NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: *Advanced Water Planning Tools for Eastern Nebraska Communities and NRDs.*

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

Sponsor Business Name: Lower Platte South Natural Resources District (LPSNRD) on behalf of the Eastern Nebraska Water Resources Assessment (ENWRA)

Sponsor Contact's Name: Katie Cameron, ENWRA Coordinator

Sponsor Contact's Address: 3125 Portia Street, Lincoln, NE 68521

Sponsor Contact's Phone: 402.476.2729

Sponsor Contact's Email: kcameron_enwra@lpsnrd.org

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

   Grant amount requested. $479,772

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

   If a loan is requested amount requested

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

2. **Neb. Rev. Stat. § 2-1507 (2)**

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

   If yes:

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

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

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

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

4. **Partnerships**

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

ENWRA is the lead agency for this proposed Project (coalition of 6 Eastern Nebraska NRDs with LPSNRD designated as the financial and grant handling agency). Attachment A includes Letters of Support from funding partners. ENWRA plans to enter into a cooperative agreement for Project work with the Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln (CSD) and a Joint Funding Agreement for Project work with federal cooperative dollars with the U.S. Geological

Survey (USGS). The CSD and USGS Draft agreement documents are attached and depend on the funding of this grant application.

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

ENWRA: ENWRA NRDs will fund the Project through LPSNRD's financial handling (Chris Barber) of the ENWRA account. ENWRA coordinator Katie Cameron will conduct administration, project coordination, reimbursement and reporting through the WSF. ENWRA NRDs will also provide input on several of the Project Tasks outlined in Section A item #7.

CSD with Jesse Korus as the Principal Investigator (PI) is tasked with implementing the Project. CSD geologists will prepare, handle, apply and archive the Project datasets, work with communities and NRDs, conduct fieldwork, develop modeling workflows, optimizations and reporting. CSD will provide long-term security of the Project outcomes via the Nebraska GeoCloud and CSD portals.

USGS will be involved in the Project implementation, defining scopes for each community, collecting associated field data, reviewing local refinements to the regional model and results communications.

5. **Other Sources of Funding**

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

The costs of the entire project will be $799,620 with $34,000 in additional value provided by the USGS in cooperative federal match dollars planned across the three years of the Project. ENWRA currently has over $300,000 in banked funds in the ENWRA account, handled by the Lower Platte South NRD, our financial handling agency. Fiscal Year 2025 Budget published online as of September 11, 2024 (https://www.lpsnrd.org/sites/default/files/files/2578/20240911finalallpages.pdf):

ANTICIPATED REVENUES		
	FY2024	FY2025
Cash and Investments (LPSNRD)	11,439,329	8,356,435
Cash and Investments (LPRCA)	559,163	580,281
Cash and Investments (ENWRA)	363,662	392,224
Deadmans Run Sinking Fund	5,390,386	5,935,403
Infrastructure Sinking Fund	447,161	471,560
Mopac East Trail Sinking Fund	371,460	391,728
Salt Creek Resiliency Sinking Fund	828,217	1,176,164
County Treasurers' Balance	125,000	125,000
Investment Income	550,000	825,000
Federal Funds	1,859,559	1,278,370
State Funds	3,161,100	2,583,895
Local Funds *	2,348,900	3,197,609
Miscellaneous	-	-
(County Treasurers' Commission)	(105,148)	(108,658)
Subtotal	27,338,789	25,205,010
NRD Property Taxes	10,514,822	10,974,438
Total	37,853,611	36,179,448

Each of the ENWRA NRDs have provided support letters indicating they plan to provide additional support for upfront costs associated with this Project beyond what the over $300,000 in banked funds and annual dues of $149,150 a year (paid every February) in our interlocal agreement is designed to cover (Attachment A).

Funding source	YEAR 1	YEAR 2	YEAR 3	Totals
ENWRA (40%)	$109,072	$116,140	$94,636	$319,848
WSF (60%)	$163,608	$174,210	$141,954	$479,772
State/Local Project total	$272,680	$290,350	$236,590	$799,620
USGS (federal cooperative dollars)	$9,000	$13,000	$12,000	$34,000
Totals	**$281,680**	**$303,350**	**$248,590**	**$833,620**

The CSD and USGS Draft agreement documents are attached and depend on the funding of this grant application.

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 builds a water planning tool aimed at helping communities and NRDs in eastern Nebraska evaluate and protect groundwater resources. Many villages and small towns struggle with the technical challenges related to protecting water quality, locating new water supplies, or managing use during times of drought. NRDs assist these communities, but such assistance demands an understanding of the complexities of the regional groundwater system. Collecting the hydrogeological information necessary to address these challenges can be difficult for small communities with limited budgets and NRDs with limited resources or technical expertise. This project aims to make technology and tools accessible to such communities and NRDs.

Recent advancements in machine learning applied to AEM make it possible to map hydrogeology from local to regional scales in a time- and cost-efficient manner. This project makes use of these advancements to build the most detailed hydrogeological model of eastern Nebraska to date. Furthermore, UNL's Conservation and Survey Division (CSD) recently acquired a ground-based, towed transient electromagnetic (tTEM) instrument, which is a scaled-down version of airborne electromagnetics (AEM). This project will use tTEM to provide much-needed local refinements for selected communities where the AEM system can't fly or is too coarse for resolving fine details.

We will develop a tool that builds upon the ~20,000 miles of AEM collected from 2006 to 2024 by fine-tuning the results of these surveys using state-of-the-science machine learning techniques. We will couple these results with new, local mapping using tTEM. Together, this new information will be made accessible through a web-based, interactive geographic information system (GIS) that will be scalable, allowing for regional and local assessment of groundwater resources. It will cover six NRDs—almost 1/3 of the state—serving a population of almost 1.5 million.

With the help of the ENWRA NRDs, we have identified six local areas where additional details are needed to address groundwater quantity and quality concerns. The local study areas will directly benefit eight communities: Adams, Brainard, Bruno, David City, Elmwood, Newcastle, Osmond, and Tekamah. The communities and NRDs will be provided with interactive, high-resolution mapping tools that predict the distribution of geological materials in the vadose zone and aquifer. The tools will assist the communities to plan, protect, and sustain their groundwater supplies. The GIS tools will be used to target new wells, focus water quality protection efforts, or revise Wellhead Protection Areas.

To facilitate the synthesis of multiple large datasets, we will leverage the power of supervised machine learning. A workflow for the application of machine learning to AEM and borehole data was recently developed by CSD scientists. The method compiles data from AEM, tens of thousands of wells and test holes, as well as the ENWRA NRDs' recently completed hydrogeological framework studies, to build a cohesive and comprehensive hydrogeological model for the region. The method uses regional data to train the model, and then it predicts hydrogeological characteristics at high resolution, making it applicable to regional and community-scale planning efforts.

By leveraging the latest in data science and technology, we aim to make innovative solutions accessible to individuals, communities, and local governments throughout eastern Nebraska.

7. **Project Tasks and Timeline**

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

- 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.

Task	Year 1	Year 2	Year 3	Total
1) Borehole data prep (test hole and select registered well database updates)	$21,300			$21,300
2) Assemble GIS files, capture previous interpretations and regionalize surfaces	$70,940			$70,940
3) Prepare AEM data and interpolate to regional 3D grid	$70,940			$70,940
4) Predict hydrogeological characteristics (apply machine learning, train, test and tune models, predict values to 3D grid)		$105,950		$105,950
5) Plan community water supply studies (define water availability and/or quality objectives with NRDs for 6 community areas)	$9,500	$8,000		$17,500
6) Conduct community water supply studies (field data coordination/collection)	$100,000	$100,000		$200,000
7) Refine maps and models (use field data for local refinements to the regional model and assemble GIS web map tools for community water planning)		$76,400	$124,295	$200,695
8) Complete final documentation, archive (GeoCloud and CSD portals), and provide educational opportunities (maps, web tools, reports to deliver/communicate results)			$112,295	$112,295
Totals	$272,680	$290,350	$236,590	**$799,620**
USGS (federal cooperative dollars on tasks 5-8)	$9,000	$13,000	$12,000	$34,000
Totals	**$281,680**	**$303,350**	**$248,590**	**$833,620**

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;

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

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

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

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

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

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

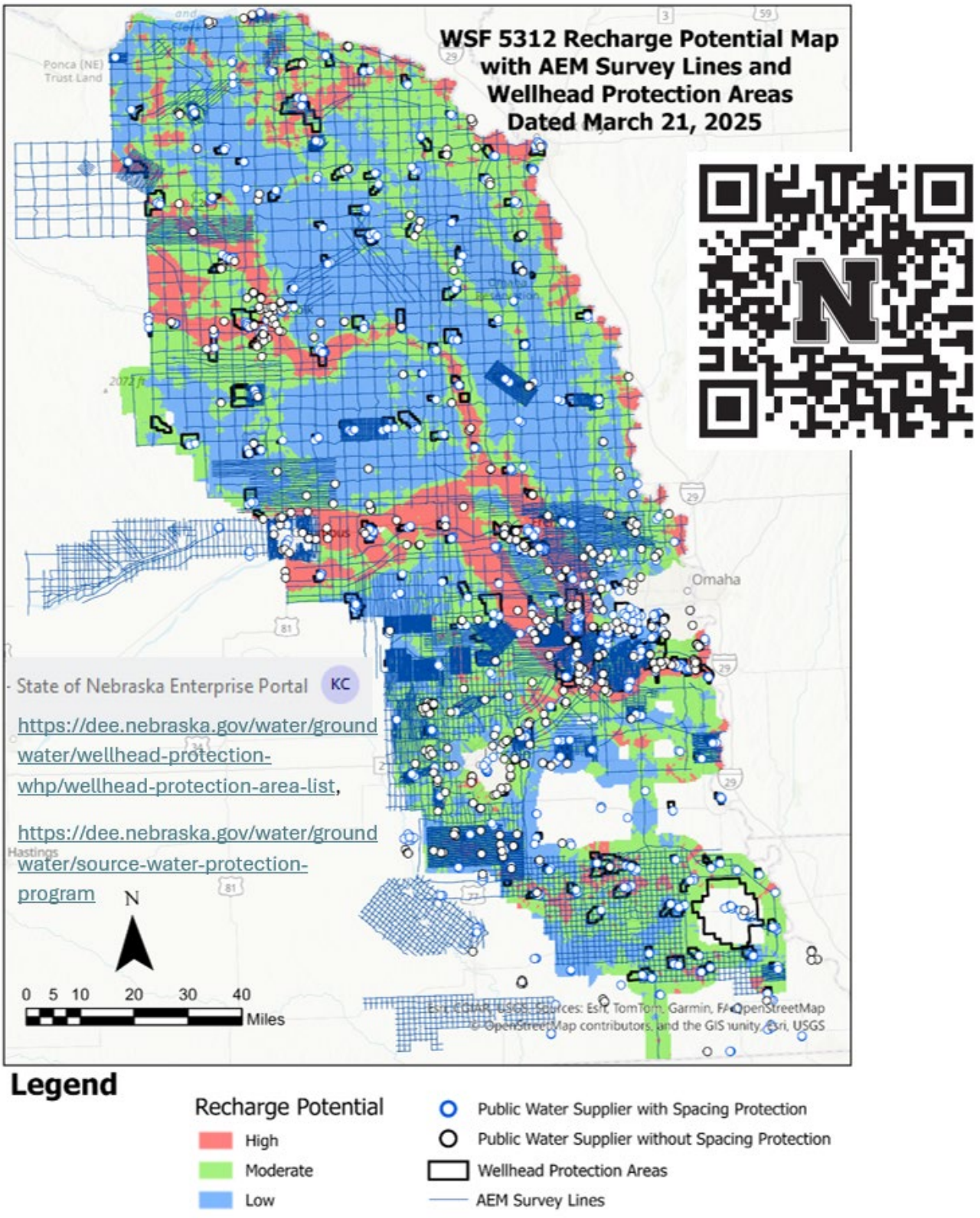
1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2);

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

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

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

The Eastern Nebraska Water Resources Assessment (ENWRA) started research activities in 2006 as a coalition of six Natural Resources Districts (NRDs) partnered with federal, state and local agencies and experts to develop a three-dimensional geologic framework and water budget for eastern Nebraska. The application of new technology has been included as a specific study objective in ENWRA's Long Range Plan since 2010. In the 15 years since the 2009 *Introduction to a Hydrogeological Study* publication, many new characterizations and technical advancements have been made for the regional assessment goals by the ENWRA scientific team (www.enwra.org partners tab) including the use and interpretation of around 20,000 line miles of Airborne Electromagnetic (AEM) surveys for groundwater management (local, state [WSF #4125, #4132, #4133, #4140, #4141, #4142, #4143, #4144, #4164, #5189, #5193, #5206, #5238, #5243, #5249, #5255, #5303, #5311, #5312, #10015, #10070] and associated federal USGS invested funds). Our current ENWRA Recharge and Focus Areas Assessment Project (WSF #5312) with the USGS and CSD expert team was showcased with ENWRA exhibits at the Nebraska State Irrigation Association/Nebraska Water Resources Association (NSIA/NWRA) November 2024 conference and Nebraska NRD Legislative Conference January 27 and 28, 2025. That project is wrapping up with the final status report to NeDNR expected June 30, 2025 (See Figure insert at the end of this Section 1.B.1). Additionally, there have been over 250 public inquiries documented by ENWRA (not including other CSD and USGS received inquiries) in the last 10 years where site specific callers in the region have sought to understand (and in turn advanced the applied science on how AEM can be effectively used to map the hydrogeologic units). The inquiries provided answers to many groundwater availability/quality questions in a variety of eastern Nebraska hydrogeologic settings benefiting more than just the individuals requesting the information due to the most up-to-date surrounding datasets being evaluated several miles in each direction. This project will employ the latest innovations in data science and technology and history of in-house knowledge applied for the benefit of eastern Nebraska individuals, communities, and local governments.


