

Seminole Integrated Wind-Water Demonstration System

Progress Report for January - March 2010

Submitted to

Texas Department of Rural Affairs
Att: Travis Brown
Tel 512-936-7878
PO Box 13231
Austin, TX 78711
Contract No 728082

Texas Water Development Board
Att: Sanjeev Kalaswad
Tel 512-936-0838
PO Box 13231
Austin, TX 78711-3231
Contract No 0804830832

Submitted by

City of Seminole
Att: Tommy Phillips, City Administrator
Tel 432-758-3676
302 South Main Street
Seminole, Texas 79360

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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 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. There may also be water bearing strata between 600 and 800 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;

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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 Associates¹ 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. A contract has been let to West Texas Consultants (WTC) for the design and layout of the infrastructure and civil works for the Seminole site. The WTC work includes site layout with attention to required spacing of the Santa Rosa well and the evaporation ponds relative to the existing Ogallala irrigation well, the building housing the RO and other equipment, wind turbine siting and the 480 V, three-phase electrical infrastructure.

Discussions were held with geophysical well logging companies to gain information, tool-suite recommendations and costs for the logging of the well. A contract is in the process of being let to West Texas Consultants for design and layout of the infrastructure and civil works for the Seminole site.

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

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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) under a purchase order issued by TTU to West Texas Consultants of Andrews, Texas work was initiated on the 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. Visits were made to prospective well drillers. An initial preliminary version of the well design and a well driller bid package was completed and provided to Seminole, TWDB and TDRA for review. The bid package also was provided to the TCEQ with subsequent approval and issuance of a permit based on the design incorporated. This design may change based on comments from the well drillers visited. The wind turbine is a problem.

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 between Texas Tech and 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 completing the well design and the associated specification and bid package. Here are the activities that took place during this period together with the projected schedule for the near future.

Review of the Well Design and Bid Document As prepared by PS&C in conjunction with Texas Tech, the subject document dated 11 December 2009 was submitted to the following parties for review and comment: City of Seminole, Kay Howard of Howco acting as contract administrator for Seminole, Sanjeev Kalaswad of the TWDB and Travis Brown of the TDRA. No comments have been received.

Submission of the Well Design and Bid Document to TCEQ The subject document dated 11 December was submitted to the Texas Commission on Environmental Quality (TCEQ) during the week of 8 February. The expected completion date for completion of the TCEQ review was during the week of 5 April 2010. However, approval and a permit were received on 15 March. This approval is based on the design included in the 11 December document. On the basis of recent visits to prospective well drillers (see below), the design may change. This may require resubmission to the TCEQ or at least a visit to explain any substantive differences.

Further Review and Configuration Coordination The well design and bid document was further reviewed in meetings with PC&S with minor revisions. The current version is dated 26 January 2010. Attention was paid principally to details of the well and the boundary between what would be included as part of the well procurement vs the balance of the system (i.e., the wind turbine, RO system, building and other infrastructure). An example is the perimeter fence required around water supply source. Another has to do with the interconnection point between the lifted well water and the balance of the system. Further small details remain to be clarified prior to issuance of the final bid document for the well procurement. This will be accomplished

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in a coordination and configuration meeting among PC&S, WTC and Texas Tech. This meeting is expected to be completed by 9 April.

Review with City of Seminole, TWDB and TDRA Following the configuration coordination meeting discussed above, review meetings are planned to be held with the City of Seminole, the TDRA and the TWDB.

Well Driller Visits and Revisions to the Bid Document In the interests of securing comments from a sampling of prospective well drillers, PC&S was requested to meet in person and review the 26 January bid document with drillers. The drillers visited during the second half of March included LT Drilling of Sun Ray, Hi Plains Drilling of Abernathy and West Texas Water Well Services of Odessa. Each provided valuable suggestions and insights that may reduce risk. Each had differing approaches to the well design. The differing approaches reflected concerns about drilling risk and possible tool loss associated with the expected clays. The findings from the visits will guide revisions to the current bid document. Each offered to provide a budgetary cost estimate.

