



USGS WATER USE DATA AND RESEARCH PROGRAM

WORK PLAN
FOR THE STATE OF NEBRASKA



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Goal of this Study:

The goal of this study is to create and implement a process for the annual collection/estimation of water use in Nebraska for the following water use types:

1. Public Supply
2. Industrial
3. Thermoelectric
4. Hydroelectric
5. Commercial
6. Domestic
7. Livestock
8. Wastewater Treatment

1. Introduction

The purpose of this document is to provide a detailed work plan for the state of Nebraska's utilization of the United State Geological Survey (USGS) Water Use Data and Research Program (USGS Program). This program is intended to provide financial assistance – through cooperative agreements with state water resource agencies – to enhance current water use data collection programs. The Nebraska Department of Natural Resources (NDNR) will be the water resources agency in Nebraska that will participate in the USGS Program, through collaboration with the USGS Nebraska Water Science Center. The NDNR will also collaborate with the numerous stakeholders who stand to benefit from this study. This work plan lays out the components of NDNR's current water use data collection efforts that are intended to be enhanced through financial assistance from the USGS Program. The NDNR understands that this financial assistance will be available on a competitive basis through future grant opportunities, as funding allows.

Figures 1a and 1b provide a breakdown of water use in Nebraska by water use sector for 2010. Figure 1a includes all thermoelectric water use, including thermoelectric withdrawals for once-through cooling, which is almost entirely a nonconsumptive use. To provide a better

Approximately 90 percent of the water use in Nebraska is for agricultural purposes.

breakdown of the consumptive use of water in Nebraska, Figure 1b excludes the thermoelectric withdrawals for once-through cooling. Figure 1b shows that, for a total water use of roughly seven million acre-feet, about 90 percent is accounted for by irrigation. Of the remaining 10 percent, public water supply accounted

for almost half, followed by livestock, aquaculture, self-supplied domestic, self-supplied industrial, thermoelectric power, and mining.

As irrigation accounts for so much of the state's overall water use, the NDNR and its water planning partners have placed most of their focus on this water use category in the past. NDNR's primary partners in water management are Nebraska's Natural Resources Districts (NRDs). The NDNR and the NRDs share responsibility for managing and regulating water; the NRDs have traditionally focused primarily on groundwater, and the NDNR has traditionally focused primarily on surface water. Figure 2 provides a map of the NRDs. The NDNR has been monitoring the withdrawal of surface water (primarily for irrigation) from Nebraska's streams and rivers for many decades. As the NRDs have implemented rules and regulations to manage groundwater, they have continued to enhance the monitoring of withdrawals of groundwater for irrigation through various means. Generally, the NRDs have information on the irrigated acres associated with each well, and in many cases the irrigation is monitored through well metering or some other means of indirect measurement.

Nebraska has historically focused its water use data collection efforts on agricultural water use.

In spite of the substantial available data regarding water withdrawals for irrigation, water use data is not uniformly available, and this data becomes less available as you look further back in time. As the state began developing regional groundwater models and other tools to better understand the relationship between surface water and groundwater, a first step was to create estimates of groundwater and surface water irrigation uses when data was not available. Nebraska statutes require management of hydrologically connected surface water and groundwater using the "best available science." Therefore, a tiered approach to compiling actual and estimated irrigation water use data was incorporated into Nebraska water management efforts.

Figure 3 is a map of surface water diversion points and groundwater well locations that provide water for irrigation use in Nebraska. Data regarding water use for the sources varies. For example, major surface water canals typically have detailed diversion data and sometimes also have field delivery data. In contrast, the only information that is typically available for a smaller water user that simply pumps water directly out of a stream might be the number of acres they are allowed to irrigate and typical crop consumptive use requirements for that location. For groundwater wells, some areas of Nebraska have required intensive groundwater management over time, and some of these areas have been measuring water use with a meter attached to every irrigation well for many decades. Other parts of Nebraska have had more limited groundwater development and/or have lower irrigation requirements, so that intensive management has not been initiated until more recently.

