

NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Western Water Use Management Modeling Update and Extension

PRIMARY CONTACT INFORMATION

Entity Name: **South Platte Natural Resources District**

Contact Name: **Rod Horn**

Address: **551 Parkland Drive, P.O. Box 294, Sidney, NE 69162-0294**

Phone: **308-254-2377**

Email: **rlhorn@spnrd.org**

Partners / Co-sponsors, if any: **North Platte Natural Resources District**

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

Grant amount requested. \$ 240,000

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, we are requesting 60% of the total project cost.

If so what % ? [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. **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) [Click here to enter text.](#)

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);
N/A

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

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

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

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);

Groundwater and surface water models are critical components of Nebraska's water planning efforts. These models work together creating tools capable of analyzing management scenarios such as the effect of conjunctive management projects, well pumping, alternative surface water operations, among others. One of these essential modeling tools for the upper portions of the North Platte and

South Platte Rivers in Nebraska is the Western Water Use Management (WWUM) modeling.

The WWUM modeling project will accomplish a number of updates, refinements, and complete an extension to the existing modeling effort. This allows North Platte and South Platte Natural Resources Districts (NPNRD, SPNRD, or NRDs) to complete essential analyses of their water management actions, projects, and to evaluate existing and potential projects to meet their Integrated Management Plans (IMPs) goals of reducing consumptive use and increasing streamflow. The NRDs implemented actions include allocations, groundwater certified acreage retirements, excess surface water recharge projects, and surface water leasing projects to lease consumptive use of surface water irrigated lands.

To determine the success of these actions and adapt to changing conditions, the NRDs rely on the WWUM modeling to quantify the effects. The results provide critical information to the NRDs to help them understand how their water management efforts benefit their constituents and downstream water rights users. Beyond the management actions and projects, each NRD works with local municipal, industrial, and agricultural water users to determine the effects of changes in well locations to the NRDs IMP goals. The analysis is primarily conducted within the WWUM modeling suite.

The modeling refinements will begin with an evaluation of the geologic and hydrogeologic datasets of Pumpkin Creek and Lodgepole Creek to refine the local aquifer's characteristics and calibration represented in the groundwater model. In Pumpkin Creek and Lodgepole Creek, a primary aquifer is the Tertiary Brule Formation fracture systems. The original modeling created initial datasets to determine the extent of this aquifer system, but additional work is necessary to improve this information, increase the accuracy of the modeling in these areas, and provide critical technical analyses to aid in management decisions by the NRDs.

Light Detection and Ranging (LiDAR) surface elevation data have been collected over the majority of the modeling area. This information will be applied to many aspects of the modeling to continue to refine the calibration and provide the NRDs with highly accurate information and analysis results.

The land use information will be updated with attributes of well location, crop type, irrigation method (flood or center pivot sprinkler irrigation), and the metered groundwater pumping information both NRDs have been collecting since the last update. This provides the critical information of where and how much water is being used. Additionally, the surface water irrigated lands within the modeling area will be re-evaluated and refined based on information from and collaboration with the Nebraska Department of Natural Resources (DNR). Continuing to refine the surface water acres especially along the North Platte River in NPNRD creates a modeling tool to more accurately evaluate the surface water use and streamflow

as it relates to the changes in climate, irrigation practices, groundwater pumping, and other extraneous activities within the modeling area. The main components that rely on this land use information are the calibration of the modeling and analyses used by the NRDs to determine their IMP obligations and the effectiveness of their management actions and strategies.

The Hydrogeology of Western Nebraska (HWN) project which was sponsored and funded by SPNRD, NPNRD, Twin Platte NRD, and the Nebraska Environmental Trust provided extensive geologic datasets throughout the WWUM modeling area. These datasets demonstrated additional complexities in the geology of the South Tablelands of SPNRD and NPNRD which require additional modeling refinements to be accurately represented in the WWUM modeling. These refinements will include additional groundwater model layers in that area to capture these complexities and provide greater confidence in the deep aquifer management of declining groundwater levels. The NRDs have already completed several analyses using different climatic and groundwater pumping allocation scenarios to help estimate possible future deep aquifer groundwater level declines. Using this modeling information and analyses, the NRDs have placed groundwater pumping limitations on deep aquifers and these refinements will enable the NRDs to continue to make highly informed decisions on future management goals and objectives. This modeling refinement will update the current aquifer interpretation, recalibrate the WWUM model, and provide a critical and more robust understanding of impacts to the deep aquifers.

To incorporate the additional layers in the WWUM modeling, a new groundwater modeling technique using the United States Geological Survey (USGS) MODFLOW package called unstructured grids will be implemented. This allows the modeling to incorporate additional aquifer layers within the groundwater model in specific areas which require this refinement. This technique also allows for variable cell sizes to be implemented throughout the WWUM modeling domain. Where data is limited or areas where groundwater development and management is minimal, larger cell sizes will be used, which will reduce overall processing requirements of the modeling. Where a high density of data exists with small features such as tributaries and canals, a much smaller grid is ideal to be able to provide highly refined inputs. This modeling refinement will provide the tools necessary to complete an accurate representation of the aquifer and surface water impacts due to pumping and management while increasing efficiency in modeling runtime.

To continue to provide the most reliable and integrated modeling tools available, the WWUM modeling will implement the use of a new surface water operations model for the North Platte River and refine the existing operations modeling along the South Platte River. This modeling will use a simple interface through a spreadsheet or other program to simulate the prior appropriations system which will include the reservoir operations along the North Platte River in Wyoming, the surface water diversions along the North Platte and South Platte Rivers, and the

Lake McConaughy storage rights. By using a simple interface for the North Platte River, analyses can be completed in a more efficient and less costly manner as compared to the current surface water operations model. This modeling will be completed with the collaboration and technical support of DNR to build an efficient and cost-effective tool to evaluate the North Platte and South Platte Rivers.

The surface water operations model will be completed in conjunction with an extension and update of the groundwater modeling where streamflow, diversion, and canal loss information will be incorporated with an updated and streamlined process to provide more efficient model updates. Finally, the modeling will extend and update the CROPSIM and the Regionalized Soil Water Balance Modeling that estimates crop consumptive use, canal and irrigation recharge, and runoff. These critical modeling updates will allow the NRDs to effectively and efficiently determine how groundwater management, differences in pumping and water use efficiency, and climate cycles affect the surface water and groundwater systems of the North Platte River and its tributaries, the South Platte River, and Lodgepole Creek.

