NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: **Addressing Critical Management Areas in the Little Blue Natural Resources District with AEM Survey Information**

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

Sponsor Business Name: **Little Blue Natural Resources District**

Sponsor Contact's Name: **Tyler Goeschel**

Sponsor Contact's Address: **100 East 6th St., Davenport, NE 68335**

Sponsor Contact's Phone: **402-364-2145**

Sponsor Contact's Email: tgoeschel@littlebluenrd.org

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

   Grant amount requested. $ **249,999**

   - If requesting less than 60% cost share, what %? **Not applicable**

   If a loan is requested amount requested. $ Click here to enter text.

   - How many years repayment period? Click here to enter text.
   - Supply a complete year-by-year repayment schedule. Click here to enter text.

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. Click here to enter text.

- What is the population served by your project? Click here to enter text.

- Provide a demonstration of need. Click here to enter text.

- **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☐

Click here to enter text.

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:
Not applicable.

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

The Little Blue NRD (LBNRD) is the sponsor for this project. It is LBNRD's goal to hire a geophysical consulting firm to conduct aerial electromagnetic (AEM) survey/data collection, and processing and interpretation of the collected geophysical data. This firm has performed many other such surveys in the state, many of which have been supported by the Water Sustainability Fund (WSF). The consultant's previous work and high level of experience will increase survey efficiency and data product quality. Moreover, opportunities may exist to divide costs of mobilization/de-mobilization with a neighboring district (Lower Big Blue NRD), allowing for decreased individual project costs for each district and/or opportunities to increase the amount of AEM data collected in each by allowing for additional flight lines. This project will be planned in conjunction with the LBBNRD project currently proposed, if funded, for these reasons. LBNRD will also continue to work with peers at LBBNRD, as well as with Katie Cameron at Eastern Nebraska Water Resources Assessment (ENWRA); Aaron Young, Jesse Korus, and staff at the University of Nebraska Conservation and Survey Division (UNL-CSD) and Nebraska GeoCloud; staff at the Nebraska Department of Natural Resources (NeDNR); and administrators and staff associated with WSF. Coordination with many of these agencies and organizations has already been crucial to aiding LBNRD with understanding and managing its water resources and will certainly continue to be so.

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.

LBNRD will be the sole source of funding for the project in addition to WSF dollars (see supplemental information document for match commitment letter). While no additional sources of funding are planned for this project in particular, LBNRD will continue to explore opportunities to share costs with local entities who have vested interest in improving understanding of aquifer characteristics through geophysical data, such as the City of Fairbury. While the project will not proceed without WSF funds at this time, LBNRD is committed to pursuing the collection of geophysical data as has been done in many other areas of the state and will explore other options if needed for funding this work and thereby improving understanding and management of groundwater resources within its boundaries.

6. **Overview**

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

This project will help LBNRD better understand the vulnerabilities and formulate management decisions affecting two key management areas in the District: the Bruning East water quality sub-area of Hydrologic Unit 1, and the Fairbury area of Hydrologic Unit 2 as identified in the NRD's Rules and Regulations [https://littlebluenrd.org/wp-content/uploads/Groundwater_Management_Area_Rules-_Regs_July_15th_2024.pdf]; supplemental information document, Figure 1).

Within the 233-square-mile area proposed for this project, known concerns include both water quality and water quantity. The primary concern in the Bruning East area is water quality, with 10 wells exceeding the nitrate regulatory maximum contaminant level (MCL) of 10 ppm and 5 wells between 7.01 and 10 ppm (of a total of 22 wells within the flight-line area; see supplemental information document, Figure 2). The Bruning East area is designated as a Level II water quality management area due to elevated nitrate per the NRD's Rules and Regulations; we note that it is not yet designated as Level III only because it was first designated as Level II in 2024, and is expected to reach Level III designation by the time of the proposed AEM flights. For the Fairbury area, both water quality and quantity are concerns, with Level III water quality designation for nitrate as 9 wells in the flight area exceed the nitrate MCL and all wells (13 total) are at 5.01 ppm or above. The area has also had a stay in place for new high-capacity wells since 2006.

The wellhead protection areas (WHPAs) for the communities of Tobias, Daykin, Alexandria, Reynolds, Fairbury, and Endicott lie within the proposed flight lines, as does the WHPA for the Rock Creek Station State Historical Park (supplemental information document, Figure 3). (Also note, the City of Fairbury supplies water to rural water customers in eastern Thayer and Jefferson Counties.) AEM data collected through this project will allow LBNRD to better understand connections between aquifer materials and nitrate concentrations, which will significantly improve information to formulate and enact groundwater management actions to improve water quality in these areas and protect public health and community water system resilience.

The stay on new high-capacity wells in the Fairbury area since 2006 has prevented this area from reaching allocation triggers, but it is also noted that this obviously halts additional high-capacity well development and, in turn, may stifle economic growth in terms of irrigation and industry. A clearer understanding of that area's paleovalley aquifer's extent may provide new information that could allow for additional, strategic, high-capacity well development, as well as help identify the best areas to explore for alternate sources for Fairbury and its rural water customers.

This project will be the first time that LBNRD has commissioned any AEM survey, and will be the first time this geophysical data is collected and interpreted for the

Bruning East and Fairbury areas or any portion of the District aside from slight overlap at the edge of the District boundaries where LBBNRD has had AEM flights. Combining this data with LBNRD's water quality and quantity records will be a valuable step toward maximizing effectiveness of groundwater management strategies, as well as providing high-quality maps for engagement of District stakeholders when management strategies are identified and discussed.

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.

Tasks	Year 1 $	Year 2 $	Total $ Amt.
Contract signing and data collection (50% down payment) and data delivery (30% payment)	$208,333		$208,333
Data delivery		$125,000	$125,000
Deliverables (data and final report)		$83,333	$83,333
TOTAL	$208,333	$208,333	**$416,666**

8. **IMP**

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

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

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

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

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

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

1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; Click here to enter text.

1.A.2 Describe the plan of development (004.01 A); Click here to enter text.

1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); Click here to enter text.

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

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

1.A.6 Discuss each component of the final plan (004.01 E); Click here to enter text.

1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1); Click here to enter text.

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

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). Click here to enter text.

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

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

AEM data collection has been used extensively across eastern Nebraska since at least 2006 when ENWRA was formed, which includes several NRDs and cooperating agencies including NeDNR, UNL-CSD, UNL School of Natural Resources, and U.S. Geological Survey. AEM uses a helicopter to carry resistivity-sensing geophysical equipment along a determined flight path. Electrical resistivity, in this context, is a measure of how well or poorly subsurface materials resist the flow of electrical current with more hydraulically conductive materials demonstrating greater electrical resistivity and less hydraulically conductive materials demonstrating less electrical resistivity. The resistivity data, gathered roughly every 20 feet during flights, is thereby used to interpret the types of materials present, e.g., clay (less electrically resistive), silt, sand, and gravel (more resistive), which is done in correlation with local borehole data. Analysis of the data provides a basically continuous set of subsurface information along flight paths, allowing for a much more detailed and comprehensive understanding of subsurface conditions.

More specifically, time-domain electromagnetics (TDEM) AEM has become the standard for large-scale AEM survey to determine aquifer characteristics in Nebraska. The ENWRA efforts beginning in 2006 had the purpose of developing a three-dimensional hydrogeologic framework and water budget for eastern Nebraska. While LBNRD has not, to date, been part of this effort, the hydrogeology of the District is comparable to many characteristics found in eastern Nebraska – particularly with the presence of paleovalley aquifers adjacent to thin/absent aquifer areas. ENWRA's efforts have proven so valuable that more than 25,000 line-miles have been flown since its inception, and several other NRDs outside of the ENWRA area have also engaged AEM consultants to conduct flights and interpret data. With this historical expertise in place and an experienced consultant having participated in all of these efforts, the methodologies and efficiencies are now well established to provide for successful surveys and reliable results.