WSF 5312 Recharge Potential Map
with AEM Survey Lines and
Wellhead Protection Areas
Dated March 21, 2025
Ponca (NE)
Trust Land
Omaha
Hastings
State of Nebraska Enterprise Portal
https://dee.nebraska.gov/water/groundwater/wellhead-protection-whp/wellhead-protection-area-list,
https://dee.nebraska.gov/water/groundwater/source-water-protection-program
N
0 5 10 20 30 40
Miles
Legend
Recharge Potential
High
Moderate
Low
Public Water Supplier with Spacing Protection
Public Water Supplier without Spacing Protection
Wellhead Protection Areas
AEM Survey Lines

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

The Project plan begins with updating the CSD test hole database and eastern Nebraska registered well data with standardized lithology descriptions from the Nebraska GeoCloud and over 5,835 newer registrations including geologic logs for around 1,800 unpublished public water supply wells with agency only access restrictions. The interpretation points and continuous surfaces with no holes will be assembled into a regional GIS project file. The GIS layers and eastern Nebraska AEM resistivity data will be assessed for quality and interpolated to the regional 3D grid. A machine learning workflow will be applied using the borehole and AEM data with a focus above bedrock surface. The resultant 3D models will be trained, tested and tuned and once optimized, hydraulic values will be predicted to the regional 3D grid.

Using the regional model as a guide, study scopes will be planned with the NRDs to characterize groundwater availability and quality for six communities in the ENWRA area. Background data and site history will be gathered and a scope of work developed for each community. Detailed field data will be collected at each site to address local groundwater availability and water quality concerns. The field data will be used to make local refinements to the regional model. GIS web map tools will be provided, maps prepared, and reports generated to help communities with local water planning. Educational opportunities will be provided to communicate results to the communities and the NRDs.

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

Between 2006 and 2023, the ENWRA NRDs conducted various AEM surveys (please refer to https://enwra.org/ website for a history of airborne applications in eastern Nebraska [WSF #4125, #4132, #4133, #4140, #4141, #4142, #4143, #4144, #4164, #5189, #5193, #5206, #5238, #5243, #5249, #5255, #5303, #5311, #5312, #10015, #10070] and the associated statewide AEM and supplementary hydrogeologic data archive, the Nebraska GeoCloud [WSF #4164] https://aem.go.unl.edu). AEM has been proven over the past 20 years in Nebraska and Nebraska has become one of the international leaders in coordinated, cutting edge use of AEM for aquifer mapping and groundwater management purposes.

The Project concept stemmed from various routine past occurrences where ENWRAs' involved study was coordinated with CSD test hole locations, USGS expertise and AEM surveys to better understand the water resources for communities and NRDs.

One example would be the community of Martinsburg, they were facing an Administrative Order (AO) from the Nebraska Department of Health and Human Services (DHHS) for

nitrates (15.8 mg/L violation in 2012) and the north well had elevated uranium levels. The Lewis and Clark NRD and CSD were planning a deep test hole and observation well in 2017 using ENWRA's $9,150 reimbursement funds (routine funds budgeted by ENWRA to facilitate local assessment to supplement regional efforts). When the NRD learned of the town's water problems, it was decided to move the well site south to assess the Dakota aquifer water quality near the town. The 2015 deeper sensing reconnaissance AEM transects (general funds contract 789 with the NeDNR) indicated a sufficient thickness of aquifer material east of Martinsburg. The combined test hole ground truthing, NRD water quality sampling, and further AEM evaluation efforts through CSD and ENWRA helped the community plan a future water source by identifying two separate production aquifers, each characterized with different quality parameter issues of concern. Data collection and expert evaluations identified that the two sources could be blended to achieve the allowable concentrations under the AO stipulations. Communications, pooling resources, cutting edge results and team coordination solved a supply issue (new well was installed in 2021 and went online in early 2024, blending results were <3.0 mg/L Nitrate [10 is MCL] and <9.0 ug/L uranium [30 ug/L is MCL]).

Several prior and subsequent projects involving ENWRA, CSD and USGS (example: WSF 4125 secondary bedrock aquifer reconnaissance and age dating project) have stemmed from NRDs helping communities with groundwater issues.

The Project principal investigator (PI) is an expert in the field of research and has developed a cost and time saving technique detailed in this recent publication: Tilahun,T., Korus,J. (2023). 3D hydrostratigraphic and hydraulic conductivity modelling using supervised machine learning. Applied Computing and Geosciences, Volume 19, September 2023, 100122

Another research publication example for an ENWRA-specific area setting north of Columbus, Nebraska from the PI: Kawo, N. S., Korus, J., Kishawi, Y., Haacker, E. M. K., & Mittelstet, A. R. (2024). Three-dimensional probabilistic hydrofacies modeling using machine learning. Water Resources Research, 60, e2023WR035910. https://doi.org/10.1029/ 2023WR035910.\

Pairing technological advancements in hydrogeologic assessment with expertise from our advisor agencies has been ENWRA's mission since 2006. Over the last 10 years following our 2014/2015 county scale AEM reconnaissance for eastern Nebraska supported by the Nebraska Department of Natural Resources (NeDNR, contract 759) and support from the Water Sustainability Fund (2016, 2018, 2020, 2023 AEM surveys), the majority of the region's aquifers and 33 local community Wellhead Protection areas (WHPAs) have been mapped and a regional framework built laying the foundation for better groundwater numerical models and the state's integrated management efforts.

This Project is a next step in getting the most benefit from the investments made to date and brings deeper understandings by updating and improving the source data with the thousands of new boreholes and the latest interpretations regionally combined with local targeted field data collection which will be fed back into the regional model. The result will be a continuous, data-driven, model-ready, scalable planning tool for communities and NRDs who require science based and sustainable solutions for the groundwater resources in eastern Nebraska.

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

NA

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).

The ENWRA NRDs work with communities (Logan East example: https://www.lenrd.org/rural-water-systems) and some have public supply wells under Administrative Order (AO) from the Nebraska Department of Health and Human Services (DHHS) and need to evaluate siting potential for new wells. Additionally, many of the ENWRA NRDs flew AEM survey block flights over several local community water systems and Wellhead Protection Areas (CWSs and WHPAs), many with outdated source data requiring updates (example: several being addressed in Lower Platte North NRD under separate WSF application this year for additional monitoring well installations). This Project will provide the latest data driven surrounding information for future adjustments to the boundaries, estimated flow paths and time of travel estimates. The Project will also provide the following: updated, engineer ready maps, GIS data and hydrogeologic model predictions, optimal future public well location and depth planning for 6 communities in the region, more cost-effective expansion planning of rural water systems, and/or identification of areas most susceptible to water quality impairments to avoid (potential pathways from surface water to groundwater or confining units separating/protecting aquifers will be evaluated). The data will also be used to help landowners, potential zoning boards, and the NRDs to narrow down areas where irrigation development surrounding communities is appropriate, and help avoid well interference issues. The predictive hydrogeologic model for the region will allow for better selection of areas within the NRDs' for managed aquifer recharge to assist with increased groundwater supplies and associated surface water objectives. The resulting tools and map products will help communities with their ongoing struggles with source water protection, meeting regulatory requirements and future community growth planning.

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 closest alternative to the regional Project scope would be manual data processing after physically advancing a large number of additional boreholes with sufficient regional spacing and depths to map all the areas with remaining hydraulic conductivity questions following evaluation of each of the AEM survey lines (and/or flying tens of thousands of additional line miles of tighter spaced surveys with selected borehole supplementary locations). The locating, obtaining permission for, and logging thousands of boreholes and wells all within a few years across the region (estimated 15 holes per 170 Wellhead Protection Areas plus 500 holes for each NRD totaling over 5,500 holes), processing the data and then trying to make sense of the resulting point data and layers into a 3D grid would be extremely time consuming and require more technical expert time than our region's current workforce has available. The complex nature of handling the old and new massive datasets without bias to accurately represent the controlling lithologies, varying stratigraphy and complex flow paths would entail coordination of multiple agencies and private industry possibly costing over $24,000,000 = $16,500,000 (borehole advancements [5,550 holes around 200-300 feet deep at $10-15/foot] and/or 5 times the 2018 WSF #5189 $3.3M regional AEM effort in additional AEM) + $7,500,000 (processing and mapping [100 $75,000 full time equivalent years]).

Regarding the 6 local community scopes, Engineering Design, Well Construction Services, Permitting, Professional Services (Administrative, Legal, Fiscal, etc.), Land Easement Acquisitions, and Connection Fee costs for one small to moderate sized community area could be on the order of $5,000,000 to $10,000,000 (Long Term Supply and NRD rural water cost examples detailed in previous WSF #5306 and WSF #10066, respectively). The risk of this alternative would be significant oversights or mis steps from using the existing data without updated and informed hydraulic conductivity predictions with the best available science. Potential investments in line with the order of magnitude spent for these example projects but without a successful location and a Project rebudget that requires additional services after a relatively short amount of time could be avoided.

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).

The project will benefit wellhead protection planning and action efforts in over 170 WHPAs across the region, including 6 specific local community areas where additional data collection and scalable model feedback is planned:

Natural Resources District	Community Area Name	Wellhead Protection	Impacts	Population Served	County
Lewis and Clark NRD	Newcastle	No Approved Plan, 2013 Map Boundary	Nitrates 1.92 to 8.25 mg/L in 2024 and 2025, 5.3 to 7.8 mg/L 2017-2019 at monitoring wells in WHPA	300	Dixon
Lower Elkhorn NRD	Osmond	Approved Plan dated December 2016	Nitrates 8 mg/L in 2024 and 2025, 11 to 14 mg/L 1997, 2016, 2017, 2018, 2021, inactive public well 2013	870	Pierce
Lower Platte North NRD	Brainard-Bruno-David City paleochannel	Approved Plans dated February 2015 (Brainard), no date (Bruno and LPNNRD), and August 2010 (David City)	Nitrates <1 to 2.55 mg/L , Selenium 0.06 mg/L 2010-2013, 17.7 mg/L 1996, 5.9 mg/L 1996, 9.8 mg/L 1995, 11 mg/L 1979 (Carbon Tet in 1986), many wells deactivated or inactive 1999, 2006, 2008, 2009	3,309	Butler
Lower Platte South NRD	Elmwood	No Plan, 2002 Map Boundary	Nitrates 12 to 14 mg/L 1985, 2023, & 2024, 2 inactive public wells 1996	698	Cass
Nemaha NRD	Adams - Wellhead Protection Plan August 2012	No Plan, 2012 Map Boundary	Nitrates 5 to 8.36 mg/L in 2024 and 2025, 11 to 14 mg/L 1984,1986, 2000, 2008 +VOCs in 1990s, many wells deactivated	604	Gage
Papio-Missouri River NRD	Tekamah	Approved Drinking Water Protection Management Plan, 2022	Nitrates 11 mg/L in 2013, Phase II Management Area and well seal work and decommissioning in 2020	1,753	Burt

Sources:https://sdwis.epa.gov/ords/sfdw_pub/r/sfdw/sdwis_fed_reports_public/200 https://drinkingwater.ne.gov/index.jsp and https://clearinghouse.nebraska.gov/

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

The cost of the Project is $799,620 with $34,000 in additional federal cooperative dollar match bringing the value of services to $833,620.00. The Project involves advanced desktop work and coordination with NRDs for targeted field data collection that will benefit/improve water sustainability for the eastern Nebraska region and six local communities. The Project does not include construction activities or construction-related costs.

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).

Nebraska Department of Environment and Energy (NDEE) Source Water Protection grants alot $150,000 a year for awards. That amount would cover engineering services but likely not cover one or more municipal well installations. This Project will provide the source information that a town or village engineer would use to plan the well or infrastructure expansion efforts. One tangible benefit would be having the eastern Nebraska agency teams on contract through cooperative agreements as they charged with accomplishing this Project. The team members are typically the ones called for expertise before water projects start up or when they run into problems. Scientific based decision making is needed for lowering long-term planning and spending costs for communities. The advanced information provided by the Project will help keep replacement well costs down, help get the most out of newer water system technologies and provide more efficient expansion or protection strategies. The entire region will benefit from the improved cost of regional model work with updates in hydrostratigraphy (GW model enhancement), scalable local data ground truthing and dataset improvements. Building on past assessment data processing, recommendations and achievements saves costs by using already invested funds and funding structure processes (WSF 5312). Example outcome: the team could use the vertically integrated conductivity (VIC) in wellhead protection areas along with the recharge potential maps to assist communities with planning future supplies and well locations. The communities could go as close as possible to town centers if the local tTEM data collection efforts show promising aquifers that the AEM didn't cover (AEM surveys avoided towns and structures). The targeted data collection and resulting hydrogeologic model updates could save the communities on piping, O&M, and multiple well installation costs.

Additionally, the nation’s demand for hydrogeologists is steadily increasing as the need for effective water resource management becomes more pressing and competitive. The

proposed Project secures the local expertise, so Nebraska benefits and continues to lead the country in advanced science applications to groundwater management. The Project also provides the eastern Nebraska region data improvement for a critical resource which in turn provides environmental, social, cultural community-based benefits.

*See cost/benefit table in the next Section, Section B #3.C

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	**Year 1**	**Year 2**	**Year 3**	**Cost TOTAL**	**Benefits -**
WSF Grant	$163,608	$174,210	$141,954	**$479,772**	potential cost of 6 community water supply wells or service expansions (proper locating to avoid costly investigations & treatment systems, avoiding inadequate supply locations, preventing long distance piping and long term associated O&M travel arrangements) OR time and expense of manual boreholes and/or additional AEM Flights
Local Match	$109,072	$116,140	$94,636	**$319,848**	
State/Local Project Total	$272,680	$290,350	$236,590	**$799,620**	
USGS (Federal In-kind Dollars)	$9,000	$13,000	$12,000	**$34,000**	
TOTALS	**$281,680**	**$303,350**	**$248,590**	**$833,620**	**>$15,000,000* to >$24,000,000***

Note: *See Section 3.B for description of estimated benefits

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.)

