

HUC –12 Project (Option 2)

Developed by the
Upper Republican NRD, Ted Tietjen, UNL and other Interested Parties
Ted Tietjen Coordinator

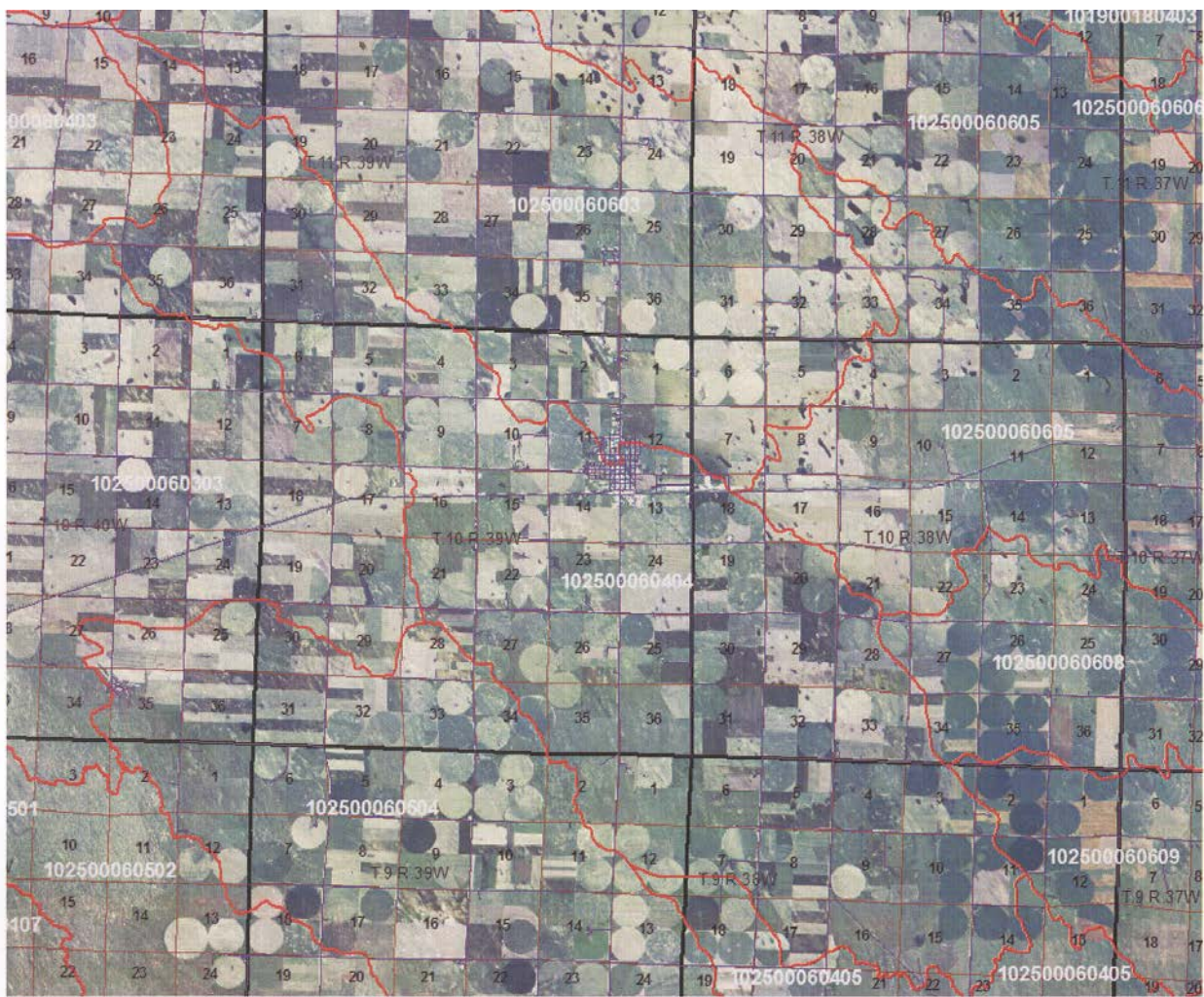
June 1, 2018

Exhibit A: Scope of Work

Hydrologic Unit Code 12, #102500060403, part of the stinking water sub-basin in the Republican River basin in Perkins County, Nebraska.

I am pleased to submit the following scope of work to the Upper Republican Natural Resource District (URNRD) and the Republican River Stakeholders for consideration.

The following sections describe our understanding of the HUC-12 Project and time table.



HUC-12 # 102500060403

Project Understanding

The project scope of work is to accurately measure Evapotranspiration (ET_m) in the confines of the HUC-12 watershed. Then make the information available for better water use management in larger sub-basins of the Republican River Basin. The goal is to better manage water use and to reduce underground water withdrawal without negatively affecting the basin economy.