The products of past AEM surveys have been leveraged by ENWRA, NRDs, and others to better plan and site new test hole and monitoring locations for unique and critical aquifer units, saving costs in comparison to previously used methods for siting. Additionally, AEM data is increasingly used to inform the development and refinement of hydrogeologic models and other studies to better represent and understand the natural system, thereby improving management strategies particularly in critical areas – such as areas like those proposed for AEM survey within LBNRD – to better safeguard water quality and quantity and ensure that socioeconomic welfare and public health are protected.

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

In review of the following information, please also refer to the attached supplemental information document, which includes:

- Figure 1: Proposed AEM Flight Lines and Existing Groundwater Management Areas
- Figure 2: Nitrate Concentrations in Project Area
- Figure 3: Wellhead Protection Areas in Project Area
- Project cost estimate letter from Aqua Geo Frameworks
- Match commitment letter from Little Blue NRD
- Figure 4: Streams within Project Area
- Figure 5: U.S. Drought Monitor for Nebraska as of March 13, 2025
- Figure 6: Spring Static Water Levels, Change from 2023 to 2024

With concerns about water quantity and quality in the project area, alongside localized variability of aquifer thicknesses, it has become critical for LBNRD to consider cost-effective study of the local subsurface. LBNRD is within an area with significant variability of depth to, and availability of, groundwater. Depth to groundwater generally varies according to the surface terrain, with these depths being as shallow as immediately below the ground surface and as deep as roughly 180 feet. Transmissivity throughout the district also varies from as little as 1,750 gallons per day per foot (gpd/ft) to greater than 285,000 gpd/ft. Time of travel for groundwater may also be variable; while it's generally understood to be about 200-350 feet/year (ft/yr), localized geologic characteristics may cause variations in time of travel to be either faster or slower.

Groundwater resources in the District have been characterized into three distinct hydrologic units. Unit 1 (a portion of the High Plains Aquifer) includes the primary aquifer that overlies bedrock and is made up of water-bearing sands and gravels and extends from west to east across the District. The aquifer is largely unconfined in this area, although some silt and clay layers may be present and create confined conditions. However, because these layers are discontinuous, sands and gravels are generally hydraulically connected and behave as a single groundwater flow system. The second aquifer, identified as Unit 2, is a buried bedrock paleovalley aquifer formed by an ancient river that eroded into the Dakota Sandstone. It is currently assumed that there is no hydrologic connection between Units 1 and 2, due to a bedrock ridge between the two. Unit 2 is estimated to contain about 332,000 acre-feet (ac-ft) of water. Finally, Unit 3 covers the remainder of LBNRD and denotes thin (generally less than 10-foot thickness) or absent aquifer. It is within this area that it is difficult to construct productive wells, and the wells that do exist are generally limited by low-capacity domestic or livestock use (LBNRD Groundwater Management Plan, 2017: https://littlebluenrd.org/wp-content/uploads/Groundwater-Management-Plan-State-Approved-December-15-2017.pdf).

With groundwater quality (elevated nitrate) and quantity concerns in the Fairbury area of Unit 2 as well as primarily quality concerns in the vicinity of the Bruning East area in Unit 1, it has become increasingly evident that greater detail leading to better understanding of the hydrogeology of these areas is critical. As noted, six community WHPAs fall within the proposed AEM flight lines, with an additional State Historical Park WHPA, and one of those communities (Fairbury) also supplies water outside of its immediate boundaries, to rural water customers in eastern Thayer and Jefferson Counties. Within the proposed flight lines for the Fairbury area, more than half of the tested wells exceed the nitrate MCL and all are above 5.01 ppm; within the proposed flight lines in Unit 1 (Bruning East area), nearly half of the wells exceed the nitrate MCL. With spring static water levels trending generally slightly downward and quantity being a clear issue with a stay for new high-capacity wells being in place in the Fairbury area since 2006, economic growth is effectively stifled, and the possibility exists of allocation triggers being reached without better understanding of the local aquifer, which would serve to further stifle the local economy. As discussed in LBNRD Rules and Regulations (Chapter 3), allocations – when triggered – apply in the Unit within which the trigger is met *and* in adjacent areas of Unit 3 when triggered in Units 1 or 2, underscoring the possible economic impact of reaching allocation triggers.

The collection and interpretation of AEM data for these vulnerable areas will yield new information that will significantly aid LBNRD staff and directors to more effectively develop management strategies and determine the most appropriate locations to institute more targeted/detailed monitoring efforts. Where water quality is concerned, management of larger areas extrapolated from information on high nitrate concentrations correlated to aquifer materials is difficult and may not be proper; further, LBNRD cannot measure nitrate (or manage it) without understanding where it is best to measure. The data collected through this project will improve the NRD’s ability to both measure and manage.

A wealth of improved understanding and, therefore, management will result from this work, including: possible delineation of new management areas and/or evaluation of existing management areas; identification of areas in which to add monitoring wells to the network; possible refinement of areas of groundwater/surface water connection; current and future groundwater modeling projects; and identification of areas to prioritize management strategies. As this will be the first time that LBNRD has commissioned AEM survey work and this project will yield the first AEM data specifically for the District, this represents a significant leap forward in management of groundwater resources in these areas.

The logistical plan for this project has been developed to be similar to past AEM projects in the state, and refined through communications with a geophysical consultant. With WSF funding, LBNRD will hire a consultant for these services:

1. Review and adjust proposed flight lines as needed to minimize interference from power lines and other infrastructure; proposed flight lines are shown in the supplemental information document, Figure 1
2. Select appropriate AEM method and equipment, and any necessary subcontractors
3. Oversee and coordinate survey activities

4. Collect and quality check AEM data
5. Process, analyze, and interpret AEM data
6. Gather and georeferenced all existing geologic data near flight lines
7. Document interpretation of all data in final report, including Google Earth and ArcPro GIS files that can be readily shared with interested parties to assist landowners, well drillers, and other local agencies with decisions regarding groundwater resources

Additionally, data and results may be provided to ENWRA, the Nebraska GeoGloud project, UNL-CSD, USGS, NeDNR, the Nebraska Department of Environment and Energy, and the general public both for purposes of collaboration and for use of the best available hydrogeologic data for the flight areas. Like NeDNR and UNL-CSD borehole records, AEM data is considered long-term “legacy” data that can be used well into the future due to its unique nature and validation of its metadata including raw data, inversion data, and interpretation.

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

The AEM work previously conducted by ENWRA, NRDs, and other partners since 2006 has gone from pilot projects testing the technology to trusted science upon which groundwater managers make important decisions. AEM, at this point, has established a proven history of detailed and accurate assessment of the subsurface underlying more than 25,000 flight miles in Nebraska. As a result, Nebraska has become an international leader in the coordinated use of AEM data for groundwater management.

AEM technology is perfectly suited for collection and analysis of subsurface data to assess the type of variability encountered in these areas of LBNRD. Historical information and analyses have demonstrated that the hydrogeologic composition of these areas can be unpredictable and rapid changes may occur across short distances. AEM has been used throughout eastern Nebraska and in the neighboring LBBNRD to assess just these types of conditions.

As outlined above in Section 1.B.2, the variability of conditions and clear vulnerability in these areas demonstrate the need for more detailed understanding of local conditions to inform management actions. With the City of Fairbury providing water not only to those within the city’s bounds but also to rural water customers in eastern Thayer and Jefferson Counties, elevated nitrate levels pose a significant public health concern. Also, as outlined above, quantities of water available for irrigators are threatened, possibly posing significant economic impact to the area.