All of the updated and refined information will be used to recalibrate and extend the WWUM modeling from the 2017 to 2020 period.

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

The WWUM modeling can generally be described as an effort designed to provide the NPNRD, SPNRD, and DNR with a set of crop consumptive use, groundwater, and surface water modeling tools to aid in management of river, stream, and aquifer systems within the modeling area. The current WWUM model is the product of many years of model development and data collection going back to the initiation of the Cooperative Hydrology Study in 1997. The WWUM modeling project builds on these prior studies. The following two excerpts are provided to document the previous research investigations utilized to substantiate the proposed project.

1. The report entitled “Groundwater Flow Model for the Southern Half of the Nebraska Panhandle” by Richard R. Luckey dated 2013 provides the following description of previous work:

“Luckey and Cannia (2006) previously described this study area and much of this section is repeated directly from that report. The earliest studies of groundwater in western Nebraska were done by Darton (1899, 1903, and 1905). Meinzer (1917) did a brief investigation of Lodgepole Creek Valley and Bjorklund (1957) did a more extensive study of the area. Cady and Scherer (1946) did the first of several studies of Box Butte County. Later studies of Box Butte County included those of Nace (1953), Souders and others (1980), and Pettijohn and Chen (1984). Wenzel and others (1946) studied Scotts Bluff County, Babcock and Visher (1951)

studied the Dutch Flats area, and Babcock and Visser (1952) studied the Pumpkin Creek valley, which is predominately in Banner and Morrill Counties. Bjorklund and Brown (1957) studied the South Platte valley. Smith (1969) studied Cheyenne County, Smith and Souders (1971) studied Kimball County, and Smith and Souders (1975) later studied Banner County.

Large area studies after the Darton (1905) study began with the Missouri River Basin Commission (1975). This was later followed by the Missouri Basin States Association (1982a and 1982b). A study of the entire High Plains aquifer was reported by Gutentag and others (1984) and Weeks and others (1988). Pettijohn and Chen (1983a and 1983b) did more detailed reports on the Nebraska portion of this study of the High Plains aquifer. Conservation and Survey Division (1998) did a report on the ground-water resources of the entire state of Nebraska. Stanton and others (2011) prepared water budgets for the entire High Plains aquifer.

More recent ground-water studies in the North Platte valley include those of Steele and others (1998), Verstraeten and others (2001), and Steele and others (2002). These studies covered only small parts of the study area. Studies of canal bed sediments and canal leakage potential include Kress and others (2004), Ball and others (2006), Burton and others (2009), and Vrabel and others (2009). Studies of western Nebraska that included a ground-water flow model or other detailed numerical analysis include Missouri River Basin Commission (1975), Lappala and others (1979), Missouri Basin States Association (1982a and 1982b), Pettijohn and Chen (1984), Luckey and others (1986), McLean and others (1997), Luckey and Cannia (2006), Ayers (2007), Peterson and others (2008), and Stanton and others (2010).

Studies of the geology of western Nebraska of particular importance to the current study include Swinehart and Diffendal (1997) and Swinehart and others (1985). Land-use studies were published for 1982 (Dappen and Merchant, 2004), 1997 (Dappen and Tooze, 2001), 2001 (Dappen and Merchant, 2003), and 2005 (Dappen and others, 2006). Testhole descriptions have been published for most of the counties in the study area. These include Arthur County (Diffendal and Goeke, 2000), Banner County (Smith, 2000a), Box Butte County (Smith, 2000b), Cheyenne County (Diffendal, 2000), Deuel County (Diffendal, 1999), Garden County (Smith and Swinehart, 2000), Keith County (Diffendal and Goeke, 2004), Kimball County (Smith 2000c), Morrill County (Souders and Swinehart, 2000), Perkins County (Dreeszen, 2000), and Scotts Bluff County (Sibray and Smith, 2000).”

2. The summary of the Luckey, 2013 report follows:

“This report documents a ground-water flow model of 11,100 mi² of the southern two-thirds of the Nebraska Panhandle. The study area extends from the limit of the High Plains aquifer on the south to ground-water divides and flow lines on the north and from 6 mi into Wyoming on the west to the dam on Lake McConaughy

on the east. Groundwater generally flows from west to east in the study area, and more locally flows to streams that drain the area. Geologic units that make up the High Plains aquifer include the fractured Brule Formation, Arikaree Group, Ogallala Group, Broadwater Formation, and various sediments of Quaternary age. Saturated thickness in the study area ranges from essentially zero to over 800 ft.

The largest saturated thickness occurs beneath the Sand Hills in the northeastern part of the study area. Elsewhere, saturated thickness is quite variable, and in places is controlled by paleovalleys. Prior to settlement, recharge occurred because of precipitation on rangeland. This recharge ranged from less than 0.20 in/yr on the tablelands in the southwestern part of the study area to more than 2.4 in/yr in the Sand Hills in the northeastern part. Beginning in the late 1800s, canals were used to irrigate land and this caused additional recharge. The primary natural discharge from the aquifer was baseflow to streams and rivers that drain the area. Prior to development of the surface-water system, most of the discharge occurred to the North Platte River and its western tributaries had little flow. In the east, Blue Creek received substantial discharge from the aquifer. A secondary mechanism for discharge from the aquifer was evapotranspiration where the water table was near land surface. The largest such area is in the Sand Hills in northern Garden County and southern Sheridan County where there are numerous lakes. There also is evapotranspiration from the riparian forests along the North Platte River and South Platte River.

Beginning in about the 1950s, pumpage for irrigation became a substantial artificial discharge from the aquifer. The history of the ground-water flow system was broken into three periods: the pre-canal period before the late 1800s; the pre-ground-water development period before the early 1950s; and the ground-water development period after the early 1950s. In the model, the first period ended in 1895, the second period ended in 1953, and the third period ended in 2011.

