NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: LENRD Aquifer Framework Mapping

PRIMARY CONTACT INFORMATION

Entity Name: Lower Elkhorn Natural Resources District

Contact Name: Mike Sousek, General Manager

Address: PO Box 1204 Norfolk, NE 68702

Phone: (402) 371-7313

Email: msousek@lenrd.org

Partners / Co-sponsors, if any: Eastern Nebraska Water Resources Assessment (ENWRA), University of Nebraska Conservation and Survey Division (CSD)

1. Dollar amounts requested: (Grant, Loan, or Combination)

   Grant amount requested. $250,000

   Loan amount requested. $ N/A

   If Loan, how many years repayment period? N/A

   If Loan, supply a complete year-by-year repayment schedule.
   N/A

2. Permits Needed - Attach copy for each obtained (N/A = not applicable)

Nebraska Game & Parks Commission (G&P) consultation on Threatened and Endangered Species and their Habitat	N/A☒	Obtained: YES☐ NO☐

Surface Water Right	N/A☒	Obtained: YES☐	NO☐
USACE (e.g., 404 Permit)	N/A☒	Obtained: YES☐	NO☐
Cultural Resources Evaluation	N/A☒	Obtained: YES☐	NO☐
Other (provide explanation below)	N/A☒	Obtained: YES☐	NO☐

3. Are you applying for funding for a combined sewer over-flow project?

   YES☐ NO☒

   If yes, do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality? N/A

   YES☐ NO☐

   If yes attach a copy to your application. N/A

   If yes what is the population served by your project? N/A

   If yes provide a demonstration of need. N/A

   If yes and you were approved for funding in the most recent funding cycle, then resubmit the above information updated annually but you need not complete the remainder of the application.

4. If you are or are representing an NRD, do you have an Integrated Management Plan in place, or have you initiated one?

   N/A☐ YES☒ NO☐

5. Has this application previously been submitted for funding assistance from the Water Sustainability Fund and not been funded?

   YES☐ NO☒

   If yes, have any changes been made to the application in comparison to the previously submitted application? N/A

   If yes, describe the changes that have been made since the last application. N/A

   No, I certify the application is a true and exact copy of the previously submitted and scored application. (Signature required) N/A

6. Complete the following if your project has or will commence prior to next July 1st.

As of the date of submittal of this application, what is the Total Net Local Share of Expenses incurred for which you are asking cost share assistance from this fund? $ 0.00

Attach all substantiating documentation such as invoices, cancelled checks etc. along with an itemized statement for these expenses. N/A

Estimate the Total Net Local Share of Expenses and a description of each you will incur between the date of submittal of this application and next July 1st for which you are asking cost share assistance from this fund.

$125,000. The Consultant requires payment of 30% of the total contract cost at the time of signing for the initial flight planning and coordination.

Section B.

DNR DIRECTOR'S FINDINGS

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

YES☐ NO☒

1(a). If yes (structural), submit a feasibility report (to comply with Title 261, CH 2) including engineering and technical data and the following information:

A discussion of the plan of development (004.01 A);
N/A

A description of all field investigations made to substantiate the feasibility report (004.01 B); N/A

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

A description of any necessary water and land rights and pertinent water supply and water quality information, if appropriate (004.01 D);
N/A

A discussion of each component of the final plan including, when applicable (004.01 E);

Required geologic investigation (004.01 E 1); N/A

Required hydrologic data (004.01 E 2); N/A

Design criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3). N/A

1(b). If no (non-structural), submit data necessary to establish technical feasibility including, but not limited to the following (004.02):

A discussion of the plan of development (004.02 A);

The Eastern Nebraska Water Resources Assessment (ENWRA) is a coalition of six eastern Nebraska Natural Resources Districts with the purpose of studying the water resources of eastern Nebraska to develop a three-dimensional geologic framework and water budget for the glaciated portion of the state. Approaches to Airborne Electromagnetics (AEM) of aquifer characteristics were tested within the glaciated portion of eastern

Nebraska starting in 2006 by ENWRA with pilot studies completed in Oakland, Ashland, and Firth. Please refer to “Eastern Nebraska Water Resources Assessment (ENWRA) Introduction to a Hydrogeological Study in the Bibliography. (CSD 2009) AEM utilizes a helicopter to carry transmitting and receiving equipment along a predetermined flight path. The ENWRA pilot studies and additional follow up work tested multiple types of AEM techniques in geologically diverse settings. In all types of AEM, the equipment remotely senses the electrical characteristics of the subsurface materials which can be used to interpret the type of subsurface materials that are in place such as clay, silt, sand, or gravel. This provides a nearly continuous set of subsurface information, a virtual borehole approximately every 50 feet, along the flight lines. The pilot studies conducted by ENWRA determined the effectiveness of the various AEM approaches for measuring aquifer characteristics (US Geological Survey 2011).

Due to the aquifer depths and variability of overlying material, Time-Domain Electromagnetics (TDEM) AEM has become the standard for large scale remote sensing of aquifer characteristics in eastern Nebraska based on results of Scientific Investigations Report 2011-5228, U.S. Geological Survey. TDEM has been successfully implemented in much of Nebraska with extensive flights in 2014, 2015, and 2016 across the eastern portion of the state. (ENWRA), and the University of Nebraska Conservation and Survey Division (CSD) assisted the Lower Elkhorn Natural Resources Districts (LENRD) with the data collection and interpretation as well as the test hole drilling to ground truth the interpretations. A map of the ENWRA flight lines is included as Figure B.1 -ENWRA Flight Lines in the Supplemental Information Attachment (SIA). These interpreted datasets have been incorporated into the existing hydrogeologic information and will assist the LENRD to make water management decisions. This Project is an extension of the collection of AEM data completed in cooperation with ENWRA and the other partners in Stanton, Colfax, Thurston, and Cuming Counties. This Project is the third phase of a four phase project to collect AEM data and create a hydrogeologic framework for the entire LENRD.

The previously collected AEM data and interpretations, and work done as part of this Project, will be utilized by the LENRD to better define aquifer boundaries and their connection with surface water. The continued development of a hydrogeologic framework will also help the LENRD gain a better understanding of recharge areas and the potential for contaminant leaching.

A description of field or research investigations utilized to substantiate the project conception (004.02 B);

Benefitting from the work done by ENWRA and its partners, this Project will utilize TDEM to map the subsurface materials of the Project area. The overall steps of the proposed Project include finalization of the anticipated flight lines, collection of AEM data, analysis and interpretation of the data, incorporation of the interpretation into the existing understanding and overall framework of the hydrogeology of the area, and completion of a report documenting the overall Project.

The proposed project area is shown in Figure B.2 – LENRD Project Area of the SIA. Additional refinement of the spacing and flight lines will be needed to ensure efficient data collection and minimal interference from artificial sources such as pipelines or electrical lines.

The collection and analysis of the AEM data will be done by a geophysical consulting company (Consultant) to determine the electrical resistivity of the subsurface materials from the raw TDEM data. Electrical resistivity is a measure of how well or how poorly the subsurface materials resist the flow of an electrical current. Electrical resistivity can be correlated with the type of subsurface materials such as gravels, sands, silts, and clays. Highly resistive materials are typically sands and gravels where less resistive materials typically are silts and clays. AEM surveys also have the ability to map the location of fresh, brackish and saline water at depth. The processed data will be provided to the LENRD, ENWRA, and CSD for further interpretation with assistance from the Consultant. An example cross-section showing interpretation results is included as Figure B.3 - Sample Interpreted Geologic Profile of the SIA.

The initial interpretation of the types of subsurface materials will be compared with the known hydrogeologic framework of the area to adjust and verify the initial interpretations. The verification will be done utilizing existing understanding of the hydrogeologic units from traditional sampling techniques and previous AEM work. These interpretations comprise the overall hydrogeologic framework necessary for understanding the location, extents, potential recharge, groundwater flow, hydraulic connection of groundwater to surface water, and discharge characteristics of the aquifer systems. A final report will be provided by the Consultant describing the data collection, processing, and interpretation of the AEM. Included with the final report are Google Earth files that can be readily shared with interested parties to assist landowners, drillers, and local agencies with decisions regarding groundwater resources. A sample landowner report from ENWRA is included as Figure B.4 - ENWRA Sample Landowner Information Map of the SIA.

With the hydrogeologic framework updated through this Project the LENRD will be better equipped to assess the overall susceptibility of the Project area groundwater resources to impacts from potential contamination sources and increasing use and development. The updated hydrogeologic framework will directly inform the delineation of the groundwater resources to be included in the next update of the LENRD Groundwater Management Plan (GMP), anticipated to begin in 2017. CSD may use the AEM data to update bedrock maps, transmissivity and specific yield maps, and maps of secondary aquifers. Please refer to CSD/USGS/ENWRA's 2016 Nebraska Geocloud and Airborne Electromagnetic (AEM) Data Integration WSF application under separate cover for CSD's immediate plans for the AEM data

A description of the necessary water and/or land rights, if applicable (004.02 C);

Remote sensing of aquifer materials requires some ground truth of the aquifer characteristics through traditional drilling and sampling techniques. The existing set of CSD test-holes, as well as existing drilling logs, can be utilized as ground truth locations. The LENRD intends to complete test-hole drilling for one new monitoring well nest in the proposed project area based on AEM results. Flight lines for this Project will be developed to make use of the existing test-holes and other hydrogeologic information where possible. Where test-holes are not available but the need for ground truth locations is critical, additional test holes may be drilled. The collected AEM data will allow for optimization of the locations of any critical test-hole needs allowing for efficient use of test-hole drilling expenditures. Should test-holes be required, access agreements with landowners will be needed. Test-hole drilling requires the use of a drilling rig on location for approximately three days to drill and describe the geologic materials. All drilled test-holes are back filled with bentonite grout and the land surface returned to its original condition. Access agreements for this type of work typically are readily obtainable as there are limited impacts to the land surface and the landowners benefit from the findings.

