

# NEBRASKA NATURAL RESOURCES COMMISSION

## Water Sustainability Fund

Application for Funding

Section A.

### ADMINISTRATIVE

**PROJECT NAME: Upper Big Blue Natural Resources District Allocation & Pooling Software Solution**

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

Sponsor Business Name: **Upper Big Blue Natural Resources District**

Sponsor Contact's Name: **David Eigenberg**

Sponsor Contact's Address: **319 E 25th St., York, NE, 68516**

Sponsor Contact's Phone: **402-362-6601**

Sponsor Contact's Email: **deigenberg@upperbigblue.org**

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

**Grant** amount requested. **\$ 105,000**

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

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

- How many years repayment period? [Click here to enter text.](#)
- Supply a complete year-by-year repayment schedule. [Click here to enter text.](#)

2. **Neb. Rev. Stat. § 2-1507 (2)**

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

**If yes:**

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

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

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

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

4. **Partnerships**

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

**N/A**

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 cost of the project will be \$175,000. The UBBNRD will provide \$70,000 in cost share with the remaining \$105,000 coming from the Water Sustainability Fund.**

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!

**The Upper Big Blue Natural Resources District (UBBNRD) has a Groundwater Management Plan and associated rules and regulations that are collectively designed to ensure the sustainable use of groundwater for the benefit of its residents. Specifically, the goal of the UBBNRD is to maintain groundwater levels at or above the water level observed in 1978. The groundwater resource in the UBBNRD supports approximately 15% of Nebraska's agricultural economy, therefore it is vital that this resource be protected for the long-term in a manner that maximizes its beneficial use. As such, the UBBNRD established groundwater level triggers that, when reached, impose reasonable and incremental requirements on its water users.**

**The first such trigger level is intended as an early warning to allow preparations for future restrictions on water use, if needed. Therefore, this trigger level was set at three feet *above* the 1978 groundwater levels. After several decades of monitoring water levels across the NRD, this first trigger level was reached in 2006. At that time, the UBBNRD began to certify irrigated acres and uses, linking wells to tracts in preparation for annual water use reporting. Generally, agricultural water users have been required to do three things: 1) maintain an accurate certification of the actual acres that are being irrigated; 2) report the amount of water used on an annual basis by every water well used for irrigation; and 3) by 2016, ensure that the measurement of water use is conducted through use of an approved flow meter. There are commensurate requirements for municipal and other large water users.**

**These requirements are intended to allow the UBBNRD to impose an allocation on agricultural users that would limit the amount of water that could be applied to each certified irrigated acre. This limitation will occur at such time when district groundwater levels fall below the 1978 groundwater level. While seemingly straightforward, the enforcement of this limitation becomes extremely complicated**

due to the inherent nature of the relationship between water wells and the lands these wells irrigate. For a wide variety of practical reasons, water users will need to pool their allocations in order to better manage water resources within these limitations in a manner that has the least socioeconomic impacts. The UBBNRD has provisions in place to allow for the pooling of certified acres by owners/operators, by common wells and by contractual agreements. Pooling allows the most flexibility for agricultural producers in managing their groundwater resource over their operation. For example, two adjacent fields served by two different irrigation wells can be combined into one pool so that a high-water use crop can be maintained on one field by planting a low water use crop on the other in order to achieve a reduction in pumping. So, if an allocation of 30 inches for 3 years is in place. One owner/operator who farms two fields can combine them and spread the allocation across both fields. As a result, it becomes extremely complicated to track water use relative to the allocation limits. Fortunately, this problem can be easily overcome through the utilization of advanced information technology solutions.

The water use measuring program that has been implemented by the UBBNRD has been a massive undertaking completed over the past decade. The UBBNRD now obtains highly accurate measurement of actual water used through the pumping of over 12,000 high capacity irrigation wells. This water sustainability fund project will provide the funding to close the loop on the tracking of water use relative to acres irrigated by user within each irrigation pool. The highly innovative approach will utilize cutting edge technology, greatly minimizing the cost and setting the stage for a highly maintainable approach to sustainable water management over the long term.

**7. Project Tasks and Timeline**

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

**For multiyear projects** please list (using the following example):

<u>Tasks</u>	<u>Year 1\$</u>	<u>Year 2\$</u>	<u>Year 3\$</u>	<u>Remaining</u>	<u>Total \$ Amt.</u>
Permits	\$18,000				\$18,000
Engineering		\$96,000			\$96,000
Construction		\$87,000	\$96,000		\$183,000
Close-out				\$8,000	\$8,000
				TOTAL	\$305,000

- What activities (Tasks) are to be completed.
- An estimate of each Tasks expenditures/cost per year.
- Activities in years 4 through project completion under a single column.

**This project will involve the development and delivery of a software solution that will allow the UBBNRD to track and manage agricultural groundwater use in their**

NRD. The project will be completed in less than one year. The cost to complete this activity will be \$160,000. Support and maintenance will cost \$500 per month. The software module will be developed during the first half of year one, so the support cost will occur for six months in year one and all year for years 2-3. Therefore, the total three-year cost of the project will be \$175,000.

