. That equates to 235,330,542 gallons of water per year that would stay in the streams (205,824,318 gallons) and other waterbodies (29,506,224) to benefit wildlife and aquatic habitat. Over the next three years if ten flowmeter and soil moisture systems were added to surface water irrigation systems due to this project an estimated 20,113,722 gallons per year would be saved in rivers, streams and waterbodies.

Cross basin benefits come with the redaction of irrigation water pumped as well as a reduction in runoff that carries sediment, phosphorus, nitrogen and *E. coli* into the Missouri River and to the Gulf of Mexico where the dead zone is a concern.

Map 1: 2024 District Nitrate Level Results (routine and rotational), BGMA Boundary, BCWP Boundary, and WHPA Boundaries.




Map 6: Title 117 Streams in LCNRD




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;

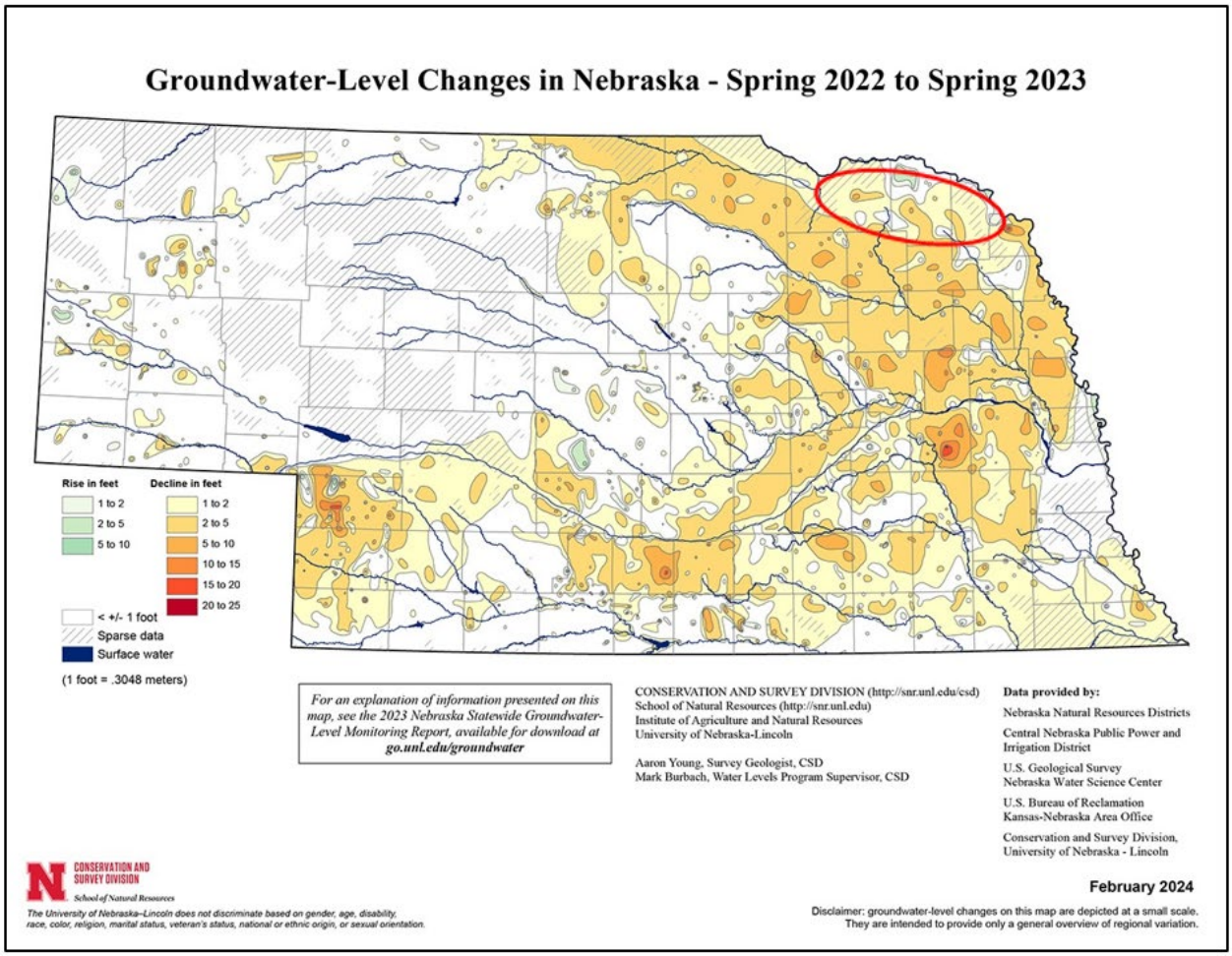
- List the goals the project provides benefits.
- Describe how the project will provide these benefits
- Provide a long range forecast of the expected benefits this project could have versus continuing on current path.

  This Project will provide a reduction in groundwater nitrates across the Missouri River valley and its tributaries by achieving the goals of acquiring accurate water use data and protecting water for domestic, irrigation, and municipal uses. Accurate groundwater usage informs not only the irrigator but the district and the state. LCNRD currently does not have a sufficient amount of accurate data to fully evaluate total groundwater use in the district. Map 5 below indicates water level changes from spring of 2022-2023. In much of the project area the one-year groundwater declines from the spring of 2022-2023 were 1 - 5 feet as noted in the “Groundwater Level Changes in Nebraska – Spring 2022 – Spring 2023”, see Map 5.