Often the hydrogeology of the rural community areas is not well-defined due to sparse or outdated data. Costs associated with the best alternatives (each local area in the region hiring an engineering firm to gather the available background data [sometimes including inquiries to our team], assess the hydrogeology, prepare models and design a long term water supply – if feasible) to the Project are all expected to go up over the proposed life of the Project. As an example, an eastern Nebraska the Long Term Water Supply Project (WSF #5306) serving a population of over 1,000 had total costs estimated at over $5,000,000 in 2020. Another example public water supplier project (WSF # 10066)

adjacent to ENWRA with Drought and nitrate concerns serving around 1,500 people was estimated at over $10,000,000 in 2023 on probable construction costs.

The Project could also assist each NRD on making decisions that limit future water allocations or identify areas better suited for managed aquifer recharge, thus safeguarding the use of groundwater for irrigation and supporting the agricultural economy of Nebraska. This Project takes full advantage of the millions of dollars invested into AEM data, test holes, and monitoring wells by the six NRDs, NRC, and NeDNR.

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 costs of the entire project will be $799,620 with $34,000 in additional value provided by the USGS in cooperative federal match dollars planned across the three years of the Project. ENWRA currently has over $300,000 in banked funds in the ENWRA account, handled by the Lower Platte South NRD, our financial handling agency. Fiscal Year 2025 Budget published online as of September 11, 2024 (https://www.lpsnrd.org/sites/default/files/files/2578/20240911finalallpages.pdf) indicated the following balance for ENWRA's account (our routine spending has continued and annual dues were received in February 2025 since this publication):

ANTICIPATED REVENUES		
	FY2024	FY2025
Cash and Investments (LPSNRD)	11,439,329	8,356,435
Cash and Investments (LPRCA)	559,163	580,281
Cash and Investments (ENWRA)	363,662	392,224
Deadmans Run Sinking Fund	5,390,386	5,935,403
Infrastructure Sinking Fund	447,161	471,560
Mopac East Trail Sinking Fund	371,460	391,728
Salt Creek Resiliency Sinking Fund	828,217	1,176,164
County Treasurers' Balance	125,000	125,000
Investment Income	550,000	825,000
Federal Funds	1,859,559	1,278,370
State Funds	3,161,100	2,583,895
Local Funds *	2,348,900	3,197,609
Miscellaneous	-	-
(County Treasurers' Commission)	(105,148)	(108,658)
Subtotal	27,338,789	25,205,010
NRD Property Taxes	10,514,822	10,974,438
Total	37,853,611	36,179,448

Each of the ENWRA NRDs have provided support letters indicating they plan to provide additional support for upfront costs associated with this Project beyond what the over $300,000 in banked funds and annual dues of $149,150 a year (paid every February) in our interlocal agreement is designed to cover (Attachment A). The table below lists the 2024-2025 property tax levies, valuations, and sources of revenue for the 6 ENWRA

project sponsors (* https://www.nebraska.gov/auditor/reports/index.cgi *accessed March 20, 2025)*:

Name of NRD	Tax Levy (per $100 valuation)*	Valuation*	Total Resources Available*	Annual Dues to ENWRA
Lewis and Clark	$0.033227	$5,240,769,546	$25,361,038	$9,150
Lower Elkhorn	$0.018459	$24,388,738,738	$20,929,954	$30,000
Lower Platte North	$0.025767	$13,508,320,694	$14,101,568	$30,000
Lower Platte South	$0.022524	$48,722,572,547	$35,119,428	$30,000
Nemaha	$0.029996	$9,674,622,315	$4,576,170	$20,000
Papio Missouri River	$0.023508	$106,525,277,934	$118,267,265	$30,000

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

NA

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

NA

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

NA, there is no construction associated with the proposed Project. Fieldwork planned at the 6 communities in the region is planned with a non-invasive technique (sleds towed by small all-terrain vehicles) and does not involve permanent equipment installations (possible soil and water data collection without installing new wells).

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

The 6 NRDs involved in this Project have the authority under the Nebraska Groundwater Management and Protection Act, Chapter 46 Article 7 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. Nebraska State Statute Chapter 2 Article 32 gives the NRDs authority to carry out projects related to the development, management, utilization and conservation of groundwater and surface water. ENWRA‘s NRD technical committee and team of advisors/partner agencies (USGS, CSD, NeDNR) have the expertise and/or regulatory background in hydrogeology and the Project aligns with their core missions.

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

Each of the 6 Project NRDs has an Integrated Management Plan (IMP) in place and is 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 results of this Project specifically meet the objectives of the GMPs to increase the NRDs' general knowledge of the hydrogeologic characteristics of their Districts, and to preserve and conserve groundwater quality and quality. This Project predicts hydrogeological characteristics at high resolution, making it applicable to regional, district and community-scale planning efforts as well as state level efforts (please refer to detailed breakdown of Plan goals the Study supports and/or satisfies in Section C, question #2).

According to the state's 2025 Fully Appropriated Basin (FAB) report, the Lower Platte Basin, the Lower Platte Missouri Tributaries (LPMT) model has been updated to include data from the years 2014-2021 and has been converted to MODFLOW6. The Lower Elkhorn NRD subregional model, completed in 2022, was built referencing the LPMT model. The Lower Platte North, Lower Platte South, and Papio-Missouri River NRDs, together with the Department, are currently developing a subregional model (3-District Model) that also references the LPMT model. Both the LENRD and 3-District models are incorporating hydrogeologic information from AEM survey data and each of these new models are being developed using the most current groundwater model software supported by the USGS, MODFLOW6. This Project will provide updated improvements to the hydrogeologic source information and advanced model ready hydrogeologic results for the four NRDs involved with the NeDNR integrated management and basin efforts as well as the Lewis and Clark NRD and Nemaha NRDs so the 5 Districts in the LPMT model area and the Nemaha Basin Model area are updated at the same time and with a continuous cohesive and comprehensive hydrogeological model for the region ready for input under future NeDNR modeling efforts when Hydrologically Connected Areas (HCAs) will be reevaluated.

According to the NDEE 2023 annual summary report for public water supplies, Nebraska is a predominantly small system state with 93.0% of all of the State's Community Water Systems (CWSs) serving 3,300 or fewer people. Statewide, often the hydrogeology of the CWS areas is not well-defined due to sparse or outdated data. Further characterizing the hydrogeology and better predicting the hydraulic conductivity of the region's aquifer units helps to mitigate both the human induced nitrates the primary constituent the state and NRDs are charged with managing as well as other naturally occurring threats such as iron, manganese, uranium, selenium, sulfate, and salinity issues.

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.

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

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

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

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

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.

This Project addresses threats to domestic and municipal drinking water supplies across the region and in six local Wellhead Protection Areas (WHPAs) with limited groundwater resources and nitrate impacts. According to the NDEE 2023 annual summary report for

public water supplies, over 60% of Nebraska's Community Water Systems (CWSs) serve populations less than 500 people and water systems with populations below 3,300 are considered to be 'small systems' by the EPA. This makes Nebraska a predominantly small system state with 93.0% of all of the State's CWSs serving 3,300 or fewer people. Often the hydrogeology of the CWS areas is not well-defined due to sparse or outdated data. Further characterizing the hydrogeology and better predicting the hydraulic conductivity of the region's aquifer units helps to mitigate both the human induced nitrates and naturally occurring threats such as iron, manganese, uranium, selenium, sulfate, and salinity issues.

By the end of 2023, Airborne Electromagnetic (AEM) surveys crossed over approximately 170 WHPAs throughout eastern Nebraska and covered 33 of those WHPAs with targeted tighter spaced block flight lines for 3D volume visualizations (Figure in Section 1.B.3 depicts AEM flight lines with WHPAs). As of February 2025, the NDEE lists 34 communities in eastern Nebraska with approved Wellhead Protection Plans (5 are Drinking Water Protection Management Plans [DWPMPs] and only 8 were listed with approval dates in the last 10 years (2015 to 2022, after the initial AEM reconnaissance flights).

This Project provides an updated data network and method for hydrogeologic modeling by research experts, which can be applied to those CWSs for which newer data is available. The Project also provides the best available, data driven, scalable predictions for surrounding areas where AEM and/or borehole datasets are lacking. These data can be used to develop improved groundwater models to delineate the capture zones of municipal wells, improving the spatial resolution of aquifers and confining units within these zones and improving the prediction of potential impacts to wells. The project will benefit wellhead protection planning and action efforts in over 170 WHPAs across the region, including 6 specific local community areas where additional data collection and scalable model feedback is planned:

Natural Resources District	Community Area Name	Wellhead Protection	Impacts	Population Served	County
Lewis and Clark NRD	Newcastle	No Approved Plan, 2013 Map Boundary	Nitrates 1.92 to 8.25 mg/L in 2024 and 2025, 5.3 to 7.8 mg/L 2017-2019 at monitoring wells in WHPA	300	Dixon
Lower Elkhorn NRD	Osmond	Approved Plan dated December 2016	Nitrates 8 mg/L in 2024 and 2025, 11 to 14 mg/L 1997, 2016, 2017, 2018, 2021, inactive public well 2013	870	Pierce
Lower Platte North NRD	Brainard-Bruno-David City paleochannel	Approved Plans dated February 2015 (Brainard), no date (Bruno and LPNNRD), and August 2010 (David City)	Nitrates <1 to 2.55 mg/L , Selenium 0.06 mg/L 2010-2013, 17.7 mg/L 1996, 5.9 mg/L 1996, 9.8 mg/L 1995, 11 mg/L 1979 (Carbon Tet in 1986), many wells deactivated or inactive 1999, 2006, 2008, 2009	3,309	Butler
Lower Platte South NRD	Elmwood	No Plan, 2002 Map Boundary	Nitrates 12 to 14 mg/L 1985, 2023, & 2024, 2 inactive public wells 1996	698	Cass
Nemaha NRD	Adams - Wellhead Protection Plan August 2012	No Plan, 2012 Map Boundary	Nitrates 5 to 8.36 mg/L in 2024 and 2025, 11 to 14 mg/L 1984,1986, 2000, 2008 +VOCs in 1990s, many wells deactivated	604	Gage
Papio-Missouri River NRD	Tekamah	Approved Drinking Water Protection Management Plan, 2022	Nitrates 11 mg/L in 2013, Phase II Management Area and well seal work and decommissioning in 2020	1,753	Burt

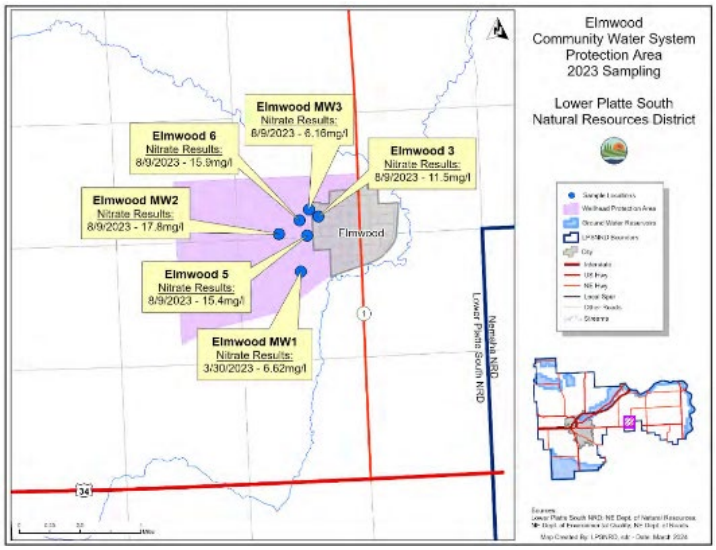
Sources:https://sdwis.epa.gov/ords/sfdw_pub/r/sfdw/sdwis_fed_reports_public/200 https://drinkingwater.ne.gov/index.jsp and https://clearinghouse.nebraska.gov/

Our most recent ENWRA Project (WSF 5312) mapped the Recharge Potential using AEM data in the top 50 feet to provide critical information to be used as a roadmap for understanding the vulnerability of groundwater resources and drinking water supplies in eastern Nebraska. For any treatment method to be effective, however, a detailed understanding of both the local and regional spatial controls of the aquifer and confining

units is required. This Project builds on previous regional work and provides direct and indirect benefits to potential drinking water remediation efforts. The Project will collect new sustainability-purposed and hydrogeologic model-enhanced field data at the above listed communities and will update related source datasets and hydraulic conductivity predictions over various spatial scales (including streambeds) for future contaminant fate and transport evaluations.

The Martinsburg blending reduced nitrate and uranium concentrations as mentioned in Section 1.B.3, a critical groundwater no flow boundary was identified by the 2016 AEM block flight for Coleridge (newer NDEE approved Plan, April 2018) and the 2020 Tekamah Phase II Groundwater Quality Management Area designation and Enhanced Well Seals and Decommissioning project each showcase how advanced hydrogeologic evaluations in WHPAs mitigate threats to municipal water supplies.

An example history of issues, solutions and long range impacts translatable to many areas in the eastern Nebraska region covered in this Project:



The Community Water Supply Protection Area (CWSPA) for the Village of Elmwood occupies slightly more than 1.5 square miles west and south of the village in central Cass County. In 2006, District sampling results indicated that the triggers for a Phase III ground water management area had been exceeded in the CWSPA. As a result, a Phase III Verification Study was initiated and was completed in 2008. As a result of the verification study and subsequent monitoring well installation and sampling, the LPSNRD designated the Elmwood CWSPA as a Phase III GWMA in December 2009. In 2012 the District began implementation of rules and regulations for the Phase III area, including requirements for nitrogen certification, fall fertilization, and soil sampling, and increased cost-share for best management practices. As part of the Phase III rules and regulations, any producer that intends to apply nitrogen has to conduct soil sampling and must report those results to the LPSNRD. Nitrogen fertilizer can then be applied after March 1st and after the results of the soil sampling have been considered by the landowner. LPSNRD will continue to work with these and all operators within the Phase III area to ensure that its regulations are implemented successfully. The Elmwood area has remained high in nitrates over the last 15 years.

