

NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: *MEASUREMENT OF GROWING SEASON ACTUAL CROP EVAPOTRANSPIRATION, CROPCOEFFICIENTS AND DORMANT SEASON EVAPORATIVE LOSSES FOR KEY VEGETATION SURFACES IN THE CENTRAL PLATTE NATURAL RESOURCES DISTRICT*

PRIMARY CONTACT INFORMATION

Entity Name: Central Platte NRD

Contact Name: Duane Woodward

Address: 215 Kaufman Ave Grand Island, NE 68803

Phone: 308-385-6282

Email: woodward@cpnrd.org

Partners / Co-sponsors, if any: [Click here to enter text.](#)

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

Grant amount requested. \$ \$172,000

Loan amount requested. \$ 0.0

If Loan, how many years repayment period? [Click here to enter text.](#)

If Loan, supply a complete year-by-year repayment schedule.
[Click here to enter text.](#)

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 <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Surface Water Right	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
USACE (e.g., 404 Permit)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Cultural Resources Evaluation	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Other (provide explanation below) Click here to enter text.	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>

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. [Click here to enter text.](#)

If yes what is the population served by your project? [Click here to enter text.](#)

If yes provide a demonstration of need. [Click here to enter text.](#)

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? [Click here to enter text.](#)

If yes, describe the changes that have been made since the last application. [Click here to enter text.](#)

No, I certify the application is a true and exact copy of the previously submitted and scored application. (Signature required) [Click here to enter text.](#)

6. Complete the following if your project has or will commence prior to next July 1st.

As of the date of submittal of this application, what is the Total Net Local Share of Expenses incurred for which you are asking cost share assistance from this fund? \$ \$0.00

Attach all substantiating documentation such as invoices, cancelled checks etc. along with an itemized statement for these expenses. [Click here to enter text.](#)

Estimate the Total Net Local Share of Expenses and a description of each you will incur between the date of submittal of this application and next July 1st for which you are asking cost share assistance from this fund.

\$ 81,700.00 for project data collection and analysis for the August 1, 2017 thru June 30, 2018 period. For the August 1 thru December 1, 2017 period we estimate \$30,000.00.

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](#));
Click here to enter text.

A description of all field investigations made to substantiate the feasibility report ([004.01 B](#)); Click here to enter text.

Maps, drawings, charts, tables, etc., used as a basis for the feasibility report ([004.01 C](#)); Click here to enter text.

A description of any necessary water and land rights and pertinent water supply and water quality information, if appropriate ([004.01 D](#));
Click here to enter text.

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

Required geologic investigation ([004.01 E 1](#)); Click here to enter text.

Required hydrologic data ([004.01 E 2](#)); Click here to enter text.

Design criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria ([004.01 E 3](#)). Click here to enter text.

- 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](#));

The main goal of this project is to do scientific research on Crop Water Use. The CPNRD has supported this Research work sense 2007 with the help from IWMPP funding over the past 10 years. The plan for this project is to continue crop water research data collection and analysis for 4 more years. Overall goals of this project are to measure actual evapotranspiration rates of various key vegetation surfaces by utilizing advanced techniques such as the Bowen Ratio Energy Balance System (BREBS) by establishing a large evapotranspiration and other surface energy

flux measurement network titled “Nebraska Water and Energy Flux Measurement, Modeling, and Research Network (NEBFLUX).” NEBFLUX, initially, is a statewide network that is designed to measure surface energy fluxes, microclimatic variables, plant physiological parameters, soil water content, surface characteristics, and their interactions for various vegetation surfaces in the Central Platte Natural Resources District (CPNRD). It is a network of micrometeorological tower sites that use mainly the Bowen ratio energy balance systems (BREBS) to measure surface water and energy fluxes between terrestrial agroecosystems and microclimate. At present, ten BREBSs and one eddy covariance system (ECS) are operating on a long-term and continuous basis.

