NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Upper Republican NRD Remote Water Monitoring and Efficiency Project

PRIMARY CONTACT INFORMATION

Entity Name: Upper Republican Natural Resources District

Contact Name: Nate Jenkins

Address: PO Box 1140, Imperial, NE 69033

Phone: 308-882-5173

Email: natejenkins@urnrd.org

Partners / Co-sponsors, if any: N/A

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

   Grant amount requested. $ $375,336

   Loan amount requested. $ N/A

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

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

   Are you requesting less than 60% cost share from the fund?
   No
   If so what % ? N/A

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

Nebraska Game & Parks Commission (G&P) consultation on Threatened and Endangered Species and their Habitat	N/A☒	Obtained: YES☐	NO☐
Surface Water Right	N/A☒	Obtained: YES☐	NO☐
USACE (e.g., 404 Permit)	N/A☒	Obtained: YES☐	NO☐
Cultural Resources Evaluation	N/A☒	Obtained: YES☐	NO☐
Other (provide explanation below) N/A	N/A☒	Obtained: YES☐	NO☐

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

YES☐ NO☒

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

YES☐ NO☐

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

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

If yes provide a demonstration of need. N/A

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

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

N/A☐ YES☒ NO☐

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

YES☐ NO☒

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

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

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

Section B.

DNR DIRECTOR'S FINDINGS

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

YES☒ NO☐

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

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

The URNRD Remote Water Monitoring and Efficiency Project will help convert an antiquated water-reporting system where it can take months for farmers and the URNRD to calculate water usage into a modern system where radio communications will provide real-time usage data, allowing farmers to become more aware and efficient users of groundwater. The portion of the project for which the URNRD requests grant funding involves the installation of minimal equipment on existing irrigation flow meters. The two pieces of equipment – a digitized register installed on existing flow meters, and a small radio module wired to the register - will collect, store and relay water usage information via a radio network that has already been installed and is currently operated by electric utility that serves more than 1,000 electric-powered irrigation wells in the URNRD. The radio network is used by the utility to remotely transmit electric meter readings using the same remote-reading radio technology commonly used by utilities across Nebraska and the U.S.

This existing radio network infrastructure that will be used by the URNRD consists of several radio towers, so precludes the need for costly and time-consuming radio-network installation by the URNRD. Radio communications also offer better reliability than cellular communications in rural areas such as the URNRD, and will allow us to use a system with proven reliability. "Piggy-backing" on an existing radio network will cut our project equipment costs by more than half and make annual operation costs about four-to-seven times less expensive than using satellite or cellular communications systems.

All irrigation wells within the URNRD, which is one of the most densely irrigated regions of Nebraska, have had flow meters for nearly 40 years. The URNRD has regulated water usage via allocations for the same amount of time. During that time, technicians employed by the URNRD have annually and manually read odometer-style flow meters to calculate the year's water usage. The method works fine for determining how much more water irrigators are allowed to use during the remainder of an allocation period, how much allocation they can transfer, etc.,

but leaves much to be desired as an irrigation-management tool to increase irrigation efficiency.

For nearly three years, the URNRD has studied and tested cellular, satellite and now radio telemetry systems for updating this system and transmitting water usage from irrigation wells. Because of the rural nature of the URNRD and the ease with which cellular signals can be compromised - in our case 7'-10' corn is the culprit - satellite and radio offer the most communications reliability. While satellite offers superb reliability, the cost is less attractive: Monthly satellite service fees for one flow meter is approximately $6. Comparatively, the cost of using the existing radio network will be approximately 85 cents per month, per meter. Applied across the 780 meters part of the project, the annual operational savings of using radio instead of satellite will be approximately $48,200.

Cost aside, in terms of function, really the sole determinant of feasibility for a telemetry system is communication coverage and reliability. In 2017, the URNRD requested that the developer of the radio networks used by the electric utilities do a propagation study to predict signal strength and the coverage of the networks in relation to irrigation flow meters in the URNRD, i.e. whether water usage from the flow meters would be able to be transmitted via the network. The results were positive and showed that all flow meters within the coverage areas of the radio networks should be able to transmit data within the networks.

An agreement has been reached with Highline Electric Association to allow reporting of water usage from flow meters using their radio network. The URNRD would acquire its own network interface, i.e. dashboard, of hardware, software and database elements to monitor and manage the flow meter data and communication network. Should grant funding be approved, the URNRD would proceed with purchasing the digital meter registers and radio modules necessary to implement the project and complete installation over approximately the next 1.5-2 years. Installation doesn't require any new or significant structures and is very straightforward. Sensors will be installed inside existing, prop-style flow meters, new digital meter heads will replace the existing heads, and radio modules will be connected to the meter heads and mounted near the meters, which are most often located at pivot points.

The white, horizontally protruding object near the center of the below picture is the digital meter head. The white box in the upper right is the radio module it is connected to and that transmits data via the radio network. That is the extent of the equipment necessary to implement the project.

Highline Electric Association's coverage area of primarily western Chase County includes the most densely irrigated areas of the URNRD and those with the most significant groundwater declines. Another electric utility that serves the URNRD, Southwest Public Power District (SWPPD) based in Palisade, Neb., has also developed a radio network that could be used to communicate flow meter data. Like Highline, a propagation study was completed for the URNRD that shows that all irrigation wells SWPPD serves within the URNRD are communicable with its radio network. The type of transmitters necessary for flow meters in the SWPPD service area require a software modification that wasn't practical for SWPPD to make in the midst of the current irrigation season. Therefore, we have not been able to have a pilot program in SWPPD this year. One is planned in 2019 and if the results are positive, we would like the option of using WSF funds to install the needed equipment within that area.

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

To test the results of the propagation study in Highline's coverage area, the URNRD this spring and summer deployed 13 of the units that will be used under the proposed project. The units include, as stated before, digital meter registers connected to radio modules mounted several feet high at irrigation wells most often located at the center point of irrigated circles.

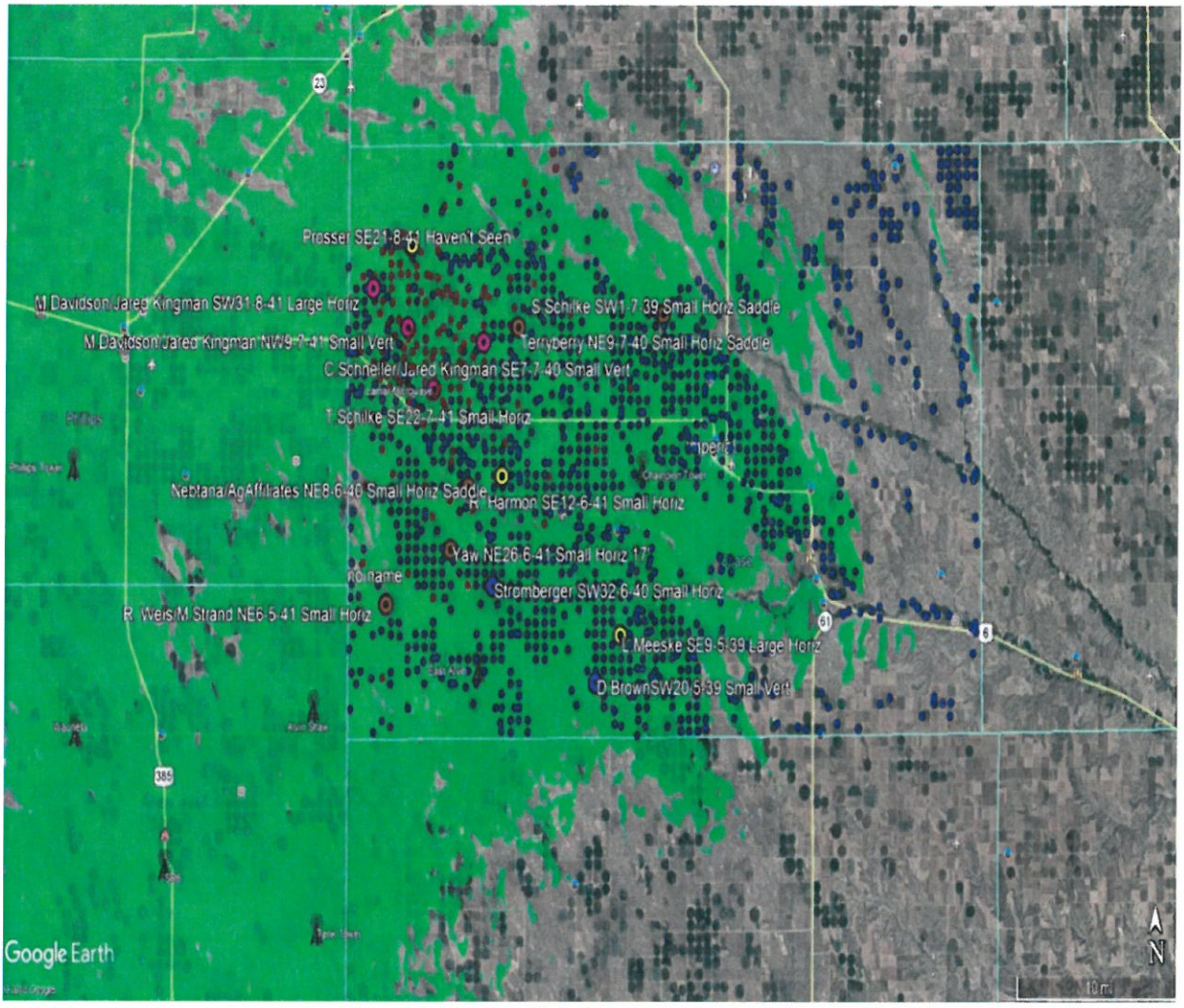
To fully test the systems, sites with variable distances from radio towers and topography were chosen. The closest test location is approximately two miles from one of the three radio towers; the furthest is approximately 8 miles. Discussions with Highline indicates some electric meters not part of their system and up to 160 miles away from their towers have communicated with their towers. The devices installed by the URNRD have communicated reliably since being deployed. As planned, every four hours they have transmitted data that shows

hourly water usage. For example, at noon water usage every hour since 8 a.m. the same day is displayed. The table below is a snapshot of meter readings at a well in the Highline service area recorded over a recent, 8-hour period.

Intervals (MDT)	Consumption (AF) - Usage	Consumption (AF) - Reading
7/20/2018 9:00	0.56	389.375
7/20/2018 8:00	0.558	388.815
7/20/2018 7:00	0.559	388.257
7/20/2018 6:00	0.556	387.698
7/20/2018 5:00	0.555	387.142
7/20/2018 4:00	0.555	386.587
7/20/2018 3:00	0.465	386.032
7/20/2018 2:00	0.555	385.567
7/20/2018 1:00	0.555	385.012

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

The map below is an illustration of the propagation study for the portion of the URNRD within Highline Electric Association's radio network. The square-shaped area outlined in light blue in the middle of the map is Chase County, located within the URNRD. The county to the north is Perkins County, and the county to the south is Dundy County, both of which are also in the URNRD. The green on the map shows the footprint of Highline Electric Association's radio network coverage, and blue dots are irrigation wells. Red dots are electric services at irrigation wells reporting electric usage to Highline, and the large dots are irrigation wells where the URNRD has tested communication reliability between flow meters and the Highline radio network.



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

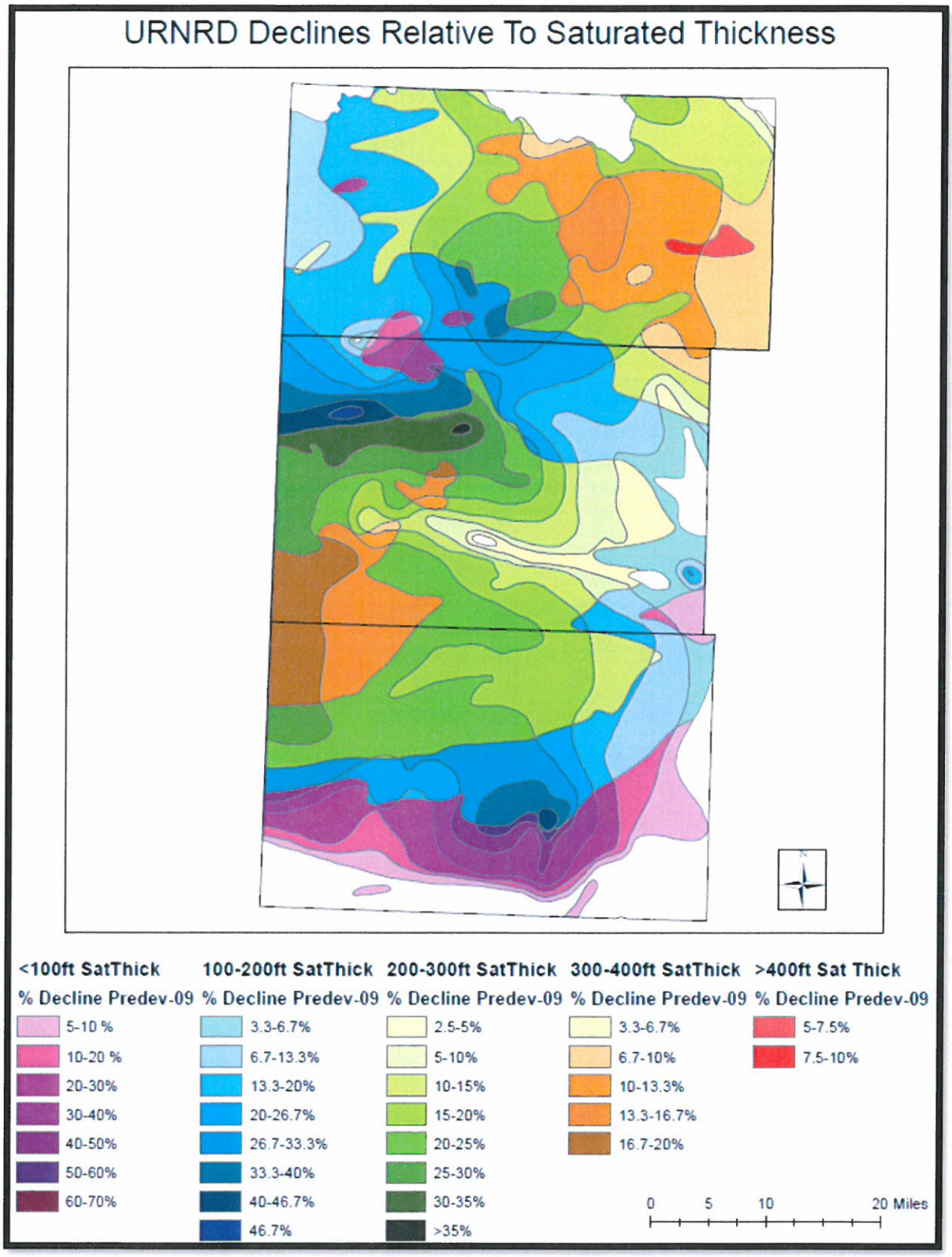
The proposed project will not require acquisition or use of water and/or land rights.