This Project will provide new site-tailored field data collection, interpretations and management tools to better target the fate and transport cause of the persistent high nitrates. The long-range impacts of groundwater contamination include degradation of human health, disruptions to the supply of public and private drinking water, and increased treatment costs for declining population bases. Consumption of water with elevated levels of nitrate can be harmful to young infants and young livestock. Excessive nitrate in infants can result in restriction of oxygen transport in the bloodstream, which can result in "blue baby syndrome". There is a growing body of evidence linking nitrate and arsenic levels with increased cancer risk. Furthermore, elevated nitrate in the vadose zone may be linked to mobilization of naturally occurring contaminants such as uranium and arsenic. Because of the relatively thick vadose zone in many areas of eastern Nebraska, there will likely be long-term impacts of nitrate on the groundwater system lasting into the foreseeable future. This Project provides a state-of-the art hydrogeologic maps and predictions for taking proactive approaches to mitigating these threats to drinking water.

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.

There are 6 NRDs with approved integrated management plans and Groundwater Management Plans (GMPs). The Lewis and Clark NRD (**LCNRD**) plan was adopted in 1986 and amended in 1995 to address water-quality concerns and an attachment was added in 2014 detailing water-quantity concerns with six designated sub-areas that are considered geologically/hydrogeologically different. The six designated sub-areas are: Niobrara Chalk Bedrock Reservoir, Dakota Sandstone Bedrock Reservoir, Area of Limited Aquifer Development Potential, Remaining Areas, Missouri River Groundwater Reservoir, and Community Water System (CWS) Project Areas. The sub-areas necessitate different methods of management and permitting to effectively monitor and manage them. On September 5, 2016, the LCNRD finalized a Voluntary IMP with the NeDNR (https://lcnrd.nebraska.gov/sites/lcnrd.nebraska.gov/files/doc/waterresources/20160808_IMPfinal.pdf). The LCNRD has a monitoring well network of approximately 60 monitoring wells designed by CSD as part of the GMP activities and IMP Goal #1 to develop and maintain a district-wide water inventory. A biennial review of the IMP was last conducted by LCNRD and NeDNR in October 2019

https://lcnrd.nebraska.gov/sites/lcnrd.nebraska.gov/files/doc/waterresources/2019%20LCNRD%20FINAL%20IMP%20REPORT%20LCNRD.pdf. The 2019 review indicated: "In the future AEM survey data could be utilized to identify areas of potential hydrogeologic connectivity and to identify where aquifer recharge occurs." The WSF 5312 Project provided H M L recharge areas using statistical analysis on the AEM data together with groundwater quality data for the region and evaluated several focus areas across NRD boundaries. This Project builds on previous project efforts and addresses four of the jointly identified action items:

- continue working with ENWRA and to define the hydrogeologic framework in eastern Nebraska
- continue working with CSD to investigate groundwater resources and hydrogeologic connection in the district.
- continue to utilize AEM surveys to evaluate the geology and geologic framework of the district to benefit knowledge and management of ground and surface water resources of the district.
- identify with directors, staff, and/or stakeholders the need for additional projects and/or studies.

The Project is being coordinated through ENWRA with part of the scope dedicated to the recommendations for groundwater quantity and quality management for the community of Newcastle as well as updating source datasets and further usage of AEM to bring the LCNRD closer to the same level for groundwater modeling as the other ENWRA NRDs (WSF #5311 [LPSNRD], WSF #10070 [LPNNRD, LPSNRD, PMRNRD], WSF#5243 [LENRD]) . The LCNRD also has a Water Quality Management Plan (WQMP) accepted by the EPA October 2019 (https://lcnrd.nebraska.gov/sites/lcnrd.nebraska.gov/files/doc/LCNRD%20WQMP%20FINAL.pdf) and has put much investment in building out the monitoring network. This Project benefits one of the primary purposes of the WQMP:

4) Maintain long term data sets for trend assessments. An evaluation of multi-year water quality data sets allows the identification of emerging resource concerns, provides a basis for assessing basin-wide improvements or declines, and is a method to evaluate the impact of implementation strategies.

In many cases, current data sets may not be sufficient to evaluate the effectiveness of conservation practices that have already been implemented in the WQMP Area. The required data for these needs can be gathered through larger-scale, ongoing monitoring networks and targeted, project-specific monitoring which directly aligns with the scope of this Project.

The **LENRD** has an adopted GMP, last revised in 2018. Results of this Project increase general knowledge of the hydrogeologic characteristics in LENRD and assist LENRD to meet the following objectives in the GMP:

- Establish a baseline of data and monitor trends in groundwater quality and quantity ‘
- Improve groundwater conservation practices and maintain and improve groundwater quality
- Cooperate with other agencies and organizations to develop and provide educational materials and programs to promote public support for and participation in management of groundwater resources
- Minimize pumping conflicts
- Protect municipal and domestic groundwater supplies
- Obtain Funding for Groundwater Management Activities

This Project also aligns with the goals and priorities of the LENRD Voluntary IMP and the Lower Platte River Basin Management Plan (LPRB Plan) finalized in 2018:

- Goal 1 of the LENRD Voluntary IMP Gain a Better Understanding of Water Resources. The plan states: “The purpose of this goal is to continually improve our understanding of the local and regional water resources system, using the best available science and data as a guiding principle. The District and Department will collect and analyze information including water use, land use, surface water flow, groundwater elevation, hydrogeologic data, and other information relevant to water resources management to enhance our understanding of water supply and use in the District and region.”
- Goal 1 of the LPRB Plan: Develop and maintain a water supply and use inventory based on the best available data and analysis. Objective 1.1: Develop and maintain a comprehensive inventory of the location and source of the Basin’s current and future water supplies, water uses and outflows.

The LENRD also has a Water Quality Management Plan (WQMP) in place (EPA Accepted 3-11-2019) and a 2017 Drought Mitigation Plan (https://static1.squarespace.com/static/54be71a0e4b096702d519464/t/586fc48f6a496365d57d2c9a/1483719880310/LENRD+Drought+Management+Plan+Draft+12_21.pdf) that the Project directly supports:

- Goal 1, Objective 1 of the QMP: Sound data and effective resource management will guide all decision-making about natural resources management activities.
- Task 1. To review and revise, as necessary, monitoring, assessment methods, and protocols to ensure that threats and impairments to natural resources are precisely measured and quantified. The LENRD continues to devote resources towards the development of a Hydrogeologic Groundwater Model that will assist the LENRD in evaluating the impacts of new uses of groundwater. The availability of this new tool

will allow the LENRD to capitalize on the wealth of geologic information that has been acquired in stages.

This Project supplements LENRD's efforts under the various plans, objectives and collaborative projects with the NeDNR by adding hydrogeologic model information generated by experts for the region and specific CWS near Osmond within the LENRD. This Project employs the two advisory agencies of ENWRA, the CSD and USGS, to develop a tool that build upon the AEM in the LENRD by fine-tuning the results of these surveys using state-of-the-science machine learning techniques. Those results coupled with new, local mapping using tTEM will be made accessible through a web-based, interactive geographic information system (GIS) that will be scalable, allowing for LENRD's management groundwater resources and enhancing the current model development work with the NeDNR.

The **LPNNRD** completed a Voluntary IMP which went in effect in June 2018 and updated their Groundwater Rules and Regulation to coincide with the IMP. The LPNNRD is also a member of the LPRB Coalition which finalized the LPRB Plan in 2018 and a member of the Lower Platte River Drought Consortium which finalized a Lower Platte River Drought Contingency Plan in October 2019 (approved by NRDs in December 2019). Current management strategies are being addressed under the GMP last updated in 1995. More specifically, Section B, Goal #2 - Management Systems Development, under the "Plan for Groundwater Management in LPNNRD" is being targeted. The overall objective of this goal is to provide a system of groundwater management to support the groundwater reservoir life goal, based upon an adequate technical foundation and public awareness of groundwater issues. Goal #2 has provided a framework for LPNNRD to implement several programs that have led to a greater understanding of the various aquifer systems throughout the District and the ways to address the issues realized through communication and data acquisition. LPNNRD has commissioned studies to map the aquifer characteristics on a macro scale to allow more specific controls on a localized level. It has also provided a network of monitoring wells and sample sites to monitor groundwater quantity and quality. Further work has been done to quantify water usage through the acre certification process which looks at the actual number of acres being irrigated throughout the LPNNRD. Annual informational classes have been held to keep groundwater users updated on the most recent data gathered by the District as well as any updates to the current management policies or LPNNRD Rules and Regulations. The LPNNRD has identified the following future actions/concerns/plans:

- additional information might need to be gathered, like a geological model (currently in progress, WSF #10070 will incorporate AEM data for the 3-NRD model work with NeDNR)

- water management could include siting of potential recharge sites, storage reservoirs (both surface and ground water, potential water reuse projects) to enhance the water supply
- additional monitoring wells, stream flow gauging, and precipitation sites will likely be necessary
- effects of climate change will also need to be considered as part of integrated water management.
- conduct intensive analysis of the groundwater quality and especially in identified Water Quality Management Areas.
- A series of chemical analysis will be conducted along with GIS mapping utilizing AEM information, to attempt to identify what Best Management Practice will be the most effective in curbing the contamination.

The Project fits well with many of the objectives above, the timing of the 3 NRD WSF award #10070 and LPNNRD current separate WSF submittal this year related to groundwater monitoring wells. The Project will be coordinated with the LPNNRD to maximize potential water level gathering efforts, groundwater quality data review and hydrogeological evaluations for both LPNNRD project monitoring well installations and applicable Local Community Area goals. This Project employs the two advisory agencies of ENWRA, the CSD and USGS, satisfying the items in:

- Goal #3 of the IMP [Action Item #3.2.2: Use new, and existing, studies and data to establish specific guidelines for sustainable development of major, minor, and pocket aquifers] and
- Goal #1 of the LPRB Plan previously mentioned. The Project will also assist in the data sharing that is necessary between neighboring NRDs in order to retain consistency in general rules that help groundwater users and NRDs manage aquifers that cross political boundaries.

This Project will meet goals and objectives of both the **LPSNRD's** Ground Water Management Plan (GWMP, equivalent to GMP acronym) approved by NeDNR in 1995 and the NRD's voluntary IMP adopted May 5, 2014. For the GMP, an update is currently contracted as of 2025 and ENWRA's previous Rechange H M L Potential Map and other Focus Area contouring and recommendation efforts (WSF#5312) have been shared with the selected consultant and ENWRA's involvement in reviews are planned through LPSNRD's review process. In addition, The Project will provide a much-improved understanding of the Elmwood area, with additional field data collection and enhancing the 2016 AEM flight block information. LPSNRD's voluntary IMP identifies three major Goal Areas: Water Inventory, Water Supply Management, and Water Use Management. This Project employs the two advisory agencies of ENWRA, the CSD and USGS, to apply state of the art hydrogeologic models fitting with Goals #1 and #2 of the IMP and Goal #1 of the LPRB Plan that LPSNRD is also a part of. The Project supports the following IMP

and LPRB Plan (previously mentioned) goals and objectives through the Study coordination products/understandings related to

- Goal #1 Water Inventory area: Ensure the District has sufficient data to enable the achievement of a water supply that is in balance with current and future water demands. Objective 1: Develop and maintain a comprehensive inventory of the location and source of the District's water supplies, water use, and outflows, Objective 5: Evaluate potential effects on water inventory if additional water supplies are accessed through coordination, innovation, and technology Objective 6: Determine the extent of hydrologically connected ground and surface waters in the District.
- Goal #2 Water Supply Management: Ensure a sustainable water supply is available in the amounts and location of the demand through management actions that meet the District's long term needs. Objectives 1: Ensure to the extent possible, that wells are located and designed to reflect the ground water geology and water supplies in accordance with aquifer characteristics Objective 3: Evaluate the potential benefits of regional supply and distribution systems and, where warranted, facilitate discussions with impacted entities.

Additionally, the following future goals were indicated by LPSNRD which relate and compliment the hydrogeologic improvement goals of this Project, the LPSNRD will continue to implement and expand its vadose zone monitoring program emphasizing advanced techniques used by UNL and coordinate that program with its ongoing groundwater monitoring and test hole drilling. The recent WSF #5311 District-wide geologic Project and groundwater model work with neighboring NRDs under WSF #10070. All of the above LPSNRD actions, plans, and goals are benefitted by the improved proposed under this Study that build upon the investments in AEM by continuing to fine-tune the results of these surveys using state-of-the-science machine learning techniques. Those results coupled with new, local mapping using tTEM in the Elmwood area will be made accessible through a web-based, interactive geographic information system (GIS) that will be scalable, allowing for LPSNRD's management groundwater resources and enhancing the current model development work.

The **NNRD** began development of a voluntary Integrated Management Plan (IMP) with the NeDNR in 2017 and each entity adopted the finalized plan in April 2022 (https://www.nemahanrd.org/sites/default/files/may2022_nnrd_final_imp.pdf effective May 2022). The overall goals of the NNRD voluntary IMP are to attain and maintain a desired balance between uses and supplies of both surface water and groundwater sources so economic viability, as well as social and environmental health, safety, and welfare, can be achieved and maintained in the District for both the near-term and long-term, while considering effects on existing surface water appropriators and groundwater users. This Project will address objectives and action items related to these goals by:

(1) utilizing the best available data and analysis tools to understand the District's water supplies for the project areas (define hydrologically connected areas, distinct sub areas, and connections with municipal supplies)

(2) use the new understandings to prevent or mitigate water-related conflicts within the District

(3) inform the public of the District's water resources in the mapped areas and provide data in support of a district regional numerical model, including updating areas without AEM data coverage with newer uniformly summarized borehole datasets.