Collection and interpretation of AEM data in these areas will provide significantly more detailed information about the availability of groundwater and the extent of local aquifers, both informing management decisions and allowing LBNRD and communities to determine the best areas for nitrate testing in potentially available areas to consider for alternate water sources.

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

Because this project will include only the collection and interpretation of aerially collected geophysical data, no land or water rights are required to complete the proposed work. Additionally, there will be no trespassing on private property or impacts to human health, and all data will be collected under Federal Aviation Administration rules and procedures. Ground-truthing of AEM data will be done with existing publicly available records, so there will also not be any land or water rights needed for this portion of the project. Should any additional borehole data need to be collected, the planning, securing of access, and implementation of those activities will be conducted in the future, after the conclusion of this project.

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

While there will not be any direct structural effects of the collection and interpretation of AEM data, it is anticipated that future structural measures may be implemented as a result of the data's use. The key purpose of this project is to gain a stronger and more detailed understanding of the hydrogeologic characteristics of these areas to inform management strategies and decisions. Thus, the data may inform future locations of monitoring efforts; siting of irrigation, public water supply, and other wells; and possibly the implementation of groundwater controls that would impact decision-making on locations of industrial and similar users.

The expected long-term benefits of this project include protection of existing and future uses – including public, irrigation, and other uses. Additionally, the AEM data collected in this project could be used to evaluate and even adjust WHPA boundaries. We note that management controls within WHPAs, in this context, typically have more to do with timing of nitrogen fertilizer application and encouraging conservation practices on agricultural land, and thus would not be considered to be structural impacts.

Prove Economic Feasibility

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

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

The next best alternative to collection of AEM data would be to drill test holes at tight intervals (the resolution of AEM data is such that an “image” of the subsurface is generated for every 50-75 feet of flight line, once the 20-foot intervals are aggregated), which would represent an expense upwards of $90 million (assuming at least $30/foot to drill, casing and development costs of at least $48/foot, and the cost of professional services to hire a hydrogeology consultant to interpret the data and create hydrogeologic cross-sections). Clearly, this project – with a cost of $416,666 (see supplemental information document, Aqua Geo Frameworks letter) – is a far more economical alternative. Additionally, to drill test holes at sufficient density to collect comparable data would also take decades. Using a similar budget to drill test holes would yield information far too sparse to be as useful in providing a detailed understanding of the local hydrogeology, given that drastic changes can exist particularly in the Fairbury area over short distances. The subsurface images produced by AEM data collection and interpretation would be the equivalent of test holes drilled to depths of up to 500 feet with a lateral distance of every 50-75 feet, producing a nearly continuous cross-section of the subsurface and capturing drastic changes in hydrogeology.

Not only does AEM allow for a much more economical, detailed view of the subsurface, it does not create any ground disturbance as would test hole drilling. There are also no concerns of trespassing or acquisition of easements or land rights and therefore no costs associated with either.

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).

Costs associated with this project include flight line planning and refinement, mobilization of the geophysical equipment and aircraft, data collection and interpretation, and production of the final report. The estimate (as outlined in the supplemental information document) for all costs amounts to approximately $1,788 per square mile; this cost estimate is provided for the flights to be conducted in the first year and final delivery of analysis in the second year.

The immediate notable benefits of this project are the avoidance of the far more costly alternative of test hole drilling. In the longer term, the benefits include possible avoidance of nitrate treatment costs for the City of Fairbury, which can be anticipated to be approximately $3 million for construction and up to approximately $800,000 annually for operation and maintenance. We also anticipate that, with additional information about available groundwater, it may be possible for more producers to drill irrigation wells, representing a roughly $3,680 per acre change in land values and variable but marked increase in farm profits with up to roughly 80 bushels/acre increase in corn production (https://littlebluenrd.org/wp-content/uploads/Groundwater-Management-Plan-State-Approved-December-15-2017.pdf).

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).

Costs within the timeframe of this project include flight line planning and refinement, mobilization of the geophysical equipment and aircraft, data collection and interpretation, and production of the final report. These costs total $416,666 (see supplemental information document, Aqua Geo Frameworks letter).

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).

While there is no generally accepted method for calculating the primary tangible benefits of this project, there are significant benefits for the sustainability of water resources in LBNRD. Key among these will be the better-informed management strategies that can be developed for addressing the very real and pressing concerns of water quality and water quantity within the areas proposed for study. As previously discussed, the City of Fairbury provides water not only to those served by its system but also to rural water customers in eastern Thayer and Jefferson Counties, with a total population served of roughly 5,000. With elevated nitrate a key concern for this water supplier and the population it serves, costs for treatment include roughly $3 million for construction and up to $800,000 annually for operation and maintenance, which can be averted through exploration of options for an alternate source. The other communities with WHPAs in the project area will also benefit through improved knowledge of their existing resources as well as potential alternate sources, should they be needed. Additionally, a more complete understanding of the extent of aquifers in the flight areas will contribute to better management decisions, and may also yield information about areas where irrigation is viable but was previously considered not viable. Potential benefits in such a situation include farm profit due to increased yields and land value increases of approximately $3,680 per acre (https://littlebluenrd.org/wp-content/uploads/Groundwater-Management-Plan-State-Approved-December-15-2017.pdf).

In addition to these benefits, AEM data may also be used to improve and refine groundwater modeling efforts and allow for better forecasting of groundwater supplies and/or impacts in response to drought, changes in use (including the introduction of large water users), and contamination.

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).

Cost Activity	**50% Down (8/1/25-12/31/25)**	**30% Payment upon Data Delivery**	**Final Report Cost (1/1/26-7/31/26)**	**Cost Total**	**Benefits (approx. costs of drilling test holes as described in 3.B.)**
Local Match	$83,333	$62,500	$20,834	$166,667	Test hole drilling & construction + unknown analysis & processing, & LBNRD time
WSF Grant	$125,000	$75,000	$49,999	$249,999	
Totals	**$208,333**	**$137,500**	**$70,833**	**$416,666**	**~$90,000,000+***

* Does not include consulting/engineering consultant fees for hydrogeologic analysis and creation of usable products, or costs of land rights/easements for drilling of test holes

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.)

As described above in Item 2, the next best alternative to collection of AEM data would be to drill test holes at intervals of roughly 50-75 feet along similar lines, which would represent an expense upwards of $90 million (assuming at least $30/foot to drill, casing and development costs of at least $48/foot, and the cost of professional services to hire a hydrogeology consultant to interpret the data and create hydrogeologic cross-sections). Clearly, this project – with a cost of $416,666 (see supplemental information document, Aqua Geo Frameworks letter) – is a far more economical alternative. Additionally, to drill test holes at sufficient density to collect comparable data would also take decades. Using a similar budget to drill test holes would yield information far too sparse to be as useful in providing a detailed understanding of the local hydrogeology, given that drastic changes can exist particularly in the Fairbury area over short distances.

As is the responsibility of all NRDs, LBNRD is statutorily responsible for development, management, use, and conservation of groundwater and for water supply management for any beneficial uses. LBNRD staff and directors have the primary consideration – alongside communities, landowners, and other constituents – of whether data collection costs are justified in terms of management of the resource. Additionally, the types and quality of data must be considered. To date, the NRD has relied on the nearest available registered well/test hole data, as well as general trends apparent in the data collected from the District's monitoring well network. However, the data available from these resources is not dense enough to accurately assess localized conditions, particularly in areas where there are sharp changes in the local hydrogeology. Adding wells to the monitoring network requires considerable staff time and coordination with landowners to obtain voluntary permission to collect data and samples from their wells. When permission is obtained, there may still be incomplete or inaccurate drilling logs with which to contend – as well as still not providing the needed information on where certain silt/clay lenses exist, their extent, or whether another well just ½ mile away would be productive.

