NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Lower Loup NRD Buffalo County Area Groundwater Model

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

Sponsor Business Name: Lower Loup Natural Resources District

Sponsor Contact's Name: Russ Callan

Sponsor Contact's Address: 2620 Airport Drive, Ord, NE 68862

Sponsor Contact's Phone: 308-728-3221

Sponsor Contact's Email: rcallan@llnrd.org

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

   Grant amount requested. $ 165,000

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

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

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

2. **Neb. Rev. Stat. § 2-1507 (2)**

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

   If yes:

- Do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality? YES☐ NO☐ 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☐

No permits are needed to complete the project.

4. **Partnerships**

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

Lower Loup Natural Resources District (LLNRD) is the project sponsor. A letter of support and financial assurance is provided in Attachment A.

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

LLNRD

- Primary sponsor, fiscal agent, and will hire a contractor to build the model.
- Staff will work directly with the contractor during development of the model.
- Will facilitate work with other project stakeholders.

Nebraska Department of Natural Resources (NeDNR)

- Will serve as a stakeholder and provide technical assistance.

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 two sources of funding are anticipated to be local funding from LLNRD and the Water Sustainability Fund (WSF). The total project cost is estimated at $275,000 and a breakdown is provided in Table 1. The LLNRD letter of support and financial assurance is provided in Attachment A.

Table 1 – Cost Breakdown by Funding Source

TASK	COST ESTIMATE	WSF 60%	LOCAL 40%
PM/Meetings	$ 30,000	$ 18,000	$ 12,000
3D Conceptual Framework	$ 90,000	$ 54,000	$ 36,000
Conceptual Model	$ 45,000	$ 27,000	$ 18,000
Flow Model Construction	$ 40,000	$ 24,000	$ 16,000
Calibration	$ 35,000	$ 21,000	$ 14,000
Deliverables	$ 35,000	$ 21,000	$ 14,000
Total	**$ 275,000**	**$ 165,000**	**$ 110,000**

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!

Significant long-term groundwater declines, more than 30 feet in areas, are a significant water resource management concern for the Lower Loup Natural Resources District (LLNRD) in the Buffalo County area. This issue first came to the attention of the LLNRD after dry periods in the early 2000s caused groundwater levels not to recover like normal. The South Loup River was experiencing declining flows, and nearby Wood River was losing segments of perennial flow in the upper reaches above Riverdale. After the drought in 2012, addressing declines in the Buffalo County area became a greater priority when again, stream flows and groundwater levels did not recover adequately.

In response, the LLNRD staff and Board of Directors (Board) have prioritized taking action to identify the extent of the decline issues and to identify potential solutions. This is in line with Goal#1 of the LLNRD Voluntary Integrated Management Plan (IMP), "develop and implement water management policies and practices that could potentially provide for additional water resources development opportunities while protecting existing surface and groundwater uses." The first major action was to fly Airborne Electromagnetic (AEM) survey in the area, generally around the Ravena area. In 2019, 360 square miles was flown, supported by the Water Sustainability Fund (WSF), to obtain data that would provide an understanding of the hydrogeology of the area. With the AEM available, the LLNRD is ready to move ahead with the development of a locally refined groundwater model.

The purpose of the proposed Buffalo County Area Groundwater Model (BC Model) is to provide the LLNRD with a refined numerical groundwater model to assist the LLNRD with evaluating:

1) The potential benefits of artificial recharge projects to increase aquifer storage and provide additional baseflow to area streams.
2) The effects on groundwater levels and/or stream flow resulting from changes in the number of existing and future irrigation wells.
3) Strategies for conjunctive management of groundwater and surface water.
4) Groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments.

The BC Model will be developed using the USGS's numerical modeling code, MODFLOW, and the pre- and post- processing software package, Groundwater Vistas. Once complete, LLNRD staff intend to access and use the completed BC Model within the Groundwater Evaluation Toolbox (GET) software platform.

The BC Model area is mainly focused on an area of significant groundwater declines in Buffalo County, located in the south-central portion of the LLNRD, as well as areas of elevating nitrate levels in groundwater. To establish a tool to help address water management decisions in the Buffalo County area, the model domain must also include areas that surround the county.

The preliminary 'model focus area' is shown in Figure 1, and Attachment B, and includes the communities of Pleasanton, Ravenna, Amherst, and Riverdale, totaling 386,000 acres. The model domain will encompass a large area beyond the 'model focus area' and extends south into Central Platte Natural Resources District (CPNRD). The size of the domain will be selected based on the major hydraulic and hydrogeologic boundary conditions, such as the Platte River to the south, and stresses that could influence water level in the model focus area. The LLNRD intends to initiate a cooperative effort with CPNRD and to continue working together to address groundwater declines in the focus area.

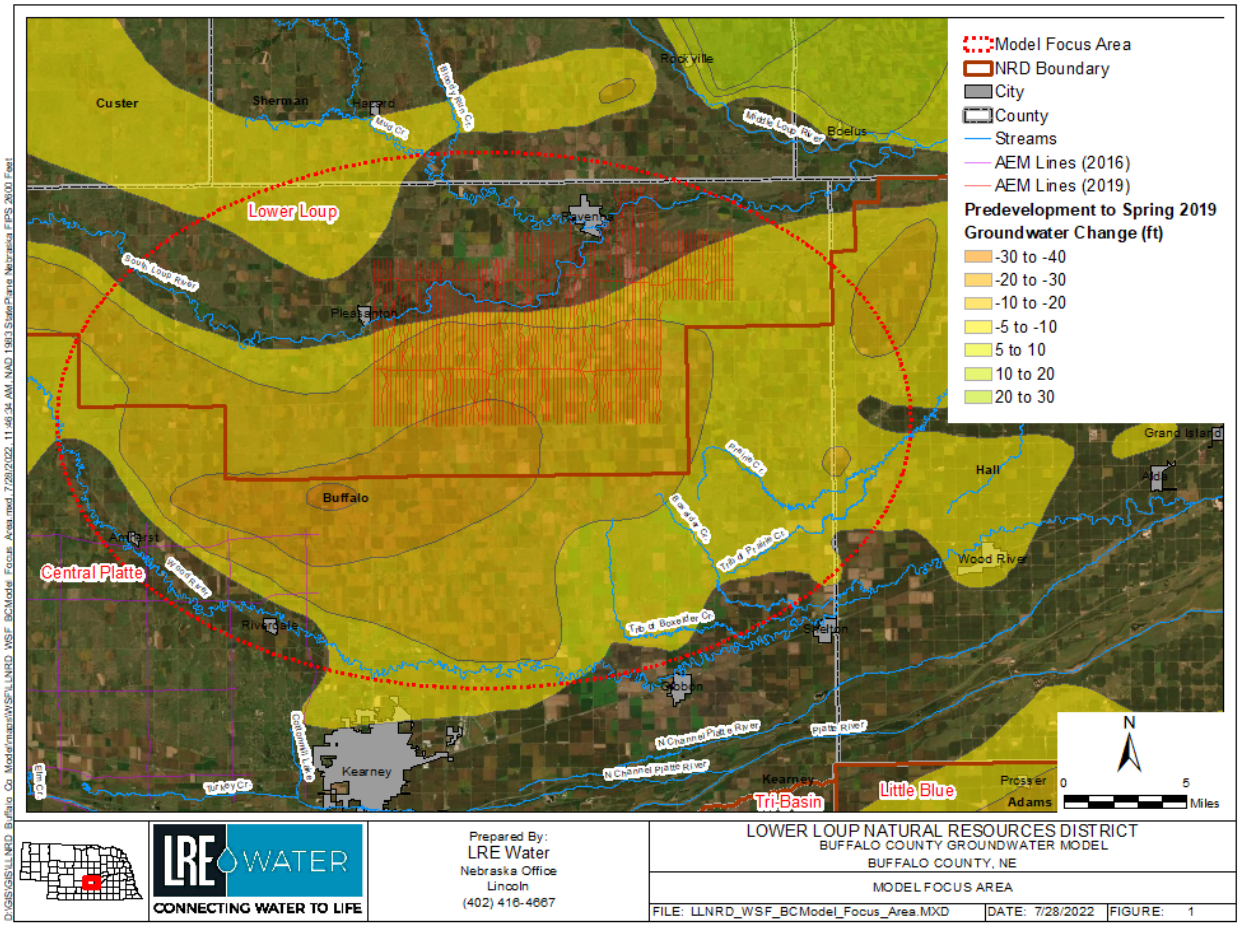

Figure 1 – BC Model Focus Area and Groundwater Declines (UNL CSD)

The BC Model will be more refined than the existing Elkhorn-Loup Model (ELM) built by the USGS, and the Central Nebraska Model (CENEB), built by the

Nebraska Department of Natural Resources (NeDNR); however, these models will be beneficial by using select hydrogeologic information and other model input files. Resources from each model will be leveraged, and serve as a cost-saving resource, when building the new BC Model.

The BC Model will be refined by using the 2019 airborne electromagnetic (AEM) Buffalo County block-flight data, and geologic logs and test holes, and will be discretized to include more model layers and cells (i.e., finer model grid). The existing AEM from flights flown in 2016 by CPNRD will also be incorporated.

After the model is calibrated, it will be used to:

- Help define the extent of groundwater declines.
- Provide a water balance.
- Locate potential water sources.
- Illustrate the relationship between declines and stream flow.
- Define the cost and benefits of potential structural and non-structural measures to achieve recharge and stream flow goals.
- Help identify specific areas where recharge or water resource projects will mitigate the declines, thus sustaining continued agricultural operations and supporting communities.
- Assist in evaluating how changes in regulations could benefit water levels and stream flow.

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.

Activities to complete the project include time and expenses for a consultant that specializes in hydrogeology to build the BC Model. A breakdown of activities, listed as task, for the anticipated project timeframe are shown in Table 2. The project timeframe is 12 months.

Table 2 – Project Activities, Cost, and Schedule

TASK	COST ESTIMATE	SCHEDULE	
		Start	End
PM/Meetings	$ 30,000	January 2023	January 2024
3D Conceptual Framework	$ 90,000	January 2023	April 2023
Conceptual Model	$ 45,000	March 2023	July 2023
Flow Model Construction	$ 40,000	June 2023	August 2023
Calibration	$ 35,000	September 2023	October 2023
Deliverables	$ 35,000	November 2023	January 2024
Total	**$ 275,000**		

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; N/A

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

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

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

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

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

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

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

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

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

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

Groundwater models are a commonly utilized tool to simulate groundwater flow systems prior to making major decisions to move forward with structural projects, or non-structural solutions, such as changes to rules and regulations. The LLNRD maintains a full-time staff member knowledgeable in the use of groundwater models. The LLNRD also utilizes the graphic user interface, the Groundwater Evaluation Toolbox, to assist in operation of groundwater models internally.

In addition to having the staff able to understand and operate models, the LLNRD will hire a qualified consulting firm, led by a professional geologist licensed in the State of Nebraska, to build the BC Model.

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

The BC Model will be constructed as a refined model based upon existing ELM built by the USGS, and the CENEB, built by the NeDNR. The model framework will be based on available geologic data including NeDNR well log and University of Nebraska Conservation and Survey Division (UNL CSD) test hole longs, and incorporation of available Airborne Electromagnetic (AEM) survey. There will be four major tasks for this effort, including:

1) **Project Management & Meetings**
   - To coordinate and communicate with LLNRD and other stakeholders.
   - Conduct progress meetings, progress reports and updates, and a group presentation at a Board meeting.

2) **Data Collection and Framework Development**
   - Coordination with LLNRD staff to ensure that data and information from all available studies are incorporated into the conceptual hydrogeologic model or framework (Framework) and BC Model development process.
   - The initial phase in developing the BC Model is to create the Framework using available data from the NeDNR wells and UNL CSD test hole logs databases, and available AEM resistivity data from the NE GeoCloud.
   - Additional geologic log data may be acquired within a reasonable buffer area to assure representative interpolation out to the BC Model domain.
   - These data, along with the AEM block-flight data in Buffalo County will be used to interpret the local hydrogeology for the Framework.
   - Develop the Framework using the existing data mentioned above in Leapfrog Works, a powerful 3D geological modeling software package from Seequent (Bentley Systems).
   - Utilizing a proven methodology to create a Framework in Leapfrog (see example in Figure 2, and Attachment B) that has been developed during similar Framework projects in Nebraska, and includes:
     - Use geologic logs from wells and test holes to define the bedrock surface, or bottom of the Principal Aquifer

- Use AEM data to define the hydrostratigraphy and AEM resistivity zones (or hydraulic conductivity zones) of the unconsolidated materials above bedrock.

