NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: PMRNRD and LPNNRD 3D AEM Hydrogeologic Framework and Assessment

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

Sponsor Business Name: Papio-Missouri River Natural Resources District

Sponsor Contact's Name: Paul Woodward

Sponsor Contact's Address: 8901 S. 154th Street; Omaha, NE 68138-3621

Sponsor Contact's Phone: 402-444-6222 ext. 272

Sponsor Contact's Email: pwoodward@papionrd.org

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

   Grant amount requested. $168,000

   - If requesting less than 60% cost share, what %? 55%

   If a loan is requested amount requested. $ N/A

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

2. **Neb. Rev. Stat. § 2-1507 (2)**

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

   If yes:

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

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

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

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

There are no permits required for this project.

4. **Partnerships**

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

Papio-Missouri River Natural Resources District (PMRNRD)
The PMRNRD is a co-sponsor and the lead agency. Their role will be to serve as the fiscal agent to the NeDNR and NRC, communicate and guide the project along with LPNNRD, NeDNR, and manage the contractor responsible for the

hydrogeologic framework. They will provide an interlocal agreement once the grant is approved to each co-sponsor, provide data, technical support, and review all work products.

Lower Platte North Natural Resources District (LPNNRD)
The LPNNRD is a project co-sponsor. Their role will be to provide data, funding, technical support, and review all work products.

Lower Platte South Natural Resources District (LPSNRD)
The LPSNRD is a supporting partner and will provide AEM data to be included in a 5-mile buffer around the LPNNRD and PMRNRD.

Nebraska Department of Natural Resources
The NeDNR is consulting with LPNNRD and PMRNRD and will provide funding, should the WSF application be successful. NeDNR staff will be responsible for reviewing products and providing technical support.

5. Other Sources of Funding

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

The total project cost is $306,000 and all funding sources are confirmed as indicated in letters of support from each sponsor (Attachment A). The cost breakdown is provided in Table 1.

NeDNR
The NeDNR is contributing $13,000 per NRD, for a total of $26,000, or 8% of the project total.

PMRNRD
The PMRNRD is contributing $66,800, or 21.8%, of the project total.

LPNNRD
The LPNNRD is contributing $45,200, or 14.8%, of the project total.

Table 1 – Detailed Cost Breakdown

NRD	Project Total	NDNR Cash	WSF Eligible Balance	WSF	NRD
Papio	$180,000	$13,000	$167,000	$100,200	$66,800.00
LPNNRD	$126,000	$13,000	$113,000	$67,800	$45,200.00
Total	$306,000	$26,000	$280,000	$168,000	$112,000.00
	% Share	8%		55%	37%

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!

AEM data is currently available for a large portion of eastern Nebraska in the Platte River watershed. Having a means to utilize this data in a user friendly and practical way to assist in water management decisions is the goal of this proposed project.

PMRNRD and LPNNRD have formed a partnership to collaborate on a two-district effort for developing a 3D AEM-based hydrogeologic framework (referred to herein as the 3D AEM Hydrogeologic Framework) using existing and already contracted Airborne Electromagnetic (AEM) data (being flown in 2020), geologic logs, and other relevant available geologic and hydrogeological reports and data. The 3D AEM Hydrogeologic Framework will be developed using state-of-the-art 3D visualization computer software to develop 3D geological models from large datasets (like AEM).

All of the AEM data is currently available with the exception of additional flight lines that are proposed along throughout the PMRNRD in the summer of 2020. The AEM from this area will be available by the time this project begins.

This project will implement a similar approach, supported and accepted by NeDNR in 2019/2020, for the Lower Elkhorn NRD (LENRD) groundwater flow modeling project. Using this method to develop the 3D AEM Hydrogeologic Framework based on AEM and geologic logs will provide these adjacent NRDs with a consistent and comprehensive assessment and deliverable that will include the most recent data and make it useable between NRD boundaries. The 3D geologic model created from the AEM data will be delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.

The 3D AEM Hydrogeologic Framework, when completed can be used for, but not limited to:

- Better understanding the geological layers and how groundwater flows through these;
- Evaluating existing wells, siting new monitoring wells, and assessing new well permit applications;
- Completing an aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices (BMPs);
- Identifying potential areas for groundwater recharge;
- Evaluating hydrologically connected surface and groundwater; and,
- Constructing new and refining existing numerical groundwater flow models (i.e., MODFLOW) and other tools that can be used to assist with several the assessment needs above.
- Evaluating groundwater and surface water interaction that is based on a framework that is consistent across the PMRNRD, LPNNRD, and LENRD boundaries.
- Wellhead Protection Areas and Drinking Water Protection Management Plans

Both NRDs will be provided the following using AEM-based data to create the 3D AEM Hydrogeologic Framework:

- Creation of datasets based on the analyses and interpolation of the processed AEM data and all available geologic logs.
- Completion of a 3D visualization geologic model for the AEM data to provide the NRDs with the data files for use in a free downloadable 3D model software viewer that allows the user to use the 3D model.
- Prepare data sets for input and initial discretization and layers for a future numerical groundwater flow model.

PMRNRD is also receiving a Detailed Hydrogeologic Assessment which further evaluates the hydrogeology only using the geologic descriptions on well logs and test hole logs (sand, gravel, clay):

- Complete a detailed hydrogeologic assessment mapping the key hydrostratigraphic surfaces and construct cross sections through the NRD using the borehole lithology from all the test holes and wells logs.
- Provide a final geodatabase and other mapping files in an electronic and/or hard copy assessment report (i.e., “map book”) deliverable format. The assessment deliverable can be used in conjunction with the 3D model software viewer to have the most up to date robust format to assist the NRD with water management decisions.

The NeDNR is consulting with both NRDs and LPSNRD will be providing AEM data and technical support, as the framework construction includes a 5-mile buffer beyond the LPN and PMR NRD boundaries.

7. **Project Tasks and Timeline**

The cost by task are provided in Table 2. The project is anticipated to begin January 2021 and be complete by December 2021. The WSF funding will be applied to all aspects of the project.

Table 2 – Cost by Task, Year One (2021)

TASK	TITLE	COST (2021)
1	PM/Meetings	$36,000
2	Develop Geology Database	$60,000
3	Create Cross Sections, Surfaces, GIS	$65,000
4	Create AEM 3D Model Framework	$80,000
5	Reporting and Map Books	$65,000
	Total	$306,000

8. **IMP**

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

Both NRDs have an approved Integrated Management Plan.

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.B.1 Insert data necessary to establish technical feasibility (004.02);
This project will utilize AEM data collected by each NRD and apply the same proven approach and techniques that were recently used to complete the 3D Hydrogeologic

Framework supported by the LENRD and NeDNR. The AEM surveys have provided excellent characterization of the hydrostratigraphy across the NRDs based on the electrical properties of earth materials from the land surface downward using electromagnetic induction. AEM data was used by LENRD's contractor in 2019 and 2020 to construct a 3D Hydrogeologic Framework for a similar project, which lies adjacent to both the PMRNR and LPNNRD.

During the LENRD project, it became apparent that defining the stratigraphic contacts between the principal aquifer and the underlying bedrock from AEM data alone could be problematic because of similar electrical properties between differing layers of geologic material. The LENRD project benefited by using borehole lithology data to define specific geologic surfaces. The LENRD's project team concluded that the borehole data was best suited to define the top of bedrock surface and bottom of principal aquifer, and to use the AEM data to define the hydrostratigraphy of the unconsolidated materials (i.e., Quaternary and Ogallala).

This same approach and workflow will be applied to the PRMNRD and LPNNRD datasets to capture the benefits of both borehole data and AEM data when building regional, NRD-wide, or localized 3D geological framework models and groundwater flow models. The AEM data will be used to develop the 3D AEM Hydrogeologic Framework and create a series of rows, columns and layers, which defines a unique set of grid blocks (i.e. model cells). The cells, which are necessary for a future MODFLOW groundwater model, will be used to represent the distribution of hydrogeologic properties and boundary conditions within each NRD, plus a 5-mile buffer into adjacent NRDs.

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

The PMRNRD and LPNNRD are collaborating on this project to ensure the data created is consistent with that of each other, and LENRD, which will enable the Lower Platte River Basin NRDs to work in sync on water management strategies. This will prove beneficial during the development of a future AEM-based MODFLOW groundwater model. Furthermore, by completing the frameworks together there is considerable cost savings (~$30,000), versus the two NRDs participating individually. The NeDNR is consulting with each NRD and will provide financial and technical support should the grant be awarded.

The AEM resistivity data has been correlated to ranges of hydraulic conductivity of the aquifer and non-aquifer materials. The contractor will obtain data from the Eastern Nebraska Water Resources Assessment (ENWRA) website or directly from ENWRA personnel, or Nebraska's GeoCloud. The AEM data will be used in a robust 3D geological modeling software to define 3D solids of resistivity zones that represent the hydrostratigraphy. These 3D resistivity zones will be used to evaluate the hydrogeologic framework, which will then be used to construct 3D numerical groundwater flow model grids with a range of hydraulic conductivity values (see

Figure 1). Down the road, these files can then be exported to Groundwater Vistas, a pre- and post-processing program for MODFLOW.