The project, to the extent that it reduces irrigation applications, has the potential to reduce leaching of fertilizer-based nitrates into the groundwater supply. Nitrate levels are trending upwards as illustrated in the graph below. Across the three counties within the URNRD, nitrate levels have increased by more than 2 parts per million since 1974. Consequently, this project is a proactive measure to ensure groundwater quality for nitrate-nitrogen is below the maximum contaminant level of 10 ppm by limiting the leaching of fertilizer and other ag chemicals out of the active root zone.

Relative to groundwater supplies, the URNRD has developed estimates of what percentage of pre-development saturated thicknesses of the aquifer throughout the

district has been depleted. This information has become increasingly pertinent to the district during its considerations of whether to approve landowner requests to transfer irrigated acres from one location to another, and as we educate irrigators and constituents on the nature and longevity of the water supply under current usage rates and lower usage rates made possible by activities such as the proposed project. Compiling real-time groundwater level data with real-time water use data will enable groundwater modelers to project potential increases in aquifer life due to savings from conservation practices adopted.

The map on the next page illustrates declines in aquifer saturated thickness as a percentage of saturated thickness existing before irrigation development began.



Combining real-time ET data, soil moisture content, groundwater level data and water usage data will allow the URNRD to construct new regulatory and incentive

programs designed to reduce water use to levels that maintain reasonable yields and economic viability while preserving more water so economic viability can continue long-term. Aside from regulatory or incentive programs implemented by the URNRD to reduce water usage, studies have concluded that the types of information developed through the course of this project, when made available to irrigators, can reduce water use.

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

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

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

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

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

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

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

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

A discussion of the anticipated effects, if any, of the project upon the development and/or operation of existing or envisioned structural measures including a brief description of any such measure (004.02 D). N/A

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 main intent of the project is to transmit water usage in near real time to accomplish goals only attainable by having the data in real time, e.g. allowing farmers to see how much water they have applied compared to ET estimates indicating how much could have been applied to provide sufficient water to growing crops. Soil moisture information aiding irrigation scheduling will also be

available to farmers who receive cost share for soil moisture probes. Because the purpose we hope to accomplish is acquiring real time data and water conservation actions informed by the data, there are no other known means of accomplishing the same purpose more economically.

As mentioned earlier, there are other options for acquiring usage data in real time using satellite and cellular communications. We have tested the equipment previously and it works well, satellite in particular, but the cost of the equipment needed for each flow meter would be approximately $1,450. The cost of the equipment needed for radio communications as proposed in this application is approximately $802 per flow meter. We are aware that grant funds couldn't be used for operational costs, but it's worth noting that operational costs the URNRD will pay ongoing if this application is approved will be significantly less than satellite-based equipment. Monthly satellite service fees for each meter would be approximately $6, compared to approximately 85 cents for each meter under this proposal.

3. Document all sources and report all costs and benefit data using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies shall be fifty (50) years or with prior approval of the Director, up to one hundred (100) years [T261 CH 2 (005)].

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

     The table below outlines all relevant cost information about the project, with the exception of URNRD staff time devoted to installing the equipment and operations cost. Neither of those two costs are included in the total costs for which we are seeking grant funds. It is estimated that installation of the telemetry equipment and associated repairs done during installation will require, on average, 2.5 hours of staff time, per flow meter. Average hourly pay of URNRD technicians is approximately $30 per hour, producing an average cost of $75 ($30 x 2.5) for each of the 780 units, or a total of approximately $58,500.

     Annual operations costs will be approximately $10,500: $7,955 total in fees to utilize the radio network; and $2,545 for the network interface that will allow us to manage and monitor water usage data.

Note that "installation/training" line item in the budget is the cost to have the equipment manufacturer's technicians provide on-demand trouble-shooting and training related to installation and operations and does not represent costs of URNRD staff installing and repairing equipment.

Installation of equipment would be able to occur very soon after the award of a grant. The expected installation time is approximately two years and will be dependent on availability of the large number of telemetry units we will be installing.

The expected project life is for the foreseeable future, for so long as the URNRD exists and has the authority to regulate water use, measuring water use will be required. Equipment installed as part of the project will be regularly maintained by district staff and replaced as needed.
The table below shows estimated project costs incurred over approximately two years, from the time the grant is awarded.

	$/unit	Quantity	Grant Funded	Cost
Equipment				
Flow Meter Digital Register and Data Logger	$450	780	Yes	$351,000
Bearing Assembly to Retrofit Meters with Digital Registers	$190	780	Yes	$148,200
Radio Modules	$162	780	Yes	$126,360
Total Reimbursable Project Costs				**$625,560**
Contracted Equipment Installation				
Installation Service/Training	$115.00	50	No	$5,750
Subtotal				**$5,750**
Software/Licensing Agreements				
Regional Network Interface		1	No	$2,545
Subtotal				**$2,545**
Total Project Costs				**$633,855**

- Only primary tangible benefits may be counted in providing the monetary benefit information and shall be displayed by year for the project life. In a multi-purpose project, estimate benefits for each

purpose, by year, for the life of the project. Describe any intangible or secondary benefits separately. In a case where there is no generally accepted method for calculation of primary tangible benefits describe how the project will increase water sustainability, such that the economic feasibility of the project can be approved by the Director and the Commission (005.02).

Achieving Water Sustainability

The proposed project is consistent with the URNRD's goals and objectives relative to groundwater and achieving sustainability: "Develop management programs to extend groundwater reservoir life to the greatest extent practicable, allowing for the beneficial use of water in an effective and efficient manner to satisfy the District's socio-economic needs and obligations while minimizing the risk that water resources will be insufficient for future generations to meet their socioeconomic needs. Develop, promulgate and enforce rules and regulations that provide for appropriate protection of the aquifer so as to slow and eventually stop water table declines in order that beneficially usable quantities of water remain in the aquifer; incentives to use water efficiently; conservation of groundwater; and maintaining or enhancing groundwater quality." (*URNRD Master Plan, 2010-2020*)

Slowing groundwater declines can only be achieved by reducing water use and is an outcome of management policies and best management practices based on information provided by the proposed project. The current system of manually measuring water use once annually is akin to an investor deciding how to invest based on market activities that occurred months ago. The proposed project will give farmers who currently have an incentive to reduce water use because of the URNRD's pumping limitations the current information they need to do so – namely how much water they are using relative to their allocation and, importantly, how much water ET data suggests they actually need to apply. For the URNRD, the project will allow for development of water management policies aimed at conserving water using analytic tools we don't currently have and that combine real-time water usage and groundwater level changes with crop water needs. The technology proposed in this project will have an impact on regional water management. Additionally, improvements in our understanding of remaining years that localized portions of the aquifer can yield water sufficient to fully irrigate crops will be made possible with groundwater modeling currently being developed.

Economic Impacts of Reduced Water Availability

It is the URNRD's intent to reduce water usage while minimizing crop yield reductions. Water preservation will extend the usable life of the aquifer; reductions in the usability of the aquifer for crop production caused by

significant groundwater declines will have potentially severe economic consequences.
A 2007 study by the University of Nebraska-Lincoln Bureau of Business research provides clues of how significant reductions in water usage would impact the economy of the area. The study assumed usage reductions caused by regulations imposed for the purposes of maintaining compliance with the Republican River Compact but could also occur because of similar, reduced levels caused by less physical access to water.

According to the report, a 15 percent reduction in irrigation in upland areas of the district (approximately 400,000 acres) would annually reduce crop sales by more than $23 million due to reduced crop production. Annual economic output, measured in business receipts, would decline by an estimated $27 million under the same scenario. Labor income would decline by an estimated $15 million. The latter figure represents loss of income to farmers, employment and labor income at businesses.

Loss of revenue to government entities including schools would also decline due to a decline in property values. Total lost property value in the District estimated in the report would be about $102 million, with a resulting loss of approximately $1.3 million in tax revenue.

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

	Comments	2019	2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
WSF Project Capital and Installation Costs in 2019-2020 and Future O&MR Costs not Covered by Grant	2018-2019 costs include equipment/ installation. 2021-2040 costs totals for each 5-year period and primarily include operations costs and maintenance of telemetry units; future replacement costs also included	$312,780	$312,780	$52,500	$60,000	$71,500	$85,000	**$894,560**
Value of Saved Water	Projected water savings begin in 2020 with 7% less water use, 9% less in 2021-2025, 10% less 2026-2030, 12% less 2031-2035 and 15% less in 2036-2040. Assumes $511 per acre foot value based on 100 bushel/acre difference irrigated-dryland and average corn price of $5.11/bushel.	$0	$3,577,000	$23,250,500	$25,933,250	$31,171,000	$38,836,000	**$122,767,750**
Net Value of Preserved Water		($312,780)	$3,264,220	$23,198,000	$25,873,250	$31,099,500	$38,751,000	**$121,873,190**

- In the case of projects for which there is no generally accepted method for calculation of primary tangible benefits and if the project will increase water sustainability, the economic feasibility of such proposal shall be demonstrated by such method as the Director and the Commission deem appropriate (005.04). N/A

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

   The URNRD has a cash balance of approximately $7.5 million and the 2017-2018 property tax levy will generate $3,175,000.

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

   Current levy authority combined with the cash balance is sufficient to pay reimbursable and annual operations costs.

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.

   The equipment installed as part of the project is non-intrusive and will have no expected impact on the natural environment. We intend for the project to have a positive impact on the environment by conserving water.

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

   Qualifications: The URNRD has extensive experience with flow meters installed on irrigation systems, having first required flow meters on all irrigation systems in 1979. The proposed project is a progressive development of water measurement systems that current staff is fully capable of operating.

   Responsibilities: The project corresponds with the URNRD's rules and regulations requiring metering of all agricultural water use in the district. Pursuant to the Nebraska Groundwater Management Act, the entire district has been established as a Groundwater Management Area wherein metering of water use is one of the management activities. The URNRD also has responsibilities related to

the Republican River Compact and related settlement agreement to report water usage to the Nebraska Department of Natural Resources for Compact accounting purposes.

Legal Authority: Nebraska Revised Statute 46-707 provides Natural Resources Districts including the URNRD authority to place meters on any water wells to track water usage regardless of whether any portion of the URNRD has been designated a groundwater management area. The installation of telemetry equipment for remote monitoring of water use is consistent with this authority.

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

The project is consistent with the URNRD's Groundwater Management Plan, Integrated Management Plan jointly developed with and approved by the State, the Master Plan, Long Range Implementation Plan and duties associated with the Republican River Compact of which the State is party.

As mentioned previously, the entire district is a Groundwater Management Area where controls designed to reduce water consumption and extend aquifer life have been in place and developed over the past 36 years. The project's intent and design to reduce water use are consistent with the State's interest in "management, protection and conservation of groundwater…that's essential to economic prosperity and future wellbeing of the State…and the public interest demands procedures for the implementation of management practices to conserve and protect groundwater supplies," (*Neb. Rev. Stat. 46-702).*

The project will help the URNRD meet Integrated Management Plan goals and objectives designed to sustain a balance between water uses and water supplies and maintain compliance with the Republican River Compact. Among the specific objectives in the IMP the project will help achieve is reducing district-wide groundwater use under average precipitation conditions.

10. Are land rights necessary to complete your project?

YES☐ NO☒

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

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

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

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

Nebraska Revised Statute 46-707 provides Natural Resources Districts including the URNRD authority to place meters on any water wells to measure water usage regardless of whether any portion of the NRD has been designated a groundwater management area. In the case of the URNRD, the whole district is a groundwater management area.

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

We do not foresee any negative environmental or ecological consequences of the project. The purpose of the project is to produce positive consequences including preserving groundwater available for human and crop consumption, and wildlife and ecological systems to the extent that reduced groundwater use mitigates impacts to stream flow. The project also has the distinct potential of helping reduce water contamination by reducing leaching of nitrates into groundwater and preventing soil erosion caused by over-irrigating.

Section C.

NRC SCORING

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

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

Notes:

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

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

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

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

1. Remediates or mitigates threats to drinking water;

   - Describe the specific threats to drinking water the project will address.