  This proposed project would improve irrigation efficiency through a number of irrigation management practices which will reduce the leaching of ag chemicals including nitrogen fertilizers into the groundwater of the local aquifer. In addition, land management practices such as conservation crop rotations and alternative cash crops will reduce the runoff from farm fields which can carry sediment containing ag chemicals which will have beneficial effects on surface water quality.

  This project will address the lack of adequate water use data. It will create a reliable source of water use data that can be shared with multiple agencies. This ensures that a true measurement of groundwater is reported for accurate and reliable aquifer depletion. A reduction in aquifer depletion will improve streamflow retained for wildlife habitat and recreational uses.

  Second, this will help to protect municipal water use through protection from overuse and significant chemigation events. This project should help reduce groundwater consumption across the LCNRD’s District. Irrigators that make educated decisions about pumping will help reduce aquifer depletion and increase the Missouri River streamflow. The overall effect in which this project has stretches well beyond LCNRD boundaries. It will create reliable data that can be shared across the state, decreased usage of shared aquifers and increased stream flows that can be utilized well beyond the Missouri River Valley.



Map 5: Groundwater Level Changes 2022-2023

This project is multifaceted combining increased water data network and best management practice implementation. These two approaches benefit multiple water supply goals as detailed below.

<u>Recreational Use</u>
LCNRD has the following streams on the impaired list in the 2022 Integrated Report: Antelope Creek for an unknown aquatic community impairment, Aowa Creek for recreation (*E. coli*) and an unknown aquatic community impairment, Bazile Creek for recreation (*E. coli*) and agriculture water supply (selenium), Bow Creek for recreation (*E. coli*), and South Creek for recreation (*E. coli*) and an unknown aquatic community impairment. LCNRD has the following lakes listed as impaired on the 2022 IR: Powder Creek Lake for Aquatic Life – Chlorophyll α (total nitrogen, total phosphorus), Buckskin Hills Lake for Aquatic Life – Fish Consumption Advisory (Mercury), and Chlorophyll α (total phosphorus), and Chalkrock Lake for Chlorophyll α (total nitrogen, total phosphorus).

USDA cost-share programs have long been available to financially support the adoption of water quality improving BMPs. However, those cost-share programs alone have not been enough to remove streams and lakes from the impaired water bodies list.

This project will increase the financial support for BMPs and provide additional training and technical support to those interested in implementing them. Research shows those who increase knowledge about and confidence in implementing BMPs are more likely to adopt them. Without a focused education and outreach program, cost-share programs are likely to fall short of enrolling the amount of acres needed to delist the streams and lakes and support the recreational beneficial use.

Wildlife Benefit

Along with *E. coli*, testing shows elevated levels of sediment, phosphorus and nitrogen in the waters of LCNRD. The high levels of stream sediment observed in streams can negatively affect fish and other invertebrates. High turbidity in the streams can decrease the ability of fish and birds who hunt by sight to catch prey leading to declining numbers of native species. Suspended particles can also damage gills negatively impacting fish and aquatic invertebrate health.

Conservation crop rotation, alternative cash crops, perennial systems, and CRP all help improve or expand habitat for upland gamebirds and other wildlife. Increasing plant diversity has a cascading effect on soil biology diversity as well as above ground biological diversity. Expanded crop rotations mixes that include different flowering plant species attract and provide resources for different insects and pollinators. Migratory birds can find a plethora of seeds in multi-species perennial systems in the summer that are stockpiled for livestock grazing in the winter. Other wildlife benefits from stockpiled systems include increased cover and food resources.

Agriculture Use:

Improved soil health from BMPs will improve water infiltration rates, increase the water and nutrient holding ability of the soil, and decrease flooding risks. Increasing soil organic matter by 1% can increase water holding capacity of an acre by 20,000 - 22,000 gallons per acre. Targeting 10,258 acres with BMPs, an increase in 1% organic matter would equate to 225,676,000 gallons conserved on growing crops. This will decrease the need to pump as much irrigation water each year and help reduce losses due to drought. Increasing organic matter also increases the nutrient holding capacity of soil minimizing the risk of nitrates leaching into the 16 wellhead protection areas located within the project boundaries.

Flood Control

With improved infiltration rates and water holding capacity of the soil, flooding risks will be reduced. Not only will flooding risks be reduced in the district, flooding along the Missouri River will also be reduced. Bow Creek flows directly into the Missouri River below Gavins Point Dam. The reduction of 225,676,000 gallons of water just from 10,258 acres in the watershed will reduce stress on the river system during

extreme weather events. Successful education and outreach efforts have the potential to influence many more acres than just the acres targeted for increased incentive payments reducing flooding risk even further.

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 will provide multiple benefits across the Missouri River valley and its tributaries. Accurate groundwater usage informs not only the irrigator but the state. This project maximizes the beneficial use of Nebraska's water resources for irrigation. Sustainability of groundwater will be improved in the LCNRD by improving irrigation water use efficiency through limiting or reducing excessive or unnecessary pumping. This project will address the lack of adequate data, excessive over-application of irrigation water, and increased incidence of fertigation/chemigation events. The only way that 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 regulations established by LCNRD. Instead, the beneficial use is becoming more efficient and sustainable where the resource is diminished. Through accurate groundwater management we can mitigate inadequate data through increased accuracy and efficiency over a broader area. Accurate water usage can be utilized to create effect regulations that will decrease nitrate-nitrogen leaching into the aquifer through the district. This project will provide an example for other districts in the state with similar water quality issues for effective water conservation practices that will benefit the waters of the state.