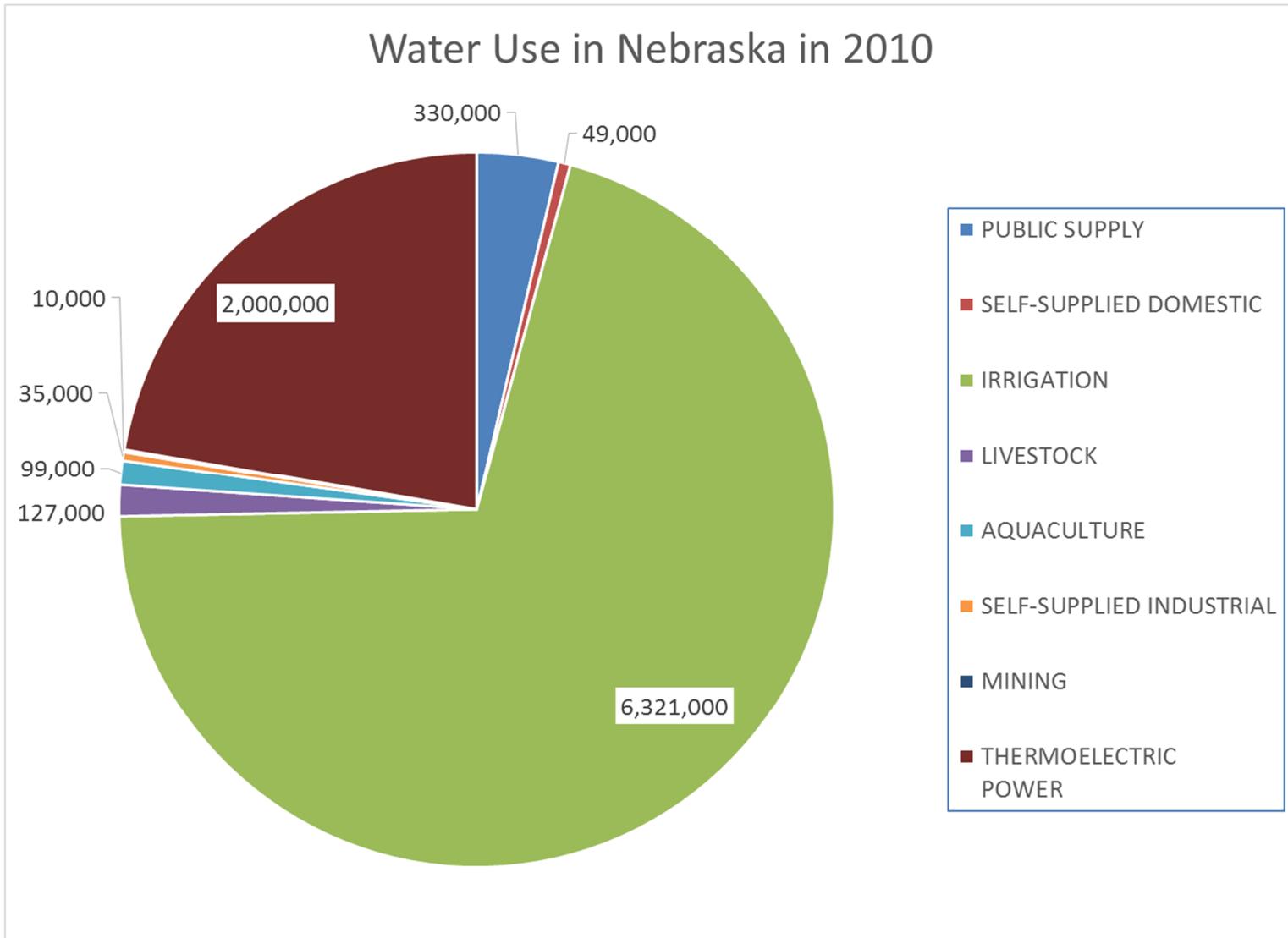


Figure 1a. Breakdown of total water use in Nebraska by water use sector , given in acre-feet (Maupin et al. 2014).