<u>Tasks</u>	<u>Year 1\$</u>	<u>Year 2\$</u>	<u>Year 3\$</u>	<u>Total \$ Amt.</u>
Software Development	\$160,000			\$160,000
Support and Maintenance	\$3,000	\$6,000	\$6,000	\$15,000
			<b>TOTAL</b>	<b>\$175,000</b>

8. **IMP**

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

## Section B.

### DNR DIRECTOR'S FINDINGS

#### **Prove Engineering & Technical Feasibility**

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

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

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

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

- 1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; [Click here to enter text.](#)
- 1.A.2 Describe the plan of development ([004.01 A](#)); [Click here to enter text.](#)
- 1.A.3 Include a description of all field investigations made to substantiate the feasibility report ([004.01 B](#)); [Click here to enter text.](#)
- 1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report ([004.01 C](#)); [Click here to enter text.](#)
- 1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information ([004.01 D](#)); [Click here to enter text.](#)
- 1.A.6 Discuss each component of the final plan ([004.01 E](#)); [Click here to enter text.](#)
- 1.A.7 When applicable include the geologic investigation required for the project ([004.01 E 1](#)); [Click here to enter text.](#)
- 1.A.8 When applicable include the hydrologic data investigation required for the project ([004.01 E 2](#)); [Click here to enter text.](#)
- 1.A.9 When applicable include the criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria ([004.01 E 3](#)). [Click here to enter text.](#)

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

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

**The Upper Big Blue Natural Resources District (UBBNRD) plans to contract with a team of experienced water and software experts to complete this project. Olsson and Don't Panic Labs (DPL) will build a portal to enable the UBBNRD to manage water allocations. The portal will be designed and built to fulfill the needs of the UBBNRD. Before doing any development, the team will utilize their expertise in user interfaces and user experiences to craft a very useful web portal. They will also complete an architectural design for the solution. This open architectural design will enable response to changes in the system over time.**

**DPL has a proven track record of developing complex water management software, including the Groundwater Evaluation Toolbox they developed for Olsson. The UBBNRD has their water data stored in a customized database developed for them by Beehive Industries. Beehive DPL plans to interact with the Beehive database in developing this software solution for the UBBNRD. The Beehive DB contains the ownership, tract, well, flow meter data, and other information regarding irrigated fields and practices for use by the NRD. One of our first tasks will be to do a technical spike, a common approach in agile software development that involves gathering additional information and testing potential solution alternatives. With this technical spike DPL will create the service to pull the data from the Beehive Database. The result of this technical spike will be a functional accessor service that DPL will use when building the final solution. This service aids in ensuring a high level of usability, sustainability, and maintainability is built into the final product.**

**The software solution will be set up in the first development iteration. The solution will include a .NET Core 2.2 web application for the Application Programming Interface (API) services. The .NET framework is a software framework developed by Microsoft. The solution will also include an Angular 8 application for the front end. Angular is an open-source web application framework developed by Google. Two environments will be set up, one for testing and one for production. Each environment will have a separate database and API. These will be hosted in Microsoft's Azure Cloud. This early iteration work will provide a good starting point for building the sub systems.**

**There will be three primary subsystems to the overall system architecture. The first sub system will be the management of tracts. The tract subsystem involves a lot of**

interactions, including the ability to import tracts, manage tracts, and view tracts on a map.

The next subsystem is pools. The pool sub system will be responsible for all aspects of managing an allocation pool. This sub system contains the real business logic of this application. DPL will write numerous automated tests to ensure this sub system is functioning correctly.

The last subsystem is reporting. The reporting subsystem is responsible for a lot of the data analysis components of this system. Many of the reports only need to be ran once per year. These reports show the water balances for the individual landowners. These reports will be the key to communicating with water users the amount of water within an allocation as pools are reallocated. Reallocation would occur each time land changes hand or contractual agreements are signed.

The system will meet the UBBNRD's requirements today and be extendable to meet requirements in the future. The software development team will build the system using industry standard practices and will enable continual agility of the platform ensuring long-term usability and maintainability.

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

The UBBNRD has a contract with Beehive Industries to create and maintain a data management system that houses the district's data, including well information and information on certified irrigated acres and water use. This database was developed during 2015 and 2016. It has stored and maintained the data since that time.

This project will allow the UBBNRD to effectively track water usage on every certified acre, which will ensure effective limits on water use as needed to ensure long-term water sustainability. The project will develop a software solution that will:

- Interface with the Beehive database
- Keep track of the pooling status of every tract
- Concatenate the water use information for each pool every water use year
- Compute the average application depth for the tracts within each pool based on the total water use and total certified irrigated acres
- Re-distribute allocations when tracts move from one pool to another
- Provide the current status of remaining water available for any tract/pool in any desired format/media

The software solution will consist of an SQL database along with the code/logic that computes net water used and net water available for each pool. The pooling module's SQL server will be connected to the current Beehive SQL database



through a web service interface. The module will be accessible to UBBNRD members via its own user interface. The module will have the ability to pull necessary data from the Beehive SQL server in real-time. In addition, UBBNRD staff will be able to input data that does not currently reside in Beehive. The module will then calculate water allocations and use by pool and tract for any given point in time.