  Reducing *E. coli* levels provides a benefit to the public since there is potential for illness or, in rare events, serious complications and death when humans come into contact with surface water containing high levels of *E. coli.* Preventing sediment from reaching the stream will provide additional benefits. Sediment covers substrates utilized as habitat by aquatic organisms, fouls these organisms' gills, and decreases water clarity. Sediment also carries nitrogen and phosphorus into the stream, creating a potential for eutrophication, and sediment-bound pesticides can harm aquatic life. By decreasing stream pollution we can expect an increase in diversity of aquatic life, increasing the benefit to anglers. The Nebraska Game and Parks Commission estimates that for every 2 acres of quality CRP established an additional pheasant is available for hunting. Expanding wild pheasant populations benefits Nebraska hunters.

Improved soil health from BMPs will also improve water infiltration rates, increase the water holding ability of the soil, decrease flooding risks, and reduce losses from drought. Increasing soil organic matter by 1% can increase water holding capacity of an acre by 20,000 - 22,000 gallons, or 1 inch over the entire acre. Targeting 10,258 acres with BMPs an increase in 1% organic matter would equate to over 225,676,000 gallons saved. Decreasing the pumping of 100,000,000 gallons of water in the Bow Creek Watershed each year will slow the depletion of aquifers.

Increasing organic matter also increases the nutrient holding capacity of soil minimizing the risk of nitrates leaching into the sixteen wellhead protection areas located within the project boundaries. Well samples in the wellhead protection area for Hartington show as high as 14.9 ppm nitrate. The EPA standard for drinking water is 10 ppm. With new research showing elevated nitrates in drinking water is connected to elevated cancer risks in children, preventing nitrate issues in public drinking water benefits Nebraska citizens.

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.

Chart 3: Total Project Costs

| Costs | | | | | |
|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total |
| Program Promotion | $ 9,000 | | | | 9000 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 |
| Flow Meter w telematry Equipment (75% of $3,000=$2250) | $ 3,000 | 0.75 | $ 2,250 | 50 | $ 112,500 |
| Telemetry Data Costs for Flow Meters (($180 per yearx3 yr) @75% is $405 | $ 540 | 0.75 | $ 405 | 50 | $ 20,250 |
| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 |
| Alternative Cash Crop - 3rd in rotation (80 acres x$150x75% | $ 150 | 0.75 | $ 113 | 240 | $ 27,000 |
| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 |
| | | | | Total | $ 731,782 |

Chart 4: Next Best Alternative Costs

| Next Best Alternative Costs | | | |
|---|---|---|---|
| Alternative Method | Number | Cost Each | Total Coat |
| Perennial Systems Conversion (in acres) (@ $250 per acre for 3 years) | 10,258 | $750 | $ 7,693,500 |
| Evapotransporation Eddy Covariance Method (each) | 50 | $50,000 | $ 2,500,000 |
| | | | $10,193,500 |

The next best alternative to reduce erosion and nitrate leaching would be to plant irrigated cropland into perennial grass or enroll it in the USDA Conservation Reserve Program (CRP). While this is currently an option it has low adoption rates. Idling crop ground in a large portion of the NRD would also have negative impacts on local communities. Allowing grazing on the perennial system would be needed to sustain rural vitality.

In Dixon County there are currently 317 active CRP contracts with acres totaling 10,949 acres, in Cedar County there are 10,747 acres enrolled, and in Knox County there are 237 CRP contracts enrolling 7,879 acres. According to a UNL Center for Ag Profitability 2025 survey (https://cap.unl.edu/realestate/) the average cash rental rates for northeast Nebraska were $365 per acre for center pivot irrigated cropland, $325 per acre for gravity irrigated cropland, $250 per acre for dryland cropland and $77 per acre for pasture. Land values for center pivot irrigated cropland was $11,970 per acre, for gravity irrigated cropland $9,810 per acre, dryland cropland with irrigation potential was $9,425 per acre, dryland cropland without irrigation potential was $7,740 per acre, and tillable grazing land was $4,385 per acre. To convert from center pivot irrigated cropland to tallageable grazing land results in a -$7,585 land value change. No farm can sustain that kind of decreased value. Likewise, USDA 2024 (https://www.fsa.usda.gov/resources/programs/conservation-reserve-program/statistics/2024-county-average-ssrs ) county average payments for CRP in Cedar County were $250 per acre, Knox County was $207 per acre and Dixon County was $233 per acre, all below the 2025 average rental rate for irrigated cropland. In order to increase adoption rates of grass or CRP the incentive payment would need to be higher than the opportunity costs associated with pivot irrigated cropland.

With a goal of 10,258 acres treated with BMPs it would cost $7,693,5,00 to offer CRP/Perennial Grass payments to improve water quality based on Cedar County average payments. It is not reasonable to believe this payment rate would be enough to convince landowners to enroll their irrigated cropland into perennial systems so that per acre payment rate would need to be increased significantly or mandated. That would not solve the problem of limited and uncertain groundwater data.

Collecting accurate groundwater usage during a single growing season is difficult to estimate without a reliable form of measurement. The current forms of manual measurement are multiplying pumping compacity in gallons per minute by the total running time pumped within a growing season or estimating water use through electrical usage records. These methods can be highly inaccurate and unreliable forms of data collection since flow rates of irrigation wells can fluctuate

significantly throughout the growing season resulting in inaccurate calculations. The LCNRD irrigation season demands are localized to specific areas of the district and accurate flow information is needed to fully understand the complex hydrogeologic factors that impact flow.