Water Use in Nebraska in 2010

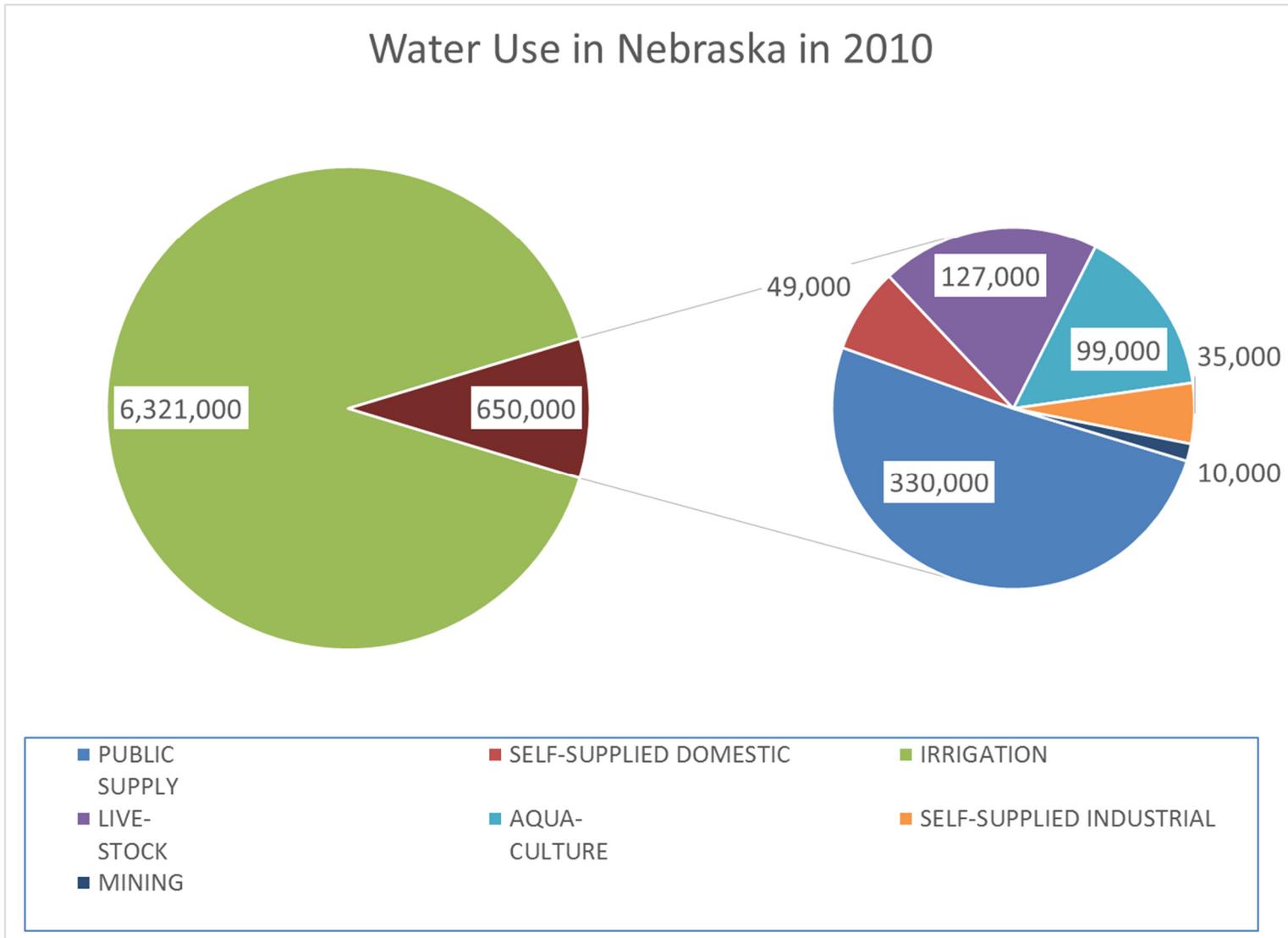


Figure 1b. Breakdown of consumptive water use in Nebraska by water use sector , given in acre-feet (Maupin et al. 2014).

This work plan will focus on the 10 percent of non-agricultural water uses in Nebraska. While these uses are a relatively small portion of total water usage in Nebraska, they are vital to the socioeconomic health and welfare of Nebraska's citizens.

The irrigation water usage across Nebraska has and will continue to be estimated using the best available information in a tiered approach. This information has been made available by the NDNR through a web portal called an Integrated Network of Scientific Information and GeoHydrologic Tools (INSIGHT) (NDNR, 2015). Currently, the INSIGHT website contains information for the entire state with the exception of the Platte River Basin, the Republican River Basin, and portions of eastern Nebraska. The Platte and Republican river basins