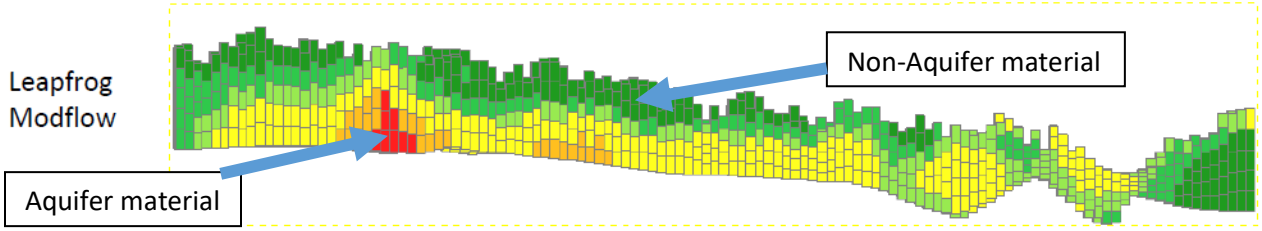

Figure 1 – LENRD Leapfrog Five Layer MODFLOW Profile Example

Due to the geographic extent of the NRDs proposed projects, large datasets, and required data analyses, 3D analysis software is necessary to compile, manipulate, interpolate, and interpret the data. Once the 3D model is developed, it will be provided to the NRDs to access and view with a free viewing application. This application will allow NRD (or others) to "fly around and through" the interpolated AEM data, cut slices (profiles or cross-sections) through the AEM data, and view select saved "scenes" that could target certain areas of interest at or near the hydrogeologic cross sections.

LIDAR data will be used to define the top of the of the 3D model and the bedrock surfaces used to define the unconsolidated bedrock contact in the model. Additionally, well and test hole lithology data will be incorporated into the project to display the lithology as boreholes. A flow chart description of the overall process is provided in Figure 2. A final deliverable will be provided to the NRDs in ESRI geodatabase format and hard copy and/or digital Detailed Hydrogeologic Assessment Mapping deliverable (i.e., "map book"). The LPNNRD and PMRNRD contractor will:

1) Obtain and manage hydrogeologic AEM and borehole lithology datasets for GIS, 3D software, and groundwater modelling;
2) Conduct GIS spatial analyses to develop key hydrostratigraphic surfaces for future spatial analyses, provide ESRI geodatabase deliverables, and create the top of bedrock hydrostratigraphic surface for constraining the AEM data;
3) Create datasets from the processed AEM data for analyses and interpolation in the 3D software from all existing and future AEM flight data;
4) Complete a 3D visualization geologic model for the AEM data and provide the NRD with the data files for their use; and,
5) Prepare data sets for input and initial discretization and layers for a future groundwater flow model.

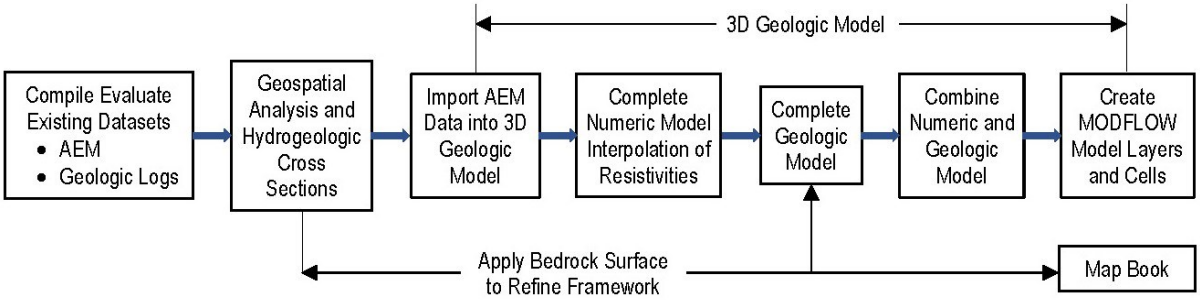

Figure 2 – Major Steps in Developing Framework

Detailed Hydrogeologic Assessment Mapping

In addition to the 3D AEM Hydrogeologic Framework, the PMRNRD will also be establishing a detailed hydrogeologic assessment which uses all available well logs and test holes. The detailed hydrogeologic assessment mapping displays the key hydrostratigraphic surfaces (clay, sand, gravel, etc.) and constructs cross sections across the NRDs using the borehole lithology from all the test holes and wells logs. The detailed hydrogeologic assessment will complement the 3D Hydrogeologic AEM Framework, allowing PMRNRD to 'cross check' information, should the data show something that needs more assessment.

The project area is shown in Figure 3.

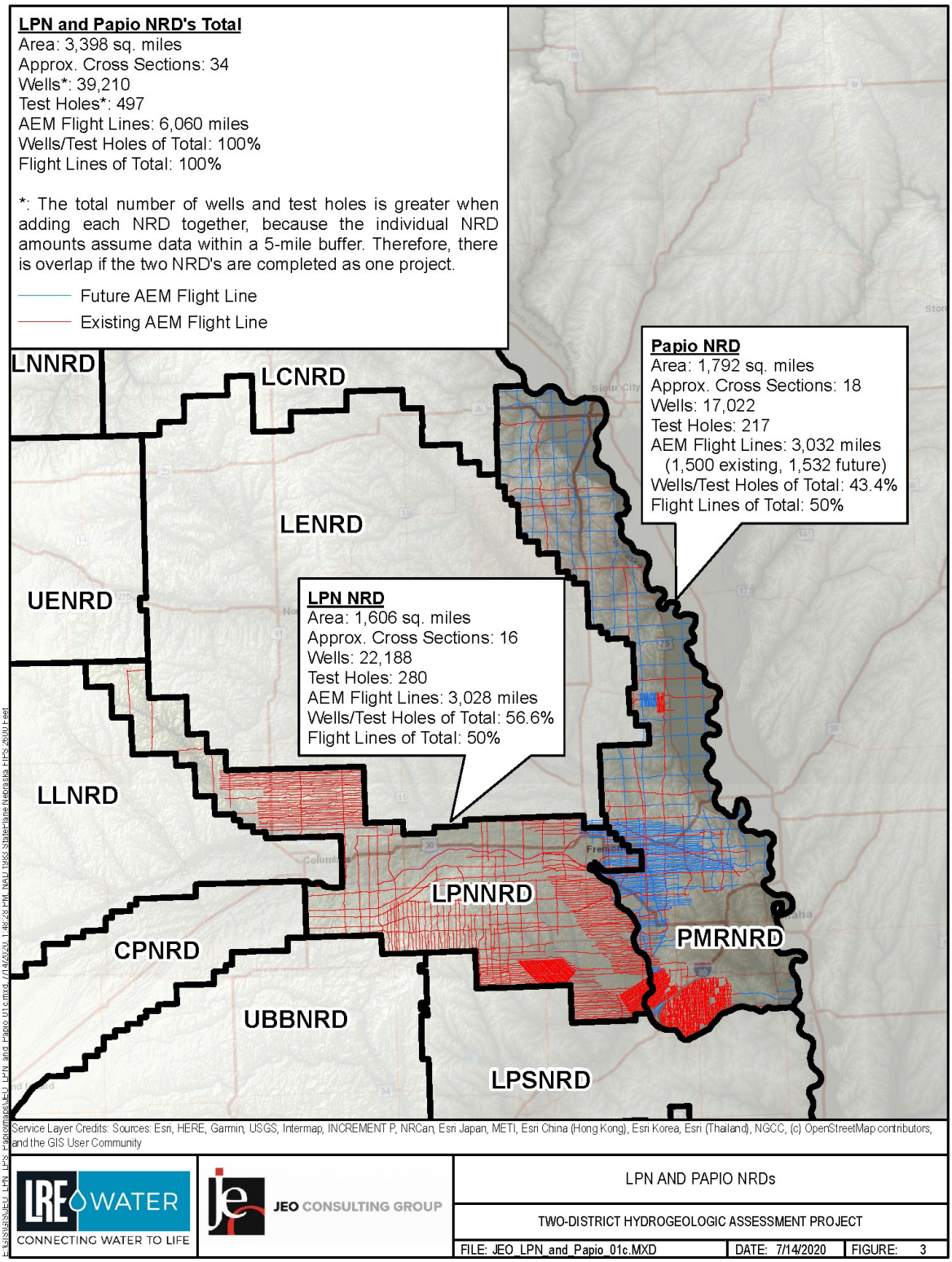

Figure 3 – Project Area and Data Availability

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

PMRNRD is collecting AEM data during the summer of 2020 across 1,532 miles as part of a separate effort. All field data will have been collected by the initiation of the project in January 2021. This project does not include new field or research investigations, only analysis of existing information.

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

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).

There will be no effects on operation of existing structural measures.

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 methodology being used to incorporate geophysical data (i.e., AEM) into a hydrogeologic framework, and eventually a groundwater model, is based upon the successful work completed by the LENRD and NeDNR during development of a Pilot-scale Area (PSA) Model (2019) which provided LENRD and NeDNR with a proven methodology on how to best use AEM data in both a 3D Hydrogeologic Framework and groundwater flow model (MODFLOW). The intent of the PSA Model was to prove that AEM data could work in a flow model.