At this time LCNRD is only monitoring groundwater extraction at 16% of the total irrigation wells district wide leaving large data gaps across a very diverse hydrogeologic area. The priority area of the BGMA has a total of 150 active irrigation wells, but only 20 (or 13%) of them are metered at this time which provides limited extraction data to the district. This proposal would add at least 25 flow meters with remote telemetry to the BGMA increasing the number of metered irrigation wells to 45 out of 150 (or 30%) that would be metered – more than half with telemetry.

Our current reported data measurements do not account for in-season fluctuations in pumping rates and result in inaccurate data. LCNRD currently only has flow meters on 16% of irrigation wells. Permanently installed totalizing flow meters with telemetry are the best method to quantify groundwater extraction and are the most affordable and reliable alternative for the district. Telemetry-enabled meters and soil moisture sensors will also provide real-time irrigation data to farmers on to allow them to match irrigation event to crop water use demands.

The next best option to estimate real time irrigation water use would be to use Eddy Covariance Systems. These systems can cost $50,000 –70,000 each. To install fifty of these systems would cost $2,500,000 compared to the cost of $165,240 for 50 flowmeters and 24 soil moisture sensors.

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.

Bank Stabilization and Navigation Project Fish and Wildlife Mitigation Project (BSNP Mitigation Project) as authorized under Section 601 of the 1986 Water Resources Development Act (WRDA) and Section 334 of WRDA 1999 and

amended by Section 3176 of WRDA 2007. The Ponca State Park site, in the northeast portion of LCNRD, is located within the 59-mile segment of the Missouri National Recreational River (MNRR). Specifically, restoration is provided for a 295-acre area on the Missouri River right bank between river miles 753.8 and 755.3 that extends approximately 8,000 feet in length and curves inland in a wide arc approximately 2,300 feet from the river bank at its widest point (MRRP Site - Ponca State Park.

This project is anticipated to reduce overirrigation and increase infiltration rates of cropland acres reducing soil erosion and flooding that impact Missouri River behavior. It is calculated that reducing surface water supplied irrigation by 0.94 inches per acre on just 9% of the 4,249 acres in watersheds down river from Lewis & Clark Lake could keep 8,093,614 gallons from leaving the stream systems. These gallons will help support aquatic habitat and wildlife that depend on those habitats. Total suspended solid (TSS) concentrations can be reduced with decreased overirrigation washing soil particles into the streams. TSS can harm fish gills and make seeing prey harder for birds that rely on fish for a major part of their diet.

Currently the LCNRD participates in the administration of the Bazile Groundwater Management Area (BGMA). The BGMA is a federally recognized groundwater quality area since many of the wells in the area exceed the 10 ppm Maximum Contaminant Level (MCL) for Nitrate-nitrogen established by the Environmental Protection Agency. This has created an issue for many of the communities to supply clean drinking water under the Safe Drinking Water Act. BGMA is affected by high levels of nitrates in the drinking water supply. Due to predominantly sandy soils in the BGMA, precipitation and irrigation water can infiltrate quickly and deeply. Nebraska Water Center, UNL, and Bazile Groundwater Management Area data indicates that nitrate leaching has a vertical transport rate of 6-7 feet per day in saturated sandy soils creating significant chemigation events. Accurate flow measurements decrease water application reducing stress from chemigation events on district aquifers and streams. The current deficiency in LCNRD is the lack of accurate groundwater measurement on irrigation wells in the district. Once this is corrected, improved water management will affect improved groundwater quality through improved management in LCNRD.

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 nitrate levels remain at higher levels, municipal wells or domestic wells may be rendered unusable for drinking water without adding treatment to remove nitrate. If groundwater quality remains in the current state or continues to decline, high quality drinking water may not be available which would be detrimental to the population in LCNRD. Maintaining high quality drinking water in the district is one of the highest priorities for natural resource management and for public health and safety.

  Several types of property damage can be prevented through the implementation of this project. Quite often when groundwater levels decrease or nitrate levels increase, well owners are required to drill existing wells deeper, relocate wells at significant cost, and/or purchase equipment for reverse osmosis (RO) or distillation. This may create challenges to find sources for domestic, municipal, industrial, or other irrigation wells having significant effects on critical water supply infrastructure for these various uses.

  The cost of replacing a domestic well could be tens of thousands of dollars while replacing a larger municipal, industrial, or irrigation well could be hundreds of thousands of dollars. Implementing RO treatment for domestic or municipal wells is expensive to install and requires maintenance to continue operating. If nitrate levels continue to increase it can become more difficult to remove sufficient concentration to achieve levels before the EPA MCL of 10ppm.

  RO systems can be costly, the City of Creighton added a reverse osmosis system to their community water system in the 1990s at a cost of $1.3 million. With today's prices (inflation factor of 2.2) that cost would be over $3 million just for installation. By targeting practices in WHPAs it could eliminate the need to install RO systems. If that could be done, it would save at a minimum $3 million for each system and it would maintain lower operation costs.

  If every section of ground where 2024 nitrate-nitrogen levels averaged over 10 ppm, (Map 3) received targeted practices and stopped the increase or reduced nitrate-nitrogen levels it has the potential to prevent one home per section from needing a RO system. This would potentially keep 75 homes from needing RO systems. With an average cost of $750 for home RO systems it would prevent local homeowners from spending $56,250.