A discussion of 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).

Results of this mapping project are anticipated to improve well construction in the project area to avoid interference of adjacent wells and existing nitrate contaminants. Knowing the depth and locations of the aquifer material furthest away from known groundwater quality impairments will provide well drillers and public water suppliers with enhanced information to drill deeper wells in better locations. If water supplies are found not to be protected from water quality impairments, the

LENRD may consider pursuing other sources for public water supply systems in the area or the potential development of a rural water system.

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

Traditional methods of collecting hydrogeologic information are accomplished through the drilling of test-holes and logging of the geologic materials found and interpretation of the materials found within the test-holes relative to the area geology. Individual test-holes provide a single point of information about the area hydrogeology which can be supplemented with existing drilling logs. The geology and the aquifer materials between these points are interpolated utilizing the experience and expertise of trained hydrogeologists. The interpolation of the hydrogeology between points is simply an estimation of the subsurface materials present, but aquifer materials and their properties may change dramatically in as little as a few tens of feet from the individual test-hole locations. Individual points of information, like test-holes, therefore provide limited information about the broader aquifer characteristics.

While limited, test holes have been the best available method for assessing aquifer characteristics until the recent improvement of AEM. AEM essentially provides thousands of virtual test-holes along the flight path thereby collecting a nearly seamless cross-section of the aquifer materials. The AEM survey method can remotely cover large areas of the subsurface in a short amount of time and with great detail. This type of seamless cross-section cannot be collected through any other known method. Results from the previous AEM surveys show changes in the subsurface related to the aquifer-nonaquifer materials present between the test holes and can be seen in Figure B.7 – Flight Line Example 2014.

All methods of AEM collection require approximately the same level of planning, acquisition, processing, and interpretation costs. Frequency Domain Electromagnetics (FDEM), another form of AEM, is comparable in cost to TDEM. The primary reasons for selecting one method over the other are the type of materials being sensed, the depth of the materials, and the water quality within the aquifer. While comparable in cost, FDEM is limited in depth of investigation and is not appropriate for most of the areas to be flown within the Project area. TDEM has been shown, through the work of ENWRA and the local NRDs, to be the most effective method for the proposed Project area.

Recent experience using AEM for projects with ENWRA has shown that the benefit to cost relationship for developing a hydrogeologic framework

is significantly improved relative to traditional methods. The continuous nature of the virtual bore-holes provided by AEM cannot be repeated through any other methods. The average cost per line mile for AEM is $680 which includes collection, interpretation and reporting. A single mile of AEM represents approximately 100 virtual test-holes with an approximate average depth of 600 feet, all collected without trespass or ground disturbance. This therefore represents approximately 60,000 feet of traditional drilling and sampling (100 test-holes of 600 feet each), a physical and economic impossibility. To make the cost comparison anyway, the current per foot costs of traditional test-hole drilling is $10 to $15 per foot. Even if it were physically and logistically possible to drill 100 test holes in a one mile line, the cost would be anywhere from $600,000 to $900,000 as compared to the price of $680 per mile of AEM.

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 shall be fifty (50) years or with prior approval of the Director, up to one hundred (100) years [T261 CH 2 (005)].

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

  The nature of the Project requires no construction, operation and maintenance, or replacement costs. The life of the Project will extend into the foreseeable future, unless it is determined that a closer grid is needed to explore more complicated aquifer systems. An example of this is the dense flight line spacing around several well head protection areas in the various NRDs from the 2016 projects.

- 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 any intangible or secondary benefits 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, such that the economic feasibility of the project can be approved by the Director and the Commission (005.02).

While the Project will not produce any tangible benefits, its intangible benefits are extremely valuable for water sustainability. The information collected through the use of AEM will assist the LENRD in delineating the District into management areas based on aquifer characteristics. This more scientific based method of delineating the District will increase the effectiveness of LENRD management decisions for individual areas, increasing the sustainability of the area's water resources.

- All benefit and cost data shall be presented in a table form to indicate the annual cash flow for the life of the proposal, not to exceed 100 years (005.03). N/A

- 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, the economic feasibility of such proposal shall be demonstrated by such method as the Director and the Commission deem appropriate (005.04).

  This Project will collect information necessary to assist the LENRD Board with decisions regarding the conservation, protection, and sustainability of water resources. Those decisions may result in the establishment of Groundwater Management Areas for quantity or quality concerns, the development of additional rural water districts, the development of Wellhead Protection Plans, or programs sponsored by the LENRD for aquifer protection. As the program, project, or action that may result from the information is not yet known, there is not currently a method for calculating the primary tangible benefits of the Project in a quantitative way. While quantifying the benefits from the Project is not a possibility, there is an ability to discuss the overall benefits from a qualitative standpoint.

  The purpose of the mapping through AEM is to identify and define the relationship of the aquifer systems to one another as well as to the land surface and the surface water systems. The water available for use from an aquifer system is dependent upon the relationships among overall use, recharge, and discharge. This Project will improve the overall understanding. This improved understanding will be used to make informed management decisions regarding the quantity available for the various groundwater demands in the area. The conservation of the water resources would be accomplished with management actions that prioritize use and limit total groundwater withdrawals as and where needed. Prioritization and limits on use would result in greater understanding of the water available to individual users, which improves the user's ability to plan for continued use and development. This ability to plan for use and development will result in a greater ability to allow for additional economic development that is dependent

upon the water resource.

The relationships among groundwater use, recharge, and discharge also inform potential actions related to groundwater quality. Where groundwater resources are more protected from surface related contaminants, management actions could prioritize use in those areas. Tailoring the locations of groundwater use decreases the potential need for expensive treatment and improves the longevity of capital investments related to water supply. Additionally, the understanding of where the groundwater resources are most susceptible to surface contaminants can be used to tailor the approaches to management of activities that can threaten those groundwater resources.

The Project improves the LENRD's ability to provide tailored approaches to management to ensure the long-term conservation and protection of the water resources. These tailored approaches can assist the users of the water resources with understanding their capacity for continued development and protect existing and future development. One form of benefit from this Project could be realized by the ability to avoid constructing replacements of wells impacted by the migration of high nitrates or avoidable interference (see Figure C.2 - LENRD Nitrate Levels of the SIA).Further benefits are realized from the public use of the data and enhanced management of the quality and quantity of groundwater.

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

Natural Resource Districts are granted the authority to impose property tax levies to generate revenue for operational needs. The LENRD currently assesses real estate property at the rate of 2.4 cents (FY 2016/2017) per hundred dollars of value. This funding stream will provide the District with sufficient funds to provide the cash contribution necessary to complete this project.

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

The LENRD currently has a budget of $8.06 million, providing sufficient funds to provide match for this project. This project will require no operation, maintenance, or replacement costs once the AEM flights have been conducted.

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

N/A

7. Describe how the plan of development minimizes impacts on the natural environment.

   Data collected during the AEM flight is remotely sensed and has no potential impact to the natural environment.

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

   The Nebraska Ground Water Management and Protection Act, passed in 1975, established the NRDs as the preferred local entities for groundwater regulation and protection. NRDs work cooperatively with cities, counties, state, and federal agencies to accomplish groundwater resource protection through programs, projects, and regulations. Each NRD is required to have in place a Groundwater Management Plan, based upon the best available information, and approved by the Director of the Nebraska Department of Natural Resources. The LENRD is also in the process of developing a voluntary Integrated Management Plan hereafter referred to as the IMP, for the hydrologically connected surface water and groundwater. It is anticipated that the public hearing for adoption of the IMP will be in late 2016.

   The District voluntarily entered into the IMP development process with NDNR to take a proactive approach to the protection of the interconnected water resources. The staff, management, and Board of Directors (Board) of the LENRD devote significant time and resources toward their duties to understand and manage the groundwater resources. The District's existing groundwater data will be combined by the staff and management of the LENRD with the information collected during this Project. The LENRD Board will utilize the full set of information regarding the groundwater resources to inform the IMP development process and future decisions about the management and protection of the groundwater resources.

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

   The data collected by the Project will be submitted to the NDNR as the "best available" information for use in the Annual Evaluation of Availability of Hydrologically Connected Water Supplies, hereafter referred to as the FAB Report. The FAB Report is a statutory requirement of the NDNR which evaluates the long-term availability of the hydrologically connected water supplies of the State. The previous collection of AEM data done by ENWRA was partially funded by the NDNR for use in modeling efforts to

determine the impacts of groundwater use on surface water availability in hydrologically connected reaches. The results of those modeling efforts, when complete, will be incorporated into the FAB Report which determines if a basin is fully appropriated or not. The Project will update the overall hydrogeologic framework and improve upon the previous AEM work that supports the FAB Report.

All Natural Resources Districts are statutorily required to have a completed Groundwater Management Plan (GMP) which includes information about the aquifers of the NRD, supplemental supplies, integrated and coordinated use, and the boundaries of management areas. The LENRD has an adopted GMP (LENRD 2015). Results of this Project specifically meet the objectives of the GMP to address specific problems of groundwater quality and quantity. The LENRD is anticipating an update to the existing GMP which will incorporate the Project information to determine the need for and type of groundwater management protection areas (Protection Areas).Protection Areas are a management tool available to NRDs to improve the protection and conservation of the groundwater resources. LENRD currently requires flow meters on all irrigation wells. The Project data will give us a better understanding of the area hydrogeology for quality and quantity management. This data will help us better define groundwater management zones based on the hydrogeology. The Project will also help the LENRD to define recharge areas and potential areas with greater contaminant leaching. A listing of NRD implemented protections for groundwater quantity and quality is shown in Figure B.5 – Groundwater Quantity Management Summary 2014 and Figure B.6 – Groundwater Quality Management Summary 2014 of the SIA.