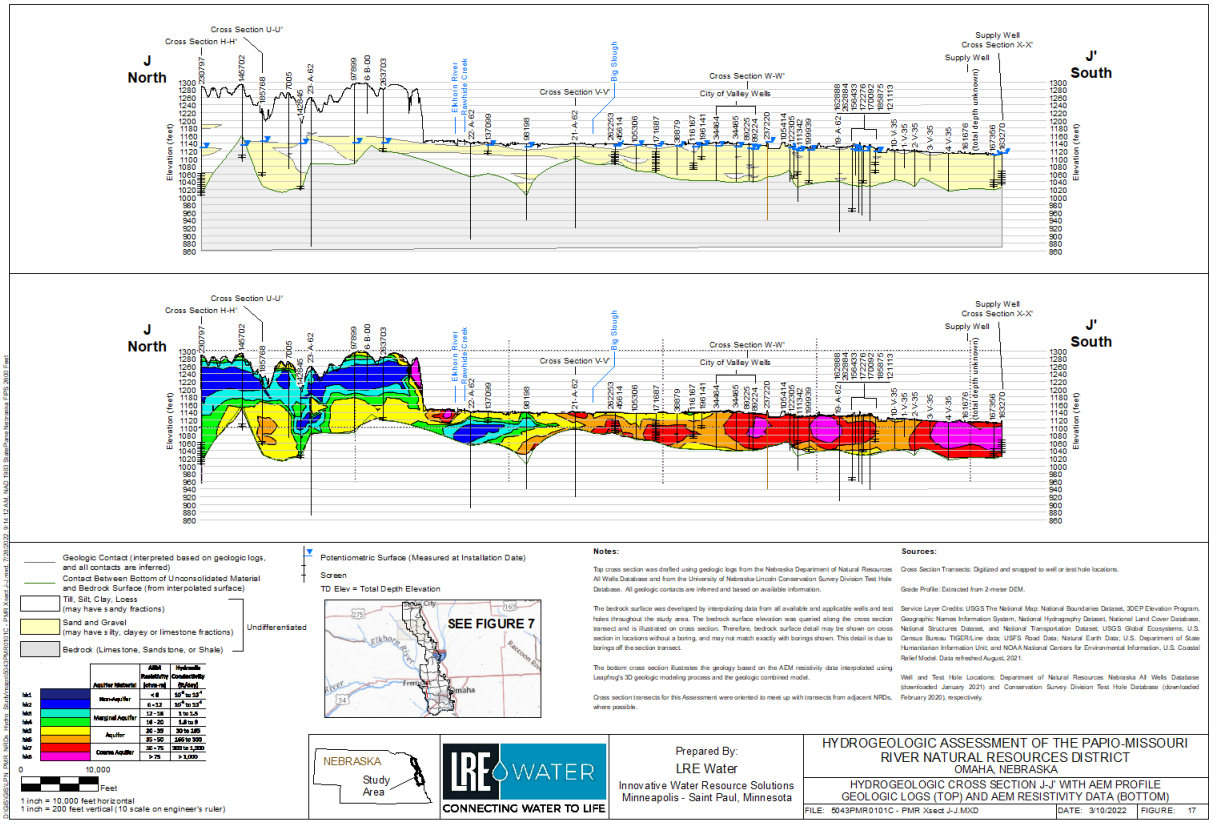

Figure 2 – Example of Cross Sections, Geologic (Top) and AEM (Bottom)

- Surficial alluvium will act as one aquifer (i.e., Principal Aquifer) with the Ogallala. As such, a surface will be created for the first encountered bedrock (below the Ogallala) that will be used to refine the Framework by creating two geologic model units in Leapfrog (unconsolidated/Ogallala and bedrock) to constrain the data analysis and for future MODFLOW discretization.
- Construct hydrogeologic cross sections in key locations across the BC Model domain to aid in developing the Framework and provide additional understanding for BC Model development.
- Given the limited availability of AEM across the potential BC Model domain, geologic data reported on well and test hole logs will be heavily utilized.
- The Framework will also be able to be viewed by LLNRD using the Leapfrog Viewer, a free viewer application. The Leapfrog Viewer file will include all AEM data (as boreholes), interpolated surfaces/volumes, DEM,

bedrock surface, well and test hole borehole lithology (e.g., sand, clay, bedrock), and a reference map.

- The goal in developing the Framework in Leapfrog is twofold:
  - To develop the conceptual model of the local hydrogeology using geologic logs and AEM data; and,
  - To construct a grid (i.e., series of rows, columns and layers that define a unique set of grid blocks or cells) for the development of the numerical groundwater flow Model in MODFLOW using Groundwater Vistas.
- Creation of a Potential Groundwater Recharge map based on the depth to the Principal Aquifer, unsaturated clay thickness, and depth of the unsaturated Principal Aquifer (unconfined). The map will help identify areas where recharge be more effective in areas where the overlying clay is located and where greater unsaturated material exists for storage. An example map is shown in Figure 3 and Attachment B.

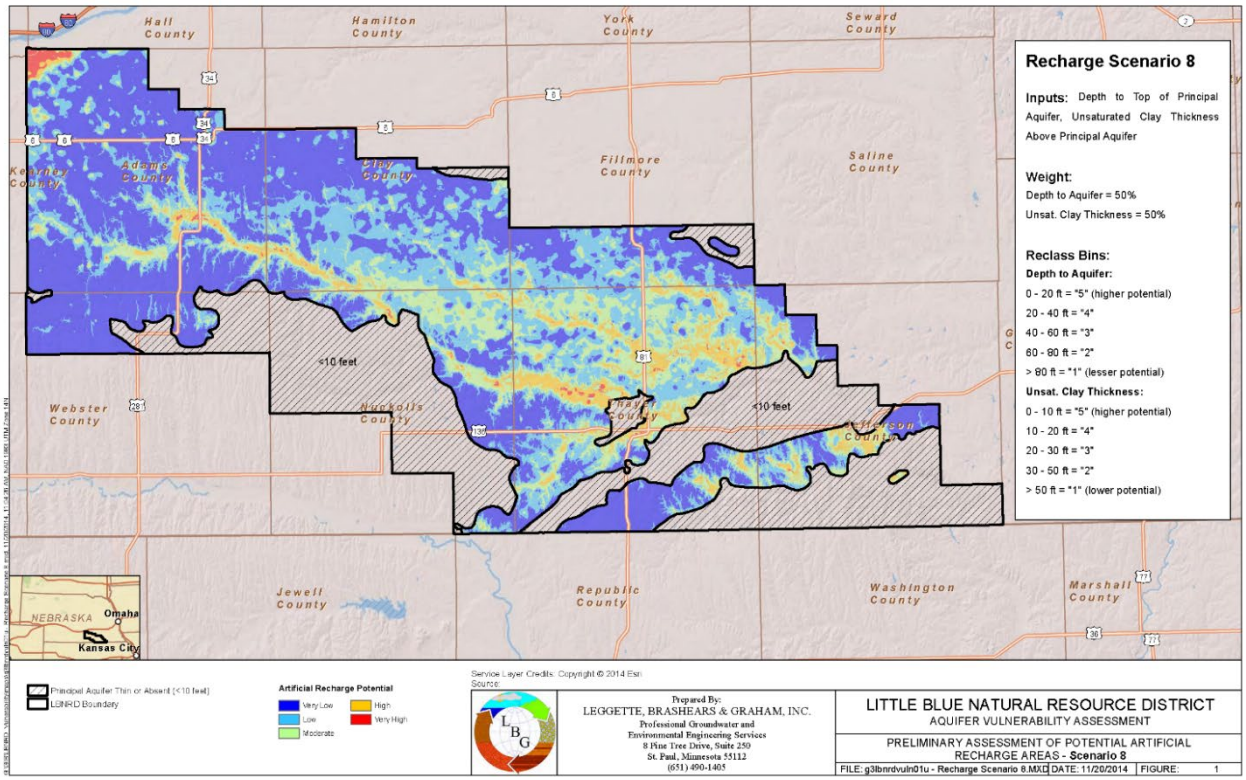

Figure 3 – Example Artificial Recharge Potential

3) Model Development and Reporting

- Includes construction of the conceptual model, flow model construction using MODFLOW-USG, and calibration.
- The BC Model will incorporate and combine conceptual information and research from the CENEB and ELM models including precipitation

recharge, canal recharge, groundwater pumping, underflow, and stream discharge.

- Define the aquifer extents, thicknesses, boundary conditions, model input parameters including hydraulic conductivity and storativity, recharge, and evapotranspiration based on project needs, data availability, and project efficiency.
- Boundary conditions and stream/river implementations via the MODFLOW River or Streamflow-Routing packages.
- Groundwater pumping estimates (both in total annual volumes and monthly pumping rates) are necessary for creating sufficient detail to analyze the relationships between precipitation, baseflow, groundwater pumping, and evaluation of new wells and/or artificial recharge.
- Obtain existing streamflow datasets and ensure that the model reasonably estimates streamflow based on existing published information.
- Incorporate existing aquifer pumping test results (if available) to provide data for aquifer parameters used to obtain model input values.
- As the BC Model is developed, the layering and hydrogeologic properties will be adjusted (calibrated) with information from the conceptual framework including estimates of aquifer and non-aquifer properties, observed water levels, and boundary conditions.
- Calibration data will be based on Nebraska state datasets, USGS datasets, and internal NRD datasets for water levels and baseflow.
- Conduct sensitivity, and uncertainty analyses to define data gaps, outlying data, and provide information on sensitive parameters for future research or that are sources of significant model uncertainty.
- Provide example model-run evaluations for drawdown and streamflow from potential new wells.
- Prepare a technical report summarizing the results of the modeling in terms of parameter estimates for hydraulic conductivity, streambed conductance values, and baseflow (groundwater flow to streams and rivers) estimates.
- This report will present the conclusions from our findings on the conceptual and numerical models, and provide recommendations based on the modeling results.

The project is anticipated to start in January 2023 and be completed early in 2024.

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

Field work will include a windshield survey of creeks, streams, and waterways to verify the presence or absence of surface water flow. This information will be used to determine which waterways, per the USGS National Hydrography Dataset (NHD), will be assigned as ‘drains’ in MODFLOW. The LLNRD will collect water levels from existing monitoring wells.

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).

N/A

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.

Groundwater models are proven technical resources to aid in water resource management, planning, and project implementation. Models have proven to be a cost-effective tool for the LLNRD. Currently, the LLNRD staff utilize the ELM and CENEB models to review stream depletion factors (SDF) and how new irrigated acres, transfers, modifications, and variances may affect SDF. The LLNRD is working to avoid further depletions to the South Loup River.

Based upon the available data, the BC Model will be mostly derived from geologic data. While AEM is present in the area, the model domain is not flown entirely with AEM at this time. The next best alternative would be to fly a substantial amount of AEM and then construct the model framework entirely on AEM.

3. Document all sources and report all **costs** and **benefit data** using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies is the project life. (Title 261, CH 2 - 005).

The project cost estimate for a $275,000 and includes a robust model that will feature a full temporal simulation of groundwater recharge. A breakdown of cost by task is shown in Table 3. The LLNRD obtained a cost estimate from LRE Water, a team to be led by a hydrogeologist licensed as a Professional Geologist in the State of Nebraska. The basis for the cost is generally associated with time and materials estimated to build and deliver the model along with supporting documentation.

Table 3 – Project Cost by Task

TASK	COST ESTIMATE
PM/Meetings	$ 30,000
3D Conceptual Framework	$ 90,000
Conceptual Model	$ 45,000
Flow Model Construction	$ 40,000
Calibration	$ 35,000
Deliverables	$ 35,000
Total	**$ 275,000**

There is no acceptable method to document the benefits. The BC Model will aid in the following:

- Help define the extent of groundwater declines.
- Provide a water balance.
- Locate potential water sources.
- Illustrate the relationship between declines and stream flow.
- Define the cost and benefits of potential structural and non-structural measures to achieve recharge and stream flow goals.
- Help identify specific areas where recharge or water resource projects will mitigate the declines, thus sustaining continued agricultural operations and supporting communities.
- Assist in evaluating how changes in regulations could benefit water levels and stream flow.

The project life is estimated at 20+ years, or longer, depending upon the availability of new geologic data. For example, if the LLNRD was to obtain additional AEM data within the model domain, an update of the model would be warranted.

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 to develop the BC Model is shown in Table 4. The LLNRD will be responsible for hiring a qualified consultant that specializes in hydrogeology and model development. The schedule is 12 months, assuming a notice to proceed of December 2022. The project life is estimated at 20+ years, or longer, depending upon the availability of new geologic data or similar data.

Table 4 – Project Cost by Task

TASK	COST ESTIMATE
PM/Meetings	$ 30,000
3D Conceptual Framework	$ 90,000
Conceptual Model	$ 45,000
Flow Model Construction	$ 40,000
Calibration	$ 35,000
Deliverables	$ 35,000
Total	**$ 275,000**

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).

The purpose of the proposed BC Model is to provide the LLNRD with a refined numerical groundwater model to assist the LLNRD with evaluating:

1) The potential benefits of artificial recharge projects to increase aquifer storage and provide additional baseflow to area steams.
2) The effects on groundwater levels and/or stream flow resulting from changes in the number of existing and future irrigation wells.
3) Strategies for conjunctive management of groundwater and surface water.
4) Groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments.

This is in line with Goal#1 of the LLNRD Voluntary Integrated Management Plan (IMP), “develop and implement water management policies and practices that could potentially provide for additional water resources development opportunities while protecting existing surface and groundwater uses.” The first major action to work towards achieving this goal is development of a locally refined groundwater model.

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 annual cash flow, for purposes of developing a groundwater model, are considered the total of all expenses necessary to create a successful tool to meet project goals.

The project cost is displayed in Table 5 based upon the WSF requested amount and LLNRD's local allocation in the FY2023 budget. The project benefits generally include the following:

- Help define the extent of groundwater declines.
- Provide a water balance.
- Locate potential water sources.
- Illustrate the relationship between declines and stream flow.
- Define the cost and benefits of potential structural and non-structural measures to achieve recharge and stream flow goals.
- Help identify specific areas where recharge or water resource projects will mitigate the declines, thus sustaining continued agricultural operations and supporting communities.
- Assist in evaluating how changes in regulations could benefit water levels and stream flow.

Table 5 – Project Cost by Task

TASK	COST ESTIMATE
PM/Meetings	$ 30,000
3D Conceptual Framework	$ 90,000
Conceptual Model	$ 45,000
Flow Model Construction	$ 40,000
Calibration	$ 35,000
Deliverables	$ 35,000
Total	**$ 275,000**

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.)