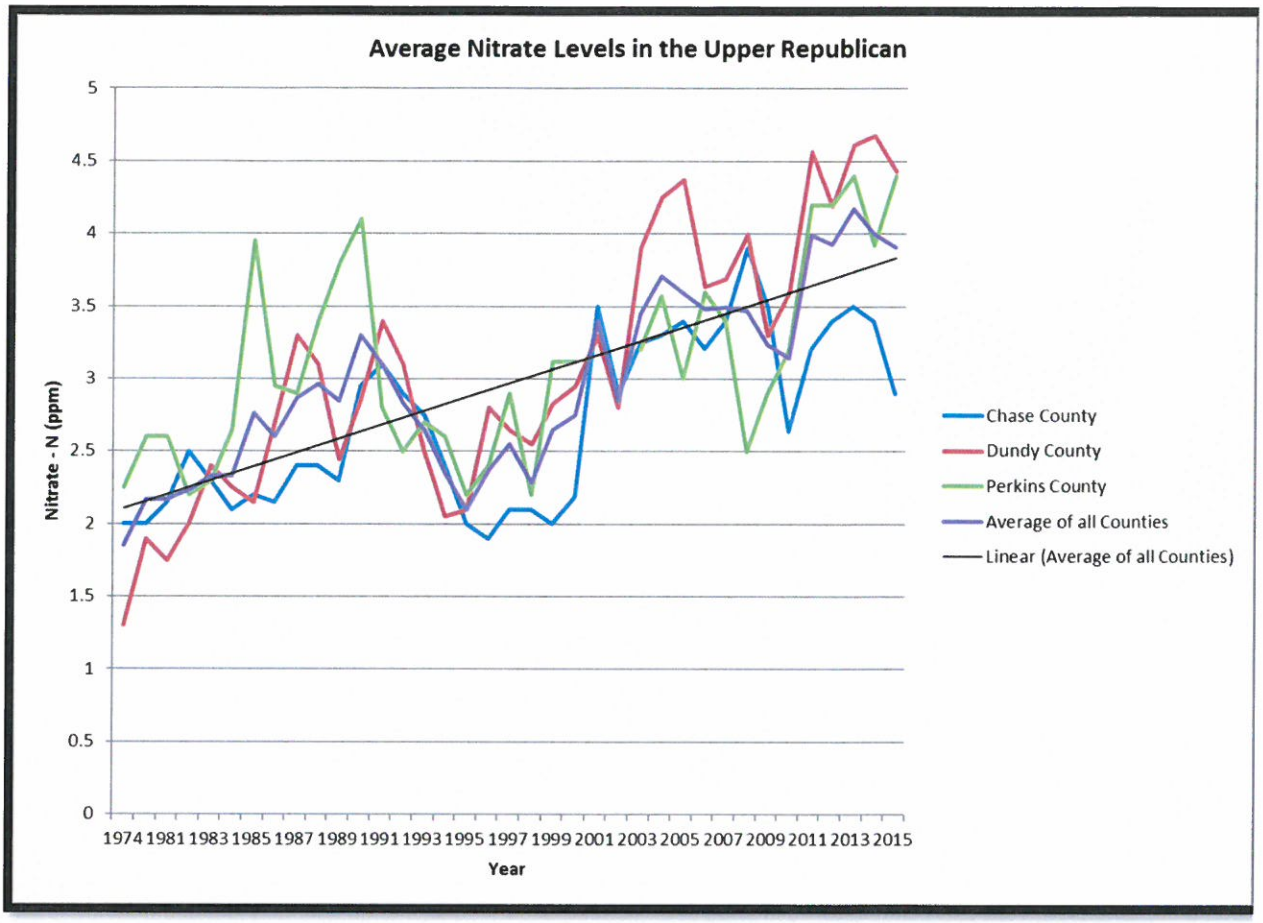
     The proposed project has the potential to reduce and, in some cases, eliminate leaching of nitrates into the groundwater/drinking water supply that is caused by over-irrigating. Under the project, mitigation of high nitrate levels caused by leaching will occur by reducing irrigation use to only that which can be consumed by crops so that soil-moisture content does not exceed what the soil can retain. This improved irrigation scheduling and reduced water application will be accomplished by the project using a combination of the three most effective water management tools

currently available: Knowledge of actual water demands of crops in near real time using evapotranspiration (ET) estimates from weather stations dispersed throughout the district and that have already been deployed separate from this proposed project; actual water use in near real time using telemetry units on irrigation flow meters in the district; and soil moisture content from the use of probes that are cost shared by the URNRD separate from this proposed project.

Actual crop-water demands will be available to irrigators in the district daily via three weather stations owned and operated by the URNRD that estimate ET. There is one in each county of the URNRD and they are in the process of being calibrated using information from a research-grade eddy covariance system that measures actual ET. The system has been deployed in the URNRD under a partnership between the URNRD and UNL.

Near real-time water usage information provided by telemetry units flow meters in the district will allow farmers to match their irrigation usage with crop water demands as indicated by the weather-station ET estimates that will be calibrated using the eddy covariance system that has been deployed in Perkins County. Additionally, soil moisture information will be available to irrigators who qualify for cost share for soil moisture probes. To date, the URNRD has helped pay for the use of soil moisture probes on more than 50,000 irrigated acres in the district.

Heavily irrigated regions such as the URNRD are especially prone to high nitrate levels because irrigation can flush nitrates from plant root zones and into the groundwater supply – "The more irrigation takes place, the greater the chances for nitrate leaching," (Haller L, McCarthy P, O'Brien T, Riehle J, Stuhldreher T, 2013). About 20% of the district is estimated to have nitrate levels that exceed the acceptable drinking water standard of 10ppm. Nitrate concentrations in the district have doubled the last 40 years by an average of 2ppm and are expected to create increasingly higher risks to drinking water within the URNRD.



Recently, water quality problems related to high uranium and arsenic levels forced the City of Benkelman in Dundy County to source and install a new water supply system. A recent UNL study established a link between nitrates and uranium levels in groundwater aquifers: "…Results indicate that nitrate, a primary contaminant, should be considered as a factor leading to secondary groundwater uranium contamination…" (Nolan J, Weber K, 2015).

The Village of Wauneta in Chase County is in the process of addressing problems associated with high arsenic levels in its drinking water supply. Rising arsenic levels have also been detected in the City of Imperial's water supply in Chase County. Research still needs to be conducted to establish whether there is a link between high nitrate and arsenic levels.

The intent of the proposed project is to limit irrigation to amounts that evapotranspiration and soil moisture data suggest are needed to sustain crops. By limiting water applications to no more than what can be consumed by crops, less water will be unused by crops and left to leach nitrates into the groundwater supply. The water quality improvements we hope to realize with the project have occurred elsewhere in Nebraska using a similar water-reduction approach. Within the Central Platte Valley, the impact of 16 years (1988-2003) of best management practices on

high groundwater nitrate concentrations was assessed in a 145,215-acre groundwater quality management area intensively cropped with irrigated corn. From 1987 to 2003, average groundwater nitrate concentrations in the primary aquifer beneath the terrace decreased from 26.4 to 22 mg/l. During the study, producers converted 69,800 acres of the furrow irrigated terrace to sprinkler irrigation. The conversion is associated with about half of the decline in nitrate concentrations and demonstrates the importance of both improved irrigation application efficiency and nitrogen management (Exner, et al., 2010). This project will further aid in the reduction of nitrates leached into the groundwater by the improvement of application efficiency and timing of irrigation events.

Additionally, the proposed project presents the opportunity to assess domestic well depths relative to aquifer saturated thickness, groundwater level changes and adjacent irrigation usage monitored under the project to help determine the risk of water shortages to residents. In many cases, such an assessment may conclude that drilling a domestic well to a deeper depth will help prevent water shortages once drought occurs. But in other cases it may indicate that development of special restrictions on irrigation usage near domestic wells is justified to protect domestic water supplies, especially during drought. Besides protecting water supplies, such an approach would reduce conflicts between irrigators and residents.

- Identify whose drinking water, how many people are affected, how will project remediate or mitigate.

Once boundaries of areas of the district with nitrate issues are better established, the proposed project will be used to analyze whether there is a correlation between groundwater pumping levels within those boundaries and higher nitrate levels. If so, the real-time metering information and associated evapotranspiration data could produce more regulations and/or education to reduce irrigation and therefore nitrate levels. As stated above, two towns in the URNRD have formally identified problems with their drinking water in recent years and rising arsenic levels in the water supply of the largest town in the district, Imperial (pop. 2,000) pose a future risk. The combined population of the three towns is approximately 4,000.

Of the approximately 9,000 residents of the District, about 45% or 4,050, live outside a city or village and rely upon domestic wells for their water supplies. Analysis is being done by the URNRD under a recently revised and more comprehensive water-testing program to determine which areas of the URNRD have high nitrate problems that warrant further action.

Given the high density of irrigated cropland in the URNRD where nitrates are applied – approximately 810,000 acres, or 47 percent, of the 1.7 million acres in the district are cropland and 24 percent of all the land in the URNRD is irrigated – it is not unreasonable to assume that nearly all residents of the district could be at varying levels of risk in the future for high nitrate levels or other elements such as uranium that can be triggered by nitrates.

The project will attempt to limit water applications to no more than what can be consumed by crops so that less water will leach nitrates into the groundwater supply.

- Provide a history of issues and tried solutions.

For more than 40 years the district has annually taken water samples from both domestic and irrigation wells that are tested for contaminants. Rules and regulations have recently been established that require more testing in areas where high nitrate levels are detected. Additionally, limitations on groundwater use (allocations) were established in 1979. Allocations were set for groundwater quantity purposes but were expected to help slow the rate of nitrate infusion into the groundwater supply.

- Provide detail regarding long range impacts if issues are not resolved.

Due to the prevalence of irrigated cropland in the URNRD, rising nitrate levels will eventually expose significant portions of, if not the majority or entire district, to elevated nitrates and associated health issues such as "blue baby syndrome". Under current rates of increase, the average nitrate level in Dundy County, for example, could exceed the acceptable 10 ppm within less than 70 years. There is sufficient time to take actions that prevent excessive nitrate levels district-wide, and it is the desire of the district with the aid of projects such as the one being proposed to take action now. As mentioned earlier, elevated nitrates could pose health problems induced by increasing levels of uranium because of the now-established connection between nitrates and uranium. Speculated but yet unestablished links between nitrates and arsenic could create additional health issues.

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

The proposed project seeks to achieve the primary goal in the URNRD Integrated Management Plan and Groundwater Management Plan: Reduce water use. Providing farmers with the best available information to make irrigation decisions that can lessen water usage is the intent of the proposed project. The URNRD currently limits all agricultural water use via an allocation system and will continue to progressively tighten its regulations.

- Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.

The Integrated Management Plan jointly developed and approved by the URNRD and Nebraska Department of Natural Resources has been formally approved four times. The initial plan became effective June 2, 2005; it was revised and approved and became effective April 3, 2008; revised, approved and became effective on Nov. 1,

2010; and was revised and approved recently, becoming effective on Jan. 15, 2016. The URNRD also has a groundwater management plan addressed by the project.

- Provide the history of work completed to achieve the goals of this plan.

To achieve IMP goals the URNRD has: 1) Further regulated groundwater pumping by limiting the amount of unused allocation, banked from previous years, that farmers can use during the district's five-year allocation periods. 2) Implemented the Rock Creek and NCORPE augmentation projects to ensure compliance with the Republican River Compact as adopted in 1943 and as implemented in accordance with the Settlement Agreement approved by the U.S. Supreme Court in 2003. The augmentation projects kept Nebraska in compliance with the compact in 2013, 2014, 2015, 2016 and 2017. 3) Reached agreements with the other NRDs in the Republican Basin and the State that apportion Compact compliance responsibilities to the NRDs based on depletions to stream flow that occur within their respective districts. This has helped achieve the second IMP goal of ensuring that water users within the district assume their share, but only their share of the responsibility to maintain compliance with the Compact; 4) Implemented a uniform groundwater allocation system whereby all water users within the URNRD have the same allocation. By implementing the augmentation projects, the URNRD has prevented water users close to the Republican and River and its tributaries from being subject to lower water allocations. This has helped achieve the third IMP goal of the district apportioning its share of Compact compliance responsibility equitably to minimize adverse economic, social, and environmental consequences arising from Compact compliance activities. 5) Continued to prohibit expansion of new irrigated acres and permanently retired approximately 1,500 acres from irrigation using district and federal funds. This has helped achieve the fourth IMP goal of protecting groundwater users whose water wells depend on recharge from the river or stream and the surface water appropriators on such rivers or streams from stream flow depletions caused by water uses begun after the time in which the Republican Basin was designated fully appropriated. The primary goal in the district's Groundwater Management Plan is to keep groundwater levels at present levels or minimize declines to ensure future generations have an adequate water supply. The URNRD's allocation system, prohibition on new irrigation wells, spacing requirements between irrigation wells and other rules and regulations have been efforts to achieve that goal. The proposed project will also help accomplish this goal by reducing water use.

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

Project Attainment of IMP Goals

Goal #1, Maintain compliance with the Republican River Compact:

The proposed project will reduce water consumption by providing water application, crop-water needs and soil moisture data in a user-friendly way easily adapted by

farmers. This will help the State stay within its allocation under the Compact and/or limit the amount of excessive use that must be offset by increasing stream flow via stream flow augmentation projects developed in the Republican River Basin. Compliance with the Compact aided by reduced water use prevents statewide liability for noncompliance that include significant penalties. For instance, the State of Kansas recently sought but did not successfully receive a court judgement of approximately $70 million for Nebraska's noncompliance with the Compact in 2005-2006.

Goal #2, Ensure water users within the URNRD assume their share, but only their share, of the responsibility to maintain compliance with the Compact:

The project will make information on depletions to stream flow caused by groundwater use available much sooner than is now possible. Now, it takes approximately three months for URNRD technicians to visit all 3,300 wells in the district, manually record water usage, and then enter the information into a database sent to the state. The information is then used to calculate depletions to stream flow caused by groundwater pumping and Nebraska's use of its Compact allocation. With telemetry units installed on flow meters as part of the project, water usage data from a significant portion of the district will be available almost instantaneously.

Calculations of Nebraska's and the URNRD's use of the Compact allocation, then, will be available much sooner, aiding a variety of water management decisions relative to the Compact. For instance, agreements reached recently among the Compact states allow Nebraska to provide volumes of water to Kansas based on actual, instead of projected, water use and water supplies. Because the projections are naturally very conservative to ensure compliance, providing actual instead of projected volumes needed to maintain compliance is expected to reduce, maybe very significantly, amounts of water that must be produced to maintain compliance. Having near real-time acquisition of water usage will aid district and State efforts to calculate actual compact compliance needs.

Goal #3, Provide the URNRD's share of compliance responsibility and impact be apportioned within the URNRD in an equitable manner and to the extent possible, minimize adverse economic, social and environmental consequences arising from compliance activities:

Recently developed augmentation projects in the Basin, the Rock Creek Augmentation Project in Dundy County and the NCORPE Augmentation Project in Lincoln County, have successfully kept the state in compliance with the Compact. But should their capacity at some be point be insufficient to ensure compliance, the only other available option to the NRDs in the Republican Basin including URNRD would be to impose stricter allocations, or prohibit irrigation altogether, on acres close to the Republican River and its tributaries (42,445 acres in URNRD) in dry years when compliance action was needed. By reducing water use and therefore the impacts on stream flow caused by groundwater pumping that are considered usage of

Nebraska's compact allocation, the project could help prevent or at least mitigate special regulations on water users close to the Republican and its tributaries.