A description of field or research investigations utilized to substantiate the project conception ([004.02 B](#));

The research project will be conducted based on science-based principles. A variety of ground-based ET measurements will be conducted in cropped fields. The field measurements will continue to be made at irrigated grassland, rainfed grassland, rainfed switchgrass, irrigated alfalfa, surface drip-irrigated vineyard, irrigated corn-soybean rotation, and irrigated popcorn. Additional site with seed corn will be included in the project, depending on the availability of resources and availability of a seed corn field that can be used for the project for long-enough periods. We will use a Deluxe version of Bowen Ratio Energy Balance Systems (BREBS) to measure energy fluxes. Identical systems are being used for each project sites. The fields in which the flux measurements are being made are fairly large to satisfy the fetch (footprint) requirements of the BREBSs. All measurements will be made for at least two years for each cropping system, and thus, the project duration will be at least teen years or longer as the long-term measurements are critical to the proper understanding of microclimate and climate interactions with the surface conditions for different vegetation surfaces. In addition to the latent heat flux (ET) during the growing and non-growing (dormant) season, following variables will be measured in each field: Incoming and outgoing shortwave and longwave radiation envelopes using global hemispherical radiation sensors, Sensible heat flux (amount of energy used to warm the environment before the energy used to evaporate water vapor from the surface), Actual vapor pressure gradients at two heights above the surface, Net radiation (above canopy or surface), Soil heat flux (under net radiometer; three sensors installed at 2.5 in. below ground) Wind speed and direction, Surface albedo, Precipitation, Soil temperature (nearby soil heat flux sensors; three soil temperature probes will be installed every inch to measure surface soil temperature profiles,) Surface soil water content above soil heat flux plates (three soil water content sensors nearby soil heat flux plates), and Soil temperature and surface soil water content data will be used to adjust soil heat flux values for the surface conditions). All flux measurements will be sampled every 30 seconds and the hourly average values of each variable will be recorded. Soil profile soil water content will be monitored on an hourly basis throughout the year using CS616-L Water Content Reflectometers. Probes will be installed with 12 inches increments down to 6 ft in the soil profile close to the BREBS towers. The research fields will be located approximately 6 to 8 miles from the High Plains Regional Climate Center weather station near Central City. We will be able to make comparisons between the actual crop ET measured using

the BREBSs and the crop ET estimated by the crop coefficient and reference ET approach using the weather station climate data. The plant physiological/phenological measurements will include, but not limited to, measurements of leaf area index, crop height to better estimate roughness coefficient, plant population, etc. The collaborators (growers) will keep a record of irrigation timing and amount, timing and amount of fertilizer application(s), timing and type of tillage practices, herbicide, insecticide, pesticide applications, and other soil and crop management practices. Final grain yield and field yield map (if available) will be obtained from the cooperator. Depending on the availability of resources, measurement of residue amount will be made after the crop is harvested to quantify the relationship between the residue amount (density) and surface soil evaporation.

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).

The expected benefits of continuing this project research include; (1) scientifically supportable process for computing crop water consumptive use for a variety of crops grown in Nebraska. (2) Sound information for implementing the CPNRD Groundwater Management Plan which applies restrictions on the number of irrigated acres across the district based on crop water use. And (3) Improved irrigation applications by producers who use crop water use to track when an irrigation application is needed.

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

The next best alternative is to rely on similar research work done by other Universities. Other Universities would include Texas A&M, University of Idaho, etc. The benefit of doing this type of research work in Nebraska though the UNL is we get results and information for the variety of crops grown in Nebraska under our local climate conditions.

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 relevant cost for this project include the salary and expenses for conducting the research work. The cost of the research equipment needed for the project was provided by the University when the project started in 2007. The equipment cost for the project totals around \$500,000 for the 7 sites.*

- 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). *The primary tangible benefit comes with better estimation of crop water use as it relates to improved decision making on groundwater management plan implementation and improved producer irrigation practices.*
 - 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). *Not applicable for this project*
 - 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). *. Looking at improved irrigation practices that reduce pumping by 1” per season on the 1,028,140 irrigated acres with -in the CPNRD could provide producer benefits of \$9,600,000 per year. The estimated cost of pumping is \$112/ acre-feet from a “Evaluating Energy Use for Pumping Irrigation Water” paper by Dr. Derrel Martin and others 2011. The 1” less pumping on 1,028,140 equates to 85,700 Acre-feet per year*
4. Provide evidence that sufficient funds are available to complete the proposal. *The CPNRD has \$81,700 budgeted for FY 2017-2018 for this project and will continue to budget additional funds in FY2018 -2019, and 2019-2020 to provide 50% cost share on this project*
 5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace). *Not applicable for this project*
 6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal. *Not applicable for this project*

7. Describe how the plan of development minimizes impacts on the natural environment.

Not applicable for this project

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

The States 88th Nebraska Legislature change the State's Groundwater Management and Protection Act through LB 1106 to require Natural Resources Districts to prepare a Groundwater Management Plan. This was completed for the CPNRD in December 1985. That Plan has been in place and revised several times since 1985. The latest being the addition of the Integrated Management Plan (IMP) in July 2009. One focus of the IMP is continued groundwater data collection and creating partnerships with outside organizations to address current data gaps. This project focus on basic data research on "crop water use".