The project creates the BC Model, a tool that will guide decisions ultimately on projects that will increase water sustainability or evaluation of how regulation would affect water levels and streamflow. The next best alternative is to build a model based on a 3D AEM Framework, which would be substantially more expensive than using data on hand and readily available for use.

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.

   A letter of support and financial assurance has been provided in Attachment A – Letter of Support. In July 2022, the LLNRD Board has budgeted cash to match the project.

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

   There is sufficient annual revenue within the LLNRD's annual budget, specifically property tax revenues obtained by the district allowable through state law. Last Fiscal Year (2022), the LLNRD had a property tax request at 0.030786 cents per $100 of valuation resulting in $5,026,444.61 from property taxes, and a total operating budget of $19,655,782.02.

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

   No loan will be requested.

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

   The study identifies work that was conducted using AEM, which is a not intrusive way to identify aquifer layering and categorize material below the substrate.

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

   In 1972, NRDs were granted statutory authority (2-3229) by the Nebraska Legislature to receive local property taxing authority to carry out the development, protection, and management of the resources in their respective areas.

   The Nebraska Groundwater Management and Protection Act, Chapter 46, Article 7, outlines responsibilities of NRDs and their duties to management groundwater.

   On May 9, 2016, the LLNRD and NeDNR signed the voluntary IMP written jointly by the two agencies. The LLNRD staff and Board have taken a proactive approach to the protection of interconnected water resources.

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

The BC Model supports goals, objectives, and action items related to sustainable water management, recognition and identification of connected groundwater and surface water, water quality goals, and others, all within the following local and state-coordinated plans:

- IMP, effective May 2016
- Lower Platte River Basin Coalition's (LPRBC) Basinwide Water Management Plan, 2017
- Master Plan, effective 2012-2022
- Groundwater Management Plan, effective 1985
- South Loup Watershed Management Plan, 2017

LLNRD Voluntary IMP

Goal #2 – "Implement this water management plan to maintain an efficient and economical balance between current and future water supplies and demands".

- Will aid in identifying opportunities to augment water supplies within the district (Objective 2.1).
- Provides an evaluation for the potential for conjunctive management programs or project opportunities (Action Item 2.1.1).
- Contributes to the ability to evaluate potential for additional groundwater and surface water storage within the District to bank future water supplies (Action Item 2.3.2).

Goal #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".

- Assist with review and analysis of storage opportunities (Action Item 3.1.1 and 3.1.2).

LPRBC Basinwide Plan

Goal #1 – "Develop and maintain a water supply and use inventory based on the best available data and analysis".

- The BC Model will produce a water balance that will help the LLNRD and its partners better understand the inflows/outflows of the South Loup River basin in relation to the decline area of Buffalo County (Objective 1.1, 1.4).
- The project supports Action Item 1.1.C, to identify locations where additional gaging data or further study/modeling would reduce uncertainty in basinwide water inventory.

Goal #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.”

- The project will evaluate the potential to store and recharge water in areas experience groundwater declines.
- Public education will be critical to encourage conservation measures to reduce water consumption as stand-alone solution, or to compliment other large-scale structural solutions.

LLNRD Master Plan

Goal #2 – “Development and management of groundwater and surface water for beneficial uses”

- The BC Model will aid to protect and utilize the water supply for beneficial use by agriculture, municipalities, domestic, and industrial users.
- Will track the interconnection of groundwater and surface water in the model focus area and address integrated water management.

Goal #3 – “Resource awareness”

- The project will provide vast amounts of highly visual information to share with communities, agricultural producers, NeDNR, Nebraska Department of Environment and Energy (NDEE), and other stakeholders on the extent of the decline issue and potential solutions.
- The project includes close coordination with CPNRD, NeDNR, and other stakeholders on identification of management challenges and potential solutions.

LLNRD GWMP

Quantity Goal – “It shall be the goal of the LLNRD to maintain a perpetual source of groundwater for all uses – domestic, agricultural, and industrial”.

- The project’s primary goal is to maintain adequate groundwater quantity to maintain agricultural and community uses without adverse impacts to stream flows.

South Loup Watershed Management Plan

Goal #1 – “The ecological condition of the South Loup River watershed will be enhanced through a comprehensive and collaborative program that efficiently and effectively implements actions to restore and protect natural resources from degradation and impairment”

- The project will help analyze project alternatives that may result in increased baseflow to the South Loup River and/or its tributaries.

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

If yes:

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

N/A

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

N/A

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

N/A

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

In 1972, NRDs were granted statutory authority (2-3229) by the Nebraska Legislature to receive local property taxing authority to carry out the development, protection, and management of the resources in their respective areas.

The Nebraska Groundwater Management and Protection Act, Chapter 46, Article 7, outlines responsibilities of NRDs and their duties to management groundwater.

On May 9, 2016, the LLNRD and NeDNR signed the voluntary IMP written jointly by the two agencies. The LLNRD staff and Board have taken a proactive approach to the protection of interconnected water resources.

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.

   The BC Model has a secondary benefit, beyond identification of groundwater decline issues and feasibility of potential solutions, that can help LLNRD, NDEE, and others working on addressing nitrate issues and to more accurately delineate

wellhead protection areas. The BC Model can be used to accurately identify groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments. Nitrate levels are elevated within the 'model focus area' as seen in Figure 4 and Attachment B.

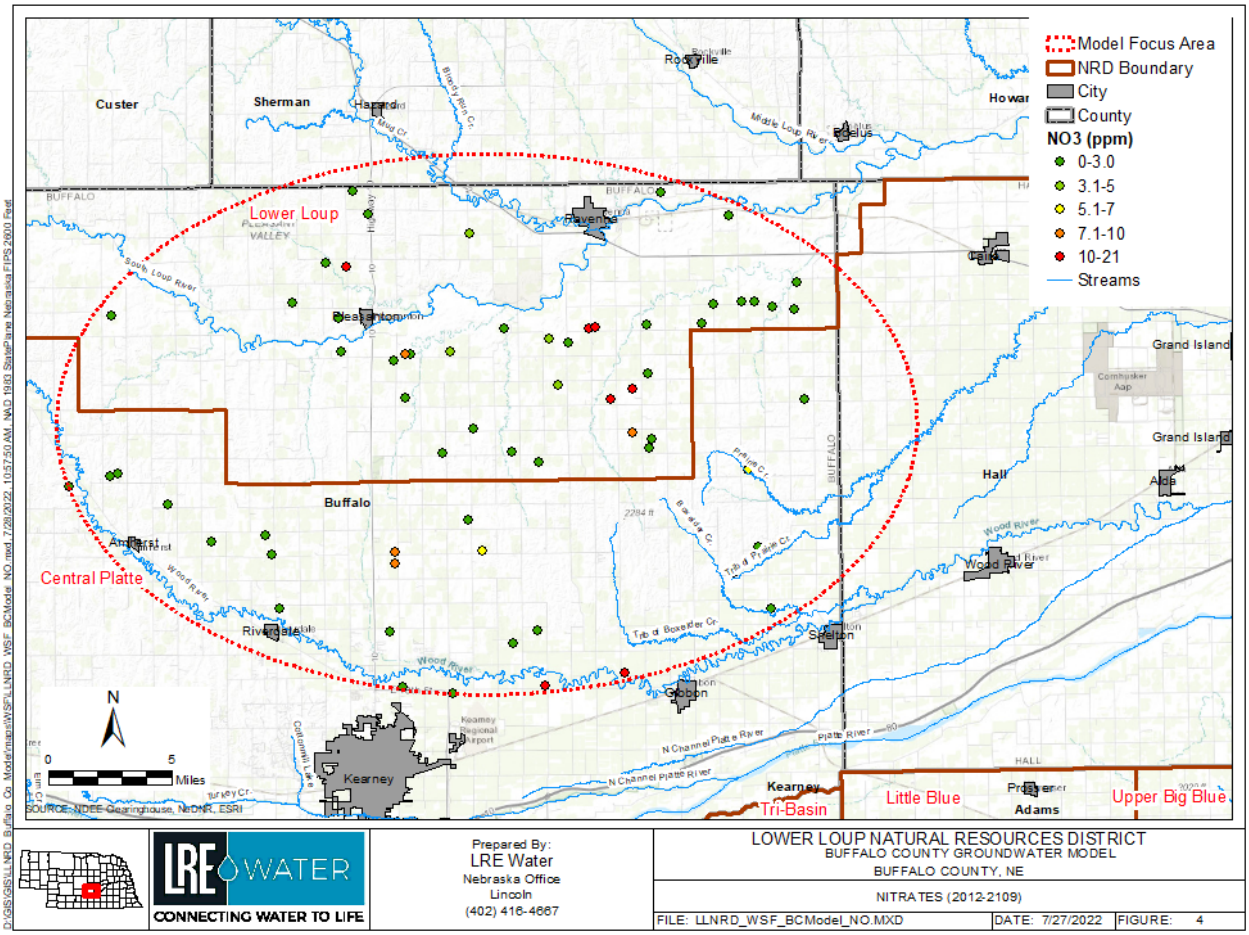

Figure 4 – Nitrate Concentrations within the Focus Model Area

Furthermore, the BC Model can be used to site new wells and provide a more accurate representation of groundwater flow paths than regional models, or other model types used by NDEE in the past.

The model grid size for most of the BC Model domain will be approximately 1,000 by 1,000 feet. The model grid size will be refined much smaller, referred to as an unstructured grid (USG), around sensitive areas such as waterways and within the 'model focus area' where model grid cells may be approximately 100 x 100 feet or less.

Once constructed and calibrated, the BC Model can be easily refined in the future in other places also, such as around public water supply areas. Figure 5,

also shown in Attachment B, shows an example where the Lower Platte – Missouri Tributaries (LPMT) regional model was used to create a sub-area model in 2021. This model (Wahoo – David City Model) was then further refined around community wellfields, to model cells approximately 100 x 100 feet, to delineate new wellhead protection areas.

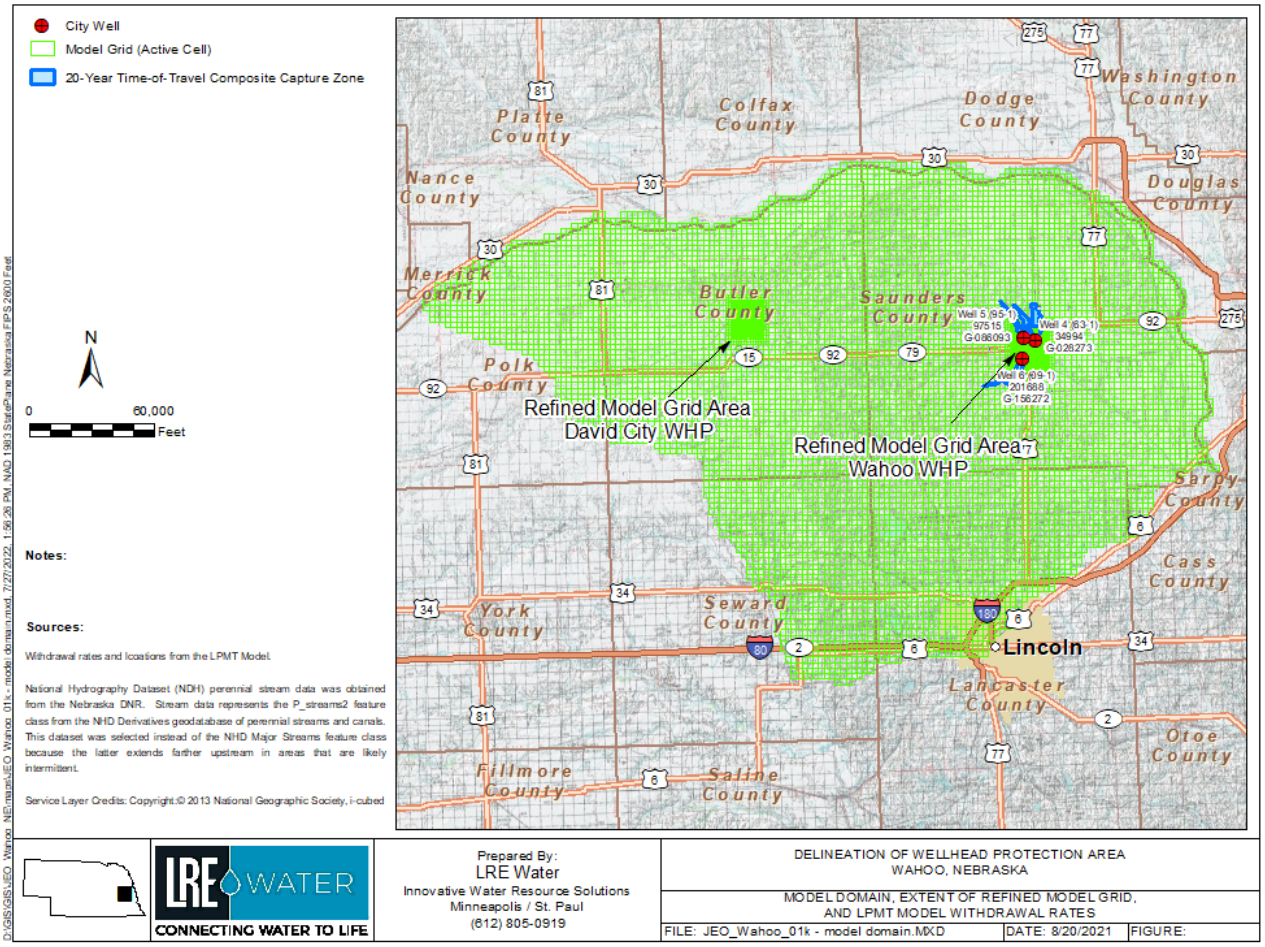

Figure 5 – Example of Regional Model Refinement

The 'model focus area', which is the priority of the LLNRD for addressing declines, includes the communities of Pleasanton, Ravenna, Amherst, and Riverdale. The full model domain, which is intentionally designed to be substantially larger than the focus area, includes a total of 45 communities that could potentially benefit from BC Model in the future.