Clean drinking water is a high priority in LCNRD which will provide benefits for public security, public health and safety.

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.

This project is planned in the Lewis & Clark Natural Resources District (LCNRD) and includes portions of Cedar, Dixon and Knox counties in northeast Nebraska covering 938,880 acres (Map 3). The population of LCNRD is 14,493. Water in LCNRD is used for residential, industrial, agricultural and recreational purposes. LCNRD has waterbodies listed on the 303d list of impaired waterbodies that include surface water streams and lakes. LCNRD also has areas of high groundwater nitrates.

LCNRD currently has two water quality based special projects, the Bow Creek Watershed Project (392,574 acres in the central part of the district) and the Bazile Groundwater Management Area 44,800 acres (70 square miles) in the southwestern part of the district. (See Map 1 for BCWP and BGMA project area boundaries including the WHPAs.) LCNRD works with 3 other NRDs to manage nitrate in groundwater as part of the full BGMA project. This project will complement both projects and help fill the gaps for irrigation technologies and water use data. BMPs that improve surface water quality also improve groundwater quality and quantity. This project will also focus on the 16 wellhead protection areas (WHPAs) and many private wells used for drinking water within LCNRD any practice that decrease nutrient leaching will have a beneficial effect.

Both the Bow Creek Project and Bazile Groundwater Management Area projects offer increased financial incentives and technical assistance to increase water quality improving BMPS. BPMs receive financial incentivized up to 90% of the estimated cost for that practice. Educational events such as workshops and field days are held in the project areas, so producers need not leave the local area to increase their knowledge of the practices and how to implement them. Demonstration farms highlight different farming and ranching and irrigation techniques and support more producers adopting BMPs. A growing body of evidence indicates increasing producer knowledge and confidence in practice implementation leads to long-term adoption of the practices. With both special projects implementation is tied to USDA NRCS conservation contracts. This project will allow both projects to support practices in addition to NRCS contracts.

Nebraska Water Center, UNL, and Bazile Groundwater Management Area data indicate that nitrate leaching has a vertical transport rate of 6-7 feet per day in saturated sandy soils. With the current rate of over-application of irrigation water, irrigators within LCNRD are not only decreasing water quantity but increasing the chance of significant chemigation events at an alarming rate. Increasing nitrate levels creates a lack of clean drinking water throughout the district. Many of the townships in the Phase III area of LCNRD have groundwater nitrate concentrations over 10 ppm representing serious drinking water concerns. The LCNRD currently has one rural water district and 21 municipalities spanning 3 counties reaching thousands of people. Each wellhead protection area has seen some indications of nitrate leaching. This program will help mitigate the impact of nitrates. Reliable irrigation well measurements can help decrease excessive groundwater pumping reducing the effects of the deep percolation of nitrates.

Due to a continued rise of nitrate levels, LCNRD's Phase III requirements went into effect in the BGMA in October of 2004. Currently all Phase III producers are required to attend certification trainings on nitrogen management, take water samples of irrigation wells for nitrogen credits, take soil samples for nitrogen residual to a depth of 3 feet, submit nitrogen management reports using these credits, and nitrogen application is prohibited in the fall and winter. This project will provide valuable water application data to farmers and the NRD as well to limit the leaching of nitrogen fertilizers into the local aquifer. This project will incentive the installation of permanently installed totalizing flow meters with telemetry. These meters will provide irrigators with near real-time data on water applications that will enable them to match irrigation water application to crop water use making irrigation water application more efficient and reducing leaching of irrigation water from farm fields into the local aquifer. Similar projects with other NRDs in NE have experienced water savings of up to 0.94 inches/acre which will limit the amount of leaching into the aquifer affecting drinking water quality.

Other alternatives to improve water quality and quantity include the compulsory planting of perennial grass or enrollment in CRP. This would eliminate the addition of commercial fertilizer onto the land that can leach into groundwater. CRP is currently an option in all areas of LCNRD but funding is limited and adoption rates are low. The cost of only 10,258 acres converted to CRP/perennial systems at the payment rate of $250 would cost $7,693,5,00. It is not reasonable to believe this payment rate would be enough to convince landowners to enroll their irrigated cropland into perennial systems so that per acre payment rate would need to be increased significantly or mandated.

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 LCNRD is a political subdivision of the State of Nebraska, created by the Legislature and given taxing authority under Nebraska Statute 77-3442 and supports this project. Our total certified valuation for 2024 was $5,240,769,546 with a current tax request of $1,741,345, a levy of $0.033227. The LCNRD's valuation is one of the lowest among the NRDs in Nebraska, and are very limited in our controlled budget increases, including groundwater management activities. We also use the Natural Resources Water Quality Fund of approximately $45,000 for water programs. Subsequent to the submittal of this application, additional funding will be pursued through the WaterSMART grant program through the Bureau of Reclamation and an RCPP grant through the USDA-NRCS. Consequently, this grant project has the potential to bring federal funding into the state as well.

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.

LCNRD is the local jurisdiction. In 1972, Legislative Bill (LB) 1357 was enacted to combine Nebraska's 154 special purpose entities into NRDs. NRDs were created to address natural resources issues such as flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues

LCNRD has a Groundwater Management Plan and a Voluntary Integrated Management Plan in place to govern water use in the district. Rules and Regulations adopted in 2014 required flowmeters on all new and replacement wells. The district currently collects groundwater use data at approximately 200 wells across the district and monitors water levels from 70 dedicated observation wells and 34 irrigation wells.