The LENRD is currently developing a voluntary IMP that should be complete in late 2016. It is anticipated that the IMP will include goals or objectives directly related to data collection and development of the understanding of the hydrogeology and surface water interactions. This Project will directly address those anticipated goals or objectives.

As one of the six ENWRA NRDs, the LENRD has been using ENWRA as a vehicle to study both groundwater and hydrologically connected water and thus ENWRA's Long Range Plan (LRP) includes AEM mapping and other assessment goals and plans specific to the LENRD. Identifying the location and volume of aquifers (LRP Objective 2) focuses the refinement of the geologic framework to areas in which there is economic and ecologic returns on the investment in the study. The specific locations listed represent areas in which competition for groundwater is occurring and scientific data to support management decisions is lacking. ENWRA anticipates working on multiple small to mid-sized projects at any given time and the projects will likely have variable scales of resolution, use a

variety of geologic and geophysical techniques, and have multiple funding sources. The purpose of the ENWRA LRP is to enhance the cost effectiveness and timeliness of these potential projects through coordination and collaboration. In addition, the ENWRA LRP addresses eight other objectives relating to understandings gained from the AEM that are applicable for each of the NRDs such as estimating recharge, assessing groundwater surface water connections, calculating water budgets, and characterizing natural and anthropogenic groundwater concerns. Further, the ENWRA coordinator, as stated in the ENWRA LRP, will provide coordination services for secondary projects (NRD-specific projects like this one) as long as they further the overall ENWRA goals and objectives.

There are also 19 Wellhead Protection Areas (WPA) in the Project area. Wellhead Protection Plans have been prepared for some of these WPAs. The AEM collected as part of this Project will be utilized to update the boundaries of the WPAs and to assist municipalities with wellhead protection planning steps.

10. Are land rights necessary to complete your project?

YES☐ NO☒

If yes, provide a complete listing of all lands involved in the project.
N/A

If yes, attach proof of ownership for each easements, rights-of-way and fee title currently held.
N/A

If yes, provide assurance that you can hold or can acquire title to all lands not currently held.
N/A

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

The LENRD is a political subdivision of the State of Nebraska with authority to levy property taxes and enter into contracts and Inter-local Cooperation Act agreements. The contract for professional services with the Consultant to collect the AEM data will require approval from the LENRD Board of Directors and be signed on behalf of the LENRD by the General Manager.

12. Identify the probable environmental and ecological consequences that may result as the result of the project.

Remote sensing projects such as AEM do not have a physical impact on the environment or ecologic communities. There are no known environmental or ecological consequences from AEM data collection. There are no human health impacts from this type of survey.

Section C.

NRC SCORING

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

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

Notes:

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

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

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

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

1. Remediates or mitigates threats to drinking water;

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

   The proposed Project area includes 481 domestic wells and encompasses 19 wellhead protection areas (see SIA Section B-1(b) Figure B.2 - LENRD Project Area) serving a combined population of more than 16,000. Water quality

sampling in the Project area has indicated that there are elevated levels of nitrate ranging from 5 to over 10 parts per million (ppm) in several areas. The City of Stanton, Village of Pender, Village of Dodge, Village of Rosalie, and the Cuming County Rural Water District 1 have received violations in the past due to nitrate/nitrite levels. Potential mitigating actions which may occur as a result of this study include deeper domestic well construction, enhanced groundwater recharge information and management, and improved water quality monitoring.

Detailed information collected from AEM combined with traditional hydrogeologic information that is incorporated into an aquifer framework provides a far more complete understanding of the physical extents and potential interactions of the local and regional aquifers and surface waters. A hydrogeologic framework includes not only the depth to the top of the aquifer and extents of the aquifer materials but also the depth to the bottom of the aquifer. Beyond the information collected about the aquifer, information about the materials that overlay the aquifer area are also important in providing greater understanding of how the recharging water migrates to the aquifer system.

Water quality problems in aquifer systems that can impact drinking water are often related to activities at or near the land surface. A particular aquifer's susceptibility to surface contaminants is partially determined by the type of overlying materials. An understanding of the overlying materials, whether the materials readily allow percolating water to recharge the aquifer or not, determines the rate at which surface contaminants can reach the aquifer. Sandier materials above an aquifer with limited clay content allow more rapid recharge, whereas thick sections of clay reduce the rate of downward migration and recharge. Other sources of information about the overlying materials, such as soils maps, only include the very near surface materials. The standard soil mapping practices also only typically sample the soil every 2.5 acres versus the data rich sampling done with the virtual boreholes of AEM. AEM provides information about the full sequence of material that overlay an aquifer. Greater understanding of the extents of materials that limit or transmit percolating water can provide LENRD with the ability to tailor management activities intended to protect drinking water quality.

Typically, contamination from the land surface tends to remain in the uppermost portion of the aquifer system versus mixing more deeply in the aquifer. Nitrate is a good example as it tends to stratify in the upper aquifer. The mapping of shallow clay zones through AEM helps delineate areas protected from contaminant transport from the surface. Locating future domestic and municipal drinking water supplies in areas where these protected aquifer units exist can help with wellhead protection and limit the impacts of the downward migration of contaminants.

Through an understanding of the full depth of the aquifer, the LENRD can establish best management practices to be used by well drillers during the

construction of new drinking water wells. Typical domestic well construction occurs in the uppermost portion of the aquifer as, once the driller has encountered enough water bearing sands, the drilling is stopped and the well is completed. Additional depth of drilling is considered an unnecessary expense once a sufficient quantity of water bearing sands is encountered. The additional drilling can, however, provide a domestic well with greater longevity and reduced impact from surface contaminants. Where sufficient depth of aquifer materials is available, recommendations for drilling to a deeper portion of the aquifer for well completion could be made. Completing the drinking water well in the deeper portion of the aquifer and sealing off the upper portion of the aquifer is an effective way to limit the wells susceptibility to contaminants. A deeper drinking water well also reduces the potential interference from nearby wells as they draw down the aquifer during use. A deeper drinking water well also has greater protection from water level declines that occur during times of drought. Such issues with groundwater quantity were experienced throughout the LENRD during the drought of 2012. Many domestic wells experienced groundwater shortages due to pumping interference with other wells. The AEM data collected will greatly help the LENRD in determining areas susceptible to a repetition of those problems previously experienced.

The LENRD has monitored groundwater quality in the Project area for the past several decades as part of its current GMP (LENRD 2015). The LENRD has installed multiple dedicated groundwater quality monitoring wells for the purpose of collecting highly reliable groundwater samples from targeted sections of the aquifer. The monitoring wells are typically completed at multiple depths. The LENRD has eleven monitoring well sites located in the Project area (see SIA Section B-1(b) Figure B.2 - LENRD Project Area), nine of which are monitored for water quality. All eleven sites are monitored for water level depth. Based on sampling of these well clusters, the LENRD has seen high nitrate levels in one of these wells.

High levels of nitrogen, as nitrate, in drinking water can be harmful to young infants or young livestock. Excessive nitrate can result in restriction of oxygen transport in the bloodstream. Infants under the age of 4 months lack an enzyme necessary to correct the restricted oxygen transport resulting in what is known as "blue baby syndrome". The long-term impacts from not fully understanding the sources of nitrate contamination and the susceptibility of the aquifer system to contamination can potentially put human health at great risk.

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 LENRD has an adopted GMP (LENRD 2015), last revised in 2015. Results of this project specifically meet the objectives of the GMP to increase our general knowledge of the hydrogeologic characteristics of the district and to conserve groundwater quality and quality.

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

   List the following information that is applicable:

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

   The collection of hydrogeologic data and assembly of that data into an overall aquifer framework provides the information necessary to help determine area recharge characteristics, aquifer extents, volume of available groundwater, interconnection with other aquifers, and stream-aquifer interactions. AEM, along with interpretation of the collected data, provides highly detailed information about the materials within the aquifer as well as the materials above, below, and adjacent to the aquifer. An example of the type of aquifer delineation that AEM can provide is included in SIA Section C-1, Figure C.1 - Sample Interpreted Voxel Display.

   Aquifer recharge is determined by the water available from precipitation for deep percolation after taking into account runoff, evapotranspiration, soil characteristics, and other factors. Recharge also is impacted by the materials that overlay the aquifer which influence the way in which the deeply percolating water reaches the aquifer. Generally speaking, the sandier the materials that overlay the aquifer, the faster the recharge will be, while more clay rich materials will tend to slow the recharge. AEM can be utilized to improve the LENRD's understanding of recharge potential by delineating the layers of material types overlying an aquifer. Recharge potential can then be utilized by the LENRD to better assess projects designed to increase recharge as well as inform the LENRD's management of preferred development zones in areas where recharge is higher.

   Preferred development areas can be used to tailor development of additional uses of groundwater to those areas where recharge more readily replenishes withdrawals, where aquifer thickness is greatest, where effects from aquifer extents are reduced, or where well impacts to streams are minimized.

Management decisions for Groundwater Management Areas (GMA) would seek to balance the needs for groundwater development with the existing uses of groundwater in an area. A more complete framework of the hydrogeology will improve the LENRD's ability to make those management decisions and improve the sustainability of the overall water resources. Potential management decisions to utilize allocations, rotation, limits on development, well spacing requirements, or other groundwater controls as part of a GMP or IMP can be better tailored to protect existing users and promote sustainable use of the water resources. These benefits will also apply to the adjacent parts of the Missouri River Basin and Platte River Basin.

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.