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 this application supports is the implementation of crop water use in the CPNRD 1985 GWMP. The 1985 GWMP was developed using the best crop water use information available in the 1980's. Today we are able to collect crop water use data directly from field measurements and apply the data to managing the amount groundwater being pumped and applied to the various crops for irrigation. Thus, as CPNRD considers regulating groundwater use for the 1985 GWMP it can take the varying use by crops in to consideration.

10. Are land rights necessary to complete your project?

YES NO

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

[Click here to enter text.](#)

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

[Click here to enter text.](#)

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

[Click here to enter text.](#)

11. Identify how you possess all necessary authority to undertake or participate in the project. *The CPNRD also has the authority under Nebraska State Statute Chapter 2 Article 32 to carry out this project under its authorized purposes relating to the development, management, utilization, and conservation of groundwater and surface water. This includes the CPNRD's authorities to enter into contracts or agreements,*

budget and expend levied property taxes, and own and operate property or equipment

12. Identify the probable environmental and ecological consequences that may result as the result of the project. *The existing groundwater management plan in conjunction with the Integrated Management Plan, require application of crop water use based upon the latest and most advanced science that can be applied. Applying up to date crop water use will help to protect and maintain groundwater resources in the CPNRD, but will also thereby, maintain groundwater flows to surface water, wetlands, or any other*

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

The drinking water supply within the CPNRD comes from the High Plains aquifer. The groundwater quantity and quality can be maintained through continued implementation of a Groundwater Management Plan. The 2010 population within the

CPNRD area is approximately 112,000. The 3 largest municipal cities in the NRD are Grand Island 48,000, Kearney 31,000, and Lexington 10,000 they each utilize pumping wells near the Platte River to supply domestic and industrial uses of water. Thus it is very important to have a Groundwater Management Plan that continues to manage and maintain the groundwater aquifer along the Platte River and though out the NRD. This project will address the Technical information that supports sustainable GW quantity management into the future. It will help support Groundwater Management within the CPNRD and help avert the need for projects to remediate and mitigate drinking water supplies

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;
 - Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.
 - Provide the history of work completed to achieve the goals of this plan.
 - List which goals and objectives of the management plan the project provides benefits for and how the project provides those benefits.

CPNRD GW MANAGEMENT PLAN, dated December 1985 is the plan being addressed by this project. Previous modeling by Peckenpaugh (USGS) and subsequent analysis, were used to establish trigger levels of groundwater decline based upon investigated sustainable levels of development. The goals and objectives of the groundwater management plan remain the same since, 1985, and are to assure an adequate supply of water for feasible and beneficial uses through proper management, conservation, development and utilization of the District's water resources. CPNRD is involved in groundwater level observations, administering irrigation runoff regulations, groundwater quantity and quality management, groundwater modeling and development of a surface water flow model which will all lead to a complete groundwater and surface water management program. The purpose of the project proposed in this application is to update the Technical Information on use of water by various crops to refine the rules established in the original plan on reducing irrigated acreage based on crop types. This project will benefit the groundwater management plan by updating the crop water use data, providing increased accuracy in the assessment of future water availability with or without various management actions.

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

List the following information that is applicable:

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

The area in which the benefits will be realized is the CPNRD and other NRD's across Nebraska. The CPNRD Groundwater Management Plan and other NRD groundwater management plans rely on efficient applications of irrigation water to preserve groundwater sustainability. Within the CPNRD effective applications of irrigation water is promoted by working with producers to follow the crop water use and soil moisture availability during the growing season. This project's research data collection on crop water use and analysis of crop coefficients supports computing field by field crop water use across the NRD. Based on current modeling and analysis groundwater withdrawals in the CPNRD are around 550,000 acre-ft per year, with related stream depletion to the Platte River and its tributaries of about 30,000 to 50,000 acre-feet per year. Decreasing irrigation applications with improved crop water use information could result in less annual pumping. Pumping 1 inch less during the growing season on CPNRD's 1,028,140 certified irrigated acres would reduce pumping 85,700 Acre-feet and reduce some stream depletion caused by pumping.