Chapter 9 of the voluntary IMP describes the proposed controls for groundwater management and proposed controls for surface water management which apply to the entire geographic area of the Nemaha NRD, maps of which are provided in Chapter 8. The groundwater controls to be implemented by the NRD are:

1. Required metering devices on all new high-capacity (pumping greater than 50 gallons per minute) wells and/or modified irrigation wells and/or irrigation systems, commercial, industrial, or municipal water supply systems.

The proposed surface water controls to be implemented by NeDNR are:

1. Required measuring devices on any new high-capacity surface water irrigators
2. Continued enforcement of the administration of surface water controls.

In addition to developing the voluntary IMP, the NNRD has an adopted GWMP, last revised in December of 2014 (NNRD GWMP 1985). Results of this Project meet the objectives of the GWMP to address specific problems of groundwater quality by identifying aquifer locations, geometries and surface water/groundwater connections supporting regulation and management decisions with the latest advancements for modeling. Groundwater quality monitoring conducted by NNRD staff has shown the northwest portion of Richardson County and area north of Humboldt to have elevated levels of nitrates. This area has been designated a Phase II Groundwater Management Area (GWMA) for groundwater quality and requires the NNRD to conduct annual sampling of wells. Areas around Auburn and Elk Creek in the proposed project footprint are in current Phase II designations as well (Appendix A of rules and regs: https://www.nemahanrd.org/sites/default/files/groundwaterrules.pdf). The NNRD also provides cost-share incentives to landowners for closing abandoned wells, soil sampling and fertilizer control systems. The NNRD also has a hazard mitigation plan which includes Drought susceptibility assessment and maps. The areas in the project footprint are also identified in the top half of the higher vulnerability scale (https://jeo.com/sites/default/files/inline-files/13_Appendix%20E.pdf). This Project's results will provide a deeper understanding to support the quantity and quality vulnerability analyses within the district, build on past mapping (WSF #5189, #5255,

#5312 and #10015). The Project will also provide updated source data and hydrogeologic model for initiating coordinated modeling efforts in the Nemaha watershed.

The **P-MRNRD** has a Voluntary IMP for the portion of the District within the LPRB (https://dnr.nebraska.gov/sites/dnr.nebraska.gov/files/doc/water-planning/lowerplatte/papio-missouri-NRD/PMRNRD_IMP_20140801.pdf) dated August 2014, adopted by both the P-MRNRD Board of Directors and the NeDNR with the following Goals :

- Goal 1 is to develop and implement water use policies and practices which better protect existing surface and groundwater uses while allowing for future development. Objectives – Utilize existing policies, manage invasive vegetation, evaluate conjunctive management projects.
- Goal 2 is to maintain a water supply and use inventory. Objectives – Develop and implement data gathering, monitoring, and evaluation, coordinate with water suppliers.
- Goal 3 is to implement water use education programs to promote urban and rural water conservation. Objectives – Promote water use education, conservation, and reuse.
- Goal 4 is to work with upstream NRDs to develop the Lower Platte River Basin Water Management Plan. Objectives – Participate in Lower Platte Basin water management, evaluate conjunctive management alternatives, evaluate additional water resource supplies, maintain stream flows to protect and maintain public water supply.

The P-MRNRD is also a member of the LPRB Coalition which finalized the LPRB Plan in 2018 and a member of the Lower Platte River Drought Consortium which finalized a Lower Platte River Drought Contingency Plan in October 2019 (approved by NRDs in December 2019). The data collected and reviewed as a result of this Project will address objectives and action items that support Goals 2 and 4 in the IMP and Goal #1 of the LPRB Plan by:

- utilizing the best available data and analysis tools to address groundwater quantity, quality planning tools for the region using the AEM, new field data and updated borehole datasets
- assess the need for additional monitoring data or study [recommendations for Tekamah area Phase II Management area]
- continue to gather and analyze hydrogeologic data
- evaluate the needs for new rural water systems and/or coordinate with public water suppliers [the village of Tekamah].

In addition to the above plans, the P-MRNRD has a new GMP (https://www.papionrd.org/wp-content/uploads/2018/03/180209-P-MRNRD-170724Final_GMP_Vol-I-adopted_180208.pdf) adopted February 2018. Since the last

update to the GMP in 1994, the P-MRNRD has supported significant data collection and research efforts across the district to better understand the complicated hydrogeology, aquifer distribution, groundwater quality, and supply. The new GMP cites ENWRA as one of the most important collaborations. The new GMP continues the goal of keeping groundwater quantity and quality sustainable forever, sets new triggers for groundwater quality phases and quantity levels, and recommends various actions for designated groundwater management areas. The P-MRNRD also has new Groundwater Management Rules and Regulations effective March 1, 2018 which reflect the GMP recommended actions. Rules and Regulations designate Phase I and Phase II Groundwater Quality Management Areas and a Level I Groundwater Quantity Management Area throughout the entire NRD. The continuous hydrogeologic model and planning tools across district boundaries from this Project specifically meet the objectives of the GMP to address specific problems of groundwater quality that are hydrologically connected to the Platte and Elkhorn rivers and includes the portion of the P-MRNRD that contributes surface water runoff to the Platte and Elkhorn rivers. This Study will also be essential as the P-MRNRD completes the following future actions:

- Water quality monitoring through a partnership with the USGS on a rotating schedule of four different aquifer areas: the Missouri River alluvium, the Platte and Elkhorn River alluvium, the Upland areas, and the Dakota Aquifer.
- 45 District dedicated monitoring wells at 16 locations (12 in Wellhead Protection Areas) sampled at least biannually. Monitoring results show a majority of the P-MRNRD with nitrate levels well below the 10 ppm MCL. However, areas of concern with nitrate levels between 5 and 8 ppm have been detected in Tekamah's WHPA and south of Springfield, NE.
- City of Springfield and City of Tekamah Drinking Water Protection Management Plans (DWPMPs approved in 2020 and 2022).

These projects used AEM in limited amounts, but with the advanced tools, Tekamah data collection and the regional hydrogeologic model improvements, the NRD can better assist these areas and beyond in 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.

This project will facilitate access to improved AEM-derived geologic models which can improve future water supply management plans and projects which include intentional groundwater recharge, flow augmentation, and other projects aimed at increasing streamflow. This proposed project specifically focuses on developing tools for smaller communities to use to address water-quality concerns; however improved geologic models can assist with other water-supply goals that are outside the scope of the current grant. As an example, if an NRD chose to divert excess surface-water for the purposes of intentional recharge, the exact location of recharge could be determined from a geologic model created through guided machine learning to provide the maximum benefit. The primary cross-basin benefit of improved geologic models is that the shared data sets will be available for water resource managers, consultants, and professionals across the state. Benefits from this effort described herein are not limited to one specific project area. Rather, shared datasets of aquifer characteristics, streambed conductivity, and water in storage will improve statewide water planning projects and management plans providing benefits to all 1.5 million residents of eastern Nebraska. The demand for additional high-capacity wells for industrial purposes has increased, as well as the demand for domestic wells. The updated data sets derived from an improved geologic model will assist the management efforts of the six ENWRA NRDs to understand the available water supply, identify monitoring needs, develop management controls and programs, and reduce depletions.

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

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

The conservation of water resources goals of the Project Sponsors is detailed for each District in #2 above relative to the Project's contribution and joint agency water supply planning and goals. Additionally, ENWRA NRDs identified six local areas to address groundwater quantity and quality concerns for community water supplies (CWSs) with the following measurable conservation and preservation goals:

- Help communities stay under the 10 mg/L nitrate concentration and meet federal and state water quality maximum contaminant levels (MCLs)
- Help communities be resilient against not having enough water at peak demand times, inform protection plans, and address potential future drought and flooding impacts
- Use the best available science to plan cost effective and resilient long-term supply expansions and/or alternatives evaluations for the future

Natural Resources District	Community Water Supply (CWS) Area Name	Wellhead Protection Areas (WHPA)	Impacts	Population Served	County
Lewis and Clark NRD	Newcastle	No Approved Plan, 2013 Map Boundary	Nitrates 1.92 to 8.25 mg/L in 2024 and 2025, 5.3 to 7.8 mg/L 2017-2019 at monitoring wells in WHPA	300	Dixon
Lower Elkhorn NRD	Osmond	Approved Plan dated December 2016	Nitrates 8 mg/L in 2024 and 2025, 11 to 14 mg/L 1997, 2016, 2017, 2018, 2021, inactive public well 2013	870	Pierce
Lower Platte North NRD	Brainard-Bruno-David City paleochannel	Approved Plans dated February 2015 (Brainard), no date (Bruno and LPNNRD), and August 2010 (David City)	Nitrates <1 to 2.55 mg/L , Selenium 0.06 mg/L 2010-2013, 17.7 mg/L 1996, 5.9 mg/L 1996, 9.8 mg/L 1995, 11 mg/L 1979 (Carbon Tet in 1986), many wells deactivated or inactive 1999, 2006, 2008, 2009	3,309	Butler
Lower Platte South NRD	Elmwood	No Plan, 2002 Map Boundary	Nitrates 12 to 14 mg/L 1985, 2023, & 2024, 2 inactive public wells 1996	698	Cass
Nemaha NRD	Adams - Wellhead Protection Plan August 2012	No Plan, 2012 Map Boundary	Nitrates 5 to 8.36 mg/L in 2024 and 2025, 11 to 14 mg/L 1984,1986, 2000, 2008 +VOCs in 1990s, many wells deactivated	604	Gage
Papio-Missouri River NRD	Tekamah	Approved Drinking Water Protection Management Plan, 2022	Nitrates 11 mg/L in 2013, Phase II Management Area and well seal work and decommissioning in 2020	1,753	Burt

Sources:https://sdwis.epa.gov/ords/sfdw_pub/r/sfdw/sdwis_fed_reports_public/200 https://drinkingwater.ne.gov/index.jsp and https://clearinghouse.nebraska.gov/

This Project builds on previous regional work and provides direct and indirect benefits to potential drinking water remediation efforts. The Project will collect new sustainability-purposed and hydrogeologic model-enhanced field data at the above listed communities and will update related source datasets and hydraulic conductivity predictions over various spatial scales for future contaminant fate and transport evaluations.

This Project will use AEM data lines that passed over 170 of the over 220 WHPAs in the region. The Project will directly benefit eight communities: Adams, Brainard, Bruno, David City, Elmwood, Newcastle, Osmond, and Tekamah coordinated with the greater coordinated effort for the region by those entities statutorily charged with management of

the surrounding water supplies. The current 34 NDEE-approved WHPA plans for the region are greater than 10 years old (before the AEM reconnaissance flights) with the exception of the following: Auburn 2018, Ashland 2020, Coleridge 2018, Osmond 2016, Springfield 2020, Syracuse 2022, Tekamah 2022, Waverly 2022. The communities and NRDs will be provided with interactive, high-resolution mapping tools that predict the distribution of geological materials in the vadose zone and aquifer. The tools will assist the communities to plan, protect, and sustain their groundwater supplies. The GIS tools will be used to target new wells, focus water quality protection efforts, or revise Wellhead Protection Areas. Without the Project efforts, these CWS areas and many of the remaining areas in the region with older or lacking datasets or less pressing needs will likely not be addressed or updated, likely not in the next decade. Additionally, piecemeal area by area approach to the needed work that is not coordinated is not cost effective, possibly doubling the time and maybe exponentially increasing local budget efforts due to cost increases and varying approach methods.

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.

To date, over 20,000 miles of AEM data have been collected in eastern Nebraska for a variety of purposes. This Project will maximize beneficial use by compiling data from AEM, tens of thousands of wells and test holes, as well as the ENWRA NRDs' recently completed hydrogeological framework studies, to build a cohesive and comprehensive hydrogeological model for the region. The method uses regional data to train the model, and then it predicts hydrogeological characteristics at high resolution, making it applicable to regional and community-scale planning efforts regarding drinking water and public supply for a variety of beneficial uses.

By leveraging the latest in data science and technology, we aim to make innovative solutions accessible to individuals, communities, and local governments throughout eastern Nebraska. The completed data sets will be served to the Nebraska GeoCloud to make this information accessible to the state of Nebraska and its 1.9 million residents they can be used for other purposes beyond their original intent. Publishing the data sets and products will give water managers the ability to assess threats to their current water supply from overexploitation and surface contamination and fully characterize potential areas needed to expand rural water system capacity. The Project will also examine 6 local community areas with additional data collection that focus on specific issues that

are of interest to the project sponsors and local communities. The focused project areas concentrate on assessing the feasibility for new water sources to increase drinking water supplies, potential future streamflow augmentation projects, reservoir planning and mapping recharge in areas where high nitrate in groundwater is an issue. The plans devised within this Study could be used as blueprints for similar issues across the state. The proposed Project would not directly lead to reductions in beneficial uses.

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 closest alternative to the regional Project scope would be manual data processing after physically advancing a large number of additional boreholes with sufficient regional spacing and depths to map all the areas with remaining hydraulic conductivity questions following evaluation of each of the AEM survey lines (and/or flying tens of thousands of additional line miles of tighter spaced surveys with selected borehole supplementary locations). The locating, obtaining permission for, and logging thousands of boreholes and wells all within a few years across the region (estimated 15 holes per 170 Wellhead Protection Areas plus 500 holes for each NRD totaling over 5,500 holes), processing the data and then trying to make sense of the resulting point data and layers into a 3D grid would be extremely time consuming and require more technical expert time than our region's current workforce has available. The complex nature of handling the old and new massive datasets without bias to accurately represent the controlling lithologies, varying stratigraphy and complex flow paths would entail coordination of multiple agencies and private industry possibly costing over $24,000,000 = $16,500,000 (borehole advancements [5,550 holes around 200-300 feet deep at $10-15/foot] and/or 5 times the 2018 WSF #5189 $3.3M regional AEM effort in additional AEM) + $7,500,000 (processing and mapping [100 $75,000 full time equivalent years]).