MODFLOW-2000 was selected as the ground-water flow modeling code for this study. The code uses block-centered finite-difference techniques to solve the ground-water flow equation at numerous points throughout the study area. The study area was divided into 177,780 cells of 40 acres each in the model. The pre-canal period was simulated using a 2,000-year period with time steps of 5 or 10 days. The pre-ground-water period was simulated with 5-day time steps for an irrigation period and a non-irrigation period each year. The ground-water development period was simulated using 5-day time steps for monthly periods. The external boundaries of the model included lateral fixed head (water-level) boundaries, lower no-flow boundaries at the base of the aquifer, and the simulated water table. Internal boundaries of the model included streams, lakes, springs, and evapotranspiration areas.

Two aquifer properties were estimated during calibration of the model: hydraulic conductivity and specific yield. Hydraulic conductivity, which describes the flow through the aquifer under laboratory conditions, ranged from 7 ft/d in part of the

Arikaree Formation to 150 ft/d in part of the Quaternary age alluvium. Specific yield, which describes release of water from storage in the aquifer, ranged from 0.135 to 0.15 (dimensionless). Other model inputs adjusted during model calibration included streambed conductance and paleovalleys. Streambed conductance, which is one parameter that controls stream-aquifer interaction, ranged from 1.0 ft/d per foot of length to 20 ft/d per foot of length in the calibrated model. Paleovalleys were used to adjust both base of aquifer and hydraulic conductivity. Within paleovalleys, base of aquifer was lowered 200 ft and hydraulic conductivity was increased to 120 ft/d. Two aquifer stress, recharge and pumpage, were estimated in concurrent studies and were provided to this study. These stresses were not changed during model calibration.

Other model inputs were set during model construction and were not changed during model calibration. Simulated 1953 water levels at 297 targets ranged from 100 ft below observed values to 86 ft above observed values. The weighted average difference was -2.9 ft and the unweighted average difference was -7.2 ft. The weighted mean absolute difference was 7.2 ft and the unweighted mean absolute difference was 20.6 ft. Simulated fall 1952 baseflow for north side tributaries to the North Platte River above Pumpkin Creek was about the same as observed baseflow. Simulated spring 1953 baseflow for the same tributaries was 19 percent greater than observed baseflow. The largest simulated inflow component of the 1952-53 water budget was recharge and the largest outflow component was streamflow.

The overall error in the water budget was 546 acre-feet, compared to overall recharge of 1,197,000 acre-feet. Simulated 2010-11 water levels at 85 targets ranged from 71 ft below observed values to 94 ft above observed values. The average difference was +2.5 ft. For 1953-2011, there were 8,290 targets at 131 sites. The weighted average difference was -2.5 ft and the unweighted average difference was -4.6 ft. The weighted mean absolute difference was 10.0 ft and the unweighted mean absolute difference was 17.0 ft. Simulated fall 2010 baseflow for north side tributaries to the North Platte River above Pumpkin Creek was about 18 percent greater than observed baseflow. Simulated spring 2011 baseflow for the same tributaries was 12 percent greater than observed baseflow. The average simulated 1953-2011 baseflow to the North Platte River at Lewellen was about 1,320 ft³/s while the average observed baseflow was about 1,290 ft³/s. The largest simulated inflow component of the 2010-11 water budget was recharge and the largest outflow components were streamflow, pumpage, and decrease in storage. The overall error in the water budget was 4 acre-feet, compared to overall recharge of 2,009,500 acre-feet.”

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).

There are currently no known structural measures which may be affected by the project. However, the WWUM modeling will provide the analysis tools upon which a number of projects will be evaluated in the future because of the requirements of the IMPs for the NRDs. Any projects that may impact streamflow and aquifer declines will need to be analyzed and projects specifically designed to improve streamflow will be assessed with the WWUM modeling for their effectiveness.

The anticipated analyses include allocation effects, certified groundwater acreage retirement effects, canal recharge project effects, and surface water consumptive use leasing. These projects are designed to enhance streamflow or reduce groundwater level declines and require complex analyses to determine the effectiveness of the management actions. In addition to these analyses, a calculation of their first and second increment depletion obligations must be completed by identifying the groundwater irrigated acres that have been developed after July 1, 1997, and then determining the depletions associated with those acres. Finally, the NRDs need to identify the change in irrigation efficiencies from a less efficient flood irrigation method to a much more efficient center pivot sprinkler irrigation method which can only be accomplished using a robust land use dataset provided through this project. This will provide additional information on these peripheral changes in irrigation methods that are influencing the surface and groundwater systems.

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 option to the numerical groundwater modeling is an analytical approach. Attempting to utilize an analytical approach would be exceedingly cumbersome, overly simplistic, and would likely fail to hold up under scrutiny.

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 total project cost is \$400,000. These costs are for payment to consultants to complete the scope of work.

- 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 project will directly increase water sustainability by providing a means to analyze the impacts of water uses in the sponsor NRDs and to determine the extent to which those uses are sustainable without taking additional actions to manage water uses and supplies. To the extent water uses are not sustainable, the WWUM modeling will provide a tool for the analysis of the effect of various management actions in reaching water sustainability to aid in management decision making. The WWUM modeling is essential to the NRDs as they implement management actions required within their Integrated Management Plans, evaluate the effectiveness of those actions, and ultimately reach and maintain a level of water use in the districts that is sustainable over the long term.

- 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).

See attached Table (Attachment A).

- 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).

The WWUM modeling project is a mandatory project for the sponsor NRDs. This is because the NRDs have a number of goals and objectives in their Integrated Management Plans and Groundwater Management Plans that they are required to accomplish, and the WWUM modeling project is essential to determine if these goals and objectives have been met. Moreover, the NRDs are required to utilize the “best available information” (Nebraska Rev. Statutes §46-709) in carrying out these duties. Without the WWUM modeling project, there is no other cost-

effective means to determine if these goals and objectives have been accomplished utilizing the best available information. These goals and objectives are inherently beneficial because they are designed to meet statutorily mandated requirements that are in place to ensure long-term water sustainability in the project area.