The PSA Model has shown that the AEM surveys provide excellent characterization of the hydrostraigraphy across the NRDs based on the electrical properties of earth materials from the land surface downward using electromagnetic induction. But it became apparent that defining some stratigraphic contacts from AEM data alone could benefit by using borehole lithology (sand, clay, gravel) data to define specific geologic surfaces.

The LENRD project team concluded that the borehole data was best suited to define the top of bedrock surface and bottom of principal aquifer, and to use the AEM data to define the hydrostratigraphy of the unconsolidated materials (i.e., Quaternary and Ogallala). This same approach and workflow will be applied to the PMRNRD and LPNNRD datasets to capture the benefits of both borehole data and AEM data when

building regional, NRD-wide, or localized 3D geological framework models and groundwater flow models.

Furthermore, by combining the framework development in PMRNRD and LPNNRD at one time, an estimated $30,000 is saved compared to doing the framework development separately.

The next best alternative is developing a framework using only point-based geologic data (well logs and test holes). That alternative would not take advantage of the NRDs, NeDNR, and NRC's investment in AEM flight data collection and would certainly take a greater amount of time and effort to develop geologic layers without using a computer automated evaluation of AEM resistivity data. Therefore, this alternative would certainly cost more and take much longer to complete.

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, up to fifty (50) years; *or*, with prior approval of the Director up to one hundred (100) years, (Title 261, CH 2 - 005).

The total cost estimate is $306,000 and was provided by JEO Consulting Group, Inc., and LRE Water Inc. who were responsible for the development of the hydrogeologic framework for the LENRD. The project cost was correlated from the LENRD project effort and then based upon the number AEM flight miles, number of well logs, and test holes per NRD.

One of the project's benefits is establishing a consistent hydrogeologic dataset between LENRD, PMRNRD, and LPNNRD boundaries. It is anticipated that LPSNRD may also follow a similar methodology in the future, enabling the Lower Platte River Corridor NRDs the ability to manage groundwater in a sustainable and consistent manner across political boundaries.

One of the top priorities of water resources management is ensuring irrigation is sustainable and a key to contributor to Nebraska's economy. This project brings forth the best available scientific information to support decisions that can help ensure irrigation continues with no or limited regulation, while sustaining surface water flows within hydrologically connected areas.

A detailed benefit cost analysis has not been completed, but it appears evident that the long-term water management benefits will far exceed the cost of the framework development cost.

The project shelf life extends well into the future because the data is geologic. The project will provide benefit until more accurate method to collect geologic data is utilized. Given that AEM is the most advanced technology, and preferred alternative for eastern Nebraska NRDs, it should be beneficial for several decades.

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).

A breakdown of the project elements by task is provided in Table 3.

Table 3 – Project Cost by Task

TASK	TITLE	COST (2021)
1	PM/Meetings	$36,000
2	Develop Geology Database	$60,000
3	Create Cross Sections, Surfaces, GIS	$65,000
4	Create AEM 3D Framework	$80,000
5	Reporting and Map Books	$65,000
	Total	$306,000

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).

Estimating the monetary value of long-term tangible benefits on data assessment and mapping projects is challenging. There is not an immediately known and accepted method for calculating tangible benefits for groundwater modeling projects. The PMRNRD and LPNNRDs staff and Board of Directors are confident it will greatly promote and increase water sustainability efforts throughout the region and within the Lower Platte River Basin. This fact is based upon the significant investment into AEM in the past several years by both NRDs.

The assessment of AEM and geologic data will provide each NRD a solid scientific background for basing water management decisions and is one step closer to having a groundwater flow model that utilizes the AEM data. The project could also assist each NRD on making decisions that limit future water allocations, thus safeguarding

the use of groundwater for irrigation and supporting the agricultural economy of Nebraska. Lastly, this project takes full advantage of the millions of dollars invested into AEM data, test holes, and monitoring wells by the two NRDs, NRC, and NeDNR.

Beyond the NRD's goals, the data will also help communities to base decisions using the available information, in a user-friendly format, to help with projects such as siting new wells, or planning for drought, among many other ancillary benefits.

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).

The total project cost is $306,000 (see Table 4) over a one-year period, split by PMRNRD, LPNNRD, NeDNR, and this WSF grant. The overall benefit is sound water management in the Lower Platte Basin utilizing the NRD, NeDNR, and previous WSF grant investments in AEM data. As previously described, there is no acceptable method to calculate cost vs. benefit for a geologic framework and assessment project. Some of the many specific benefits include:

1) Better understanding of the connection and flow of groundwater systems;
2) Evaluating existing wells and assessing new well permit applications;
3) Completing aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices;
4) Identifying potential areas for groundwater recharge and water quality contamination;
5) Evaluating hydrologically connected surface and groundwater; and,
6) Constructing new and refining existing numerical groundwater flow models and other tools that can be used to assist with a number of the assessment needs above.

Table 4 – Cost by Task, Year One (2021)

TASK	TITLE	COST (2021)
1	PM/Meetings	$36,000
2	Develop Geology Database	$60,000
3	Create Cross Sections, Surfaces, GIS	$65,000
4	Create AEM 3D Framework	$80,000
5	Reporting and Map Books	$65,000
	Total	$306,000

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.)

See 3. C above for the cost. The next best alternative is developing a framework using only geologic data (well logs and test holes). That alternative would not take advantage of the NRDs, NeDNR, and NRC's investment in AEM flight data collection. Another alternative would be for the two NRDs to conduct separate projects, which would cost approximately $30,000 more than the combined project.

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.

Letters of support and financial assistance are found in Attachment A – Letters of Support. Each contributing organization has confirmed that funding is available in their respective budgets cover the 2021 calendar year.

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

Nebraska Department of Natural Resources
The NeDNR is contributing $13,000 per NRD, for a total of $26,000, or 8% of the project total.

Papio-Missouri River Natural Resources District (PMRNRD)
The PMRNRD is contributing $66,800, or 21.8%, of the project total. The PMRNRD has estimated the 2020-2021 property tax request at 0.037384 cents per $100 of valuation resulting in 27,292,882 from property taxes, and a total operating budget of $83,837,482.

Lower Platte North Natural Resources District (LPNNRD)
The LPNNRD is contributing $45,200, or 14.8%, of the project total. The NRD's FY 19 – 20 operating budget was $6,579,860 with $3,480,715 of that required from LPNNRD local tax levy. That needed .035512 cents per $100 valuation from District property. The 2020-2021 budget is anticipated to be similar.

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

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

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

Groundwater management is a statutory duty of NRDs. The development of this project will aid each NRD in adhering to the statutory responsibilities and authorities given to the NRDs by the State of Nebraska, including but not limited to Nebraska Revised Statutes 2-3,201 through 2-3,243 and 46-701 through 46-755. Each NRD is well qualified to carry out this project and supported by the NeDNR. Since the NRDs started in 1972, they been collecting groundwater data and utilizing that data for management decisions. The NRDs have been instrumental to incorporating cutting edge AEM data into the management process. As one of the state's preferred regulators of groundwater, each NRD is clearly both qualified and responsible to carry out the proposed project.

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

This project supports implementation of actions to achieve goals of the Lower Platte River Basin Coalition's Basin Water Management Plan for both NRDs and NeDNR. Additionally, each NRD has a voluntary integrated water management plan (IMP), whose primary goal is to management the hydrologically connected portions of each NRD to achieve and sustain a balance between water uses and water supplied for the long-term.

- LPNNRD's IMP was effective in July 2018
- PMRNRD IMP was effective in August 2014

This project is directly related to implementation and support of plans and programs of the state resource development plans.

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

If yes:

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

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

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

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

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

Section C.

NRC SCORING

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

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

Notes:

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

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

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

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

1. Remediates or mitigates threats to drinking water;

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

One specific and concerning threat to drinking water in both NRDs is nitrate contamination. LPNNRD is also actively managing issues with quantity, well interference,

and assessing the potential for residential development in the district as pressure from Lincoln and Omaha mounts. LPNNRD is currently working on a project in a groundwater management area that is utilizing AEM to help evaluate the vulnerability of the aquifers which will assist with source water protection.

Drought is another significant concern for both NRDs as outlined in the Lower Platte River Drought Contingency Plan (WSF award #4151 involving LPNNRD and PMRNRD). LPNNRD updated its Groundwater Management Plan (GWMP) in June of 2018, while PMRNRD established a new GWMP in 2018. A demographic summary of each NRD is provided in Table 5 and a map showing LPNNRD (Figure 4) and PMRNRD (Figure 5) Groundwater Management Areas.

In the PMRNRD, the proposed project area includes an estimated 1,400 active domestic wells (including registered and unregistered wells) serving approximately 4,200 people and 14 WHPAs serving a combined population of approximately 750,000 including Omaha's MUD and Fremont.