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

   - Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.
   - Provide the history of work completed to achieve the goals of this plan.

- List which goals and objectives of the management plan the project provides benefits for and how the project provides those benefits.

The BC Model supports goals, objectives, and action items related to sustainable water management, recognition and identification of connected groundwater and surface water, water quality goals, and others, all within the following local and state-coordinated plans:

- Integrated Management Plan (IMP), effective May 2016
- Master Plan, effective 2012-2022
- Groundwater Management Plan, effective 1985
- South Loup Watershed Management Plan, 2017

LLNRD Voluntary IMP

Goal #2 – "Implement this water management plan to maintain an efficient and economical balance between current and future water supplies and demands".

- Will aid in identifying opportunities to augment water supplies within the district (Objective 2.1).
- Provides an evaluation for the potential for conjunctive management programs or project opportunities (Action Item 2.1.1)
- Contributes to the ability to evaluate potential for additional groundwater and surface water storage within the District to bank future water supplies (Action Item 2.3.2)

Goal #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".

- Assist with review and analysis of storage opportunities (Action Item 3.1.1 and 3.1.2)

LPRBC Basinwide Plan

Goal #1 – "Develop and maintain a water supply and use inventory based on the best available data and analysis".

- The BC Model will produce a water balance that will help the LLNRD and its partners better understand the inflows/outflows of the South Loup River basin in relation to the decline area of Buffalo County (Objective 1.1, 1.4).
- The project supports Action Item 1.1.C, to identify locations where additional gaging data or further study/modeling would reduce uncertainty in basinwide water inventory.

Goal #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.”

- The project will evaluate the potential to store and recharge water in areas experience groundwater declines.
- Public education will be critical to encourage conservation measures to reduce water consumption as stand-alone solution, or to compliment other large-scale structural solutions.

LLNRD Master Plan

Goal #2 – “Development and management of groundwater and surface water for beneficial uses”

- The BC Model will aid to protect and utilize the water supply for beneficial use by agriculture, municipalities, domestic and industrial users.
- Will track the interconnection of groundwater and surface water in the model focus area and address integrated water management.

Goal #3 – “Resource awareness”

- The project will provide vast amounts of highly visual information to share with communities, agricultural producers, NeDNR, Nebraska Department of Environment and Energy (NDEE), and other stakeholders on the extent of the decline issue and potential solutions.
- The project includes close coordination with CPNRD, NeDNR, and other stakeholders on identification of management challenges and potential solutions.

LLNRD GWMP

Quantity Goal – “It shall be the goal of the LLNRD to maintain a perpetual source of groundwater for all uses – domestic, agricultural, and industrial”.

- The project’s primary goal is to maintain adequate groundwater quantity to maintain agricultural and community uses without adverse impacts to stream flows.

South Loup Watershed Management Plan

Goal #1 – “The ecological condition of the South Loup River watershed will be enhanced through a comprehensive and collaborative program that efficiently and effectively implements actions to restore and protect natural resources from degradation and impairment”

- The project will help analyze project alternatives that may result in increased baseflow to the South Loup River and/or its tributaries.

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

   List the following information that is applicable:

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

   The need for increasing aquifer recharge, reducing depletion, and increasing streamflow has been clearly identified by LLNRD and UNL CSD. Groundwater declines have been identified by the LLNRD through their static water level monitoring as reported in the State Water Level Report, 2022. Figure 6 (also provided in Attachment B) shows the area with significant declines in the project area. According to information provided by UNL CSD, since pre-development of irrigation, the are has experienced declines of -30 to -40 feet (Figure 7 and Attachment B).

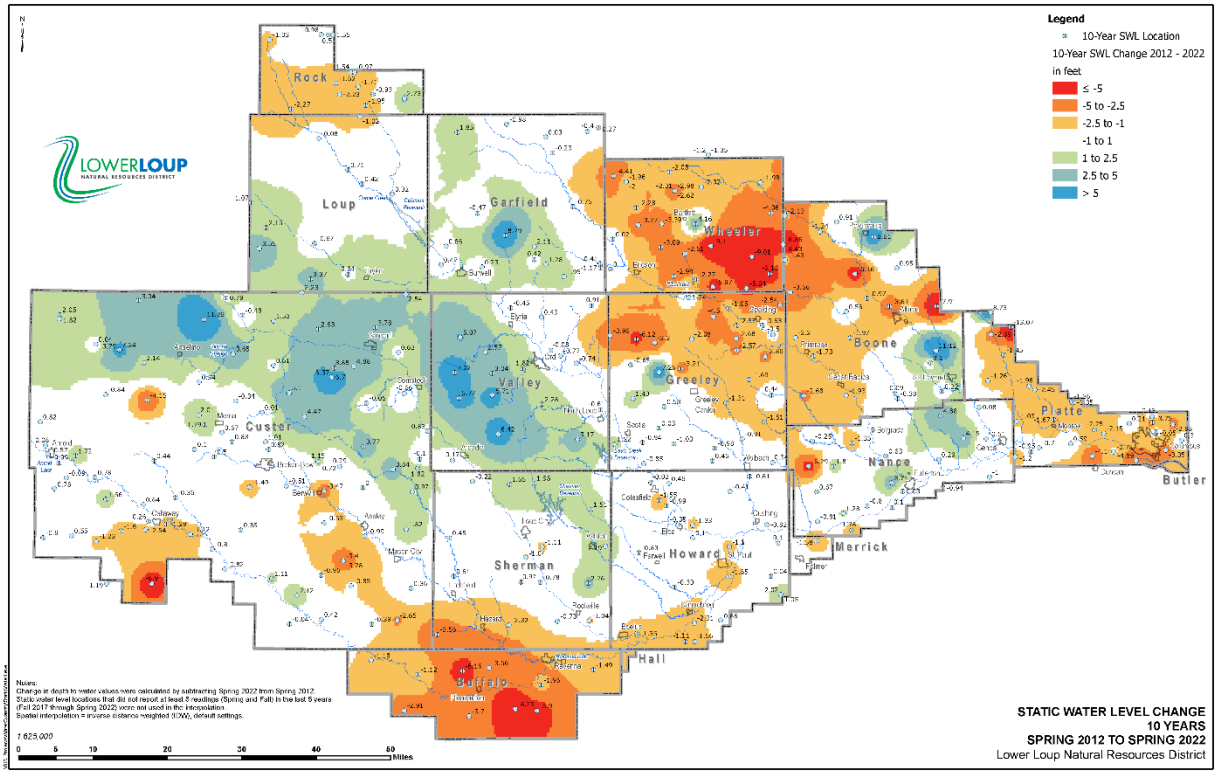

Figure 6 – Static Water Level Changes Spring 2012 to Spring 2022 (LLNRD)

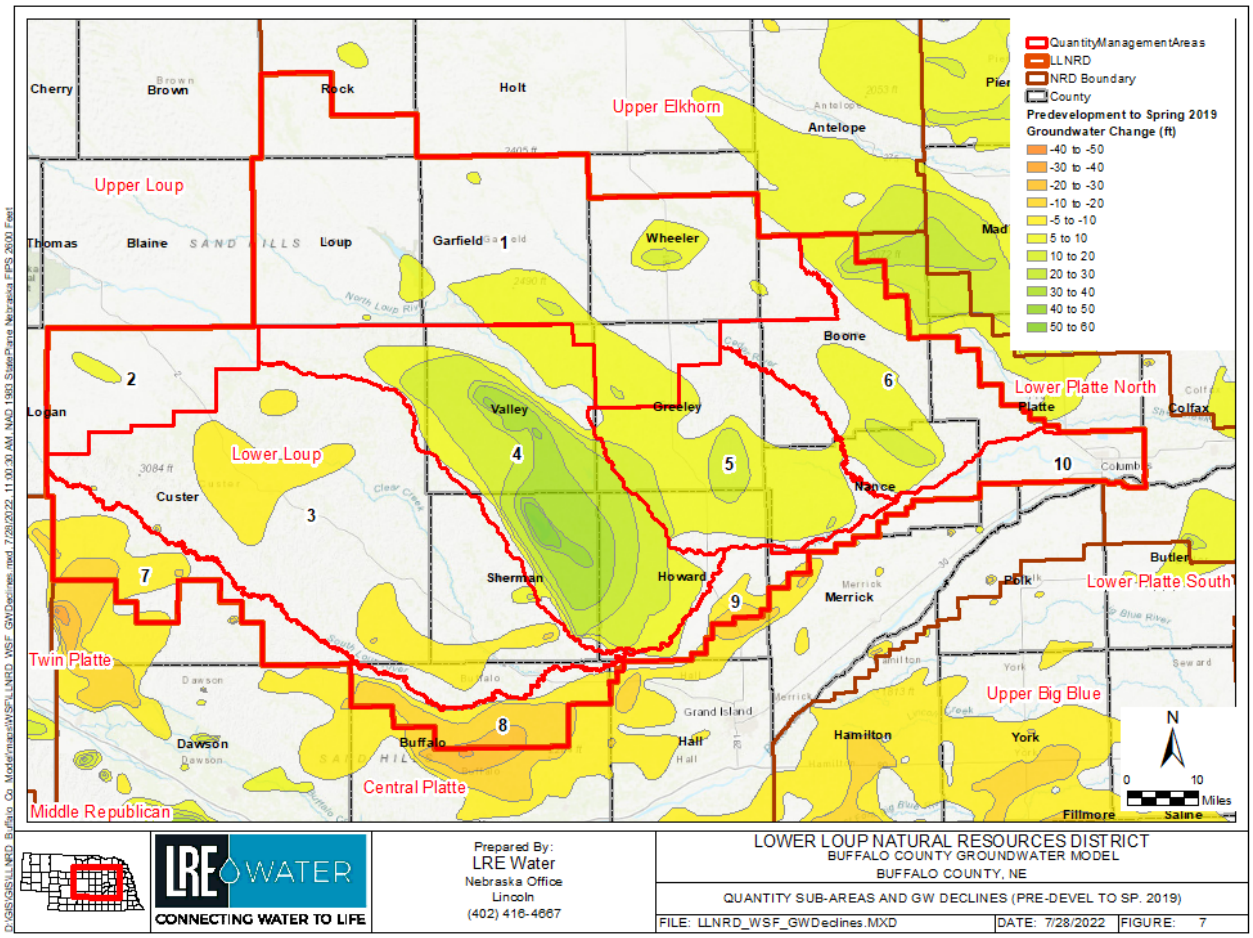

Figure 7 – Static Water Level Changes Pre-Dev. to Spring 2019 (UNL CSD)

The main purpose of creating the BC Model is to provide the LLNRD staff and Board a tool to evaluate the benefits of structural and non-structural actions intended to increase aquifer recharge, reduce depletion, and to increase streamflow. Once complete, the model will help evaluate:

- The potential benefits of artificial recharge projects to increase aquifer storage and provide additional baseflow to area steams.
- The effects on groundwater levels and/or stream flow resulting from changes in the number of existing and future irrigation wells.
- Strategies for conjunctive management of groundwater and surface water.
- Groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments.
- Assist in evaluating how changes in regulations could benefit water levels and stream flow.

The ‘model focus area’, totaling 386,000 acres, is shown in Figure 8 (also provided in Attachment B), along with the full model domain. The domain will

encompass areas beyond the focus area including all of Buffalo County and all or portions of the counties that are immediately adjacent to Buffalo County. The size of the domain will be selected based on the major hydraulic and hydrogeologic boundary conditions and stresses that could influence water level declines centered in Buffalo County.

