NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Bow Creek Watershed Project

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

Sponsor Business Name: Lewis & Clark Natural Resources District

Sponsor Contact's Name: Becky Ravenkamp

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: bravenkamp@lcnrd.org

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

   Grant amount requested. $152,970

   - 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. N/A
- What is the population served by your project? N/A
- Provide a demonstration of need. N/A
- **Do not complete the remainder of the application.**

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

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

G&P - T&E consultation (required)	N/A☒	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 to carry out the proposed Bow Creek Watershed Project.

4. **Partnerships**

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

This project is supported by partnerships with: Nebraska Department of Environment and Energy, Nebraska Game and Parks Commission, UNL Department of Agronomy and Horticulture, UNL Extension, and NRCS. All support confirmation is included in Attachment A.

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

Nebraska Department of Environment and Energy provides guidance on the 319 nonpoint source pollution Project Implementation Plan and has allocated $300,000 in funds for Phase II of the Bow Creek Watershed Project for years 2023 - 2026.

USDA NRCS provides guidance on the Technical Advisory Committee and provides cost-share dollars to qualifying producers. NRCS also conducts compliance reviews for practice implementation as part of their regular duties.

Nebraska Game and Parks Commission provides environmental consultation to producers implementing voluntary conservation practices, provides guidance on the Technical Advisory Committee and provides cash payments for producers implementing small grains in cropping rotations.

UNL Assistant Professor Andrea Basche provides guidance on the Technical Advisory Committee and agronomy capstone students create farm management plans through the UNL Agriculture Capstone class. Student travel expenses are partially paid through UNL.

UNL Extension provides guidance on the Technical Advisory Committee and provides direct producer support in livestock and cropping systems management.

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.

This project is supported by partnerships with: Nebraska Department of Environment and Energy, Nebraska Game and Parks Commission, UNL Department of Agronomy and Horticulture, and UNL Extension.

Total project cost not including in-kind and personnel not allowable under WSF: $290,950.

Total Project Cost (including in-kind and personnel not allowable under WSF): $630,014.

Other sources of funding that are confirmed are listed below and detailed in Chart 1:

NDEE 319 nonpoint source pollution grant $300,000: $270,000 of this funding will be used for portions of staff expenses not allowable under WSF but which are vital for project completion, and $30,000 will be used to provide best management practice incentive payments which are allowable under WSF.

LCNRD $153,980: $52,000 of this funding will be used for portions of staff expenses not allowable under WSF but which are vital for project completion, and $101,980 will be used for other expenses that are allowable under WSF such as: BMP incentive payments, education and outreach, supplies, equipment and travel.

UNL - $7700 in-kind, $3000 cash: UNL in-kind contributions include staff time on the Technical Advisory Committee twice a month, planning the UNL student visit, and direct farmer support from senior capstone students. Cash contributions will be used for student travel related expenses to the area to spend time on farms with producers.

UNL Extension - $6,364 in-kind; Cropping Systems and Beef Specialists with UNL Extension work directly with farmers to plan cropping systems and livestock integration strategies in the project area. They also serve on the Technical Advisory Committee and support Bow Creek educational events as needed.

NGPC - $3,000 in-kind, $3,000 cash; NGPC in-kind support includes staff time on the Technical Advisory Committee twice a month and consultations and support to farmers implementing conservation practices. The $3,000 cash contribution will be used for incentive payments for the small grains program to promote crop rotation practices.

Chart 1

Bow Creek Watershed Project Sponsors

Sponsor	Confirmed Cash Match	In-Kind or Cash Contributions (Not part of WSF grant application)	Total Project Inputs
Nebraska Department of Environment and Energy (319)	$30,000	$270,000	$300,000
Lewis & Clark NRD	$101,980	$52,000	$153,980
UNL	$3,000	$7,700	$10,700
UNL - Extension	$0	$6,364	$6,364
Nebraska Game and Parks Commission	$3,000	$3,000	$6,000
Water Sustainability Funding	$152,970	$0	$152,970
Totals	**$290,950**	$339,064	$630,014

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 for the Bow Creek Watershed Project (BCWP) is to improve water quality in Bow Creek and ultimately remove Bow Creek from the impaired waterbodies list (303d list) for nonpoint source pollution of Escherichia coli (*E. coli*) bacteria in the Nebraska Integrated Report to the EPA.

Bow Creek was first included on the 303d List of Impaired Waters, due to high *E. coli* levels, in the 2012 Nebraska Integrated Report. The Integrated Report is submitted to the EPA every two years as a “state of the waters" report. Inclusion on the 303d list does not require corrective action. The 2012 report was based on 2010 water quality testing conducted by the Nebraska Department of Environmental Quality, now the Nebraska Department of Environment and Energy (NDEE), as part of their basin rotation testing. Basin rotation testing follows a six-year cycle covering all basins in the state of Nebraska. The next time NDEE tested Bow Creek was during the 2016 basin rotation testing which identified elevated levels of total suspended solids, phosphorus, nitrogen, and *E. coli* bacteria in Bow Creek. The continued high *E. coli* levels resulted in all of the recreational use designated stream sections of the Bow Creek Watershed Project (BCWP) being retained on the 303d list in the 2018 Nebraska Integrated Report. There currently are no guidelines for listing surface waters on the 303d list due to total suspended solids, phosphorus or nitrogen levels.

In 2019 the Lewis & Clark Natural Resources District (LCNRD) and NDEE worked with FYRA Engineering and local stakeholders, including farmers and ranchers, to create the LCNRD Water Quality Management Plan (WQMP). The WQMP identified best management practices (BMPs) that have been effective in reducing *E. coli* levels, and have the most potential to be voluntarily adopted by local farmers and ranchers in the Bow Creek Watershed Project (BCWP) area. That list includes no-till, cover crops, diversified crop rotation, nutrient management, prescribed grazing, Conservation Reserve Program (CRP) enrollment, buffer strips, and other practices. In order to achieve the *E. coli* load reduction goal to remove Bow Creek from the 303d list, FYRA modeling shows at least one BMP is needed on all 392,574 acres in the BCWP area.

Local, state and federal cost-share programs have been effectively used to establish BMPs in the BCWP area, and these cost-share programs are expected to continue into the future. However, for multiple reasons, these programs alone fall short of enrolling the number of acres needed to reduce *E.coli* to levels that would allow Bow Creek to be removed from the 303d list. LCNRD and partners believe additional education and incentives can increase BMP adoption in partnership with the current programs on enough acres to improve water quality in the project area.

Research by Carlisle, 2016, indicates producers who are more knowledgeable about the environmental and agronomic benefits of BMPs, and who have confidence in their ability to properly implement them, are significantly more likely to adopt them. With this in mind, the BCWP objectives are to: increase producer knowledge about environmental and agronomic benefits of BMPs, increase producer confidence in successfully implementing BMPs, increase producer networks of knowledge, resources, and technical assistance for BMP implementation, and increase acres managed under BMPs.

To increase producer knowledge about the benefits of BMPs and encourage their adoption, the BCWP will establish demonstration farms and host local education events including field days and workshops. To increase producer confidence of successful BMP implementation, mentoring groups and expanded technical assistance will be developed. Incentive and education payment contracts will be offered to increase BMP implementation on 5,000 acres. Through the combination of education and incentive strategies the BCWP will target all acres in the watershed.

Models in the WQMP show implementing BMPs on 5,000 acres in the watershed can reduce Bow Creek *E. coli* loads by 125,433 billion CFUs, phosphorus loads by 6,224 pounds, nitrogen loads by 27,534 pounds, and sediment loads by 3,034 tons over three years. Reducing *E. coli* levels provides a benefit to the public since there is potential for illness and, in rare events, death when humans come into contact with surface water containing high levels of *E. coli.* In addition to the local residents who enjoy summer recreational activities on the creek, 2,049 vehicles entered the Bow Creek Recreation Area during the 2022 recreation season. Data collected by the Lewis & Clark NRD showed elevated levels of *E. coli* during 90% of the 2022 recreation season.

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. Although the wildlife habitat benefit is hard to quantify, the cost of lost nutrients to farmers or ranchers can be measured. The financial savings of BMP implementation on 5,000 acres is over $27,000 for nitrogen and $6,000 for phosphorus. Improved soil health from BMPs improves water infiltration rates, increases the water holding ability of the soil, and decreases flooding risks.

Similar projects in the state have proven effective at improving water quality but required long-term commitments. The LCNRD has made budgetary commitments to hire staff and implement portions of the program now and into the future. The first phase of the project has been initiated and will conclude at the end of June 2023. Producer interest and BMP implementation continue to grow as a result of the project's efforts.

Phase II of the project will use the momentum from Phase I to increase the positive impact on water quality over the next three years. Continued funding from the NDEE 319 program has been allocated to Phase II of this project. Ongoing allocation of USDA programs, NGPC small grain program, NSWCP, and LCNRD will continue to provide cost-share programs in the project area. Working together this project can improve water quality and provide a benefit to the people of Nebraska.

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.

Project costs are detailed in Chart 2 below.

Chart 2 Bow Creek Watershed Project Costs				
Tasks	Year 1	Year 2	Year 3	Total
Workshops	$8,300	$8,200	$8,300	$24,800
Field Day	$8,334	$8,333	$8,333	$25,000
UNL Student Visit	$5,500	$5,500	$5,000	$16,000
Demo Farm	$10,750	$10,750	$10,750	$32,250
Mentoring	$2,833	$2,833	$2,834	$8,500
TA training	$500	$500	$4,400	$5,400
BC Signs	$2,000	$2,000	$2,000	$6,000
Travel	$1,667	$1,667	$1,666	$5,000
Supplies	$10,000	$4,000	$4,000	$18,000
WQMP Update	$20,000	$0	$0	$20,000
Best Management Practices	$43,334	$43,333	$43,333	$130,000
Totals	**$113,218**	**$87,116**	**$90,616**	**$290,950**

8. **IMP**

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

The Lewis & Clark NRD Integrated Management Plan was prepared voluntarily by the LCNRD Board of Directors and took effect September 5, 2016. The IMP includes several goals that are addressed with implementation of the Bow Creek Watershed Project. An expanded explanation is found in section C, questions 2 and 11.

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

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

1. Does your project include physical construction (defined as moving dirt, directing water, physically constructing something, or installing equipment)?
YES☐ NO☒

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

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

1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; N/A

1.A.2 Describe the plan of development (004.01 A); N/A

1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); N/A

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

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

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

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

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

1.A.9 When applicable include the criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3). N/A

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

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

According to the NDEE Integrated Report: Section 303(d) of the federal Clean Water Act (CWA) enacted by Congress in 1972, states, territories, and authorized tribes (states) are required to identify and establish a priority ranking for all waterbodies where technology-based effluent limitations required by section 301 are not stringent enough to attain and maintain applicable water quality standards. Once identified, states are to establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the (revised) list of impaired waterbodies and TMDLs to the U.S. Environmental Protection Agency (EPA). The requirements to identify and establish TMDLs apply to all waterbodies regardless of whether a waterbody is impaired by point sources, nonpoint sources, or a combination of both (Pronsolino v. Marcus, 2000 WL 356305 (N.D. Cal. March 30, 2000).

Water quality in Bow Creek was first evaluated by the Nebraska Department of Environmental Quality, now Department of Environment and Energy (NDEE), in 2010. Data from that testing showed elevated levels of *E. coli* above the EPA standard for recreational streams. Bow Creek was considered impaired and listed on the 303d list in the next published (2012) Nebraska Integrated Report to the EPA. Bow Creek remained on the 303d list after NDEE's 2016 testing showed *E. coli* levels continued to be above acceptable levels based on the EPA standard. Inclusion on the 303d list does not mandate corrective action.

In 2019 LCNRD worked with FYRA Engineering, NDEE, and local stakeholders to develop a Water Quality Management Plan that included a watershed management plan for Bow Creek. Development of this plan included modeling for *E. coli* reduction from BMP implementation and feedback from local farmers and ranchers indicating which water quality improving BMPs they were likely to implement.

Using the Water Quality Management Plan as a guide, LCNRD developed a Project Implementation Plan (PIP) that was accepted by the NDEE and EPA to address *E. coli* loading in Bow Creek. This project implements Phase II of the Bow Creek PIP. Phase I project components will be completed in 2023.

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

The LCNRD worked closely with NDEE, NRCS, local stakeholders, and FYRA Engineering to develop the 2019 Water Quality Management Plan (WQMP) and Phase I of the Bow Creek Project Implementation Plan (PIP).

During the creation of the WQMP a detailed pollutant load model was developed to understand the sources and load allocations that contribute to the water quality impairment. The model utilizes concepts of the Simple Method (Schueler, 1987) and the Spreadsheet Tool for Estimating Pollutant Load (STEPL) (Tetra Tech, 2011). Both runoff and groundwater/baseflow contributions of annual average flow and pollutant loads from the watershed are simulated. The ratio of surface to

groundwater runoff was calibrated to match the baseflow index (BFI) for Bow Creek, and pollutant concentrations based on land uses and flow pathways were applied. The results of the sub watershed sampling are represented as published in the WQMP below. Table 10-16 represents the modeled existing *E. coli* loads and Figure 10-14 represents the *E. coli* loads in the watershed.

Data collected and input into the model included land use, livestock numbers, septic systems, soil data (e.g., hydrologic soil group), rainfall characteristics (for example, annual rainfall total and number of rainfall/runoff events), and existing conservation practices (identified via aerial photograph or discussions with the NRCS). Major inputs were downloaded from the STEPL data server (Tetra Tech, 2013) and refined using locally-available data. Stream bank erosion and gully information were input into the model based on a GIS analysis of stream bank slopes, soil information, and local knowledge of stream conditions.