In addition, many of these goals are related to obligations that the State of Nebraska has to the Platte River Recovery Implementation Program (PRRIP), an interstate agreement signed by the Governors of Nebraska, Colorado, and Wyoming, and the U.S. Secretary of the Interior. Under the PRRIP, Nebraska has made a number of commitments to the other States and the signatory federal agencies. Without the WWUM modeling project, Nebraska will be unable to demonstrate that it has met those obligations, which otherwise would threaten to deprive Nebraska of the benefits provided by the PRRIP. These benefits are related to the Endangered Species Act; more specifically to three endangered and one threatened species on the Central Platte River, the whooping crane, the least tern, the pallid sturgeon, and the piping plover, respectively. The PRRIP is beneficial to Nebraska. It fully meets any conditions that the U.S. Fish and Wildlife Service might require for water users in the Platte River Basin, which would, without the program, likely cost many hundreds of millions of dollars in direct expenses and reduced economic output. For example, the Environmental Impact Statement for the PRRIP indicated that implementation of other alternatives could cost approximately \$250 million and the economic output could be reduced by over \$10 million annually for the Platte River Basin in Nebraska.

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

See attached documents that present the NRDs budgets for FY 2017-2018 and attached letters documenting that the NRDs intend to budget adequate funds in FY 2019-2020 and FY 2020-2021 (Attachment B).

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace).
N/A
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 project will have no negative impact on the natural environment.

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

The NRDs have a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). As Nebraska’s preferred regulator of groundwater they are clearly both qualified and responsible to carry out the proposed project. Specifically, Nebraska Rev. Statutes §46-707(f) confers to the NRDs the power to “conduct investigations and cooperate or contract with ... public or private corporations, or any association or individual on any matter relevant to the administration of the [Ground Water Management and Protection] act.” The NRDs have a number of potential funding sources available to use in meeting their share of the project cost.

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 being implemented to fulfill, in part, the requirements of the Integrated Management Plans (IMPs) for the sponsor natural resources districts. The IMPs are written in accordance with the Basin-Wide Plan for the Upper Platte River Basin. Both the IMPs and the Basin-Wide Plan are required by the Nebraska Ground Water Management and Protection Act (GWMPA). In addition, Nebraska is a signatory to an interstate agreement called the Platte River Recovery Implementation Program (PRRIP). This project will assist the NRDs and the State of Nebraska to demonstrate that the State is meeting its obligations under the PRRIP. Finally, both NRDs have groundwater management plans (GMP) pursuant to the GWMPA. The WWUM modeling will assist Nebraska and the sponsor NRDs in meeting the requirements of all of these plans.

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.

The South Platte and North Platte Natural Resources Districts are specifically tasked by the legislature to manage groundwater as well as hydrologically connected groundwater and surface water. They have a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). These responsibilities and authorities require the development and use of management tools such as the WWUM modeling. Specifically, Nebraska Rev. Statutes §46-707(f) confers to the NRDs the power to “conduct investigations and cooperate or contract with agencies of the United States, agencies or political subdivisions of this state, public or private corporations, or any association or individual on any matter relevant to the administration of the [Ground Water Management and Protection] act.”

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

There will be no negative environmental or ecological consequences as a result of the project.

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 approximately 62,000 people that live in the North Platte Natural Resources District (NPNRD) and South Platte Natural Resources District (SPNRD) rely on the High Plains Aquifer for drinking water. The Nebraska Department of

Environmental Quality's 2015 Nebraska Groundwater Quality Monitoring Report¹ indicates there are already six community public water supply systems with mandatory requirements triggered by high levels of nitrates. In addition, there are two community public water supply systems that are required to treat their drinking water due to high levels of uranium. The annual maps included in the report clearly indicate that the nitrogen contamination has become an increasingly important concern over the last several decades. Also, the uranium is naturally occurring, so there is every reason to expect that drinking water quality will continue to be an issue for this area. Future alternate drinking water supplies will likely need to be identified, most likely coming from other groundwater sources. However, all of the NPNRD and SPNRD is designated as either fully appropriated or overappropriated. This means that any new use of hydrologically connected groundwater can only be developed if such use will not adversely impact existing users. In the absence of alternate water supplies, communities will be forced to turn to treatment options, which are generally much more expensive to implement and maintain, making this alternative a poor long-term solution. The most scientifically sound and up-to-date modeling tools are required in order to analyze new uses to ensure these adverse impacts do not occur. Therefore, the WWUM modeling will be a critical tool in order for communities to meet increased challenges of providing safe drinking water to the people in this area.

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

This project will assist the SPNRD and the NPNRD in meeting the goals and objectives of each NRDs' Integrated Management Plan (IMP) and Groundwater Management Plan (GMP). The SPNRD's IMP was jointly adopted by the SPNRD and the DNR on June 20, 2008 and updated on August 19, 2009². The NPNRD's IMP was jointly adopted by the NRD and the DNR on August 13, 2009 and updated on April 16, 2013³. The Districts first increment of their IMPs will be completed in 2019 and the second increment planning is in progress. The WWUM modeling has been essential in evaluating the first increment's success and will be used to determine the second increment's goals and objectives. The most recent version

¹ <http://deq.ne.gov/publica.nsf/Pages/WAT230>

² http://dnr.nebraska.gov/Media/iwm/PDF/SouthPlatte_IMP_0809.pdf

³ http://dnr.nebraska.gov/Media/iwm/PDF/NPNRDIMP_04112013.pdf

of the SPNRD's GMP was adopted in 2002⁴. The most recent version of the NPNRD's GMP was adopted in 1993⁵

SPNRD IMP

The goal of the SPNRD's IMP is to work together for the greater good of all citizens of the South Platte Natural Resources District to cooperatively develop and implement a local Integrated Surface Water/Ground Water Plan that has an acceptable degree of certainty of 1) maintaining a sufficient water supply for use by present and future generations, 2) maintaining, enhancing and protecting the region's agricultural economy and the viability of its cities and villages, and 3) promoting the growth of economic activities while seeking to avoid adverse impacts on the environment. Additional goals in the overappropriated section of the IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the SPNRD would cause noncompliance by Nebraska with any interstate compact or decree or other formal state contract or agreement, and 3) maintain consistency with the Basin-Wide Plan. This project will assist the SPNRD in achieving all of these goals by providing the tools required to assess progress in meeting these goals.

The history of work that has gone into meeting the goals and objectives of the SPNRD's IMP begins with the original adoption of the IMP in 2009. Since then the NRDs and the DNR have held basin-wide meetings every year, developed a detailed protocol for use in monitoring the success in meeting these goals, and implemented a number of studies and data collection efforts. These will culminate in modeling evaluation utilizing the WWUM models under this project.