Regarding the 6 local community scopes, Engineering Design, Well Construction Services, Permitting, Professional Services (Administrative, Legal, Fiscal, etc.), Land Easement Acquisitions, and Connection Fee costs for one small to moderate sized community area could be on the order of $5,000,000 to $10,000,000 (Long Term Supply and NRD rural water cost examples detailed in previous WSF #5306 and WSF #10066, respectively). The risk of this alternative would be significant oversights or mis steps from using the existing data without updated and informed hydraulic conductivity predictions with the best available science. Potential investments in line with the order of magnitude

spent for these example projects but without a successful location and a Project rebudget that requires additional services after a relatively short amount of time could be avoided.

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 Project helps the state meet its contracts and cooperative agreements related to integrated water management with other agencies and ongoing previous WSF contract awards with the best available science for decision making (described in Section C, Question #2 above). There are many areas in eastern Nebraska applicable to federal laws and much joint state and federal funds have been spent together with associated federal requirements on water projects:

- According to the NDEE Clean Water State Revolving Fund 2024 Annual report, as of June 30, 2023, the EPA had awarded $263.1 million in capitalization grants to the State. Of the $263.1 million awarded, approximately $20 million was funded by the American Recovery and Reinvestment Act (ARRA), and $9.1 million was funded by the Bipartisan Infrastructure Law (BIL).
- The U.S. Army Core of Engineers Principles, Requirements and Guidelines for Federal Investments in Water Resources (PR&G) govern how Federal agencies evaluate proposed water resource development projects. Since 1983, the Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G) have provided direction to Federal agencies when evaluating and selecting major water projects, including projects related to navigation, storm resilience, wetland restoration, and flood prevention.
- Farm Bill related, NRCS, and USDA related joint projects and funding
- Nebraska Emergency Management Agency (NEMA) and drought-related joint taskforces and projects.

The improvements to the source datasets and hydrogeologic model for the region will help the state as an agency partner have the best available coordinated information without deficiencies when Federal funds, water data sharing and predictions are involved.

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and EPA funding of Drinking Water Projects (There are 5 approved Drinking Water Protection Management Plans [DWPMPs] in eastern Nebraska: Syracuse, Waverly, Auburn, Springfield, Tekamah). Public water

suppliers are required to provide drinking water that meets various federal standards or Maximum Contaminant Levels (MCLs), with the most applicable being the 10 parts per million MCL for nitrate-nitrogen. The Safe Drinking Water Act of 1947 (SDWA; Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) also discusses the designation of a sole source aquifer (section 1427) and the establishment of wellhead protection areas (section 1428). This Project will help communities meet the standards set forth by the SDWA. The Project would create and improve maps and update all the source data each of these type of projects use and could be used by municipalities to delineate groundwater capture zones and update or create wellhead protection areas for newly drilled wells. In addition, the Project will provide ENWRA NRDs with additional information to promote agricultural best management practices (BMPs) in these areas so as to minimize the occurrence and likelihood of nitrate contamination of groundwater supplies. The Project will help provide updated source data and hydrogeologic models for more areas in eastern Nebraska looking for cost effective updates to NDEE WHPAs and EPA approved DWPMPs with less background work for achieving federal funding awards.

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.

Water security and public health and safety for Nebraskans is directly tied to clean and sustainable groundwater resources. About 85% of the state's population uses groundwater as drinking water. However, decades of crop production have allowed fertilizers and some agricultural chemicals to reach groundwater. The proposed project will benefit public security, health, and safety by providing communities and water managers with tools to assess threats to drinking water quality, explore options on future groundwater development, and assess current groundwater supplies. The water supplies associated with 6 communities are facing threats to long term groundwater resource availability (quantity) as well as quality concerns, such as increasing nitrate concentrations and natural contaminants such as uranium, arsenic and/or manganese. Critical infrastructure for public water supply systems in these areas are threatened by elevated nitrate concentrations in groundwater. Wise water management decisions which protect drinking water supplies will preclude the need for more costly water treatment.

Costs associated with the best alternatives (each local area in the region hiring an engineering firm to gather the available background data [sometimes including inquiries to our team], assess the hydrogeology, prepare models and design a long term water supply – if feasible) to the Project are all expected to go up over the proposed life of the Project. This Project utilizes agencies whose missions are aligned with, and routinely provide, science for public benefit.

Groundwater character and mapping products are needed prior to investment in increasing the capacities of rural water systems or siting irrigation or domestic wells. For example, installing a municipal, irrigation, or domestic well in a poor aquifer location that would then later need to be replaced or modified can save an additional expenditure of $200,000 - $500,000, $40,000 - $80,000, or $900 - $8,750, respectively. This Project provides regional advanced water planning tools and field data collection for 6 community areas to address quantity and quality threats on groundwater risking long term regional and local security (example: possibly avoiding future Administrative Orders [AOs]).

9. Improves water quality;

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

This project will benefit the groundwater quality in eastern Nebraska for approximately 1.5 million Nebraska residents. This Project addresses threats to domestic and municipal drinking water supplies across the region and in six local Wellhead Protection Areas (WHPAs) with limited groundwater resources and nitrate impacts. Nebraska is a predominantly small system state with 93.0% of all of the State's CWSs serving 3,300 or fewer people. Often the hydrogeology of the CWS areas is not well-defined due to sparse or outdated data. Further characterizing the local hydrogeology and better predicting groundwater vulnerability to contamination has long remained a challenge for smaller communities with limited staff and financial resources.

The proposed project delivers water-quality benefits at two different scales; regional scale across the 6 ENWRA NRDs and local scale for 6 selected WHPAs (communities affected, a brief water-quality history including the primary contaminants of concern, and number of residents affected):

Natural Resources District	Community Area Name	Wellhead Protection	Impacts	Population Served	County
Lewis and Clark NRD	Newcastle	No Approved Plan, 2013 Map Boundary	Nitrates 1.92 to 8.25 mg/L in 2024 and 2025, 5.3 to 7.8 mg/L 2017-2019 at monitoring wells in WHPA	300	Dixon
Lower Elkhorn NRD	Osmond	Approved Plan dated December 2016	Nitrates 8 mg/L in 2024 and 2025, 11 to 14 mg/L 1997, 2016, 2017, 2018, 2021, inactive public well 2013	870	Pierce
Lower Platte North NRD	Brainard-Bruno-David City paleochannel	Approved Plans dated February 2015 (Brainard), no date (Bruno and LPNNRD), and August 2010 (David City)	Nitrates <1 to 2.55 mg/L , Selenium 0.06 mg/L 2010-2013, 17.7 mg/L 1996, 5.9 mg/L 1996, 9.8 mg/L 1995, 11 mg/L 1979 (Carbon Tet in 1986), many wells deactivated or inactive 1999, 2006, 2008, 2009	3,309	Butler
Lower Platte South NRD	Elmwood	No Plan, 2002 Map Boundary	Nitrates 12 to 14 mg/L 1985, 2023, & 2024, 2 inactive public wells 1996	698	Cass
Nemaha NRD	Adams - Wellhead Protection Plan August 2012	No Plan, 2012 Map Boundary	Nitrates 5 to 8.36 mg/L in 2024 and 2025, 11 to 14 mg/L 1984,1986, 2000, 2008 +VOCs in 1990s, many wells deactivated	604	Gage
Papio-Missouri River NRD	Tekamah	Approved Drinking Water Protection Management Plan, 2022	Nitrates 11 mg/L in 2013, Phase II Management Area and well seal work and decommissioning in 2020	1,753	Burt

Sources:https://sdwis.epa.gov/ords/sfdw_pub/r/sfdw/sdwis_fed_reports_public/200 https://drinkingwater.ne.gov/index.jsp and https://clearinghouse.nebraska.gov/

ENWRA has focused much of its work on mapping the groundwater resources of Eastern Nebraska with AEM. By the end of 2023, AEM surveys crossed over approximately 170 WHPAs throughout eastern Nebraska and covered 33 of those WHPAs with targeted tighter spaced block flight lines for detailed hydrogeologic characterization (refer to AEM Lines and WHPA locations on Figure in Section B #1.B.1). This Project provides updated

regional hydrogeologic modeling by research experts, which can be applied to those CWSs for which newer data is available. The Project also provides the best available, data driven, scalable predictions for surrounding areas where AEM and/or borehole datasets are lacking. These data can be used to develop improved groundwater models to delineate the capture zones of municipal wells, improving the spatial resolution of aquifers and confining units within these zones and improving the prediction of potential impacts to wells. The project will benefit wellhead protection planning and action efforts in over 170 WHPAs across the region.

This proposed project will provide new site-tailored field data collection, interpretations and management tools to better target the fate and transport cause of the persistent high nitrates. For these selected WHPA across the ENWRA area hydrogeologists from CSD and the USGS will supplement publicly available water-quality, water-level, and geologic data with additional geophysical mapping to improve the local geologic framework, examine local groundwater vulnerability, and provide advanced tools to evaluate existing and future water supplies.

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.

Letters of support from the supporting jurisdictions are provided in Attachment A. The table below lists the 2024-2025 property tax levies, valuations, and sources of revenue for the 6 ENWRA project sponsors (* https://www.nebraska.gov/auditor/reports/index.cgi *accessed March 20, 2025)*:

Name of NRD	Tax Levy (per $100 valuation)*	Valuation*	Total Resources Available*	Annual Dues to ENWRA
Lewis and Clark	$0.033227	$5,240,769,546	$25,361,038	$9,150
Lower Elkhorn	$0.018459	$24,388,738,738	$20,929,954	$30,000
Lower Platte North	$0.025767	$13,508,320,694	$14,101,568	$30,000
Lower Platte South	$0.022524	$48,722,572,547	$35,119,428	$30,000
Nemaha	$0.029996	$9,674,622,315	$4,576,170	$20,000
Papio Missouri River	$0.023508	$106,525,277,934	$118,267,265	$30,000

Additional to the local NRD funding, the USGS, through Cooperative Matching Funds will provide $34,000 as in-kind funds for this grant (letter included in Attachment A).

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 NRDs have the authority under the Nebraska Groundwater Management and Protection Act, Chapter 46 Article 7 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. Nebraska State Statute Chapter 2 Article 32 gives the NRDs authority to carry out projects related to the development, management, utilization and conservation of groundwater and surface water.

The LCNRD would like to continue quantity and quality study through ENWRA as it relates to several sustainability goals and objectives identified in the LCNRD GMP and IMP as well as the Bazile Groundwater Management Area Plan developed jointly by the Nebraska Department of Environment and Energy (NDEE), LCNRD, LENRD, Lower Niobrara (LNNRD) and Upper Elkhorn (UENRD) to address water quality concerns within Antelope, Knox, and Pierce counties. In response to significant irrigation development and drought conditions of 2012, the LCNRD enacted Groundwater Quantity Rules and Regulations, adopted by the LCNRD in August of 2014. The rules include the requirement of permits for high capacity well development and expansion of irrigated acres. The rules also establish required irrigation management in times of sustained groundwater decline. Over the last 9 years, LCNRD has been working with CSD advancing test holes and installing observation wells (Nebraska Environmental Trust award and smaller reimbursements from the ENWRA partnership) to establish further study of the LCNRD aquifer systems in tandem with the 2014-2018 AEM results (WSF #4143 and #5189). The LCNRD groundwater monitoring network now includes approximately 60 monitoring wells, many of which are in ideal locations for use in this project. This project will provide new District-wide understanding using deeper AEM analysis:

- areas where the geology is diverse and complicated
- WHPAs at quantity and quality risk
- locations where well interference occurs impacting agricultural or domestic uses
- regions where nitrate or other contaminants are impacting groundwater resources
- additional target areas where future development may be possible or alternatively, not recommended

The Project will also address the Newcastle area with more detailed evaluation in Dixon County where hydrogeologic connections between ground and surface water systems as well as connection to younger deposits is poorly understood. Additionally, this Project will bolster the CSD aquifer boundary mapping efforts in Dixon County, USGS and CSD WSF award (#4164) goals to populate the Nebraska GeoCloud, and evaluate NDEE defined boundaries for WHPAs. The stakeholders for the LCNRD areas of the Project are the individual owners of domestic and agricultural water supply wells, campgrounds, and municipal and local NRD water managers.

The **LENRD** has an adopted GMP which details the management actions of the District regarding groundwater quantity and quality. LENRD also has a Drought Mitigation Plan (https://static1.squarespace.com/static/54be71a0e4b096702d519464/t/586fc48f6a496365d57d2c9a/1483719880310/LENRD+Drought+Management+Plan+Draft+12_21.pdf) and is part of the Lower Platte River Basin Management Plan (LPRB Plan) finalized in 2017. This Project aligns with the goals and priorities of those plans and the LENRD Voluntary IMP, the development of which was overseen by a stakeholder group composed of 23 individuals. Both the GMP and the IMP were developed under the authority granted through the Groundwater Management and Protection Act (GMPA) and both have the overarching intent to plan for and maintain water sustainability across the entire LENRD, and this Project will assist in fulfilling those responsibilities. One of the goals listed in the IMP developed by the LENRD in collaboration with NeDNR is to "Develop and maintain a water supply and use inventory based on the best available data and analysis." In addition to fulfilling the overall goal of water sustainability, the Project will also help achieve many objectives within the LENRD's Long Range Implementation Plan, such as:

- Increase our general knowledge of the hydrogeologic characteristics of the district
- Protect municipal and domestic groundwater supplies
- Utilize all land within the district for its most suitable purposes, with consideration given to conserving the resources and their continued productivity for future generations.
- Monitor groundwater to detect changes, trends, or problems
- Improve groundwater conservation practices through education and information dissemination.