When this software module is completed the software development team will deliver the module to the UBBNRD and train district staff to use it.

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

Previous work that substantiate the project development are the development of the Beehive Software by the DPL team, the construction of the UBBNRD database by Beehive Industries, and the development and deployment of the Groundwater Evaluation Toolbox by DPL and Olsson. These activities demonstrate the proven concept of sustainable water management solutions within a cloud-based framework.

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](#)).

Initially the positive effects are two-fold, but the UBBNRD understands that as this software solution is deployed unseen positive effects may surface. One positive effect allows the UBBNRD to more efficiently and effectively track and enforce groundwater regulation. The second, provides an educational opportunity for agricultural producers to better view and understand their data to make sound irrigation management decisions.

To track water use efficiently and effectively the UBBNRD needs a software solution that connects and interfaces with the dynamic nature of its data. District data is ever changing as land ownership and operators change and the well(s) watering those lands change with it.

The UBBNRD is very efficient with the collection of water use information, but lags in providing that data back to the farmer for their use as a management tool. This advanced software solution will provide an educational opportunity for farmers to better track their water use over their operation. By looking at their water use data over their operation they can identify areas of inefficiency to make positive changes to increase their irrigation efficiency.

## **Prove Economic Feasibility**

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

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

**The next best alternative to the development of this software solution would be to hire staff to manually conduct the necessary calculations and pooling assignments. This alternative would be highly inefficient, potentially inaccurate, and would involve perpetual costs. Additional staff would cost the district approximately \$75,000 per year in salary and benefits and would necessitate the purchase of additional hardware and software. Therefore, the project will provide an automated software solution with an approximate return on investment of 2 years. The software is expected to function essentially as delivered for at least ten years with ongoing maintenance of approximately \$6,000 per year.**

**This project involves a one-time expenditure that will ensure that the UBBNRD can efficiently and accurately compute water uses relative to water use restrictions in order to ensure the sustainability of its groundwater supply. Ongoing support and maintenance costs are nominal compared to the cost of even one full time staff person.**

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 project is anticipated to provide a consistent level of benefits with only routine maintenance through year 10 of the project. The initial project cost will be \$160,000. Maintenance will cost \$6,000 per year, and these costs will begin to be incurred halfway through year 1. So, the total maintenance costs will be \$57,000 through year 10, and the total cost of the project through year 10 will be \$217,000. The alternative to developing this project would be to hire an additional staff member to manually complete all calculations on an annual basis. This alternative is expected to cost \$75,000 per year, or a total of \$750,000 through year 10 of the project. By developing the project, the UBBNRD will avoid the need to hire this additional staff member. Therefore, the project benefit will be \$750,000 through year 10 of the project. These total benefits and total cost yield a benefit-cost ration of 3.45.**

- 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

**The cost to develop the software module will be \$160,000. Support and maintenance will cost \$500 per month. This provides on-demand access to a software engineer experienced with the software, a guaranteed response time, monitoring, maintenance, and alerts. The software module will be developed during the first half of year one, so the support cost will occur for six months in year one and all year for years 2-3. Therefore, the total three-year cost of the project will be \$175,000. The software module is expected to be viable well beyond year three, but ongoing costs after year three are not being requested as part of this application.**

- 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 primary benefit of this project will be the delivery of a software solution that will allow the UBBNRD to efficiently and effectively track water use across the district and ensure compliance with any limitations that are needed to ensure water sustainability. Water availability is vital to the agricultural economy of the district and the State of Nebraska, and approximately 15% percent of the State's agricultural economic activity comes from within the district.**

**As documented in (2) above, the projected return on investment relative to the next best alternative is approximately two years. After that, this project will provide an economic benefit to the UBBNRD in the amount of the difference between annual software maintenance costs (\$6,000) and the annual cost of another employee (\$75,000) that would be needed to manually complete the numerous computations that would be needed without the software. Therefore, the ongoing economic benefit over the useful life of the software (at least ten years) will be approximately \$70,000 per year or more.**

- 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). **See Attachment A.**
- 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 primary benefit of this project will be the delivery of a software solution that will allow the UBBNRD to efficiently and effectively track water use across the district and ensure compliance with any limitations that are needed to ensure water sustainability. Water availability is vital to the agricultural economy of the district and the State of Nebraska, and approximately 15% percent of the State's agricultural economic activity comes from within the district.**

**As documented in (2) above, the projected return on investment relative to the next best alternative is approximately two years. After that, this project will provide an economic benefit to the UBBNRD in the amount of the difference between annual software maintenance costs (\$6,000) and the annual cost of another employee (\$75,000) that would be needed to manual complete the numerous computations that would be needed without the software. Therefore, the ongoing economic benefit over the useful life of the software (at least ten years) will be approximately \$70,000 per year or more.**

**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.

**See Attachment B from the General Manager of the UBBNRD documenting the Natural Resources District's 2019 budget.**

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

**See Attachment B from the General Manager of the UBBNRD documenting the proposed Natural Resources District's 2020 budget. The NRDs have been authorized to collect property tax revenues by the Nebraska Legislature for over 40 years. As the states preferred regulator of groundwater, there is no reason to expect those authorities will not remain into the future.**

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.).