information is now available and will be added to the INSIGHT website during 2016. Figure 4 shows the INSIGHT subbasins. Figure 5 shows the surface water

diversion points across Nebraska; these diversions are almost exclusively for irrigation. Figure 5 also shows groundwater well locations that provide water for some use other than irrigation. The NDNR is currently developing groundwater models for eastern Nebraska, and the irrigation information developed for those studies will also be added as it becomes available.

Given the significant effort that went into compiling data and estimates for irrigation use, and given other existing initiatives to improve upon this information over time, this work plan will not include any proposed work for further improvements in collecting irrigation water use data. This work plan will focus on non-agricultural water use in Nebraska.

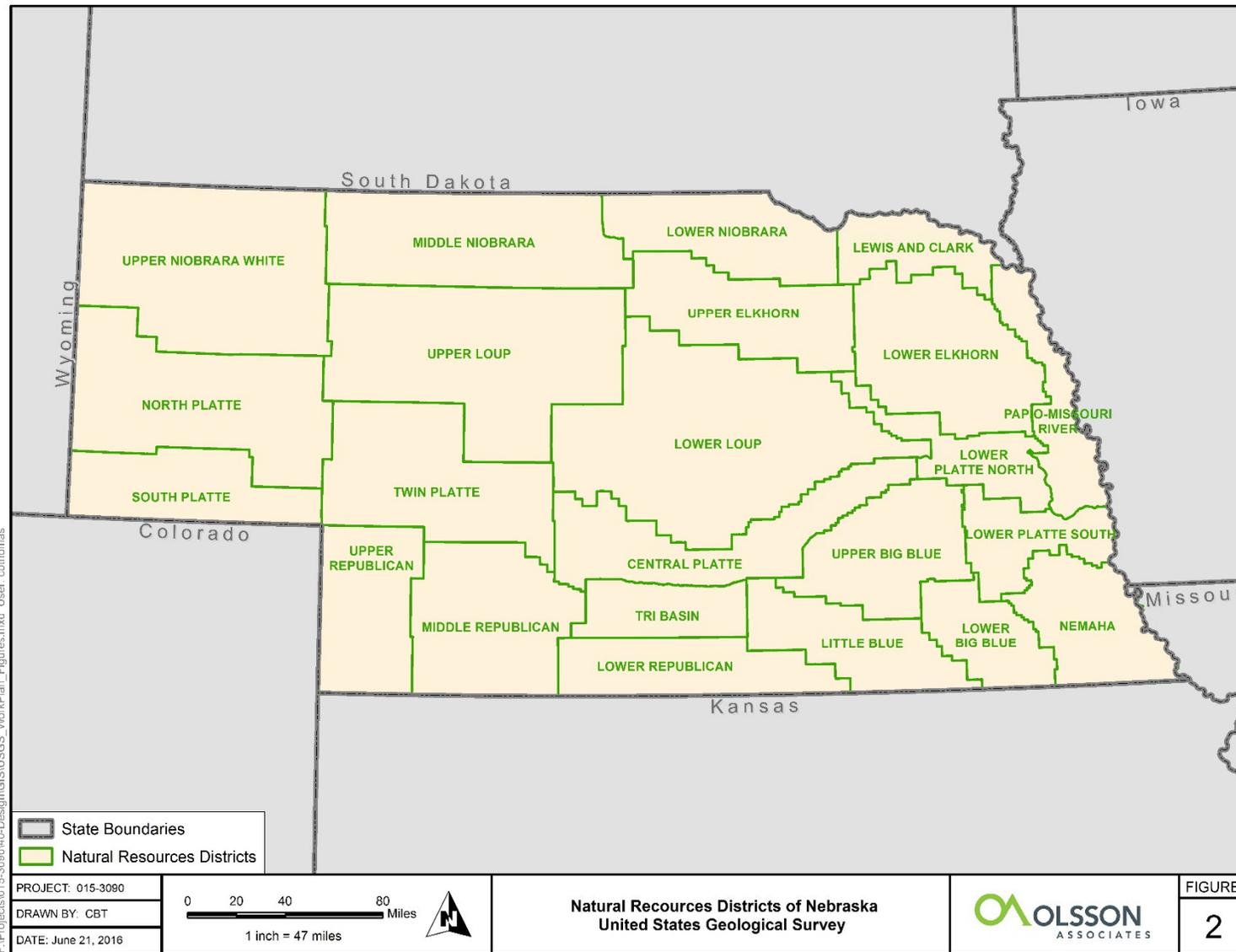


Figure 2. Natural Resources Districts of Nebraska.