Since the water supply is at the same time both finite and renewable, aquifer life management must assess and incorporate both concepts. The finite aspect of the system suggested that there is only a given amount of precipitation and of water in the aquifer that can be safely and effectively developed under current conditions.

The renewable component is defined by the fact that the area, watershed/basin, receives new water every year as precipitation. As there is little that can currently be done to impact the amount of annual precipitation, this component remains a constant. Unfortunately, about 90% of this water is already being consumed by current land use practices. Much of it is occurring with little planning or consideration. Of this current consumption, it is likely that about 30% directly evaporates with little or no benefit to area water needs. The remaining 10% produces flow from the basin and recharge to groundwater storage.

Changing how precipitation interacts and is consumed at the initial contact with the land surface is the earliest point at which water management can occur and represents the greatest potential amount for change. Understanding if, how and how much change can practically be accomplished to improve water utilization potential is an area that has not historically been well quantified or considered.

From work done at UNL, simply changing all irrigated acres to no till is one potential practice that could significantly increase water availability to the area through reduced evaporation and runoff prevention. The exact amount of potential and the ability to create and utilize this potential is not currently well understood. Some of the potential of these practices is also currently in effect, so the remaining potential to increase water availability is somewhat less but still important and needs to be quantified. Better quantifying this and other management opportunities at a watershed scale could be an important goal in better understanding the long-term sustainability of the region.

Beyond not having water, water supply variability is one of the next most limiting factors to effective water development. Water storage and the ability to withdraw this stored water when needed is the classic way to mitigate climatic variability. How to come up with and quantify adequate water to prevent long term ground water depletions has been an ongoing challenge.

To optimize the available water supply, the consumption components of the renewable water supply can and should be managed as effectively and efficiently as possible. The practical how, what and how much opportunities of this watershed management concept that might exist are intended to be developed through this effort.

Project Scope

The project scope of work is to determine how, how much or even if the above understanding can be utilized for basin water management. To accomplish this will require the ability to accurately and reliably measure and monitor precipitation and evapotranspiration (ET_m) across the confines of the HUC-12 watershed. Then make the information available in a practical way that is effective for producers and supports more sustainable watershed management in a select sub-basin or sub-basins of the Republican River Basin.

The project outcome is to better understand, quantify and document the available water supply and consumption to see if a reduction in long-term groundwater depletion can be reliably accomplished without negatively affecting the basin's economic future.

Project Objectives

The specific objectives of HUC-12 Project are listed below:

- Install four LI-Cor Eddy Covariance ET Stations to measure ET_m starting in 2019. UNL Water for Food Institute and LI-Cor will provide the technical expertise to analyze the data and make available the results to the URNRD and RR Stakeholders.
 - Year one measure the actual ET_m of irrigated corn and Soybeans
 - Year two measure the actual ET_m of irrigated wheat and residue managed fallow
 - Year three measure the actual ET_m of pasture of CRP.
- Encourage growers to install of weather stations and ET gauges that measure ET^o to support the accuracy of the LI-Cor ET stations data.
 - Have available a minimum of 20 weather stations along with the telemetry for real time access through a website or cell phone. The stations would read daily ET^o and rainfall. Be able to read hourly temperature, humidity, ground temperature, wind speed, solar radiation and dew point.
- Encourage ET Gauge installations at each irrigated field and read weekly under the supervision of the Perkins County extension staff.
- Encourage the installation of telemetry to measure in real time flow meter readings to be supported by the URNRD staff.
- Coordinate with NRCS to measure percent residue in the requested fields.
- Coordinate with Midwest electric and other vendors to provide energy use in real time if available and encourage efficiency testing of irrigation wells
- Have Air Scout fly the HUC-12 eight to ten times during the growing season and provide the ET^o available on a website within 24 hrs. After the over flight.
- Water quality component (In Process)
- Make available the ET and rainfall data in an easy to gather and use format on the URNRD website.

UNL extension may be able to help with this phase

 - Forecast the estimated ET usage for the next seven days.
 - Provide educational updates at special events.

- Monitoring urban and wild life components
 - Randomly select wells for water testing.
 - Have NRCS participate in bio-assessment sampling of selected playas for micro-invertebrates.
 - Soil sample certain fields for nitrate levels from the surface to a depth of 10 ft. Analyze in one foot increments. This sampling is to be done three times during the growing season, at planting, tasseling and after harvest.
 - Work with the Grant Utilities Manager to review the city's storm water management
- Learning how growers make water management decisions.
 - What additional tools if any should be made available?
 - How relevant is the historical information in the decision making process?
 - How do the decisions affect risk exposure?
 - Do the decisions include meeting family goals?

HUC-12 History

The HUC-12 (#102500060403) is located in the Upper Republican NRD in Perkins County, NE. The HUC-12 comprising 33 459 Acres is part of the Stinking Water sub-basin. What is unique about this watershed is that it is an enclosed watershed. That means no water comes in from an outside source nor does any of it leave the watershed. The only source of water is from precipitation and the underground aquifer. This eliminates many variables, when trying to measure actual supply and consumption and to better understand Evapotranspiration (ET), such as dams, streams, flood plains, riparian areas or surface water.

