

# **Seminole Integrated Wind-Water Demonstration System**

## **Progress Report for August 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, and construction at the site continued.

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Construction activities were completed, with startup now tentatively planned for September. Some photos of the site taken on August 1 are included in this report.

**2.2 Site Construction** West Texas Consultants (WTC) reported Tejas Partners' construction work 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 were completed, with input from Crane Environmental representative Jim Almond on the RO system effluent plumbing connections. 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. Completion should happen in September.

**2.4 RO System** The RO system was moved to the RO building in May. Startup of the RO system with representatives from Crane Environmental and PSC is currently scheduled for September 24. PSC will work with the City and WRC to get Texas Commission for Environmental Quality (TCEQ) approval for the 90-day demonstration after the water sample results were determined from the Santa Rosa well. It should be noted that it is possible to operate the system prior to the TCEQ demonstration period as long as the water is not used for potable purposes. The RO system also can operate with grid-based power.

**2.5 Santa Rosa Well** Texas On August 1, Gil Gillespie of West Texas Water Well Service (WTWWS), from Midland, Texas, met WRC and PSC representatives at the site for collection of a water sample for laboratory analyses. Prior to starting the pump, the downhole pressure transducer/conductivity sensor/temperature sensor with datalogger indicated that the depth to water was only 96 ft, much closer than the 743 ft noted soon after the well was constructed. The pump was run for one hour, during which the water level in the well dropped to about 400 ft below ground surface. After the sample was collected, the pump was turned off, and the depth to water decreased to 116 ft within one hour. Ken Rainwater returned to the site the next day to program the datalogger to collect data at one-hour intervals, and the depth to water had returned to 96 ft. PSC received the water analyses from TraceAnalysis in Lubbock, and the results are shown in Table 1. The water is likely a mixture of waters from the three perforated zones in the well. The TDS level of 2330 mg/L should be easily handled by the RO system.

**2.6 Local Outreach** Thanks to the Llano Estacado Underground Water Conservation District and the WRC and WiSE staff, we continue to collecting photos of the construction of the wind turbine and site improvements. The photos will be used in a kickoff workshop and website media we are developing 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 late October after 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.

Table 1. Seminole Santa Rosa Well Water Quality

Parameter	Result	Units	Reporting Limit
Hydroxide Alkalinity	<1.00	mg/L as CaCO <sub>3</sub>	1
Carbonate Alkalinity	32	mg/L as CaCO <sub>3</sub>	1
Bicarbonate Alkalinity	345	mg/L as CaCO <sub>3</sub>	4
Total Alkalinity	377	mg/L as CaCO <sub>3</sub>	4
Dissolved Calcium	7.85	mg/L	1
Dissolved Potassium	19.5	mg/L	1
Dissolved Magnesium	8.31	mg/L	1
Dissolved Sodium	829	mg/L	1
Specific Conductance	3420	µmhos/cm	
Total Iron	1.01	mg/L	0.01
Fluoride	<2.50	mg/L	0.5
Chloride	424	mg/L	2.5
Sulfate	747	mg/L	2.5
Nitrite-N	<0.200	mg/L	0.04
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pH	8.8	s.u.	2
Phosphate-P	<12.5	mg/L	2.5
Total Strontium	0.679	mg/L	0.005
Total Dissolved Solids	2330	mg/L	10
Total Silver	<0.00500	mg/L	0.005
Total Arsenic	<0.0100	mg/L	0.01
Total Barium	<0.0100	mg/L	0.01
Total Cadmium	<0.0100	mg/L	0.01
Total Chromium	<0.0100	mg/L	0.01
Total Mercury	<0.000200	mg/L	0.0002
Total Lead	<0.0100	mg/L	0.01
Total Selenium	<0.0200	mg/L	0.02
Total Suspended Solids	17.5	mg/L	1



Figure 1. Santa Rosa Well during purge before sample collection, August 1, 2012



Figure 2. Daniel Albus (PSC), Leonard Nail (PSC), Gil Gillespie (WTWWS), Ken Rainwater (WRC), Lori Barnes (LEUWCD), Charles George (LEUWCD)