LCNRD's Phase III requirements went into effect in October of 2004 when the Bazile Groundwater Management area was identified after excessive nitrate levels were identified. Currently all Phase III producers are required to attend certification trainings on nitrogen management, take water samples of irrigation wells for nitrogen credits, take soil samples for nitrogen residual to a depth of 3 feet, submit nitrogen management reports using these credits, and nitrogen applications are prohibited in the fall and winter. Groundwater quality monitoring consists of roughly 300 irrigation wells being tested annually to track nitrate nitrogen levels and also monitors in the 70 dedicated observation wells.

The objectives of this project are to:

- Refine an outreach/education program to increase producer knowledge of water quality and quantity concerns and available programs that support adopting irrigation technology and other BMPs.

- Increase adoption of BMPs that improve water quality and quantity including but not limited to installing soil moisture sensors with telemetry, completing pivot VRI upgrades, and supporting chemigation system upgrades per year.

- Increase confidence in groundwater data used by LCNRD board of directors for decision-making by increasing the number of irrigation systems with flow meters and telemetry.

- Promote real-time data utilization for irrigators while simplifying resource tracking for the district through the Producer Connect App. developed by Nebraska's NRDs.

- Support the inclusion of a third cash crops and alternative crops in corn-soy rotations to improve soil conditions, and reduce irrigation water and fertilizer use.

- Create one Demo Farm that will convert irrigated cropland to a perennial system on 30-40 acres. This trial will track nitrate in the soil and vadose zone providing an opportunity to evaluate the benefit of offering incentives to landowners in high impact areas of wellhead protection areas to mitigate nitrate-nitrogen leaching.

  Acres in WHPAs qualify for increased cost-share rates through USDA NRCS. The Bazile Groundwater Management Area (BGMA) has provided extra cost-share on NRCS practices and education outreach to BGMA producers for the NRCS approved practices. Producers in the Bow Creek Watershed are encouraged to participate in cost share programs and producer groups to share information and to build robust cropping systems that reduce soil erosion and runoff. Even with the increase in cost-share rates and outreach, BMP adoption rates are not sufficient to remove nitrate threats to drinking water. This is in part to limited USDA NRCS funding that cannot cover all applications and because some of the practices payments are not high enough to entice producers to

implement the practice. This project will provide cost share for irrigation technology and land practices that show potential in the BGMA and throughout the district. The education and outreach component of this project will increase producers' knowledge and confidence to implement new technology and BMPs successfully and will increase adoption in WHPAs.

Implementing a combination of BMPs, such as crop rotations, alternative cash crops and perennial systems, in WHPAs can increase soil organic matter. A 1% increase in soil organic matter can increase the water holding capacity of an acre by 20,000 - 22,000 gallons. By increasing the water-holding capacity of the soil leaching of nitrates into groundwater can be reduced. Organic matter also increases the nutrient holding capacity of soils. Sandy soils have an average cation exchange capacity of around 3-5 cmolc/kg (centimol positive charge per kg of soil), clay soils have an average cation exchange capacity of around 30-50 cmolc/kg, but soil humus can have cation exchange capacity of 150-250cmolc/kg. Increasing the soil's ability to hold cations and water in the root zone will allow plants to use those nutrients before they have a chance to leach into the groundwater of the sixteen wellhead protection areas within the project area.

Currently the LCNRD has flow meters on approximately 200 – 250 wells out of approximately 1674 active registered wells in the district. LCNRD is working to increase accuracy through more effective, widely used irrigation management technology ensuring a sound groundwater management plan that benefits the producer and the district. LCNRD currently has one rural water district and 21 municipalities spanning 3 counties reaching thousands of people. Each well head protection area (WHPA) has seen some indication of nitrate leaching. This program will help mitigate the impact of nitrates. Reliable irrigation well measurements can help decrease excessive nitrate leaching into the local aquifer.

Stakeholders in this initiative include the LCNRD board of directors and committee members, municipal water providers, including rural water districts, private well owners, and irrigators within the district. Each of these stakeholders have a vested interest and will benefit in the success of improving groundwater management to sustain water quantity for all uses and improving drinking water quality.

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.

This project addresses multiple statewide water quality and quantity issues.

The LCNRD and several other areas within the State of Nebraska have documented and well-known groundwater nitrate contamination issues. Within the LCNRD Phase III areas, many of the average groundwater nitrate contaminant levels are over 10 ppm, the MCL set by the EPA. Currently 80% of Nebraska residents have safe, clean, monitored drinking water provided by local municipalities and the remaining 20% have unmonitored private domestic wells. The current nitrate levels have doubled since 1978 causing significant dangers along with it. The LCNRD is not alone in this, Nebraska is facing increased nitrate levels that have been linked to significant dangers in children. This project will address the leading cause of groundwater leaching, through over irrigation. The Nebraska Water Center has recently documented that nitrates can achieve vertical transport rates of 6-7 feet per day in our sandy soils when totally saturated.

This project will provide irrigation flow meters with telemetry on 50 irrigation wells in the district to benefit irrigation water management on an estimated 6,650 acres for approximately 50 farmers. This project will not only benefit landowners and operators in LCNRD, but also other areas in the State of Nebraska that may replicate similar programs. At this time LCNRD is only monitoring groundwater extraction at 16% of the total irrigation wells district wide leaving large data gaps across a very diverse hydrogeologic area. The priority area of the BGMA has a total of 150 active irrigation wells, but only 20 (or 13%) of them are metered at this time which provides limited extraction data to the district. This proposal would add at least 25 flow meters with remote telemetry to the BGMA increasing the number of metered irrigation wells to 45 out of 150 (or 30%) that would be metered – more than half with telemetry.