Site Layout and Infrastructure Design Preliminary overall site layout and building/piping documents were prepared by WTC, along with associated cost estimates for the engineering design of the site and equipment costs. As detailed in the first of these two drawings, the site will occupy about 14 acres. This area includes two 1-acre evaporation ponds. After a review by Texas Tech, these documents have been revised with some changes and added detail. The revised layout drawings bearing the date 26 March will be transmitted with this report. The files in pdf format are named *47940-Site Layout-Overall Site Plan-WTC-26Mar10.pdf* and *47940-Site Layout-Site Plan-WTC-26Mar10.pdf*. A separate estimate provided by PC&S indicates a larger required area. The bases for these estimates will be compared and the estimates reconciled.

Possibility of Zero-Liquid Discharge As a result of their work with the City of Andrews, WTC has brought to our attention an American corporation based in Canada, Saltworks Technologies, Inc. Their technology is described as being ideal for integration with an RO system for reducing the concentrate volume. The system operates at pressures less than 10 psi thus minimizing energy costs. A major potential advantage is a significantly reduced requirement for land area. A potential disadvantage is the system cost. We have requested a pro forma proposal for our system, based on 40 gpm of feed water and 10 gpm of concentrate. Their web site address is <http://www.saltworkstech.com/>.

Environmental Review The environmental review required under the TDRA contract was initiated by Howco in early February and is ongoing. Needed supporting information is being provided by Texas Tech and others. This has included site layout information (discussed above) and ground level heights of the site relative to the Gaines County airport. The ground level heights are substantially the same, as summarized in Table 1.

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Table 1. Altitude and coordinate measurements made 17 March 2010 near the Seminole brackish well site and the highest point of the Gaines County airport runways.				
Location	North Coordinates	West Coordinates	Altitude (ft)	Uncertainty (ft)
Brackish Well Site (1)	N32deg 41.0727 min	W102 deg 39.9643 min	3321	+/- 9
Gaines County Airport (2)	N32deg 41.7119 min	W102 deg 39.8710 min	3320	+/- 9
Notes:			Well-AirportAltMeas-JC-17Mar10.xlsx	
1. Measurements were made by placing the GPS unit on the ground about 3 ft SE of the existing engine-driven Ogallala irrigation well.				
2. Measurements were made by placing the GPS unit on the center of the runway surface at the west end of the east-west runway adjacent to the "A" marker.				
3. The measurements were made with a DeLorme PN-40 GPS unit, after stabilizing for 15 minutes. In both measurements, eight or nine satellites were in view.				

Turbine Height Concerns Expressed on Behalf of Gaines County Airport The altitude measurements given in Table 1 were facilitated by Mr. Lex Hinds, operator of Aero Clinic, Inc. at the Gaines County Airport (tel 432-758-6455, cell 432-788-7455 and e-mail aeroclinic@crosswind.net). Mr. Hinds facilitated the measurements by allowing Mr. Chapman of Texas Tech access to the active E-W runway for the measurements. During this process, Mr. Hinds expressed concerns about the current location and height of the turbine in that it might affect approaches to the airport. Chapman explained that the turbine would be less than 200 ft in height (highest point of the rotating blades) and stated that we would be grateful for any information he might have that addresses height restrictions. Chapman provided him with his cell number and e-mail address. Mr. Hinds subsequently emailed Chapman documents that he interpreted as requiring that the turbine be as much as 16,000 ft distant from the airport. These documents were forwarded to Howco and the City on 26 March. They were provided also to PC&S who have some experience in this area.

Tentative Schedule for the Well Procurement and Completion Pursuant to TDRA project rules, procurement of the drilling, characterization and completion of the well will formally be handled by the City of Seminole with support from PS&C, WTC, Cirrus Associates and Texas Tech. The planned schedule and completion dates are outlined below. Pending resolution of TCEQ approval, driller availability and a number of other factors, these dates must be considered preliminary and probably optimistic. No doubt there are other events missing. And we recognize that there are emerging issues that may result in delays.