Table 10-16. Modeled Existing *E. coli* Loads

Subwatershed	Annual Existing Bacteria Load (Billions of CFU)	Percent Total
Lower West Bow Creek	2,202,631	32%
Norwegian Bow Creek	673,751	10%
Outlet East Bow Creek	1,108,653	16%
Middle Bow Creek	1,426,346	21%
Lower Bow Creek	966,792	14%
Stream Corridors	504,151	7%
Total	**6,882,324**	100%

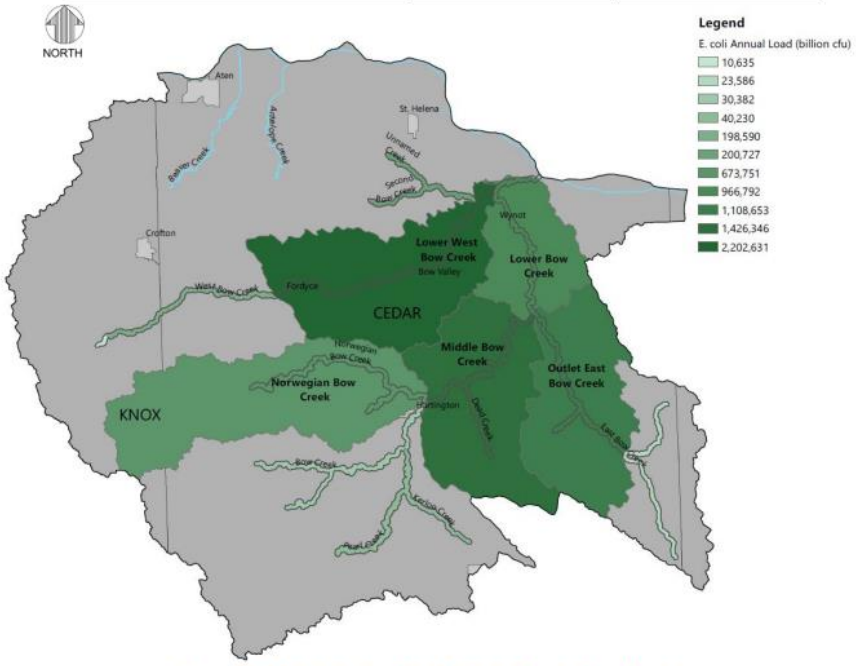

Figure 10-14. Subwatershed Modeled Annual E. coli Loads

The Water Quality Index (WQI) modeling results identified hot spots with the greatest potential for pollution in the lower portion of the watershed along the main branches of Bow Creek. The WQI was developed using EPA's Recovery Potential Screening (RPS) tool. The WQI was designed to be strictly a reflection of the potential for pollution, and the indicators were strategically selected and customized for the conditions in the WQMP Area. Social indicators were not included, as there were several factors accounted for during the committee meetings and this tool was used to provide insight solely on the characteristics of the land (that is, on water quality "stressors").

Many of the land use and soil characteristics are similar across the watershed, with the primary difference being the concentration of animal feeding operations (AFOs) and the proximity to the impaired stream segments that highlighted the hotspots in this watershed. Paired with a lower implementation rate of conservation practices in these areas, the WQI results accurately represent the locations in the Bow Creek Watershed with the greatest potential for pollution.

When modeling was completed, a series of meetings were conducted with the LCNRD, NDEE, stakeholder committee, technical committee, and the public to select the Priority Area. Several 'social' factors were considered when determining the Priority Area for the first 5 years of planning efforts. The LCNRD and the Cedar County NRCS offices are both located in the heart of Bow Creek and have established working relationships with producers. The committees determined that these relationships would facilitate the education/outreach efforts and allow for more efficient promotion of practices and implementation assistance, which will be needed to address the large area in the Bow Creek.

This project encourages the NRCS 'systems approach' to address priority natural resource concerns. The main point of this approach is that a variety of BMPs in sequence often work better than individual BMPs. A cornerstone of this approach is to encourage producers to implement a system of complementary practices that address specific, high-priority resource concerns in selected watersheds.

Pollutant removal efficiencies for several high priority watershed-based practices have been documented (provided in Table 7-1 of the LCNRD WQMP) and include but are not limited to: no-till, cover crops, nutrient management, CRP, small grain rotation, irrigation management, contour farming, rotational grazing, livestock exclusion, stream buffers, and soil health management. Upon assessment of the WQMP Area and coordination with the local stakeholders, these practices were identified as the most applicable to the WQMP area's characteristics (for example, land use, topography, soils, and land owner/operator acceptance) that would most effectively address the impairments impacting the water bodies.

Table 7-1. Pollutant Removal Efficiencies for Priority BMPs

Practice\pollutant and removal	Sediment (%)	Phosphorus (%)	Nitrogen (%)	*E. coli* (%)
No-Tillage Farming[1]	75	45	55	33
Cover Crops[1,5]	70	29	38	33*
Manure Application and Nutrient Management[1,6,8]	-	35	15	15
Grassed Waterways[1]	75	75	75	50*
WASCOBs [6,7]	80	85	42	70*
Riparian Buffer/Filter Strips[3]	86	65	27	70
Sediment Control Basin[3]	75	53	30	70
Constructed Wetlands [1,4]	89	69	55	70[8]
Contour Farming[1]	40.5	55	48.5	33*
Land Use Change: CRP[6,*]	80	80	61	61
Land Use Change: Small Grains Crop Rotation[6,*]	25	25	42	25
Livestock Exclusion - Fencing & Alternate Water Source[3,*]	0	100	100	100
Grazing Management/Rotational Grazing[3]	49	75	62	40
Grade Control Structure/In-Stream Weir[1,*]	75	75	75	75
Stream Bank Stabilization[1]	75	75	75	75
Waste Water Management/Runoff Control[1]	0	75	75	75
Waste Storage Facilities[1,*]	0	60	65	50
Septic Improvements*	0	100	100	100
Composting Facility[1,*]	0	60	65	50

Based on the WQMP modeling LCNRD and NDEE developed a 319 Project Implementation Plan (PIP) which was approved by EPA. Phase I of the PIP was implemented in 2021-2023. This project was well received by local producers and was able to incentivize BMP adoption within the watershed. Phase II of the project is proposed to start July 2023 and run through June 2026. Phase II will build from Phase I success and expand acres under BMPs by focusing on education and outreach activities in the entire watershed.

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

NDEE sampled water quality in Bow Creek during the 2010 state Basin Rotation testing cycle which identified elevated levels of total suspended solids, phosphorus, nitrogen, and *E. coli* bacteria in the creek. The high *E. coli* levels

which exceeded EPA's safe levels, resulted in all of the recreational use designated stream sections of the Bow Creek Watershed Project (BCWP) being listed on the impaired water bodies 303d list. In 2016 NDEE returned and conducted Basin Rotation testing in Bow Creek which found elevated levels of sediment, phosphorus, and nitrogen, and *E. coli* bacteria in portions of Bow Creek still exceeding the EPA's safe levels.

EPA guidelines state *E. coli* bacteria shall not exceed a geometric mean of 126 colony forming units per 100 mL (CFUs/100 ml). For increased confidence of the criteria, the geometric mean should be based on a minimum of five samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines. The following single sample maxima shall be used solely for issuing periodic public advisories regarding use of water bodies for Primary Contact Recreation: 298 CFUs/100 ml at moderately used recreational waters, 406 CFUs/100 ml at lightly used recreational waters and 576 CFUs/100 ml at infrequently used recreational waters.

The color coded Chart 3 below shows the *E. coli* levels from sampling in 2016. *E.coli* levels that exceed the single day maximum of 576 CFUs/100 ml for infrequently used recreational waters are shaded red, *E. coli* levels that were below the most stringent 126 colony forming units per milliliter (CFUs/100 ml) for highly used waters are shaded green, and levels between the two are shaded yellow/orange.

Grab samples from May – September 2016 resulted in the following data reported Chart 3 in three segments of Bow Creek:

Chart 3
2016 E. Coli Results

Activity Start Date	*West Bow	East Bow	Bow
5/2/2016	>RL (24196)	5794	>RL (24196)
5/9/2016	No Data	No Data	No Data
5/16/2016	921	980	866
5/23/2016	>RL (24196)	>RL (24196)	>RL (24196)
5/31/2016	2909	961	2420
6/6/2016	1046	649	1203
6/13/2016	6867	1414	8164
6/20/2016	9208	1483	7701
6/27/2016	2064	2420	2359
7/5/2016	2603	1300	2755
7/11/2016	2755	1553	1842
7/18/2016	1160	866	1986
7/25/2016	2420	110	816
8/1/2016	2420		24196
8/8/2016	1120	184	1300
8/15/2016	1553	167	1300
8/22/2016	1553	163	548
8/29/2016	3130	548	2420
9/6/2016	>RL (24196)	1733	>RL (24196)
9/12/2016	8664	1414	10462
9/19/2016	11199	1203	7701
9/26/2016	1733	2420	2420

During the recreation season, May - September, in 2021 and 2022 LCNRD along with NDEE conducted the Bow Creek special study sampling to evaluate water quality in Bow Creek. These studies expanded the testing site numbers from three in 2010 and 2016 to twelve points throughout the entire watershed. *E. coli* levels were above acceptable levels about 90% of the time during both recreation seasons as seen in the tables below. See Charts 4 and 5 for the results from the 2021 and 2022 sampling. The color coding for the chars are the same as for Chart 3 above.

Chart 4

2021 E. Coli Results

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10*	Week 11	Week 12	Week 13
Location	**5/5/2021**	**5/10/2021**	**5/17/2021**	**5/24/2021**	**6/1/2021**	6/7/2021	6/14/2021	6/21/2021	6/28/2021	7/13/2021	7/27/2021	8/9/2021	8/23/2021
Bow Creek - Gage Station (195)	344.8	228.2	920.8	1785	866.4	1299.7	1299.7	601.5	1413.6	7270	816.4	116.6	65.2
Bow Creek 1 Mile N of Wynot (207)	344.8	185	365.4	980.4	37.9	478.6	478.6	920.8	1986.3	9208	727	120.3	53.5
Bow Creek (south of School) 434	579.4	328.2	579.4	3654	770.1	829.7	829.7	472.1	1119.9	2382	1553.1	258.1	230
Bow Creek south of Wynot (302)	488.4	307.6	410.6	1986.3	1119.9	1553.1	1553.1	1119.9	1553.1	6294	1732.9	192.4	343.6
East Bow Creek south of Wynot (104)	307.6	218.7	344.8	1203.3	613.1	478.6	478.6	387.3	547.5	360.9	191.8	156.5	298.7
East Bow Creek 10 miles E of Hartington (192)	547.5	344.8	1046.2	1732.9	1046.2	2419.6	2419.6	727	1046.2	1203.3	461.1	228.2	866.4
Norwegen Bow (Fairgrounds) 105	547.5	1413	1203.3	5172	980.4	721.5	721.5	1986.3	2419.6	>24196	1986.3	866.4	1046.2
Norwegen Bow (Broadway) 243	613.1	344.8	1203.3	2481	920.8	658.6	658.6	1413.6	2419.6	>24196.0	1203.3	387.3	1986.3
Pearl Creek (202)	206.4	253.9	920.8	7701.1	2419.6	1732.9	1732.9	1299.7	1553.1	1785	1553.1	123.8	202.9
2nd Bow (101) staff gage	648.8	161.6	920.8	8664	547.5	1413.6	1413.6	1986.3	343.6	1986.3	980.4	1413.6	1732.9
West Bow @ Pinkelman Bridge (101)	328.2	435.2	2419.8	5475	2419.6	960.6	960.6	2400	2419.6	2419.6	1203.3	2419.6	629.4
West Bow 1 mile west of Fordyce	198.9	67	2419.8	3076	1553.1	1299.7	1299.77	1119.9	2909	2603	2981	128.4	593.8

Chart 5

2022 E. Coli Results

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10*	Week 11	Week 12	Week 13	Week 14	Week 15
Location	**5/2/2022**	**5/9/2022**	**5/16/2022**	**5/23/2022**	**5/30/2022**	6/6/2022	6/13/2022	6/20/2022	6/27/2022	7/11/2022	7/25/2022	8/9/2022	8/22/2023	9/12/2022	9/27/2022
Bow Creek - Gage Station (195)	240	770.1	410.6	190.4	12997	378.4	1413.6	1553.1	456.9	40.7	65.3	97.6	130.5	195.1	201.4
Bow Creek 1 Mile N of Wynot (207)	172.5	980.4	365.4	125.9	14136	547.5	1413.6	257.5	601.5	95.7	193.6	83.5	167.4	344.1	189.2
Bow Creek (south of School) 434	123.4	325.5	1986.3	185	2419.6	360.9	816.4	866.4	316.9	488.4	524.7	270	478.4	183.5	686.7
Bow Creek south of Wynot (302)	240	3448	920.8	196.8	19863	613.1	1413.6	1046.2	686.7	202.9	648.8	83.7	357.8	648.8	1046.2
East Bow Creek south of Wynot (104)	156.5	866.4	727	191.8	3282	141.4	290.9	238.2	261.3	214.3	248.9	178.2	148.3	410.6	387.3
East Bow Creek 10 miles E of Hartington (192)	40.8	172.2	524.7	261.3	110.6	98.5	151	158.5	285.1	517.2	410.6	488.4	791.5	686.7	648.8
Norwegen Bow (Fairgrounds) 105	1119.9	1732.9	960.6	436	2419.6	816.4	920.8	1203.3	435.2	816.4	816.4	147.1	>24196.0	1986.3	1046.2
Norwegen Bow (Broadway) 243	86.5	1986.3	816.4	328.2	24196	1119.9	770.1	648.8	648.8	144.5	686.7	920.8	1119.9	1553.1	727
Pearl Creek (202)	14.5	110.6	501.2	396.8	2419.6	488.4	2419.6	866.4	727	686.7	357.8	172.9	344.8	330	235.2
2nd Bow (101) staff gage	814.4	1732.9	1119.9	436	24196	2755	1986.3	1413.6	501.2	308.8	1553.1	1046.2	2419.6	1553.1	>2419.6
West Bow @ Pinkelman Bridge (101)	1299.7	1553.1	1299.7	686.7	24196	4219.6	2419.6	2419.6	689.3	214	920.8	343	571.7	113.3	686.7
West Bow 1 mile west of Fordyce	125.9	178.5	980.4	648.8	24196	2419.6	1986.3	593.8	214	2209	727	478.6	437.1	1553.1	1046.2

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 the project. A detailed explanation of the process can be found in Chapter 5 of the LCNRD WQMP. The model of the Bow Creek priority HUC-12 watersheds 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 results of the subwater sampling are represented as published in the WQMP below. Table 10-16 represents the modeled existing *E. coli* loads and and Figure 10-14 represents the *E. coli* loads in the watershed.