According to the Nebraska Department of Environment and Energy, bacterial *E. coli* impairments are by far the most common stream impairment statewide. Every major river basin in the state either has, or has had *E. coli* stream impairments, some that impact recreational use as is the case in the Bow Creek Watershed. In the most recent Integrated Report, over 60% of Nebraska streams designated for recreation were impaired for *E. coli*. Elevated *E. coli* levels pose a human health risk for *E. coli* infections in streams or rivers with recreational use designations. While infections are usually mild lasting up to 10 days, serious illness and long-term health problems and even death can result from infections. Therefore, reducing *E. coli* levels provides a benefit to the public.

Medical organizations vary in their account on how long *E. coli* symptoms last, citing numbers between 5-10 days. With mild symptoms such as abdominal cramps, diarrhea, vomiting and nausea it is reasonable to believe the cost of an illness would require sick leave but not medical attention. Serious complications requiring hospitalization such as hemolytic uremic syndrome (HUS) can result from *E. coli* infections. HUS can lead to kidney failure and death. The cost of

HUS is estimated to be over $541,000 per person. Fortunately, HUS is rare, and no known cases of HUS have been linked to Bow Creek. Over a three-year period, the cost for illness from high levels of *E. coli* in Bow Creek alone could cost $540,692 in lost productivity. Extrapolate the cost from Bow Creek across all river basins and it is clear we have the potential to lose millions due to *E. coli* infections in the state of Nebraska.

Practices that reduce soil erosion that bring new *E. coli* loads into the stream can help reduce bacterial levels and the human health threat. These include reducing over irrigation to the point of runoff, increasing water infiltration rates to reduce runoff and erosion, crop rotations to increase soil organic matter and perennial systems to trap soil and water before it makes it to the stream system. This program supports reducing *E. coli* in the water of Nebraska that then flow into the Missouri River. Reducing *E. coli,* nitrogen and other compounds making their way to the Missouri River is a beneficial impact for the entire watershed.

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.

This project will assist with the initial purchase of irrigation management technologies including soil moisture probes, flow meters with telemetry, chemigation/fertigation equipment, and variable rate irrigation (VRI) conversion, as well as offer cost share for land management practices such as growing alternative cash crops, adding a third crop to the rotation and incorporating perennial crops into the system. The total cost of this proposed project is $731,828 with 60% from the WSF grant, 40% from the LCNRD budget, and additional cost above offered cost-share will be covered by participating producers.

| Costs | | | | | | Partner Contribution | |
|---|---|---|---|---|---|---|---|
| Practice | Estimated Costs | Cost-Share % | Amount | Number | Total | WSF | LCNRD |
| Program Promotion | $ 9,000 | | | | 9000 | $ 5,400 | $ 3,600 |
| Moisture Sensors (40 ac min.) | $ 1,805 | 0.75 | $ 1,354 | 24 | $ 32,490 | $ 19,494 | $ 12,996 |
| Flow Meter w telematry Equipment (75% of $3,000=$2250) | $ 3,000 | 0.75 | $ 2,250 | 50 | $ 112,500 | $ 67,500 | $ 45,000 |
| Telemetry Data Costs for Flow Meters (($180 per yearx3 yr) @75% is $405 | $ 540 | 0.75 | $ 405 | 50 | $ 20,250 | $ 12,150 | $ 8,100 |
| Chemigation/ Fertigation Equipment ($1200 equipment +7.50 per ac*80acres = 1800/yr) | $ 1,800 | 0.75 | $ 1,350 | 8 | $ 10,800 | $ 6,480 | $ 4,320 |
| Pivot Technology Upgrade to VRI $50K-70K (75% of 70K=52,500) | $ 70,000 | 0.75 | $ 52,500 | 8 | $ 420,000 | $ 252,000 | $168,000 |
| Conseravtion Crop Rotation (328) small grain $54.12/ac | $ 54 | 0.75 | $ 41 | 240 | $ 9,742 | $ 5,845 | $ 3,897 |
| Alternative Cash Crop - 3rd in rotation (80 acres x$150x75% | $ 150 | 0.75 | $ 113 | 240 | $ 27,000 | $ 16,200 | $ 10,800 |
| Demo Farm - Perennial Conversion (40 acres for 5 years x $600/ac) | 600 | 0.75 | $ 450 | 200 | $ 90,000 | $ 54,000 | $ 36,000 |
| | | | | Total | $ 731,782 | $ 439,069 | $292,713 |

Although WSF cannot be used for personnel no project can function without personnel costs. The Bow Creek Watershed Project and Bazile Groundwater

Management Area Project both leverage federal funds for personnel costs. The Bow Creek Watershed Project also leverages Nebraska Environmental Trust funds for a portion of personnel costs. LCNRD will provide personnel costs for technicians to facilitate this project.

LCNRD will continue applying for additional funding throughout 2025. An application will be completed for the RCPP and Water SMART Funds as supported by the district. Implementation of this project will remain similar and expand the program. LCNRD's budget comes from a small levy assessed to the district's property value. We will use some of these funds to pay for the LCNRD share of the cost share and project implementation including staff time and overhead. LCNRD's operating budget for Fiscal Year of 2025 (Attachment A) was approved by the Board of Directors at our September meeting and included up to $600,000 for water projects. If other funding sources are not realized LCNRD will be able to complete this project as proposed.