Managing in vulnerable areas, for these reasons, can be especially challenging. Applying management controls to broad areas where localized hydrogeologic conditions may suggest that controls are not needed throughout can unnecessarily limit the amount of irrigation or industrial production/development that could sustainably occur; conversely, not knowing where localized hydrogeology is such that these uses would not be appropriate in the context of protecting existing and future uses could easily produce situations where large uses are approved but go on to create unsustainable impacts.

The collection of AEM data will allow for the most cost-effective, better-informed development of management strategies for the vulnerable areas identified for this project. LBNRD will gain greater insight in just two years than could be gained in a decade – and at a fraction of the cost – to help inform where additional irrigation and/or industrial development could or should be allowed, where communities may be able to explore alternate well locations to deal with nitrate concerns, and even refine the development of localized groundwater models to better predict the outcomes of future development scenarios. All of this information and the resulting improved management strategies go directly to the heart of sustainable management of groundwater resources in these areas.

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 LBNRD board of directors approved and directed staff to proceed with development of this WSF application, with understanding of the 40% local match requirement, and LBNRD is prepared to dedicate the necessary $166,667 of its budget in FY2026 and FY2027 to meet this requirement (see supplemental information document, Little Blue NRD letter). The NRD budget is finalized after July 1 each year; the table below shows LBNRD levies, property tax revenues, and budgets for the past three fiscal years.

Fiscal Year	Levy per $100 Assessed Valuation	Property Tax Revenue	Total Budget
FY2025	0.019037	$2,120,302	$15,338,007*
FY2024	0.017509	$1,746,756	$4,843,618
FY2023	0.020621	$1,893,440	$4,330,782

* Note, 2025 total budget includes a $10 million grant from USDA for rural water project.

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

   Any costs to maintain the data and reports are included in LBNRD's annual budget, as with the maintenance of any NRD records. Because this project includes only data collection, interpretation, and reporting, there are no associated equipment replacement costs. Should LBNRD partner with ENWRA and/or Nebraska GeoCloud, the dues will also be incorporated into the NRD's annual budget; likewise, associated operation and maintenance costs will be absorbed in the costs of ongoing information and data maintenance as part of the District's annual budget.

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

   Not applicable.

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

   As there is no physical development involved in this project, there will be no impact on the natural environment. Flights will be conducted outside of major bird migration timeframes, to minimize/avoid any conflict or interference. Local airports will be utilized during AEM survey, so there will be no concerns regarding permission to access private land. Surveys will also be conducted according to Federal Aviation Administration rules and policies, to minimize disturbance to property owners. Further, because the alternative to this project (extensive test hole drilling) would involve significant ground disturbance by way of drilling and mobilization of support vehicles, this project will actually avoid disturbances to the natural environment that would otherwise need to occur to gain comparable information.

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

The Nebraska Groundwater Management and Protection Act of 1975 designated the NRDs as the preferred local entities for groundwater management and protection. NRDs accomplish these requirements through their Groundwater Management Plans (GMPs), Rules and Regulations, and cooperative relationships with state agencies such as NeDNR and federal, county, and community agencies. LBNRD most recently updated its GMP in 2017, and cooperatively developed a voluntary Integrated Management Plan (IMP) with NeDNR, adopted in 2019. These recent plans, along with updates to LBNRD Rules and Regulations in 2024, outline the NRD's proactive approach to sustainable management of its groundwater resources. Beyond this, LBNRD has had dedicated staff for groundwater management since 1974, with responsibilities including the collection, interpretation, and maintenance of data from the monitoring well network. LBNRD has also historically partnered with many local communities for development of wellhead protection plans. With the wealth of experience and data already maintained with NRD staff, LBNRD is well positioned to effectively use the data and information gathered through this project to improve groundwater management strategies.

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

As has been discussed throughout this application, LBNRD is aware of the efforts of other NRDs, ENWRA, and Nebraska GeoCloud to collect, interpret, maintain, and use AEM data throughout especially the eastern portions of the state. We are also well acquainted with NeDNR's annual Fully Appropriated Basins (FAB) analysis, the collaboratively IMP for our District, and other organizations' efforts across the state such as the USGS Water Science Center's goals and UNL-CSD's goals and efforts. Our staff and directors are in regular communication with other staff and directors across the state, as well as agency staff; thus, all necessary connections exist for collaborative efforts to review and make use of the data and information collected through this project.

With the key purpose of this project being to develop a more detailed and comprehensive understanding of the hydrogeology in the areas to be surveyed, we look especially to our IMP, which includes the following goals:

1. Better and more scientific data and methods to support wise management of interconnected groundwater and surface water;
2. Scientifically sound, locally based management actions to protect interconnected groundwater and surface water; and
3. Education efforts to raise the level of awareness about finite, interconnected groundwater and surface water resources

As shown in Figure 4 (supplemental information document), the proposed flight areas include portions of the Little Blue River and its tributaries. The interconnection in these specific areas is assumed and even regionally modeled, but not extensively understood. Clearly, the AEM data collected and interpreted through the proposed project will allow for far more detailed information than ever before to critically assess these areas and better elucidate the nature of hydrologic connection. This information will clearly support all three outlined goals of the IMP, as the information itself supports the first and the actions resulting from this information will support the other two. With high-resolution images of the subsurface and potentially the development of a refined, local groundwater model(s), we will have better information for management decisions and more compelling imagery to support outreach efforts.

This information will also directly support LBNRD's GMP, most recently updated in 2017, and its objective to evaluate the actions necessary to protect the District's water resources for future generations. With higher-resolution data than ever before on the extents of aquifers in the critical areas proposed for AEM survey, the NRD's staff and directors will be better informed on how best to implement future management strategies that will both allow for the maximum beneficial use of the available water and protect those resources for ongoing beneficial uses into the future.

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. Click here to enter text.

10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. Click here to enter text.

10.C Provide assurance that you can hold or can acquire title to all lands not currently held. Click here to enter text.

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

As a statutorily created and authorized political subdivision in the state of Nebraska, LBNRD has authority to undertake the proposed project because its purpose directly relates to LBNRD's statutorily authorized mission, which includes the development, management, beneficial utilization, and conservation of water as designated in Neb. Rev. Stat. Chapter 2, Article 32. Additional authorities of NRDs are defined in Neb. Rev. Stat. Chapter 46, Article 7, to enter into contracts and agreements, to budget and expend levied property taxes, to own and operate equipment and property, and to conduct investigations relative to the protection and management of groundwater. The contract for professional services with the Consultant to collect, interpret, and report on AEM data will require approval from the LBNRD board of directors and be signed on behalf of LBNRD by the general manager.

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

Because this project will assist LBNRD with a more detailed and comprehensive understanding of local hydrogeology, it is anticipated to ultimately inform refinement of groundwater management strategy and result in the beneficial conservation of groundwater where needed, allow for sustainable development to occur where it can be done without negatively impacting existing and future users, and possibly even allow for public water systems with water quality (nitrate) concerns to explore alternative options for well locations – thereby avoiding significant costs of water treatment. It will also help the NRD identify previously unknown areas of vulnerability, which will further help prioritize areas for specific management strategies. Past AEM studies throughout eastern Nebraska have elucidated areas of complex hydrogeology, with implications for both quality and quantity of water.