Project Attainment of IMP Objectives

Objective #3: Reduce existing groundwater use within the URNRD by 20 percent from the 1998 to 2002 baseline pumping volumes under average precipitation conditions so that, when combined with stream flow augmentation and incentive programs, the URNRD's groundwater depletions are maintained within their portion of Nebraska's allowable groundwater depletions as computed by the Republican River Compact Administration Model. Additionally, voluntary reductions in baseline pumping volumes will continue to be pursued by the URNRD with the incentive of limiting the level of long-term management actions that are necessary during Compact call years:

The project's ability to reduce groundwater usage will help achieve this objective in a very direct manner. The project proposes to apply research-validated tools related to the use of ET and soil moisture data to improve irrigation decisions so that water usage is reduced without impacting crop yields. ET data within the district is now being collected using a network of weather stations already in use by the URNRD and that will be calibrated using a research-grade ET system operated under a partnership between the URNRD and UNL. This ET information will be available to farmers in real-time, via the URNRD website, to indicate whether or not it is necessary to irrigate and whether previous irrigations have been necessary. Irrigators will also be able to view their water usage relative to the average water use in his area. Research has shown that this information alone can reduce energy usage. This suite of water management tools – ET, soil moisture content, amount of water being applied via irrigation and water usage relative to neighbors – will replace a decision-making process that is now often based on field observations and habit.

Multiple studies have concluded that using information in the manner proposed under the project can significantly reduce water use. A California study (California Department of Water Resources, 1997) estimated that use of ET data to guide irrigation decisions reduced water use by 13 percent. An Oregon study (Dokter, 1996) indicated reduced water use of 15 percent using similar technology. Similarly, the general use of irrigation scheduling that will be made easier and more effective by crop water demand information available under the proposed project was shown to reduce water applications by 11 percent in Nebraska (Kranz et al., 1992) and 20 percent in Kansas (Buchleiter et al. 1996).
For the purposes of the cost-benefit table also provided in the administrative section, we assumed water use reductions due to the project of 15 percent eventually.

Objective #4, Make such additional reductions in Compact call years as are necessary, after taking into account any reduction in beneficial consumptive use achieved through basin-wide incentive and stream flow augmentation programs, to achieve a reduction in beneficial consumptive use in the URNRD that ensures the district limits its groundwater depletions to the Allowable Groundwater Depletions for the URNRD:

Reductions in pumping resulting from the project will lessen further reductions in pumping that may have to be made in Compact call years so that allowable depletions to stream flow caused by groundwater use are not exceeded.

Objective #5, Cause the reductions in water use required for compact compliance to be achieved through a combination of regulatory, incentive, and augmentation programs designed to reduce consumptive use. To the extent funds are available, incentive programs will be made available through targeted incentive programs:

The proposed project will trigger reductions in water use from both regulatory and incentive programs. From a regulatory standpoint, the ET portion of the project will offer the URNRD the opportunity to compare water/irrigation demands of crops with actual water usage in real time provided by the telemetry units. These comparisons may suggest there is overuse of water. If so, it will help guide decisions on tightening regulations to lessen water use without significantly impacting yields. Similarly, irrigators will have incentive to reduce water use and lessen energy costs associated with pumping water if it is demonstrated to them that they can apply less water and still meet crop water demands.

Objective #7, Develop a program to provide offsets for new consumptive uses of water so that economic development in the district may continue without producing an overall increase in groundwater depletions caused by new uses:

Meeting this objective with the project is not specifically part of the project proposal but using the project to do so could be an option for the district moving forward. Currently, new industries that use significant amounts of water such as ethanol plants must offset water they will consume by retiring existing uses. This is normally accomplished by buying irrigated land and retiring it from irrigation so an equal amount of water historically used on the cropland can be used for their industry. This can pose costly obstacles to new industries considering locating to the district. Conceivably, a small portion of the water use reductions achieved by irrigators under the program could be used to offset some industrial uses should water conservation criteria be 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 western half of Chase County, an area of about 450 square miles, will be the area of focus for the project due to its high density of irrigated cropland, the fact it has the largest area of the most significant groundwater declines in the URNRD, and an existing radio

network that will allow water usage from irrigation flow meters to be communicated in near real time. This information will be available to irrigators and the URNRD. Irrigators will be able to match their irrigations with crop-water needs that are estimated by weather stations in the district, already deployed, that estimate ET. The ET data will be calibrated using a research-grade eddy covariance system that has been installed under a partnership between UNL and the URNRD. Additionally, the real-time water usage data will help the growing number of irrigators who use soil moisture probes in the district, many of which are cost-shared by the URNRD, ensure their irrigations more closely match what probes indicate are needed.

A study in California (California Department of Water Resources, 1997) estimated that use of nearby weather stations by irrigators to estimate ET reduced water use by 13 percent. Similarly, an Oregon study (Dokter, 1996) indicated reduced water use of 15 percent using similar technology. The general use of irrigation scheduling that will be made easier and more effective by crop water demand information available under the proposed project was shown to reduce water applications by 11 percent in Nebraska (Kranz et al., 1992) and 20 percent in Kansas (Buchleiter et al. 1996). Finally, there is strong evidence that simply knowing usage on a regular basis can reduce usage. Studies have shown (Vines et al., 2013) that providing people feedback on their utility usage, for example when and how much they are using, can reduce consumption by 5 percent to 20 percent.

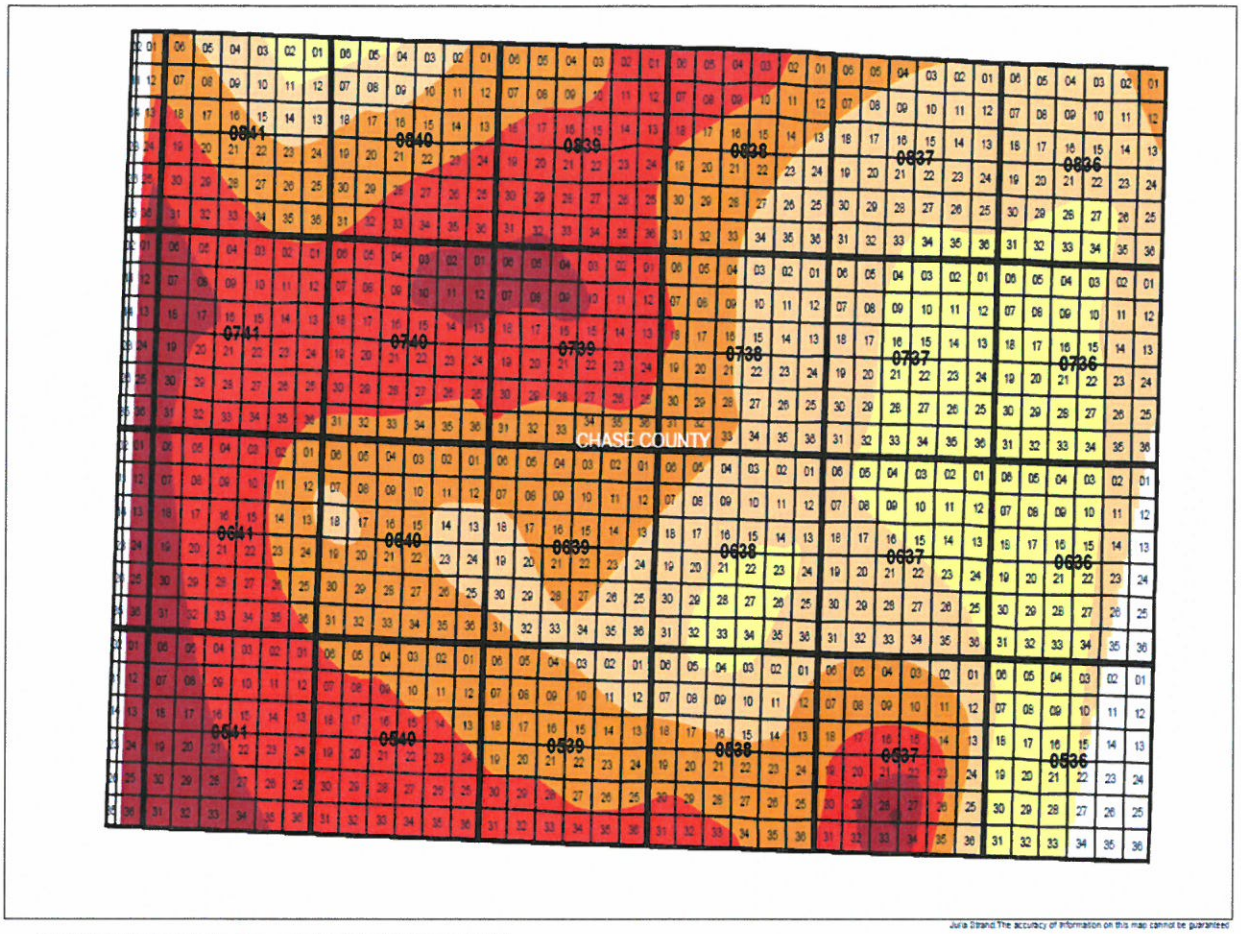
From a regulatory standpoint, the real-time water usage data will be a key input into a groundwater model currently being developed by the URNRD. The model will help determine the volume and accessibility of water in the aquifer during different time periods under variable pumping rates. In other words, how much water will be available for irrigation and other uses – i.e. aquifer life – under different groundwater pumping rates over time. Once the model is completed and operable, the URNRD will educate constituents across the district, but particularly those in high-decline areas such as the project area, about the long-term viability of the aquifer and irrigated agriculture if pumping rates don't change, and if they are reduced. We expect this process to possibly result in additional regulations to indefinitely extend aquifer life in the district. It is quite possible there will be different groundwater usage regulations for different parts of the district as a result of this process. In any case, having real-time water usage is an important part of this process. Groundwater level information is abundant, as we twice-annually measure groundwater levels at almost 400 locations in the district and we have real-time groundwater level data at 15 sites.

Total, annual groundwater withdrawals from the 780 irrigation wells in the project area equipped with telemetry units under the proposed grant average approximately 101,500 acre feet annually. We expect the project, once fully developed, to reduce withdrawals and aquifer depletion by approximately 7,000 acre feet in 2020. The reduction in use is expected to increase over time, eventually reaching 15% less than current, average annual use, within approximately 15 years. Should this staggered increase in the rate of water use reduction in the area occur as we hope and expect, the project by the year 2040 will have reduced water use by a total of approximately 240,000 acre feet as irrigators become

more accustomed to using real-time water usage information, ET data and soil moisture information to make irrigation decisions.

The western half of Chase County (west of Imperial) where the project will be located, and in particular the northwest part of the county, has experienced widespread groundwater declines of approximately 60'-80' since the early 1970's and 30'-50' since 1980. The area encompasses approximately 1/6 of the land area of the URNRD but contains about 1/3 of the irrigated acres in the district. Much of the area is comprised of flat land with relatively good soil so was some of the first land in the district to be developed for irrigation. In 1979, shortly after the Legislature gave NRD's the authority to regulate groundwater use, the URNRD became the first entity in Nebraska and possibly the country to regulate agricultural groundwater use and also imposed limits on how closely irrigation wells could be to each other. But by that time, most irrigation development that would occur had already occurred in western Chase County.
The map below shows declines in Chase County since 1980; as you can see the steepest declines have occurred in the western half of the county.

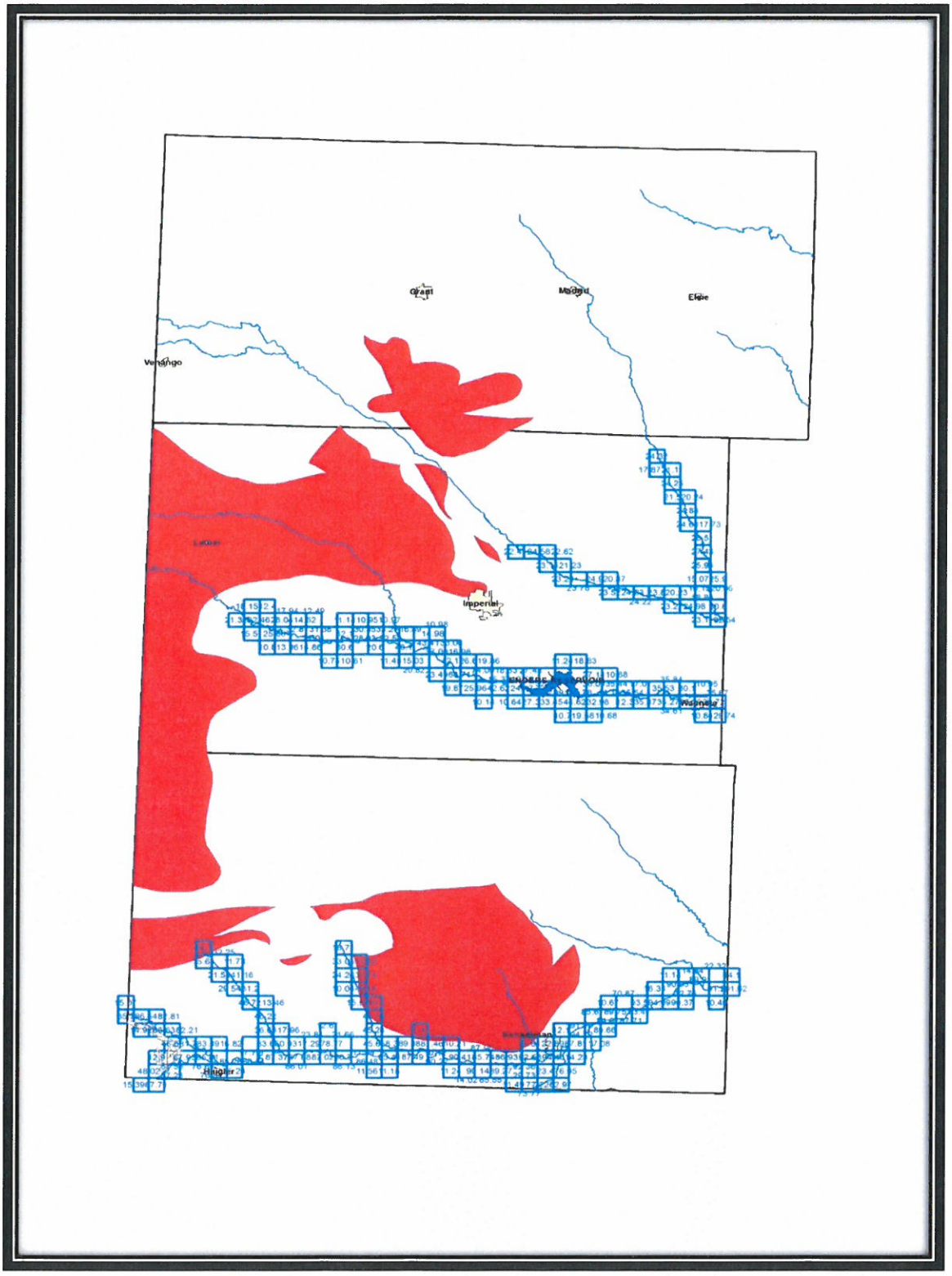
Chase County Groundwater Level Declines 1980-2016



Ground Water Level Declines in Feet

0.46 - 10	30 - 40
10 - 20	40 - 50
20- 30	50 - 52.89

To better understand the significance of groundwater declines, one must know how they relate to the available water supply. For example, a 10' decline in an area of 20' of remaining water presents more imminent problems than a decline of 10' in an area where there is 200' of remaining water. The map below shows areas of the district where at least 25% of the original saturated thickness of the aquifer, as it existed before irrigation began, has been depleted. Such areas are in red, and you'll note that much of them are in the project area of western Chase County (Chase County is the center county; Dundy County is to the south and Perkins County to the north).