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.

This project will provide cost share to producers for irrigation technologies and BMPs that improve health and function the Missouri River watershed by stabilizing groundwater levels and provide additional tools to help mitigate groundwater nitrate contamination. Nothing is more important to the health and function of a watershed than an adequate high quality water supply for wildlife, people, and plants for the natural landscape and food production. This project will implement water saving and water quality 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.

Additionally, by assisting private landowners and managers to implement best management practices in the watershed we can reduce *E. coli* bacteria, nitrogen, total suspended solids, nitrogen and phosphorus in the surface water, increase water infiltration, water and nutrient holding capacity of the soil, and repair ecosystem processes and function.

Completion of this project will have positive environmental and ecological consequences. In terms of ecosystem functioning all four ecological processes, water cycle, nutrient cycle, energy flow, and biological communities, will improve as a result of this project. The water cycle will benefit from conservation crop rotations, irrigation management, and nutrient management. Adding more diverse crop rotations allow the biological processes that build stable aggregates to take place. By increasing stable soil aggregates we can increase the pore space in the soil that increases water infiltration rates. At the same time

increasing crop plant diversity and plant growth patterns we can protect the soil surface from raindrop impact that dislodges soil particles and washes them into surface waters. Protecting the soil from the sun's rays will also decrease evaporation, making water more available for crop or grass growth. As we increase soil aggregates, we will also build soil organic matter. A 1% increase in soil organic matter can increase water holding capacity of an acre by 20,000-22,000 gallons. An increase in water holding capacity can decrease the need for irrigation water, thus improving aquifer recharge. Increasing soils water holding ability will also decrease flooding events and help retime water into streams.

The nutrient cycle is improved by the same practices as the water cycle. With an increase in soil organic matter, nutrient holding capacity also increases. Nutrient holding capacity is measured in cation exchange capacity. Sandy soils have an average cation exchange capacity of around 3-5 cmol/kg (centimol positive charge per kg of soil), clay soils have an average cation exchange capacity of around 30-50 cmol/kg, but soil humus can have cation exchange capacity of 150-250 cmol/kg. Increasing the soil's ability to hold cations and water in the root zone will allow plants to use those nutrients before they have a chance to leach into the groundwater of the sixteen wellhead protection areas within the project area.

Energy flow in expanded crop rotations is increased with the addition of winter cereals, small grain crops such as oats, and multi-species cover/forage crops in perennial systems. With winter cereals more days of photosynthesis is taking place on the land. Different plant structures in the canopy of multi-species crops capture more sunlight for use in growth and allow less to hit vulnerable soil surfaces. With increased days of photosynthesis more carbon is introduced into the soil via root exudates.

The increased carbon in soil feeds soil microbes that drive healthy water and nutrient cycles. Bacteria that associate with legume and grass plants to fix atmospheric nitrogen and fungal hyphae networks that extend soil root reach are often more populous in soils managed under BMPs. Diverse plant communities found in CRP and multi-species cover/forage crops provide different pollen and nectar sources for pollinators, increased food sources for upland game birds, and habitat for other furbearers. Increased water quality may have a positive impact on native fish species.

By reducing over irrigation this project can prevent soil erosion from reaching surface waters. Preventing sediment from reaching the streams and rivers will provide environmental benefits. Sediment covers substrates utilized as habitat by aquatic organisms, fouls these organisms' gills, and decreases water clarity. Sediment also carries nitrogen and phosphorus into the stream, creating potential for eutrophication, and sediment-bound pesticides can harm aquatic life.

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 irrigation management program to implement water quantity and quality practices pertaining to irrigation, soils, and crops is an opportunistic project for the NeDNR to collaborate with LCNRD and meets several of the goals identified by the NeDNR in the 2024 Annual Report 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 streamflow's, 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 NDNR will directly benefit as a collaborator with the LCNRD 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.

LCNRD has staff resources to implement the project. With two water technicians, one information & education technician, BCWP Coordinator and BGMA Coordinator, promoting and facilitating the program can be accomplished. With the financial contribution from LCNRD and WSF cost-share programs can be implemented.

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 the implementation of the LCNRD Voluntary IMP. This project also supports PIP goals for both the Bow Creek Watershed Project and Bazile Groundwater Management Area.

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

LCNRD intends to utilize funding from the NDNR to initiate this program in priority areas of the district and then expand upon this by leveraging federal funds with the district and state dollars to support groundwater management in the LCNRD. Currently BCWP and BGMA leverage federal funds to improve water resources in LCNRD. This project will further leverage federal funds.

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 LCNRD and the NeDNR which will also include the cooperation of private industry to implement technology. As this program evolves, the Bureau of Reclamation may be involved to provide funding through the WaterSMART program.

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

This project will generate water use data in a usable digital format that will be readily available for irrigators for water management decisions as well as water managers for basin wide water management and reporting. LCNRD is a partner in the Producer Connect App that will facilitate the reporting of water use data to the district for use by the farmer as well as the district.

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.

Elevated groundwater nitrate concentrations are well-documented in the Bazile Groundwater Management Area (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 Creighton, Bazile Mills, Winnetoon, and Wausa, Nebraska. This was later expanded to the current BGMA, which covers 21 townships, or 756 square miles. Three of these townships are in the LCNRD. 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.