Table 5 – NRD Population Summary

NRD	Total Population	No. of Communities	NRD Size (AC)
Lower Platte North	64,500	28	1,031,000
Papio-Missouri River	780,000	30	1,116,800
TOTALS	**844,500**	**58**	**2,147,800**

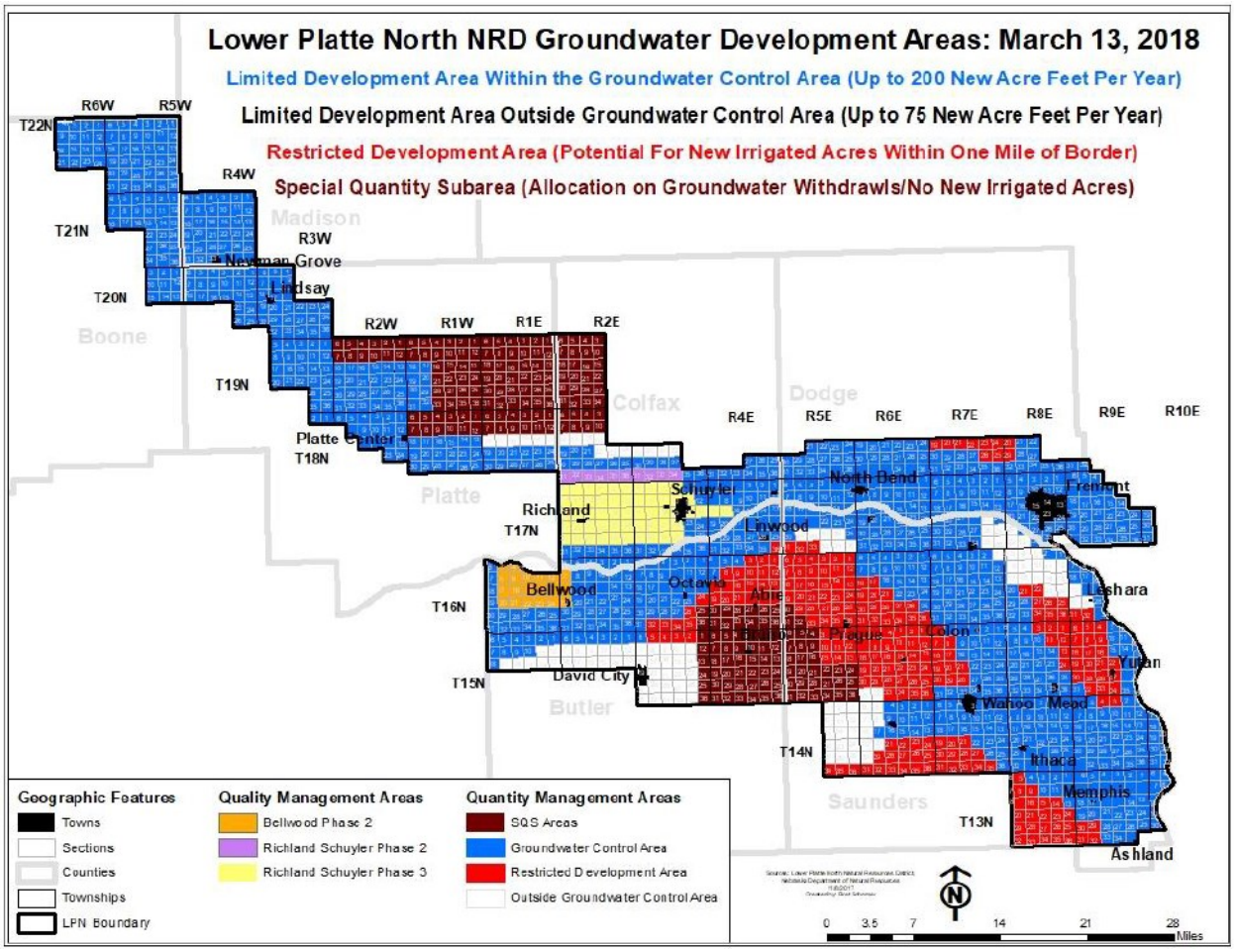

Figure 4 – LPNNRD GWMAs

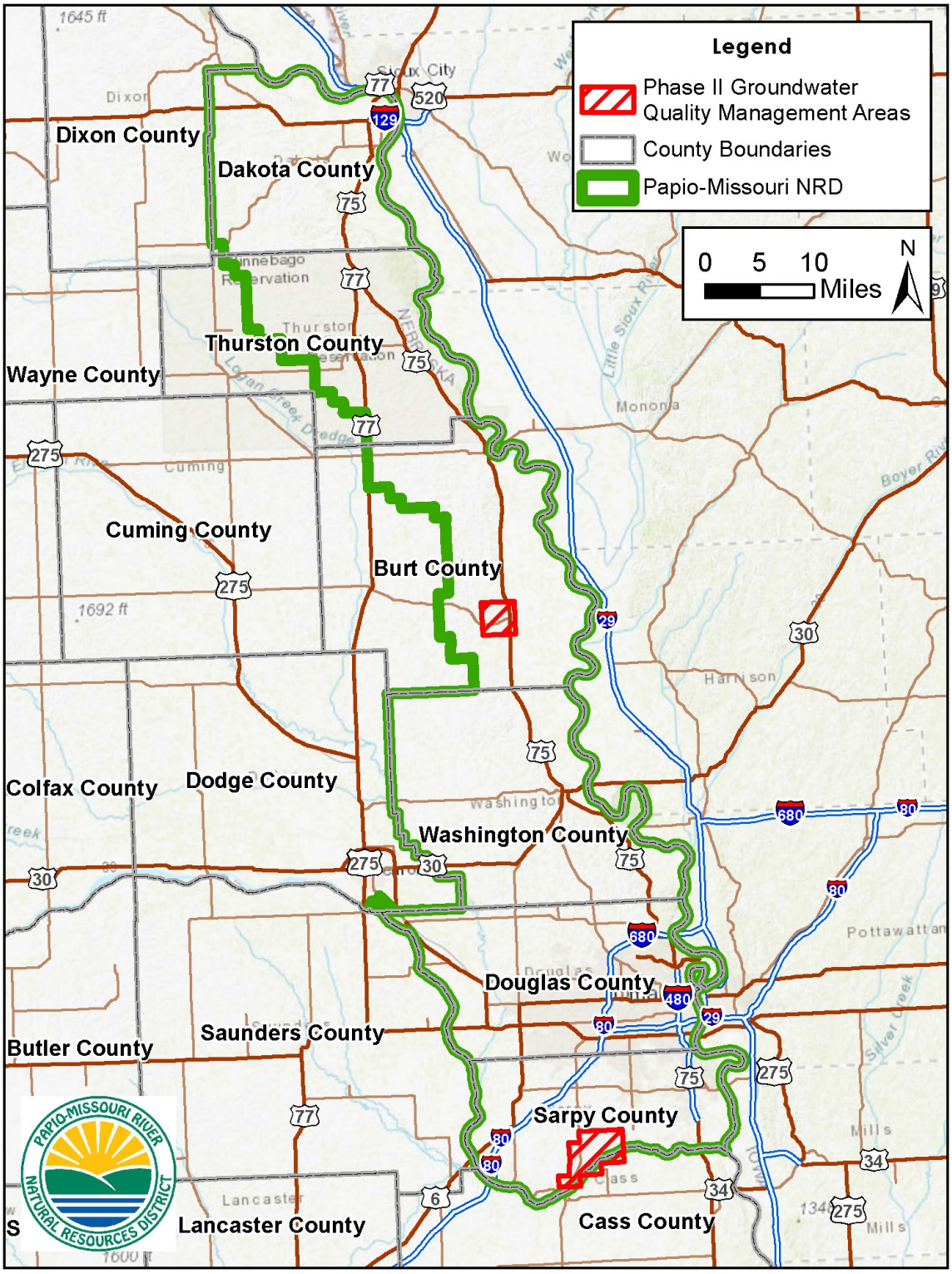

Figure 5 – PMR Groundwater Management Areas (GWMAs)

Within the PMRNRD, water quality sampling has occurred since 1992. Data has indicated that there are elevated levels of nitrate ranging from 5 to over 10 parts per

million (ppm) at various locations in the alluvial systems associated with the Platte and Elkhorn River. The PMRNRD Groundwater Management Plan sets 5 ppm (half of the drinking water limit of 10 ppm) as a trigger level for further study and with the potential for actions to address the nitrate contamination, as is the case with Tekamah and Springfield GWMPAs. This is a reason why a detailed 3D AEM Hydrogeologic Framework of the alluvium would provide valuable insight when mapping nitrate concentrations and drilling future wells.

In LPNNRD and PMRNRD, issues with groundwater quantity were experienced during the drought of 2012 and, to a lesser extent, 2013. Many domestic wells experienced groundwater shortages due to pumping interference with other wells. Many public water suppliers, including City of Lincoln and Omaha's Metropolitan Utilities District, also encountered shortage concerns. The drought of 2012 pointed to the need for Nebraska to make conserving water resource quantities a priority. This 3D Hydrogeologic Framework will help determine and further evaluate areas susceptible to a repeat of those problems previously experienced. This project will greatly inform the development and employment of the Lower Platte River Drought Contingency Plan (WSF award #4151) involving LPNNRD and PMRNRD, the LPNNRD Restricted Development area evaluation, and other NRD drought management efforts.