NPNRD IMP

The goals of the fully appropriated portion of the NPNRD's IMP are to 1) protect existing users, local economy, environmental health, and recreational uses to the extent possible, 2) manage total water supply in the NPNRD to achieve a balance between water uses and water supply so that economic viability, social and environmental health, safety, and welfare are maintained for the near term and long term, and 3) ensure no act or omission of the NPNRD will cause the state to be in noncompliance with applicable state and federal laws and with any applicable interstate water compact or decree, or other formal state contract or agreement pertaining to surface water or groundwater use or supplies.

Additional goals in the overappropriated section of the IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the NPNRD would cause noncompliance by Nebraska with any interstate compact or decree, or other formal state contract or agreement, and 3) maintain consistency with the Basin-Wide Plan. This project will assist the NPNRD in achieving all of these goals by providing the tools required to assess progress in meeting these goals.

⁴ See Attachment C.

⁵ See Attachment D.

The history of work that has gone into meeting the goals and objectives of NPNRD's IMP begins with the original adoption of the IMPs in 2009. Since then the NRDs and the DNR have held basin-wide meetings every year, developed a detailed protocol for use in monitoring the success in meeting these goals, and launched a number of new studies and data collection efforts. These will culminate in modeling evaluation utilizing the WWUM models under this project.

SPNRD and NPNRD GMPs

The goal of the SPNRD's GMP is "to maintain an adequate supply of groundwater for all reasonable uses into the future. An adequate supply of groundwater is a supply that can maintain current annual demands without depleting the aquifers and without degrading groundwater quality." The goal of the NPNRD's GMP is to "(m)aintain an adequate supply of acceptable quality groundwater to forever fulfill the reasonable groundwater demands within the North Platte NRD for domestic, municipal, agricultural, industrial, wildlife habitat and other uses deemed beneficial by the people of the North Platte NRD." The WWUM modeling project will assist the SPNRD and the NPNRD in meeting these goals by supplying the information necessary to take management actions that will be required to ensure an adequate supply of groundwater will be available over the long-term.

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 WWUM modeling project will contribute to water sustainability by providing the necessary tools to implement management actions that will increase aquifer recharge, reduce aquifer depletion, or increase streamflow by facilitating informed decision making by the SPNRD and the NPNRD. Aquifer recharge can be increased through diversions of surface water during times of excess flows, allowing the water to soak into the ground beneath canals and laterals. The modeling tools will help these efforts by providing information on potential diversion times and amounts. The modeling tools can also assist the NRDs in reducing aquifer depletion and increasing streamflow by providing the information required to make future regulatory decisions.

4. Contributes to multiple water supply goals, including, but not limited to, flood control, agricultural use, municipal and industrial uses, recreational benefits,

wildlife habitat, conservation of water resources, and preservation of water resources;

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

The WWUM modeling project will contribute to multiple water supply goals, including conservation and preservation of water resources and aquifer sustainability, by providing essential information that will be used to drive informed decision making. The SPNRD and the NPNRD need the WWUM models to predict the potential benefits of various management actions, to assist in monitoring those actual benefits, and to make well-informed future adjustments in management decisions. Over the long term, the ability to make these informed management decisions will ensure these water supply goals will be met. Without the WWUM modeling project, the relative success of meeting these goals will be unknown and cannot be ensured.

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

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

The Integrated Management Plans for the SPNRD and the NPNRD, which address hydrologically connected surface and groundwater, have the goal of achieving and maintaining a fully appropriated condition for the overappropriated portions of the NRDs. The aquifers in these NRDs are also highly stressed due to the extremely low average precipitation in this part of Nebraska. As a result of these factors, both NRDs have rules and regulations that limit the amount of groundwater that can be pumped per irrigated acre. Both NRDs are striving to strike the appropriate balance between maximizing beneficial consumptive use and limiting impacts to the aquifers and streamflow. The WWUM modeling project will allow the NRDs to make informed decisions regarding the appropriate level of regulation to accomplish both goals. This provides a beneficial impact to Nebraska's residents by ensuring that the contribution of the residents of these NRDs to the state's economy will be impacted only to the extent required as a result of any necessary regulations on water use.

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 total cost of the project is \$400,000. There is no other technically comparable way of achieving the same benefits and the WWUM modeling project is a mandatory project for the SPNRD and the NPNRD. This is because the NRDs have a number of goals and objectives in their Integrated Management Plans that they are required to accomplish, and the WWUM modeling project is essential to determine if these goals and objectives have been met. In other words, without the WWUM modeling project, there is no other cost-effective means to determine if these goals and objectives have been accomplished. These goals and objectives are inherently cost-effective because they are designed to meet statutorily mandated requirements that are in place to ensure long-term water sustainability in the area of the project.

In addition, many of these goals are related to obligations that the State of Nebraska has to the Platte River Recovery Implementation Program (PRRIP), an interstate agreement signed by the Governors of Nebraska, Colorado, and Wyoming, and the U.S. Secretary of the Interior. Under the PRRIP, Nebraska has made a number of commitments to the other States and the signatory federal agencies. Without the WWUM modeling project, Nebraska will be unable to demonstrate that it has met those obligations, which otherwise would threaten to deprive Nebraska of the benefits provided by the PRRIP. These benefits are related to the Endangered Species Act; more specifically to three endangered and one threatened species on the Central Platte River, the whooping crane, the least tern, the pallid sturgeon, and the piping plover, respectively. The PRRIP is beneficial to Nebraska. It fully meets any conditions that the U.S. Fish and Wildlife Service might require for water users in the Platte River Basin, and, without the program would likely cost many hundreds of millions of dollars in direct expenses and reduced economic output. For example, the Environmental Impact Statement for the PRRIP indicated that implementation of other alternatives could cost approximately \$250 million and the economic output could be reduced by over \$10 million annually for the Platte River Basin in Nebraska.

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 WWUM modeling project is essential to Nebraska's ability to meet its obligations under the Platte River Recovery Implementation Program (PRRIP), an interstate agreement. Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP)⁶, a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The sponsor NRDs have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires the WWUM modeling project. Without this project, it will be impossible to properly document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs.

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the United States such that their incapacitation would have a debilitating effect on public security or public health and safety;
 - Identify the property that the project is intended to reduce threats to.
 - Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
 - Identify the potential value of cost savings resulting from completion of the project.
 - Describe the benefits for public security, public health and safety.