- To ensure public awareness of the district's responsibilities, programs, projects and goals, and to increase public concern for the proper management and conservation of our natural resources.

The LENRD has also delineated groundwater quality and groundwater quantity management areas when such an area is deemed necessary for protection. The LENRD is working with ENWRA and the CSD targeting specific aquifers that have been defined with the 2014 to 2018 AEM surveys. Water in the Project area is utilized for residential, industrial, agricultural, and recreational uses. When this Project is complete, all citizens within the LENRD will benefit from the information obtained through the use of advanced planning tools using the most up-to-date hydrogeologc datasets and scalable model results. The information is an enduring source of information that supports the efforts of the LENRD and CSD to catalogue the geology and groundwater of eastern Nebraska (example: Nebraska GeoCloud WSF #4164).

The Osmond area serves around 870 customers and the Ogallala and Plio-Pleistocene aquifer units need defined boundaries. More well locations have been cropping up recently with reduced production (problematic edge areas)/ Long term water quality data is lacking and has not been a focus with test holes and monitoring wells since the late 1990s. Outside of the town boundaries, there is a problem area approximately 6 mi east along HWY 20 where the AEM showed connections with aquifers. This Project and resulting decision making tools will enable the LENRD to manage ground water use in a manner that achieves and sustains a balance between water uses and water supplies. This will provide environmental benefits to the residents of the LENRD by maintaining adequate groundwater/surface water supplies and minimizing conflicts between water users in the future.

The **LPNNRD** has applied the following management considerations for sustainable water use:

• GMP Rules and Regulations Implemented in 1997, the District has required permitting of all water wells which exceed a pumping rate of 50 gallons per minute (gpm).
• Since 2008 flowmeters have been required on all wells that have approved permits for flowrates greater than 50 gpm.
• Cost-share is provided for soil moisture sensors and Evapotranspiration (ET) gauges with local University of Nebraska-Lincoln (UNL) Extension working directly with producers for installations.
• Cost-share provided for flowmeters in two Special Quantity Areas designated in 2015 because of concerns of in-season water decline. A rolling allocation of 27 inches in a 3-year period was implemented for these areas.
• A ranking system is utilized for well permits and expanding of irrigation acres for the Restricted Development and Hydrologically Connected Areas.

The continuous hydrogeologc character predictions and tools from this Project helps support the NRD's evaluation of test hole data submitted, thickness of the aquifer and depth to bedrock. This information will be invaluable in determining future water use as more housing development is being expanded in groundwater restricted areas. Demand for drinking water will continue to increase and the need to find potable water sources will be needed in the different geological formations.

The **LPSNRD** has several programs in place to support sustainable water use. Since the adoption of its GMP in 1995, the District has required permitting of all water wells which exceed a pumping rate of 50 gallons per minute (gpm). LPSNRD has required additional actions for these permits (such as water quality sampling, and, under certain circumstances, aquifer testing) to ensure that the groundwater resource is of adequate quality and quantity for the intended use. Since 2011, the District has required all water wells pumping more than 50 gpm to have a properly installed water meter, and the owners of those meters are required to report their water use on an annual basis. At that same time, the District required all irrigated fields larger than one acre to be certified as irrigated with the LPSNRD. Due to concerns over in-season water declines, the District designated the Dwight-Valparaiso-Brainard Special Management Area (DVB SMA) covering about 100 square miles in the northwestern portion of the District in 2013. LPSNRD has not allowed any additional irrigated acres in that area, and portions of it are under a three-year allocation of 21 inches for both sprinkler and gravity systems. Additionally, LPSNRD has delineated the Salt Creek Groundwater Reservoir and seven WHPAs as groundwater quality management areas for nitrate concerns. Further, the LPSNRD partnered with PMRNRD, LPNNRD and other agencies on the Lower Platte River Drought Contingency Plan (WSF Award #4151). This Project, by updating groundwater level maps and providing more information on recharge areas, will help LPSNRD and local public water suppliers better manage their water resources. Regarding the Elmwood Community area, updated source datasets and understanding the hydrogeologic characteristics will be increasingly important to municipal and irrigation users as management actions are needed in the future. All of these actions help to ensure that groundwater use in the District is managed responsibly and sustainably. More recently in January 2020, LPSNRD implemented revisions to Groundwater Rules and Regulations and is in contract for an update of their 1995 GMP. The following future goals were indicated by LPSNRD which relate and compliment the study goals of this project: the LPSNRD will continue to implement and expand its vadose zone monitoring program emphasizing advanced techniques used by UNL and coordinate that program with its ongoing groundwater monitoring and test hole drilling. The LPSNRD will begin utilizing the completed AEM data by initiating efforts for District-wide geologic and groundwater models. All of the above LPSNRD actions, plans, and goals are benefited by the hydrogeologic advanced tools, data collection and predictions proposed under this Study.

The **NNRD** developed a voluntary IMP with the NeDNR in 2017, which establishes measurable goals and targets for managing the District's aquifers. The results of this Project will support sustainable water use by providing a deeper understanding and recommendations to better manage domestic, municipal, agricultural, and industrial water supplies and water quality. Benefits of the Project will address the threat of nitrate contamination for an estimated population of around 20,000 (https://sdwis-dhhs.ne.gov:8443/DWW/index.jsp populations served for rural water systems). Stakeholders involved in the Project will include the Board and staff of the NNRD, NeDNR, CSD, and local landowners. The NNRD has an adopted GWMP, last revised in 2014. Results of this project specifically meet the objectives of the GWMP to address specific problems of groundwater quality. Groundwater quality monitoring by NNRD staff, as part of the GWMP, has shown a parts of the Project area to have elevated levels of nitrates. Since May of 2013 the NNRD has applied the following management considerations for sustainable water use:

- Flowmeters have been required on all new or replacement wells that have approved permits for flowrates greater than 50 gpm
- Cost-share provided for flowmeters and soil moisture monitoring equipment
- Developed a well permit scoring system that requires a test hole be submitted along with the application which takes in account aquifer thickness and transmissivity.

The density of registered wells within 6,000 feet of a proposed high capacity well is also considered in the permit scoring system. The advanced hydrogeologic information and tools with updated source data for the Project will help support the NNRD's evaluation of the test hole data submitted, thickness of the aquifer, and the depth to bedrock. Additionally, the community of Adams will benefit from the latest in data science and technology tools to assist in planning, protecting, and sustaining their groundwater supplies.

The **P-MRNRD** has a new GMP (https://www.papionrd.org/wpcontent/uploads/2018/03/180209-P-MRNRD-170724-Final_GMP_Vol-Iadopted_180208.pdf) adopted February 2018. Since the last update to the GMP in 1994, the P-MRNRD has supported significant data collection and research efforts across the district to better understand the complicated hydrogeology, aquifer distribution, groundwater quality, and supply. The new GMP cites ENWRA as one of the most important collaborations. The new GMP continues the goal of keeping groundwater quantity and quality sustainable forever, sets new triggers for groundwater quality phases and quantity levels, and recommends various actions for designated groundwater management areas. The P-MRNRD also has Groundwater Management Rules and Regulations effective March 1, 2018 which reflect the GMP recommended actions. Rules and Regulations designate Phase I and Phase II Groundwater Quality Management

Areas and a Level I Groundwater Quantity Management Area throughout the entire NRD. Groundwater quality monitoring conducted by USGS and cooperative efforts with the City has shown portions of the proposed Tekamah community area to have high nitrates and is designated a Phase II Management area. Results of this Project specifically meet the objectives of the GMP to address specific problems of groundwater aquifers with complex and poorly understood hydrologic connections between the uplands and Missouri River floodplain and alluvial aquifer system. The P-MRNRD is one of the NRDs participating in the Lower Platte River Drought Contingency Plan and the LPRB Plan. Improved geologic data and interpretation from this Study will also be essential as the P-MRNRD completes the following future actions:

- Water quality monitoring is done through a partnership with the USGS on a rotating schedule of four different aquifer areas; the Missouri River alluvium, the Platte and Elkhorn River alluvium, the Upland areas, and the Dakota Aquifer.
- The District has in place 45 dedicated monitoring wells at 16 locations (12 in Wellhead Protection Areas) that are sampled at least biannually. Monitoring results show a majority of the P-MRNRD with nitrate levels well below the 10 ppm MCL. However, areas of concern with nitrate levels between 5 and 8 ppm have been detected in Tekamah's WHPA and south of Springfield, NE (both areas covered with advanced hydrogeologic tools in this Project scope). The P-MRNRD also recently worked with the City of Tekamah and City of Springfield to map wellhead protection areas and develop draft Drinking Water Protection Management Plans (recently reviewed and approved by NDEE and EPA). Both projects have used AEM in limited amounts, but the advanced hydrogeoloc tools with this Project will better assist these areas and beyond in the future without town by town or GWMA by GWMA individual assessment efforts.
- The results of this Project will support sustainable water use by improving the placement, installation and long-term use of water supply wells. Local WHPA plans will also benefit from the enhanced hydrogeologic source datasets and model training work.

12. Addresses a statewide problem or issue;

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

This Study covers eastern Nebraska, the most populated portion of the state (refer to table below for benefit impact populations/acres https://www.nrdnet.org/nrds/find-your-nrd) with complicated glaciated hydrogeology where assessment and understanding for

the current statewide integrated management and modeling needs are especially difficult due to the non-orderly hydrogeological setting (https://enwra.org). It will cover six NRDs—almost 1/3 of the state—serving a population of almost 1.5 million.

NRD	Population	Acres
Papio-Missouri River NRD	725,250	1,116,800
Lewis and Clark NRD	15,018	938,880
Lower Elkhorn NRD	89,256	2,526,700
Lower Platte North NRD	64,500	1,031,000
Lower Platte South NRD	314,722	977,525
Nemaha NRD	44,560	1,537,460
TOTAL	**1,253,306**	**8,128,365**

Having accurate hydrogeologic data and support for science-based decision making is necessary to sustain statewide and local water management outcomes. According to the state's 2025 Fully Appropriated Basins (FAB) Evaluation, the Lower Platte Basin, the Lower Platte Missouri Tributaries (LPMT) model has been updated to include data from the years 2014-2021 and has been converted to MODFLOW6. The Lower Elkhorn NRD subregional model, completed in 2022, was built referencing the LPMT model. The Lower Platte North, Lower Platte South, and Papio-Missouri River NRDs, together with the Department, are currently developing a subregional model (3-District Model) that also references the LPMT model. Both the LENRD and 3-District models are incorporating hydrogeologic information from Airborne Electromagnetic (AEM) survey data. This Project will update the source datasets and develop tools that build upon the ~20,000 miles of AEM collected from 2006 to 2024 by fine-tuning the results of these surveys using state-of-the-science machine learning techniques. We will couple these results with new, local mapping. Together, this new information will be made accessible through a web-based, interactive geographic information system (GIS) that will be scalable, allowing for regional and local assessment of groundwater resources and incorporation into the Nebraska's unique statewide water management system with shared responsibility of NeDNR and the 6 eastern Nebraska NRDs.

According to the NDEE 2023 annual summary report for public water supplies, Nebraska is a predominantly small system state with 93.0% of all of the State's Community Water Systems (CWSs) serving 3,300 or fewer people. Often the hydrogeology of the CWS areas is not well-defined due to sparse or outdated data, another statewide issue. Further characterizing the hydrogeology and better predicting the hydraulic conductivity of the region's aquifer units helps to mitigate both the human induced nitrates the state and local agencies are charged with managing and the naturally occurring threats such as iron, manganese, uranium, selenium, sulfate, and salinity issues.

A local example addressed with this project (typical scenario statewide), would be the Osmond area which serves around 870 customers, multiple aquifer units need defined boundaries, there are problematic aquifer edge areas and there are unknown connections with aquifers and surface water inputs. Long term water quality data is lacking and has not been a focus with test holes and monitoring wells in the last 25 years. This Project and resulting decision making tools will enable the local and regional entities to manage ground water use in a manner that achieves and sustains a balance between water uses and water supplies, minimizing conflicts between water users in the future.

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.

The costs of the entire project will be $799,620 with $34,000 in additional value provided by the USGS in cooperative federal match dollars planned across the three years of the Project leveraging local state and federal dollars. ENWRA currently has over $300,000 in banked funds in the ENWRA account, handled by the Lower Platte South NRD, our financial handling agency. Fiscal Year 2025 Budget published online as of September 11, 2024 (See Section 1.B.3 and https://www.lpsnrd.org/sites/default/files/files/2578/20240911finalallpages.pdf).

Each of the ENWRA NRDs have provided support letters indicating they plan to provide additional support for upfront costs associated with this Project beyond what the over $300,000 in banked funds and annual dues of $149,150 a year (paid every February) in our interlocal agreement is designed to cover (Attachment A).

Funding source	**YEAR 1**	**YEAR 2**	**YEAR 3**	**Totals**
ENWRA (40%)	$109,072	$116,140	$94,636	$319,848
WSF (60%)	$163,608	$174,210	$141,954	$479,772
State/Local Project total	$272,680	$290,350	$236,590	$799,620
USGS (federal cooperative dollars)	$9,000	$13,000	$12,000	$34,000
Totals	**$281,680**	**$303,350**	**$248,590**	**$833,620**

The CSD and USGS Draft agreement documents are attached and depend on the funding of this grant application.