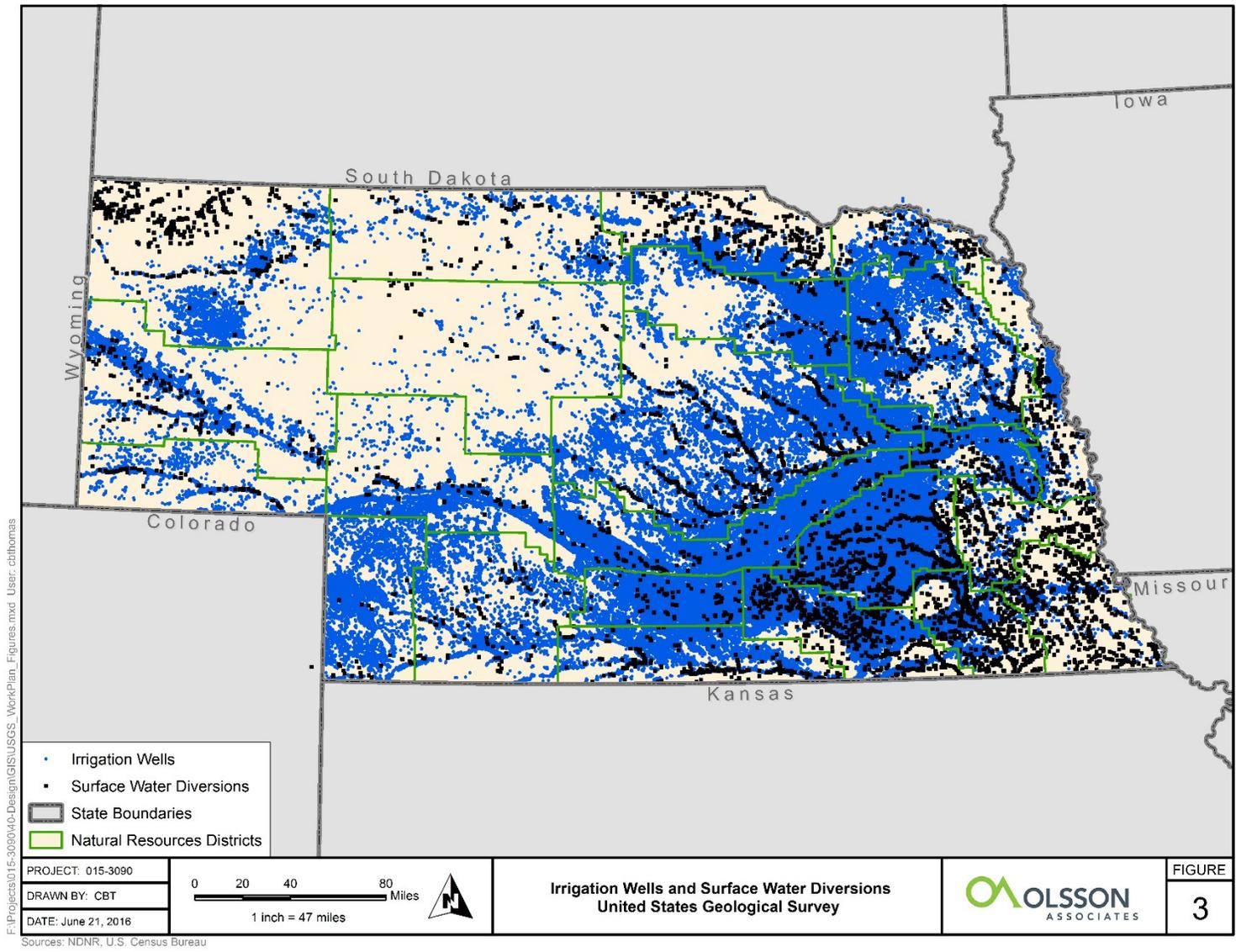


Figure 3. Irrigation Wells and Surface Water Diversions in Nebraska

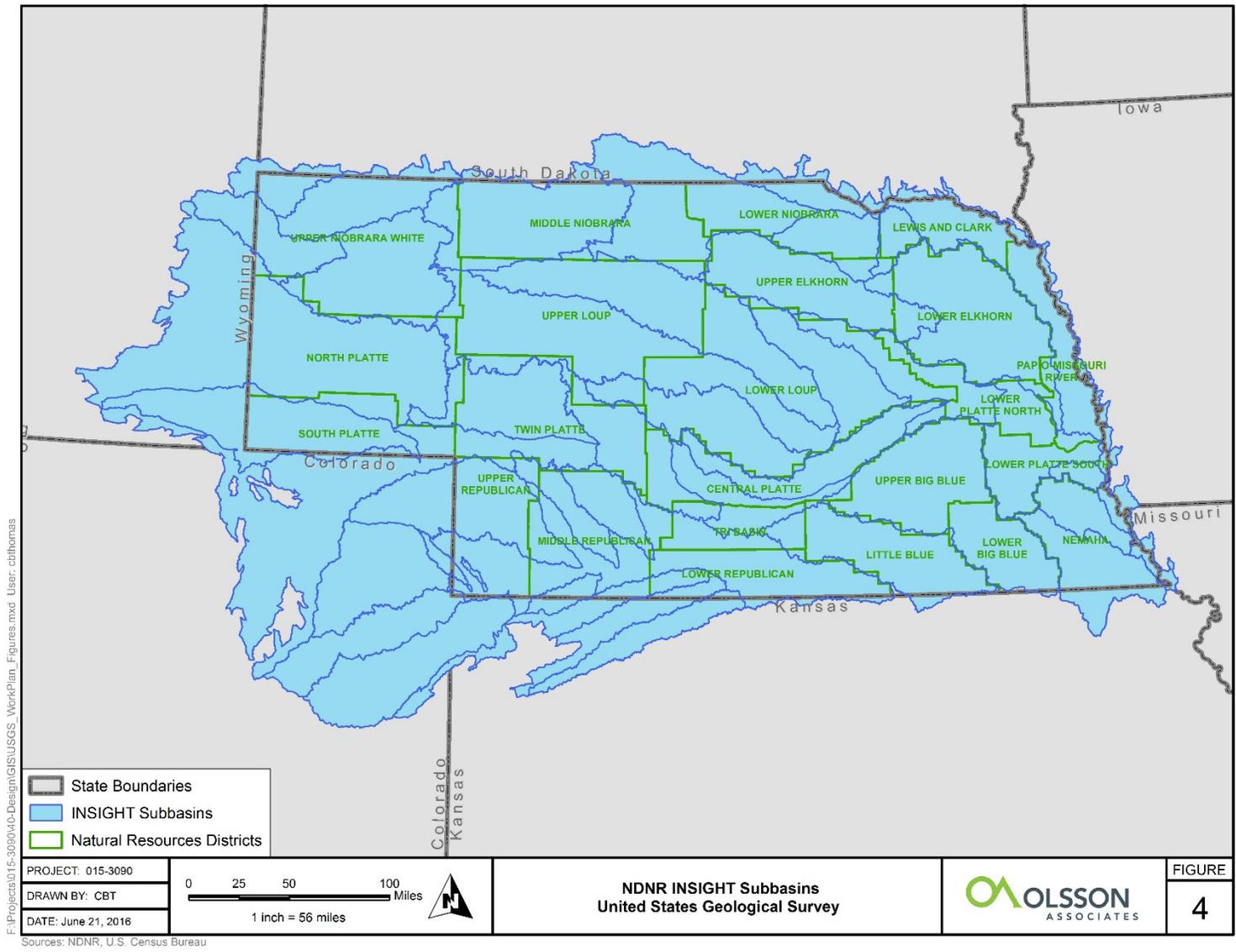


Figure 4. Nebraska Department of Natural Resources INSIGHT Subbasins.