The groundwater supply in the SPNRD and the NPNRD is vital to the State of Nebraska and the United States. Without this supply, there would be a debilitating effect on public security, public health and safety. The ability to manage this supply through an informed decision-making process is vital to ensuring the sustainability of this supply, and the WWUM modeling project is absolutely necessary for this to happen. As an example of the concern, the United States Department of Homeland Security's Office of Cyber and Infrastructure Analysis recently released a report entitled Analysis of High Plains Resource Risk and Economic Impacts⁷. The report analyzed how continued depletion of the High Plains aquifer in Kansas and Nebraska might impact critical infrastructure and the economy at the local, regional, and national levels.

A key finding of this report is that "(i)f current water use practices are continued into the future, sixty counties in Kansas and seven in Nebraska are projected to face exhaustion of groundwater supplies in 100 years or less." It is clear that water use practices will need to be carefully managed to ensure that groundwater is available in the future. This clear benefit to public security, public health and

⁶ http://dnr.nebraska.gov/Media/iwm/PDF/NebraskaDepletionPlan_Attachment5.pdf

⁷ See Attachment E.

safety will be provided by the WWUM modeling project. It will provide information on the current status of groundwater availability and how that might change over time, allowing the SPNRD and the NPNRD to make well-informed management decisions.

9. Improves water quality;

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

N/A

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 local jurisdictions that support the WWUM modeling project are the SPNRD and the NPNRD. These NRDs have and will continue to support the proposed project through their tax levy authority. The tax levy from the FY 2018-2019 for the NPNRD is 5.7¢ per \$100 valuation and the current tax levy for the SPNRD is 4.9196¢ per \$100 valuation. The sponsor NRDs have also utilized other funding sources for this continued effort in the past, including the Interrelated Water Management Plan Program Fund administered by the NDNR and the Nebraska Environmental Trust (when the WWUM modeling was a part of the Cooperative Hydrology Study).

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 SPNRD and the NPNRD are local jurisdictions with multiple plans in place that support sustainable water use, including both Integrated Management Plans (IMPs) and Groundwater Management Plans (GMPs). Both NRDs have completed an extensive amount of work to achieve the goals of these plans, including the development and implementation of rules and regulations concerning groundwater quality and quantity, extensive monitoring of the status of groundwater quality and quantity, and extensive implementation of information and educational programs. The SPNRD's IMP was jointly adopted by the NRD and the DNR on June 20, 2008 and updated on August 19, 2009. The NPNRD's IMP was jointly adopted by the NRD and the DNR on August 13, 2009 and updated on April 16, 2013. The Districts first increment of their IMPs will be completed in 2019 and the second increment planning is in progress. The WWUM modeling has been essential in evaluating the first increment's success and will be used to determine the second increment's goals and objectives. The most recent version of the SPNRD's GMP was adopted in 2002. The most recent version of the NPNRD's GMP was adopted in 1993.

The goal of the SPNRD's IMP is to work together for the greater good of all citizens of the [SPNRD] to cooperatively develop and implement a local Integrated Surface Water/Ground Water Plan that has an acceptable degree of certainty of 1) maintaining a sufficient water supply for use by present and future generations, 2) maintaining, enhancing and protecting the region's agricultural economy and the viability of its cities and villages, and 3) promoting the growth of economic activities while seeking to avoid adverse impacts on the environment.

Additional goals in the overappropriated section of the SPNRD's IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the SPNRD would cause noncompliance by Nebraska with any interstate compact or decree or other formal state contract or agreement, and 3) maintain consistency with the Basin-Wide Plan. This project will assist the SPNRD in achieving all of these goals by providing the tools required to assess progress in meeting these goals.

The goals of the fully appropriated portion of the NPNRD's IMP are to 1) protect existing users, local economy, environmental health, and recreational uses to the extent possible, 2) manage total water supply in the NPNRD to achieve a balance between water uses and water supply so that economic viability, social and environmental health, safety, and welfare are maintained for the near term and long term, and 3) ensure no act or omission of the NPNRD will cause the state to be in noncompliance with applicable state and federal laws and with any applicable interstate water compact or decree or other formal state contract or agreement pertaining to surface water or groundwater use or supplies.

Additional goals in the overappropriated section of the IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the NPNRD would cause noncompliance by Nebraska with any interstate compact or decree or other formal state contract or agreement, and 3) maintain consistency with the Basin-Wide Plan. This project will assist the NPNRD in achieving all of these goals by providing the tools required to assess progress in meeting these goals.

The history of work that has gone into meeting the goals and objectives of both NRDs IMPs begins with the original adoption of the IMPs in 2009. Since then the NRDs and the DNR have held basin-wide meetings every year, developed detailed protocol for use in monitoring the success in meeting these goals, and implemented a number of studies and data collection efforts. These will culminate in modeling evaluation utilizing the WWUM models under this project.

The goal of the SPNRD’s GMP is “to maintain an adequate supply of groundwater for all reasonable uses into the future. An adequate supply of groundwater is a supply that can maintain current annual demands without depleting the aquifers and without degrading groundwater quality.” The goal of the NPNRD’s GMP is to “(m)aintain an adequate supply of acceptable quality groundwater to forever fulfill the reasonable groundwater demands within the North Platte NRD for domestic, municipal, agricultural, industrial, wildlife habitat and other uses deemed beneficial by the people of the North Platte NRD.” The WWUM modeling project will assist the SPNRD and the NPNRD in meeting these goals by supplying the information necessary to take management actions that will be required to ensure an adequate supply of groundwater will be available over the long-term.

The WWUM modeling project will support sustainable water use by providing the information required to properly manage the groundwater and hydrologically connected water supply in the NPNRD and the SPNRD. These NRDs are home to nearly 62,000 people and cover nearly 5 million acres of the state. The aquifer in this area is used for many beneficial purposes, including agricultural, domestic, livestock, industrial, and municipal uses. The stakeholders in this project are the nearly 62,000 people that live in the sponsor NRDs and will benefit from this project.

12. Addresses a statewide problem or issue;

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

The WWUM modeling project helps the state meet its obligations under the Platte River Recovery Implementation Program (PRRIP), which is clearly a statewide issue. This interstate agreement was signed by the Governor. The Legislature has provided a significant amount of general fund appropriations through the DNR to implement the PRRIP. The WWUM modeling project is essential to Nebraska's ability to meet its obligations under the PRRIP.

Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The SPNRD and the NPNRD have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires the WWUM modeling project.

Without this project, it will be impossible to properly document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs. Successful implementation of the PRRIP and the NNDP provides benefits to the approximately 500,000 irrigated acres in the Platte River Basin that were developed subsequent to 1997. By successfully offsetting the impact of these irrigated acres, Nebraska's economy will benefit significantly by allowing those acres to remain in irrigated agriculture.

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 NPNRD and the SPNRD will pay 40% of the project cost, thereby contributing \$160,000 to the project. This funding source is made available through the budgets of the sponsor NRDs, which are provided through their tax levy authority. Attached are copies of the NRD budgets showing their commitment to the project and letters documenting the NRDs intent to include the appropriate matching funds in their budgets for Fiscal Years 2019-2020 and 2020-2021 (See Attachment B). The budgetary commitment authority ensures the project will proceed and be completed.

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 WWUM modeling project will assist the NPNRD and the SPNRD in managing the hydrologically connected water supply of the North Platte River, the South Platte River, and Lodgepole Creek. The project will contribute to watershed health and function by providing the information required to make appropriate management decisions regarding consumption of these water supplies, and potential replacement of water supplies through managed recharge or streamflow augmentation.

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 WWUM modeling project is a significant part of the DNR’s objective of Integrated Management Modeling efforts for the Upper Platte River Basin. This can be seen on pages 25-26 of the Annual Report and Plan of Work for the Nebraska State Water Planning and Review Process⁸, submitted to the Governor and Legislature by the DNR in September of 2015. As stated in the report, “(t)he model components work together to create tools capable of analyzing varied management scenarios such as the effect of conjunctive management projects, well pumping, alternative surface water operations, etc. The tools are being developed to meet the goals and objectives of the IMPs.”

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 providing regulatory certainty with regard to the U.S. Endangered Species Act (ESA). The federally listed least tern, pallid sturgeon, piping plover, and whooping crane must be addressed under the ESA; if the PRRIP did not exist other water management actions would be required of the states or individual

⁸ <http://dnr.nebraska.gov/2015-annual-report-and-plan-of-work>

water users. The WWUM modeling project is essential to Nebraska's ability to meet its obligations under the PRRIP. Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The sponsor NRDs have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires the WWUM modeling project. Without this project, it will be impossible to properly document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs.

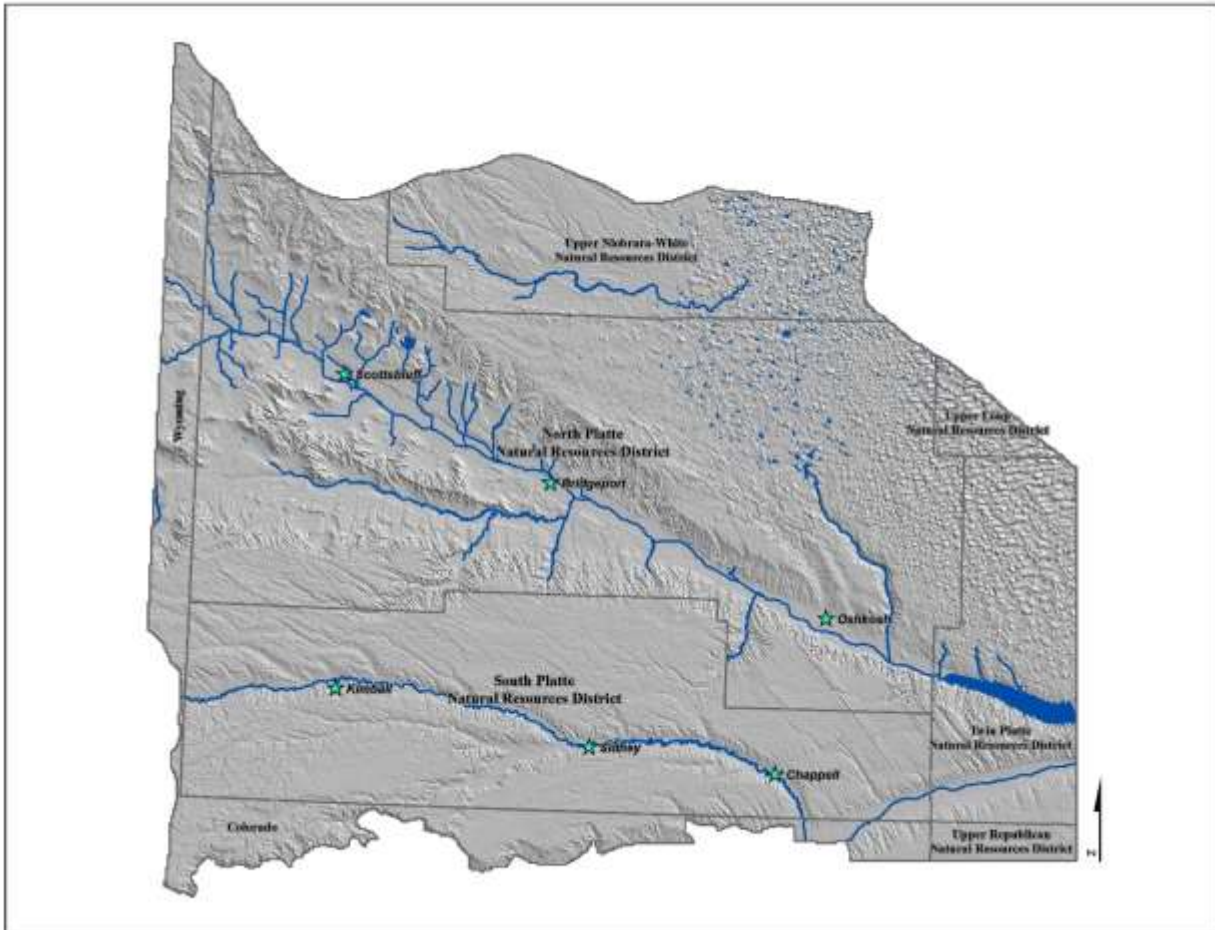
Section D.

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.