A consequence of not conducting the proposed work would be maintenance of the status quo, which would be anticipated to be detrimental given current trends of groundwater quantity approaching allocation triggers – producing conditions that reduce the amount of available water for irrigation. Additionally, nitrate concentrations for some public water systems (e.g., the city of Fairbury, which also serves eastern Thayer and Jefferson Counties) would be expected to remain stable or increase, representing significant costs to these systems to treat water so that it is safe for consumption. Clearly, the resources invested in water treatment rather than exploring alternate sources represent missed opportunities in the longer term for other civic improvements that would contribute to the long-term vitality of these communities, and the burden of these costs is passed to customers. The data and information collected from this project, then, will promote more sustainable and wiser use of the available resources.

Further, because AEM data collection does not disturb the natural environment, this project represents the avoidance of alternative options that would impact the natural environment and include far greater costs – environmental, ecological, and economic impacts that are hardly necessary when the option of AEM data collection exists.

Section C.

NRC SCORING

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

The following 15 criteria constitute the items for which points will be assigned. Point assignments will be 0 to 6 for items (1) - (9); and 0 to 3 for items (10) - (15). Two additional points will be awarded to projects which address issues determined by the NRC to be the result of a federal mandate.

Notes:

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

- There is a total of 72 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted above. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.

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

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

1. Remediates or mitigates threats to drinking water;

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

    Specific threats to drinking water that this project will address include threats to both quantity and quality (specifically, quality threats due to elevated levels of nitrate). The City of Fairbury, providing water to its citizens as well as to rural water networks in eastern Thayer and Jefferson Counties, serves approximately 5,000 people and has been designated within the Level III groundwater management sub-area for elevated nitrate. Additionally, the communities of Tobias (population 114), Daykin (population 188), and Alexandria (population 148) all have WHPAs within the proposed Bruning East flight area, and are within or near a currently designated Level II management area for nitrate that will very likely reach Level III designation by the time the survey flights occur. In addition to the public water systems, there are 74 registered domestic wells within the proposed AEM flight areas, meaning that over 5,500 people throughout these areas rely on groundwater for their drinking water and are currently facing concerns due to elevated nitrate.

LBNRD samples dedicated wells in its monitoring network annually for nitrate, and designated a water quality management area in the vicinity of due to elevated nitrate levels. As discussed previously, most of the network wells in this area currently exceed the MCL for nitrate of 10 ppm, and all have tested greater than 5 ppm. Clearly, elevated nitrate is a significant concern in this area, and gaining a more complete, detailed understanding of the local hydrogeology is critical to helping the NRD and its partnering community and county governments determine how best to address this concern.

Beyond the water quality issues, water quantity remains a concern in these areas. With the Fairbury area being near the portion of the District where the aquifer is presumed to be thin or absent, this presents an especially significant challenge to exploring alternative water sources for the community. AEM data showing significantly greater detail of the local hydrogeology will quickly elucidate whether alternative source aquifers may be explored, as it will show not only the presence of aquifers but also their extents – allowing for a more accurate prediction of available water in the area. The importance of this opportunity also extends to private domestic well owners who may experience interference, particularly during the irrigation season as LBNRD is within an area of the state already in moderate drought at the time of this application (see supplemental information document, Figure 5). As has also been mentioned, the more detailed understanding of local hydrogeology will aid the NRD and its local partners with the development of more appropriate management strategies to maintain protections for existing and future users, tailored as needed to more localized conditions.

Groundwater accounts for 98% of all water used for domestic water supply, industry, manufacturing, and agriculture in LBNRD – quite simply, it is the economic lifeblood of the District. Within the Level III quality management area in the vicinity of Fairbury, controls include: (1) farm operator training and certification on best management practices (BMPs); (2) crop consultant training and continuing education; (3) designation of a demonstration field for implementing BMPs; (4) soil sampling in the demonstration field; (5) irrigation scheduling; and (6) annual farm operations reporting. Even with these requirements in place, nitrate concentrations in these areas have continued to be such that removal of the designation as a Level III water quality management area has not occurred, and it is widely understood that nitrate contamination in groundwater is difficult to mitigate in short periods of time. Additionally, the Bruning East area is already designated as a Level II quality management area, and is expected to reach Level III designation by the time the proposed AEM flights occur.

With regards to water quantity, a stay has been in place for new high-capacity wells in the Fairbury area since 2006, and water levels continue to decline throughout the District (supplemental information document, Figure 6). With annual variability in precipitation, predictability of hydrologic conditions from one year to the next is essentially impossible, so it has become critical for many NRDs/groundwater management districts in Nebraska and beyond to employ the most cost-efficient science available for determining local extents of aquifers.

Without this project, LBNRD will continue with the status quo – implementing management strategies that may or may not be appropriate for each specific area where they are implemented, and not having detailed knowledge that will inform better management strategies or alternatives for drinking water sources.

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;

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

   The proposed project serves to meet the goals of both the updated GMP adopted by LBNRD in 2017 and the jointly developed voluntary IMP that the District prepared in cooperation NeDNR and adopted in 2019. The IMP includes the following goals:

   1. Better and more scientific data and methods to support wise management of interconnected groundwater and surface water;
   2. Scientifically sound, locally based management actions to protect interconnected groundwater and surface water; and
   3. Education efforts to raise the level of awareness about finite, interconnected groundwater and surface water resources

   As shown in Figure 4 (supplemental information document), the proposed flight areas include portions of the Little Blue River and its tributaries. The interconnection in these specific areas is assumed and even modeled, but not extensively understood. Clearly, the AEM data collected and interpreted through the proposed project will allow for far more detailed information than ever before to critically assess these areas and better elucidate the nature of hydrologic connection. This information will clearly support all three outlined goals of the IMP, as the information itself supports the first and the actions resulting from this information will support the other two. With high-resolution images of the subsurface and potentially the development of a refined, local groundwater model(s), we will have better information for management decisions and more compelling imagery to support outreach efforts.

This information will also directly support LBNRD's GMP and its objective to evaluate the actions necessary to protect the District's water resources for future generations. With higher-resolution data than ever before on the extents of aquifers in the critical areas proposed for AEM survey, the NRD's staff and directors will be better informed on how best to implement future management strategies that will both allow for the maximum beneficial use of the available water and protect those resources for ongoing beneficial uses into the future.

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.

   Through the collection and interpretation of AEM data, the District will have more detailed information than ever before in areas where groundwater allocation triggers are near being reached, namely, the Unit 2/Fairbury area. This information will directly help LBNRD determine how best to address quantity management in this area – and, potentially, others – to ensure that detrimental aquifer depletions are slowed or halted, thereby producing benefits as well to streamflow in the area. The more complete hydrogeologic framework yielded through this project will improve our ability to make better informed management decisions – such as altering the timing/conditions under which allocations are triggered, implementing more stringent well spacing requirements, or other similar controls – to thereby better manage groundwater resources in the District now and in the future.

   Further, AEM data can be used – as has been done elsewhere in the state, such as the Lower Elkhorn NRD – to refine local groundwater models to better predict the impacts of development, depletion management actions, and other on-the-ground activities that impact groundwater levels. With the recent completion of the Blue River Basin model, a collaborative effort between the Blue Basin districts and NeDNR, we can now also pursue the development of more detailed local models to be able to examine localized impacts and interferences, allowing for more proactive decision-making to protect existing and future users.

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.

    For nearly 20 years, the value of AEM data has been proven to help address a variety of water resources issues including the mapping of buried paleovalley aquifers (like that within LBNRD) in glacial terrain and assessing previously untapped aquifers for water supply. By providing cost-effective and high-resolution subsurface information, AEM surveys have also allowed for the refinement of local groundwater models, such as that developed within the Lower Elkhorn NRD.

