

Seminole Integrated Wind-Water Demonstration System

Progress Report for October 2012

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, Texas Tech University and the US Department of Energy through Texas Tech University. The project was initiated in April 2009, and the completion date is currently set at March 2013.

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 were believed to occur in Gaines County at depths ranging from 1500 to 2000 ft. There may also be water-bearing strata between 600 and 800 ft. Our drilling and geophysical investigation found potentially productive zones at 540-650 ft, 890-920 ft, and 1610-1770 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 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 wind turbine 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, and
- 7) Documentation and reporting of project results and performance.

2.0 SUMMARY OF ACTIVITIES THIS PERIOD

2.1 Overview Collaboration between the City of Seminole, WRC and WiSE researchers, and engineering/management consultants continued. Most construction activities were completed, and startup of the RO system occurred in early October.

2.2 Site Construction West Texas Consultants (WTC) reported Tejas Partners' construction work as completed. The building that houses the RO system now has lights and grid-based electricity. On-site plumbing and the lift station for the water leaving the building are complete, and grid-based power is also available for the well.

2.3 Wind Turbine and Site Preparation The installation of the tower, nacelle, and blades was completed on March 13. The final electrical connections at the wind turbine and the meter boxes with Xcel Energy are all that remain to be done. WTC requested assistance from WRC and WiSE faculty to make sure the details of those connections are properly negotiated with Xcel. A meeting with representatives of WTC, Xcel, WRC, WiSE, and Real-Time Automation was scheduled at the site for October 2, but the Xcel representative had to postpone until November 2. WTC prepared the documents required for the metering connection.

2.4 RO System The RO system was moved to the RO building in May. Startup of the RO system with Keith Summerford of Crane Environmental and PSC took place on October 2 through 5. The RO system currently operates with grid-based power. According to Summerford, the RO system operates properly and drops the TDS in the water from over 2000 ppm to less than 100 ppm easily. Lance Lovelady and several other City of Seminole water staff members were trained on the operation of the RO system, and they are running the well and RO system for 30 minutes to 1 hour most days to prevent deterioration of the membranes and other parts of the system. PSC and the WRC are working with the City to identify sources of affordable replacement filters and purchase of items for ongoing operation and maintenance.

2.5 Santa Rosa Well As noted last month, the recent static water level in the well has remained at approximately 96 ft below ground surface, much higher than the 750 ft below ground surface shortly after the initial well construction and pump test. Under the current conditions, the pump set at 900 ft below ground surface is subject to much higher intake pressures than the initial conditions, so the discharge from the pump is a much higher pressure than the design conditions for the variable speed booster pump between the well pump and the RO system. To allow controllable flow and pressure during the system start-up period and the short-term operations since, part of the flow is bypassed to the land surface. The WRC and PSC are proposing a variable frequency drive addition to the well pump controls to allow pressure control at that position, which should allow properly pressurized flows with the currently high static water level as well as lower static water levels if the well behavior tends back to the deeper static water level seen initially. That design selection should be completed in November, and will also likely include a sand separator for suspended solids removal upstream of the RO system. Figures 1 and 2 show the changes in depth to water and TDS vs. time from 9:00 a.m. October 2 through 9:00 a.m. November 2. It is interesting that the TDS levels vary in response to changes in depth to water caused by the short-term pumping periods. We will evaluate these data over time, and the observations indicate likely mixing of different water qualities from the different producing zones in the well.

2.6 Local Outreach The kickoff workshop and media event is still being planned to explain the different aspects of the project for the local public and other interested parties. The workshop had been tentatively planned for late August, but is now postponed until all systems are operational. The WRC and WiSE staff will be contacting all contributing organizations for their interest and availability as the final date is confirmed.

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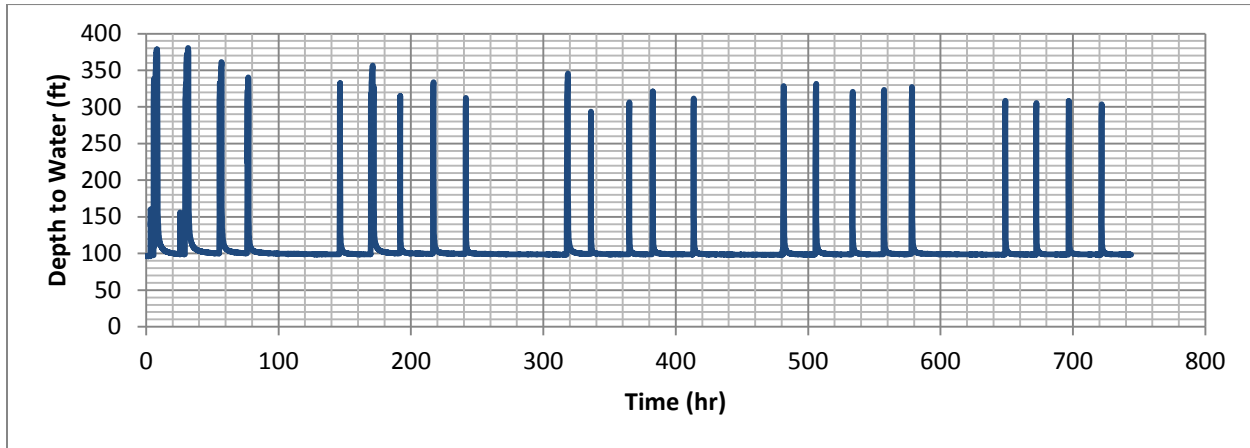


Figure 1. Depth to water in the Santa Rosa Well from 9:00 a.m. October 2, 2012

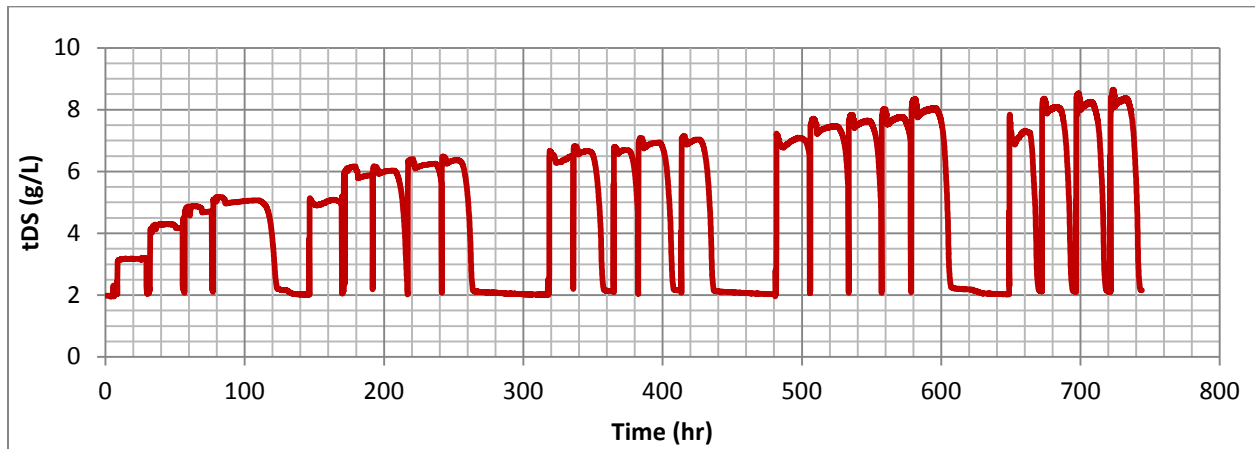


Figure 2. TDS in the Santa Rosa Well from 9:00 a.m. October 2, 2012