One of the challenges is that the underground aquifer does not follow the watershed. Since the water movement in the underground aquifer moves very slowly it will have only a small impact as the movement both in an out will be about the same. The URNRD and Department of Natural Resources (DNR) also have access to several ground water models that simulate and estimate this water movement.

Cropping practices have changed from the late 1880's when the surface area was covered with native grass. This all changed when homesteaders broke the sod and planted wheat, corn and other crops to feed their livestock and produce revenue in support of their families. Pumping water from the underground aquifer started in the late 1950's to increase crop yields and to increase income to the farm families. In 2017 there were 10,027 acres under irrigation, 15,475 acres under rain fed farming and 7,957 acres in pasture, CRP, buildings shelter belts and roads for a total of 33,459 acres in the watershed.

Project Management

The HUC-12 Project would be managed jointly by multiple partners including the URNRD. Additional support would come from the following:

- UNL/Water For Food would provide the technical assistants for collecting and analyzing the data from the LI-COR weather stations.

- Residue measurements would be under the direction of NRCS.
- ET gauge installations and record keeping would be managed by the Perkins County Extension office.
- Collecting and reporting weather station data will be under the direction of various partners including the URNRD.
- Air Scout would collect digital and thermal imagery data , which is made available on their website.
- Website postings and management including education and promotions at special events will be under the direction of WCR&E. (Subject to farther discussion)
- The collection of information about decision making in farming operation will be under the direction of Ted Tietjen. Data and information will be evaluated by a group of designated representatives.
- Grant Utilities Manager collect information and data needed to better storm water management.
- The Grant Utilities manager will also collect water quality data on municipal water supplies and changes in the water table levels.

Time Table

2018 will be used to prepare and test the project for full implementation in 2019.

Install and start recording data on the LI-COR weather station

- Install and prepare complete weather stations for reporting weather data including ET° and precipitation. Then make the information available on the URNRD, NWBA/Aqua/Mart and UNL.
- Have NRCS perform some Residue measurements and get prepared for 2019 and beyond/ (limited)
- Have the Perkins County Extension office install some ET gauges and collect the data.
- Start collecting information on how and why growers make management decisions.

2019 will be the first year the project in in full operation.

- Plan on having four LI-COR weather stations in operation UNL/Water For Food collecting and analyzing the data.
- All weather stations functioning and reporting.
- All residue measurement plans in place. (subject to further discussion)
- Eight to 10 fly over flights by Air Scout during the growing season.
- ET gauges read weekly during the growing season.
- Make available to growers daily ET data and then a forecast of ET up to seven days in advance.

2020 and 2021 repeat

- Continued project activities and review.

2022

- Complete project and prepare report

Budget proposal for 2018 through 2022

2018

- One portable LI-COR weather station \$9000 (9 months)
 - 10-Air Scout Fly overs $\$.07/A \times 10 = .70/A \times 33,459A = \$23,421$ Total
 - Weather station incentives \$20,000
 - ET Gauges \$4,000
 - Technical support and assessment \$10,000
 - Miscellaneous out of pocket expenses and labor up to \$10,000
- Total \$76,421.

2019

- Four complete LI-COR weather stations \$55,000 each = \$220,000
 - 10-Air Scout Fly overs \$23,421
 - Weather station incentives \$2,000
 - technical support and assessment \$30,000
 - Miscellaneous out of pocket expenses and labor up to \$10,000.
- Total \$285,421.

2020

- 10- Air Scout Fly over \$23,421?
 - Weather station incentives \$2,000
 - Miscellaneous technical support and assessment \$30,000
 - Miscellaneous out of pocket expenses and labor up to \$10,000
- Total \$65,421.

2021

- 10- Air Scout Fly over \$23,421,
 - Weather station incentives \$2,000
 - Technical support and assessment \$10,000
 - Miscellaneous out of pocket expenses and labor up to \$10,000?
- Total \$65,421.

2022

- Complete report \$4000

Potential Funding and Support Entities

- US Bureau of Reclamation (Water Smart)
- NE Water Sustainable Fund
- NE Environmental Trust
- NWEBA???
- NDEQ
- Charitable Institutions.
- NRD, NRCS, UNL, Water for Food, UNL Extension, NEWBA/AquaMart (In kind).

Follow Up and Reviews

Each Nov a review in conducted with adjustments made for the next year.

- Yearly report on the project to be available for distribution by Jan of the next year.

Final Report

- Due by Jan 2022 for presentation to the boards and public along with recommendations.

This is an important proposal and I'm asking for support from the Republican River Stakeholders to move forward. It is still a work in process and will require MOU's, contracts and agreements with the interested parties. Future funding will require the development, submittal and approval of various potential grant applications