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Seminole Integrated Wind-Water Demonstration System

Progress Report for November 2009

Submitted to

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1.0 INTRODUCTION AND OVERVIEW

1.1 Scope and Content This progress report is submitted jointly to the Texas Department of Rural Affairs (TDRA) and to the Texas Water Development Board (TWDB). TDRA formerly was called the Office of Rural and Community Affairs (ORCA). The report is submitted as part of TDRA contract number 728082 and TWDB contract number 0804830832. In addition to project funding from the TDRA and the TWDB, major participants include the City of Seminole, Entegrity Wind Systems, Texas Tech University and the US Department of Energy through Texas Tech University. The project was initiated in April 2009 and is expected to run for two years.

1.2 Project Description This project addresses the continuing depletion of the Ogallala aquifer, the current principal source of potable groundwater for much of west Texas and northward through Kansas. The approach is to access, lift and purify brackish, much deeper water-bearing formations in the Santa Rosa of the Dockum group. On the basis of preliminary evidence, these formations are believed to occur in Gaines County at depths ranging from 1500 to 2000 ft.

The purification will be accomplished using reverse osmosis (RO). The electrical energy required for the well lift pumps and those of the RO system will be supplied principally by a grid-connected 50 kW wind turbine. The purified water is to be utilized as part of the municipal water supply of Seminole, Texas, a community with a population of about 7,000. Seminole is located in Gaines County in the southern panhandle of west Texas bordering New Mexico. The results are expected to be applicable to many other arid and semi-arid regions as well.

The project encompasses the following broad tasks:

1) The siting, permitting, drilling and characterization of a well drilled into the Santa Rosa, including site acquisition, pre-drilling hydro-geological investigations, permitting, logging, well completion and test;
2) The design and construction of required infrastructure, including well completion, site preparation, foundations and civil works to support the wind turbine, RO system and other system elements;
3) Installation and commissioning of a 50 kW wind turbine provided by Entegrity Wind Systems, including the foundation, electrical infrastructure and liaison with the local utility;
4) The procurement, installation and commissioning of a commercial reverse osmosis system, including necessary permits, civil structures, electrical work and piping;

5) The design, permitting and construction of an evaporation pond or other means for dealing with the concentrate from the RO system;
6) Operation and characterization of the integrated wind-water purification system for a period of 12 months;
7) Documentation and reporting of project results and performance.

1.3 Summary of Previous Activities A site visit and project initiation meeting was held in Seminole on 27 April Monday. Attending were Travis Brown and Julie Hartley of TDRA; Sanjeev Kalaswad of the TWDB; Mayor Wayne Mixon and City Administrator Tommy Phillips of Seminole; Kay Howard of Howco and Jamie Chapman of Texas Tech University. Reviewed were the procurement rules and procedures, schedule and other contract details. A proposed project organizational structure was presented and approved.

Subsequent to this meeting, procurement guidelines for design and engineering services and for construction activities were discussed and reviewed extensively with procurement officials from the TDRA. It was agreed that *design and engineering services* provided by outside vendors would be procured by TTU on behalf of Seminole, invoiced by the vendors to TTU and that TTU would in turn invoice Seminole. Design, engineering and management services provided by TTU faculty and staff also would be invoiced to Seminole.

It was agreed that *construction services* would be procured directly by Seminole with support from TTU.

Two hydro-geological investigations were conducted through Gaines County, in which Seminole is located. For each, well logs were procured and analyzed to assess the currently-available information about the Santa Rosa formation of the Dockum group. The wells and their associated logs traversed North to South and West to East across Gaines County. The depths of interest extended to about 2000 ft bgs. The investigations were conducted by Judy Reeves of Cirrus Associates[1] under contract to Texas Tech University. The analyses indicated that the Santa Rosa horizon appears to be situated at about 1440 to 1840 ft bgs. The analyses indicated the presence of several, separated, potential water-bearing sandstone layers within this range. There also may be a secondary sequence of potential water-bearing layers at 600 to 700 ft bgs.

In addition to the Cirrus activities, work was initiated with Parkhill, Smith and Cooper of Lubbock for the design and permitting of the production well together with a possible test hole. As part of this effort, contacts were made with drillers and pump manufacturers. This work is being accomplished under a purchase order issued to PS&C by Texas Tech University.

Discussions were held with geophysical well logging companies to gain information, tool-suite recommendations and costs for the logging of the well.