Table 10-16. Modeled Existing *E. coli* Loads

Subwatershed	Annual Existing Bacteria Load (Billions of CFU)	Percent Total
Lower West Bow Creek	2,202,631	32%
Norwegian Bow Creek	673,751	10%
Outlet East Bow Creek	1,108,653	16%
Middle Bow Creek	1,426,346	21%
Lower Bow Creek	966,792	14%
Stream Corridors	504,151	7%
Total	**6,882,324**	100%

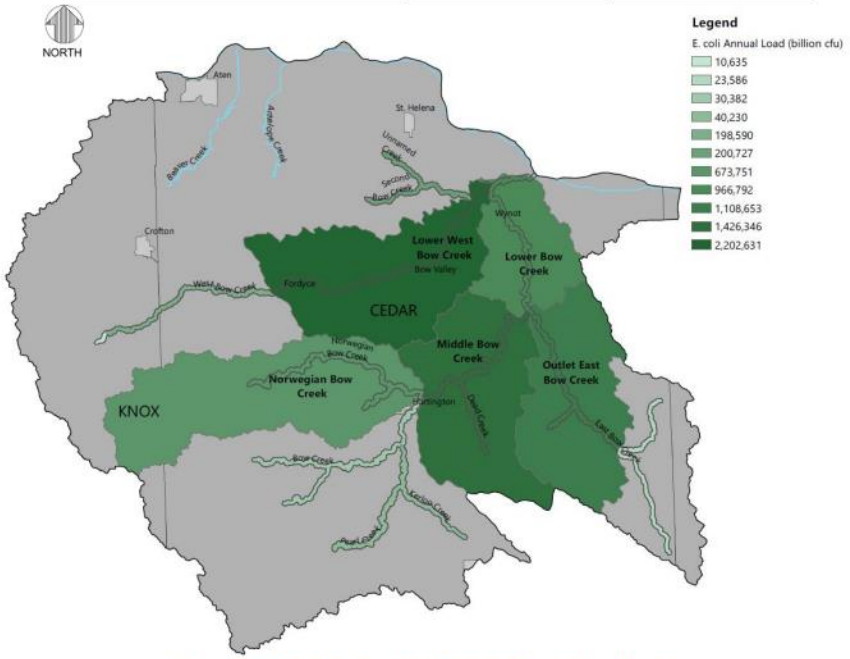

Figure 10-14. Subwatershed Modeled Annual E. coli Loads

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

Because we will be working with landowners or operators who have control of the land, no water or land rights are required to implement this project. Producers and/or landowners who wish to implement BMPs will enter into conservation contracts with USDA NRCS, USDA FSA, NGPC or LCNRD and will follow all eligibility requirements for the applicable programs. Landowners or operators who have a conservation contract will be eligible to participate in the Bow Creek incentive program. Any irrigation water management contracts must follow local irrigation water rules and regulations. Compliance with those rules and regulations will be part of the conservation contract approval process through other agencies.

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 increased adoption of a series of BMPs in the watershed, 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 six wellhead protection areas that serve 1776 people in the project area will also benefit from the decreased risk of nitrate leaching.

Each acre that receives conservation tillage or no-till treatments will increase stable soil aggregates. Stable soil aggregates are imperative to increase water infiltration rates. 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 water bodies in water runoff causing nonpoint source pollution.

The addition of cover crops and/or diverse crop rotations to conservation tillage/no-till help accelerate the building of stable soil aggregates. While increasing stable soil aggregates, these practices 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 the 5,000 acres targeted for practice incentives it would total 100,000,000 gallons. Extrapolated to all the 392,574 acres in the Bow Creek Watershed it would total 7,851,480,000 gallons of increased water holding capacity. 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.

In addition to six wellhead protection areas located in the BCWP area, Cedar Knox Rural Water is planning to build a new water treatment plant in the Bow Creek Watershed Project area. Increasing infiltration rates and water holding capacity of the soils can help recharge the aquifer these water systems depend on. Increasing the water and nutrient holding capacity of the soil will help prevent nitrates from contaminating groundwater sources.

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.

Several options were considered to address the *E. coli* impairment in Bow Creek. One option would be to do nothing. The fact that Bow Creek has remained on the impaired list of waterbodies the last ten years with the current cost-share programs shows this option will not accomplish the goal of reducing *E. coli* and removing Bow Creek from the 303d list of impaired water bodies. With the current discussion in the Nebraska legislature on stream buffers an intense stream buffer program was explored. Since this option would result in *E. coli* reduction we deemed it the next best option.

The next best alternative to reduce *E. coli* and delist Bow Creek from the 303d list of impaired water bodies would be to create a compulsory Stream Corridor Reserve Easement Program (SCREP), modeled after the Wetland Reserve Easement program. Permanent easements, 30-year, 10-year, or 3-year easements could be offered. Permanent easements are conservation easements in perpetuity and would pay 95% of fair market value and 100% of buffer establishment. For 30-year easements SCREP would pay 70% of fair market value and 75% of buffer establishment costs. To make it more like conservation contracts for EQIP or NE Buffer Program a medium term 10-year easement or short term 3-year easement could be calculated at 25% or 10% of easement value and of buffer establishment. Because of the steep slopes of land in the Bow Creek Watershed buffer strips would generally be 250 ft wide (125 on both sides).

There are 164 miles (865,920 feet) of stream segments in the Bow Creek Watershed. On average 85% of stream corridors run through cropland, with 80% of the cropland being irrigated (Irrigated acres 3379, non-irrigated cropland 845 acres and non-tillable acres 745). UNL 2022 Nebraska Farmland Values state an average cost of $10,135 per acre for irrigated farm ground. $7485 per acre for non-irrigated farm ground, and $2470 per acre for non-tillable grassland. Establishment costs are estimated at $173 per acre.

To enroll the entire stream corridor in SCREP permanently would cost $41,107,238 For 30-year easements the cost would be $30,289,513. For 10-year easements the cost would be $10,817,694. For 3-year easements and buffer establishment the cost would be $4,327,077.

In addition to the cost of easements would be the legal fees to create and enforce a compulsory program, not to mention the loss of collaboration with landowners the LCNRD serves. This program would not provide the soil health benefits that protect groundwater on the wider project area.

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).

   Best management practice costs are based on 2023 NRCS payment schedules. Chart 6 details the anticipated cost to provide incentive payments to producers to bring the cost mitigation of implementing an approved conservation practice up to 90% of the implementation cost. NRCS or LCNRD typically provide the base practice payment to producers which is typically around 50% of the actual cost. Cover crops and no-till have a large spread in payment costs ($4.40 for no-till and $16.35 for cover crop multi-species); the highest amount is listed below. Bow Creek incentive contracts have a maximum payout of $7500 for one practice and $10,000 for multiple practices. In Phase I, almost 40% of contracts exceeded the maximum payment rate.

Chart 6			
Cost of Planned Practice Intentive Payments			
2023-2026	**Acres**	***90% incentive**	***75% Incentive**
Nutrient Management	2000	$20,000	$16,667
Cover Crops / No-till	2250	$36,788	$30,656
small grain rotations	100	$2,400	$2,400
CRP	80	$40,000	$40,000
Livestock Exclusion	160	$5,000	$5,000
Buffers/Filter Strips	50	$12,500	$12,500
Rx Grazing	160	$5,000	$5,000
Soil Health Management	200	$5,000	$5,000
Total acres	**5000**	**$126,688**	**$112,223**
*Incentive payments will be at 90% OR 75% depending on the practice.			

Education, travel, and supplies costs are based on Phase I costs. Other costs for the update of the Water Quality Management Plan (WQMP) are based on discussions from other NRDs that have updated plans. UNL student visit costs are based on the previous two years' (non Covid-19 lockdown) expenses.

UNL NebGuide G1850 estimates the cost of pumping per acre inch as 1.97 times the cost of diesel. The current cost of diesel is $3.76 so to pump one acre inch would cost $3.76 x 1.97 = 7.41.

Education benefits are calculated from Bow Creek education event evaluations and show $7-$100 per acre benefit.

Farmer nutrient costs are based on current costs of $1 per pound each of nitrogen and phosphorus.

Modeling done by FYRA Engineering for the 2019 Water Quality Management Plan (Table 10-25 from the WQMP below) was used to determine the environmental benefit of Best Management Practices.

Table 10-25. Recommended Best Management Practices and Load Reductions

BMP or Action[1]	Quantity	Units	Area Treated (acres)	Modeled Annual Load Reduction			
				E. coli (billions of CFU)	Phosphorus (lbs)	Nitrogen (lbs)	Sediment (tons)
Manure Application and Nutrient Management	76,000	acres	76,000	2,430,051	144,602	336,205	0
Cover Crop/No Tillage Farming	76,000	acres	76,000	720,587	60,713	457,522	95,402
Land Use Change: Small Grains Rotation	11,100	acres	11,100	65,908	8,299	50,992	1,406
Contour Farming	11,100	acres	11,100	66,452	10,443	47,881	2,465
Land Use Change: CRP	8,450	acres	8,450	277,593	34,975	390,348	14,912
WASCOBs	2,220	each	22,200	234,929	21,978	62,698	7,752
Grassed Waterways	852,000	ft	42,600	231,843	34,118	206,798	9,686
Sediment Control Basins	400	each	39,700	269,221	15,951	49,286	7,570
Constructed Wetlands	790	each	39,700	269,221	20,766	90,358	8,983
Livestock Exclusion - Alternate Water Source and Fencing	60	each	6,000	1,341,648	2,410	10,712	0
Riparian Buffers/Filter Strips	1,390	acres	11,530	145,620	8,542	20,144	5,952
Grazing Management/Rotational Grazing	90	each	44,300	144,091	31,535	169,786	8,415
Waste Water Management/Runoff Control (uncontrolled feedlots)	5	each	50	573,119	14,944	74,721	0
Septic System Improvements	1,880	each	---	381,124	3,192	9,885	0
Stream Bank Stabilization	16	miles	---	1,144	17,488	81,491	4,169
Grade Control Structure/In-Stream Weir	230	each	---	1,144	17,488	81,491	4,169
Waste Storage Facility	74	each	---	*	*	*	---
Composting Facility	74	each	---	*	*	*	---
Soil Health Management	undetermined			388,153	n/a	397,306	n/a

There is no accepted method to calculate the financial benefits for reducing E. coli. However, EPA studies have been done that make the following formula the best option to try to put a monetary value on it. Based on the EPA study the estimated cost of missing work due to recreation activities in E. coli impacted streams is $163.85 per day.

Calculation for evaluating benefits of E. coli reduction based on recreation use: percent of time E. coli levels exceed EPA recommendations, multiplied by total population exposed, multiplied by incidences per 1000

exposures, equals the expected illness rates. Take that multiplied by 10 days of illness, multiplied by sick leave cost per day to get an estimated cost of illnesses with total recovery.

The following explains how each figure is obtained to calculate the cost of missed work days due to recreation activities in *E. coli* impacted streams:

- Testing done in 2022 show *E. coli* levels exceed 126 CFU/ml 90% of the recreation season.

- Bow Creek Recreation Area recorded 2049 vehicles paid for a parking pass during the 2022 recreation season. At least one person was in each car so we assume 1 person per car recreating in the creek. Plus, we don't know how many locals access the creek on private lands, it would be reasonable to assume at least as many as what use the recreation area so, 2049 additional exposures over the recreation season. A total of 4098 people were exposed.

- The United States Census Bureau lists the median income for families in Cedar County Nebraska at $85,200; that comes to $163.85 per day ($85,200 / 2 incomes = $42,600 divided by 260 (52 weeks x 5 days per week = 260 work days) = $163.85 per day)

- The World Health Organization states on their website that most people recover from *E. coli* illnesses within 10 days.

- On page 53 of EPA's publication EPA-600/1-80-031 "Health Effects Criteria for Marine Recreational Waters" Victor Cabelli figures, on average, swimmers had 39 per 1000 had highly credible GI cases and 13 per 1000 non swimmers had highly credible GI cases in high E. coli waters. With no way of knowing how many people swim and don't swim in Bow Creek we averaged the cases to 26 per 1000.

Therefore: 0.90 x 4098 x 0.026 x 10 x 163.85= total cost of illnesses
(0.90 x 4098 x 0.026 = 95 illnesses x 10 days x $163.85 = **$157,121.01 per year related to exposure.**)

For those who develop the serious complication Hemolytic Uremic Syndrome (HUS) from an *E. coli* illness the economic burden is estimated to be over $500,000 per person, according to the Minnesota Department of Health's online factsheet (https://www.health.state.mn.us/diseases/ecoli/ecoli.html). With an incidence rate of 2-7% of *E. coli* illnesses leading to HUS, we can expect 1-3 cases of HUS costing $500,000 - $1,500,000.

The benefit from increasing acres of CRP can be calculated using the economic return from hunting. The Wild Pheasant Conservation Plan (2021) estimates $172 is spent in Nebraska per wild pheasant harvested. Nebraska Game and Parks Commission has estimated one additional pheasant can be harvested for every two acres of quality CRP established.

Total economic benefits and environmental benefits are presented in Chart 7 and Chart 8 below.