**This project will not have a negative impact on the natural environment.**

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

**The UBBNRD has a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes 2-3,201 through 2-3,243 and 46-701 through 46-755. As the state's preferred regulator of groundwater, the UBBNRD 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 is being implemented to assist with the requirements of the UBBNRDs Groundwater Management Plan<sup>1</sup> (GMP). The GMP was developed through the authority granted by the Groundwater Management and Protection Act (GMPA).**

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

**If yes:**

- 10.A Provide a complete listing of all lands involved in the project.
- 10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held.
- 10.C Provide assurance that you can hold or can acquire title to all lands not currently held.
11. Identify how you possess all necessary authority to undertake or participate in the project.

**The UBBNRD has a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes 2-3,201 through 2-3,243 and 46-701 through 46-755. As the state's preferred regulator of groundwater, the UBBNRD is clearly both qualified and responsible to carry out the proposed project.**

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

**There would likely be positive environmental and ecological consequences if the project is completed. The project will provide highly valuable assistance to the district to allow them to more effectively and efficiently manage the quality and quantity of groundwater in the district, a vital component to the environment and ecology of the district.**

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<sup>1</sup> Upper Big Blue Natural Resources District, 1978, Groundwater Management Plan.

## 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 Upper Big Blue Natural Resources District (UBBNRD) is home to over 56,000 residents, all of whom rely on groundwater as their primary source of drinking water. The UBBNRD has rules and regulations in place that are designed to protect**

the quantity available and the quality of this drinking water supply. A primary threat to the drinking water supply is excessive irrigation pumping, which depletes the amount of water available for drinking water and promotes leaching of fertilizers into the groundwater supply. This project is an essential component to the UBBNRDs overall water use measuring program. This program is designed to educate water users on the amount of water they are applying to each acre of land that is irrigated, and to impose limitations on irrigation applications when that becomes necessary. The UBBNRD and its irrigators have expended tremendous resources through this program to ensure that accurate readings from totalizing flow meters are obtained on an annual basis from every well in the district. However, due to the complex relationship between the distribution of water wells and the lands those wells irrigate, it is extremely complicated to manually determine the application of water applied to any given field from flow meter readings alone. This project will deliver a software solution that will automate the computation of water application for every irrigated tract. This will allow water users to more responsibly manage water applications (whether voluntary or mandatory), thereby protecting the quantity and quality of the drinking water supply in the UBBNRD.

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 Upper Big Blue Natural Resources District (UBBNRD) has a groundwater management plan (GMP) that was adopted on December 12, 1978 and an integrated management plan (IMP) that was adopted on October 18, 2010. The UBBNRD adopted rules and regulations pursuant to their GMP that state:

*The objective of promulgating these rules and regulation is to encourage, promote, and regulate the efficient management and conservation of groundwater and maintain an adequate supply for the foreseeable future.*

*The long-term goal of the District is to hold the District groundwater level above the 1978 District groundwater level through various programs sponsored by the District and through the requirements of ... these rules and regulations.*

Since the initial adoption of the GMP and these rules in 1978, the UBBNRD has expended significant resources in the furtherance of these goals and objectives. This has included careful monitoring of water levels and the initiation of



requirements that water users now certify their irrigated acres, measure their water use with a flow meter, and annually report this water use to the UBBNRD. Furthermore, the UBBNRD has spent countless man hours developing a customized database in order to make efficient use of this data. This project will directly assist the UBBNRD in meeting these goals and objectives by providing a necessary solution to “encourage, promote, and regulate” the sustainable use of groundwater within the UBBNRD by automatically evaluating this data and providing tract level information on irrigation application rates. This will allow the UBBNRD to meet its long-term goal of holding District groundwater levels above the 1978 District groundwater level.

The goals of the UBBNRDs IMP are to:

- 1. Protect to the extent possible existing users, local economy, environmental health, and recreational uses.*
- 2. Maintain the total water supply in the integrated management area to achieve sustainability of supply and use while allowing for growth and changes in use.*

In order to implement this IMP the UBBNRD tracks annually a number of activities and reports these to the Department of Natural Resources. This project will further assist the UBBNRD in conducting these annual tracking activities, which help ensure that the goals of this IMP are met.