   Conservation and preservation of water resources for the beneficial use of the residents of the state requires detailed information about the aquifer characteristics and interactions of the groundwater and surface water resources. Sound strategies for conservation and preservation in this area, whether management actions, programs, or projects, depend on that detailed information to understand the volume and distribution of available groundwater and water quality concerns.

   Municipal, industrial, agricultural, and recreational water supply uses in this area will also realize benefits from the aquifer framework mapping. Improved well location and construction methods will ensure improved reliability and reduce potential water quality issues. Continuing to allow public water supply, industrial, and agricultural uses without proper management may lead to well interference, overuse, and water quality contamination.

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

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

   The beneficial use of Nebraska's water resources is established and prioritized in the Nebraska Constitution with drinking water use being the highest priority and

agricultural use and industrial use following from there. Water is considered a natural want and a shared resource of the State. The LENRD has long worked with other area NRDs and the State to best manage the water resources for beneficial use. The aquifer framework developed through this AEM collection project will further the District's understanding of the aquifer systems and their interaction with the land surface and area streams. This understanding will be shared with other NRDs as well as state agencies including NDNR and CSD. The shared understanding of the water resources will provide the agencies tasked with understanding and managing Nebraska's water resources the best available information to make the best possible decisions regarding the beneficial use of the water resources. The development of this aquifer framework will provide the LENRD with some of the necessary information to facilitate additional beneficial uses of groundwater in areas with resources adequate to support the expansion. It will also assist in designating areas that are unable to facilitate additional beneficial uses without negatively impacting the aquifer systems in that particular area.

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.

AEM data collection and interpretation provide an understanding of the aquifer systems that cannot be developed through traditional drilling and sampling techniques. The only real alternatives to consider for the collection and interpretation of data that provides a hydrogeologic framework are the different methods of AEM. The work of ENWRA and the USGS have provided the necessary studies to review of the methods of AEM data collection to conclude that TDEM, the method proposed for this Project, is the most effective method given the types of overlaying materials.

The total cost of the Project for collection, processing, interpretation, and reporting is estimated at $416,666 (Figure C.3 – Cost Letter of the SIA). Other forms of AEM data collection would be nearly identical in price but would lack the ability to differentiate the subsurface materials to a sufficient depth for the development of a hydrogeologic framework. The benefits, as mentioned in Section B-2 of the application, are potentially many and economically substantial. Without the full hydrogeologic framework, the LENRD does not have the ability to make science based decisions regarding the need for specific programs, projects, or actions. Once complete, the hydrogeologic framework will inform the activities of the LENRD which will result in the conservation and protection of the water resources for the beneficial use of drinking water, agricultural, and industrial users maintaining the resource for continued development.

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.

   While this project does not directly meet state obligations, it will indirectly assist in the protection of endangered species. With a better understanding of the aquifer systems within it, the LENRD will have an additional tool to utilize when making groundwater management regulations or expansions of groundwater use. By understanding the aquifer resources, the LENRD can make responsible decisions that will reduce potential negative impacts to its local endangered species, the Topeka Shiner and the Western Prairie Fringed Orchid. In addition, responsible decisions made within the LENRD will help ensure that stream flows are maintained, protecting the habitat of endangered species downstream.

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 Untied 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.

   Information resulting from this Project will help protect critical infrastructure, primarily the municipal and domestic drinking water wells which serve over an estimated 16,000 people including 19 public water suppliers. This data can help protect these drinking water supplies by preventing future overuse of the aquifer and reducing the threat of contamination. Understanding the entire aquifer framework is essential to prevent future drinking water supply contamination and ensure a reliable public water supply for the future development of this area. Cost savings resulting from the completion of this project are unknown at this time. However, installing a municipal, irrigation, or domestic well in a poor aquifer location that would then later need to be replaced could save an additional expenditure of $200,000 - $500,000, $40,000 - $80,000, or $900 - $8,750 respectively dependent on the type of well being replaced.

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.

Groundwater quality in the Project area has been an ongoing problem for the area drinking water supplies. Drinking water users in the Project area are susceptible to Nitrate contamination to varying degrees depending upon the location and depth of the municipal or domestic wells. Portions of the area also have naturally occurring including elevated levels of iron, manganese, sulfates and dissolved solids, which contribute to taste, odor staining and other aesthetic water quality problems. Where drinking water supplies are impacted, and the owners of those wells are aware of the impacts, costly treatment systems are needed to remove these water quality problems. Creation of a hydrogeologic framework that delineates the extents, thickness, and interaction of the area aquifer systems allows the Board of the LENRD to make science based decisions regarding the protection of the water resources, and can help well drillers to locate and design wells to minimize these problems.

The Project would provide the information necessary for those science based decisions. The LENRD would be able create programs or projects that directly impact water quality, protect the water resources from further degradation, and protect the health of the residents dependent upon the groundwater for their drinking water supply. More than 16,000 people get their drinking water from groundwater supplies, municipal or domestic, in the Project area. Large scale uses, such as agricultural or industrial, have withdrawals that can potentially impact other users. The understanding of the extents and interaction of the aquifer system also allows for science based decision for the conservation of the water resources for the long term beneficial uses of the residents and businesses.

The Cuming County Rural Water System was implemented in the late 1970s to address the poor water quality and the sporadic water quantity issues of a portion of the area (Cuming and parts of Thurston and Wayne Counties). This system has very effectively provided potable water for domestic and livestock use, but has a limited capacity.

The rural water system, as well as the villages of Stanton, Dodge, Pender, and Rosalie have all experienced problems with nitrate contamination in their wells. Finding new well sites in this geologically complex area is increasingly difficult for public water suppliers. The hydrogeologic framework developed from the proposed AEM project will help public water suppliers to evaluate new well sites with greater confidence.

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

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

    The LENRD devotes substantial time and resources to the assessment of the overall water quality and quantity of the groundwater resources of the District. This proposed Project is part of the LENRD's groundwater quality and quantity programs and would be budgeted for funding in the July 1, 2017 to June 30, 2018 fiscal year. Past financial input from the LENRD in support of these projects includes annual water quality and quantity monitoring, installation of test holes and monitoring wells, other studies of groundwater quality and quantity and support of ENWRA since its inception 11 years ago. These comprise a total budgeted amount of approximately $4.6 million over the past 10 years. The LENRD spent approximately $766,000 to collect AEM data in 2013, 2014, and 2015 combined. The LENRD has and will continue to support the proposed project through their tax levy authority. LENRD fiscal year 2017 budget provides for a property tax requirement of $4.4 million and a total budget of $8.06 million. The proposed levy has been set at 2.4 cents per $100 actual valuation. The total Project costs for this proposed AEM data collection, interpretation and reporting is $416,666. Of that total Project cost, the LENRD will use general funds to cover the required local match of 40%, or $166,666. The remaining $250,000 of funds needed for the Project is this grant request. Partners will also contribute over $60,000 of in-kind geologist time for three separate CSD geologists/hydrogeologists towards the 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 LENRD has an adopted Groundwater Management Plan which details the management actions of the District regarding groundwater quantity and quality, promoting sustainable use of groundwater resources. Our Board of Directors recently approved a change to the plan which will require the installation of flow meters on ALL active irrigation wells by January 1, 2018. The LENRD also currently does not allow installation of high capacity wells, except in the case of replacement wells. When new wells are installed, they are required to receive a permit from the LENRD prior to drilling. The LENRD has also created groundwater quality and groundwater quantity management areas when such an area is deemed necessary for protection of groundwater resources.

The LENRD is working with the Eastern Nebraska Water Resources Assessment and the University of Nebraska Conservation and Survey Division on this project, with this phase of the project targeting all of Cuming county and portions of Stanton, Thurston, and Colfax Counties with a combined population greater than 16,000. Water in the project area is utilized for residential, industrial, agricultural, and recreational uses. The information from this project will assist the District in the development of future groundwater management strategy and policies and should help the District target specific areas to generate necessary improvements.

When all phases of this project are complete, all citizens within the LENRD will benefit from the information obtained through the aquifer framework mapping. The information is an enduring source of information that supports the efforts of the NRD and CSD to catalogue the states geology and groundwater, thus, the information will be part of the historical record, similar to the CSD test-hole database.

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.

Nitrate contamination in groundwater is a statewide issue and is a main priority of NRDs throughout the state. The LENRD has conducted AEM surveys in other areas of the District, and the information obtained is available to the public. The information obtained is of use to the LENRD to better understand the complex geology within the District. This better understanding will assist the LENRD in the future to make more educated management decisions regarding nitrate contamination. This phase of the Project is focused on all of Cuming County and

portions of Thurston, Stanton, and Colfax Counties, with a combined population of more than 16,000.

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.

    In addition to the $166,666 provided by the LENRD as match, the University of Nebraska Conservation and Survey Division will provide an estimated value of $60,000 of geologists' time assisting with the project. A letter of support committing to this is attached as Figure C.3. Without the $250,000 from the Water Sustainability Fund, this project will not be able to move forward.

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 encompasses all of Cuming County and portions of Thurston, Stanton, and Colfax Counties. The Project area consists primarily of the Lower Elkhorn and Logan Watersheds. The data resulting from this Project will benefit both watersheds, and will be vital for making informed decisions regarding management within the watersheds.

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 Annual Report and Plan of Work for the Nebraska State Water Planning and Review Process (NDNR 2015) lists the following objectives:

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

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

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

4) Provide resources to map and identify areas vulnerable to flood damage; and

5) Provide coordination of federal agencies, state agencies, local Natural Resources Districts (NRDs), and other water interests for the development of water resources programs and projects.

The collection of AEM data and the incorporation of that data into an overall aquifer framework directly supplements Objective 1 through improved data, information, and analysis capabilities. The data collected provides greater understanding of the extents, thickness, and interconnectedness of aquifer systems. That greater understanding directly informs analysis of streamflows in the hydrologically connected water resources of the State. Water uses and supplies are analyzed as part of the FAB Report, done annually by the NDNR, through modeling of those hydrologically connected areas. The AEM data and the resulting interpretation and framework will be submitted to the NDNR as the best available data for use in the FAB Report.