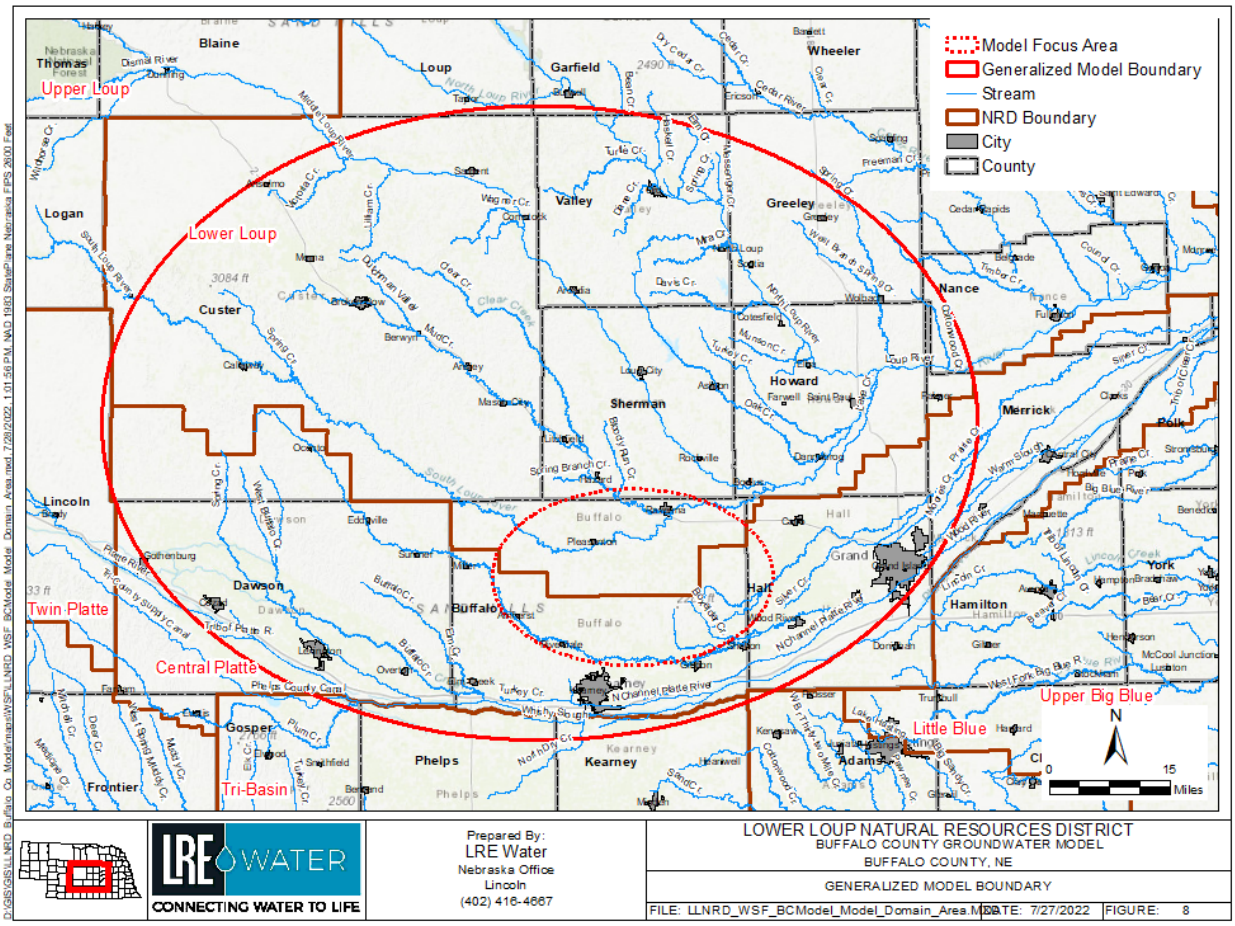

Figure 8 – Model Focus Area and Potential Model Domain

One type of project that could be considered, and evaluated within the BC Model, is Managed Aquifer Recharge (MAR). MAR could be a viable option to consider for managing water rights and in-stream flows, the timing of water supply availability, water quality, and well yields. Free river, existing water rights, or treated effluent could be recharged into the alluvial aquifers within the decline areas for augmentation of river flows, increasing groundwater levels, or short-term storage and retiming of excess water supplies. The water rights, regulations, location, and operations of MAR would require careful evaluation; however, many MAR projects across the Midwest and West have demonstrated that the challenges can be addressed to maximize the benefits of water supplies.

Project such as MAR, or other options such as dams, weirs, and use of natural infrastructure such as oxbow reconnections, will be selected using tools from the Framework, one of the first steps to building a model. The Framework will produce multiple hydrogeologic cross sections (see example, Figure 9 and Attachment B) as well as a map produced to identify areas with the most likely chance to recharge groundwater (see example in Figure 10 and Attachment B). These tools, in addition to the BC Model, will be used to evaluate cost-effective locations for projects to move forward.

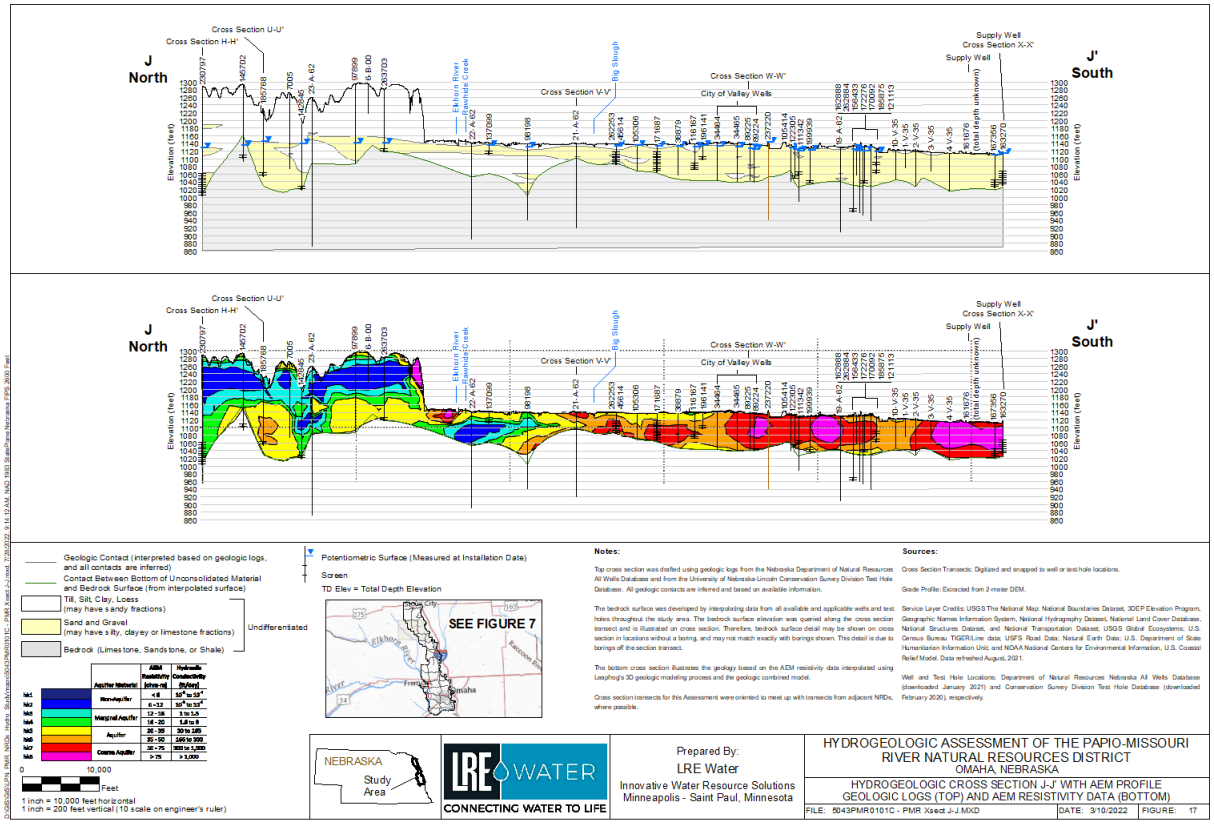

Figure 9 – Example of Cross Sections, Geologic (Top) and AEM (Bottom)

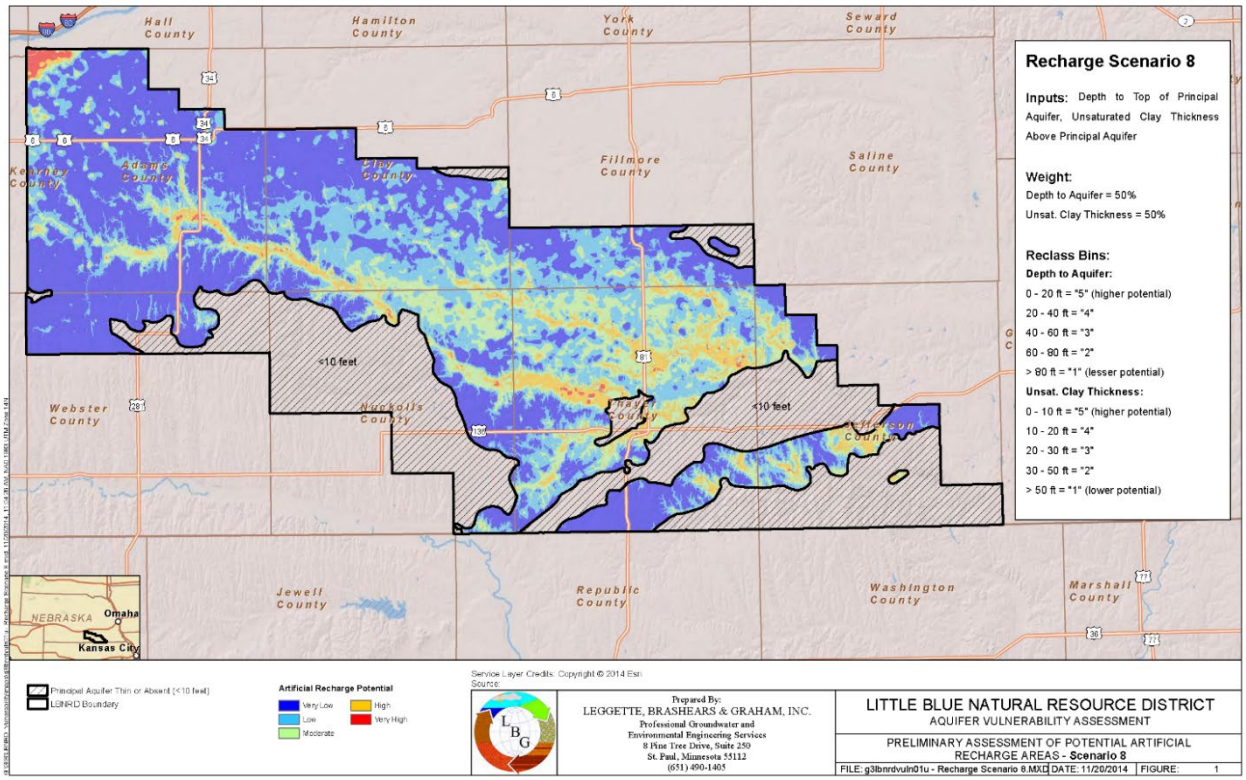

Figure 10 – Example Artificial Recharge Potential

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.

   Since 1943, the USGS stream gage at St. Michael on the South Loup River has shown a flow decrease of approximately one-foot, which when considering the steady-flow nature of this Sandhills fed stream, is a considerable amount of water over time (Figure 11). Conservation of this critical water resources is a priority of LLNRD, NeDNR, and downstream water users.

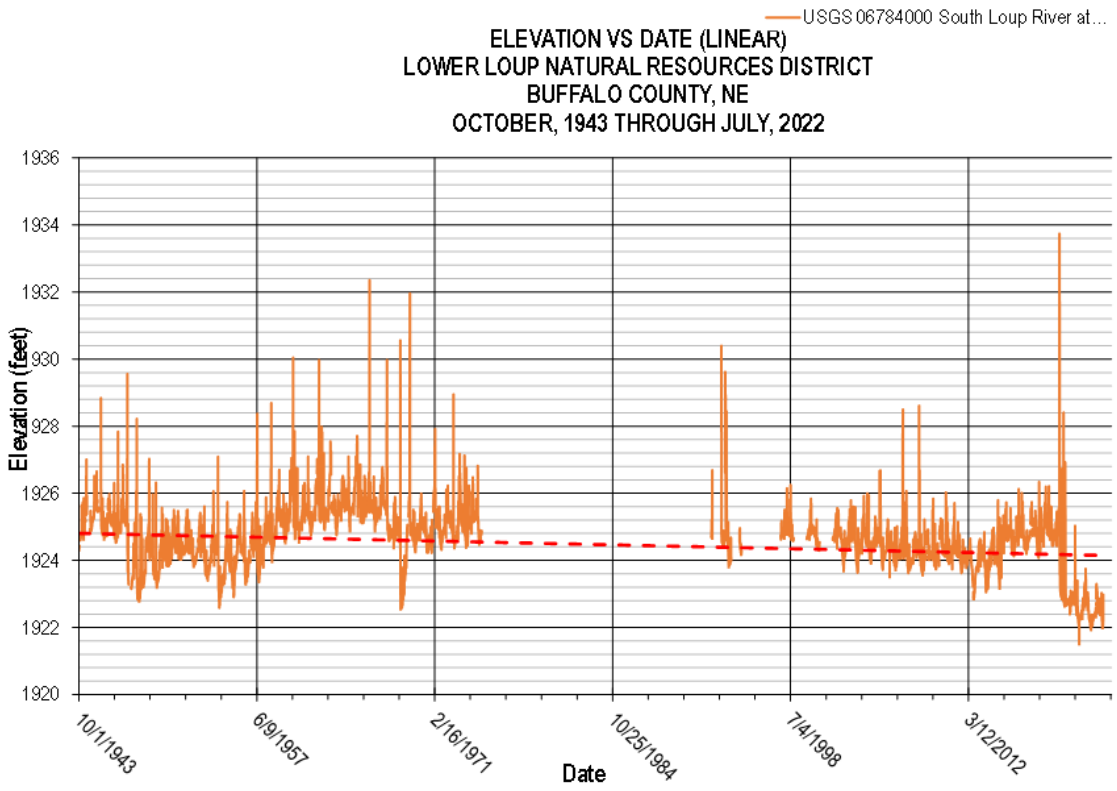

Figure 11 – Long-term Flow Trend, South Loup River @ St. Michael (USGS)

In addition to the AEM flown in 2019 to obtain data within the project area, the LLNRD has also completed two studies to help identify recharge project opportunities in the South Loup River basin, most of which would provide wildlife habitat, conservation opportunities, and preservation of resources. One, completed in 2018, included a preliminary investigation of potential recharge and retiming structures along the river. The second, completed in 2019, identified potential recharge sites in the Ravenna area (see Figure 12 and Attachment B).