Chart 7

Economic Benefits

Benefit	Year 1	Year2	Year3	Total
Decreased pumping costs	$12,350	$12,350	$12,350	$37,050.00
Illness risk reduction	$552,374	$552,374	$552,374	$1,657,122
Pheasant Hunting Potential	$22,933	$22,933	$22,933	$68,800
Farmer Benefit from N loss	$9,178	$9,178	$9,178	$27,534
Farmer Benefit from P loss	$2,074	$2,075	$2,075	$6,224
Education Benefit	$11,000	$12,000	$12,000	$500,000
	$609,909	**$610,910**	**$610,910**	**$2,296,730**

Chart 8

Environmental Benefits

Benefit	Year 1	Year2	Year3	Total	
E. coli Reduction	41811	41811	41811	125433	billion CFU
P Reduction	2075	2075	2075	6224	pounds
N Reduction	9178	9178	9178	27,534	pounds
Sediment Reduction	1011	1011	1011	3034	ton
Increased water holding capacity				100,000,000	gallons

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).

Travel and supplies for the administration of the program are estimated at $5,000 and $18,000.

Educational program costs include contracting speakers to come to field days and workshops. These speakers usually charge $1,000-$2,000 per day plus travel expenses. Their dynamic and innovative messages draw attendees from the entire region, not just the local watershed. Diverse attendees at workshops

and field days create an opportunity to expand the personal networking opportunities for local attendees. The cost charged to this project is $49,800.

Locally relevant information from demonstration farms is a powerful tool to increase confidence and capacity in other producers and increase adoption of conservation practices. Not only will demonstration farms serve as local resources for producers to see successful implementation of conservation practices, they also provide knowledge for ag professionals who support adoption of conservation practices by supporting farmers and ranchers through challenges. To decrease the financial risk associated with adopting conservation practices the project will pay $2500 per year of farmer participation in the demonstration farms and cover the cost of soil and crop testing for three demo farms. These demonstration farms will be featured in education events, videos and factsheets created by the project. Total cost of the demonstration farms is $32,250.

Mentoring producers adopting soil health practices is key to success. There are a few producers in the watershed that have successfully adopted conservation practices who are willing to share their expertise with others. Because they are taking time away from their operations to help others avoid costly mistakes, a nominal yearly compensation to attend meetings and to make mentoring farm visits is appropriate. Three mentors will receive $500 in compensation per year. Experiences from other organizations show mentoring programs work best if someone organizes and hosts them. For this project the LCNRD will organize and host the meetings. Building a sense of community between the attendees will strengthen the bond and allow natural development of subgroups. Continuing education stipends for mentors to attend advanced education events will be provided and are estimated at $1244 per year. $8,500 is budgeted for mentoring.

Technical assistance is provided to farmers and ranchers by many sources. A deep understanding of soil health and how it is connected to farm profit and water quality is important for the area. By providing local technical service providers, including crop consultants, seed, fertilizer and chemical dealers, and others, with continuing education in these areas we can extend the influence of the program. Working with NRCS and UNL Extension a technical assistance curriculum will be developed and facilitated in the watershed. This program will be open to all service providers and farmers and ranchers. It will focus on the why, what, and how of conservation planning and implementation. The program will be developed and delivered for $5,400. This will cover the cost of travel for planning the program, outside consultation, meeting expenses and materials.

UNL Capstone students have provided technical assistance to four farmers and farm operations in the Bow Creek Watershed each of the past three years. This exchange of ideas between students and producers has proven beneficial to all involved. To continue this program the next three years will cost $16,000 of which UNL will provide $3,000 cash.

Recognition for work that will improve water quality can be a powerful and positive social influence that increases adoption of BMPs. For producers willing to implement conservation practices that improve water quality. LCNRD will provide a sign to be posted at the farm/field of willing, participating farmers. These signs will include the water quality parameter being addressed by the practice and the quantity of benefit expected from the practices. The expected cost for signs is $6,000.

Best Management Practice Incentive payments will increase producer financial support up to 90% of estimated cost to implement practices as identified in the WQMP. All acres in the project area will be eligible for incentive payments. Cost for these payments is $130,000 with $33,000 coming from NDEE 319 and NGPC.

Ongoing evaluation of the program and future water quality planning for the continued sustainability of local water resources will be included in the budget at $20,000. This will include working with NDEE to update water quality assessments and data analysis, and additional support with modeling and load reduction assessments to update the Water Quality Management Plan.

Total cost for the project not including personnel and in-kind: $290,950.

Annual operation costs for personnel (this is not allowable under WSF but vital for the project) of $313,000 has been included in the LCNRD budgeting process. The costs will be covered by LCNRD local budget and a 319 grant from NDEE. This shows a long-term commitment by the LCNRD Directors to continue the program. Staff time will be used to promote the project, organize educational events, facilitate mentor groups, establish demo farms, develop technical assistance training to support farmers and ranchers, process incentive contracts, and complete all required reporting. Conservation contract planning, execution, and compliance reviews will be handled by the agency offering the contract. Partner agencies also provide in-kind personnel time to support producers implementing best management practices.

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).

The primary benefits for this project include reducing non-point source (nps) pollution loads with the implementation of Best Management Practices (BMPs).

With our goals of BMP implementation we expect 5,000 acres treated will reduce *E. coli* by 125,433 billion CFUs, phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons. Improved soil health from BMPs will also improve water holding capacity of soil of 5,000 acres by 100,000,000 gallons.

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.

The ecological benefits of this project are illustrated on Chart 7.

These figures come from the LCNRD Water Quality Management Plan Table 10-25. Modeling shows 2000 acres of nutrient management can reduce *E. coli* by 63,948 billion cfu/100ml, phosphorus by 3,805 pounds, and nitrogen by 8,847 pounds. Cover crops / no-till on 2250 acres can reduce *E. coli* by 21,333 billion cfu/100ml, phosphorus by 1,797 pounds, nitrogen by 13,545 pounds and sediment by 2,824 tons. The addition of small grain crop rotations on 100 acres can reduce *E. coli* by 593 billion cfu/100ml, phosphorus by 74 pounds, nitrogen by 469 pounds and sediment by 12 tons. Eighty acres of CRP can reduce *E. coli* by 2,628 billion cfu/100ml, phosphorus by 331 pounds, nitrogen by 3,695 pounds and sediment by 14 tons. Livestock Exclusion from 160 acres can reduce *E. coli* by 35,777 billion cfu/100ml, phosphorus by 64 pounds, and nitrogen by 285 pounds. Fifty acres of buffer or filter strips can reduce *E. coli* by 631 billion cfu/100ml, phosphorus by 37 pounds, nitrogen by 87 pounds and sediment by 25 tons. Prescribed grazing on 160 can reduce *E. coli* by 520 billion cfu/100ml, phosphorus by 113 pounds, nitrogen by 613 pounds and sediment by 30 tons.

In addition to the ecological benefits, 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.*

There is no recognized method to calculate benefits for reducing E. coli. However, EPA studies have been done that make the following formula the best option to try to put a monetary value on it:

percent of time *E. coli* levels exceed EPA recommendations, multiplied by total population exposed, multiplied by incidences per1000 exposures, equals the expected illness rates. Take that multiplied by 10 days if illness, multiplied by sick leave cost per day to get an estimated cost of illnesses with total recovery.

The following explains how each number was reached:

- Testing done in 2022 show *E. coli* levels exceed 126 cfu/ml 90% of the recreation season.

- Bow Creek Recreation Area recorded 2049 vehicles paid for a parking pass during the 2022 recreation season. At least one person was in each car so we assume 1 person per car recreating in the creek. Plus, we don't know how many locals access the creek on private lands, it would be reasonable to assume at least as many as what use the recreation area so, 2049 additional exposures over the recreation season. A total of 4098 people exposed.

- The United States Census Bureau lists the median income for families in Cedar County Nebraska at $85,200; that comes to $163.85 per day.

- The World Health Organization states on their website that most people recover within 10 days.

- On page 53 of EPA's publication EPA-600/1-80-031 "Health Effects Criteria for Marine Recreational Waters" on average swimmers had 39 per 1000 had highly credible GI cases and 13 per 1000 nonswimmers had highly credible GI cases in high E. coli waters. With no way of knowing how many people swim and don't swim in Bow Creek we averaged the cases to 26 per 1000.

Therefore: 0.90 x 4098 x 0.026 x 10 x $163.85= total cost of illnesses (0.90x4098x0.026= 95 illnesses x 10 days x $163.85 = $157,121.

For those who develop the serious complication Hemolytic Uremic Syndrome from an *E. coli* illness the economic burden is estimated to be over $500,000 per person, according to the Minnesota Department of Health's online factsheet (https://www.health.state.mn.us/diseases/ecoli/ecoli.html). With an incidence rate of 2-7% of E. coli illnesses leading to HUS, we can expect 1-3 cases of HUS costing $500,000 - $1,500,000.

Increasing soil organic matter by 1% can increase water holding capacity of an acre by 20,000 - 22,000 gallons, or 1 acre inch. Targeting 5,000 acres with BMP an increase in 1% organic matter would equate to 100,000,000 gallons. It is unlikely we will realize this increase in the next three years but in the next 10-15 years it is possible. With an average pumping cost of $7.41 per acre inch, decreased pumping costs on 5,000 acres would be $37,050 (5,000 x $7.41 = $37,050).

Practices like CRP and the addition of small grains in a rotation not only help improve water quality, they also are beneficial habitat additions for pheasants. The Wild Pheasant Conservation Plan (2021) estimates $172 is spent in Nebraska per wild pheasant harvested. With the addition of 80 acres of CRP, entering 10-year contracts, pheasant populations may be increased by 40 birds

per year. This population increase could create an additional $68,800 of economic spending from hunters over the next ten years.

Evaluations from the Bow Creek Watershed Project winter workshops showed producers valued the workshop anywhere from $7-$100. Using the range of $7 - $100 on 5,00 acres the total value of all planned workshops would fall between $36,000 and $500,000. In addition to the economic benefit to attendees, evaluations showed all attendees increased knowledge about stream impairments, best management practices, and implementation of best management practices. Almost all attendees indicated an increase in likelihood of implementing best management practices.

The benefits of the project are listed on Charts 7 and 8 below.

Chart 7

Economic Benefits

Benefit	Year 1	Year2	Year3	Total
Decreased pumping costs	$12,350	$12,350	$12,350	$37,050.00
Illness risk reduction	$552,374	$552,374	$552,374	$1,657,122
Pheasant Hunting Potential	$22,933	$22,933	$22,933	$68,800
Farmer Benefit from N loss	$9,178	$9,178	$9,178	$27,534
Farmer Benefit from P loss	$2,074	$2,075	$2,075	$6,224
Education Benefit	$11,000	$12,000	$12,000	$500,000
	$609,909	**$610,910**	**$610,910**	**$2,296,730**

Chart 8

Environmental Benefits

Benefit	Year 1	Year2	Year3	Total	
E. coli Reduction	41811	41811	41811	125433	billion CFU
P Reduction	2075	2075	2075	6224	pounds
N Reduction	9178	9178	9178	27,534	pounds
Sediment Reduction	1011	1011	1011	3034	ton
Increased water holding capacity				100,000,000	gallons

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).

This is a project that does not fit into a traditional business model, therefore cost and benefits are hard to put in a cash flow. Chart 9 represents the annual expenses for the life of the project. Chart 7 represents the benefits over the life of the project. Chart 10 represents the cash flow for the life of the project.

Chart 9 **Bow Creek Watershed Expenses**				
Tasks	**Year 1**	**Year 2**	**Year 3**	**Total**
Personnel	**$ 107,822**	**$ 112,721**	**$ 118,521**	**$ 339,064**
Workshops	$8,300	$8,200	$8,300	$24,800
Field Day	$8,334	$8,333	$8,333	$25,000
UNL Student Visit	$5,500	$5,500	$5,000	$16,000
Demo Farm	$10,750	$10,750	$10,750	$32,250
Mentoring	$2,833	$2,833	$2,834	$8,500
TA training	$500	$500	$4,400	$5,400
BC Signs	$2,000	$2,000	$2,000	$6,000
Travel	$1,667	$1,667	$1,666	$5,000
Supplies	$10,000	$4,000	$4,000	$18,000
WQMP Update	$20,000	$0	$0	$20,000
Best Management Practices	$43,334	$43,333	$43,333	$130,000
Totals	**$ 221,040**	**$ 199,837**	**$ 209,137**	**$ 630,014**

Chart 7 **Economic Benefits**				
Benefit	**Year 1**	**Year2**	**Year3**	**Total**
Decreased pumping costs	$12,350	$12,350	$12,350	$37,050.00
Illness risk reduction	$552,374	$552,374	$552,374	$1,657,122
Pheasant Hunting Potential	$22,933	$22,933	$22,933	$68,800
Farmer Benefit from N loss	$9,178	$9,178	$9,178	$27,534
Farmer Benefit from P loss	$2,074	$2,075	$2,075	$6,224
Education Benefit	$11,000	$12,000	$12,000	$500,000
	$609,909	**$610,910**	**$610,910**	**$2,296,730**

Chart 10 **Total Bow Creek Watershed Cost Flow including personnel and producer costs**				
Tasks	**Year 1**	**Year 2**	**Year 3**	**Total**
NDEE 319	$100,000	$100,000	$100,000	$300,000
LCNRD	$52,620	$47,080	$54,280	$153,980
WSF	$60,731	$45,070	$47,170	$152,970
UNL	$3,567	$3,567	$3,566	$10,700
UNL Extension	$2,122	$2,121	$2,121	$6,364
NGPC	$2,000	$2,000	$2,000	$6,000
Totals	**$221,040**	**$199,838**	**$209,137**	**$630,014**

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.)

There is no generally accepted method for calculating the primary tangible benefits of this project. Efforts have been taken to research reasonable estimations of benefits from this project and a detailed accounting of benefits can be found in question 3B, above.

Anticipated benefits in the reduction of human health risks of *E. coli* infection and serious complications can be as much as $1,657,122. Additional benefits from increasing CRP acres and pheasant populations could add up to an additional $68,800 in economic benefit from hunters. Decreased irrigation pumping could result in $37,050 savings and an additional $33,758 in savings from reducing the loss of applied crop nutrients could be realized from applying best management practices on 5,000 acres. The education benefit is valued at up to $500,000. In total these benefits add up to $2,296,730

Cost of the project only including allowable expenses for the project is $290,950. The total cost of the proposed project is $650,014, this includes the cost of personnel paid for with funds outside of WSF.