The Project directly supplements the staff and resources of the State for planning and management of the water resources of the state. The Project partners will utilize the data collected and the interpretation of that data to further their expertise in the local hydrogeologic framework. That expertise is utilized by the management and LENRD Board of Directors to develop the appropriate plans, programs, and projects for the protection and conservation of the water resources. The LENRD partners with many agencies of the state including NDNR, NDEQ, DHHS, NG&PC, and others with an interest in the protection and conservation of the state's water resources.

The Project partners represent local, regional, and state level interests, cooperatively studying the water resources of the state. Additionally, the data collected is shared with other non-partner agencies and the general public to provide an overall greater understanding of the hydrogeologic framework. That understanding is fundamental to any program or project undertaken to protect and conserve the water resources.

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.

The Safe Drink Water Act of 1947 (Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) targets the protection of drinking water sources, such as groundwater sources regulated by the LENRD. It also calls for the protection of Public Water Systems and Wellhead Protection Areas. The proposed Project will aid the LENRD in defining the hydrogeologic framework of Cuming County, as well as portions of Thurston, Stanton, and Colfax Counties. The proposed Project is phase three of a four phase project to define the hydrogeologic framework of the entire LENRD. This information can be used for many purposes, such as determining areas of recharge, as well as areas at higher risk of contamination. There are 19 Wellhead Protection Areas within the Project area, and more than 16,000 residents, most of whom use groundwater as a drinking water source, and many of whom rely on Public Water Systems to supply safe drinking water. Knowing the hydrogeologic framework will be useful to the LENRD, as well as the communities within it, when working to ensure they have a safe, clean, sustainable drinking water supply.

Section D.

PROJECT DESCRIPTION

1. Overview

In 1,000 characters *or less*, provide a brief description of your project including the nature and purpose of the project and objectives of the project.

The process of proactively identifying and evaluating water resources through the use of both traditional and state of the art techniques is critical to the state's water planning activities. Equipped with the best available information, state and local agencies are most able to develop the necessary plans to ensure the sustainability and protection of the state's water supply. Traditional techniques of aquifer characterization rely upon assessments of subsurface materials from numerous individually drilled borehole locations. The remote sensing technique of Airborne Electromagnetics (AEM) has the capability of collecting many thousand virtual boreholes at a fraction of the cost of traditional drilling. AEM is then combined with existing information about aquifer characteristics to provide an overall three dimensional framework of the aquifer extents and interactions. This Project seeks funding to collect AEM data and interpret the results into that three dimensional framework.

2. Project Tasks and Timeline

Identify what activities will be conducted by the project. For multiyear projects please list what activities are to be completed each year.

The Project will map flight transects across the Project area, covering approximately 608 miles of AEM survey (see SIA Section B-1(b) Figure B.2 - LENRD Project Area) to extend the hydrogeologic framework in the area. The Project will consist of the planning of flight lines, collection of AEM data along the flight lines, processing of the raw AEM data, interpretation of the processed data, and reporting of the overall results. The AEM survey results will be incorporated into a Geographic Information System (GIS) spatial database for use by LENRD and Project Partners. The resistivity data from the processed results will be tied to local geologic interpretations from traditional subsurface mapping.

The Project will provide CSD geologists the necessary information to in the future evaluate the AEM survey results with CSD cross section and ancillary data to make interpretations of the regional geologic setting types encountered and evaluate how well the AEM results match-up relative to the cross sectional data. The resultant map publication conclusions that could come from this study (example: northeast Nebraska County Atlas work and AEM integration WSF application under separate cover, other aligned CSD mission efforts) would

provide those interested in the hydrogeology of eastern Nebraska a comprehensive and improved understanding of the varying hydrogeological settings. That interpretation would follow the approach used for previous ENWRA work. The LENRD will use groundwater reservoir delineations and associated maps to address groundwater quality problems and to help mitigate potential quantity concerns in the area.

Upon notice of award of the WSF grant, the LENRD will contract with the Consultant to refine proposed flight lines. Payment of 30% of the total contract amount of $416,666, or $125,000 will be due at the time of contract signing (anticipated before July 1, 2017). The Consultant, working with the LENRD will develop the flight lines maximizing the coverage area while avoiding infrastructure that creates ground interference. The Consultant will combine all flight lines from any additional NRDs receiving WSF grant funding for AEM flights into an efficient flight plan to minimize mobilization, de-mobilization, and logistical costs for the data collection.

The single year of this Project grant request will include the collection, processing, and interpretation of AEM data with a final report of the Project completed by June 2018. An additional 50% of the total contract amount of $416,666, or $208,333, will be due to the Consultant at the end of the AEM data collection. The remaining 20% of the total contract amount, or $83,333, will be due at the delivery of the final report.

The interpretations and GIS spatial database will be provided to ENWRA, CSD, and NDNR at the time of the final report delivery. CSD and NDNR will incorporate the findings of the Project into existing datasets and models, as appropriate and at their schedule. The work required for incorporation of the datasets into the overall hydrogeologic framework is not included in the funding from this grant application.

3. Partnerships

Identify the roles and responsibilities of agencies and groups involved in the proposed project regardless of whether each is an additional funding source. List any other sources of funding that have been approached for project support and that have officially turned you down. Attach the rejection letter.

The LENRD will be in charge of project facilitation. The hired consultant agency, Aqua Geo Frameworks (Consultant), will build the database, perform the geophysical analysis and inversion, and complete the interpreted hydrogeologic framework and report. The University of Nebraska Conservation and Survey Division will provide geologists' time to continue the study of the aquifer systems of the District with the evaluation of AEM results. They also will continue to commit to providing geologist time to coordinate and log the test holes drilled, verify geophysical results, archive the samples and enter data into the CSD test-

hole database, prepare final logs with stratigraphic breaks/contacts for locations across the LENRD. The Eastern Nebraska Water Resources Assessment will provide coordination, grant fund administration, evaluation assistance, and public inquiry services for the project.

4. Other Sources of Funding

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

The sources of funding for the Project are the required local match from the LENRD of 40% ($166,666) and the WSF application request of 60% ($250,000). No other sources of funding are proposed for this Project. While there are no other sources of funds proposed for this Project, the LENRD, the other partnering NRDs of ENWRA, and NDNR have spent considerable time, effort, and money to develop this technology and implement it in many areas of the state. The Project partners are committed to utilizing AEM to continue to develop a hydrogeologic framework and block areas necessary for the protection and conservation of the groundwater resources.

5. Support/Opposition

Discuss both support and opposition to the project, including the group or interest each represents.

AEM data collection is supported by the numerous NRDs across the state that have utilized this type of detailed information to make improved management decisions. Over the several years that the NRDs have been collecting this type of information, there have been no instances of opposition. From the earliest collection of AEM data in Nebraska until now, more agencies and organizations have supported the NRD efforts or undertaken their own AEM data collection including the Nebraska Department of Natural Resources and the US Army Corp of Engineers. NDNR was a partner on AEM data collection through ENWRA in 2007 with pilot projects through IWMPP funding and reconnaissance flights in 2014 and 2015. The US Army Corps of Engineers collected AEM data to support their efforts at cleanup of the Former Nebraska Ordinance Plant near Mead, Nebraska.

Supplemental Information Attachment

LOWER ELKHORN NATURAL RESOURCES DISTRICT

Lifelong Learning Center • 601 East Benjamin Avenue • P.O. Box 1204

(402) 371-7313 FAX: (402) 371-0653 www.lenrd.org NORFOLK, NE 68702-1204

Gordon "Jeff' W. Fassett, P.E., Director
Nebraska Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676
via Electronic Submission

Re: Lower Elkhorn NRD Application for Water Sustainability Fund Grant

Dear Jeff,

The Lower Elkhorn Natural Resources District (LENRD) submits the included application to the Water Sustainability Fund for the collection of hydrogeologic information through Airborne Electromagnetic Mapping (AEM). The LENRD Board of Directors recognizes the importance of utilizing detailed hydrogeologic information to make science based management decisions to conserve and protect water resources. In an effort to obtain the best available data, the Board has approved this application, and is committed to providing the necessary matching funds. We foresee this information being vital to our efforts of delineating management areas, as well as providing a better understanding of the complex characteristics of the hydrogeology within the LENRD

The LENRD hopes that the Natural Resources Commission shares our goal of obtaining detailed hydrogeologic information to better conserve and protect Nebraska's water resources. The LENRD is committed to working with partner agencies, the University of Nebraska Conservation and Survey Division, Eastern Nebraska Water Resources Assessment and other state, city, and county agencies to protect our groundwater resources for the continued benefit of Nebraska's citizens. Should the Department or the Natural Resources Commission require any additional information or clarification regarding this application, please contact me directly and I will ensure that your request is met. Thank you for your consideration of this grant.

Sincerely,

General Manager
Lower Elkhorn N RD

University of Nebraska Lincoln

SCHOOL OF NATURAL RESOURCES
Conservation and Survey

July 27, 2016

Mr. Jeff Fassett and Nebraska Natural Resources Commission
Nebraska Department of Natural Resources
301 Centennial Mall South
Lincoln, Nebraska 68509-4676

Re: Lower Elkhorn Natural Resources District (NRD) Water Sustainability Fund (WSF) Application

Dear Director and Reviewers:

This letter confirms the support and partnership of the Conservation and Survey Division (CSD) with the Lower Elkhorn Natural Resources District (LENRD) in the proposed Aquifer Characteristic Mapping of the Lower Elkhorn NRD using Airborne Electromagnetic (AEM) surveys. The goals of this project are fully in accordance with the mission of CSD.