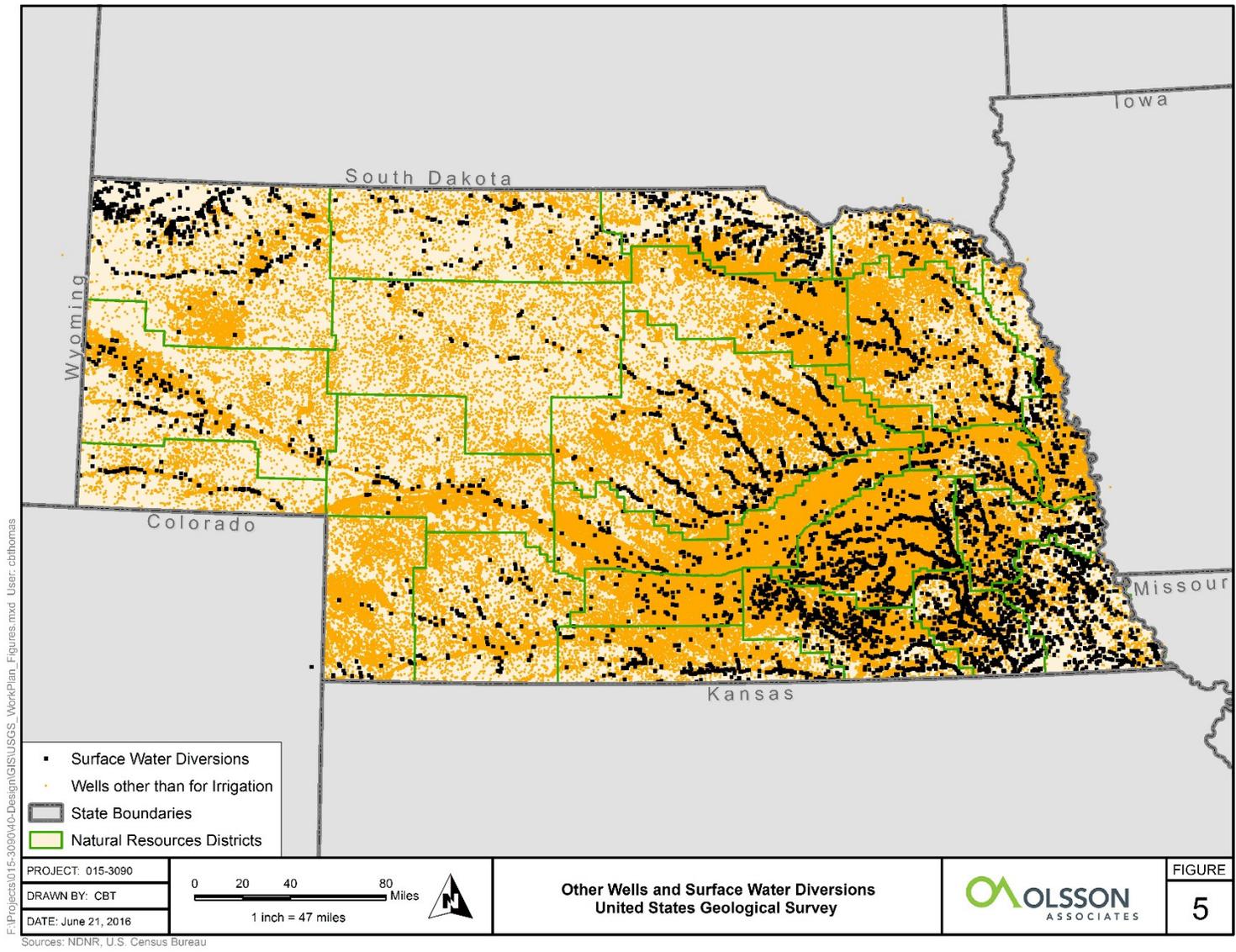


Figure 5. Other Wells and Surface Water Diversions in Nebraska

2. Project Purpose

The NDNR Project will target the following water usage categories in Nebraska: public supply, industrial, thermoelectric, self-supplied domestic, livestock, commercial, hydroelectric, and wastewater treatment. The project will use the same hierarchical approach that the NDNR previously used in the development of irrigation water use data. This will ensure that the best available data is used as well as allow for a complete dataset for each of these water use types. The project will include the development of data estimation methods where needed. This approach will require a flexible data platform that will enable the ability to compile data from multiple sources and variable data types. Finally, the project will provide the back-end functionality to allow for multiple reporting functions at several temporal and spatial scales.

The NDNR Project will use the same hierarchical approach that the NDNR previously used in the development of irrigation water use data.

3. Existing Data Inventory

As part of this work plan development, an inventory of currently available data within the NDNR for the eight water use categories included in this work plan was conducted. Results of this inventory indicate a need to create a single uniform platform to enhance data availability and to eliminate reporting redundancies. Most of the available data within NDNR falls into the public water supply and industrial categories. Table 1 contains a summary of water use data collected by NDNR for the eight water use categories in this work plan as well as agricultural data collected.

Traditionally, the NDNR has been the agency that permits the transfer of water off of the overlying land for municipal and industrial purposes. These municipal and industrial transfer permits are not mandatory. Their purpose is to protect a municipality or industry from potential damage assessments due to potential injury incurred by surrounding landowners as a result of the water transfer. The municipalities and industries that have applied for and been granted these permits are generally required to report their annual water usage to the NDNR (in some cases monthly use may also be available). This information stored at the NDNR will be useful in providing data regarding the water use for cities and industries that have a permit; however, there are several limitations to this data source. These limitations include the potential that a municipality or industry may have other sources of water that do not fall under the transfer permit, as well as the obvious fact that these permits are not mandatory, and many cities and industries have never applied for a transfer permit.

There are several existing sources of data, primarily for public water supply and industrial uses. These will be further evaluated and utilized as appropriate for this project.

Water Use Type	Data Collected?	Data Collection Technique	Frequency of Data Collection
Agriculture	Yes	Metered or estimated from crop type and irrigation requirement	Annual
Public Supply	Partially	Reported by user	Annual
Industrial	Partially	Reported by user	Annual
Thermoelectric	No	N/A	N/A
Hydroelectric	Partially	Stream gage	Daily
Commercial	No	N/A	N/A
Domestic	No	N/A	N/A
Livestock	No	N/A	N/A
Wastewater Treatment	No	N/A	N/A

Table 1. Summary of water use data collection by NDNR.

More recently, the NDNR and a number of Nebraska’s NRDs have embarked on a new water planning process called integrated water management. Through this process, the NDNR and the NRDs adopt and implement integrated management plans that are designed to meet certain statutory requirements. As such, many of these plans have necessitated the development of data collection processes for municipal and industrial water use data. While this effort is fairly new, it does cover a significant amount of the state and can also be used as a starting point for this project.



4. Planned Data Improvements

The NDNR Project will accomplish the baseline goals (Tier 1 data) for water use data in Nebraska as defined in the USGS Water Use Data and Research Guidelines for the following water use types: public supply, industrial, thermoelectric, self-supplied domestic, livestock, commercial, hydroelectric, and wastewater treatment. The top priority for this project will be collecting water use data for the public supply and industrial categories. The goal for these water use types is to obtain measured use data by water user on an annual basis across the state. The next priority will be hydroelectric and thermoelectric water use, which will also target measured water use data by facility. For the final four water use categories, estimates will be generated on an annual basis using the most appropriate techniques that will be allowed, given available information and remaining resources. In addition, the water use data will meet the following requirements:

1. All data will be stored in an electronic format.
2. A description of methods used to estimate values, coefficients, and/or other data will be provided.
3. A description of data quality assurance and control procedures will be provided.
4. Non-sensitive data, which is available for export or download from the state agency database, will be accessible to the USGS.
5. The data will be made available to the USGS at the hydrologic unit code (HUC)-8, county, and aquifer (for groundwater sources) levels.
6. The NDNR will coordinate with the USGS Nebraska Water Science Center personnel.

The USGS Water Use and Research Guidelines list a number of research priorities that reflect the priorities outlined by the USGS National Water Use Information Program. The NDNR Project aligns with the following:

- Water-use reporting at the HUC-8 level
- Water-tracking and interbasin transfers between HUC-8 units
- Inventory of self-supplied industrial uses
- Improvement of domestic per capita water use coefficients
- Identification of groundwater use by aquifer and HUC of withdrawal
- Estimation of public supply deliveries to customer groups or classes such as commercial, industrial, and domestic
- Improvement of data collection and delivery processes

The NDNR Project will be closely coordinated with the USGS Nebraska Water Science Center and will be well aligned with the USGS and their Water Use and Research Guidelines.