    By collecting AEM data within these vulnerable areas in LBNRD, this project will allow the District both to gain a better understanding of local conditions and enable more proactive management decisions and possibly alternate sources of drinking water for roughly 5,000 residents currently served by the City of Fairbury’s wells, all of which are threatened with elevated nitrate and lie within a Level III groundwater management area for water quality. It will also allow the NRD to tailor its high-capacity well permitting process to both protect existing users and allow for future development, including irrigation and possibly industrial uses, thereby helping to secure the economic vitality of the area.

    Without the information that will be made available through this project, the NRD will not have a clear understanding of the extent of the paleovalley aquifer or other available groundwater in the area, potentially leading to unnecessary expense for the City of Fairbury and its customers to explore alternate sources or even for water treatment. Unnecessary expenses are something that small communities/water systems can ill afford as rural population centers shrink and potential industry looks elsewhere, where water sources are better understood and less expensive. Likewise, agricultural production – as the lifeblood of the area and the state – relies significantly on irrigation to ensure reliable crop yields. Without understanding the full extents of local aquifers, the NRD and its producers may well miss opportunities for irrigation and therefore economic viability.

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

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

   This project will maximize the beneficial use of water resources in these areas by providing detailed information of local aquifers, thereby providing key information needed to determine the extent to which existing uses require protection, how best to proactively offer those protections, and how much additional development of beneficial uses can be allowed. Agricultural production is the key economic driver of the area – indeed, of the state. Irrigation, identified as a natural want per Neb. Rev. Stat. §46-201, is a critical factor in reliable crop production, and detailed information on aquifer extents is needed to determine how much additional irrigation is sustainable. Beyond this, the City of Fairbury currently serves water to its residents and approximately another 1,000 people in eastern Thayer and Jefferson Counties. With domestic use being first among preferred uses in Nebraska (per Neb. Rev. Stat. §46-613), there can be no argument that the use of groundwater to serve these residents is beneficial. With the threat of elevated nitrate forcing the City to begin considering alternate sources and/or treatment options, the data provided through this project will potentially allow for significant cost savings as it will show, in greater detail than ever before, the extent of available groundwater in the area and therefore help identify the best areas to explore and sample for alternate sources. The avoidance of costly treatment or uninformed exploration will be passed along to the City's customers and the rural water districts to which it provides water as well, which is particularly important in a time of economic uncertainty and shrinking rural population centers.

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 total cost for this project is $416,666, which includes planning/refinement of flight lines, conducting survey flights, interpreting gathered data, and development of the report. No costs are associated with construction, O/M, or land or water acquisition. The next best alternative to collection of AEM data would be to drill test holes at tight intervals, such that a total cost would be upwards of $90 million, and ground disturbance would occur, on a timeline of several decades vs. two years for the proposed project. Using a budget similar to this project to drill test holes would yield information far too sparse to be as useful in providing a detailed understanding of the local hydrogeology, given that drastic changes can exist particularly over short distances. The “virtual borehole” produced by AEM data collection and interpretation would be the equivalent of test holes drilled to depths of up to 500 feet with a lateral distance of every 50-75 feet, producing a nearly continuous cross-section of the subsurface and capturing drastic changes in hydrogeology. Clearly, a much shorter-term project at less than 1% of the cost for test hole drilling is a quite cost-effective option.

While there is no generally accepted method by which to calculate benefits, it is noted that the cost of installing reverse osmosis (RO) for a public drinking water system would easily cost millions of dollars may be as high as $2M per million liters/day capacity, and operation may be as high as $1.50 annually per cubic meter of water produced. Assuming a production need of 300 liters per person per day, the cost for installing an RO system for the City of Fairbury (also covering the customers that it serves in eastern Thayer and Jefferson Counties) could be reasonably estimated to cost approximately $3M for construction and up to approximately $800,000 annually for operation. Clearly, avoidance of these costs by way of cost-efficient exploration for an alternate water source produces a significant benefit. Additionally, benefits by way of increased agricultural production – and increased land values – due to a better understanding of available water for irrigation are fairly straightforward, with corn yields roughly 50 bushels/acre higher (https://nebraskacorn.gov) and land values about $3,680/acre higher (as described previously). These benefits may be expected to be accrued for areas not previously understood to have water available for irrigation.

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.

The Blue River Basin Compact, entered into by the states of Nebraska and Kansas in 1971, set forth the following agreed-upon purposes: (1) to promote interstate comity between the States of Nebraska and Kansas; (2) to achieve an equitable apportionment of the waters of the Big Blue River Basin between the two States and to promote orderly development thereof; and (3) to encourage continuation of the active pollution-abatement programs in each of the two States and to seek further reduction in both natural and man-made pollution of the waters of the Big Blue River Basin (Neb. Rev. Stat. §1-115). The Compact specifically includes the Little Blue River.

This project will positively impact the responsibilities, apportionment, and water quality controls along with general provisions built into this Compact. With the Little Blue River (which flows into the Big Blue River with the confluence near Blue Rapids, KS) and some of its tributaries flowing through the proposed AEM flight areas, greater information will be available on the hydrogeology and interconnectedness of groundwater and surface water in these areas than ever before. This will allow for the development of further proactive management strategies to ensure that users in Nebraska may avail themselves of the greatest portion of water available while still meeting Compact requirements. More complete understanding of hydrogeologic characteristics in the proposed areas may also assist with identifying the most critical wells to be shut down should the Compact require it, thereby meeting Compact requirements without requiring ***all*** of these wells to be shut off.

The information provided from this project will also allow LBNRD and its partners to determine more proactive/critical BMPs for areas where water quality remains a concern, with both of the proposed flight areas experiencing quite elevated levels of nitrate. These management actions will directly address the Compact's goal for pollution abatement, as well as Nebraska Title 118 – Groundwater Quality Standards and Use Classifications, and help to ensure safe drinking water for the 5,000+ domestic water users in these areas and others that they serve.

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 described previously, the tasks necessary to complete the AEM data collection virtually eliminate physical impacts to the landscape compared to any alternatives that would produce comparable information. Regarding reductions to threats to property and critical infrastructure achieved by completing this project, protections will be afforded to public water supply systems and domestic drinking water wells serving at least 5,000 residents of the immediate project area and other areas served by public water systems in the project area. Further, declining groundwater levels and/or increasing concentrations of nitrate that impact wells often require private well owners and public water systems to lower their pumps, drill new or deeper wells (if possible), or install expensive treatment equipment. As described in Item 6, the avoidance of reverse osmosis treatment for the City of Fairbury and the rural water districts it serves totals millions of dollars of benefit, which is particularly critical given the relatively small population served by the system and the significant financial impacts that would be incurred and passed along to customers.

Gaining a complete understanding the local aquifer framework through AEM data collection and interpretation is essential to protecting these drinking water supplies and other beneficial uses from future overuse, as well as reducing the threat of groundwater contamination.

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.

With nitrate being a long-standing concern for groundwater quality in Nebraska in general and within the proposed flight areas, improvement upon these concerns is a key issue. However, nitrate – while perhaps the most ubiquitous contaminant in Nebraska's groundwater – proves difficult to mitigate in short time periods, with many efforts undertaken across the state since the 1990s and earlier, but little to no improvement seen in nitrate levels in almost any area where these efforts have occurred.

The areas proposed for AEM survey in this project are designated currently as Level II and Level III water quality management areas under LBNRD's Rules and Regulations; specifically, the Bruning East area is designated as Level II with Level III designation expected to occur in 2025, and the Fairbury area has Level III designation. Level II controls include operator training and certification and crop consultant training, soil sampling on a demonstration field, irrigation scheduling required on a demonstration field and encouraged on other fields, and annual farm operations reports; Level III controls include all Level II requirements but expanded to all fields, prohibition of nitrogen fertilizer application prior to March 1 without an inhibitor, and requirements that producers adhere to licensed soils test laboratory recommendations including nitrogen credits. With the most stringent of the NRD's water quality-related controls in place in these areas, we continue to experience the same frustration as many other areas of the state – little to no improvement.