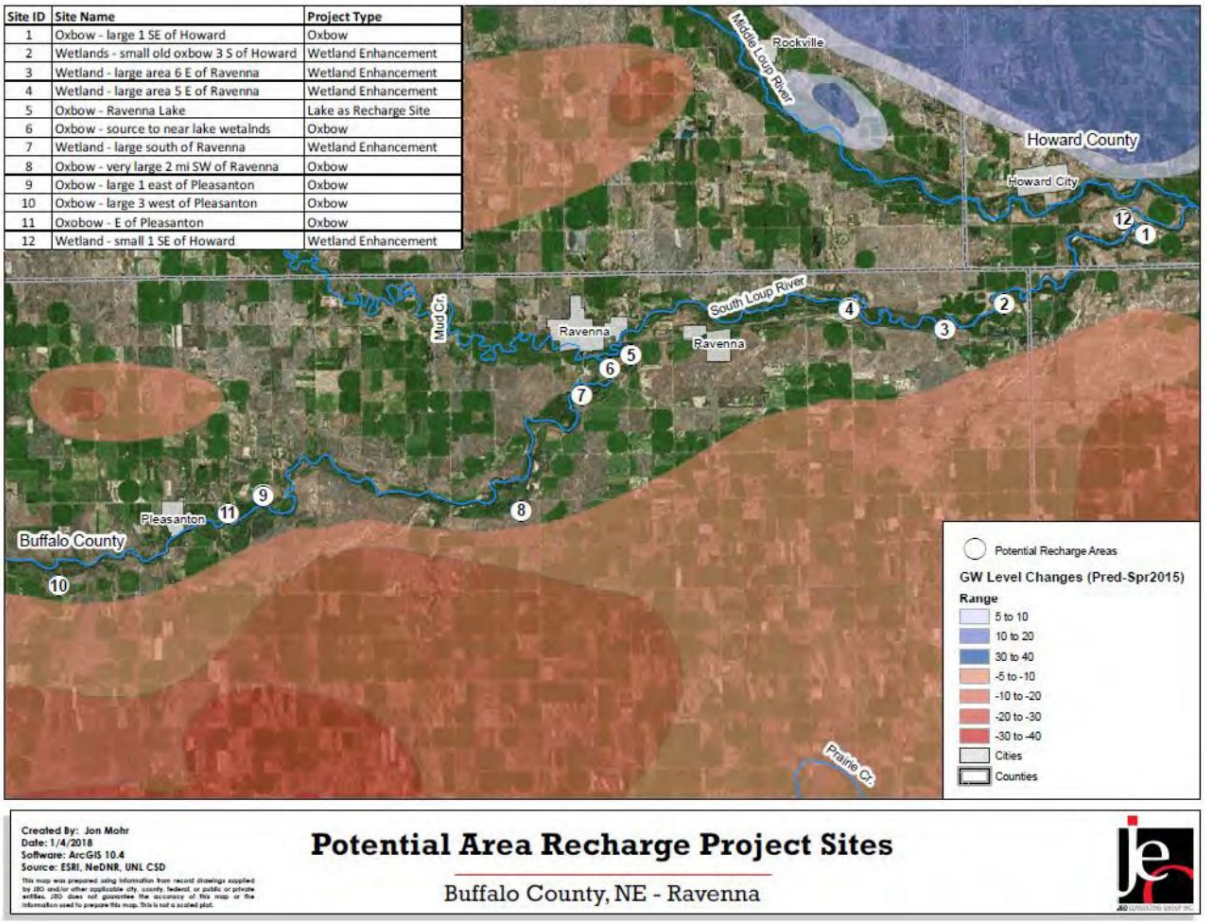

Figure 12 – Potential Recharge Project Sites near Ravenna

The BC Model will be a critical tool for the LLNRD to meeting multiple goals and moving ahead with project concepts that have been previously identified. Model benefits include:

- Addressing declining groundwater levels – areas of southern Buffalo County and surrounding areas are experiencing significant groundwater declines. The BC Model will evaluate potential benefits of artificial recharge projects to increase aquifer storage and provide additional baseflow to area steams.
- Increasing stream baseflow – the South Loup River and Wood River are experienced declines in baseflow as a result of declining groundwater levels. The BC model will evaluate the effects on groundwater levels and/or stream flow resulting from changes in the number of existing and future irrigation wells.
- Water quality – the 'model focus area' is experiencing rising nitrate levels. The BC Model will evaluate groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments.

- Sustaining the agricultural economy - The LLNRD staff and Board is committed to finding solutions that reverse the declining trend, while increasing baseflow, and ensuring agricultural producers can continue to irrigate and support the regional and state economy.

The LLNRD has used groundwater models successfully to identify the extent of decline issues, and to identify solutions, in the past, including the recently constructed Columbus Recharge Project. The LLNRD had observed area water levels near Columbus were falling from 2010 to 2014. That was having impacts on area irrigation, commercial, and municipal wells.

The LLNRD is charged with maintaining water resources and, rather than utilizing regulatory authority over area water users, the LLNRD opted for a recharge project to augment groundwater back into the area. The LLNRD conducted a multi-year study starting in 2014 to determine a water budget for the area, to characterize the geology and hydrology within the study area, and to evaluate possible solutions for providing recharge to the area based on the availability of various water sources. In 2022, The LLNRD began operation of the Columbus Recharge Project. The BC Model will now be the next opportunity to seek similar success in recharging the declining aquifer in the Buffalo County area.

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

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

The Ogallala Aquifer is the single most important water source in the Great Plains and is critical to the state's economy. The Aquifer provides sufficient groundwater for irrigation and domestic water supply, two primary beneficial uses, but if mismanaged, could be overused, causing significant groundwater declines. This is the case in the Buffalo County area, and portions of LLNRD's Groundwater Quantity Management Sub-Areas 3, 7, and 8.

At the statewide level, the benefit to residents is sustaining the agricultural economy. According to UNL (Nebraska Today, IANR Media, October 2020), agriculture is a critical component of Nebraska's economy, accounting for nearly 34% of business sales and nearly a quarter of all jobs. Irrigation, mostly of which is sourced from groundwater in the 'model focus area', is critical to maintain a strong agricultural economy. Mismanagement of groundwater resources can lead to regulations on groundwater pumping, limiting the ability of a private property owners' abilities to beneficially use the groundwater resources beneath their property.

The LLNRD staff and Board is committed to finding solutions that reverse the declining groundwater level trend, while increasing baseflow, and ensuring agricultural producers can continue to irrigate and support the regional and state economy. The staff have engaged with producers in the Buffalo County area through the work to write the South Loup Watershed Management Plan in 2017. Producers have been made aware of the declining aquifers and reduced flows in the river.

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 first major action was to fly AEM survey in the area, generally around the Ravena area. In 2019, 360 square miles was flown, supported by the WSF, to obtain data that would provide an understanding of the hydrogeology of the area. With the AEM available, the LLNRD is ready to move ahead with the development of a locally refined groundwater model, maximizing the investment in AEM.

The LLNRD has completed two studies to help identify recharge project opportunities in the South Loup River basin. One, completed in 2018, included a preliminary investigation of potential recharge and retiming structures along the river. The second, completed in 2019, identified potential recharge sites in the Ravenna area. The cost-effectiveness of the BC Model is enhanced by the fact that the LLNRD has already invested resources in understand the extent of the issue and a planning level review of potential opportunities (see Figure 13 and Attachment B).

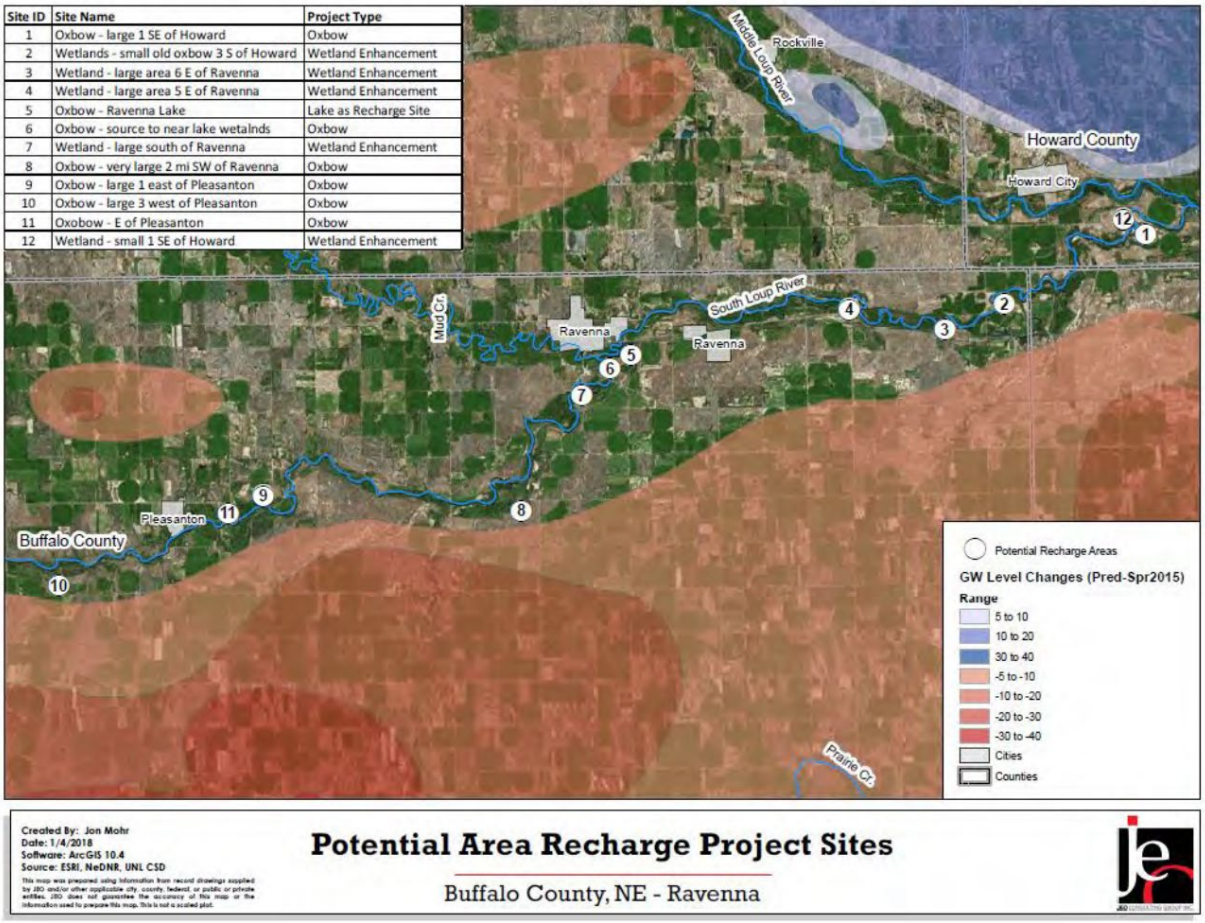

Figure 13 – Potential Recharge Project Sites near Ravenna

Models have proven to be a cost-effective tool for the LLNRD. Currently, the LLNRD staff utilize the ELM and CENEB models to review stream depletion factors (SDF) and how new irrigated acres, transfers, modifications, and variances may affect SDF. The LLNRD is working to avoid further depletions to the South Loup River.

The LLNRD also has used groundwater models successfully to identify the extent of decline issues, and to identify solutions, in the past, including the recently constructed Columbus Recharge Project. The LLNRD had observed area water levels near Columbus were falling from 2010 to 2014. That was having impacts on area irrigation, commercial, and municipal wells. The LLNRD is charged with maintaining water resources and, rather than utilizing regulatory authority over area water users, the LLNRD opted for a recharge project to augment groundwater back into the area. This project reduced the risk to agricultural producers that faced potential regulations such as pumping allocations.

In 2022, the LLNRD began operation of the Columbus Recharge Project. The BC Model will now be the tool to seek similar opportunities for success in recharging the aquifer in the Buffalo County area.

The BC Model project cost is based on resources necessary for a qualified hydrogeologic consultant to build the BC Model. Project cost, summarized by task, along with a summary of the schedule, is shown in Table 6.

Table 6 – Cost Breakdown by Task and Schedule

TASK	COST ESTIMATE	SCHEDULE	
		Start	End
PM/Meetings	$ 30,000	January 2023	January 2024
3D Conceptual Framework	$ 90,000	January 2023	April 2023
Conceptual Model	$ 45,000	March 2023	July 2023
Flow Model Construction	$ 40,000	June 2023	August 2023
Calibration	$ 35,000	September 2023	October 2023
Deliverables	$ 35,000	November 2023	January 2024
Total	**$ 275,000**		

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.

There are state agreements initiated between the LLNRD and NeDNR. In 2016, the LLNRD and NeDNR worked collaboratively to produce a Voluntary IMP. The IMP directs LLNRD and NeDNR, and supporting partners, to allow groundwater and surface water to be managed conjunctively. A goal of the IMP is to “Develop and implement water use policies and practices that prioritize and contribute to the protection of existing surface and groundwater uses while allowing for future water development” with the objective to “Identify available water storage opportunities throughout the LLNRD” which includes groundwater recharge with aquifer storage.

The BC Model would help evaluate potential projects that would induce artificial aquifer recharge to protect current groundwater and surface water uses and could allow for sustaining existing, and potentially adding additional development in the future.

The major resource deficiency in the project area is groundwater declines. For several decades, groundwater levels have been dropping, raising concerns for the LLNRD staff and Board. The LLNRD Static Water Level Report, 2022 identifies resource deficiencies in the Buffalo County Area (see Figure 14).