Grant
Madrid
Elsie
Imperial
Winnela

Should the project reduce groundwater declines to the extent we expect, rates of decline could decrease by approximately 20%, helping lead to eventual stabilization of the aquifer in the area.

- 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.

An eventual 15 percent reduction in pumping that studies indicate could occur under the project, applied to the district-wide average annual use of 12 inches per acre, would reduce water usage by about 1.8 inches per acre, or approximately 15,200 acre feet annually in the project area. Groundwater pumping in the project area has, on average, a 15 percent impact on stream flow over the long term. Annual additions to stream flow caused by a 15% reduction would be approximately 2,300 acre feet over the long term in the form of additional baseflow. These would primarily be accretions to Frenchman Creek, which is one of the largest tributaries of the Republican River. It generally flows through central Chase County before its confluence with the Republican River in Hitchcock County near McCook. To put 2,300 acre feet of additional stream flow in context, it represents approximately 20% of the average annual depletions to stream flow caused by groundwater use in the URNRD that has exceeded allowable depletions under the Compact, i.e. had that level of benefit been achieved by the time action was needed the last several years to maintain Compact compliance, the URNRD would have had to produce 20% less than it had to the past several years to maintain compliance with the Compact.

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;

More stream flow resulting from less stream depletions caused by groundwater use will aid wildlife in streams and reservoirs both in and outside of the URNRD; recreational uses of reservoirs will benefit from additional inflows resulting from less groundwater use; municipal and industrial wells will face less long term risk of being insufficient because of excessive irrigation usage; drinking water quality will be improved because less irrigation will help prevent leaching of nitrates into the groundwater supply and the usable life of the aquifer for agricultural purposes will be prolonged, hopefully indefinitely, because of the preservation and conservation of water.

- List the goals the project provides benefits.
- Conservation of water
- Preservation and protection of municipal, domestic and industrial water supplies

- Agricultural use
- Stream flow benefitting wildlife and recreation

- Describe how the project will provide these benefits

Conservation of water: The URNRD's current allocation system limits water use, encourages conservation and has slowed groundwater declines. But significant advancements are possible with real-time water usage data available to irrigators and the URNRD under the project. The fundamental question the project will answer is this: How do I know exactly how much water to apply, and if I'm told how much to apply, how do I know I am applying the correct amount?

Current and developing programs in the URNRD are helping answer the first two parts of that question. As mentioned earlier, the URNRD provides cost share for soil moisture probes that have been installed on more than 50,000 acres in the district. They allow farmers to look on their computers or smart phones and see whether irrigations are needed based on soil-moisture content at depths of up to approximately 3'. Farmers who follow the recommendations offered by the probes tell us that they believe use of the probes reduces their summer irrigation usage by 2"-3" per acre. That level of savings is significant. If all irrigators in the URNRD reduced water use by 3", average, district-wide water use would decline by 25% and cut annual water use by more than 100,000 acre feet. While farmers say use of the probes reduces water use, they say the reductions would be greater if they knew exactly how much water they were applying to prevent irrigating more than what is recommended by use of the probes. Water-usage info provided by the proposed project would fill this gap.

In addition to soil-moisture content, information on how much water crops are consuming and how much applied water is evaporating, i.e. evapotranspiration, or ET, allows farmers to significantly improve their decision making. As stated earlier, study in California (California Department of Water Resources, 1997) estimated that use of nearby weather stations by irrigators to estimate ET reduced water use by 13 percent. Similarly, an Oregon study (Dokter, 1996) indicated reduced water use of 15 percent using similar technology. The general use of irrigation scheduling that will be made easier and more effective by crop water demand information available under the proposed project was shown to reduce water applications by 11 percent in Nebraska (Kranz et al., 1992) and 20 percent in Kansas (Buchleiter et al. 1996).

But where do irrigators go to get accurate, localized ET information? Before this year, there was only one weather station within the URNRD that estimated ET and from which data was publicly available. While many such stations are in the Platte Valley of central Nebraska, few are in southwest Nebraska. This spring, the URNRD installed three such stations in the district, one in each of the URNRD's three counties. To improve the accuracy of their estimates, the URNRD partnered with UNL to install a research grade ET instrument, called an eddy covariance system. The system is currently in use and the information from it will be used to calibrate the

three URNRD weather stations to make their ET estimates as accurate as possible. Once the instruments have been calibrated, irrigators will be able to go to the URNRD website, click on the station closest to them, and easily see crop-water use from a number of different crops.

Like the use of probes, however, this information will be much more applicable if irrigators know exactly how much water they are applying relative to the ET estimates. The proposed project will provide this information.

There are financial incentives to not over-irrigating: At current power rates, reducing pumping by just 1.5 inches over the course of an irrigation season can reduce costs of irrigating a quarter section of land by approximately $1,000. Additionally, irrigators are expected to use the real-time information to know what their water use is in relation to their allocation which is expected to encourage more conservative water use. Finally, the information will let district staff know whether over-watering is occurring using the same comparisons of water use and ET. We will be able to respond to the information by creating programs and rules modifications to reduce water use to levels that the data suggests is reasonable to slow groundwater declines without causing undue economic harm.

Preservation and protection of domestic, municipal and industrial water supplies: Domestic and industrial water supplies face long-term threats if water use isn't reduced in the project area. In some parts of the project area of western Chase County, for instance, approximately 75% of the land mass is irrigated cropland. These areas have experienced 60'-80' declines where, under current rates of declines, domestic water systems may have to undergo costly modifications, i.e. drilling wells deeper, to continue to provide water. A decreasing water supply would also make the region less attractive to industry, primarily agribusiness. For instance, the region was recently selected by a large organic dairy operation to grow feed and locate dairy cows for milking. These types of opportunities that grow the economy of the area will be lessened if concerns over reduced water supplies aren't mitigated. Simple awareness that action is being taken to conserve water as this project proposes is a positive sign to industry that water supplies will be extended and provide business sustainability.

Because the URNRD is heavily irrigated, all domestic, municipal and industrial wells are susceptible to irrigation usage. Well depths relative to aquifer saturated thickness, groundwater level changes and adjacent irrigation usage monitored under the project will help determine risk of water shortages to residents, towns and industry. Groundwater modeling that is not part of this grant proposal but that will be conducted will help determine the level of risk posed to domestic and municipal wells by current, average pumping rates and other pumping rates assumed under different regulatory scenarios. For instance, the modeling and information about domestic well depths may indicate when the wells may experience water availability issues should current, average rates of pumping continue. If issues are identified and special programs or regulations are established to prevent domestic shortages, the real-time

water usage will be used to ensure water usage doesn't exceed what can occur without jeopardizing domestic water availability.

Reliability of irrigation water supply: The project seeks to prevent aquifer levels from lowering enough that long term water availability and therefore well capacity is insufficient to meet water demands, namely during dry periods. This will primarily be achieved by developing regulations and encouraging irrigation decisions by irrigators that help ensure irrigation usage doesn't exceed crop-water needs.

Stream flow benefitting wildlife and recreation: Reduced pumping caused by more attention to crop-water needs relative to what is pumped at the time crop-water needs are known via the ET, soil moisture and pumping data available under the project will increase stream flow compared to what would have occurred had there not been reduced water use. As stated earlier, if our projections of reduced water use under the project come to fruition, annual stream flow will increase by approximately 2,300 acre feet compared to what would have otherwise occurred. Given the location of the project in the western half of Chase County, near the Frenchman River, most of this increased baseflow will enter Enders Reservoir. A Nebraska State Park, Enders is the most-used recreation area in the URNRD and one of the most popular within a multi-county region outside of the URNRD. Reduced stream flow primarily caused by groundwater pumping upstream of Enders has threatened the long-term viability of the reservoir. The proposed project, combined with other actions to reduce groundwater use and increase flow to Enders, will help maintain its important recreational function in the area.

Champion Lake in Chase County would also benefit from the reduced pumping caused by the project. Located west of Enders, it is also fed by the Frenchman and has experienced declining levels. It is a popular recreational and historical site to the State and Nebraska, home to a well-maintained flour and feed mill built in 1888 that visitors can tour and that was the last commercially operated, hydro-powered feed and flour mill in Nebraska. The mill is currently listed on the National Register of Historic Places.

- Provide a long range forecast of the expected benefits this project could have versus continuing on current path.

It is reasonable to expect that the URNRD's goal of significantly slowing and eventually stopping groundwater declines won't occur unless tools such as the ones proposed in this project are implemented.

The saturated thickness of the aquifer in the URNRD ranges from approximately 50 feet – 400 feet. Areas of little saturated thickness where water supplies are close to being insufficient to providing an adequate irrigation supply will almost immediately benefit from the project by allowing farmers to be more productive with marginal wells and extending the usable life of those wells. For other areas of the project area where significant saturated thickness exists but water tables are declining, the project

has the potential over many years to prolong the capability of wells to yield enough water to sufficiently irrigate crops.

The URNRD has a formally adopted goal of "developing, promulgating and enforcing rules and regulations that provide for appropriate protection of the aquifer to slow and eventually stop water table declines in order that beneficially usable quantities of water remain in the aquifer; incentives to use water efficiently; conservation of groundwater; and maintaining or enhancing groundwater quality." (*URNRD Master Plan, 2010-2020*).

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.

The beneficial use of Nebraska's water resources will be maximized by making more water available in future years for beneficial uses without sacrificing current levels of production. In other words, conservation now will make more water available to be put to productive use in the future, without sacrificing current productivity. Nebraska Revised Statutes 46-204 designates the highest priorities for beneficial use as domestic first and agricultural use second. This project will extend protection to these highest beneficial uses within the State.

This will be achieved by reducing and hopefully eliminating unnecessary water applications by indicating to irrigators and the district to what extent current levels of usage are unnecessary using ET and soil moisture data. These unnecessary water applications which could be significantly reduced or eliminated under the project could be deemed non-beneficial if they resulted in an event such as runoff water leaving a tract of irrigated land.

The URNRD's current method of measuring water use once annually serves primarily administrative purposes: For us and irrigators to be aware of how water usage corresponds with the URNRD's allocations that limit water use. The method proposed in this project allows water measurement to be used as more than an administrative tool: It will be a day-to-day water management, irrigation scheduling tool that can optimize water that is applied and negate water applications that have little or no crop-yield advantage. The URNRD's rules and regulations have incentivized the use of the most efficient water-delivery systems available. Because there is relatively little room to improve water-application efficiencies, the approach proposed in this application applications represents what we believe to be the most promising new realm of water management in the district.

   - Describe the beneficial uses that will be reduced, if any.

This project intends to reduce or eliminate excessive water use that doesn't measurably increase crop yields. Beneficial uses will not be reduced.

- Describe how the project provides a beneficial impact to the state's residents.

The project provides a beneficial economic impact to residents of the State by helping to sustain water resources, and therefore sustaining income tax revenue derived from irrigated crops. The total, average annual market value of agricultural products produced in Chase, Dundy and Perkins Counties that comprise the District is approximately $840 million. Should groundwater availability decline to the point that a 15 percent reduction in irrigation and resulting decreases in yields occur in upland areas with more water availability and a 40 percent reduction in irrigation near streams where there tends to be less groundwater available occur, annual economic output impacting state revenues could drop by an estimated $27 million (UNL Bureau of Business Research, 2007).

The project as described earlier also helps the URNRD and State achieve compliance with the Republican River Compact by reducing water usage and therefore depletions to stream flow. If current augmentation projects at some point in the future did not have enough capacity to help maintain Compact compliance because depletions rose to unmanageable levels, the State would be at risk of noncompliance. There is not a specified financial penalty associated with noncompliance, but Kansas had sought $70 million from the State for noncompliance in 2005 and 2006.

Should the project be approved, the URNRD will be the only NRD in the State with such a water-management system. It could be used as a template for other regions of the State facing similar challenges and help lead to reduced water use benefitting residents other than those within our district and the Republican Basin.

6. Is cost-effective;

- List the estimated construction costs, O/M costs, land and water acquisition costs, alternative options, value of benefits gained.

The total estimated project cost is $633,855 and excluding portions of the project which we are not seeking reimbursement for the total for the purposes of the grant application is $625,560. We are requesting WSF funds pay for 60% of the project, or $375,336, and the URNRD paying the remainder. The WSF funds will only be used to pay for equipment necessary to equip 780 flow meters with real-time telemetry capabilities: Digital registers for the flow meters that log data; bearing assemblies and sensors embedded in the flow meters; and radio modules that transmit the water usage data to the radio network.

Costs for which we are not seeking reimbursement are $5,750 for installation service and training and $2,545 for a regional network interface that will allow us to manage and

monitor the water usage data. Irrigators will have access to their data via a log-in provided by the URNRD.

Annual operation and maintenance costs will be approximately $13,000. The cost will primarily be for access to and use of the existing radio network owned by the utility that owns and operates the network, Highline Electric Association based in Holyoke, Colo. There are no land or water acquisition costs; the equipment will be installed on existing pivots and flow meters.