The 3D AEM Hydrogeologic Framework, when completed can be used to manage nitrate contamination, well interference, and groundwater quantity issues. The framework will provide the NRDs with a consistent and comprehensive assessment deliverable that will include the most recent data, delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes. Some of the specific benefits include:

1) Better understanding of the connection and flow of groundwater systems;
2) Evaluating existing wells and assessing new well permit applications;
3) Completing aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices;
4) Identifying potential areas for groundwater recharge and water quality contamination;
5) Evaluating hydrologically connected surface and groundwater; and,
6) Constructing new and refining existing numerical groundwater flow models and other tools that can be used to assist with a number of the assessment needs above.

The 3D AEM Hydrogeologic Framework and associated digital data will also allow both NRDs to communicate with illustrative graphics easing the communication gap between citizens and producers.

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.

This project directly supports most of the goals for both NRDs GWMPs and IMPs. The PMRNRD 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 (still under review by NDEE and EPA). LPNNRD recently began work to evaluate nitrate travel through the vadose zone of the Bellwood and Richland/Schuyler/GWMAs. Both projects have used AEM in limited amounts, but with the new framework, the NRDs can better assist these areas and beyond in the future without town by town or GWMA by GWMA individual assessment efforts.

Lower Platte North NRD GWMP and IMP Summary

The LPNNRD's GWMP was approved in July 1995 and implemented in January 1, 1997. The rules and regulations were updated on June 15, 2018. Both have been adopted by the LPNNRD and reviewed by NeDNR. Specific goals and objectives within the GWMP that are achieved or assisted by this project include:

LPN Groundwater Management Plan (GWMP) Goals

Master Plan Goal 1 – Assure Adequate Quantity and Quality of the Stream Flow, Groundwater, and Surface Water Reservoirs within the NRD for Beneficial Uses as Prescribed by Law.
Objectives – There is a total of 13 objectives all related to working with citizens and producers to manage groundwater, assisting federal and state agencies, program development, recognizing instream flows, and wellhead protection.

#1 – Groundwater Reservoir Life
Objectives – Multiple related to establishment of a management program, groundwater management areas, phased management strategy, information and education, and agency coordination.

#2 – Management Systems Development
Objectives – Multiple listed related to aquifer mapping, water level monitoring, enhanced data collection, data analysis, installing monitoring wells, supporting studies, and agency collaboration.

LPN IMP Goals

The LPN IMP became effective on July 15, 2018, after it was developed by the LPNNRD and NeDNR in a collaborative effort. An abbreviated summary of the specific goals and objectives supported by this project include:

Goal #1 – Water supply
Objectives – conduct data collection and analysis of current water supplies, determine inflows and outflows of surface water and groundwater and changes in storage

Goal #2 – Develop and maintain a District-wide water demand inventory
Objectives – Evaluate current and future water demands, impacts to streamflow, estimate future impacts

Goal #3 – Develop and implement water use policies
Objectives – Update policies, practices, and programs to improve supply, conserve, etc.

Goal #4 – Public Outreach
Objectives – Incorporate new data, technologies, and programs to enhance public outreach

Goal #5 – Basin-wide Coordination
Objectives – participate with Lower Platte River Basin Coalition, expand conjunctive management, coordinate with ENWRA, etc.

Papio-Missouri River NRD GWMP and IMP Summary

The PMRNRD's GWMP was completely revised and adopted on February 8, 2018. The rules and regulations are current as of March 1, 2018. Both have been issued by the PMRNRD and accepted by NeDNR. Specific goals and objectives within the GWMP that are achieved or assisted by this project include:

PMRNRD Groundwater Management Plan Goals

Overall Goal – "The District's goal is to maintain the existing conditions of its groundwater reservoir quantity and quality – forever.

Sustainability Goal – "Water use is sustainable when it promotes healthy watersheds and aquifers, improves water quality, protects water supplies through BMPs, and manages surface and groundwater resources conjunctively to protect the ability of future generations to meet their needs."
Objectives – Water conservation, policies and procedures, BMPs, wellhead protection, fertilizer management, water quality monitoring, and cost-share programs.

PMRNRD IMP GOALS

The PMRNRD IMP became effective in August 2014, after it was developed by the PMRNRD and NeDNR in a collaborative effort. An abbreviated summary of specific goals and objectives supported by this project include:

Goal #1 – Develop and implement water use policies and practices
Objectives – Utilize existing policies, manage invasive vegetation, evaluate conjunctive management projects

Goal #2 – Develop and maintain a water supply and use inventory
Objectives – Develop and implement data gathering, monitoring, and evaluation, coordinate with water suppliers

Goal #3 – Develop and implement water use educational programs for conservation
Objectives – Promote water use education, conservation, and reuse

Goal #4 – Work with upstream NRDs as part of the Platte River Basin Coalition
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

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.

One of the top priorities of water resources management is ensuring irrigation is sustainable and a key contributor to Nebraska's economy. This project brings forth the best available scientific information to support decisions that can help ensure irrigation continues with no or limited regulation, while sustaining surface water flows within hydrologically connect areas. It is anticipated that creating this hydrogeologic framework for the LPNNRD and PMRNRD will lead to an enhanced and more accurate groundwater MODFLOW model which will be better suited to managing aquifer depletions and reducing streamflow depletion across both NRDs.

Another one of the project's benefits is establishing a consistent hydrogeologic dataset between LENRD, PMRNRD, and LPNNRD boundaries. It is anticipated that

LPSNRD may also follow a similar methodology in the future, enabling the Lower Platte River Corridor NRDs the ability to manage groundwater in a sustainable and consistent manner across political boundaries and the ability to create a groundwater flow model that isn't restricted by NRD boundaries. This improved geologic assessment will help inform NRDs about ground level geology and potential near-surface recharge, guiding future projects aimed at enhancing or protecting these groundwater recharge areas.

The 3D AEM Hydrogeologic Framework, when completed can be used for, but not limited to:

- Better understanding of the connection and flow of groundwater systems;
- Evaluating existing wells and assessing new well permit applications;
- Completing aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices;
- Identifying potential areas for groundwater recharge and water quality contamination;
- Evaluating hydrologically connected surface and groundwater; and,
- Constructing new and refining existing numerical groundwater flow models and other tools that can be used to assist with several the assessment needs above.

The project is designed to open the door for future cross basin benefits by having a consistent hydrogeologic dataset with neighboring NRDs based on AEM data, NeDNR well logs, and UNL CSD test holes. This project's approach, key tasks, and costs are based on the work completed by Lower Elkhorn Natural Resource District (LENRD) and NeDNR since 2018 on the LENRD's pilot study (completed) and district-wide hydrogeologic framework and district-scale numerical groundwater flow modeling project (in progress). An example of an AEM cross section, including well log and test hole interpolation of the bedrock surface, is shown in Figure 6.

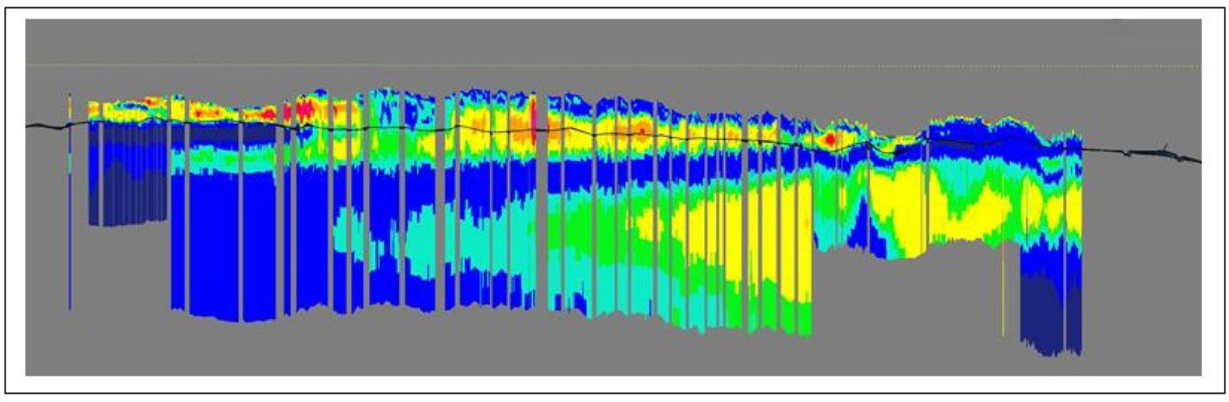

Figure 6 – AEM data represented in cross section as 'boreholes' and bedrock surface (blackline) interpolated from well logs and test holes (LENRD)

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

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

The primary goal of the project is to enhance both NRD's Board of Director's ability to make sustainable management decisions to achieve a balance or maintain a sustainable use of water supplies for agricultural, environmental, private, and municipal and industrial purposes. This is a legislative purpose for all NRDs. The framework provides a robust and scientifically advanced tool to support achieving multiple water supply goals as listed in the both NRD's IMP, GWMPs, Lower Platte River Drought Contingency Plan, and Lower Platte River Basin Coalition Basin Water Management Plan.