Coordination and Configuration Review (WTC, PC&S, Texas Tech)	7 April Wednesday
Revision of the Bid Document	14 April Wednesday
Coordination/Resubmission to TCEQ	21 April Wednesday

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Placement of the Well Procurement Advertisement	28 April Wednesday
Date for Receipt of Bids from Well Drillers	14 May Friday
Bid Opening and Award	14 May Friday
Confirmation of Contract Details; Contract Signing	21 May Friday
Completion of the Howco Environmental Review	In Progress, TBD
Driller Mobilization/Onset of Drilling	26 July Monday
Completion of Drilling, Casing and Cementing	29 July Thursday
Completion of Well Logging and Field Analysis	4 August Wednesday
Completion of Test Pumping	9 August Monday
Installation, Hookup and Acceptance Test of Production Pump	13 August Friday
Acceptance and Sign-Off on Completed, Tested Well	18 August Wednesday

2.3 Site Layout and Balance of System Design Since the details of the site design and layout impact the well surface configuration, the current activity and near-term plans were discussed above.

2.4 Wind Turbine As has been conveyed previously, Entegri Wind Systems suffered severe financial problems and subsequently was placed into receivership. The assets of the Canadian corporation were auctioned. The principals of Entegri did not receive the assets. Nevertheless, Mr. James Heath, the principal behind Entegri plans to continue with the basic design under his continued control of intellectual property assets remaining from the original Vermont company, Atlantic Orient. Mr. Heath recently has offered to provide a 50 kW turbine for about \$250,000. He indicated also that a turbine might be available from an installation owned by the City of Camden, Maine.

In light of this disappointing development, Texas Tech with help from others is considering these possibilities and other available turbines. Other possibilities include a 50 kW turbine available from a Canadian company (apparently affiliated with Saltworks), the Northwind 100 kW turbine whose installed cost is estimated to be \$600,000 and a used Kenetech 56-100 turbine rated at 100 kW. From an energy perspective, a 100 kW machine is more desirable than a 50 kW turbine.

The major issue is how to put together funds in an amount ranging from \$250,000 to \$600,000.

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2.5 Computer Files Referenced and Transmitted The following files have been transmitted to participants and interested parties. They can be provided also to others having an interest.

Files transmitted by TTU to Seminole, Howco, TDRA, TWDB and PS&C:

A. Preliminary site layout drawings from WTC dated 26 March 2010:

47940-Site Layout-Overall Site Plan-WTC-26Mar10.pdf

47940-Site Layout-Site Plan-WTC-26Mar10.pdf

B. Files provided by Lex Hinds, operator of Aero Clinic, Inc.
relating to airport restrictions:

DOC031810.pdf windmill.pdf (Gaines County commissioners, Feb 1979)

7460-1.pdf (FAA form 7460-1, Notice of Proposed Construction or Alteration,
February 1999)

AC 70-7460-2K FAR77 explained.pdf (FAA Advisory Circular AC 70/7460-2K,
Construction or Alteration of Objects that May Affect the Navigable Airspace,
1 March 2000)

7460_how to file_off airport.doc (Note from Linda Steele, FAA Ft. Worth office:
*How to File the Paperwork for to Complete an Airspace Study for Construction
Near Your Airport - Projects NOT on Airport Property*, revised 12 March 2010)

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Distribution:

Sanjeev Kalaswad, TWDB
Travis Brown, TDRA
Tommy Phillips, City of Seminole
Kay Howard, Howco
Pam Groce, SECO
Judy Reeves, Cirrus
Ramon Carrasco, WTC
Zane Edwards, PS&C
Leonard Nail, PS&C
Ken Rainwater, TTU
Phil Nash, TTU
Andy Swift, TTU
Jamie Chapman, TTU

sanjeev.kalaswad@twdb.state.tx.us
Travis.Brown@tdra.state.tx.us
tphillips@mywdo.com
kay@howco.net
pam.groce@cpa.state.tx.us
jreeves@cirrusassociates.com
ramoncarrasco@westtexasconsultants.com
zedwards@TEAM-PSC.com
LNail@team-psc.com
ken.rainwater@ttu.edu
phil.nash@ttu.edu
andy.swift@ttu.edu
jamie.chapman@ttu.edu