A reasonable way to assign a value to the benefits of the project is to estimate the value of water potentially saved assuming the preserved water may someday be put to beneficial use. Studies have indicated that use of similar technology can reduce water savings by anywhere from 5 percent to 20 percent. For purposes of the cost-benefit analysis provided earlier in the Director's Findings portion of this application, it was conservatively assumed that annual water reductions would grow from 7 percent to 15 percent less water applied over a 20-year period. A relatively conservative value of $511 per acre foot was assigned based on average, per-acre irrigated yield increases of 100 bushels an acre over average dry-land yields. Finally, an average of 12 inches of irrigation applied per acre was used.

Using the same estimates of water values described earlier - $511 per acre foot using the NRC's commodity value applied to irrigated cropland productivity versus dryland and $350 per acre foot using what the URNRD has previously paid for water – the annual value of benefits gained assuming an average, 15% reduction in water use is approximately $7.7 million

- Lists the costs of the project.
  See the table below

	$/unit	Quantity	Grant Funded	Cost
Equipment				
Flow Meter Digital Register and Data Logger	$450	780	Yes	$351,000
Bearing Assembly to Retrofit Meters with Digital Registers	$190	780	Yes	$148,200
Radio Modules	$162	780	Yes	$126,360
Total Reimbursable Project Costs				**$625,560**
Contracted Equipment Installation				
Installation Service/Training	$115.00	50	No	$5,750
Subtotal				**$5,750**
Software/Licensing Agreements				
Regional Network Interface		1	No	$2,545
Subtotal				**$2,545**
Total Project Costs				**$633,855**

- Compare these costs to other methods of achieving the same benefits.

The URNRD has studied and tested cellular, satellite and now radio telemetry systems for transmitting water usage from irrigators. Because of the rural nature of the URNRD and the ease with which cellular signals can be compromised - in our case 7'-10' corn is the culprit - satellite and radio offer the most communications reliability. While satellite offers superb reliability, the cost is less attractive: Monthly satellite service fees for one flow meter is approximately $6. Comparatively, the cost of using the existing radio network will be approximately 85 cents per month, per meter. Applied across the 780 meters part of the project, the annual operational savings of using radio instead of satellite will be approximately $48,200.

Cost aside, in terms of function, really the sole determinant of feasibility for a telemetry system is communication coverage and reliability. In 2017, the URNRD requested that the developer of the radio networks used by the electric utilities do a propagation study to predict signal strength and the coverage of the networks in relation to irrigation flow meters in the URNRD, i.e. whether water usage from the flow meters would be able to be transmitted via the network. The results were positive and showed all flow meters within

the coverage areas of the radio networks should be able to transmit data within the networks.

An agreement has been reached with Highline Electric Association of Holyoke, Colo., to allow reporting of water usage from flow meters using their radio network. The URNRD would acquire its own network interface, i.e. dashboard, of hardware, software and database elements to monitor and manage the flow meter data and communication network. Should grant funding be approved, the URNRD would proceed with purchasing the digital meter registers and radio modules necessary to implement the project and complete installation over approximately the next 1.5-2 years. Installation doesn't require any new or significant structures and is very straightforward – sensors are installed inside existing, prop-style flow meters, new digital meter heads replace the existing heads, and a radio module is connected to the meter heads and mounted near the meters, which are most often located at pivot points.

- Describe how it is a cost effective project or alternative.

We believe the water saved and therefore able to be put to beneficial use in the future under the project will come at a significantly cheaper cost than strictly regulatory alternatives.

An average 15% reduction in water use resulting from the project would equal approximately 15,200 acre feet less water being withdrawn on an annual basis in the project area. The shortest formal planning horizon for the URNRD is 10 years (URNRD Master Plan) and the total estimated cost of the project is $633,855. Should an annual, 15,200 reduction in water use occur, over 10 years reduced water use would equal 152,000 acre feet, resulting in a cost of approximately $4.17 for each acre foot of reduced water use total over the period. This cost is much less than prices the URNRD has paid for water previously and the value of water when one considers its beneficial impact on corn yields in the district.

In 2007, the URNRD purchased surface water for approximately $300 per acre foot which adjusted for inflation would cost approximately $350 per acre foot in 2018 dollars. Assuming the proposed project was just implemented for one year, resulting in 15% less water use, the cost of that 15,200 acre feet of water left in the aquifer for future use would be approximately $42 per acre foot ($633,855/15,200) - more than eight times less than the $350 cost of water purchased previously by the NRD.

Another method of estimating the value of water is to consider its effect on yields. The average difference between dryland and irrigated corn yields in the URNRD is 100 bushels per acre and the average 2014 corn price as suggested by the Natural Resources Commission's commodity price index for WSF grants is $5.11 per bushel. Using this price and approach, the value of water in the URNRD is $511 per acre foot (100 bushels x $5.11) since average water use in the district is 12" per acre.
Assuming a $511 per acre foot value of water in the District and a 15% reduction in water use resulting in 15,200 fewer acre feet of water being withdrawn from the aquifer, the annual value of water saved by the project in water would be $7.7 million.

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.

   The Compact the project will help meet is the Republican River Compact between Nebraska, Kansas and Colorado as adopted in 1943 and as implemented in accordance with the Settlement Agreement approved by the U.S. Supreme Court in 2003.

   - 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.

   Water consumption reduced under the project will help ensure Nebraska doesn't exceed its Compact allocation. It will also reduce the amount of water use exceeding the allocation that must be offset by increasing stream flow via stream flow augmentation projects developed in the Republican River Basin. The project will help prevent and/or reduce statewide liability for noncompliance that include significant penalties. As an example, the State of Kansas recently sought but did not successfully receive a court judgement of approximately $70 million for Nebraska's noncompliance with the Compact in 2005-2006.

   Information on depletions to stream flow caused by groundwater use for Compact accounting purposes will be available much sooner than is now possible because groundwater use, via the telemetry units on flow meters, will be available almost instantaneously. Beneficial agreements reached recently among the Compact states allow Nebraska to provide volumes of water to Kansas based on actual, instead of projected, water use and water supplies. Because the projections are naturally very conservative to ensure compliance, providing actual instead of projected volumes needed to maintain compliance is expected to reduce, maybe very significantly, amounts of water that must be produced to maintain compliance. Having near real-time acquisition of water usage will aid URNRD and State efforts to calculate actual Compact compliance needs.

   Recently developed augmentation projects in the Basin, the Rock Creek Augmentation Project in Dundy County and the NCORPE Augmentation Project in Lincoln County, have successfully kept the state in compliance with the Compact. But should their capacity at some be point be insufficient to ensure compliance, the only other available option to the NRDs in the Republican Basin including URNRD would be to impose stricter allocations, or prohibit irrigation altogether, on acres close to the Republican River and its tributaries (42,445 acres in URNRD) in dry years when compliance action was needed. By reducing water use and therefore the impacts on stream flow caused by groundwater pumping that are considered usage of Nebraska's compact allocation, the

project could help prevent or at least mitigate special regulations on water users close to the Republican and its tributaries.

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the Untied States such that their incapacitation would have a debilitating effect on public security or public health and safety;

- Identify the property that the project is intended to reduce threats to.
- Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
- Identify the potential value of cost savings resulting from completion of the project.
- Describe the benefits for public security, public health and safety.

Infrastructure is normally thought of as dams, roads, rail, etc. But there is also organizational infrastructure just as vital to the economy, albeit in a much different way. A primary example is supply and processing systems that provide food and fuel. Infrastructure risk experts increasingly cite dwindling water supplies as a threat to these types of organizational infrastructure. By reducing water use as the project proposes through improved irrigation scheduling based on actual crop water needs as the project proposes, these types of infrastructure will face lower risk threats.

When projecting future crop yields that might impact those infrastructure areas, the U.S. Department of Homeland Security Office of Cyber and Infrastructure Analysis used Dundy County as one of the three counties in the URNRD as its lone example. Counties of highest concern overlying the aquifer are those the modeling described in the report showed as having 25 or fewer years of groundwater use available. No such counties in Nebraska were shown to be facing that imminent of a problem. But of the seven counties in Nebraska where the life of the aquifer usable for irrigation was shown to be 50-100 years, two are in the district (Dundy and Chase). One of the four counties in the Nebraska with a usable aquifer life of 100-200 years was in the District (Perkins). While low in population, the three counties in the URNRD are big players in the state and even national farm economy, making the stability of agriculture in each of them important to economic and organizational infrastructure. The combined market value of products sold in the three counties according to the most recent U.S. Department of Agriculture Census of Agriculture is approximately $840 million. Perkins County is ranked 3rd among Nebraska's 93 counties in corn for grain production and 38th among the 3,079 counties in the U.S. It ranks 5th and 209th, respectively, in wheat for grain production. Chase County is 20th in Nebraska for corn for grain production, 13th in wheat production and 15th in corn for silage. Dundy County is ranked 14th for wheat production and 23rd in corn for silage.

The 2015 report from the Department of Homeland Security indicated that dwindling groundwater resources could reduce corn production 70% by 2060 and soybean production would decline by more than 40%. Food and fuel (ethanol) prices could rise due to less crop production and water and wastewater systems could be negatively impacted by growing populations and declining groundwater levels, according to the 2015 report. Transportation systems infrastructure could be affected by potentially less demand for transportation services as a result of less agriculture and ethanol production. Decreases in critical infrastructure caused by dwindling water supplies could be experienced in the food and agriculture, energy, and chemical sectors, according to the analysis.

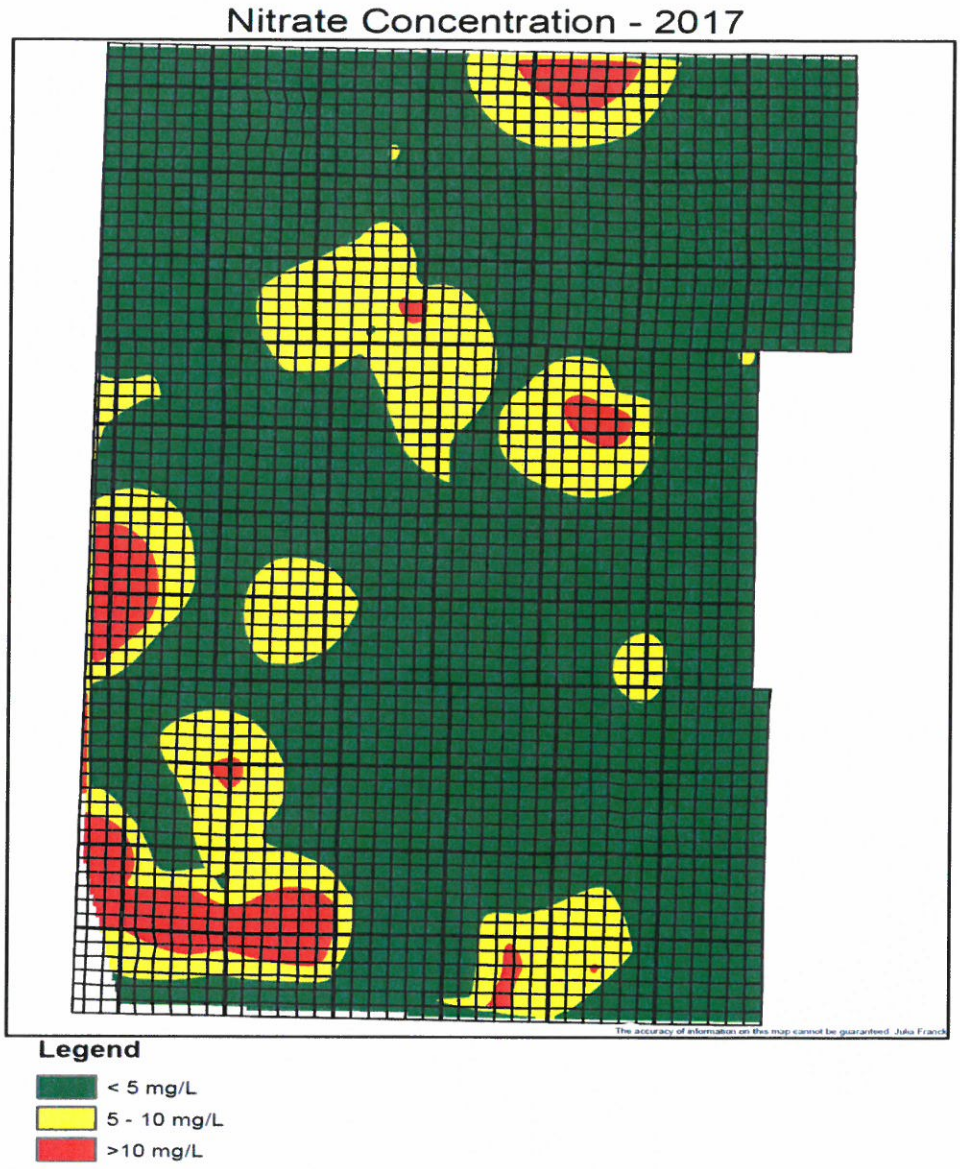
DHS modeling showed that in the future, dryland crop yields might actually decline slightly and reliance on groundwater irrigation could be more tenuous. "Whereas farmers have used irrigation to offset impacts of climate variability on crop yields in the past, the depletion of the High Plains Aquifer could hinder their ability to do so in the future," according to the report. "As groundwater availability decreases over time, it is possible that more agricultural land will be converted from irrigated to dryland farming." This project will also protect the property value of irrigated land in the URNRD by preventing the conversion of cropland from irrigated to dryland. Irrigated land is valued approximately three times higher than dryland cropland. The stabilization of groundwater levels via the project will help protect property values.

9. Improves water quality;

   - Describe what quality issue(s) is/are to be improved.

Approximately 20% of the URNRD is estimated to have nitrate levels that exceed the acceptable drinking water standard of 10ppm. The areas are primarily located in the southwest, southeast and east-central parts of the district, including the primary project area of western Chase County. Nitrate concentrations in the district have doubled the last 40 years by an average of 2 ppm and are expected to create increasingly higher risks to drinking water within the URNRD. The map on the next page shows nitrate levels within the URNRD. Chase County is the county in the middle of the map.

Approximately 7% of the project area of western Chase County, or roughly 30 square miles, has nitrate levels that exceed the federally acceptable drinking water standard of 10 ppm. Approximately 15% of the project area has nitrate levels of 5-10ppm that are close to exceeding acceptable drinking water standards.