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

List the following information that is applicable:

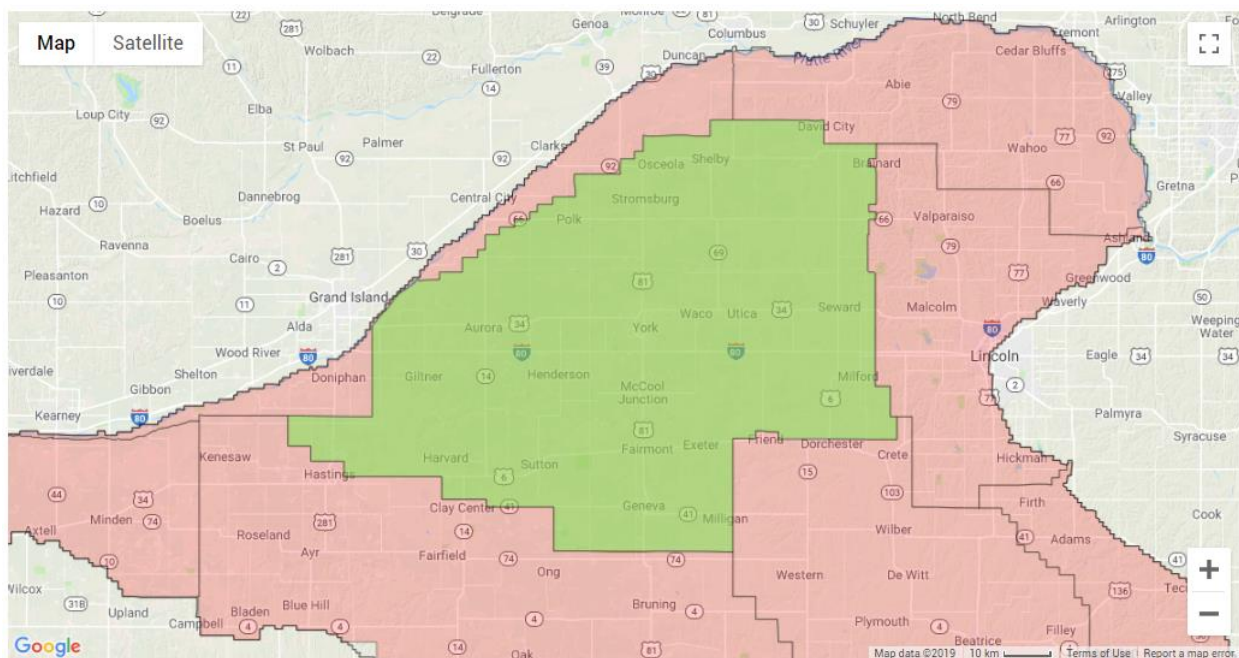
- The location, area and amount of recharge;
- The location, area and amount that aquifer depletion will be reduced;
- The reach, amount and timing of increased streamflow. Describe how the project will meet these objectives and what the source of the water is;
- Provide a detailed listing of cross basin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

The Upper Big Blue Natural Resources District Allocation & Pooling Software Solution will result in reductions in aquifer depletions, which will in turn lead to increases in streamflow. These benefits will occur across the entire district, positively effecting both the Big Blue River Basin and the Platte River Basin, which borders the UBBNRD to the north and is impacted by groundwater pumping in the UBBNRD. By efficiently providing actual pumping applications by irrigated tract to the irrigators in the UBBNRD, this project will help educate producers on their water use, which is likely to voluntarily reduce pumping. These voluntary reductions will assist the UBBNRD in meeting their goals regarding aquifer depletion, which is to maintain the District groundwater level above the 1978



District groundwater level. To the extent that voluntary reductions in groundwater use are insufficient, the District has rules in place that will trigger mandatory reductions in groundwater use. The net result will be reductions in groundwater depletions which will also result in increases to streamflow.

In order to illustrate the benefits of even a small reduction in water use, the Groundwater Evaluation Toolbox (GET) was used to simulate a 5 % reduction in groundwater pumping across the UBBNRD. The GET platform contains the groundwater model of the Blue River Basin that was developed for the NeDNR. By simply selecting the UBBNRD and setting the appropriate adjustment to pumping the GET platform simulates the changes in the system over a 50-year timeframe (Figure 1).

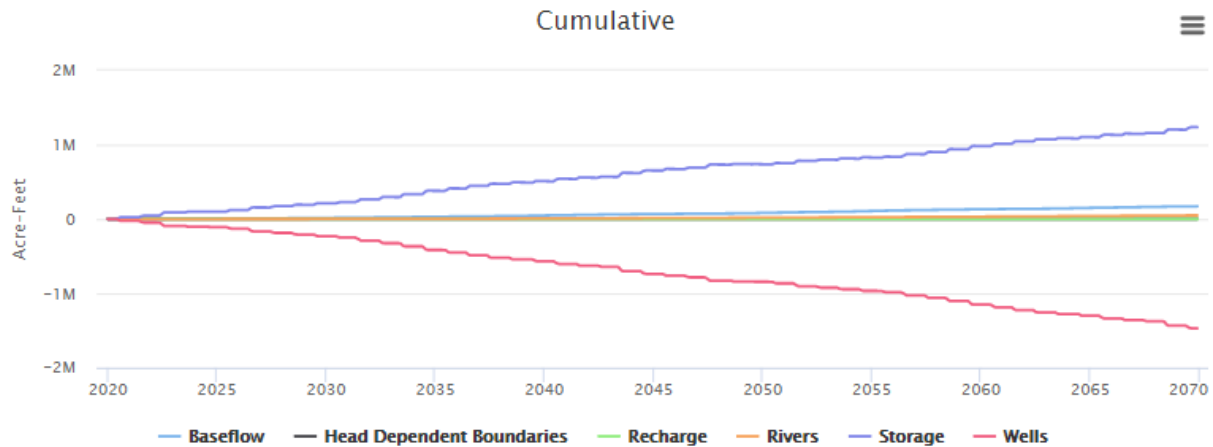


Zone Name	Adjustment
LOWER PLATTE NORTH	0%
CENTRAL PLATTE	0%
UPPER BIG BLUE	-5%
LOWER PLATTE SOUTH	0%
NEMAHA	0%
LOWER BIG BLUE	0%
TRI BASIN	0%
LITTLE BLUE	0%

Figure 1. The Blue River Basin groundwater model in the GET platform with the UBBNRD selected and a 5% reduction in irrigation specified.