4. Contributes to multiple water supply goals, including, but not limited to, flood control, agricultural use, municipal and industrial uses, recreational benefits, wildlife habitat, conservation of water resources, and preservation of water resources;
 - List the goals the project provides benefits.
 - Describe how the project will provide these benefits
 - Provide a long range forecast of the expected benefits this project could have versus continuing on current path.

This project will update the Technical information for the CPNRD Groundwater Management Plan (GWMP), The main goal of the GWMP is to provide water supply sustainability for all groundwater uses including agriculture, municipal, industrial, and baseflow returns for integrated management uses. The project will provide benefits by having new or up to date technical information (crop water use) to support management rules and regulations. The long-range forecast for a updated GWMP would be to maximize the many benefits of precipitation that falls within the NRD area, and groundwater or surface water that flows into the NRD

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

Improved decision-making information, like the crop water use research data collected in the CPNRD can help maintain or increase beneficial uses of our water resources by providing for the scientifically defensible means to sustainably water

resources management. The project seeks to provide supporting data for a hydrologic water budget approach to the GWMP technical analysis which can result in preserving or enhancing the current beneficial uses across the NRDs. Current beneficial uses within the CPNRD include domestic and industrial water supply for a population of 112,000, plus irrigation water supply for 1 million irrigated acres, and over 1 million acre-feet of water in the Platte River annual for recreational and wildlife habitat use. The proposed project is directly beneficial to CPNRD and Nebraska residents by helping to maintain groundwater supplies that are directly tied to the long-term agricultural sustainability, domestic water use sustainability, and sustainable Platte River flows.

6. Is cost-effective;

- List the estimated construction costs, O/M costs, land and water acquisition costs, alternative options, value of benefits gained.
- Compare these costs to other methods of achieving the same benefits.
- List the costs of the project.
- Describe how it is a cost effective project or alternative.

The project will cost \$344,000 in total between grant funds, and CPNRD funds, but the groundwater resources in the CPNRD, which will be maintained and preserved through this research project, support multiple interests, including: 1) municipal water supplies of nearly 780,000 residents of Nebraska (CPNRD, Lincoln, and Omaha); 2) ethanol production totaling \$559 million per year (265 million gal/yr); 3) agricultural production of over \$2 billion per year within CPNRD. Hence, the cost of the study, and the \$172,000 requested from the grant, are only a very small fraction of the value of the resources supported by groundwater in the CPNRD, which will be preserved and maintained through this work.

7. Helps the state meet its obligations under interstate compacts, decrees, or other state contracts or agreements or federal law;

- Identify the interstate compact, decree, state contract or agreement or federal law.
- Describe how the project will help the state meet its obligations under compacts, decrees, state contracts or agreements or federal law.
- Describe current deficiencies and document how the project will reduce deficiencies.

The Platte River Program has benefited from the current CPNRD GWMP and will continue to benefit from an updated Plan. The Platte River Program developed from a 3 state (NE, CO, & WY) and federal government (USFWS & USBR) cooperative agreement. One of Nebraska's obligations under the Program is to return to 1997 development levels for Groundwater and Surface Water uses. The CPNRD has developed an Integrated Management Plan as part of their GWMP to help the State meet the obligations for the Program. The difference between the current development and 1997 development can be determined with the updated technical information for the

GWMP. The goal of the GWMP is maintain a sustainable GW aquifer which is important for Program goals of conjunctively managing groundwater and surface water to improve habitat for endangered and threatened species.

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

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

The groundwater aquifer in the CPNRD supports public drinking water, industry, and the agricultural economy of the CPNRD, and as such can be considered critical infrastructure. Groundwater provides drinking water for over 112,000 residents of the CPNRD as well as contributing to the downstream cities of Lincoln and Omaha (population 667,337), whose well fields in the lower Platte River alluvium, are recharged through river flows in part supplied by groundwater discharge to the Platte River, occurring within the CPNRD. Access to high-quality drinking water is a fundamental aspect of public health and safety. Value of related cost savings is difficult to assess, but if the affected population instead drank 2 bottles of water per day at a cost of \$2 per bottle, the cost would be more than \$3.1 million per day.