In addition to irrigation as a priority, the LPNNRD and PMRNRDs are also subject to rural residential, commercial, and industrial development. This project brings forth the best available scientific information to support decisions that can help ensure economic growth of all kinds can occur with no or limited regulation, while sustaining surface water flows within hydrologically connected areas. A highlight of specific plans, purposes and goals this project benefits are listed below:

Lower Platte Basin Coalition – Basinwide Water Management Plan

This project helps achieve the three listed purposes of the LPBC Basin Water Management Plan (October 2017) by making use of the investment in AEM data and providing a consistent hydrogeologic dataset across NRD boundaries, increase the capability for NRDs to management cross-basin water issues.

"The purpose of this Plan is to:

1) Provide guidance and a framework for Coalition members to develop water use policies and practices that contribute to the protection of existing surface and groundwater uses, while allowing for future water development.

2) Assist in the development and maintenance of a water supply and use inventory, based on the best available data and analysis.

3) Provide consistency and information for incorporation into individual NRD Integrated Management Plans."

Lower Platte North NRD GWMP and IMP Goals

LPN GWMP Plan Goals

Master Plan Goal 1 – Assure Adequate Quantity and Quality of the Stream Flow, Groundwater, and Surface Water Reservoirs within the NRD for Beneficial Uses as Prescribed by Law.

Objectives – There is a total of 13 objectives all related to working with citizens and producers to manage groundwater, assisting federal and state agencies, program development, recognizing instream flows, and wellhead protection.

#1 – Groundwater Reservoir Life
Objectives – Multiple related to establishment of a management program, groundwater management areas, phased management strategy, information and education, and agency coordination.

#2 – Management Systems Development
Objectives – Multiple listed related to aquifer mapping, water level monitoring, enhanced data collection, data analysis, installing monitoring wells, supporting studies, and agency collaboration.

LPN IMP Goals

Goal #1 – Water supply
Objectives – conduct data collection and analysis of current water supplies, determine inflows and outflows of surface water and groundwater and changes in storage

Goal #2 – Develop and maintain a District-wide water demand inventory
Objectives – Evaluate current and future water demands, impacts to streamflow, estimate future impacts

Goal #3 – Develop and implement water use policies
Objectives – Update policies, practices, and programs to improve supply, conserve, etc.

Goal #4 – Public Outreach
Objectives – Incorporate new data, technologies, and programs to enhance public outreach

Goal #5 – Basin-wide Coordination
Objectives – participate with Lower Platte River Basin Coalition, expand conjunctive management, coordinate with ENWRA, etc.

PMRNRD GWMP Goals

Overall Goal – "The District's goal is to maintain the existing conditions of its groundwater reservoir quantity and quality – forever.

Sustainability Goal – "Water use is sustainable when it promotes healthy watersheds and aquifers, improves water quality, protects water supplies through BMPs, and manages surface and groundwater resources conjunctively to protect the ability of future generations to meet their needs."

PMRNRD IMP GOALS

The PMRNRD IMP became effective in August 2018, after it was developed by the PMRNRD and NeDNR in a collaborative effort. An abbreviated summary of specific goals and objectives supported by this project include:

Goal #1 – Develop and implement water use policies and practices
Objectives – Utilize existing policies, manage invasive vegetation, evaluate conjunctive management projects

Goal #2 – Develop and maintain a water supply and use inventory
Objectives – Develop and implement data gathering, monitoring, and evaluation, coordinate with water suppliers

Goal #3 – Develop and implement water use educational programs for conservation
Objectives – Promote water use education, conservation, and reuse

Goal #4 – Work with upstream NRDs as part of the Platte River Basin Coalition
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

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

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

This project will enhance the PMRNRD and LPNNRD's ability to manage water for beneficial uses with an impact to a total population of over 840,000. Improved water

management in the Lower Platte Basin would also benefit the City of Lincoln and Omaha's MUD Water Systems located on, or near, the Platte River.

A specific topic of statewide interest that will be benefited by the framework is using the geologic data to evaluate projects that may reduce the impacts of severe drought on the Lower Platte River and specifically the impact to Omaha and Lincoln water supplies. Drought was addressed as part of the Lower Platte River Drought Contingency Plan, completed in October 2019. There were several action items suggested in that plan, including new reservoirs within LPNNRD and PMRNRD areas or nearby, pumping from sandpits, and release from upstream sources to ensure an adequate supply to Lincoln and Omaha water supplies. Sound water management decisions throughout the Lower Platte Basin will benefit streamflows, which in turn, increase flows in the Platte River. Increased flows in the Platte, especially during drought, reduce the chances of either Lincoln or Omaha using their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. This project will help evaluate a preferred alternative should action be taken as a result of the Drought Contingency Plan.

The LPNNRD and PMRNRDs are also subject to helping ensure rural residential, commercial, and industrial development has a sustainable water supply, in addition to agricultural water management. The project improves how the NRD staff and Board of Directors can work one-on-one with agricultural producers, developers, municipalities, and industries. Once the 3D model is developed, it will be provided to the NRDs to access and view with a free 3D model viewer application. This viewer application will allow NRDs (or others) to "fly around and through" the interpolated AEM data, cut slices (profiles or cross-sections) through the AEM data, and view select saved "scenes" that could target certain areas of interest or near the hydrogeologic cross sections. The NRD staff will be able to create customized maps specific to the needs of those asking important questions. This tool will provide benefits to the state's residents.

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.

By completing the frameworks together there is considerable cost savings (~$30,000), versus the two NRDs participating individually. The project approach, key tasks, and costs estimates are based on a proven, cutting-edge methodology from an identical project completed by the LENRD and NeDNR in 2019/2020 to establish a district-wide 3D AEM Hydrogeologic Framework and model files, which

is now being used to construct a district-scale numerical groundwater flow modeling project. The LENRD project has provided a means for other NRDs to follow with an approach that was successful in converting AEM data into a hydrogeologic framework and creation of groundwater modeling files. The estimated cost for the PMR/LPN NRDs project is shown in Table 6.

Table 6 – Project Cost by Task

TASK	TITLE	COST
1	PM/Meetings	$36,000
2	Develop Geology Database	$60,000
3	Create Cross Sections, Surfaces, GIS	$65,000
4	Create AEM 3D Framework	$80,000
5	Reporting and Map Books	$65,000
	Total	$306,000

The LENRD project is the first in eastern Nebraska that has utilized AEM data and incorporated borehole lithology data to develop a refined 3D AEM Hydrogeologic Framework or conceptual hydrogeologic model that was used in a numerical groundwater flow model. The NeDNR is consulting with the LENRD on their project and will also consult with the PMRNRD and LPNNRD on this project.

The NRD's have invested a significant amount of time and financial resources to better understand the hydrogeology by obtaining state-of-the art AEM survey data. Implementing a similar approach as used for the LENRD project will provide the NRDs with a consistent and comprehensive assessment deliverable that is cost-effective and will include the most recent data, delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.

The next best alternative is developing a framework using only point-based geologic data (well logs and test holes). That alternative would not take advantage of the NRDs, NeDNR, and NRC's investment in AEM flight data collection and would certainly take a greater amount of time and effort to develop geologic layers without using a computer automated evaluation of AEM resistivity data. Therefore, this alternative would certainly cost more and take much longer to complete.

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.

This project will help the LPNNRD, PMRNRD work with other Lower Platte River NRDs, including LENRD and LPSNRD, to achieve the NeDNR's goal of having all basins 'not fully or overappropriated'. The LPNNRD and PMRNRD Board of Directors understands that the potential to become fully appropriated is real and water management need to be addressed in a consistent manner amongst both NRDs. Datasets and information analyzed as part of this project will allow for smarter water management decisions and will lead to a future, robust sub-regional groundwater flow model for the entire LPNNRD and PMRNRD. This project will reduce the chances of the State needing to intervene with further IMP requirements.

Areas of the LPNNRD and PMRNRD are home to three federally listed endangered species in the Lower Platte Basin. This project will assist the state and NRDs in managing groundwater and surface water to meet its obligation under the instream flow appropriation permit granted to the Nebraska Game and Parks Commission for the central and lower Platte River on June 26, 1998 (with a instream flow priority date of November 30, 1993).

This project will assist PMRNRD and LPNNRD with one current and significant deficiency which is a need to properly analyze AEM data. The AEM data alone is valuable, but once incorporated into a framework and 3D model, areas between flight lines can be interpolated, thus making the entire area of both NRDs data sufficient.

A specific topic of statewide interest that will be benefited by the framework is using the geologic data to evaluate projects that may reduce the impacts of severe drought on the Lower Platte River and specifically the impact to Omaha and Lincoln water supplies. Drought was addressed as part of the Lower Platte River Drought Contingency Plan, completed in October 2019. There were several action items suggested in that plan, including new reservoirs within LPNNRD and PMRNRD areas or nearby, pumping from sandpits, and release from upstream sources to ensure an adequate supply to Lincoln and Omaha water supplies. Sound water management decisions throughout the Lower Platte Basin will benefit streamflows, which in turn, increase flows in the Platte River. Increased flows in the Platte, especially during drought, reduce the chances of either Lincoln or Omaha using their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. This project will help evaluate a preferred alternative should action be taken as a result of the Drought Contingency Plan.