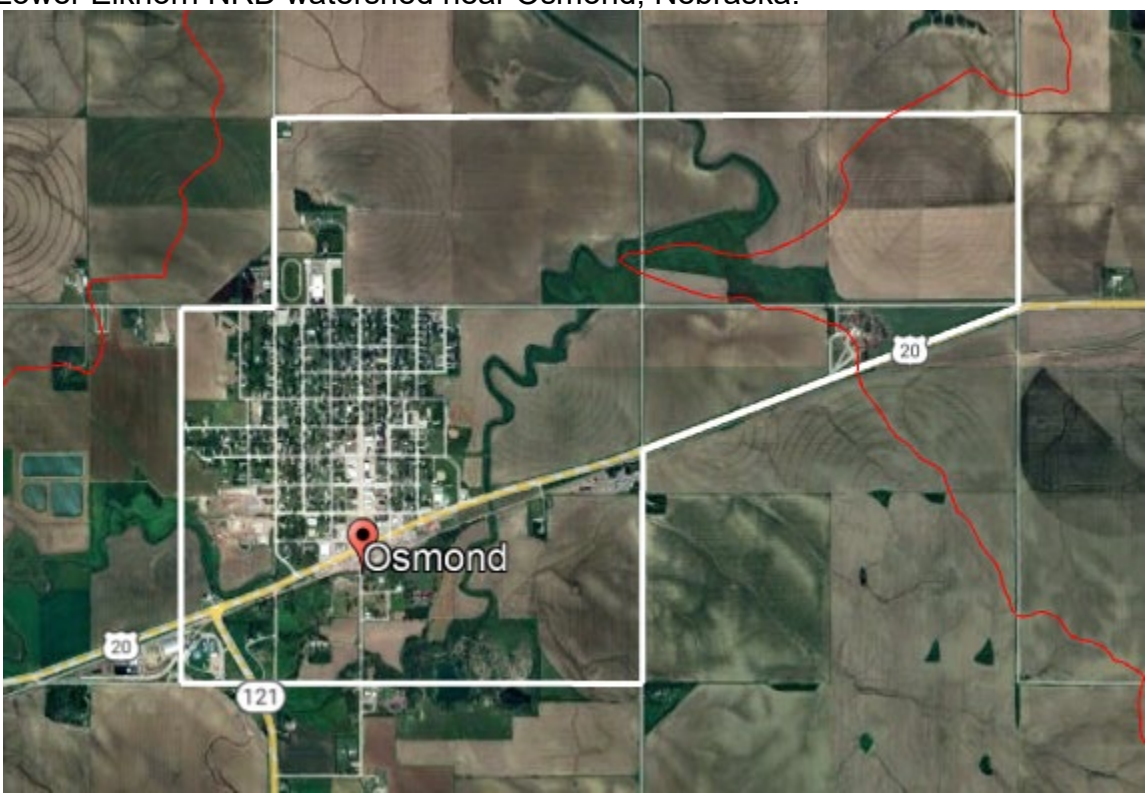
14. Contributes to watershed health and function;

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

Maintaining stream flow volume is critical to watershed health and function. Understanding and stabilizing groundwater levels and aquifer volumes across 6 political subdivisions will help protect stream flows, thereby contributing to the health and function of the Lower Platte Missouri Tributaries (LPMT) and Nemaha watershed basins and (NeDNR model target areas) regionally with this Project. Additionally, the 6 community areas addressed with local hydrogeologic field data collection supplementing the critical watershed understandings for this Project include:

Walnut Creek-Missouri River and Headwaters Aowa Creek for the Newcastle Area in Lewis and Clark NRD watershed (white polygons are WHPAs, red lines are Hydrologic Unit [HUC 12] boundaries):

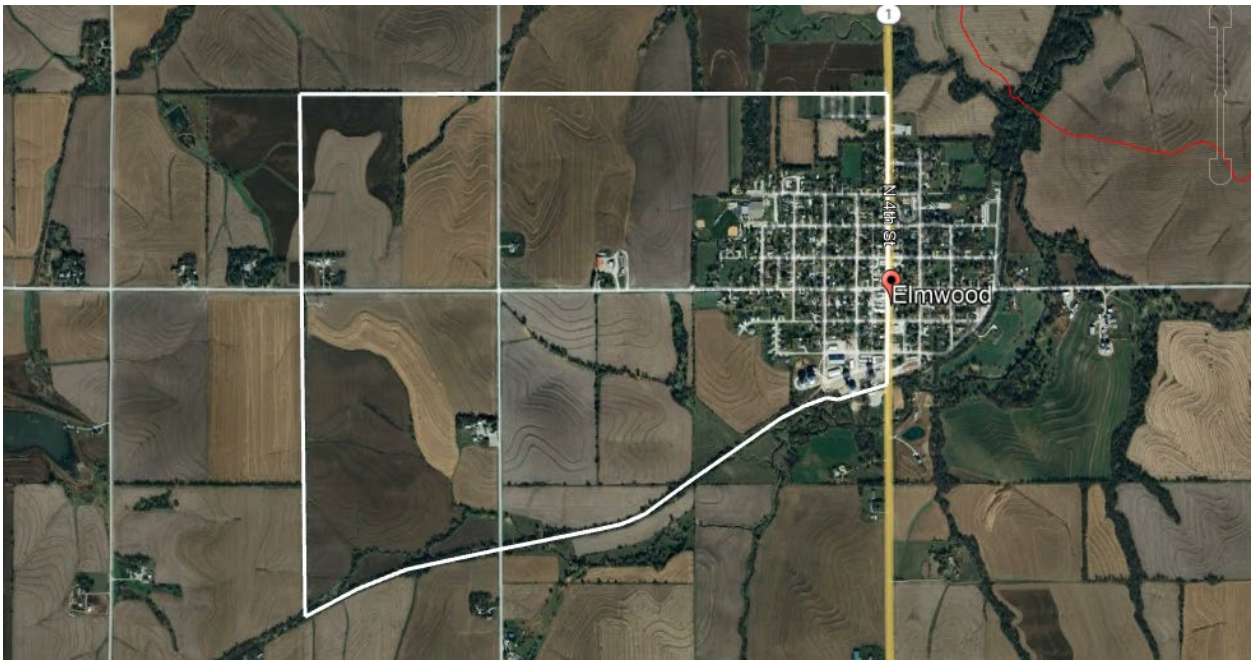
City of Osmond-North Fork Elkhorn River and East Branch North Fork Elkhorn River in the Lower Elkhorn NRD watershed near Osmond, Nebraska:



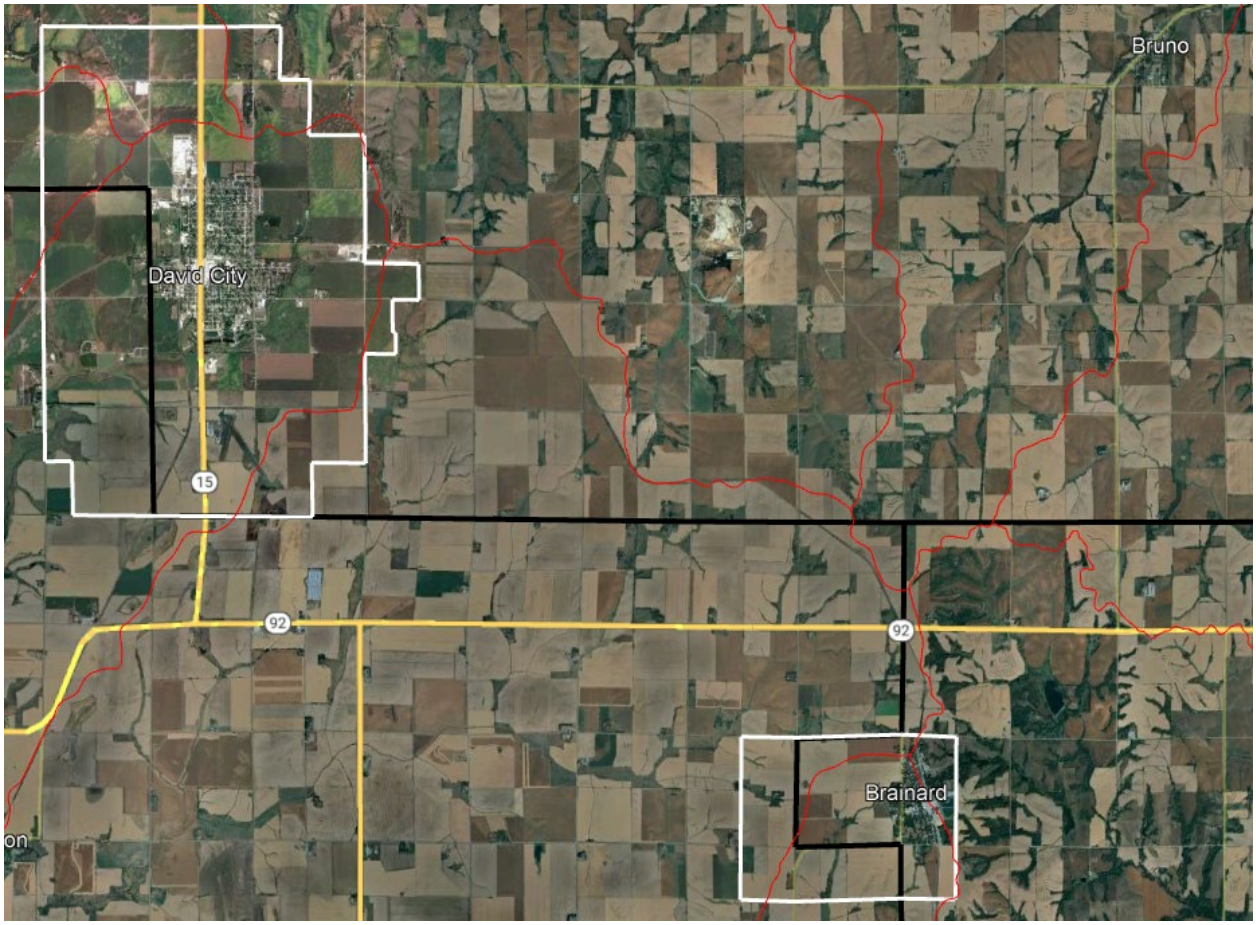
Shaw Creek And Outlet Middle Branch Big Nemaha River near Adams in Nemaha NRD:

Tekamah Creek and County Line Ditch-Missouri River in Papio-Missouri River NRD watershed:

Stove Creek-Weeping Water Creek near Elmwood in Lower Platte South NRD watershed:



Complex hydrologic watershed convergence area of the following: Kezan Creek Middle North Branch Big Blue River, Upper North Branch Big Blue River Deer Creek-Platte River, Headwaters Bone Creek, Headwaters Plum Creek, City of Abie, Headwaters Skull Creek, Middle Oak Creek-North Oak Creek in the David City - Bruno - Brainard area of the Lower Platte North watershed and edges of neighboring Lower Platte South and Upper Big Blue NRD watersheds (black lines):



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.

This project addresses objectives mentioned in the NeDNR's 2024 Annual Report to the Legislature related to water planning and the 2025 Fully Appropriated Basins (FAB) Evaluation (Sections 2.3 for the Lower Platte River Basin and Section 2.4 for the Missouri Tributary Basins). This project directly supports Goals 1 and 3 in the 2024 Annual Report:

- **GOAL #1:** Establish strong state leadership, involvement, and support for science-based decision making (advanced regional and community based hydrogeologic tools and predictions with this Project) that is necessary to sustain state and local water management outcomes.
- **GOAL #3:** Develop and implement customized and decentralized water management plans established through collaboration with local Natural Resources Districts (6 NRDs and two basins in this Project) and stakeholders (6 specific community areas covered in this Project) that provide for long-term sustainability of the state's water resources

Additionally, the Project supports the remaining Annual Report Goals 4 through 6 (applicable to 6 NRDs, two basins and 6 specific community areas in this Project):

- **GOAL #4:** Encourage strong public engagement with multiple constituents and stakeholder groups in planning and implementation activities to ensure that local and state needs are addressed
- **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.
- **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 Project will enhance the understanding of groundwater availability across Eastern Nebraska and update local aquifer system characteristics supporting each of the NeDNR Plan goals. Focused community area studies will assess the state of the current data and identify data gaps to address specific water supply issues to the areas.

According to the 2025 FAB report, In the Lower Platte Basin, the Lower Platte Missouri Tributaries (LPMT) model has been updated to include data from the years 2014-2021 and has been converted to MODFLOW6. The Lower Elkhorn NRD subregional model, completed in 2022, was built referencing the LPMT model. The Lower Platte North, Lower Platte South, and Papio-Missouri River NRDs, together with the Department, are currently developing a subregional model (3-District Model) that also references the LPMT model. Both the LENRD and 3-District models are incorporating hydrogeologic information from AEM survey data and each of these new models are being developed using the most current groundwater model software supported by the USGS, MODFLOW6. This Project will provide model ready improvements to the hydrogeologic source information using AEM survey data for the four NRDs involved with the Department efforts as well as the Lewis and Clark NRD and Nemaha NRDs so the 5 Districts in the LPMT model area and the Nemaha Basin Model area are updated at the same time. Continuous hydrogeologic

maps and character predictions will be ready for input under future NeDNR modeling efforts when Hydrologically Connected Areas (HCAs) will be reevaluated.

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 Drinking Water Act of 1947 (SDWA; Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) discusses the protection of groundwater sources from contaminants identified as threats to public health and quantifies the acceptable levels of these contaminants in public systems. Public water suppliers are required to provide drinking water that meets various federal standards or Maximum Contaminant Levels (MCLs), with the most applicable being the 10 parts per million MCL for nitrate-nitrogen. The SDWA also discusses the designation of a sole source aquifer (section 1427) and the establishment of wellhead protection areas (section 1428). This project will help 6 communities meeting the standards set forth by the SDWA. The Project would create and improve groundwater system-related maps that could be used to assess groundwater vulnerability of drinking water aquifer from surface contamination. Updated groundwater availability maps could be used by municipalities to delineate groundwater capture zones and update or create wellhead protection areas for newly drilled wells. In addition, the local community focus area details for each ENWRA NRD will provide multiple local communities with additional groundwater availability information to cite future public water supply wells in the safest locations for long term sustainability and security.