Groundwater and surface water models are a critical component of Nebraska's water planning efforts. These models work together to create tools capable of analyzing varied management scenarios such as the effect of conjunctive management projects, well pumping, alternative surface water operations, etc. One of these key modeling tools is the Western Water Use Management (WWUM) model and its areal extent is shown below.



The WWUM modeling project will accomplish a number of updates, refinements, and complete an extension of the existing modeling effort. This allows North Platte and South Platte Natural Resources Districts (NPNRD, SPNRD, or NRDs) to complete essential analyses of their water management actions, projects, and to evaluate existing and potential projects to meet their Integrated Management Plans (IMPs) goals of reducing consumptive use and increasing streamflow. The NRDs implemented actions include allocations, groundwater certified acreage retirements, excess surface water recharge projects, and surface water leasing projects to lease consumptive use of surface water irrigated lands.

For the NRDs to determine the success of these actions and adapt to changing conditions, they rely on the WWUM modeling to quantify the effects. The evaluation's results provide critical information to the NRDs to understand how their water management efforts benefit their constituents and downstream water rights users. Beyond the management actions and projects, each NRD works with local municipal, industrial, and agricultural water users to determine the effects of changes in well locations to the NRDs IMP goals. The analysis is primarily conducted within the WWUM modeling suite.

The modeling refinements will begin with an evaluation of the geologic and hydrogeologic datasets of Pumpkin Creek and Lodgepole Creek to refine the local aquifer's characteristics in the groundwater model. The original modeling created initial datasets to determine the extent of this aquifer system, but additional work is necessary to improve this information and provide essential technical analyses to aid in management decisions by the NRDs.

Light Detection and Ranging (LiDAR) surface elevation data have been collected over the majority of the modeling area. This information will be applied to many aspects of the modeling to continue to provide the NRDs with highly accurate information.

The land use information will be updated with attributes of well location, crop type, irrigation method (flood or center pivot sprinkler irrigation), and the metered groundwater pumping information both NRDs have been collecting. This provides the critical information of where and how much water is being used. Additionally, the surface water irrigated lands within the modeling area will be re-evaluated and refined based on information from and collaboration with the Nebraska Department of Natural Resources (DNR). Continuing to refine the surface water acres especially along the North Platte River in NPNRD creates a modeling tool to more accurately evaluate the surface water use and streamflow. The main components that rely on this land use information are the calibration of the modeling and analyses used by the NRDs to determine their IMP obligations and the effectiveness of their management actions and strategies.

The Hydrogeology of Western Nebraska (HWN) project, which was sponsored and funded by SPNRD, NPNRD, Twin Platte NRD, and the Nebraska Environmental

Trust, provided extensive geologic datasets throughout the WWUM modeling area. These datasets demonstrated additional complexities in the geology of the South Tablelands of SPNRD and NPNRD which require additional modeling refinements to be accurately represented in the modeling. These refinements will include additional groundwater model layers in specific areas to capture these complexities. The modeling information and analyses will assist the NRDs with placing appropriate and highly informed groundwater pumping limitations and management goals on the deep aquifers. This modeling refinement will update the current aquifer interpretation, recalibrate the WWUM model, and provide a critical and more robust understanding of impacts to the deep aquifers.

To incorporate the additional layers at specific locations within the WWUM modeling, a new groundwater modeling technique using the United States Geological Survey (USGS) MODFLOW package called unstructured grids will be implemented. This technique also allows for variable cell sizes to be implemented throughout the model. Where data is limited or areas where groundwater development and management is minimal, larger cell sizes will be used, which will reduce overall processing requirements of the model. Where a high density of data exists with small features such as tributaries and canals, a much smaller grid is ideal for a highly refined model area. This modeling refinement will provide the tools necessary to complete an accurate representation of the aquifer and surface water impacts due to pumping and management while increasing efficiency in modeling runtime.

To continue to provide the most reliable and integrated modeling tools available, the WWUM modeling will implement the use of a new surface water operations model for the North Platte River and refine the existing operations modeling along the South Platte River. This modeling will use a simple interface through a spreadsheet program to simulate the prior appropriations system which will include the reservoir operations, surface water diversions and downstream storage rights. By using a simple interface, analyses can be completed in a more efficient manner as compared to the current surface water operations model. This modeling will be completed with the collaboration and technical support of DNR.

The surface water model will be completed in conjunction with an extension and update of the groundwater modeling. Finally, the modeling will extend and update the CROPSIM and Regionalized Soil Water Balance Modeling. These critical modeling updates will allow the NRDs to effectively and efficiently determine how groundwater management, pumping, and climate cycles affect the surface water and groundwater systems of the North Platte River, the South Platte River, and Lodgepole Creek.

All of the updated and refined information will be used to recalibrate and extend the WWUM modeling from the 2017 to 2020 period.

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.

The WWUM modeling project will be conducted in two phases. Phase one, will complete a number of tasks to further refine and create a new surface water modeling that have been identified as being necessary prior to the extension of the model. This Phase will be completed in Fiscal Year 2019-2020. Phase two will consist of continued refinements and the model extension. This phase will be completed in Fiscal Year 2020-2021. Phase one tasks include: 1) Work on compiling, interpreting, and incorporating the geologic and hydrogeologic datasets of Pumpkin Creek and Lodgepole Creek into the ground water model; 2) Begin work on the new surface water model along the North Platte River and refinements to the South Platte River surface water modeling; 3) Refine the groundwater model using unstructured grids MODFLOW package; 4) Refine the groundwater model geology and hydrogeology with additional layers in the Southern Tablelands, and; 5) Update Modeling with LIDAR Data, and; 6) Coordination and documentation of the project. Phase two tasks include: 1) Finish the new surface water model along the North Platte River and refinements to the South Platte River surface water modeling; 2) Update the land use for 2017 through 2020 and refinements to the surface water land use; 3) Complete Groundwater Model, CROPSIM Model, and Regionalized Soil Water Balance Model update and extension, and; 4) Coordination and documentation of the project.

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.

The SPNRD and the NPNRD are the sole entities involved in the project and their general responsibilities involve hiring a consultant to complete the project on time and within budget.

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 entire project is \$400,000. The SPNRD and the NPNRD would provide 40% of this total, with the Water Sustainability Fund providing the other 60%. There are no other sources of funding for the project.

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 each NRDs board of directors and there is no known opposition to the project.