The NDNR Project will ensure that appropriate metadata are developed along with the water use data in order to document the source(s) of the water use data. Also, a thorough quality assurance/quality control (QA/QC) process will be developed and implemented.

5. Project Implementation Plan

The NDNR Project will identify programs and processes to collect, store, publish, and exchange existing and additional data for the eight water use categories identified above. As documented in Section 2, a variety of existing data and ongoing data collection processes are already in place in Nebraska. In order to be sure that these are well understood, and to identify any other needs of Nebraska's data users, the project will begin with a series of data user workshops. From these, a determination will be made with regard to the structure of the various data types that will be brought into the final database.

Figure 6 is a conceptual design of the process envisioned for the collection/estimation of the water use data for the eight water use categories and storing the water use data in a centralized database. The process will allow for voluntary (or mandatory, when required) water use reporting or reporting for other water use proxies. It will also contain a process to identify gaps in reported data. These data gaps will be filled through other estimation methods that will utilize other water use proxies (such as population data) to estimate water use. While the data that is accumulated for each water use category may come from a blend of directly reported and indirectly estimated sources associated with varying levels of uncertainty, the process will create and link appropriate

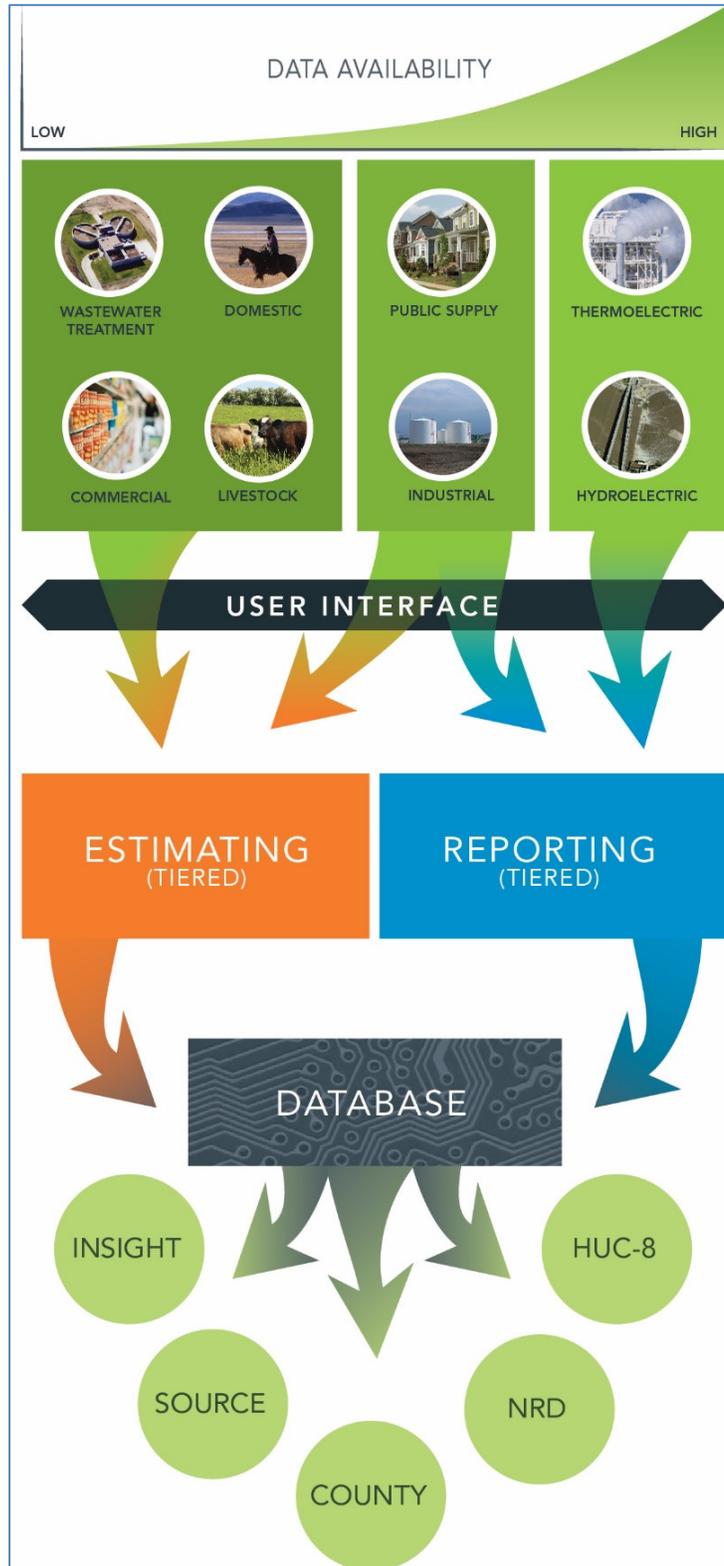


Figure 6. Conceptual design for the NDNR Project.

metadata so these uncertainties are clear and transparent to any data users.

The data that is stored within the central database will be available to data users through a reporting process that will provide data summaries by county, HUC-8 subbasin, INSIGHT subbasin, NRD, and water source. In order to facilitate data flow into and out of the database, the project will develop a front-end interface and a water use summary reporting feature. These features will be designed with input from data users and in close coordination with staff from the USGS Nebraska Water Science Center.

The NDNR Project will make the resulting data available in multiple summarized formats, including county level and HUC-8 level.

Project implementation will include user outreach through the development of outreach materials. Additional user workshops will also be held to ensure that the project is adopted by a wide range of water users and water data users.