The next best alternative, creating a Stream Corridor Reserve Easement Program (SCREP), modeled after the Wetland Reserve Easement program would cost significantly more than the proposed project ranging from $4.2 million to $40.2 million.

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.

The WSF budget for Bow Creek Watershed Project not including personnel or in-kind cost is $310,950; including other operating expenses such as in-kind and personnel the project cost is $650,014.

Between all supporting partners and the WSF we will be able to cover all expenses for the program. LCNRD has allocated $153,980 over three years for personnel and other parts of the project. The Nebraska Department of Environment and Energy has indicated support of $300,000 to the project in a 319 grant. A large portion of that will help pay for personnel, not allowable under WSF. Nebraska Game and Parks Commission, UNL, UNL Extension, and local producers will make up the remainder of the contributions needed for the project. The proposed project budget is summarized in Chart 10 below and includes the total costs to be incurred by LCNRD and partners. Confirmations of project commitment are included in Attachment A and the LCNRD budget is in Attachment B.

Chart 10

Total Bow Creek Watershed Cost Flow including personnel and producer costs

Tasks	Year 1	Year 2	Year 3	Total
NDEE 319	$100,000	$100,000	$100,000	$300,000
LCNRD	$52,620	$47,080	$54,280	$153,980
WSF	$60,731	$45,070	$47,170	$152,970
UNL	$3,567	$3,567	$3,566	$10,700
UNL Extension	$2,122	$2,121	$2,121	$6,364
NGPC	$2,000	$2,000	$2,000	$6,000
Totals	**$221,040**	**$199,838**	**$209,137**	**$630,014**

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

The total LCNRD budget for the Bow Creek Watershed Project is $153,980. This budget will cover the 40% WSF match requirement and includes a significant portion of staff costs. The remainder of staff expenses will be covered by funds from NDEE's 319 program. The 319 funds have already been allocated for Phase II but no contracts have been signed. The LCNRD directors have

indicated a long-term commitment to the Bow Creek Watershed Project beyond 2026. Initial discussions for including Bow Creek in a National Water Quality Initiative (NWQI) with NDEE and NRCS are taking place. The LCNRD board would need to consider and approve the creation of the NWQI area. This would allow Best Management Practices (BMP) budgets to be used for other aspects of the project while maintaining the up to 90% cost-share payments that will provide the financial support producers need to implement water quality BMPs. The LCNRD budget is included as Attachment B.

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

There is no loan proposed for this project.

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

The Bow Creek Watershed Project (BCWP) 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, prescribed grazing practices, CRP, buffer strips, prairies strips, and the NGPC Small Grain Initiative all help improve or expand habitat for upland gamebirds and other wildlife. The small grains planted on croplands have restrictions on when they can be harvested to ensure nesting habitat stays intact until the first clutches are hatched. Increasing plant diversity has a cascading effect on soil biology diversity as well as above ground biological diversity. Expanded crop rotations or cover crop 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 cover crops planted in the summer that are stockpiled for livestock grazing in the winter. Other wildlife benefits from stockpiled cover crops or forage crops include increased cover and food resources.

The high levels of stream sediment observed in Bow Creek can negatively affect fish and other invertebrates. High turbidity in the stream 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. The proposed BMPs may reduce sediment in Bow Creek by 3,034 tons over the next 3-5 years.

Representatives from NRCS and NGPC regularly participate in monthly advisory committee meetings for the BCWP ensuring close collaboration of the agencies.

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.

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. The Bow Creek Watershed is located in Cedar, northwestern Dixon, and northeastern Knox Counties within the LCNRD boundaries.

In 2019 the LCNRD worked in partnership with NDEE and FYRA Engineering to develop a Water Quality Management Plan (WQMP) to improve the water quality and environmental integrity of local watersheds. The WQMP is based on the Environmental Protection Agency’s (EPA) nine key elements, requirements that are critical for achieving improvements in water quality. Using information from the WQMP, LCNRD and NDEE developed a Project Implementation Plan (PIP) to address water quality concerns in the Bow Creek Watershed. That PIP has been accepted by EPA for implementation.

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 was developed in conjunction with the Nebraska Department of Environment and Energy (NDEE) by the Lewis & Clark NRD (LCNRD), as such it addresses plans and programs of both state and local agencies responsible for resource development and protection.

In 2019 the LCNRD worked in partnership with NDEE to develop a Water Quality Management Plan (WQMP) to improve the water quality and environmental integrity of local watersheds. The WQMP is based on the Environmental Protection Agency's (EPA) nine key elements, requirements that are critical for achieving improvements in water quality. The Development of the WQMP included stakeholder meetings with representatives from local governments, residents, and local state agencies.

Using information from the WQMP, LCNRD and NDEE developed a Project Implementation Plan (PIP) to address water quality concerns in the Bow Creek Watershed. The PIP outlines actions required to reduce nonpoint source pollution in Bow Creek in order to remove it from the 303(d) list of impaired water bodies on the Nebraska Integrated Report to the EPA. The Bow Creek PIP has been accepted by EPA for implementation.

The technical advisory committee for the Bow Creek Watershed Project consists of representatives from UNL Extension, Nebraska Game and Parks Commission (NGPC), and NRCS to ensure activities are in line with common goals. For example, the NGPC small grains program promotes the inclusion of a small grain crop in a diverse cropping system to increase upland bird habitat and food sources. This practice also addresses soil health resource concerns and is an approved NRCS practice. This practice also helps prevent soil erosion and trap sediment before it can enter the stream system.

The Lewis & Clark Integrated Management Plan was prepared voluntarily by the LCNRD Board of Directors and took effect September 5, 2016. The IMP has several goals the Bow Creek Watershed Project meets:

Goal 1: Develop and maintain a district-wide water inventory.

Objective 1.1 - Create and maintain a comprehensive database of ground and surface water information. The Bow Creek Watershed Project (BCWP) has worked closely with the Nebraska Department of Environment & Energy (NDEE) to create an expanded *E. coli* baseline database for Bow Creek. Twelve sites across the watershed were tested for 15 weeks during the recreational season May - September in 2021 and 2022. Water quality measurements included *E. coli*, total suspended solids, phosphorus, nitrogen, water level, temperature, conductivity, turbidity, and dissolved oxygen levels. This testing expanded NDEEs previous testing of four sites every six years. NDEE has express interest in continuing this data collection in 2023 and beyond to monitor stream health.

Objective 1.2 - Address data gaps in the surface and groundwater monitoring network. The extensive testing (see objective 1.1) expanded on the limited 3-4 sites that are tested every 6 years through the basin rotation testing done by NDEE staff. NDEE staff use the data collected through the Bow Creek Watershed Project to expand their surface water database and advise on nonpoint source pollution loads.

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

Objective 2.3: Improve water resource sustainability through innovative management strategies. By using best management practices we aim to decrease *E. coli* loads in Bow Creek to the point it can sustain the recreational use designation. Additionally the benefits of increasing soil organic matter by 1% can increase the water holding capacity of the land by 20,000-22,000 gallons. This would decrease the need for irrigation ensuring aquifers are not over appropriated. Increasing soil organic matter also increases the soil's ability to hold onto nutrients, decreasing the potential for nitrate leaching into groundwater supplies.

Goal 3: Increase public awareness and understanding of integrated water management.

Objective 3.1: Expand public outreach programs for ground and surface water. Over the next three years we will provide outreach programs that include winter workshops and summer field days to increase public awareness of the Bow Creek impairments, the best management practices that can be implemented to correct the impairments, and public benefits of the project. LCNRD will also be updating their water quality management plan during this project.

The Bow Creek Watershed Project also addresses half of the six DNR agency goals identified in the 2022 Annual Report.

Goal 3: Develop and implement customized and decentralized water management plans established through collaboration with local Natural Resource Districts and stakeholders that provide for long-term sustainability of the state's water resources.

- The Bow Creek Project follows recommendations outlined in the 2019 Water Quality Management Plan developed by the LCNRD.

Goal 4: Encourages strong engagement with multiple stakeholder groups in planning and implementation to meet local needs, and

- Local stakeholders, including farmers, ranchers, state agency representatives and federal agency representatives, collaborated with the LCNRD during the development of the WQMP.

Goal 5: Protects existing water uses through collaborative investments in water resource projects.

- Working together with the LCNRD and partners on this project will help protect water uses.

Nebraska's Sediment Control Act (LB474) was adopted by the 1986 Nebraska Legislature to reduce erosion on Nebraska lands and to reduce sedimentation and other problems that result from that erosion. The purpose of this program is to augment many existing erosion and sediment control efforts, including those of federal, state, and local governments. Interrelated in a regulatory sense are the Sodbuster and Cross Compliance portions of the Food Security Act of 1985, P.L. 99-198.

Bare soil that is heavily tilled is prone to erosion. The proposed BCWP will provide education and financial incentives to adopt no-till or minimum tillage, crop rotation and cover crop practices to decrease sediment eroding from the land and making its way into the stream. Over the next three years the BCWP is expected to decrease sediment entering Bow Creek from erosion by 3,034 tons.

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

If yes:

10.A Provide a complete listing of all lands involved in the project. N/A

10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. N/A

10.C Provide assurance that you can hold or can acquire title to all lands not currently held. N/A

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

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. Boundaries of the original NRDs were based on Nebraska's major river basins to enable the application of appropriate management practices to areas with similar topography.

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. The Bow Creek Watershed is located in Cedar, northwestern Dixon, and northeastern Knox Counties within the LCNRD boundaries.

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

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 no-till, conservation crop rotations, irrigation management, nutrient management and grazing management. By decreasing disturbance from mechanical tillage we will decrease the rate of destruction of stable soil aggregates and 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 and range plant diversity and plant growth patterns we can protect the soil surface from raindrop impact that dislodges soil particles and washes them into Bow Creek. Protecting the soil from the sun's rays will also decrease evaporation making water more available for crop or range 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.

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 six 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 that extend the growing seasons. 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.

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 CRP and multi-species cover/forage crops 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.

The primary benefits for this project include reducing nonpoint source pollution loads with the implementation of Best Management Practices (BMPs). The main pollutant we are targeting is *E. coli* as it is a human health concern. In 2021 and 2022 Bow Creek had *E. coli* loads above EPA's acceptable levels over 90% of the recreation season (May - September). With thousands of people using Bow Creek for recreational purposes in the summer, high *E. coli* levels have the potential to make people sick, and in rare cases can lead to serious, long-lasting side effects or death.

With our goals of BMP implementation we expect 5,000 acres treated will reduce *E. coli* by 125,433 billion colony forming units (CFUs), phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons. Preventing sediment from reaching the stream 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 a potential for eutrophication, and sediment-bound pesticides can harm aquatic life.

Section C.

NRC SCORING

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

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

Notes:

- The responses to one criterion *will not* be considered in the scoring of other criteria. Repeat references as needed to support documentation in each criterion as appropriate. The 15 categories are specified by statute and will be used to create scoring matrixes which will ultimately determine which projects receive funding.

- There is a total of 69 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted above. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.

- The Commission recommends providing the requested information and the requests are not intended to limit the information an applicant may provide. An applicant should include additional information that is believed will assist the Commission in understanding a proposal so that it can be awarded the points to which it is entitled.

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

1. Remediates or mitigates threats to drinking water;

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

   Even though the primary purpose of this project is to address *E. coli* in the Bow Creek, best management practices (BMPs) that are used for that purpose also

help decrease the chances nitrates will leach into groundwater. Preventing nitrates from becoming a problem in groundwater is a benefit of this project.

There are six Wellhead Protection Areas (WHPAs) in the Bow Creek Watershed surrounding public drinking supplies. The City of Hartington serves 1436 people, the Village of Wynot serves 220 people, and Bow Valley Water Works serves 120 people. Additionally, the Village of Fordyce serves 135 people, and Crofton serves 754 people, but presently receives drinking water from the Cedar-Knox Rural Water Project while maintaining WHPAs. The WHPA is not the primary drinking water source for the Village of Fordyce and City of Crofton. The Cedar-Knox Rural Water Project is building a new water treatment facility in the Bow Creek Watershed. WHPA for the new groundwater source for the Cedar-Knox Rural Water Project has not been designated at this time.