As you can see from the map, western Chase County has the third largest area of elevated nitrate levels within the URNRD. The region of concern is not exceptionally large and groundwater quality issues there aren't imminently critical. However, the area could be at particular risk of rising nitrate levels in the future. This is because within western Chase County, the distance from the land surface to the top of the water table is relatively short – in many areas, less than 50'. Nitrates that leach through the soil, then, have a relatively brief trip before reaching groundwater.

Research has shown that conversion from furrow to center-pivot irrigation and using fertigation offers the greatest opportunity to improve water quality (Watts et al., 1997). Increasing irrigation efficiency will produce health and environmental benefits in the area through decreased concentrations of nitrates in groundwater.

Telemetry units installed on all flow meters will let them know that amounts they are applying correspond with these actual water demands. Consequently, the project will help prevent irrigation that exceeds the soil's ability to hold water and the crops' ability to consume it, lessening chances of nitrates leaching into the groundwater.

- 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.

Studies have verified that leaching of nitrates into the groundwater supply increases with more irrigation. The proposed project is intended to help reduce volume and instances of leaching by reducing and hopefully eliminating excessive applications of irrigation water that can't be consumed by crops and leaches nitrates down past crop root zones and into the groundwater supply. To the extent that the project reduces irrigation usage to preserve quantities of water in the aquifer, it also protects the quality of the water.
The intent is to reduce water usage and therefore nitrate leaching on approximately 101,000 irrigated acres within western Chase County. The population of the western half off the county is approximately 2,000 people.

- Describe other possible solutions to remedy this issue.

Other ways of reducing the increases in nitrate levels include restricting the amount of fertilizers farmers can use, and when they use them. The analysis of nitrate issues in the URNRD will have to be completed before deciding whether this is a prudent course of action. However, it is likely that implementation of actions to reduce water use such as those proposed in this project will occur first, and results gathered, before imposing fertilizer application restrictions.

- Describe the history of the water quality issue including previous attempts to remedy the problem and the results obtained.

The URNRD has annually taken water samples from both domestic and irrigation wells for more than 40 years to test for contaminants. Rules and regulations have been established that require more testing in areas where high nitrate levels are detected. Additionally, limitations on groundwater use (allocations) were established in 1979. Allocations were set for groundwater quantity purposes but are expected to help slow the rate of nitrate infusion into the groundwater supply.

Beginning in the 1970's, about 276 wells were sampled for nitrate each year. The same domestic and livestock wells were sampled as in the winter, and if a well had a nitrate concentration greater than 4 mg/l, then an additional 12 groundwater samples in a 3-mile radius were taken. These additional wells were mainly domestic and stock wells but they may also include irrigation wells. This normally added up to a little more than 200 wells (213 wells were sampled in 2015). In addition, 63 irrigation wells were sampled and tested in the summer for nitrate and the results submitted to UNK for inclusion in their water quality database.

A new program established within the last two years is intended to provide more geographic uniformity of water testing in the district and better identify possible sources of water quality problems. The new water testing program will also provide more potential solutions to water-quality problems.

The goals of the current water testing program are twofold – identify and reduce human health risk and improve the general health of the aquifer beneath the URNRD. Beginning in the summer of 2017, summer sampling began to focus on the general "aquifer health" within the URNRD. One hundred thirty-four irrigation wells will be sampled to estimate the average nitrate concentration throughout the district. The locations of the wells were chosen to obtain an accurate nitrate concentration throughout the district. The results of the analyses determine the boundary designations of the different phase requirements for farm management practices within the district. While most of the district has relatively good water quality, some areas have higher nitrate concentrations, and in those areas the URNRD requires land owners and operators to follow farm management practices that will maintain or reduce nitrate concentrations in the ground water. The winter sampling focuses more on human health.

There are about 380 registered domestic wells in the district, and the URNRD will sample approximately 76 wells each year on a 5-year cycle, so all registered domestic wells will be sampled every 5 years. If a well has a nitrate-nitrogen concentration greater than 10 mg/l, then an URNRD representative will inspect the well's construction information and site to determine the potential source of the high nitrate.

Unregistered wells may be sampled upon request, but the owner must first register the well. The sampling program is focused on nitrate, but if the owner has other water quality concerns, then the owner may request that the sample be tested for other water quality constituents.

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.

The jurisdiction that supports the project is the URNRD. We believe our experience metering and regulating all agricultural water use in the area since the 1970's makes us qualified to pursue an advanced metering and water management scheme as proposed.

- List current property tax levy, valuations, or other sources of revenue for the sponsoring entity.

The District's 2017-2018 tax levy is $.083328 per $100 of valuation and will generate $3.2 million of revenue. The URNRD's other source of revenue is the $10-per-irrigated-acre occupation tax that generates approximately $4.4 million annually.

- List other funding sources for the project.

The URNRD in 2016 received a $300,000 grant from the U.S. Bureau of Reclamation WaterSMART program to implement a program to prepare the area for drought. The grant thus far has been used to help pay for weather stations, mentioned before in this application, that will calculate the ET that farmers and the URNRD can use to make water management decisions, transducers in 20 wells to allow for real-time information on groundwater levels, and telemetry units on approximately 300 flow meters to relay water usage in real time. The $300,000 is *not included* in the total project cost for the purposes of the WSF grant.

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.

The local jurisdiction applying for the grant, the URNRD, has a long term and master plan that address short, mid-term and long-range goals associated with water use and availability. The overarching goal of the plans is to achieve sustainability by slowing and eventually stopping groundwater declines. Specifically, the URNRD has formally adopted goal of "developing, promulgating and enforcing rules and regulations that provide for appropriate protection of the aquifer to slow and eventually stop water table declines in order that beneficially usable quantities of water remain in the aquifer; incentives to use water efficiently; conservation of groundwater; and maintaining or enhancing groundwater quality." (URNRD Master Plan, 2010-2020).

The URNRD's Integrated Management Plan, first approved in 2005, revised and approved in 2008, again in 2010, and revised and approved again in January 2016, has goals and objectives with a purpose of "sustaining a balance between water uses and water supplies so that the economic viability, social and environmental health, safety and welfare of the river basin…can be achieved and maintained for both the near and long term."

The URNRD also has a Groundwater Management Plan, the main goal of which is to stop or slow groundwater declines.

- Provide the history of work completed to achieve the goals of these plans.

The URNRD has pursued sustainable water use since the 1970's when it became, in 1979, the first entity in Nebraska and possibly the country to limit agricultural water use by establishing an allocation on the use of groundwater. Since that time, allocations have been reduced by approximately 40%. The regulations have slowed groundwater declines compared to what was predicted to occur absent regulations. Average groundwater declines are approximately 60% less than what USGS predicted they would be if

regulations weren't established (Lappala, 1978) and the most significant groundwater declines are approximately half what USGS estimated would occur without regulations.

In addition to allocations, regulations limiting proximity of irrigation wells to one another were approved in 1979 and again in 1992. In 1997, the URNRD approved and implemented the first well-drilling moratorium in Nebraska. Larger declines in areas that abut the URNRD in Kansas and Colorado which do not have regulations or whose regulations are less stringent also illustrate the beneficial impact of these actions within the district. Average annual declines in areas of Kansas with a similar climate have been more than double those observed in the URNRD.

In 2013, the URNRD made some of its most significant rules changes in its history when it restricted the use of unused allocation, or "carry-forward", and created new penalties for water users who use more than their water allotments. All agricultural water use has been metered since the late 1970's and approximately 400 wells are measured in the spring and fall. Metering, well measurements and allocations have created an extensive database from which the URNRD can base decisions to further its long-term goal of slowing groundwater declines. The proposed project represents the next step in water management for the district.

- List which goals and objectives this project will provide benefits for and how this project supports or contributes to those plans.

The primary goals which the project will help achieve are to slow and eventually stop groundwater declines and improve water quality. The project will help achieve this goal by giving irrigators and the URNRD tools to eliminate unnecessary water use so that irrigation applications more closely match actual crop needs (URNRD Master Plan 2010-2020).

The project will also help achieve the following objectives contained in the District's Long Range Implementation Plan:

- Develop, promulgate and enforce rules and regulations that provide for appropriate protection of the aquifer, incentives to use water efficiently, conservation of ground water, and maintenance and enhancement of groundwater quality: The project supports these objectives by providing the URNRD data that could be used to improve rules to reduce water use that would therefore protect the aquifer.
- Conduct monitoring and other data collection activities and research necessary for interpretation of changes in groundwater levels and actual and potential pollution of the aquifer: The project directly addresses this objective because the project is dependent on data collection that increases our understanding of the relationship between pumping, groundwater levels and groundwater quality.
- Cooperate with other agencies to plan and conduct data collection activities related to ground and surface water quantity and quality: The data collected as

part of the project will be able to be shared with other experts in the fields of water quantity and quality such as UNL.

- Reduce the potential for non-point contamination of ground and surface water through education, research, management practices, incentives and rules that protect the water but also minimize adverse effects on the economy of the area: Less water use and subsequently less leaching of nitrates into the groundwater supply via the project will help achieve this objective.

Additionally, one of the URNRD's primary objectives related to groundwater quantity is contained in the district's Groundwater Management Plan "to reduce the amount of groundwater being withdrawn." The proposed project will help achieve this objective. The URNRD's IMP also has a goal of balancing uses and supplies which the project will help achieve by reducing water consumption.

- 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.

The project's primary intent is to support and create more sustainable water use by reducing groundwater pumping by giving irrigators, and the URNRD, the best available data. Consumers can't be expected to spend money as responsibly as possible without knowing exactly how much they're spending; likewise, water users and managers can't be expected to use and manage water as well as possible without knowing how much water is being used day-to-day or week-to-week. The proposed project will make this data available so that irrigators can make their water applications more precisely match the water that ET data and soil moisture tools indicate is needed. The goal is to prevent over-watering and make irrigators more efficient. The information will also greatly improve our groundwater modeling efforts which are expected to lead to modified regulations in the future to reduce water use. As mentioned earlier, similar technology has been shown to reduce water usage by 5 percent – 20 percent; the URNRD has the unique ability to require further reductions if information collected as part of the project warrants it. If successful, these water-use reductions would be possibly the biggest step the URNRD has taken towards reducing water use in approximately 35 years.

The target area is approximately 101,000 irrigated acres in the western half of Chase County. This area was selected because of an existing radio network in that part of our district operated by an electric utility so it can receive electric meter readings remotely. Utilizing their radio network will make remote readings of water usage from our flow meters significantly less expensive than the alternatives. Other, similar radio networks exist in the URNRD and we plan to test their usability for our purposes in 2019. Technical issues related to software changes that would have to be made for communication of water usage prevented a test of those networks for our purposes this year.

While existing radio infrastructure dictated the project area be western Chase County, it is likely the best location in the NRD for such a project. It has the highest density of

irrigated acres and steepest groundwater declines of any other area of the URNRD. The land area of the project area is about 1/6 of the total land area of the URNRD but it has about 1/3 of all irrigation wells in the URNRD.

An eventual, annual 15% percent reduction in water use would preserve approximately 15,200 acre feet annually in the project area and possibly reduce rates of groundwater declines in the area by 20%.

- List all stakeholders involved in project.
- Identify who benefits from this project.

We consider all residents of the URNRD stakeholders in, and beneficiaries of, the project and believe residents across the state benefit to the extent the project helps preserve a State-owned resource.

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.

1.) **Maintaining Nebraska's irrigated economy for the long term by preserving water through data-based decision making:** Water and crop-related data that can now be processed and packaged in ways that are easy-to-understand give irrigators a great advantage. Under the proposed project, real-time water usage will allow irrigators to know exactly how much water they're applying relative to actual crop-water needs provided by ET and soil-moisture data. Reducing pumping cost is an incentive to limit pumping, and in the URNRD irrigators also have the incentive of limiting water use to what's allowed by the URNRD's allocation system. Nebraska has the strongest irrigated economy in the U.S., and its sustainability is directly tied to our ability to preserve water for future use. We believe the proposed project is a significant step towards combining key data irrigators need to make decisions that benefit them and the State.

2.) **Increasing regulatory agency awareness of irrigation use relative to actual crop demands:** Regulatory entities, namely NRDs in Nebraska, have managed water for both quantity and quality to date using the best information available to them. To date, the best available information has been once-a-year information in those NRDs where flow meters are required and manually checked by technicians in the fall. This once-a-year collection of data is insufficient for both long and short-term planning. For instance, the real-time water usage and groundwater level information gathered as part of the project will allow the NRD amid a hot, dry summer to know if irrigation usage is high enough to threaten domestic wells. If it is, steps can be taken to help prevent that problem. For the mid and long term, actual irrigation amounts compared to actual crop water needs inform decisions

about whether regulatory or incentive actions need to be taken to lessen irrigation applications. In addition to preserving water owned by the State, the project could be a model statewide. Most utilities in 2018 utilize remote, real-time metering systems to improve operations management. The same should be done for groundwater resources that drive the irrigated economy.

3.) **Decreasing conflict between water users:** In Kansas and other states with dwindling water supplies, irrigators have turned against one another as they seek prevention of, and compensation for, reduced water availability. The URNRD and other areas of the State are at the point where action is needed to help prevent such conflicts in the future. Conflict has existed between primarily groundwater and surface water users in the Republican Basin of Nebraska for some time, most recently resulting in the development of a basin-wide water plan that included stakeholders from across the basin representing almost all water-related interests. A main desire expressed during this three-year process was for a reduction in groundwater pumping to lessen impacts on stream flow and ensure a long-term supply of groundwater. The project will help accomplish both.

4.) **Provide timely water-use data to manage water use under interstate agreements and develop robust groundwater models:** Projections of depletions to stream flow caused by groundwater use in the Republican Basin and whether or not those depletions exceed Nebraska's allowable depletions under the Republican River Compact will be improved with real-time data. Currently, data that can be used by the model that helps produce the projections isn't provided until sometimes well after the irrigation season. Real-time data produced under the proposed project may help allow preliminary projections of depletions to made sooner, aiding planning for Compact compliance activities.

- Describe the total number of people and/or total number of acres that would receive benefits.
- Identify the benefit, to the state, this project would provide.