Gaining a more complete understanding of local hydrogeology will be critical for determining how management strategies may be adapted to best produce the result of lowering nitrate levels in these areas and thus protecting public health. The Bruning East area includes the wellhead protection areas for Tobias, Daykin, and Alexandria; and the Fairbury area includes the WHPAs for Reynolds, Fairbury (plus rural water customers in eastern Thayer and Jefferson Counties), Endicott, and Rock Creek Station State Historic Park; the total public water system-served population of these areas is approximately 5,600 people. Additionally, 74 domestic wells lie within the two proposed flight areas.

In addition to development of additional management strategies, the AEM data collected during this project can be used to develop more refined, local groundwater models which can, in turn, be used to validate and/or refine WHPAs. With this more detailed information, we may begin to "move the needle" on nitrate contamination in these areas.

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.

LBNRD devotes significant time and resources to water quality and quantity assessment and management. Throughout its history, LBNRD has dedicated budget to growing and maintaining its monitoring program, the development and updating of its Groundwater Management Plan and related triggers/controls outlined in its Rules and Regulations, and partnering with local jurisdictions for the development of wellhead protection programs. Recognizing the value of high-resolution subsurface data to support these efforts into the future, the LBNRD Board of Directors unanimously approved a resolution at their February 11, 2025 regular meeting to pursue this application for WSF funding to support AEM data collection.

LBNRD's FY2025 budget (July 1, 2024 through June 30, 2025) is $15,338,007 (including a $10 million USDA grant for a rural water project) with a property tax levy of $0.019037 per $100 valuation and, thus, collection of $2,120,302 in local property taxes. The total cost for this project – including the collection and interpretation of AEM data and reporting/generation of products – is $416,666, of which LBNRD will match 40% or $166,667 (see supplemental information document). The remaining $249,999 is requested from WSF funds.

While there are not yet secured additional sources of funding, LBNRD will continue to pursue options for local cost-share with communities – including the City of Fairbury – that will benefit from this project.

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

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

The local jurisdiction is LBNRD, one of Nebraska's 23 NRDs granted authority under the Nebraska Groundwater Management and Protection Act – Neb. Rev. Stat. §46-707 – regarding groundwater to enter into contracts or agreements, budget and expend levied property taxes, own and operate property and equipment, and conduct investigations relative to the protection and management of groundwater. Neb. Rev. Stat. §46-707 gives the NRDs authority to carry out projects related to the development, management, utilization and conservation of groundwater and surface water.

Developed jointly with NeDNR, LBNRD's IMP was adopted in 2019. This was a voluntary IMP recognizing that water resources in the Little Blue River basin are critical for the long-term viability of the agricultural economy, business and industry, municipalities, fisheries and wildlife, and the society of the basin as a whole. The following is excerpted from Chapter 2 of the IMP (the IMP's goals are also contained in Section B, Item 9 of this application):

> "This plan will serve as a road map for jointly managing hydrologically connected groundwater and surface water in the District for the short term and the long term. It further serves as a framework which enables the District and Department to coordinate management actions and monitor groundwater and surface water, in order to better protect water resources for future generations" (Integrated Management Plan, p. 1).

To date, work toward meeting the goals and objectives of the IMP (outlined in Section B, Item 9 of this application) has included rules changes that removed the option to pool acres for allocations, set allocations (when triggered) at 65 inches for a 5-year period, submittal of a U.S. Bureau of Reclamation WaterSMART grant for small-scale water efficiency, and plans made for upgrading 81 aging flow meters on high-capacity wells in areas showing groundwater declines.

Additionally, LBNRD's GMP (most recently updated in 2017) recognizes water – and groundwater in particular – as essential to everything we do and thus requiring conservation for future generations, and serves as a guideline for its groundwater-related Rules and Regulations which were most recently updated in 2024. Significant work toward the goals of LBNRD's GMP (all historical versions) has also been completed, and includes (in addition to work outlined above to advance the goals of the IMP): ongoing, proactive updates to the GMP and rules and regulations; pilot projects to evaluate options for managed recharge; ongoing expansion of the monitoring well network; and investigations pertaining to emerging contamination concerns such as rising uranium levels in the vicinity of Hastings, likely related to ongoing nitrate concerns in that area.

LBNRD established its first Groundwater Control Area in 1979. For this area, groundwater level triggers were established but were later (in 1992) determined by the Board of Directors to have been erroneously calculated and, rather than imposing allocations that were not needed, the Board opted to revise the Rules and Regulations. The early passage of a control area and the adaptation to revise regulations rather than impose unnecessary controls demonstrates that LBNRD has a long history of both proactive and adaptive management of this critical resource.

Upon passage of LB1106 in 1984, LBNRD – like all NRDs – prepared its first GMP, which was adopted in 1986. Ahead of most, if not all, other NRDs in the state, LBNRD revised its original GMP in 1994 to outline a strategy for dealing with water quantity and quality issues that continued to evolve. As early as 1997, the NRD had triggers in place to establish groundwater quality management areas with specific controls, including prohibition of fall fertilizer application for agricultural lands, to address rising nitrate concerns. The NRD again updated its GMP in 2005 to allow a stay on high-capacity well and acre expansion in the isolated paleovalley that will, in part, be studied during this project. Again, LBNRD has demonstrated from the beginning of required GMPs that its Board and staff continue to adapt to meet the needs of the District.

In general, the results of this project will support sustainable water use in the project area by creating an aquifer framework to better manage domestic, municipal, agricultural and industrial water supplies, and water quality. Benefits of the project will address the persistent groundwater nitrate contamination in both proposed flight areas, as well as areas of declining water levels for an estimated 149,000 acres, including the Wellhead Protection Areas of seven public water systems. In addition to the more immediate availability of high-resolution data on the subsurface in the proposed flight areas, AEM data generated through this project may be used in the future for the refinement of local groundwater models to better understand localized impacts and more reliably assess and predict the impacts of historic, current, and proposed groundwater pumping on streams. Stakeholders of this project will include the Board and staff of the LBNRD, local communities, landowners, and any other local water users with the potential for

UNL-CSD, ENWRA, NeDNR, NDEE, other agencies, and the public through the Nebraska GeoCloud to be included.

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.

With groundwater as the primary source for all uses of water in Nebraska – including for domestic and agricultural purposes – managing its quality and quantity is a statewide concern. Groundwater supplies in LBNRD, particularly in the proposed AEM survey areas, face threats to both quality (due to elevated nitrate) and quantity. While these issues are not unique to LBNRD, they are certainly magnified in the proposed project area. With threats to drinking water via nitrate contamination are of greatest concern, the benefits of this project for the community and rural populations served cannot be overstated. Because the aquifers in the district – especially in the Fairbury area – can be quite limited and variable, gaining a better understanding of their extents is critical to understanding how best to manage these issues and, potentially, to mitigate drinking water quality concerns by having a clearer picture of where best to explore alternate sources.

Rural population decline presents significant issues across the state both in terms of smaller customer bases to support small-community infrastructure needs and in terms of the economic impact upon those customers that remain. As the City of Fairbury – and the areas in eastern Thayer and Jefferson Counties to which it provides water – faces sustained high nitrate levels that may necessitate installation of expensive treatment or exploration for an alternate source, the concern is therefore also raised as to how the residents of the area will afford costs passed along through utility bills. The Fairbury area's task, then, is to consider whether an alternate source with both enough water and water of sufficient quality can be tapped at less expense and, if not, whether the community will remain vital or its population will continue to decline or declines will become more pronounced. These concerns all loom, also, for the public water systems in the Bruning East area.