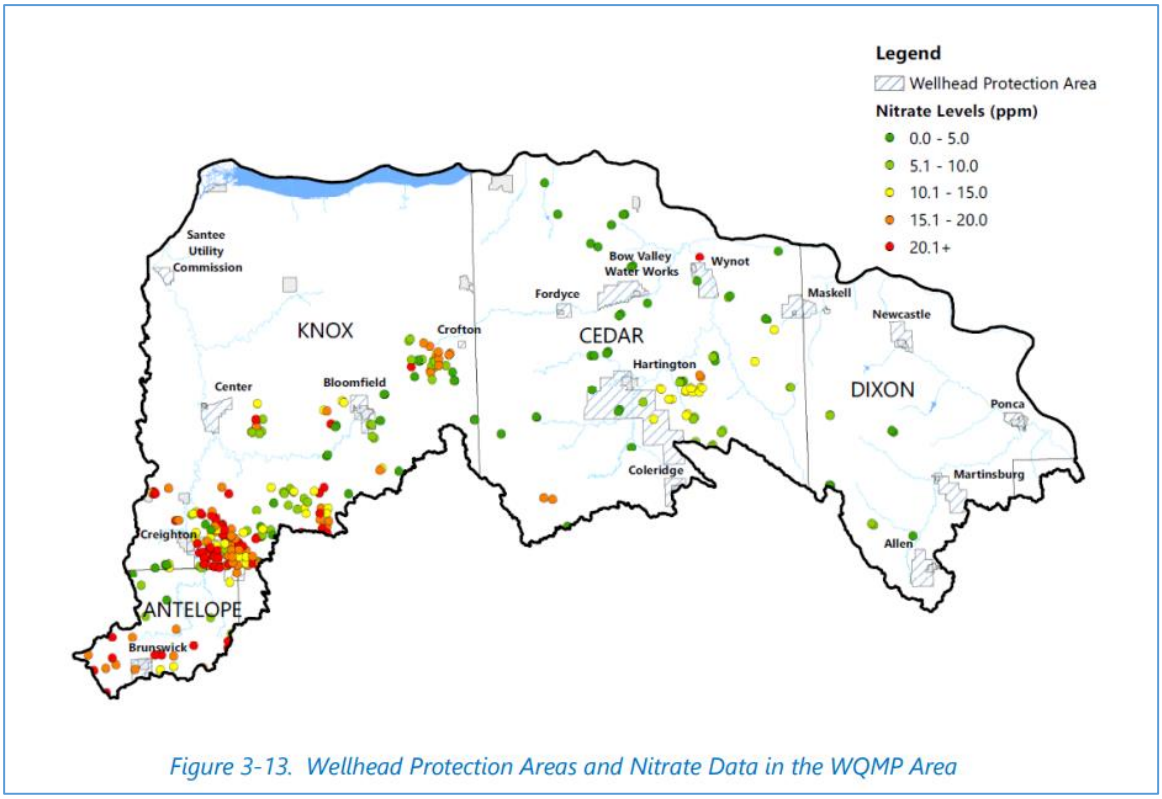

Figure 3-13. Wellhead Protection Areas and Nitrate Data in the WQMP Area

Nitrate sampling data for current WHPAs indicate levels in most areas range from 0-5 ppm to 5-10 ppm. These levels are below the drinking water standard of 10 ppm, but are high enough to warrant taking actions to reduce loss of nitrate to groundwater. The Hartington WHPA has shown increased levels above the standard, with levels as high as 14.9 ppm. Sampling data near Coleridge reveal nitrate concentrations generally between 3 and 5 ppm, but levels have been higher historically. Figure 3-13 in the Lewis & Clark NRD's Water quality Management Plan shows wells just outside the WHPAs for Wynot have nitrate concentrations above 20 ppm. The Hartington WHPA has wells near it that have nitrate levels above 10 ppm, and one well tested inside the WHPA has more than

10 ppm. Figure 3-13 from the LCNRD WQMP shows nitrate concentrations of wells near WHPAs.

Acres in WHPAs qualify for increased cost-share rates through USDA NRCS. Even with the increase in cost-share rates, use of the cost-share program to implement best management practices to reduce nitrate leaching into groundwater remains low. This project will bring an increased awareness of the potential for nitrate contamination and economic benefits of best management practices (BMPs). The education and outreach component of this project will increase producers' knowledge and confidence to implement BMPs successfully, and will increase adoption in WHPAs.

Implementing a combination of BMPs, such as no-till, crop rotations, and cover/forage crops, 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 six wellhead protection areas within the project area.

If nitrates continue to increase in WHPAs the small communities would be forced to relocate the supply wells or install a reverse osmosis system. The City of Creighton, located in the LCNRD, installed a reverse osmosis system to treat nitrates in their water in 1993. At that time the system cost $1.3 million. The small villages and towns in the Bow Creek Watershed Project would not have the capital to cover the cost of a reverse osmosis system. Establishing new wells could also be cost prohibitive with an average of $500,000 for each well and may just move the problem further into the future. This could potentially leave more than 1,700 residents without a safe water supply. The Cedar-Knox Rural Water Project could possibly supply the residents with water but would more than likely require an upgrade in distribution lines. If new distribution lines must be run, water rates would need to be increased over the whole district to cover the costs.

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 Lewis & Clark Integrated Management Plan (IMP) was prepared voluntarily by the LCNRD Board of Directors and took effect September 5, 2016. There are three goals in the IMP that this project meets:

Goal 1: Develop and maintain a district-wide water inventory.
The LCNRD has collected water quality and quantity data in the district that includes static water levels, nitrate concentrations in irrigation water, and the USGS has a stream gauge in Bow Creek.

Objective 1.1 - Create and maintain a comprehensive database of ground and surface water information.

The Bow Creek Watershed Project (BCWP) has worked closely with the Nebraska Department of Environment & Energy (NDEE) to create an expanded *E. coli* baseline database for Bow Creek. Twelve sites across the watershed were tested for 15 weeks during the recreational season May - September in 2021 and 2022. Water quality measurements included *E. coli*, total suspended solids, phosphorus, nitrogen, water level, temperature, conductivity, turbidity, and dissolved oxygen levels. Atrazine testing was done in May and June. This testing expanded NDEEs previous testing of three to four sites every six years. NDEE has expressed interest in continuing this data collection in 2023 and beyond to monitor stream health.

Objective 1.2 - Address data gaps in the surface and groundwater monitoring network. The extensive testing done through the BCWP expanded on the limited 3-4 sites that are tested every 6 years through the NDEE basin rotation testing. NDEE staff use the data collected through the BCWP to expand their surface water database and advise on nonpoint source pollution loads.

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

LCNRD has rules and regulations in place to evaluate all new irrigation well applications and irrigated acre expansion requests. The district is also in the process of certifying all groundwater irrigated acres. These rules were reviewed in early 2023 and will continue review and revision of groundwater rules and regulations as well as the district groundwater management plan. DNR oversees surface water irrigation.

Objective 2.3: Improve water resource sustainability through innovative management strategies.

By using best management practices we aim to decrease *E. coli* loads in Bow Creek to the point it can sustain the recreational use designation. Additionally the benefits of increasing soil organic matter by 1% can increase the water holding

capacity of the land by 20,000-22,000 gallons per acre. This would decrease the need for irrigation ensuring aquifers and surface water sources are not over appropriated. Increasing soil organic matter also increases the soil's ability to hold onto nutrients, decreasing the potential for nitrate leaching into groundwater supplies.

Goal 3: Increase public awareness and understanding of integrated water management.

The LCNRD is working on a web-based dashboard to store, organize and share water data collected over the years. Producer trainings in the Bazile area are conducted yearly to increase awareness and introduce management strategies to manage nitrate leaching into groundwater. The BCWP started hosting winter meeting workshops and field days to expand educational opportunities for local producers and to bring awareness to the Bow Creek impairment.

Objective 3.1: Expand public outreach programs for ground and surface water.

Over the next three years the project will provide outreach programs that include winter workshops and summer field days to increase public awareness of the Bow Creek impairments, the best management practices that can be implemented to correct the impairments, and public benefits of the project. LCNRD will also be updating their water quality management plan during this project.

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.

   The Bow Creek Watershed Project will support the adoption of best management practices (BMPs) that improve water infiltration rates, increase the water holding ability of the soil, and decrease irrigation needs. These benefits will help recharge the aquifers and streams, reduce aquifer and stream depletion, and "retime" water entering Bow Creek.

   Increasing infiltration rates allow more water to infiltrate during rain storms and snow melt. The more water that infiltrates, the greater the potential to make it through the vadose zone and into the groundwater and aquifer. While there are

no hard and fast numbers as to how much faster water infiltrates into soil managed with best management practices (BMPs), observations and unofficial records show farm ground managed with long-term BMPs infiltrates 3 inches per hour and farm ground not managed with long-term BMPs infiltrates 0.25 inches per hour. Soil health management practices such as cover crops are known to consistently increase infiltration rates by >35% on average, even after being used for a short time, when compared to fields with more conventional management (Stewart et al. 2018; Basche and DeLonge 2019). Improved water infiltration will contribute to the "retiming" of water into the stream. Instead of an immediate and excessive increase in stream volume from runoff events, a steady contribution from groundwater discharge will lead to a more consistent stream flow over the summer months.

Increasing soil organic matter by 1% can increase water holding capacity of an acre by up to 22,000 gallons. According to the DNR website there are 11 surface water irrigation systems in Bow Creek irrigating a total of 1201.1 acres. With increased water holding capacity of 22,000 gallons per acre the benefit of decreased surface water pumping would increase stream flow by 26,424,200 gallons per year (22,000 gallons x 1201.1 acres).

Watersheds impacted include: 101701011001 Upper West Bow Creek, 101701011002 Middle West Bow Creek, 101701011004 Lower West Bow Creek, 101701011101 Pearl Creek, 101701011102 Norwegian Bow Creek, 101701011103 Upper Bow Creek, 101701011104 Headwaters East Bow Creek, 101701011105 Outlet East Bow Creek, 101701011106 Middle Bow Creek, 101701011107 Lower Bow Creek, 101701011003 Second Bow Creek, 101701011202 Beaver Creek, and 10170101120 Antelope Creek.

Using available data from LCNRD irrigation well records, there are 158,627 acres irrigated by groundwater in the project area. A one percent increase in organic matter on each acre would hold an additional 3,489,794,000 gallons of water that would not need to be pumped from the aquifers. Although it is unlikely a 1% increase of soil organic matter will be realized on all acres within the next three years, it is possible in 10-20 years. The sand and gravel formations that irrigate 90,885 acres could increase water holding capacity by 1,999,470,000 gallons, the Dakota Formation that irrigates 6,558 acres could increase water holding capacity by 144,276,000 gallons, and the Niobrara Formation that irrigates 61,184 acres could increase water holding capacity by 1,346,048,000 gallons.

Adopting a more diverse crop rotation can also reduce the irrigation pumping needs in the project area. The predominant crop rotation in the project area is corn/soybean. A corn crop requires 19-31 inches of water per year and soybeans require 17-28 inches of water per year. The Project area receives on average 24-26 inches of moisture per year and irrigators in the area are pumping an average of 9 inches per year on their fields. Alternative crops that can successfully be grown in the area include winter or spring peas (14-19 inches), sorghum/millet

(18 - 26 inches), winter cereals (16-17 inches), oats (18-26 inches), and vetch (12-24 inches). Increasing the inclusion of these alternative crops in the rotations could decrease irrigation needs.

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.

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.

   The primary benefit of this project includes reducing nonpoint source pollution loads in Bow Creek so the recreational use is met. Because we are focusing on implementing conservation farming and ranching practices as the main way to meet this goal, other benefits that are expected include reduced erosion, reduced flooding, and improved wildlife habitat.

   Recreational Use
   Testing conducted by the Nebraska Department of Environment and Energy (NDEE) in 2010 and 2016 showed *E. coli* levels in Bow Creek were significantly above the EPA's standards for recreational streams. Testing done by NDEE and Lewis & Clark NRD (LCNRD) showed the levels were above EPA standards over 90% of the time during the summer recreation seasons for 2021 and 2022. Due to these elevated levels of *E. coli* Bow Creek does not meet the standards for recreational beneficial use and was placed on the 303d list of impaired waterbodies in the Nebraska Integrated Report to EPA. Cost-share programs have long been available to financially support the adoption of *E. coli* reducing BMPs. However, those cost-share programs alone have not increased the adoption rate to levels needed to increase water quality enough to remove Bow Creek from the impaired water bodies list.

   The Bow Creek Watershed 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 Bow Creek and support the recreational beneficial use.

With BMP implementation on 5,000 acres the expected benefit to Bow Creek will be to reduce *E. coli* by 125,433 billion CFUs, phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons.

Wildlife Benefit

Along with *E. coli*, testing shows elevated levels of sediment, phosphorus and nitrogen in the waters of Bow Creek. The high levels of stream sediment observed in Bow Creek can negatively affect fish and other invertebrates. High turbidity in the stream 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. The proposed BMPs may reduce sediment in Bow Creek by 3,034 tons over the next 3-5 years.

Conservation crop rotation, prescribed grazing practices, CRP, buffer strips, prairies strips, and the Nebraska Game & Parks Commission's Small Grain Initiative all help improve or expand habitat for upland gamebirds and other wildlife. The small grains planted on croplands have restrictions on when they can be harvested to ensure nesting habitat stays intact until the first clutches are hatched. Increasing plant diversity has a cascading effect on soil biology diversity as well as above ground biological diversity. Expanded crop rotations or cover crop 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 cover crops planted in the summer that are stockpiled for livestock grazing in the winter. Other wildlife benefits from stockpiled cover crops or forage crops 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 5,000 acres with BMPs, an increase in 1% organic matter would equate to over 100,000,000 gallons. 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 six 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 Bow Creek Watershed, flooding along the Missouri River will also be reduced. Bow Creek flows directly into the Missouri River below Gavins Point Dam. The reduction of over 100,000,000 gallons of water just from 5,000 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 5,000 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.

The primary benefit of this project is to reduce nonpoint source pollution loads in Bow Creek with the implementation of Best Management Practices (BMPs). Testing conducted by the Nebraska Department of Environment and Energy (NDEE) in 2010 and 2016 showed *E. coli* levels were significantly above the EPA's standards for recreational streams. Testing done by NDEE and Lewis & Clark NRD (LCNRD) showed the levels were above EPA standards 90% of the summer recreation seasons for 2021 and 2022.

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.*

Medical organizations state illnesses last up to 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 haemolytic uraemic syndrome (HUS) can result from *E. coli* infections. HUS can lead to kidney failure and death. Fortunately, HUS is rare, developing in 2-7% of *E. coli* infections, and no known cases of HUS or death have been linked to Bow Creek.

Along with *E. coli*, testing shows elevated levels of sediment, phosphorus and nitrogen in the waters of Bow Creek. With our goal of BMP implementation on 5,000 acres *E. coil* will be reduced by 125,433 billion CFUs, phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons. With nitrogen costs over a dollar per pound, the financial savings to Nebraska farmers will be over $27,000 for nitrogen and $6,000 for phosphorus.

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 5,000 acres with BMPs an increase in 1% organic matter would equate to over 100,000,000 gallons. 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 six 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.

The estimated costs of the project including O/M personnel expenses (not allowable under WSF but vital for the project) are listed in Chart 9 below.