[1] Information about Cirrus may be found at the web site http://www.cirrusassociates.com .

2.0 SUMMARY OF ACTIVITIES THIS PERIOD

2.1 Overview Activities this period included the following: 1) under a purchase order issued to Parkhill, Smith and Cooper by Texas Tech, work continued on the investigation, design, permitting and expected cost of the Santa Rosa well; 2) Further discussions were held with and a purchase order issued by TTU to West Texas Consultants of Andrews, Texas. The initial scope included layout of the Santa Rosa well, the location of the facility components (wind turbine, RO building and other subsystems), the associated infrastructure and advice on well details and potential well-driller bidders.

2.2 Design and Permitting of the Santa Rosa Well Activity on the design, permitting and anticipated cost of the Santa Rosa well continued under a contract with PC&S. As described in the previous report, a production well and a separate, smaller-diameter test well were deemed not affordable under the current TWDB funding. Thus the production well will also serve as the test well as originally proposed. The focus during this reporting period was on determining the smallest drilled-hole size necessary to accommodate a pump having the capacity to lift the Santa Rosa water from 1800 ft bgs. Discussions were held with pump manufacturers and distributors in efforts to identify pump diameters and required casing inner diameters.

Production Well With regard to the production well, the issues addressed thus far include 1) the location within the 520 acre parcel to which Seminole has the water rights; 2) the expected cost of the well; 3) the expected cost of the geophysical logging and the techniques to be utilized; 4) the anticipated time required for permitting together with the time required under TDRA rules for the advertising of the request for proposals (RFPs), receipt of bids and evaluation of bids; and 5) the expected lead time for the onset of drilling after a bid review and award is made.

Earlier information indicated that the required drilled-hole well diameter would need to be 20 in so as to accommodate a pump diameter of 16 in. These dimensions were driven by the 1800 to 2000 ft depth from which water is to be lifted and the pump clearance within the well casing. Further investigations and discussions were held with pump manufacturers. Based on these investigations, a well casing having a 12-3/4 in ID is believed adequate to accommodate a pump having the capacity to lift 30 to 40 gpm from 2000 ft. This implies a drilled-hole well diameter of 16 in. Compared to a 20 in drilled hole, these findings imply reduced costs for the completed well.

The schedule for the well design and the associated documentation to be submitted to the TCEQ for review and permitting is as follows:

8 December – Interim review of the well design;
15 December – Final review of the well design;
18 December – Submission to the TCEQ.

With the well design documentation submitted, work will begin on the bid package for the drilling of the well. The package will include copies of the Cirrus analyses, the well design as submitted to the TCEQ and other relevant information. Pursuant to TDRA procurement

guidance, the availability of the package will be advertised. In addition, a bidder's informational meeting is planned to be held following placement of the advertisement.

Well Location Seminole is in the process of acquiring title to about five acres within the 520 acre water rights parcel. An existing Ogallala well formerly used for center-pivot irrigation is situated with the 520 acres. It may be desired to be able to use this well for future municipal supply. However there is a TCEQ requirement that any other wells be situated more than 300 ft from an existing well. An additional factor is the placement of the evaporation pond. These factors will affect the shape of the five acre parcel and may require the purchase by Seminole of additional acreage. To address these and other issues, a purchase order was issued to West Texas Consultants by Texas Tech.

Other Information Sources In addition to expertise from TTU, PC&S, Cirrus/Reeves, the geophysical logging companies and drillers, it has been suggested that the City of Hereford, Texas has extensive experience with Santa Rosa wells, although at depths of about 1000 ft. Visits are planned.

We recently have learned also about a 2300 ft well near Flagstaff, New Mexico.

2.3 Entegrity Wind Turbine The wind turbine to be utilized as the principal electrical energy source is a 50 kW unit to be supplied by Entegrity Wind Systems, with offices in Boulder, Colorado. The availability and use of this wind turbine for a period of two years has been committed by Entegrity to Texas Tech University for use as a research wind turbine initially intended for installation at the University's Reese Test Center. With the emergence and possibility of the ORCA-TWDB Seminole wind-water project, the installation was delayed for possible use in this project.

With the ORCA and TWDB contracts in place, the documentation underlying this use is being drawn up between Entegrity and the University. The documentation will be in the form of a lease for a period of two years for a nominal payment. Schedule and maintenance support are being negotiated. It has always been agreed that the project would pay for the wind turbine foundation, installation and electrical infrastructure.