6. Schedule

The NDNR Project will be initiated in July of 2016 (beginning of Fiscal Year [FY] 2017) and will last for three years. Figure 7 contains a detailed schedule identifying tasks and subtasks. The NDNR will plan to meet quarterly with the water use specialist at the USGS Nebraska Water Science Center. The initial task will be user outreach, which will be facilitated through outreach materials, surveys, and user workshops. Following this, the NDNR Project will develop the data compilation processes, which will take the remainder of the first year and all of the second year. Year three will be used to build the front end and reporting features for the water use database and to initiate implementation of the process. Implementation will be facilitated by a series of user workshops across the state. The final task that will be completed near the end of year three will be the development of metadata and QA/QC processes.

The NDNR Project will be a three-year project and will include coordination with the USGS on a quarterly basis and with the data users at the beginning and end of the project for project kickoff and to facilitate final project implementation,

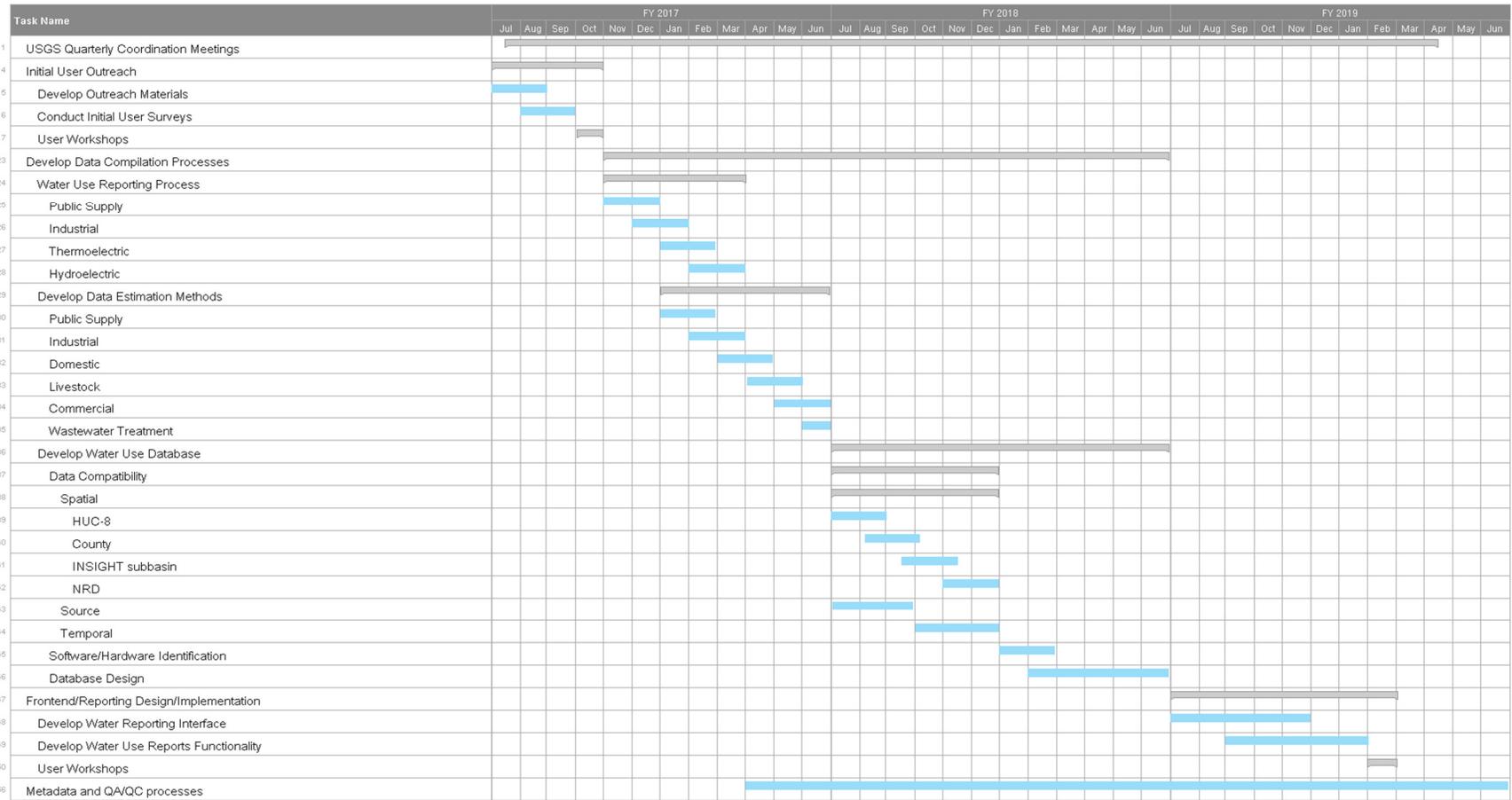


Figure 7. Detailed schedule for the NDNR Project with tasks and subtasks.

7. Funding

The overall budget for the NDNR Project is spread out equally over a three-year timeframe in increments. While the project could be completed in less time, it is spread out over three years to satisfy the understanding that the USGS would prefer to fund projects with this type of schedule and annual funding requirement.

8. References

Maupin, M.A., Kenny, J.F., Hutson, S.S., Lovelace, J.K., Barber, N.L., and Linsey, K.S. 2014. Estimated use of water in the United States in 2010: U.S. Geological Survey Circular 1405, 56 p. <http://dx.doi.org/10.3133/cir1405>.

Nebraska Department of Natural Resources (NDNR) 2015. INSIGHT: an Integrated Network of Scientific Data and GeoHydrologic Tools. <http://data.dnr.ne.gov/insight/index.html>.