Chart 9

Bow Creek Watershed Expenses

Tasks	Year 1	Year 2	Year 3	Total
Personnel	**$ 107,822**	**$ 112,721**	**$ 118,521**	**$ 339,064**
Workshops	$8,300	$8,200	$8,300	$24,800
Field Day	$8,334	$8,333	$8,333	$25,000
UNL Student Visit	$5,500	$5,500	$5,000	$16,000
Demo Farm	$10,750	$10,750	$10,750	$32,250
Mentoring	$2,833	$2,833	$2,834	$8,500
TA training	$500	$500	$4,400	$5,400
BC Signs	$2,000	$2,000	$2,000	$6,000
Travel	$1,667	$1,667	$1,666	$5,000
Supplies	$10,000	$4,000	$4,000	$18,000
WQMP Update	$20,000	$0	$0	$20,000
Best Management Practices	$43,334	$43,333	$43,333	$130,000
Totals	**$ 221,040**	**$ 199,837**	**$ 209,137**	**$ 630,014**

The next best alternative to reduce *E. coli* and delist Bow Creek from the 303d list of impaired water bodies would be to create a compulsory Stream Corridor Reserve Easement Program (SCREP), modeled after the Wetland Reserve Easement program. Permanent easements, 30-year, 10-year, or 3-year easements could be offered. Permanent easements are conservation easements in perpetuity. SCREP would pay 95% of fair market value and 100% of buffer establishment for permanent easements. For 30-year easements SCREP would pay 70% of fair market value and 75% of buffer establishment costs. To make it more like conservation contracts for EQIP or the NE Buffer Program a medium term 10-year easement or short term 3-year easement could be calculated at 25% and 10% of easement value and of buffer establishment. Because of the steep slopes of land in the Bow Creek Watershed buffer strips would generally be 250 ft wide. The estimated costs for the next best alternative is listed in Chart 12 below.

Chart 12

Stream Conservation Restoration Easement Program Cost

	Irrigated Acres	Non-irrigated Acres	Non-tillagle Acres	Estabmishment Costs	Total Costs
Perpetual	$32,533,857	$6,008,584	$1,748,143	$816,655	$41,107,238
30-Year Easement	$23,972,316	$4,427,378	$1,288,105	$601,746	$30,289,544
10-Year Easement	$8,561,541	$1,581,206	$460,038	$214,909	$10,817,694
3-Year Easement	$3,424,617	$632,483	$184,015	$85,964	$4,327,078

SCREP would reduce *E. coli* by 1,119,074 billion CFUs annually. This was calculated by using the FYRA Engineering data from the 2019 LCNRD Water Quality Management Plan indicating one acre of riparian buffer strips reduce *E. coli* by 145,620 billion CFUs annually. Although the program would reduce *E. coli* it would not bring the other associated benefits that the BCWP would bring that are outlined in Charts 7 and 8 below. SCREP would not reduce the risk of nitrate leaching in WHPAs.

Chart 7				
Economic Benefits				
Benefit	**Year 1**	**Year2**	**Year3**	**Total**
Decreased pumping costs	$12,350	$12,350	$12,350	$37,050.00
Illness risk reduction	$552,374	$552,374	$552,374	$1,657,122
Pheasant Hunting Potential	$22,933	$22,933	$22,933	$68,800
Farmer Benefit from N loss	$9,178	$9,178	$9,178	$27,534
Farmer Benefit from P loss	$2,074	$2,075	$2,075	$6,224
Education Benefit	$11,000	$12,000	$12,000	$500,000
	$609,909	**$610,910**	**$610,910**	**$2,296,730**

Chart 8					
Environmental Benefits					
Benefit	**Year 1**	**Year2**	**Year3**	**Total**	
E. coli Reduction	41811	41811	41811	125433	billion CFU
P Reduction	2075	2075	2075	6224	pounds
N Reduction	9178	9178	9178	27,534	pounds
Sediment Reduction	1011	1011	1011	3034	ton
Increased water holding capacity				100,000,000	gallons

The costs to implement the SCREP program are much greater than the costs to implement the Bow Creek Watershed Project and are not within the LCNRD budget. The benefits of the Bow Creek Watershed Project are greater than the costs to implement the program. The return on investment of the Bow Creek Watershed Project project is 264.55%.

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.

   Federal Clean Water Act

   According to the NDEE Integrated Report: Section 303(d) of the federal Clean Water Act (CWA) enacted by Congress in 1972, requires states, territories, and authorized tribes (states) to identify and establish a priority ranking for all waterbodies where technology-based effluent limitations required by section 301 are not stringent enough to attain and maintain applicable water quality

standards. Once identified, states are to establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the (revised) list of impaired waterbodies and TMDLs to the U.S. Environmental Protection Agency (EPA). The requirements to identify and establish TMDLs apply to all waterbodies regardless of whether a waterbody is impaired by point sources, nonpoint sources, or a combination of both (Pronsolino v. Marcus, 2000 WL 356305 (N.D. Cal. March 30, 2000)).

The NDEE has opted to utilize alternatives to TMDLs by developing 5-Alts for waterbodies that are impaired, but other pollution control alternatives besides a TMDL are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control alternatives include, but are not limited to, watershed management plan development, best management practice implementation, and adaptive management strategies. Category 5-Alt waters are not approved or disapproved by EPA; however, EPA agrees to accept the alternative.

Bow Creek is currently not meeting the recreational beneficial use due to high *E. coli* levels. Bow Creek was first listed as impaired for *E. coli* in the Nebraska Integrated Report to the EPA in 2012 and remains on the impaired list due to testing in 2016 that revealed *E. coli* continues to remain above acceptable levels.

Working with NDEE, LCNRD created a Water Quality Management Plan (WQMP) in 2019 following the 5-Alt method that included strategies to reduce *E. coli* in Bow Creek. Using information in the WQMP NDEE and LCNRD created a Project Implementation Plan that was accepted by EPA for the BCWP. The PIP objectives include adoption of best management practices (BMPs) modeled to reduce *E. coli*, sediment, phosphorus and nitrogen reaching the stream. This project will incentivize farmers and ranchers to adopt BMPs and provide additional education and technical support for successful implementation of the practices.

Nebraska's Sediment Control Act (LB474) was adopted by the 1986 Nebraska Legislature to reduce erosion on Nebraska lands and to reduce sedimentation and other problems that result from that erosion. The purpose of this program is to augment many existing erosion and sediment control efforts, including those of federal, state, and local governments. Interrelated in a regulatory sense are the Sodbuster and Cross Compliance portions of the Food Security Act of 1985, P.L. 99-198.

Bare soil that is heavily tilled is prone to erosion. The proposed BCWP will provide education and financial incentives to adopt no-till or minimum tillage, crop rotation and cover crop practices to decrease sediment eroding from the land and making its way into the stream. Over the next three years the BCWP is expected to decrease sediment entering Bow Creek from erosion by 3,034 tons.

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.

As part of the Missouri Tributaries, Bow Creek flows into the Missouri River (River) below Gavins Point Dam which is the last dam on the River that helps prevent flooding to Sioux City, Omaha and many other communities. This project will incentivize BMPs that increase water infiltration rates, increase the water holding ability of the soil, and decrease flooding risks.

A few of the structures down river from the Bow Creek Watershed Project include the Papio Missouri River NRD levees R-513 and R-616, as well as the Omaha Public Power District intake tubes. While damaging floods may threaten all three structures, low water levels can also cause problems for the public power district. Decreasing the amount of water entering the Missouri River during regional extreme weather events like bomb cyclones or derechos can help reduce flooding downstream. Increasing water infiltration during these type events can result in a steady stream flow that helps keep the Omaha Public Power District intake tubes from low water threats.

It is hard to estimate the reduction of flooding due to increased infiltration rates. Increasing infiltration rates from .25 inches per hour to three inches per hour (these are unofficial observations of farmers and conservation professionals), could eliminate a significant amount of water runoff from working crop ground and grassland in the project area during heavy rain events. Soil health management practices such as cover crops are known to consistently increase infiltration rates by >35% on average, even after being used for a short time, when compared to fields with more conventional management (Stewart et al. 2018; Basche and DeLonge 2019).

Increasing soil organic matter by 1% can increase water holding capacity of an acre by 20,000 - 22,000 gallons, or 1 inch of water over the surface of the acre. Targeting 5,000 acres with BMPs an increase in 1% organic matter would equate to more than 100,000,000 gallons. Targeting the entire Bow Creek Watershed area, 392,574 acres, for a 1% increase in organic matter would equate to increasing the storage of 7,851,480,000 gallons of water. Holding and additional

7.8 billion gallons of water during heavy rain events would drastically decrease flooding risks.

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.

The primary purpose for the Bow Creek Watershed Project (BCWP) is to improve water quality in Bow Creek and ultimately remove Bow Creek from the impaired waterbodies list (303d list) for nonpoint source pollution of Escherichia coli (*E. coli*) bacteria in the Nebraska Integrated Report to the EPA.

Water quality will be improved by adopting BMPs on the land. Practices will be incentivized up to 90% of the estimated cost for that practice. Educational events such as workshops and field days will be held in the project area so producers need not leave the local area to increase their knowledge of the practices and how to implement them. Demonstration farms will be established on local farms to highlight different farming and ranching techniques and mentoring groups will be expanded to support more producers adopting BMPs. UNL Capstone Course students will visit the area and consult with producers on farm improvement plans that will include BMPs that improve profitability and water quality. Technical service will be expanded with the assistance of UNL Extension specialists and by providing additional training to local agriculture professionals.

The target areas include the Bow Creek, Beaver Creek, and Antelope Creek Watersheds in the Lewis & Clark NRD. The project area consists of 392,574 acres in portions of Cedar, Knox and Dixon Counties. Water from Bow Creek is mainly used for recreation and agriculture. The project will incentivize the adoption of conservation contracts for BMPs that improve water quality by decreasing E. coli, sediment, phosphorus and nitrogen loads in the streams. A major part of the program is education and outreach to local producers. A growing body of evidence indicates increasing producer knowledge and confidence in practice implementation leads to long-term adoption of the practices.

Other possible solutions would be to continue with the current USDA NRCS and FAS cost-share programs only. Although there have been acres enrolled in these programs over the past ten years since Bow Creek was first listed as impaired, this option has not proven to be effective at improving water quality enough to delist Bow Creek. Focusing on the stream corridors for buffer strip practices is

another option that has been explored, but payment rates to make that effective are cost prohibitive at this point.

In 2019 LCNRD launched the Bow Creek Watershed Project in 2020. During Phase I of the project, eight workshops and two field days were held. The 2022 field day was attended by more than 80 people, triple the attendance in 2021. Incentive contracts have been executed for nutrient management, cover crops, crop rotations, no-till and irrigation water management. The success of Phase I will be built upon in Phase II.

Water quality benefits expected from Phase II of the program are listed in Chart 8 below.

Chart 8

Environmental Benefits

Benefit	Year 1	Year2	Year3	Total	
E. coli Reduction	41811	41811	41811	125433	billion CFU
P Reduction	2075	2075	2075	6224	pounds
N Reduction	9178	9178	9178	27,534	pounds
Sediment Reduction	1011	1011	1011	3034	ton
Increased water holding capacity				100,000,000	gallons

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 Lewis & Clark NRD supports this project. LCNRD budget information is attached to this application. The current property tax rate for LCNRD is 0.026759. The valuation is $4,164,990,331.00.

Other cash funding sources for this project include NDEE $30,000, UNL $3,000 and NGPC $3,000.

The LCNRD has committed $154,000 to the project over the next three years. This is the maximum amount the LCNRD can contribute to the project without negatively impacting other programs.

Current LCNRD budget information is attached. See Attachment B.

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

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

The Bow Creek Watershed Project (BCWP) is a project of Lewis & Clark NRD. Stakeholders in the BCWP include: LCNRD, NDEE, USDA NRCS, Nebraska Game and Parks Commission, UNL Extension, local producers, and local citizens. Stakeholders meet twice per month to consult on the program activities and progress.

LCNRD has an Integrated Management Plan, a Water Quality Management Plan (WQMP), and a 319 Project Implementation Plan in place. This project will address goals and objectives in all of these plans.

The Bow Creek Watershed Project was created to address water quality issues using information in the WQMP. Working with the Nebraska Department of Environment and Energy (NDEE) a Project Implementation Plan (PIP) was created and accepted by the EPA to address *E. coli* impairments. The PIP was initiated in 2020 with Phase I of the Bow Creek Watershed Project. This project will continue with Phase II of the project.

PIP Goals:
Goal 1: Implement the first phase of the LCNRD WQMP for the Bow Creek Watershed and for achieving water quality standards utilizing comprehensive and collaborative actions that efficiently and effectively restore and protect water resources from degradation and impairment by nonpoint source pollution.

In 2020 the first phase of the BCWP was initiated. Criteria for the incentive program was established and will be continued with this project. The BCWP will implement incentive programs that will bring total payment up to 90% of estimated costs for practice implementation on 5,000 acres.

Goal 2: Educate and inform agriculture producers, resource managers, public officials, community leaders, youth and other private citizens through public outreach programs.

Outreach and education events will be continued in the watershed. Eight workshops, two field days and four school visits have already been held in the first phase of the program. These will continue in Phase II with an increased focus on training technical service providers to assist producers in implementing BMPs. Demo farms, mentoring programs, and TA trainings are planned in Phase II.

Goal 3: Initiate pollutant load reduction by implementing best management practices (BMPs) within the priority area and carry out the first phase of removing Bow Creek from Nebraska's 303d list of impaired water bodies.

Promotion of the BMP incentive program and one-on-one support for practice implementation will facilitate the implementation of BMPs on 5,000 acres across the entire watershed.

The Lewis & Clark Integrated Management Plan was prepared voluntarily by the LCNRD Board of Directors and took effect September 5, 2016. The IMP has several goals the Bow Creek Watershed Project meets:

Goal 1: Develop and maintain a district-wide water inventory.

Objective 1.1 - Create and maintain a comprehensive database of ground and surface water information. The Bow Creek Watershed Project (BCWP) has worked closely with the Nebraska Department of Environment & Energy (NDEE) to create an expanded *E. coli* baseline database for Bow Creek. Twelve sites across the watershed were tested for 15 weeks during the recreational season May - September in 2021 and 2022. Water quality measurements included *E. coli*, total suspended solids, phosphorus, nitrogen, water level, temperature, conductivity, turbidity, and dissolved oxygen levels. This testing expanded NDEEs previous testing of four sites every six years. NDEE has express interest in continuing this data collection in 2023 and beyond to monitor stream health.