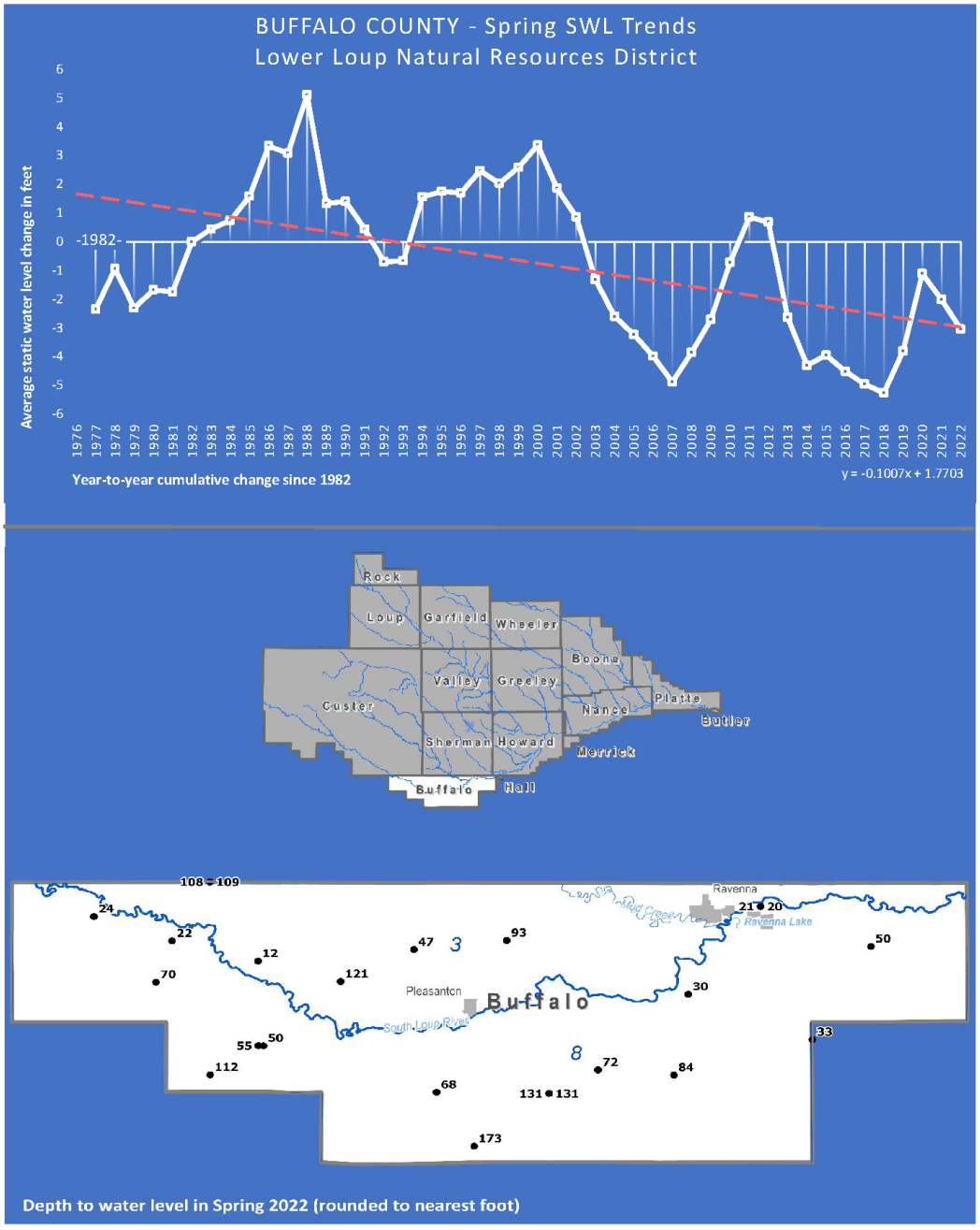

Figure 14 – Buffalo County Spring Static Water Level Trends (LLNRD)

The groundwater declines, based upon UNL CSD data, for pre-development compared to 2019 levels, are shown in Figure 15 (also shown in Attachment B) along with the 'model focus area'.

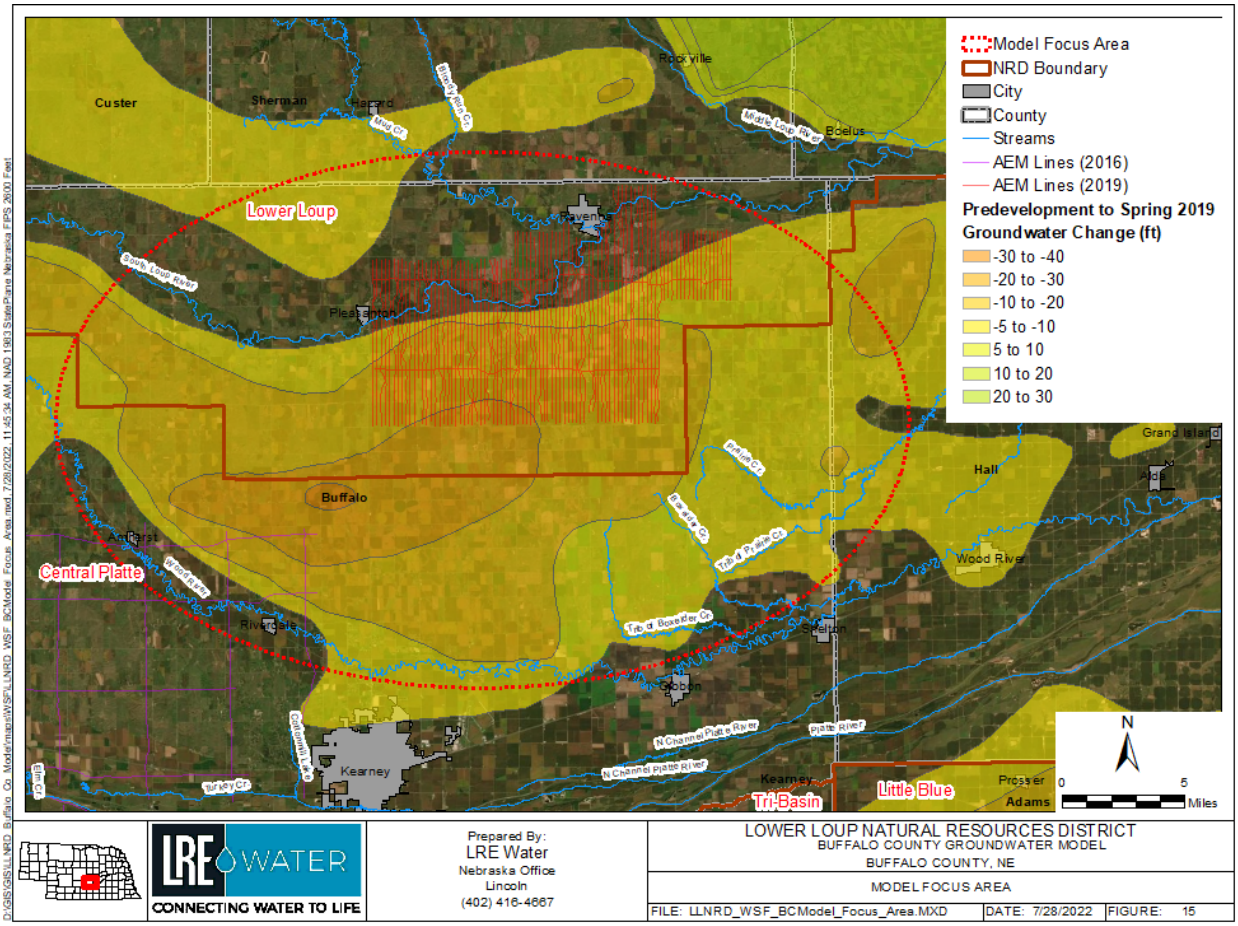

Figure 15 – Model Focus Area and Groundwater Declines (UNL CSD)

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.

A considerable threat to the value of property, and personal income, is a lack of groundwater to sustain irrigation on row crop agriculture in Nebraska. According to UNL (Nebraska Today, IANR Media, October 2020), agriculture is a critical component of Nebraska's economy, accounting for nearly 34% of business sales and nearly a quarter of all jobs. Irrigation, mostly of which is sourced from groundwater, is critical to maintain a strong agricultural economy. Mismanagement of groundwater resources can lead to regulations on groundwater pumping, limiting the ability of a private property owners' abilities to beneficially use the groundwater resources beneath their property. Groundwater declines are a threat to how property can be utilized for the benefit of the owner and the State's economy.

The LLNRD is working to reverse the declines in the Buffalo County area by identifying projects or programs that return water to the aquifer. The BC Model is the first major step to achieving this goal.

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.

There are two water quality issues in the project area including elevated nitrates in the aquifer supplying drinking water and reduced stream flows leading to the conversion of streams that were historically perennial to now flow intermittently. The BC Model will help projects that achieve:

- Increasing stream baseflow – the South Loup River and Wood River are experienced declines in baseflow as a result of declining groundwater levels. The BC model will evaluate the effects on groundwater levels and/or stream flow resulting from changes in the number of existing and future irrigation wells.
- Water quality – the 'model focus area' is experiencing rising nitrate levels. The BC Model will evaluate groundwater flow directions and gradients to better understand possible flow paths and velocities to assist with nitrate contamination assessments.

An illustration of nitrate levels, based on the NDEE"s Clearinghouse, are shown in Figure 16 (also shown in Attachment B).

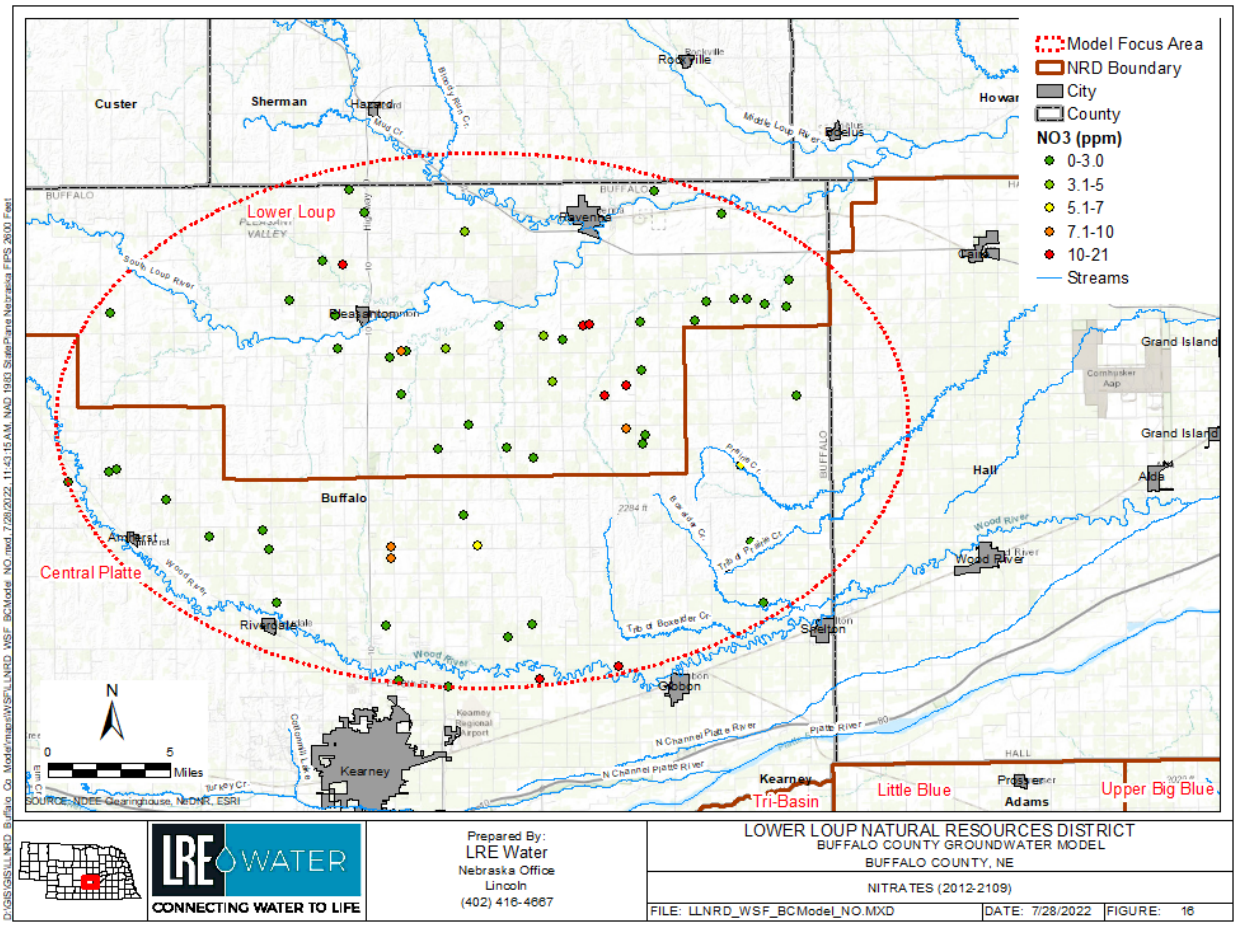

Figure 16 – Nitrate Concentrations within the Focus Model Area (NDEE)

Within the full model domain, there are 45 communities, many of which are facing challenges from rising nitrate issues. The LLNRD can share the BC Model which can then utilized by the community engineer and/or hydrogeologist to aid in siting wells in known low nitrate areas.