9. Improves water quality;

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

The project of updating the Technical information for the Groundwater Management Plan does not have a direct benefit to improving water quality. The current Groundwater Management Plan does have a Water Quality component that has been applied across the CPNRD since 1987 to improve groundwater quality by reducing nitrates leached into the aquifer. Some of the crop water use research information that updates the GWMP within the NRD may have indirect benefits for future water quality management actions

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

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

The Central Platte NRD is the local jurisdiction supporting the project. The FY 2015 /2016 Tax Levy for CPNRD is 0.03842, the property tax valuation is \$15,919,152,725.00, and the property tax collected is \$6,115,709.64.

11. Has a local jurisdiction with plans in place that support sustainable water use;

- List the local jurisdiction and identify specific plans being referenced that are in place to support sustainable water use.
- Provide the history of work completed to achieve the goals of these plans.
- List which goals and objectives this project will provide benefits for and how this project supports or contributes to those plans.
- Describe and quantify how the project supports sustainable water use, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- List all stakeholders involved in project.
- Identify who benefits from this project.

The local jurisdiction on the project is the Central Platte NRD. The results of the project are improved Technical analysis and information, which will improve the CPNRD's groundwater management plan. Groundwater Management Plans are developed to implement and support sustainable water use. The history of work and goals and objectives of this project are provided in Section B item 1b above. The stakeholders involved in the include CPNRD staff and board, producers and Irrigation Districts in the CPNRD area that use surface water and groundwater, city staff and industrial owners that use groundwater. Therefore, this project directly benefits all the producers, irrigators, ethanol producers, cities, industry, municipal and domestic groundwater users within the CPNRD

12. Addresses a statewide problem or issue;

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

This project will help manage and preserve groundwater resources in the CPNRD. Maintaining groundwater resources in the CPNRD will benefit baseflows to the Platte River and its tributaries which support Platte River Program issues (a statewide issue) by maintaining and increasing the amount of water in the Platte River. The project will similarly benefit stakeholders in the Lower Platte River Basin, and help maintain Platte River flows that recharge municipal well fields for the cities of Lincoln and Omaha, population of over 667,000, which is also a statewide interest.

13. Contributes to the state's ability to leverage state dollars with local or federal government partners or other partners to maximize the use of its resources;

- List other funding sources or other partners, and the amount each will contribute, in a funding matrix.
- Describe how each source of funding is made available if the project is funded.
- Provide a copy or evidence of each commitment, for each separate source, of match dollars and funding partners.
- Describe how you will proceed if other funding sources do not come through.

The University of Nebraska is doing the research on this project and has already contributed the equipment cost of \$500,000 for the projects 7 field measurement sites. The cost of the research equipment was provided by the University when the project started in 2007 and they continue to pay the salary of the professor leading the research project.

14. Contributes to watershed health and function;

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

The US EPA defines a healthy watershed as one in which “natural land cover supports dynamic hydrologic and geomorphic processes within their natural range of variation; habitat of sufficient size and connectivity supports native aquatic and riparian species; and water quality supports healthy biological communities” (US EPA, 2012). This definition encompasses six distinct but interrelated attributes of watersheds and the aquatic ecosystems within them: landscape condition; habitat; hydrology; geomorphology; water quality; and biological condition. Watershed Hydrology is one of the six interrelated attributes and this project is focused on it. The EPA’s notation of a hydrologic regime; is quantity and timing of flow or water level fluctuation. Highly dependent on the natural flow regime and hydrologic connectivity, including surface-ground water interaction. This project is developing crop water use research information that will support Hydrologic Water Budget development across the state. The research information develop with this project can be used to assess current and future watershed health. The watershed included in the CPNRD area is the Central Platte River and its tributaries from Gothenburg, NE to Columbus, NE.

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 Department of Natural Resources Annual Report and Plan of Work, dated September 2015 has 5 major objectives. Objective #3 is to Support locally developed water management plans for managing hydrologically connected water supplies. The Four-Year Work Projection for the Upper Platte River Basin outlines plans on using the COHYST groundwater model and pertinent data sets for future integrated management plan analysis. This project creates pertinent data on Crop Water Use to support Technical analysis and information for the CPNRD GWMP and other NRD groundwater management plans.