The proposed project will promote water conservation which will have a positive cumulative impact on stream flow by minimizing aquifer depletion. More educated decisions can be made by each Board, particularly within the hydrologically connected areas, which will help reduce pumping impacts on streamflow. The beneficial impacts will be maximized in areas with the highest stream flow depletion factor (SDF) as defined by the NeDNR SDF analysis.

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.

Protection of private property owner's ability to irrigate, with no or minimal regulation, is one of the largest goals to be achieved using the information to be provided by this project. Sound water management requires the use of the best available science, in this case AEM data, ensuring a sustainable water supply for not only irrigators, but also municipalities (including Lincoln and Omaha), and thousands of private well owners.

As mentioned above, a severe drought could lead to Lincoln and Omaha utilizing their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. While necessary to supply municipal water sources, limiting irrigation harms the state's economy. This project may have the ability to help prevent such a priority call from occurring depending on accurate groundwater modeling and management decisions.

9. Improves water quality;

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

The Project would provide information that would improve the understanding of the extent and connectedness of groundwater resources, as well as the types of materials overlying the resource. That information can be utilized to improve or create programs or projects that directly improve water quality for both NRDs and across the political boundaries with LENRD.

An immediate and specific benefit to water quality is using the framework to more accurately refine boundaries of groundwater management sub-areas. The framework will help determine flow patterns, where pollutants (mainly nitrates) are originating, and where to create programs to limit nitrate leaching in the future. This allows for targeting the most vulnerable areas susceptible to leaching of nitrates into the groundwater supply in vulnerable areas, and the planning for providing cost-share programs to encourage BMP adoption. The framework illustrations will help education the public on the importance of improving water quality management.

Converting the AEM data into a geologic framework and 3D model will improve near-surface recharge estimates and help identify groundwater areas vulnerable to direct recharge contamination. The only other solution at this time is to rely on USDA soil survey information which only extends to 5 feet below ground surface (bgs). AEM data can provide recharge and vulnerability information deeper into the soil profile and vadose zone.

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

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

The LPNNRD and PMRNRDs are the two primary jurisdictions supporting this project. Both NRD's have placed funding in their 2021 FY budget. This project will be completed during the calendar year of 2021. Letters of support and financial assurance can be found in Attachment A. Information on each of their budgets and financial sources are here:

Papio-Missouri River Natural Resources District (PMRNRD)

The PMRNRD is contributing $66,800, or 21.8%, of the project total. The PMRNRD has estimated the 2020-2021 property tax request at 0.037384 cents per $100 of valuation resulting in 27,292,882 from property taxes, and a total operating budget of $83,837,482.

Lower Platte North Natural Resources District (LPNNRD)

The LPNNRD is contributing $45,200, or 14.8%, of the project total. The NRD's FY 19 – 20 operating budget was $6,579,860 with $3,480,715 of that required from LPNNRD local tax levy. That needed .035512 cents per $100 valuation from District property. The 2020-2021 budget is anticipated to be similar.

The NeDNR is consulting with the NRDs and will be a financial and technical partner, planning to contribute $13,000 per NRD, for a total of $26,000, or 8% of the project total.

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 LPNNRD and PMRNRD have invested a significant amount of time and financial resources to better understand their hydrogeology by obtaining state-of-the art AEM survey data. Each NRD has also invested a significant amount of time to develop groundwater management plans, integrated management plans, drought contingency plans, wellhead protection plans, and others. Now is the time to take action, and a major step is utilizing the AEM data to develop a hydrogeologic framework and 3D model.

LPNNRD and PMRNRD are proposing a similar approach as used for the LENRD project which will provide the NRDs with a consistent and comprehensive assessment deliverable that will include the most recent data, delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.

The 3D AEM Hydrogeologic Framework, when completed can be used for, but not limited to:

1) Better understanding of the connection and flow of groundwater systems;
2) Evaluating existing wells and assessing new well permit applications;
3) Completing aquifer vulnerability assessment for protection of groundwater

resources and identifying areas for implementing best management practices;
4) Identifying potential areas for groundwater recharge and water quality contamination;
5) Evaluating hydrologically connected surface and groundwater; and,
6) Constructing new and refining existing numerical groundwater flow models and other tools that can be used to assist with a number of the assessment needs above.

The local jurisdictions are LPNNRD and PMRNRDs and other stakeholders involved include LPSNRD, NeDNR, ENWRA, numerous municipal water systems, and thousands of private well owners and irrigators. Below is a list of specific plans that have water management goals that support water sustainability that will be supported by the development of a 3D AEM Hydrogeologic Framework as part of this project. A summary of the total population of both NRDs is shown in Table 7.

Table 7 – NRD Population Summary

NRD	Total Population	No. of Communities	NRD Size (AC)
Lower Platte North	64,500	28	1,031,000
Papio-Missouri River	780,000	30	1,116,800
TOTALS	**844,500**	**58**	**2,147,800**

Lower Platte Basin Coalition – Basinwide Water Management Plan

This project helps achieve the three listed purposes of the LPBC Basin Water Management Plan (October 2017) by making use of the investment in AEM data and providing a consistent hydrogeologic dataset across NRD boundaries, increase the capability for NRDs to management cross-basin water issues.

"The purpose of this Plan is to:

1) *Provide guidance and a framework for Coalition members to develop water use policies and practices that contribute to the protection of existing surface and groundwater uses, while allowing for future water development.*
2) *Assist in the development and maintenance of a water supply and use inventory, based on the best available data and analysis.*
3) *Provide consistency and information for incorporation into individual NRD Integrated Management Plans."*

The goals of the LPBC Basinwide Water Management Plan are:

1) Develop and maintain a water supply and use inventory based on the best available data and analysis.

2) Implement a water management plan for the Basin that maintains a balance between current and future water supplies and demands.
3) Develop and implement water use policies and practices that contribute to the protection of existing surface and groundwater uses while allowing for future water development.

This project helps support implementation of multiple water supply goals, including, agricultural use, municipal and industrial uses, conservation of water resources, and preservation of water resources, as listed in both NRDs IMPs and GWMPs.

Lower Platte Drought Contingency Plan

Drought Monitoring and Vulnerability Assessment

Development of a 3D Hydrogeologic Framework will enhance the assessment of monitored groundwater levels and allow for an improved vulnerability assessment of what those groundwater levels mean in terms of flash or long-term drought conditions.

Drought Mitigation Measures

Use of the competed framework and 3D model will greatly improve the accuracy of evaluations for proposed drought mitigation measures in LPNNRD and PMRNRD. Future groundwater modeling will play a very important role in the accurate assessment of these potential projects.

Lower Platte North NRD GWMP and IMP Goals

LPN GWMP Plan Goals

Master Plan Goal 1 – Assure Adequate Quantity and Quality of the Stream Flow, Groundwater, and Surface Water Reservoirs within the NRD for Beneficial Uses as Prescribed by Law.

Objectives – There is a total of 13 objectives all related to working with citizens and producers to manage groundwater, assisting federal and state agencies, program development, recognizing instream flows, and wellhead protection.

#1 – Groundwater Reservoir Life
Objectives – Multiple related to establishment of a management program, groundwater management areas, phased management strategy, information and education, and agency coordination.

#2 – Management Systems Development

Objectives – Multiple listed related to aquifer mapping, water level monitoring, enhanced data collection, data analysis, installing monitoring wells, supporting studies, and agency collaboration.

LPN IMP Goals

Goal #1 – Water supply
Objectives – conduct data collection and analysis of current water supplies, determine inflows and outflows of surface water and groundwater and changes in storage

Goal #2 – Develop and maintain a District-wide water demand inventory
Objectives – Evaluate current and future water demands, impacts to streamflow, estimate future impacts

Goal #3 – Develop and implement water use policies
Objectives – Update policies, practices, and programs to improve supply, conserve, etc.

Goal #4 – Public Outreach
Objectives – Incorporate new data, technologies, and programs to enhance public outreach

Goal #5 – Basin-wide Coordination
Objectives – participate with Lower Platte River Basin Coalition, expand conjunctive management, coordinate with ENWRA, etc.

Papio-Missouri River NRD GWMP and IMP Goals

The PMRNRD GWMP was adopted on February 8, 2018. The rules and regulations are current as of March 1, 2018. Both have been issued by the PMRNRD and approved by the NeDNR. Specific goals and objectives within the GWMP that are achieved or assisted by this project include:

PMRNRD GWMP Goals

Overall Goal – "The District's goal is to maintain the existing conditions of its groundwater reservoir quantity and quality – forever.

Sustainability Goal – "Water use is sustainable when it promotes healthy watersheds and aquifers, improves water quality, protects water supplies through BMPs, and manages surface and groundwater resources conjunctively to protect the ability of future generations to meet their needs."
Objectives – Water conservation, policies and procedures, BMPs, wellhead protection, fertilizer management, water quality monitoring, and cost-share programs.