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

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

The first major action was to fly AEM survey in the area, generally around the Ravena area. In 2019, 360 square miles was flown, supported by the WSF, to obtain data that would provide an understanding of the hydrogeology of the area. With the AEM available, the LLNRD is ready to move ahead with the development of a locally refined groundwater model.

While the BC Model is the next major step to identify solutions, the LLNRD has invested previously in addressing declines in groundwater levels and stream flows in the Buffalo County area. The LLNRD has completed two studies to help identify recharge project opportunities in the South Loup River basin. One, completed in 2018, included a preliminary investigation of potential recharge and retiming structures along the river. The second, completed in 2019, identified potential recharge sites in the Ravenna area. These resources, and other available studies, will be leveraged into the BC Model development process.

The LLNRD is the project sponsor. There is sufficient annual revenue within the LLNRD's annual budget, specifically property tax revenues obtained by the district allowable through state law. Last Fiscal Year (2022), the LLNRD had a property tax request at 0.030786 cents per $100 of valuation resulting in $5,026,444.61 from property taxes, and a total operating budget of $19,655,782.02.

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 target area is defined within the 'model focus area', shown in Figure 17 (also shown in Attachment B). There are 386,000 acres this area, which could expand. Within the 'model focus area', the LLNRD has 701 fields with certified irrigated acres, totaling 82,104 acres. The average field size is 117 acres with 142 that are currently using some level of gravity irrigation. There are a total of 682 acres irrigated with surface water. There four communities including Pleasanton, Ravenna, Amherst, and Riverdale.

Within the initial model domain, which is subject to change, there are 41 communities. Other project stakeholders include CPNRD and NeDNR, plus the hundreds of agricultural producers and communities.

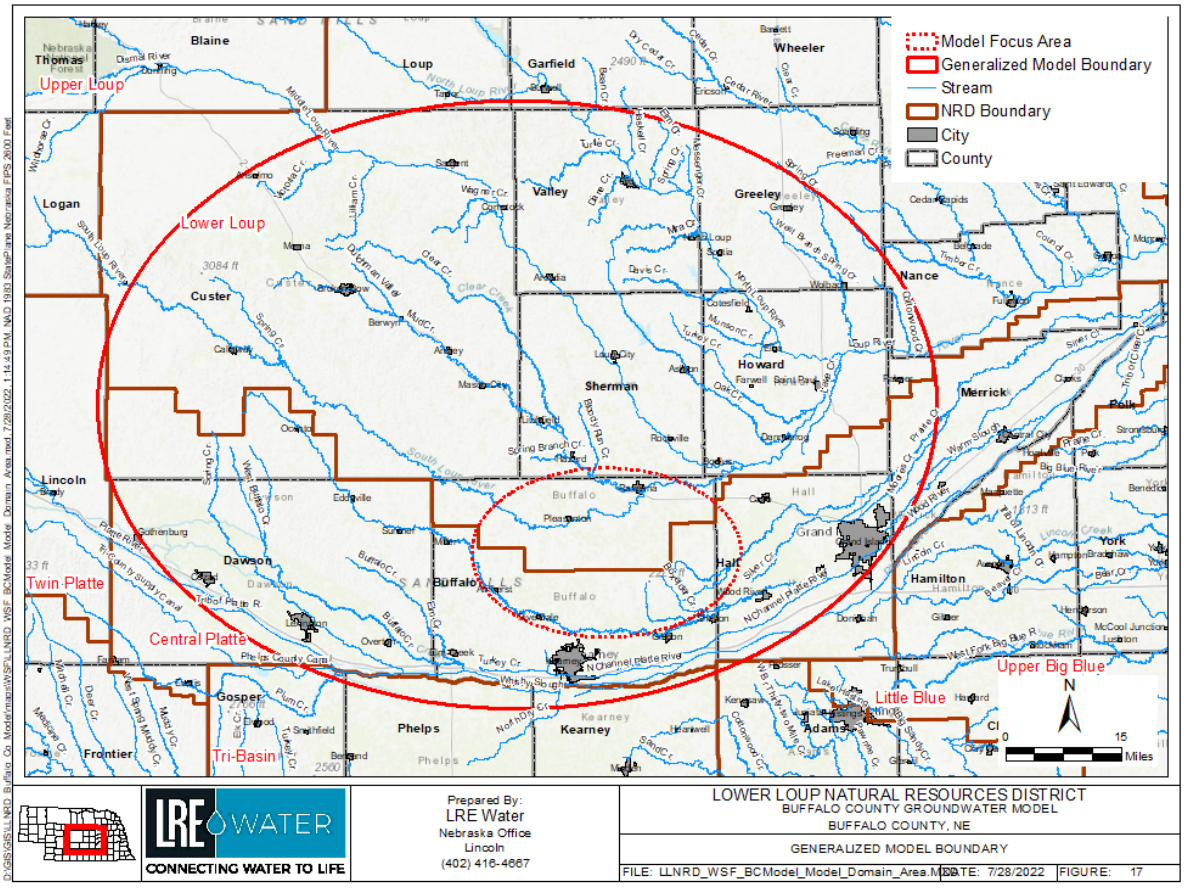

Figure 17 – Model Focus Area and Initial Model Domain

These producers specifically are most likely to immediately benefit from potential recharge projects, in addition to downstream users, such as the Loup Public Power District, with hydropower demands on the Loup River; the State of Nebraska, as it works to meet in stream flow at Louisville for endangered species; and other irrigators dependent on South Loup River flows and natural recharge.

The BC Model supports goals, objectives, and action items related to sustainable water management, recognition and identification of connected groundwater and surface water, water quality goals, and others, all within the following local and state-coordinated plans:

- Integrated Management Plan (IMP), effective May 2016
- Master Plan, effective 2012-2022
- Groundwater Management Plan, effective 1985
- South Loup Watershed Management Plan, 2017

LLNRD Voluntary IMP

Goal #2 – “Implement this water management plan to maintain an efficient and economical balance between current and future water supplies and demands”.

- Will aid in identifying opportunities to augment water supplies within the district (Objective 2.1).
- Provides an evaluation for the potential for conjunctive management programs or project opportunities (Action Item 2.1.1)
- Contributes to the ability to evaluate potential for additional groundwater and surface water storage within the District to bank future water supplies (Action Item 2.3.2)

Goal #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”.

- Assist with review and analysis of storage opportunities (Action Item 3.1.1 and 3.1.2)

LPRBC Basinwide Plan

Goal #1 – “Develop and maintain a water supply and use inventory based on the best available data and analysis”.

- The BC Model will produce a water balance that will help the LLNRD and its partners better understand the inflows/outflows of the South Loup River basin in relation to the decline area of Buffalo County (Objective 1.1, 1.4).
- The project supports Action Item 1.1.C, to identify locations where additional gaging data or further study/modeling would reduce uncertainty in basinwide water inventory.

Goal #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.”

- The project will evaluate the potential to store and recharge water in areas experience groundwater declines.
- Public education will be critical to encourage conservation measures to reduce water consumption as stand-alone solution, or to compliment other large-scale structural solutions.

LLNRD Master Plan

Goal #2 – “Development and management of groundwater and surface water for beneficial uses”

- The BC Model will aid to protect and utilize the water supply for beneficial use by agriculture, municipalities, domestic and industrial users.
- Will track the interconnection of groundwater and surface water in the model focus area and address integrated water management.

Goal #3 – “Resource awareness”

- The project will provide vast amounts of highly visual information to share with communities, agricultural producers, NeDNR, Nebraska Department of Environment and Energy (NDEE), and other stakeholders on the extent of the decline issue and potential solutions.
- The project includes close coordination with CPNRD, NeDNR, and other stakeholders on identification of management challenges and potential solutions.

LLNRD GWMP

Quantity Goal – “It shall be the goal of the LLNRD to maintain a perpetual source of groundwater for all uses – domestic, agricultural, and industrial”.

- The project’s primary goal is to maintain adequate groundwater quantity to maintain agricultural and community uses without adverse impacts to stream flows.

South Loup Watershed Management Plan

Goal #1 – “The ecological condition of the South Loup River watershed will be enhanced through a comprehensive and collaborative program that efficiently and effectively implements actions to restore and protect natural resources from degradation and impairment”

- The project will help analyze project alternatives that may result in increased baseflow to the South Loup River and/or its tributaries.

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.

Management of the Platte River instream flows is a statewide challenge. The Loup River, a major tributary, contributes approximately 45% of the flow to the

Platte River at the confluence below Columbus (USGS, 2009-5011), where in dry years, the Platte River has gone completely dry. The LLNRD is part of the Lower Platte River Basin Coalition (LPRBC) and through implementation of the LPRBC Basinwide Water Management Plan, are responsible for reporting contributions to flow augmentation to NeDNR annually as acre-feet.

One specific action that has been taken by LLNRD is to place a stay on new irrigated acres in the South Loup River Basin, as well as working with NeDNR to restrict new surface water rights in the South Loup River.

The BC Model is the next big effort to address groundwater declines and reduced baseflow in the South Loup River and Wood River. The BC Model will aid staff and the Board in decision related to projects that will recharge groundwater, which then will increase baseflows. The model will quantify the benefits, which when reported to NeDNR, will benefit a statewide problem.

There are 386,000 acres in the initial 'model focus area', however, this area could expand, benefiting additional agricultural producers in the decline area. Within the 'model focus area', the LLNRD has 701 fields with certified irrigated acres, totaling 82,104 acres. The average field size is 117 acres with 142 that are currently using some level of gravity irrigation. There are a total of 682 acres irrigated with surface water.

These producers specifically are most likely to immediately benefit from potential recharge projects, in addition to downstream users, such as the Loup Public Power District, with hydropower demands on the Loup River; the State of Nebraska, as it works to meet in stream flow at Louisville for endangered species; and other irrigators dependent on South Loup River flows and natural recharge.

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 LLNRD is leveraging the investment made in 2019, in partnership with the Natural Resources Commission and NeDNR, to fly 360 square miles of AEM. This data has provided an understanding of the hydrogeology of the area. With the AEM available, the LLNRD is ready to move ahead with the development of a locally refined groundwater model.

The WSF and LLNRD are the two funding partners. A breakdown of project development cost by tasks, and split by funding partner, is shown in Table 7. Last Fiscal Year (2022), the LLNRD had a property tax request at 0.030786 cents per $100 of valuation resulting in $5,026,444.61 from property taxes, and a total operating budget of $19,655,782.02. The LLNRD Board has added $110,000 to the Fiscal Year 2023 budget to cover the local share. A letter of support and financial assurance is provided in Attachment A. Should the WSF request fail, the LLNRD will group and either apply again in 2023 or seek other funding sources.

Table 7 – Cost Breakdown by Funding Source

TASK	COST ESTIMATE	WSF 60%	LOCAL 40%
PM/Meetings	$ 30,000	$ 18,000	$ 12,000
3D Conceptual Framework	$ 90,000	$ 54,000	$ 36,000
Conceptual Model	$ 45,000	$ 27,000	$ 18,000
Flow Model Construction	$ 40,000	$ 24,000	$ 16,000
Calibration	$ 35,000	$ 21,000	$ 14,000
Deliverables	$ 35,000	$ 21,000	$ 14,000
Total	**$ 275,000**	**$ 165,000**	**$ 110,000**

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 effort being taken by the LLNRD by build the BC Model will support identification of projects that recharge groundwater. Potential projects may include reconnection of relic oxbows, wetland restoration, in-stream weirs, recharge basins, ponds, among other options. These types of projects can provide numerous watershed benefits including:

- Reestablishing a contiguous riparian corridor and a more natural hydrologic regime.
- Restoration of former wetlands and improvement of the quality of existing wetland habitat.
- Wildlife and aquatic habitat enhancement
- Restored stability, function, and dynamic processes of the floodplain to a more natural, less degraded condition, which is present as a result of past stream straightening

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

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

The September 2020 is the latest version of the NeDNR Annual Report and Plan of Work for the State Water Planning and Review Process. The BC Model, and the projects which it will help support in the future, uses objectives as provided by NeDNR. Specifically, the project meets the following objectives:

Objective #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".

- The BC Model will be a powerful tool, leveraging existing NeDNR resources, that will provide capabilities to analyze conjunctive management projects that have been identified in previous planning efforts and studies.
- The project address deficiencies in groundwater levels and streamflow.

Objective #2 – "Provide staff and resources to support planning and implementation of water resources projects".

- The BC Model will support implementation of the IMP and will become the foundation for future water resources projects.
- NeDNR will be a project partner by providing staff and resources to support implementation of plans and development of critical water resource projects.

Objective #3 – "Support locally developed water management plans for conjunctively managing hydrologically connected groundwater and surface water supplies".

- This project is in line with Goal #1 of the LLNRD Voluntary IMP, "develop and implement water management policies and practices that could potentially provide for additional water resources development opportunities while protecting existing surface and groundwater uses."
- The project supports goals and objectives of the LPRBC Basinwide Plan.

Objective #4 – "Provide resources to map and identify areas vulnerable to flood damage"

- The project does not benefit flood risk reduction.

Objective #5 – "Participate in interagency collaboration with federal agencies, state agencies, local NRDs, and other water interest entities on various water resources programs and projects".

- The LLNRD will lead the effort and be supported by neighboring NRDs and NeDNR.

- The BC Model will aid the implementation of goals in the LPRBC Basinwide Plan.

Objective #6 – "Consolidate and present information in a form that is understandable and useful to the public and interagency collaborators".

- Maps and visuals, such as hydrogeologic cross sections, artificial recharge potential maps, and model scenario results, will be available to educate the public and interagency collaborators.

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