Beyond this community issue lies the question of how much additional irrigation can be supported in these areas, and where. With irrigated crop yields clearly higher than dryland, not to mention the ability to reliably produce a profitable crop when irrigation is available, the area's and state's producers continue to expand irrigation when it permitted and feasible. With the Fairbury area in a stay for high-capacity well development since as early as 2006 due to groundwater level declines, it has been assumed but not fully known whether irrigation can sustainably be expanded.

Ultimately, having high-resolution hydrogeologic data such as the data that will come from this project is critical to assessing the complicated glaciated materials that make up these underlying aquifers. As has also been mentioned, the data may be used to refine local groundwater models, allowing for more reliable predictions of the impacts of further development on groundwater levels and local streams. Taken together, this project will provide both for the protection of existing users and the protection and benefit of potential future users, both in terms of community drinking water needs and agricultural production. These are clearly substantial benefits in Nebraska with its many small population centers in rural areas and its reliance on agriculture as the key economic driver, but the overarching benefit also lies with LBNRD’s ultimate ability to manage limited and/or vulnerable groundwater supplies for long-term sustainability for current users while making informed decisions about resource availability for future users.

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.

As listed, the funding sources for this project in its entirety are this grant application (60%, or $249,999) and LBNRD (40%, or $166,667; see supplemental information document). The project will provide benefits to local public water suppliers, domestic well owners, and irrigators. The detailed AEM data will be highly valuable to local suppliers in managing existing limited groundwater supplies, as well as identifying new well locations should that become necessary. Public water suppliers make use of a variety of funding sources (e.g., the State Revolving Fund and U.S. Department of Agriculture Rural Development) when upgrading or installing new water or wastewater systems. The information on groundwater occurrence, as well as near-surface geology, will prove highly valuable when evaluating new facility sites. This project will also aid refined aquifer volume estimates that will help facilitate required analysis for the establishment of new groundwater-based drinking water systems.

As part of this AEM project, there are anticipated locations where increased groundwater monitoring will be optimized for the project area. Past partnerships for monitoring well installations and domestic water sampling in the District have included federal agencies. Data and deliverables from this project will also result in leveraging state dollars with local, federal, or other partners to implement further water monitoring and water quality BMPs to conserve and protect water resources.

In the absence of WSF funding to support this project, LBNRD likely will not pursue AEM survey at this time, but will consider exploring other options for funding in future fiscal years.

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.

The project area includes several HUC10 watersheds contributing directly or ultimately to the Little Blue River, including: Dry Sandy Creek (1027020607); Outlet Big Sandy Creek (1027020608); Little Sandy Creek-Little Blue River (1027020701); Rose Creek (1027020702); and Joy Creek-Little Blue River (1027020703). The Little Blue River watershed is part of HUC 10180001.

Collectively, the above-mentioned watersheds lie within the larger Big Blue River basin (subject to an interstate compact). The use of high-resolution AEM data such as proposed for this project in other areas has already proven important for better understanding areas of hydrologic connectivity (stream/aquifer interactions) and even the refinement of local groundwater models to more reliably predict impacts of groundwater pumping in those areas. Gaining this more detailed understanding of local hydrogeology will allow LBNRD and its partners to make better decisions about how to manage these connected resources in such a way as to ensure both local and state economic and social vitality, as well as maintain compliance with the interstate compact with Kansas to which the area is subject. Ultimately, this improved management will provide most sustainable outcomes for the various plant and animal species – some of which are threatened or endangered – that rely on the Big Blue River watershed.

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

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

The 2024 NeDNR Annual Report lists six goals, with Goals 3, 5, and 6 being:

- Goal 3: Develop and implement customized and decentralized water management plans established through collaboration with local Natural Resources Districts and stakeholders that provide for long-term sustainability of the state's water resources;
- 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; and
- Goal 6: Provide agency-wide services and support in the areas of information technology and transparent data sharing, business improvement, public information, and administration of state-aid funds in conjunction with the Natural Resources Commission

The collection of AEM data and the incorporation of that data into an overall aquifer framework directly supports Goals 3, 5, and 6 by gathering improved data for making water management decisions that provide for water sustainability through refined planning and implementation efforts. AEM data will provide greater understanding of the extents, thicknesses, and interconnection of aquifer systems. That improved understanding can, in turn, directly inform analysis of streamflow in the hydrologically connected areas of the District.

The project will also support the staff and resources of the state for planning and management of the water resources. Any project partners may utilize the data to further their expertise in the local hydrogeologic framework; expertise is, in turn, used by the staff and Board of Directors at LBNRD to develop the appropriate plans, regulations, programs, and projects for the protection and conservation of water. LBNRD partners with many agencies of the state including NeDNR, the Nebraska Department of Environment and Energy (NDEE), the Nebraska Department of Health and Human Services (NDHHS), the Nebraska Game and Parks Commission (NGPC) and others with an interest in the protection and conservation of the state's water resources.

This project's stakeholders represent local-, regional-, and state-level interests, cooperatively studying the water resources of the area. Beyond this, AEM data and its products will be shared with other agencies, producers, and the public to better illustrate the area's hydrogeologic framework and engage in planning and implementation of BMPs and other management efforts. Visual representation of unseen resources – precisely a key product of the final report that will result from this project – is a key element of public engagement to ensure local buy-in to management efforts and overall for keeping the public informed about the resource itself and the efforts to protect it.

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.

As discussed throughout this application, one primary issue to be explored and addressed through this project is that of nitrate contamination; through better understanding of the local hydrogeology, LBNRD will be able to assist the City of Fairbury – as well as public water systems within the Bruning East area, if needed – with options for exploring alternate sources of drinking water in lieu of expensive treatment to meet the regulatory MCL for nitrate. Established due to public health concerns related to methemoglobinemia or “Blue Baby Syndrome”, the U.S. Environmental Protection Agency established the drinking water standard for nitrate, as applied to public water systems, as 10 ppm (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#Inorganics).

As mentioned, the City of Fairbury has had concerns regarding elevated nitrate for quite some time, with the area being established as a Level III management area for water quality; the Bruning East area was also established as a Level II management area in 2024 and is expected to reach Level III designation by the time of the proposed AEM surveys. Trends in nitrate levels in these areas do not indicate decline. Nitrate in drinking water is not a unique issue to LBNRD or these areas; it has been a concern across Nebraska for quite some time, to the extent that the Nebraska Department of Environment and Energy recently completed and published a study on nitrate in drinking water (https://dee.nebraska.gov/water/nitrate-drinking-water-study).

Detailed information on local hydrogeology, as will be gained through this project, will be essential for the NRD and the public water systems with wellhead protection areas in the proposed survey zones – including Tobias, Daykin, Alexandria, Reynolds, Fairbury, Endicott and the Rock Creek Station State Historical Park – to evaluate both management options to reduce the nitrate threat and where to consider alternate sources. It will also provide information to LBNRD on where best to promote and/or require nitrate-related BMPs to protect groundwater supplies.

The project will also assist the State of Nebraska in better understanding those characteristics of areas that pertain to the Blue River Basin Compact. Approved June 3, 1960, Public Law 489 of the United States granted consent to the states of Kansas and Nebraska to negotiate the Compact, which was ratified by the states on January 25, 1971. As mentioned previously, this project will allow the NRD and the State to better understand areas of hydrologic connection and, thus, better manage the use of groundwater in these areas to help ensure that the State meets its obligations under the Compact. The Blue River Basin Compact is also unique in that it includes the purpose of protecting water quality

– which the data collected through this project will directly benefit by informing better/more targeted management strategies.