PMRNRD IMP GOALS

The PMRNRD IMP became effective in August 2018, after it was developed by the PMRNRD and NeDNR in a collaborative effort. An abbreviated summary of specific goals and objectives supported by this project include:

Goal #1 – Develop and implement water use policies and practices
Objectives – Utilize existing policies, manage invasive vegetation, evaluate conjunctive management projects

Goal #2 – Develop and maintain a water supply and use inventory
Objectives – Develop and implement data gathering, monitoring, and evaluation, coordinate with water suppliers

Goal #3 – Develop and implement water use educational programs for conservation
Objectives – Promote water use education, conservation, and reuse

Goal #4 – Work with upstream NRDs as part of the Platte River Basin Coalition
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

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.

The creation and use of the framework deliverables will help inform proactive management decisions and in turn prevent a potential fully appropriated designation by the State on hydrologically connected within the respective NRDs. This project will help the LPNNRD, PMRNRD work with other Lower Platte River NRDs, including LENRD and LPSNRD, to achieve the NeDNR's goal of having all basins 'not fully or overappropriated'.

The LPNNRD and PMRNRD Board of Directors understands that the potential to become fully appropriated is real and more attention will be given to water management policies as time goes on. Datasets and information analyzed will allow for smarter water management decisions and will lead to a future, robust sub-regional groundwater flow model for the entire LPNNRD and PMRNRD. This project

will reduce the chances of the State needing to intervene with further IMP requirements.

Areas of the LPNNRD and PMRNRD are home to three federally listed endangered species in the Lower Platte Basin. This project will assist the state and NRDs in managing groundwater and surface water to meet its obligation under the instream flow appropriation permit granted to the Nebraska Game and Parks Commission for the central and lower Platte River on June 26, 1998 (with a instream flow priority date of November 30, 1993).

Sound water management decisions throughout the Lower Platte Basin will benefit streamflows, which in turn, increase flows in the Platte River. Increased flows in the Platte, especially during drought, reduce the chances of either Lincoln or Omaha using their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. This project may have the ability to help prevent such a priority call from occurring depending on accurate groundwater modeling and management decisions.

The estimated population, shown in Table 8, to benefit from this project includes the estimated population of LPN and PMRNRDs and the City of Lincoln, due to its wellfield being located near the PMRNRD and LPNNRD boundaries, near Ashland, within the LPSNRD on the Platte River.

Table 8 –Population Potentially Benefited

JURISDICTION	Total Population	No. of Communities	NRD Size (AC)
LPNNRD	64,500	28	1,031,000
PMRNRD	780,000	30	1,116,800
Lincoln	293,905	1	N/A
TOTALS	**1,138,405**	**59**	**2,147,800**

*The 2020 estimated population

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.

A summary of funding sources is shown in Table 9. Each funding organization has obligated cash funding within the FY2021 budget, and all funds are being managed by PMRNRD through an interlocal agreement. The project is anticipated to start in January 2021 and be complete by December 2021. A letter of support and financial commitment can be found in Attachment A – Letters of Support. The PMRNRD, LPNNRD, and NeDNR funding sources are secured as of July 2020.

Table 9 – Detailed Cost Breakdown

NRD	Project Total	NDNR Cash	WSF Eligible Balance	WSF	NRD
PMRNRD	$180,000	$13,000	$167,000	$100,200	$66,800.00
LPNNRD	$126,000	$13,000	$113,000	$67,800	$45,200.00
Total	$306,000	$26,000	$280,000	$168,000	$112,000.00
	% Share	8%		55%	37%

14. Contributes to watershed health and function;

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

The LPNNRD and PMRNRD have approved IMPs and are active partners in support of implementation the Lower Platte River Drought Contingency Plan and Lower Platte River Basin Coalition Basin Water Management Plan. These four plans include similar goals aimed at maintaining adequate flows in the Elkhorn River and Lower Platte Rivers, and associated tributaries. Understanding the hydrological connection between groundwater and surface water is paramount in the success of these planning efforts and will direct actions within each NRD to maintain adequate flows through sound groundwater management.

The hydrogeologic framework will provide information to enhance integrated management decisions, ultimately leading to actions that will safeguard, or enhance streamflow as water demand and supply are balanced.

This in turn directly contributes to watershed health and function, especially in the Lower Platte River, home to the endangered pallid sturgeon and least tern, and the threatened piping plover and a source of drinking water to Lincoln and Omaha.

This project will assist the state and NRDs in managing groundwater and surface water to meet its obligation under the instream flow appropriation permit granted to the Nebraska Game and Parks Commission for the central and lower Platte River on June 26, 1998 (with a instream flow priority date of November 30, 1993).

The primary major watersheds benefited through this project include: Shell Creek, Salt Creek, Papillion Creek, Lower Platte River, Lower Elkhorn River, and Missouri River tributaries.

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.

NeDNR Annual Report and Plan of Work - 2019

In 2019, the NeDNR completed the most current Annual Report and Plan of Work[1]. The NeDNR utilizes several of its program areas to implement the state water planning and review process. Five of the six implementation objectives identified in the Annual Plan of Work will be addressed through this project. They include:

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

This objective is achieved with the establishment of a 3D Hydrogeologic Framework and model files for the LPNNRD and PMRNRD. NeDNR is consulting with both NRDs, providing data, product reviews, and technical support.

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

NeDNR staff are involved with ENWRA and individual NRDs to support IMP implementation. Staff have been supporting this application and will be supporting the framework development.

3) Support locally developed water management plans for conjunctively managing hydrologically connected groundwater and surface water supplies;

The LPNNRD and PMRNRD framework and model files are a first major step to establishing flow models utilizing AEM. These models will be used by both NRDs and NeDNR to model stream depletion factors and mapping hydrologically connected groundwater and surface water supplies.

[1] NeDNR. Annual Report and Plan of Work for the State Water Planning and Review Process. September 2019. Page 1 - 2

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

NA

5) Participate in interagency collaboration with federal agencies, state agencies, local natural resources districts (NRD's), and other water interest entities on various water resources programs and projects; and

This project is a shining example of collaboration as multiple NRDs work together to create consistent datasets allowing for water resource management crisply across political boundaries. This interagency collaboration will reduce future conflicts between NRDs, NeDNR, and other agencies related to water management in the Lower Platte River.

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

A primary deliverable to LPNNRD, PMRNRD, NeDNR, and other stakeholders is completion of a 3D visualization geologic model for the AEM data, with the data files for use a free downloadable 3D model software viewer that allows the water management staff to use the 3D model. The 3D modelling software is highly illustrative and will aid in education of the public when discussing groundwater management. An example of a 3D model output of the LENRD is shown in Figure 7.

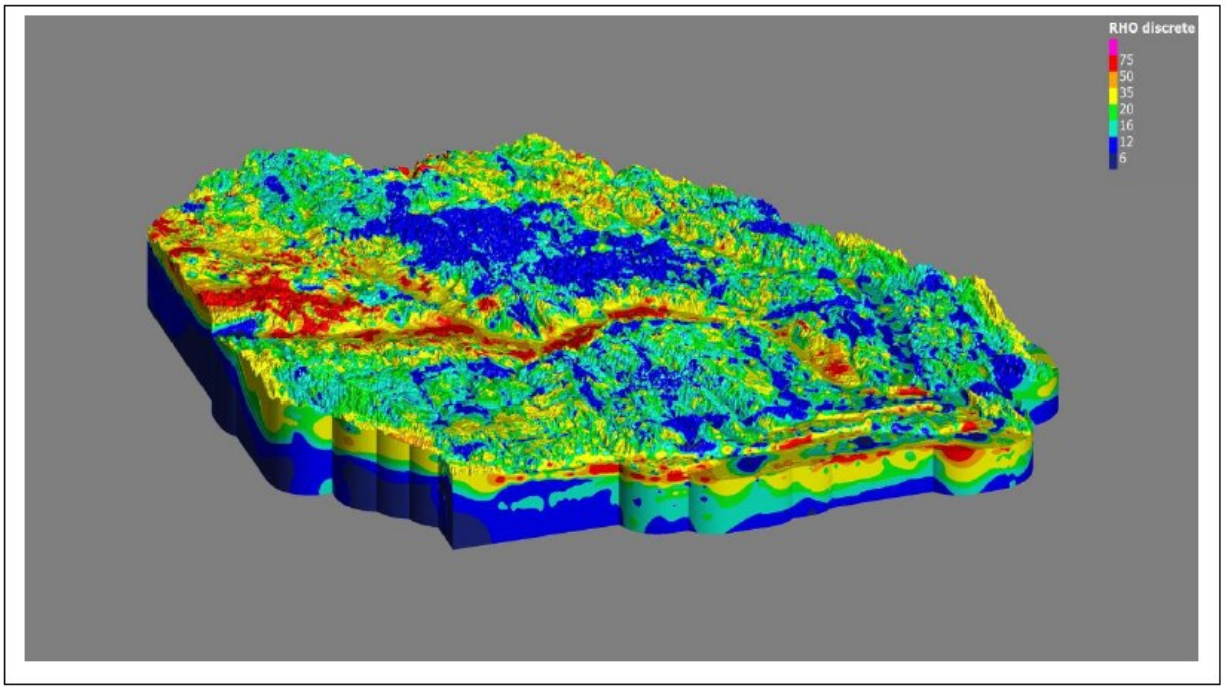

Figure 7 – Numerical Model (Leapfrog) output showing interpolated resistivity data as 3D solids in the LENRD

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.

    N/A