The State has explicitly identified in state statute protection and conservation of groundwater as being essential to the economic prosperity and wellbeing of the State. The proposed project we believe corresponds with this statewide objective and therefore benefits all residents of Nebraska. As mentioned earlier, the direct economic benefit to the whole State of preserving water in one portion of the State such as our district is sustaining tax revenues and economic outputs associated with irrigated agriculture that touch people outside our district and across Nebraska.

We also believe the project can illustrate the benefits of real-time water management and be replicated in other parts of Nebraska. If this occurs, the project will have helped initiate water savings across Nebraska far in excess of what will occur in our district.

We believe all 9,000 residents will benefit by the reduced water use achieved under the project because of how large of a factor irrigation is to the area economy. The radio telemetry units funded by the proposed grant will be installed on approximately 101,000 irrigated acres.

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.

If approved, the project will leverage state dollars with federal dollars received via a $300,000 grant from the U.S. Bureau of Reclamation WaterSMART program. The grant is being/has been used to implement a drought resiliency program that includes installation of weather stations, sensors to provide real-time groundwater level information at sites across the district, and telemetry units like those proposed in this application to receive water usage in near real-time. Each of those aspects of the WaterSMART project will contribute to the proposed project in this grant application.

- Describe how each source of funding is made available if the project is funded.

The federal funds will reimburse project expenses up to $300,000 regardless of whether this grant application is approved.

- Provide a copy or evidence of each commitment, for each separate source, of match dollars and funding partners.

Please see "Attachment 1", letter from U.S. Department of Interior.

- Describe how you will proceed if other funding sources do not come through.

Progress will primarily be determined by whether this grant application approved.

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.

To the extent that reduced groundwater pumping under the proposed project can mitigate decreases in stream flow, the project could reduce impairment of the Upper Republican and Frenchman watersheds by increasing dissolved oxygen and dilution of phosphorus, nitrogen and selenium. Less leaching of nitrogen and phosphorus due to reduced irrigation may decrease their presence in groundwater and therefore natural discharges to streams (base flow), improving watershed health.

There are two watersheds defined by the U.S. Environmental Protection Agency that are entirely or partially contained within the project area: Upper Republican and Frenchman. Both are considered impaired waters for the following reasons:

Upper Republican – E. Coli; Chlorophyll; Dissolved Oxygen; Nitrogen; Phosphorus; Selenium
Frenchman – E. Coli; Chlorophyll; Selenium

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 section of the September 2017 Annual Report and Plan of Work for the State Water Planning and Review Process that focuses on the Republican Basin has two action items the proposed project will help achieve:

1. **"The Department and Republican River Basin NRDs will continue to meet annually to review the IMPs and progress made towards achieving the goals of each plan. These reviews focus on the assessment of two key compliance standards: limitations on groundwater depletions and limitations on groundwater pumping, with the purpose of ensuring long-term groundwater depletions remain stable or decrease." (p. 30)**
   The proposed project's ability to reduce water usage by improving irrigation scheduling through real-time water usage data, ET and soil-moisture content will help meet the above-stated objectives of reducing depletions to stream flow caused by groundwater pumping and limiting groundwater use. Secondarily, the project will aid the review of progress towards meeting these objectives by providing pumping data earlier than what now can be provided.

2. **"Based on needs across the state, the Department continually prioritizes and evaluates its data collection and analysis capabilities to support state and local planning efforts. These efforts will continue in the area of streamgaging, floodplain mapping, and integrated management." (p.31)**
   The data collection and analysis capabilities of the state will be improved by better and more timely data collection made possible by the proposed project. Water usage data over any timeframe from individual wells or collections of wells in intervals greater than one hour will be possible.

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.

Congressional approval was required for the Republican River Compact to be entered into by Nebraska, Colorado and Kansas and Congressional approval would be required to dissolve it. Therefore, we consider it a federal mandate. The IMP approved by the URNRD and State that outlines how Compact compliance will be achieved includes groundwater pumping reductions. The proposed project is designed to lessen groundwater pumping, therefore is also designed to help achieve Compact compliance, a federal mandate.

The Compact was entered into with Congressional approval in 1943 and allocates the annual, average supply of the Republican River among the three states thusly: 49 percent to Nebraska; 40 percent to Kansas; and 11 percent to Colorado. The amount of water subject to those percentages varies annually depending upon stream flows.

Before a 2002 settlement agreement between the compact states, the accounting that determined each state's consumptive use under the compact included surface water and alluvial groundwater for irrigation, municipal and industrial uses, and evaporation from U.S. Bureau of Reclamation Reservoirs. Subsequent to the 2002 agreement approved by the U.S. Supreme Court, depletions to stream flow caused by all groundwater use including from upland wells is included in the calculations. A groundwater model was developed to compute depletions to stream flow caused by groundwater pumping.

Annually, the State of Nebraska, using estimates of surface water supplies and depletions, forecasts whether action will need to be taken the following year to ensure compliance with the compact. A primary intent of the IMPs developed by the NRDs in the Republican Basin and NDNR is to ensure compact compliance. One way it seeks to do this is by mitigating impacts on stream flow caused by establishing goals to reduce groundwater pumping. Reducing groundwater pumping is the main intent of the proposed project and, if achieved as projected, will therefore aid the federal mandate of compact compliance.

The Compact, by constraining uses to allocations between the states, is naturally a limiting force on groundwater pumping and this has been demonstrated in many ways over the past approximately 20 years. All wells in the Lower and Middle Republican NRDs were metered because of the compact (wells in URNRD were metered because of water quantity concerns that predated compact issues); moratoriums on new irrigation development were established because of efforts to comply with the compact; and water use restrictions, or allocations, were implemented in the Lower and Middle Republican

NRDs because of the compact (water quantity concerns predating compact concerns caused allocations in the URNRD). In this way, there is a direct connection between the federal mandate of Compact compliance and water sustainability goals.

Section D.

PROJECT DESCRIPTION

1. Overview

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

While remote metering of water and electricity in municipalities has been common for years, similar metering of arguably Nebraska's most important natural and economic resources – groundwater for irrigation – is not. Particularly in areas like the Upper Republican NRD where significant groundwater declines have occurred, this lack of real-time water usage data is akin to making a budget for future spending without knowing how much you're spending now. The proposed project seeks to change this in a productive and very densely irrigated agricultural area of the state, western Chase County, that along with Box Butte County has the largest area of significant groundwater declines of any region of Nebraska.

Most of the western Chase County project area of 101,400 irrigated acres has experienced groundwater declines of 50'-80' since the early 1970's. Groundwater use regulations in the URNRD have lessened the rate of decline in the area by approximately 60% compared to what was expected to occur without regulations, and regulations will be tightened in the future. But irrigators in the area want and need additional tools to reduce water use. The project would give them and the URNRD an important one: Constant access to exactly how much water is being applied in intervals as short as one hour. Previous grants received by the URNRD, along with URNRD funds, have already helped pay for implementation of weather stations that estimate evapotranspiration, and installation of soil-moisture probes. Farmer use of data from both tools has been shown in studies throughout the country, including Nebraska, to reduce irrigation by up to 20%. Studies of utility users' responses to simply knowing how much energy they are consuming have shown similar reductions in usage by 5 percent to 20 percent (Vines et al., 2013).

Under the project, irrigation flow meters on approximately 780 wells in western Chase County would be equipped with devices that would cost $802 for each well: A digital register that would log and store water usage data from the existing flow meter; a sensor and bearing conversions needed to install the sensor in the flow meter; and a radio module that would transmit the water usage data to farmers and the URNRD via an existing radio network built and operated by the electric utility that serves the project area, Highline Electric Association in Holyoke, Colo.

The white, horizontally protruding object near the center of the below picture is the digital meter head. The white box in the upper right is the radio module it is connected to

and that transmits data via the radio network. That is the extent of the equipment necessary to implement the project.

The URNRD has studied and tested telemetry equipment for flow meters for nearly three years. The equipment that would be used with this project costs approximately half of the cost of cellular or satellite telemetry units we have tested. Additionally, the annual service fees would be approximately seven times less than the $6/month fees associated with using satellite units. The cost of utilizing the already existing radio network in the project area will cost approximately 85 cents per month. A propagation study has been completed verifying that all wells in the project area will be able to communicate with the radio network. Additionally, the URNRD has tested several units in the project area with very positive results.

Once installed, irrigators and the URNRD will have direct access to their water usage and its relationship to the average water use in their area. ET data indicating the irrigation demands of crops will be displayed on the URNRD website and provided to farmers directly when they view their water usage on an electronic dashboard viewable from computers or smartphones, and the real-time water usage data will help them ensure they are not irrigating more than what is necessary. Additionally, farmers who use soil moisture probes which have become very common in the district will be able to better match irrigation amounts with amounts probes suggest are needed.

The real time usage will greatly aid the URNRD's current groundwater modeling efforts by allowing model inputs reflecting groundwater use during different periods of the irrigation season rather having one total, as exists now, collected after the end of the irrigation season. These modeling efforts will inform modifications to the URNRD's

rules and regulations designed to reduce water use so groundwater declines can be lessened and, eventually, eliminated.

The project isn't predicated on the notion that all irrigators will want to reduce water usage using the information simply for the sake of saving water. The URNRD's current limits on groundwater use provide for farmers to use all available information to reduce usage so that they don't exceed the limits. Also, by not exceeding the limits and underusing so that unused allocation can be used in future years, irrigators can increase the value of their land. All sales of irrigated land in the URNRD include knowledge of water use history, remaining allocation, etc. Finally, irrigators' pumping costs are reduced by avoiding unnecessary irrigations.

2. Project Tasks and Timeline

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

Project activities related to installation of equipment that will be installed as part of the project are relatively straightforward. Upon receipt of the grant, we would purchase radio modules and the digital meter heads needed for approximately 1/3 of the project area. Should all the equipment arrive in a timely manner, installation of approximately 260 units would occur in the winter and spring of 2019. Remaining equipment needed for approximately 520 meters would be installed in the fall/winter of 2019 and spring of 2020.

By the end of 2018, calibration of three weather stations already purchased and now operated by the URNRD that estimate ET will be completed. The data, then, will be available for usage during the 2019 irrigation season at approximately 260 locations. Irrigators will also have access to their real-time water usage via the radio network at those locations in 2019.

3. Partnerships

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

Highline Electric Association, based in Holyoke, Colo., is the owner and operator of the radio network in the project area. Highline Electric has agreed to allow the URNRD to utilize the radio network at a reasonable cost that is much less than cellular or satellite alternatives. A radio network also exists in Dundy County and the eastern half of Chase County that is operated by Southwest Public Power District. We are hopeful that a similar project can be implemented in that coverage area and plan to have a pilot project there during the 2019 irrigation season.

4. Other Sources of Funding

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

The total cost of the project is $633,855 and the portion of the project for which the URNRD is seeking WSF funds is $625,560. Approximately $180,000 remaining of a $300,000 grant from the federal government's WaterSMART program approved for the URNRD in 2016 will be used to install similar equipment on other flow meters and that grant has not been included in total project costs for which the URNRD is seeking funding.

5. Support/Opposition

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

There is no known opposition to the project. All water-management entities within the Republican Basin have expressed interest in reduced water use that the project is expected to achieve.

Attachment 2

United States Department of the Interior

BUREAU OF RECLAMATION
PO Box 25007
Denver, Colorado 80225-0007

IN REPLY REFER TO:

84-27852
1.3.11

June 23, 2016

VIA ELECTRONIC MAIL

Upper Republican Natural Resources District
Attn: Nate Jenkins
511 East Fifth Street
Imperial, NE, 69033-1140

Subject: Funding Opportunity Announcement (FOA) No. R16-FOA-DO-006 – WaterSMART: Drought Resiliency Project Grants for Fiscal Year (FY) 2016 – Drought-009- Your Application Titled, "Upper Republican NRD Drought Mitigation and Groundwater Management Project."

Dear Mr. Jenkins:

Thank you for submitting a WaterSMART Drought Resiliency Project Grant application. The Bureau of Reclamation is pleased to inform you that your application was among those receiving the highest ratings and is now being considered for award of a financial assistance agreement. Your application included a request for $300,000 to complete your proposal titled, "Upper Republican NRD Drought Mitigation and Groundwater Management Project." Reclamation anticipates awarding Federal funds in the amount of $300,000 for your proposed project.

Please note that this letter is not a final commitment of funding. A financial assistance agreement will not be executed and funds will not be awarded until further information about your project is developed and all statutory and regulatory requirements have been met as described in Section V.C of the FOA. In addition, Reclamation must have sufficient evidence prior to award that non-Federal cost share will be available by the start of the project. The final funding amount may be adjusted if necessary. No funding for implementation of the project will be made available until all necessary environmental compliance measures have been completed.

Federal statute (42 U.S.C. 10364(a)(3)(B)) requires that before any funds are awarded, you agree not to use any water savings resulting from your proposed project to increase your total irrigated acreage or to otherwise increase the consumptive use of water in your operations. This requirement, which was discussed in Section III.H of the FOA, will be included in the financial assistance agreement for your project.

Please be advised that your application has been ranked, in part, based on your description of the benefits you expect to result from your project. Selection criteria placed an emphasis on improving drought resiliency, the extent to which a proposed project was supported by an existing drought plan, the severity of current and/or future drought as well as the resulting impacts, and other activities that address climate-related impacts on water. Revisions to the

scope of the project described in your application can be made only after Reclamation determines that revisions would be consistent with the selection process and that the expected benefits of the project would not be reduced.

Also please be advised as stated in Section VI.C of the FOA, we intend to post copies of successful Drought Resiliency Project Grant applications as examples on Reclamation's website. While this generally does not raise any issues, we find it prudent to provide successful grant applicants with an opportunity to redact any sensitive information from their proposals prior to posting them on our website. As a rule, we remove the SF-424s; however, if there are any other items you would like redacted, please let me know by Friday, July 1, 2016. Should we not hear from you by this date we will assume that there are no objections to posting the full application.

Thank you for your interest and participation in the WaterSMART program. If you have any questions about the program, please contact Mr. Darion Mayhorn, Drought Response Program Coordinator, at 303-445-3121 or dmayhorn@usbr.gov. The Grants Specialist that will be responsible for awarding and administering your agreement will contact you to finalize your award. If you have questions concerning the next steps in awarding this agreement, please contact me at 303-445-2025.

Sincerely,

Irene M. Hoiby
Grants Officer