The cumulative reduction in pumping over 50 years would be nearly 1,500,000 acre-feet (Figure 2). Approximately 89% of this pumping reduction, or approximately 1,300,000 acre-feet, would remain in the aquifer for future use. The remainder of the

water saved would constitute an increase in streamflow in the Big Blue River and its tributaries.



**Figure 2. A depiction of the cumulative change in the water budget terms in the Blue River Basin groundwater model from a 5% reduction in groundwater pumping.**

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.

This project contributes to these water supply goals: sustainable agricultural water use, protection of municipal, industrial, livestock and domestic uses, and the conservation and preservation of water resources. The UBBNRD Allocation & Pooling Software Solution is designed to provide information regarding the application of water to each irrigated tract, in order to allow irrigators and the UBBNRD to evaluate the necessity of the volumes of water pumped per well. This will allow irrigators to voluntarily adjust pumping amounts, or, if needed, the UBBNRD to require limits on the amount of water pumped per acre. Without the proposed software solution that will be developed through this project, it is difficult, if not impossible, to relate water pumped as measured by existing flow meters to field application rates. This is due to the complicated relationship between the existing and potential future irrigation wells and the fields that those wells irrigate. By providing actual groundwater applications for every irrigated tract it will be possible for the irrigators and/or the UBBNRD to conserve the groundwater resource. This will increase the resilience and sustainability of the groundwater resource in the UBBNRD for long-term beneficial use for agricultural use as well as municipal and industrial uses. By limiting aquifer drawdowns

**numerous water resources, including wetlands and streams, will be preserved for future generations.**

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 develop a software solution that will allow the UBBNRD to effectively and efficiently relate water pumped as measured by existing flow meters to field application rates. It is currently extremely difficult to accomplish this due to the complicated relationship between the existing and potential future irrigation wells and the fields that those wells irrigate. By providing actual groundwater applications for every irrigated tract it will be possible for the irrigators and/or the UBBNRD to conserve the groundwater resource. By reducing unneeded pumping more water will be available for future beneficial use, thereby ensuring that the beneficial use of Nebraska's water resources will be maximized for the benefit of the state's residence. Furthermore, by providing more accurate information on irrigation water applications, farmers will be able to optimize their operations by adjusting irrigation levels so that any water consumption due to groundwater pumping will provide the maximum benefit to their operation. This will cause reductions in water use that may have otherwise been beneficial, but only marginally so. The agricultural economy of the UBBNRD constitutes approximately 15% of the total agricultural economy of the State. Therefore, by helping to sustain this local agricultural economy this project will provide a benefit to all of Nebraska'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.

**The cost of to develop the software module will be \$160,000. Support and maintenance will cost \$500 per month. The next best alternative to the development of this software solution would be to hire staff to manually conduct the necessary calculations and pooling assignments. This alternative would be highly inefficient, potentially inaccurate, and would involve perpetual costs. Additional staff would cost the district approximately \$75,000 per year in salary and benefits and would necessitate the purchase of additional hardware and software. Therefore, the project will provide an automated software solution with an approximate return on**

investment of 2 years. The software is expected to function essentially as delivered for at least ten years with ongoing maintenance of approximately \$6,000 per year.

This project involves a one-time expenditure that will ensure that the UBBNRD can efficiently and accurately compute water uses relative to water use restrictions in order to ensure the sustainability of its groundwater supply. Ongoing support and maintenance costs are nominal compared to the cost of even one full time staff person.

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 assist the State in meeting its obligations to the Platte River Recovery and Implementation Program (PRRIP), an interstate agreement, and the Blue River Basin Compact, an interstate compact. Portions of the UBBNRD lie along the critical habit reach of the Platte River for several endangered species. Nebraska is required to limit its impacts to the flows of the Platte River anywhere within or above this critical habitat reach. This project will result in reductions in aquifer depletions, which will in turn lead to increases in streamflow. To the extent those increases to Platte River streamflow mitigate any negative impacts not permitted under the PRRIP, the project will assist the state in meeting its obligation to this interstate agreement.