The proposed project will improve our understanding of water resources in a geologically complex area. CSD has committed in-kind geological support for the project from Sue Lackey (study of the aquifer systems of the district with the evaluation of AEM results), Kathleen Cameron (coordination, grant-fund administration, evaluation assistance, and public inquiry services), and Jesse Korus (geological research and development of concepts related to eastern Nebraska hydrogeology). CSD will continue to provide geological expertise for the coordination and logging of test holes drilled, the verification of geophysical results, archiving of samples, entry of data into the CSD test-hole database, uploading of AEM results to the proposed Nebraska GeoCloud, the preparation of final logs with stratigraphic interpretations, and publication of research results. The value of this in-kind contribution, in addition to LENRD's local match requirement, is an estimated to be in excess of $60,000 (more than 0.5 FTE with FTE @ $75,000).

Sincerely,

R. M. Joeckel, Ph.D.
State Geologist and Associate Director for Conservation and Survey
School of Natural Resources

616 Hardin Hall / P.O. 830989 / Lincoln, NE 68583-0996 / (402) 472-7537 / FAX (402) 472-2946 / http://snr.unl.edu

SECTION B

B-1(b)

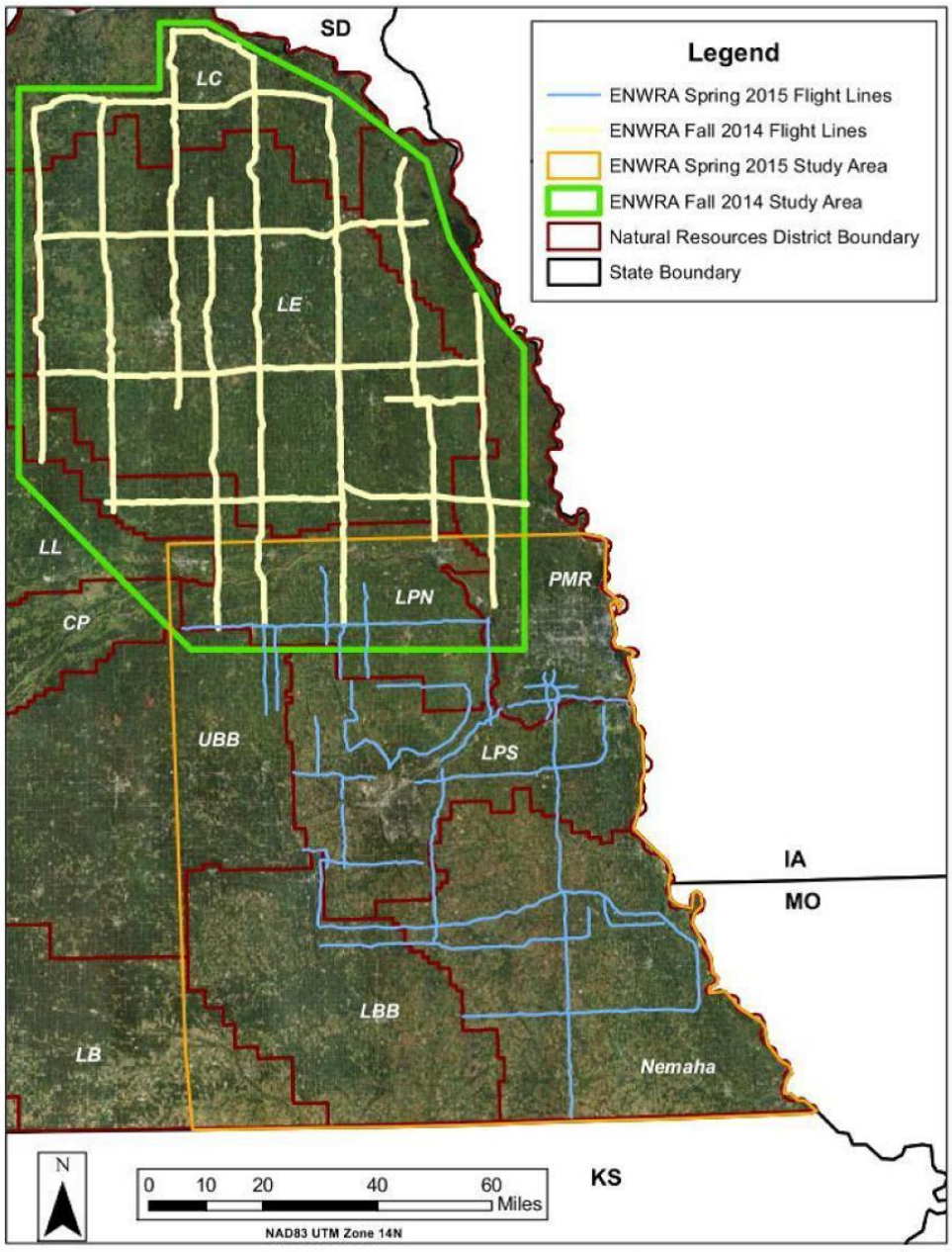


Figure 1-1: Map of the ENWRA project area, with the northern extent of the survey area (Phase I) and flight lines highlighted in green and yellow, respectively. The southern half of the project area (Phase II) is outlined in orange.