Objective 1.2 - Address data gaps in the surface and groundwater monitoring network. The extensive testing (see objective 1.1) expanded on the limited 3-4 sites that are tested every 6 years through the basin rotation testing done by NDEE staff. NDEE staff use the data collected through the Bow Creek Watershed Project to expand their surface water database and advise on nonpoint source pollution loads.

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

Objective 2.3: Improve water resource sustainability through innovative management strategies.

By using best management practices we aim to decrease *E. coli* loads in Bow Creek to the point it can sustain the recreational use designation. Additionally the benefits of increasing soil organic matter by 1% can increase the water holding capacity of the land by 20,000-22,000 gallons. This would decrease the need for irrigation ensuring aquifers are not over appropriated. Increasing soil organic matter also increases the soil's ability to hold onto nutrients, decreasing the potential for nitrate leaching into groundwater supplies.

Goal 3: Increase public awareness and understanding of integrated water management.

Objective 3.1: Expand public outreach programs for ground and surface water. Over the next three years outreach programs will be facilitated that include winter workshops and summer field days to increase public awareness of the Bow Creek impairments, the best management practices that can be implemented to correct the impairments, and public benefits of the project. LCNRD will also be updating their water quality management plan during this project.

Reducing *E. coli* levels provides a benefit to the public since there is potential for illness and, in rare events, death when humans come into contact with surface water containing high levels of *E. coli.* In addition to the local residents who enjoy summer recreational activities on the creek, 2,049 vehicles entered the Bow Creek Recreation Area during the 2022 recreation season. Data collected by the Lewis & Clark NRD showed elevated levels of *E. coli* during 90% of the 2022 recreation season.

The WQMP outlines steps that will reduce nonpoint source pollution of Bow Creek. Namely the implementation of best management practices known to reduce sediment entering the stream. Chart 13 below highlights the main practices we propose for this project, the number of acres anticipated in each practice, and the nonpoint source pollution reduction each is expected to provide.

Chart 13
Bow Creek Watershed Project Costs

Practice	Acres	E. coli (B CFUs)	Phosphorus (Pound)	Nitrogen (Pound)	Sediment (Ton)
NM w manure	2000	63949	3805	8848	0
Cover Crops / No-till	2250	21333	1797	13545	2824
small grain rotations	100	594	75	459	13
CRP	80	2628	331	3696	141
Livestock Exclusion	160	35777	64	286	0
Buffers/Filter Strips	50	631	37	87	26
Rx Grazing	160	520	114	613	30

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.

According to the Nebraska Department of Environment and Energy, Bacteria/*E. coli* impairments are by far the most common stream impairment statewide. Every major river basin in the state either currently has or has had *E. coli* stream impairments. 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 haemolytic uraemic 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 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.

This project will provide education and outreach to producers who manage the 392,574 acres within the project boundaries. It also specifically targets 5,000 acres for adoption of BMPs to reduce nonpoint source pollution and bring *E. coli* levels down. Technical and financial support for BMPs will help get practices initiated and will contribute to those practices becoming adopted long-term.

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 combines local, state, and federal dollars to improve water quality. Chart 10 represents the cost flow of the project.

Chart 10
Total Bow Creek Watershed Cost Flow including personnel and producer costs

Tasks	Year 1	Year 2	Year 3	Total
NDEE 319	$100,000	$100,000	$100,000	$300,000
LCNRD	$52,620	$47,080	$54,280	$153,980
WSF	$60,731	$45,070	$47,170	$152,970
UNL	$3,567	$3,567	$3,566	$10,700
UNL Extension	$2,122	$2,121	$2,121	$6,364
NGPC	$2,000	$2,000	$2,000	$6,000
Totals	**$221,040**	**$199,838**	**$209,137**	**$630,014**

*Personnel is represented in project total although it is not allowable under WSF guidelines. Without personnel the project could not operate.

LCNRD has budgeted $154,000 over three years to pay portions of salary and benefits, travel, supplies, equipment and other expenses. This includes items that are not allowable under WSF such as personnel.

NDEE 319 grant has been allocated to Phase II of the project and will start in July 2023. This will pay portions of salary and benefits, and incentives for BMPs. This includes items that are not allowable under WSF such as personnel.

Nebraska Game and Parks Commission will provide in-kind support totaling $3,000 to landowners / operators implementing conservation practices, and serve on the technical advisory committee. They will provide cash contributions of $3,000 in the way of cost-share for small grain rotations.

University of Nebraska will provide in-kind support to producers via capstone student farm conservation plans, and planning support from Dr. Andrea Basche totaling $7,7000, and cash match of $3,000 will be provided for student travel.

Nebraska Extension will provide in-kind support to producers through area beef and cropping system specialists.

LCNRD and NDEE have allocated funding to Phase II of the project. UNL and NGPC have also already pledged funding for the project. This will allow us to continue to build the momentum from Phase I of the project. Combined these funds will allow for the continued incentive and education program that is increasing adoption of best management practices.

WSF will allow us to expand education opportunities to target agricultural professionals that support producers in making management decisions and provide public signs for farms that are adopting management practices to improve water quality. Workshops, field days, demonstration farms and mentoring programs would all be cut substantially without WSF support. Without the education programs the long-lasting benefits of BMP adoption may be reduced due to decreased success of implementation.

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.

Watershed health related to water quality and habitat will be addressed with this project. Water quality testing done by the Nebraska Department of Environment and Energy has shown poor water quality in the Bow Creek Watershed Project area. Four recreational stream segments are impaired for E. coli bacteria, elevated levels of total suspended solids decrease aquatic habitat, and high levels of phosphorus and nitrogen increase risks for eutrophication.

By assisting private landowners and managers to implement best management practices in the watershed we can reduce E. coli bacteria, 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 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 no-till, conservation crop rotations, irrigation management, nutrient management and grazing management. By decreasing disturbance from mechanical tillage, we will decrease the rate of destruction of stable soil aggregates and 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 and range plant diversity and plant growth patterns we can protect the soil surface from raindrop impact that dislodges soil particles and

washes them into Bow Creek. Protecting the soil from the sun's rays will also decrease evaporation making water more available for crop or range 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.

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 six 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. 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.

The primary benefits for this project include reducing nonpoint source pollution loads with the implementation of Best Management Practices (BMPs). With our goals of BMP implementation, we expect 5,000 acres treated will reduce E. coil by 125,433 billion CFUs, phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons. Preventing sediment from reaching the stream 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 a potential for eutrophication, and sediment-bound pesticides can harm aquatic life.

The Bow Creek watershed is the primary watershed that will benefit from the project, however Antelope Creek and Beaver Creek are also included in the Bow Creek Watershed Project. The Bow Creek Watershed lies within the Lewis and Clark Lake HUC-8 (10170101) and contains 392,574 acres in portions of Cedar, Dixon, and Knox Counties.

Bow Creek HUCs
101701011001 – Upper West Bow Creek

101701011002 – Middle West Bow Creek

101701011004 – Lower West Bow Creek

101701011101 – Pearl Creek

101701011102 – Norwegian Bow Creek

101701011103 – Upper Bow Creek

101701011104 – Headwaters East Bow Creek

101701011105 – Outlet East Bow Creek

101701011106 – Middle Bow Creek

101701011107 – Lower Bow Creek

101701011003 – Second Bow Creek

10170101120 - Beaver Creek

101701011205 - Antelope Creek

Four stream segments are assigned the Primary Contact Recreation (PCR) use, which are Bow Creek (MT2-11300 & MT2-11400), West Bow Creek (MT2-11310), and East Bow Creek (MT2-11410).

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 2022 Annual Report lists the following goals this project addresses:

Goal 1: Establish strong state leadership, involvement, and support for science-based decision making that is necessary to sustain state and local water management outcomes.

The Bow Creek Watershed Project (BCWP) is supported by close collaboration with Nebraska Department of Environment and Energy (NDEE), Nebraska Game and Parks Commission (NGPC), UNL Extension and NRCS. All of these agencies provide support in the way of guidance during our Technical Advisory Committee (TAC) Meetings. Meetings are held twice a month and are vital for decision making on local water management outcomes.

Goal 3. Develop and implement customized and decentralized water management plans established through collaboration with local Natural Resource Districts and stakeholders that provide for long-term sustainability of the state's water resources.

Working with the Nebraska Department of Environment and Energy (NDEE) the LCNRD developed the Project Implementation Plan (PIP) for the BCWP. This PIP is specific to water management decisions that can reduce nonpoint source pollution in Bow Creek. Support from DNR for this project would help the BCWP make progress towards the long-term goal of removing Bow Creek from the 303(d) list of impaired water bodies on the Nebraska Integrated Report.

Goal 4. Encourage strong public engagement with multiple constituents and stakeholder groups in planning and implementation activities to ensure that local and state needs are addressed.

The BCWP provides several public events each year that engage local farmers, ranchers, agronomists and crop advisors that influence management practices on land in the watershed. Feedback from those events is considered in the planning of the next event. The BCWP along with NGPC conducted events for youth including the 2022 stream assessment activities with two local high schools. A strong partnership with the UNL senior agronomy capstone class has allowed undergraduate students to learn about water quality concerns and approaches local farmers are using to address them. Students then support other local farmers to consider these options through individualized farm planning.

Goal 5. Protect existing water uses through collaborative investments in water resource projects, planning, administration and permitting of surface water rights, and the registration of groundwater wells.

The BCWP will be a collaborative investment from several funding pools. The LCNRD will contribute local dollars, NDEE will contribute federal dollars. USDA NRCS and FSA federal payments to farmers and ranchers to increase the implementation of best management practices known to improve water quality are leveraged with the other investments to achieve higher implementation.

LCNRD will be updating their Water Quality Management Plan over the course of the next three years. Funding for the BCWP will aid in the updating of that plan which will identify local water resource concerns and potential plans of corrective action.

Goal 6: Provide agency wide services and support in the areas of information technology and transparent data sharing, business process improvement, public information, and administration of state-aid funds in conjunction with the NRC.

The BCWP will include aspects of public information sharing during field days and workshops. This will include updates on water resource concerns and partnerships that support the program. As a partner in the BCWP NeDNR will be mentioned in our public outreach sessions.

The 2022 Report (annualreport2022FINAL.pdf (nebraska.gov) also includes LB 925 Resilient Soils and Water Quality Act in the list of Water Initiatives. This project will address all the objectives of LB925 listed in The Report:

- Accelerate the use of BMP for healthy soil;
- Protect and improve soil and water quality, protect the public's health and enhance agriculture production and profitability;
- Address soil health economics, resource stewardship, and environmental issues, increase awareness, education and promotion of BMP for healthy soils through producer-to-producer and mentoring relationships;
- provide proof of healthy soil benefits through demonstration and research farms.

A substantial component of the Bow Creek Watershed Project (BCWP) is the accelerated use of BMPs for healthy soil in the context that the same BMPs for soil health are BMPs used to improve water quality. The BCWP incentive program is structured in a way that increases the incentive for implementing more than one complementary soil and water conserving practice. Producers who implement one BMP are eligible to receive an incentive payment that, along with cost-share payments from other conservation contracts, will bring their out of pocket expenses to 25% of estimated expenses. Producers implementing two or more practices are eligible to receive an incentive payment that, along with cost-share payments from other conservation contracts, will bring their out of pocket expenses down to 10% of estimated expenses. The outreach and education around these practices that the BCWP will provide will increase the confidence and capacity of producers to implement the practices successfully. A body of research is supporting the importance of increased knowledge and confidence as a driving factor for increased BMP implementation.

Priority practices identified for BCWP contracts address all five of the soil health principles to keep the soil covered, minimize disturbance, increase diversity, increase living root days, and integrate livestock. Applying these practices on

5,000 acres will reduce *E. coli* by 125,433 billion CFUs, phosphorus by 6,224 pounds, nitrogen by 27,534 pounds, and sediment by 3,034 tons. *E. coli* levels in Bow Creek are significantly above acceptable levels for public health. While *E. coli* illnesses usually include mild symptoms serious complications can result in long-term health consequences or death. With nitrogen costs over a dollar per pound, reducing soil erosion from water runoff will provide financial savings to farms of over $27,000 for nitrogen and $6,000 for phosphorus. Improved soil health from BMPs will also improve water infiltration rates, increase the water holding ability of the soil both of which will decrease irrigation costs, and decrease flooding risks.

Producer education and support will continue with our mentoring groups and demonstration farms. These educational objectives have allowed producers to learn from local farms and observe the implementation of these practices without leaving their community. Three to five demo farms will be established and the southern half of the BCWP will be targeted for the development of a learning community to complement the mentoring group established in 2021.

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.

Although LCNRD is not required to take corrective action on stream impairments, addressing the impairment furthers the goals of water sustainability. Implementing conservation practices on the working lands of the Bow Creek Watershed helps to improve water quality and quantity in the watershed.

According to the NDEE Integrated Report: Section 303(d) of the federal Clean Water Act (CWA) enacted by Congress in 1972, requires states, territories, and authorized tribes (states) to identify and establish a priority ranking for all water bodies where technology-based effluent limitations required by section 301 are not stringent enough to attain and maintain applicable water quality standards. Once identified, states are to establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the (revised) list of impaired waterbodies and TMDLs to the U.S. Environmental Protection Agency (EPA). The requirements to identify and establish TMDLs apply to all water bodies regardless of whether a waterbody is impaired by point sources, nonpoint sources, or a combination of both (Pronsolino v. Marcus, 2000 WL 356305 (N.D. Cal. March 30, 2000)).

The NDEE has opted to utilize alternatives to TMDLs by developing 5-Alts for waterbodies that are impaired, but other pollution control alternatives besides a

TMDL are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control alternatives include, but are not limited to, watershed management plan development, best management practice implementation, and adaptive management strategies. Category 5-Alt waters are not approved or disapproved by EPA; however, EPA agrees to accept the alternative.

LCNRD and NDEE developed 5-Alts for the Bow Creek Watershed PIP. This project will update the BCWP PIP.