One of the purposes of the Big Blue River Compact is:

*To encourage continuation of the active pollution-abatement programs in each of the two States and to seek further reduction in both natural and man-made pollution of the waters of the Big Blue River Basin.*

Portions of the aquifer underlying the UBBNRD have elevated levels of nitrates. One cause of high nitrates is overirrigation, which causes nitrates in the soil profile to be leached downward into the underlying groundwater. This project will develop a software solution that will allow the UBBNRD to effectively and efficiently relate water pumped as measured by existing flow meters to field application rates. It is currently extremely difficult to accomplish this due to the complicated relationship between the existing and potential future irrigation wells and the fields that those wells irrigate. Through the identification of tracts that are receiving excessive irrigation applications, the UBBNRD can work with producers to reduce these

applications, thus reducing the leaching of nitrates downward into the underlying groundwater. This benefit will be realized across the entire district at any location where overirrigation is one of the causes for elevated levels of nitrates in the groundwater. The only solution to the issue of overirrigation is to locate and quantify the magnitude of the overirrigation, so there are no other possible solutions to remedy this issue. Maintaining the quality of the groundwater in the UBBNRD has been an ongoing issue for the district for decades. The UBBNRD has identified areas with elevated nitrates through routine testing of water samples. They have placed restrictions on areas that have experienced elevated nitrates through their rules and regulations. This project will provide the UBBNRD with an additional tool to assist with their statutory mandate to manage groundwater quality.

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.

The groundwater supply in the UBBNRD is vital to the state of Nebraska and the United States of America. Currently the High Plains aquifer supplies water to 25% of the agricultural production in the US and without this supply there would be a debilitating effect on public security, public health and safety. As an example of the concern, the United States Department of Homeland Security's Office of Cyber and Infrastructure Analysis recently released a report entitled Analysis of High Plains Resource Risk and Economic Impacts which analyzed how continued depletions of the High Plains aquifer in Kansas and Nebraska might impact critical infrastructure and the economy at the local, regional, and national levels. In the introduction, the threat is described as follows, "The area overlying the High Plains Aquifer is one of the most prolific agricultural regions in the Nation, covering 111.8 million acres (175,000 square miles) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Following World War II, improved pumps and center pivot irrigation technology made High Plains groundwater available for large-scale irrigated agriculture. The High Plains has since become one of the most intensively irrigated areas in the United States, accounting for about 30 percent of all groundwater withdrawn for irrigation. As of 2007, the High Plains supported 50 million acres of cropland, 15.4 million acres of which were irrigated. The High Plains supplies approximately one-fourth of the Nation's agricultural production. Associated crops provide significant amounts of



feed to the Midwest cattle operations that account for 40 percent of U.S. feedlot beef output. The aquifer also provides drinking water to 82 percent of the people who live within its boundaries. Increasing reliance on the High Plains aquifer has exceeded groundwater recharge rates. Water-level declines began in parts of the High Plains Aquifer soon after the onset of substantial irrigation, around 1950; by 1980, water levels had declined by more than 100 feet in parts of Texas, Oklahoma, and southwestern Kansas.”

A key finding of this report is that “(i)f current water use practices are continued into the future, sixty counties in Kansas and seven in Nebraska are projected to face exhaustion of groundwater supplies in 100 years or less.” It is clear that water use practices will need to be carefully managed to ensure that groundwater is available in the future. This clear benefit to public security, public health and safety will be provided by this software solution as it will provide accurate information on the current status of groundwater use across the district allowing the UBBNRD Board of Directors and its agricultural producers to make well-informed water management decisions in the future.

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.

Portions of the aquifer underlying the UBBNRD have elevated levels of nitrates. One cause of high nitrates is overirrigation, which causes nitrates in the soil profile to be leached downward into the underlying groundwater. This project will develop a software solution that will allow the UBBNRD to effectively and efficiently relate water pumped as measured by existing flow meters to field application rates. It is currently extremely difficult to accomplish this due to the complicated relationship between the existing and potential future irrigation wells and the fields that those wells irrigate. Through the identification of tracts that are receiving excessive irrigation applications, the UBBNRD can work with producers to reduce these applications, thus reducing the leaching of nitrates downward into the aquifer. This benefit will be realized across the entire district at any location where overirrigation is one of the causes for elevated levels of nitrates in the groundwater. The only solution to the issue of overirrigation is to locate and quantify the magnitude of the overirrigation, so there are no other possible solutions to remedy this issue. Maintaining the quality of the groundwater in the UBBNRD has been an ongoing issue for the district for decades. The UBBNRD has identified areas with elevated nitrates through routine testing of water samples. They have placed restrictions on areas that have experienced elevated nitrates through their rules and regulations.

**This project will provide the UBBNRD with a software solution to assist with their statutory mandate to manage groundwater quality.**

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 Upper Big Blue Natural Resources District is the local jurisdiction that supports this project through their tax levy authority. The draft budget for fiscal year 2020 provides for a property tax requirement of \$3,718,121.62. The levy is expected to be set at 0.0245 per \$100 actual valuation.**

**This application is for the development of a software solution that is part of a much larger program that is funded and managed by the UBBNRD. The UBBNRDs Water Department is currently comprised of nine staff members. The Water Department staff consists of the Department Manager, Water Resources Technicians, a Water Conservationist, and a Water Data Specialist. The Water Department is responsible for implementing and managing water conservation programs aimed at protecting both the Quantity and the Quality of Nebraska's groundwater.**