Figure B.1 – ENWRA Flight Lines

Figure B.2 - LENRD Project Area

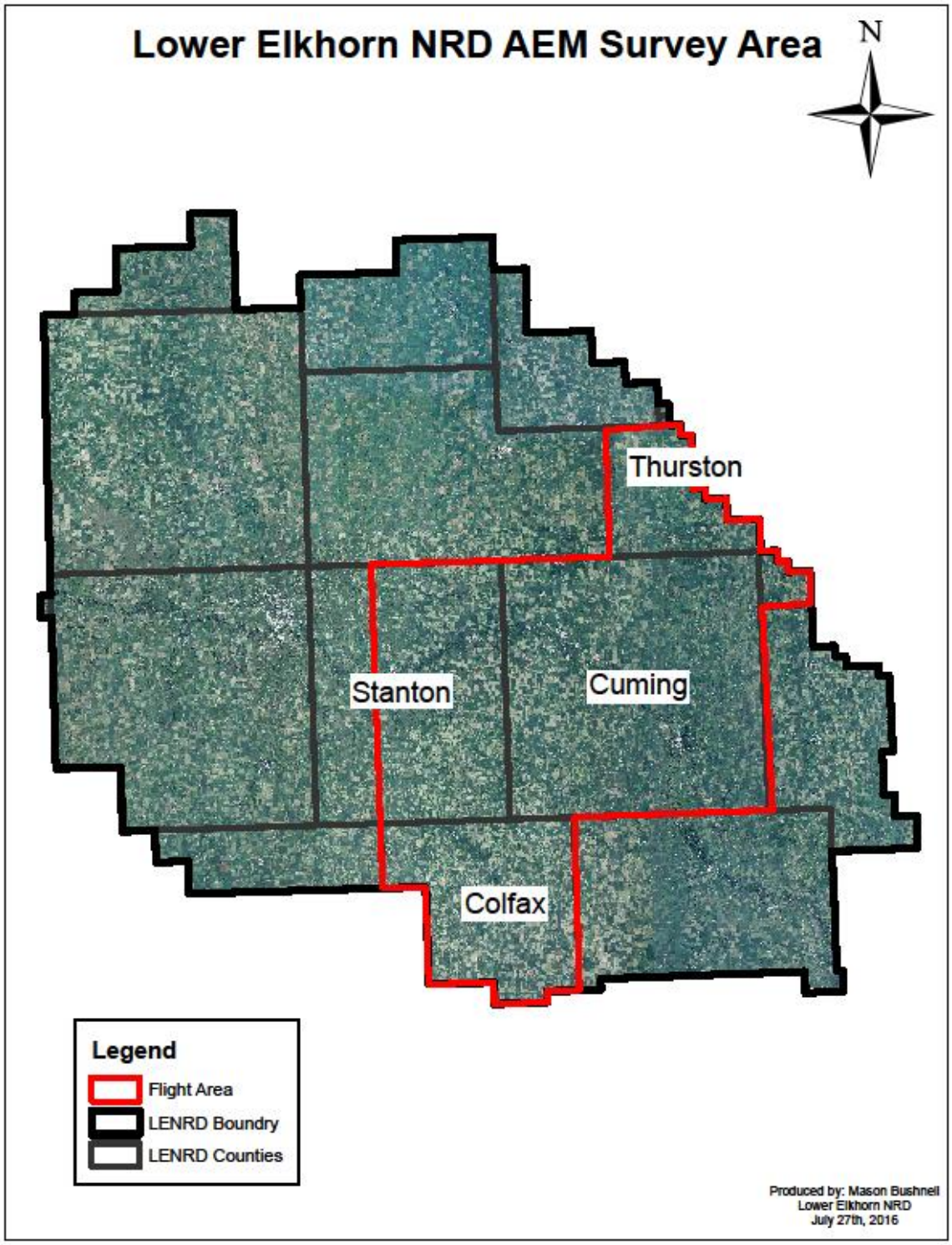


Figure B.3 - Sample Interpreted Geologic Cross-Section of Plans for Dams

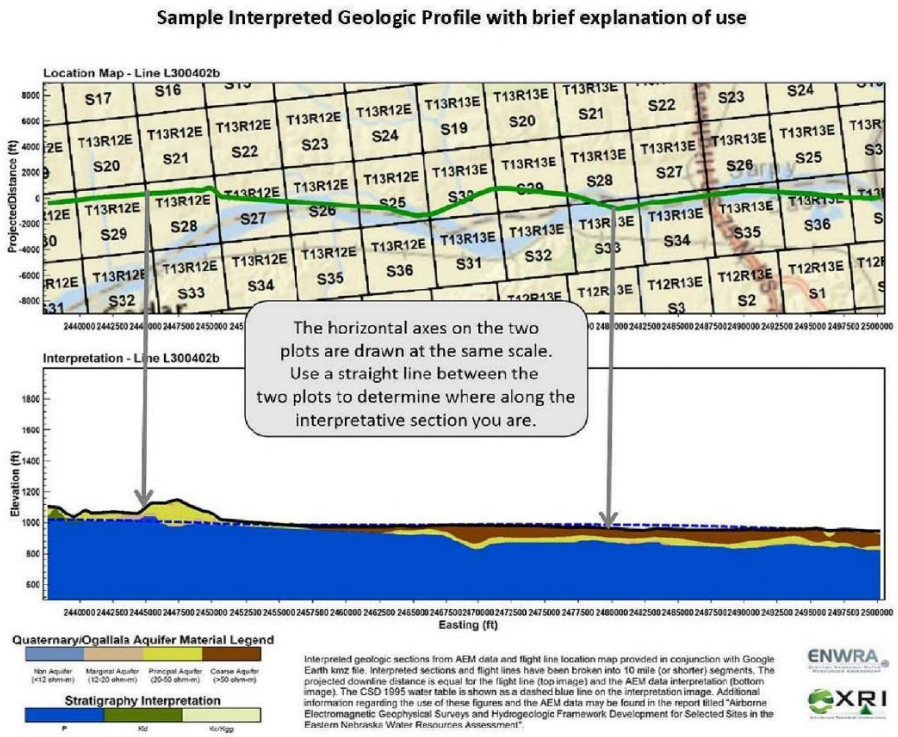


Figure B.4 - ENWRA Sample Landowner Information Map

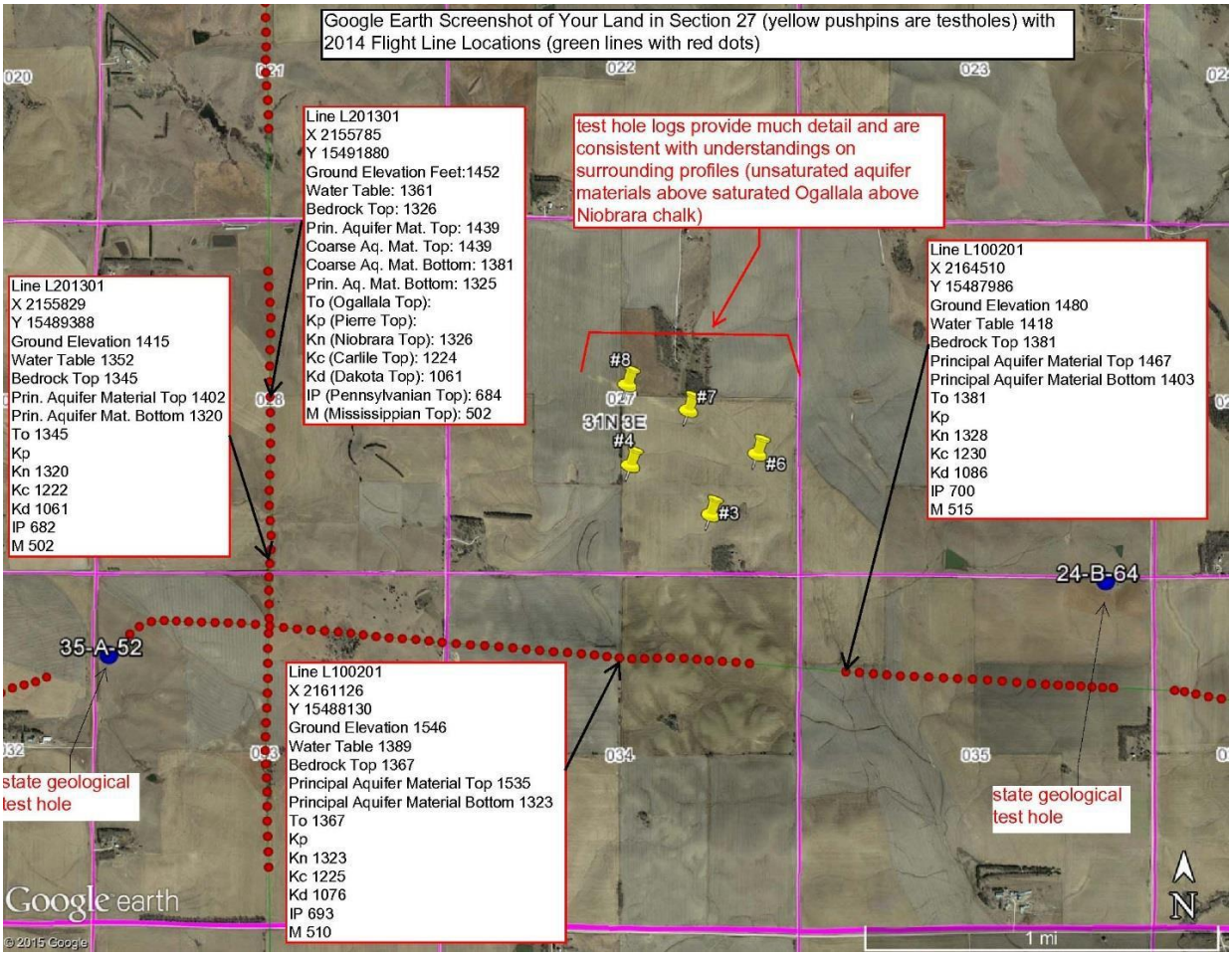


Figure B.5 - Groundwater Quantity Management Summary 2014

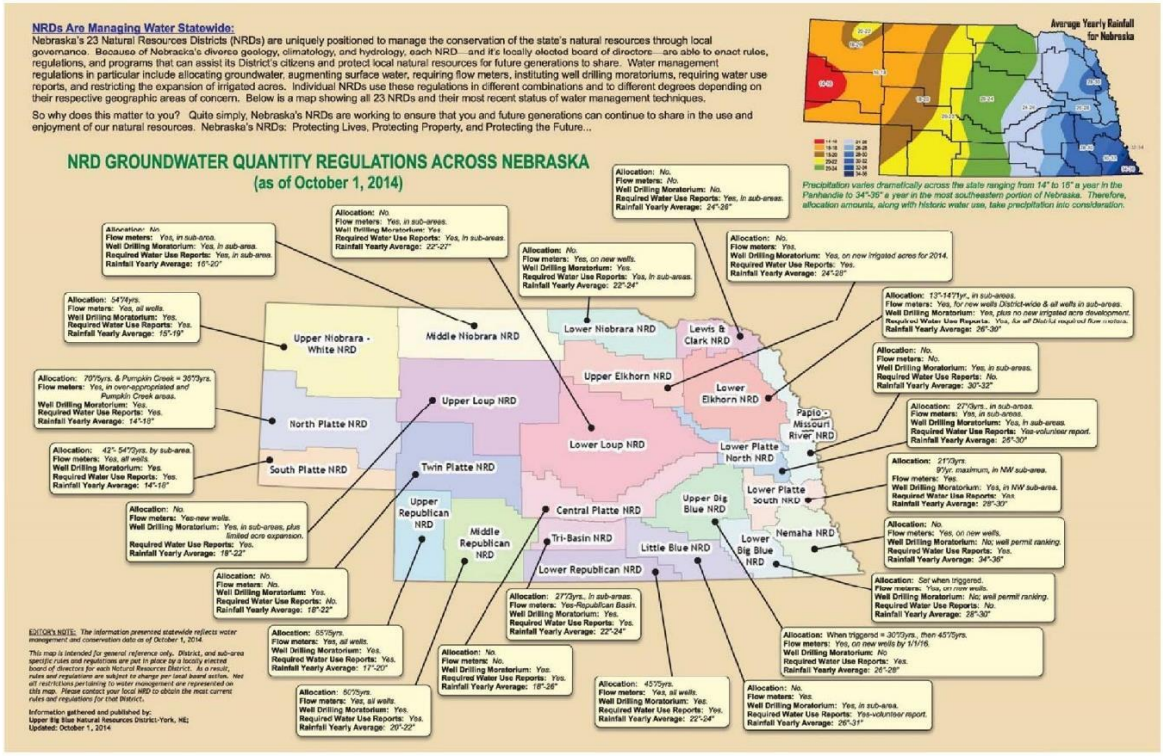


Figure B.6 - Groundwater Quality Management Summary 2014

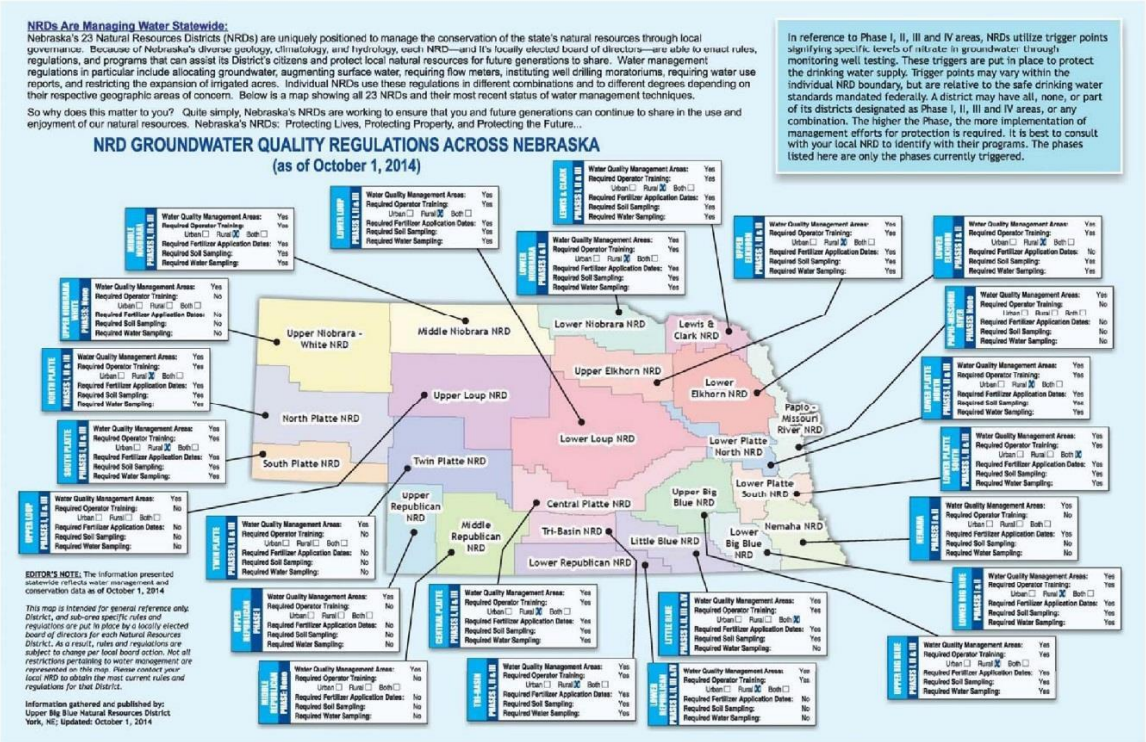
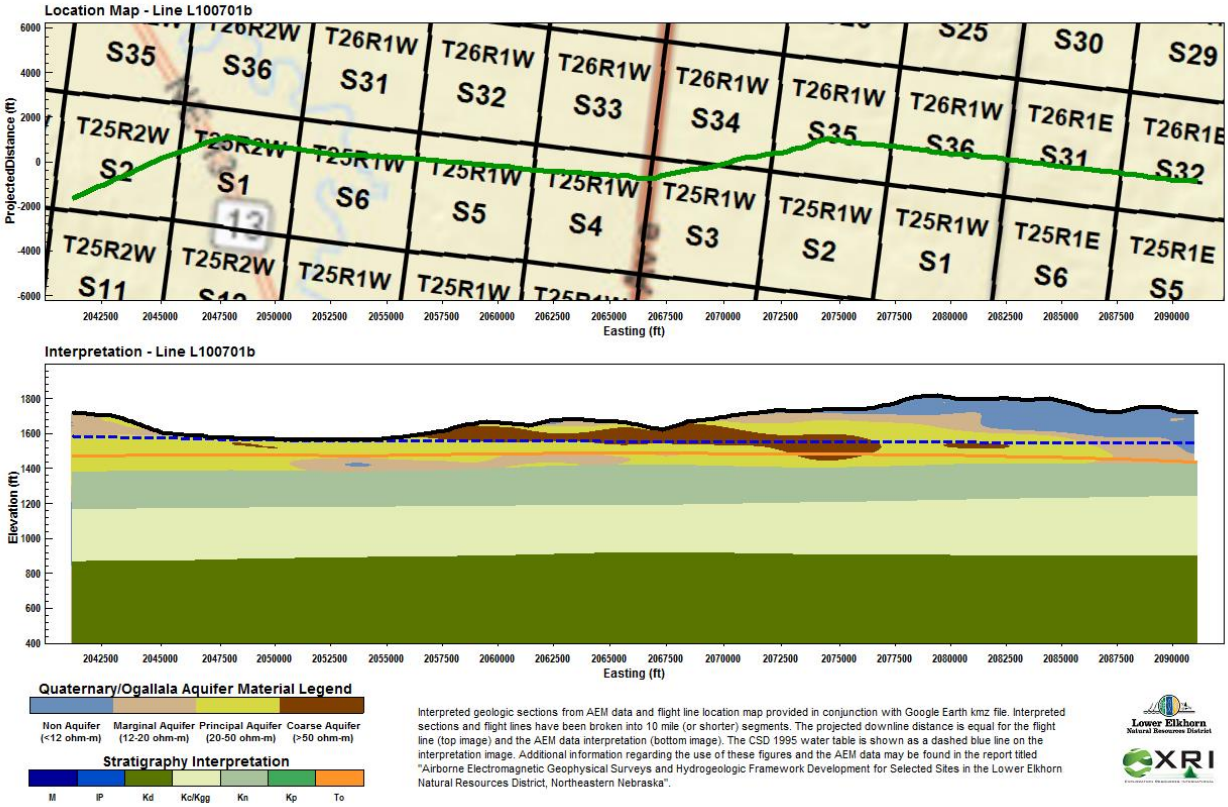


Figure B.7 – Flight Line Example 2014



SECTION C

C-1

Figure C.1 - Sample Interpreted Voxel Display

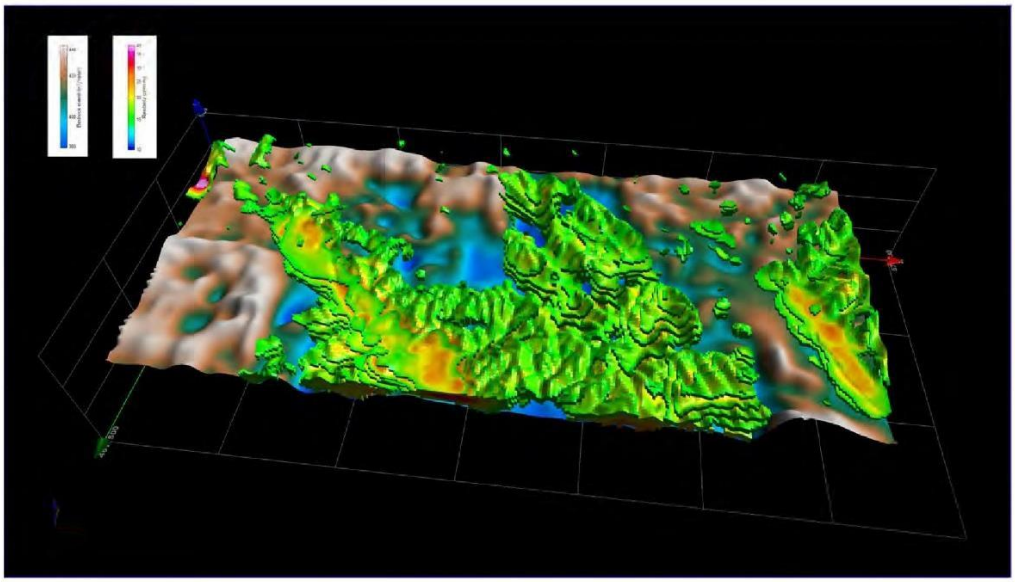
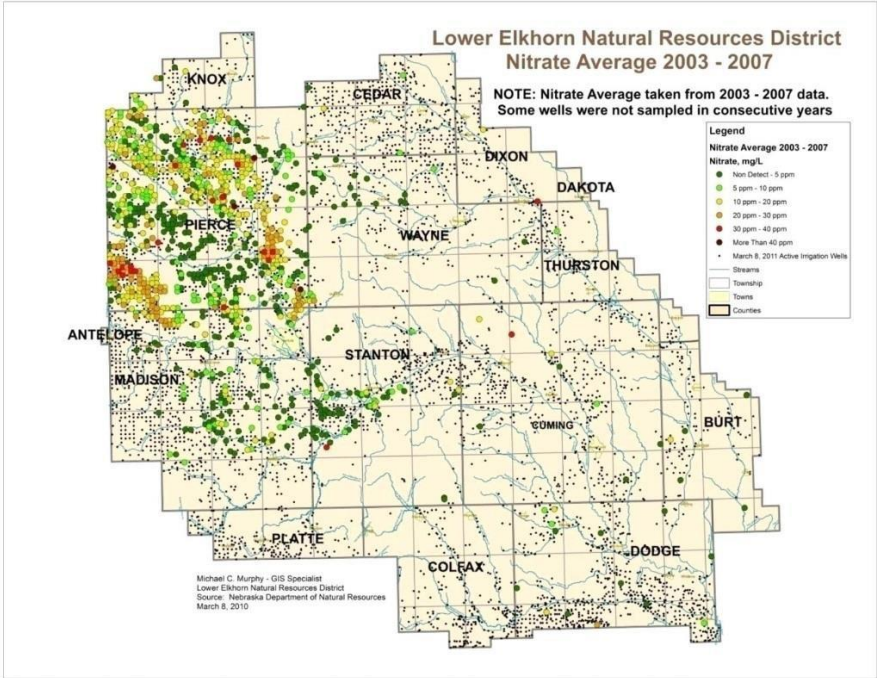


Figure A-6- 3-D voxel display of 15 ohm-m or greater resistivity zones overlying the Cretaceous bedrock surface.

XRI – LENRD AEM Survey Report *31*

Figure C.2 - LENRD Nitrate Levels



C-6

Figure C.3 - Cost Letter

AQUA GEO FRAMEWORKS

130360 CR D
Mitchell, NE 69357

7/21/2016

Mr. Mike Sousek
General Manager
601 E. Benjamin Avenue
Suite 101
Norfolk, NE 68701

Dear Mike,

As requested the estimated costs associated for completion of Airborne Electromagnetic (AEM) surveys of the flight locations within your district is as follows. Approximately 608 miles of AEM data will be collected as part of the project. AGF will build the database, perform the geophysical analysis and inversion, and complete the interpreted hydrogeologic framework and report.

Costs

AEM survey	$191,666
Database Development	$29,167
Geophysical Analysis	$54,167
Hydrogeologic framework and report	$141,666
Total	$416,666

If you have any questions, please do not hesitate to call.

James C. Cannia P.G.

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