16. Federal Mandate Bonus. If you believe that your project is designed to meet the requirements of a federal mandate which furthers the goals of the WSF, then:

- Describe the federal mandate.
- Provide documentary evidence of the federal mandate.
- Describe how the project meets the requirements of the federal mandate.
- Describe the relationship between the federal mandate and how the project furthers the goals of water sustainability.

The federal mandate is the Platte River Recovery Implementation Program (PRRIP) which is the means by which the states of Colorado, Wyoming, and Nebraska are collaborating to provide sufficient water supplies to the endangered species, such as Piping Plovers, Interior Least Tern and Whooping Cranes, pursuant to the U.S. Endangered Species Act. The interstate program aims at providing sufficient environmental flows to and through the Central Platte River habitat area to assist in improving and maintaining habitats for target species. This project can help accurately quantify changes in streamflow in the Platte River from computations of groundwater pumping using crop water use and land use activity changes.

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.

Efficient use of water resources in semi-arid agro-ecosystems of the Central Plains of the U.S.A. has been an important issue because of the rapid depletion of freshwater resources and drought conditions, and degradation of groundwater quality in recent years. In the Central Plains of the United States, including Nebraska, 90% or more of the precipitation is returned to the atmosphere by evapotranspiration (ET). Accurate and consistent quantification of ET is one of the key elements for better planning, managing, and allocating water resources. Accurate quantification of ET in irrigated and rainfed agriculture and other key natural systems is critical in the context of crop production, water allocations, irrigation management, evaluation of the effects of changes in land use on water yields, and environmental assessment by developing best management practices, quantification of groundwater recharge rates, and groundwater quality protection. Thus, accurate quantification of ET is critical for predicting the status of the soil water supplies and their allocation and efficient use.

Overall goals of this project are to measure actual evapotranspiration rates of various key vegetation surfaces by utilizing advanced techniques such as the Bowen Ratio Energy Balance System (BREBS) by establishing a large evapotranspiration and other surface energy flux measurement network titled "Nebraska Water and Energy Flux Measurement, Modeling, and Research Network (NEBFLUX)." NEBFLUX, initially, is a statewide network that is designed to measure surface energy fluxes, microclimatic variables, plant physiological parameters, soil water content, surface characteristics, and their interactions for various vegetation surfaces in the Central Platte Natural Resources District (CPNRD). It is a network of micrometeorological tower sites that use mainly the Bowen ratio energy balance systems (BREBS) to measure surface water and energy fluxes between terrestrial agro-ecosystems and microclimate. At present, ten BREBSs and one eddy covariance system (ECS) are operating on a long-term and continuous basis.

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.

TIMELINE OF ACTIVITIES for Program coordination and infrastructure development, instrumentation and others include 1) Planning and coordination 2) Update on assessment of basic infrastructures (availability and needs) 3) Procurement of additional equipment (if needed) 4) Installation of BREBS and supporting instruments

5) Instrumentation and data quality control 6) Field research, data collection 7) Data processing, analysis, and interpretation 7) Method/procedure calibration analysis 8) Instrumentation/equipment maintenance and calibration 9) Method/procedure review and validation analysis 10) Integration of results 11) Progress report and journal articles preparation. The project will operate to collect data for 4 years.

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.

Partners in this project include the University of Nebraska at Lincoln Department of Bio-system and Agricultural Engineering Professor Dr. Suat Irmak and the CPNRD. The Universities role is to do the field research and write project papers for publishing. The CPNRD has helped by locating producers in the Merrick County area willing to have data collected on their land and providing funding to UNL for support staff and graduate students. The project started in 2007 and has been supported by DNR funding thru the IWMPPF funding program which is no longer available.

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 cost of the funding request from the University of Nebraska Bio-system and Agricultural Engineering Department for 4 years of research on Crop Consumptive water use or ET was \$344,000. The University is contributing a professor's time and equipment purchases to the project. They have invested \$500,000 in equipment cost to date for the 7 data collection sites. The CPNRD is seeking \$172,000 from the Water Sustainability Fund to support the 4 year project. Other grants will be applied for like NET if this WSF grant is not provided.

5. Support/Opposition

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

There is a high level of support for the project from the CPNRD. We have not identified opposition to the project.