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 Upper Big Blue Natural Resources District (UBBNRD) has a groundwater management plan (GMP) that was adopted on December 12, 1978 and an integrated management plan (IMP) that was adopted on October 18, 2010. The UBBNRD adopted rules and regulation pursuant to their GMP that state:**

***The objective of promulgating these rules and regulation is to encourage, promote, and regulate the efficient management and conservation of groundwater and maintain an adequate supply for the foreseeable future.***

***The long-term goal of the District is to hold the District groundwater level above the 1978 District groundwater level through various programs sponsored by the District and through the requirements of ... these rules and regulations.***

Since the initial adoption of the GMP and these rules in 1978, the UBBNRD has expended significant resources in the furtherance of these goals and objectives. This has included careful monitoring of water levels and the initiation of requirements that water users now certify their irrigated acres, measure their water use with a flow meter, and annually report this water use to the UBBNRD. Furthermore, the UBBNRD has spent countless man hours developing a customized database in order to make efficient use of this data. This project will directly assist the UBBNRD in meeting these goals and objectives by providing a necessary solution to “encourage, promote, and regulate” the sustainable use of groundwater within the UBBNRD by automatically evaluating this data and providing tract level information on irrigation application rates. This will allow the UBBNRD to meet its long-term goal of holding District groundwater level above the 1978 District groundwater level.

The goals of the UBBNRDs IMP are to:

- 1. Protect to the extent possible existing users, local economy, environmental health, and recreational uses.***
- 2. Maintain the total water supply in the integrated management area to achieve sustainability of supply and use while allowing for growth and changes in use.***

In order to implement this IMP, the UBBNRD tracks annually a number of activities and reports these to the Department of Natural Resources. This project will further assist the UBBNRD in conducting these annual tracking activities, which help ensure that the goals of this IMP are met.

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.

**Water sustainability is a statewide issue. This project will directly and indirectly affect the approximately 56,000 residents of the Upper Big Blue Natural Resources District (UBBNRD) which will support addressing the statewide issue of**



**sustainability. By providing accurate water use reports to the agricultural producers across the district, the UBBNRD will be able to manage water use in a manner that achieves and sustains a balance between water uses and water supplies. This will provide environmental benefits to the inhabitants of the state of Nebraska by maintaining adequate groundwater and surface water supplies for their use. The agricultural economy of the UBBNRD constitutes approximately 15% of the total agricultural economy of the State. There are over 1.24 million irrigated acres in the UBBNRD. By helping to sustain this local agricultural economy this project will provide a benefit to all of Nebraska's residents.**

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.

**This Water Sustainability Fund application is only a small portion of the total amount of money that has been invested locally as part of the Upper Big Blue Natural Resources Districts (UBBNRD) water metering program. The UBBNRD has invested heavily in their water database both financially and with staff time. The UBBNRD Beehive database is the foundation for everything water related for the District. Before flow meters were required the UBBNRD provided cost share for producers that wished to install a groundwater flow meter. There are currently 11,500 totalizing flow meters installed on every irrigation well in the UBBNRD, all purchased as a local expense. To ensure long term accuracy of flow meter readings, the UBBNRD provides routine flow meter maintenance at no cost to the flow meter owner and flow meter repair cost share for those flow meters requiring more intensive repairs.**

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.

**This project will contribute to watershed health and function across the entire UBBNRD by improving water quality and water quantity. By reducing the amount of groundwater applied to each irrigated tract, the project will increase stream baseflows and reduce the level of nitrates in those streamflows. By efficiently providing actual pumping applications by irrigated tract to the irrigators in the UBBNRD, this project will help educate producers on their water use, which is likely to voluntarily reduce pumping. These voluntary reductions will assist the UBBNRD**

in meeting their goals regarding aquifer depletion, which is to maintain the District water level above the 1978 District water level. To the extent that voluntary reductions in groundwater use are insufficient, the District has rules in place that will trigger mandatory reductions in groundwater use. The net result will be reductions in groundwater depletions which will also result in increases to streamflow

Portions of the aquifer underlying the UBBNRD have elevated levels of nitrates. One cause of high nitrates is overirrigation, which causes nitrates in the soil profile to be leached downward into the underlying groundwater. This project will develop a software solution that will allow the UBBNRD to effectively and efficiently relate water pumped as measured by existing flow meters to field application rates. It is currently extremely difficult to accomplish this due to the complicated relationship between the existing and potential future irrigation wells and the fields that those wells irrigate. Through the identification of tracts that are receiving excessive irrigation applications, the UBBNRD can work with producers to reduce these applications, thus reducing the leaching of nitrates downward into the aquifer.

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

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

The Annual Report and Plan of Work published by the Department of Natural Resources (Department) contains the following objective:

*The Department will work to improve and update the Blue Basin model that provides data and information necessary for the Department's FAB Evaluation and other water planning analyses. The Department will continue discussions with the Blue River NRD's regarding potential collaboration in future modeling activities. The Department will also continue to coordinate with other state and local water management agencies to expand data collection activities and analyses of hydrologic data to better understand hydrologically connected water resources.*

This project will provide significantly improved information regarding groundwater applications, which will assist the Department with this objective.

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**