

Seminole Integrated Wind-Water Demonstration System

Progress Report for May, June and July 2009

Submitted to

Office of Rural and Community Affairs	Texas Water Development Board
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Contract No 728082	Contract No 0804830832

Submitted by

City of Seminole
Att: Tommy Phillips, City Administrator
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4 August 2009

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1.0 INTRODUCTION AND OVERVIEW

1.1 Scope and Content This progress report is submitted jointly to the Office of Rural and Community Affairs (ORCA) and to the Texas Water Development Board. The report is submitted as part of ORCA contract number 728082 and TWDB contract number 0804830832. In addition to project funding from ORCA and the TWDB, major participants include the City of Seminole, Entegri Wind Systems and 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, 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 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 Entegri 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;

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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 ORCA; 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.

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2.0 SUMMARY OF ACTIVITIES THIS PERIOD

2.1 Procurement Guidelines and Division of Responsibilities In attempts to obtain clear guidelines regarding the rules for procurement and what entities should do the purchasing, a number of telephone conversations and emails were held following the site meeting. The participants were Kay Howard representing Seminole, Jamie Chapman of Texas Tech and Julie Hartley of ORCA. As background, it was agreed during the site visit that all procurements (using either ORCA or TWDB funds) would be accomplished following ORCA procurement regulations and guidance. The ORCA regulations are dictated by and are consistent with US HUD rules. The ORCA funds came from HUD.

It was agreed 1) that any and all procurements could come from Seminole, the holder of the ORCA and the TWDB contracts; 2) that it would be very desirable and was requested by ORCA that Texas Tech, acting on behalf of Seminole, directly procure *services* and then bill to Seminole; 3) that procurements of *construction* items, such as the drilling of the well and related project infrastructure, would be accomplished by Seminole with assistance as required from Texas Tech. The implementation of item 2) requires an agreement between Seminole and Texas Tech authorizing Texas Tech to procure such services on behalf of Seminole and invoice to Seminole for the cost of such services. While this agreement has not yet been executed, it has not impeded project activity.

Separately, a proposal from Texas Tech to Seminole for management services is to be implemented and funded under the ORCA contract.

2.2 Well Site The water rights for the Santa Rosa well site were purchased by the Seminole in support of this project and other water planning programs of the city. The city secured the rights to 520 acres. This parcel is not the location of the city's current Ogallala well field. As shown in Fig. 1, the parcel is located in Gaines County about 2 miles south of the city between the north-south County Roads 301 and 303. The parcel is bounded to the south by the east-west County Road 306. As originally proposed, the well site was to be located at the southern end of the 520 acre parcel. The approximate coordinates of this originally-proposed site are (32° 40.952' N, 102° 39.973' W).

In addition to the water rights, ownership of several acres for the project infrastructure, wind turbine and the evaporation pond have been optioned and are being acquired.

Changed Well Location Land use considerations have indicated the desirability of changing the well site to a new location about 300 m to the north. The approximate coordinates of this relocated well site are (32° 41.0654' N, 102° 39.9647' W). This changed well location is approximately 700 ft to the north of the location shown in Fig. 1. In response to a query about the impact of this apparently minor relocation of the well site, Ms. Reeves of Cirrus Associates has indicated that this change should not materially affect the utility and applicability of her hydro-geological investigations.

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Fig. 1. Illustrating the positions of the originally-proposed Santa Rosa well location.

2.3 Hydro-Geological Investigations Previous conversations with knowledgeable well drillers have indicated a paucity of reliable hydro-geological information at the depths of interest for this project (up to 2000 ft). This perceived lack of information is viewed by drillers as requiring a risk premium in their pricing and quotes.

As part of the characterization of the Santa Rosa and in an effort to reduce risk by providing more reliable information about the geology at these relatively shallow depths (as viewed by drillers of oil and gas wells), two hydro-geological investigations have been conducted. The investigations utilized well logs and other information from a number of sites and sources. Both investigations traversed E-W across Gaines County, one slightly to the north of the well site and the second nearer the well site. The investigations have been conducted by Judy Reeves of

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Cirrus Associates¹ under contract to Texas Tech University. The first investigation was focused on the existing Ogallala well field. The second focused on the location of the Santa Rosa well. This second report from Cirrus, *Evaluation of the Proposed Well Location for a Municipal Water Supply Well in the Dockum Aquifer, Gaines County, Texas* dated 26 June will be submitted electronically at the same time as this report. The first has substantially the same information and will not be forwarded at this time.

Reproduced here are the conclusions and recommendations from the report. These appeared on pages 3 and 4.

Conclusions

The east-west cross section suggests that the target Santa Rosa horizon is 1540 to 1800 feet bgs. The north-south cross section suggests that the target Santa Rosa horizon is 1440 to 1840 feet bgs. Because the control wells on the east - west cross section are in closer proximity to the location of the proposed water supply well than the wells on the north-south cross section, it is more likely that the east west depths are more representative of the elevations of the Santa Rosa Formation in the vicinity of the proposed well. The actual zone can be determined during placement of a test well.

The logs indicate that the target Santa Rosa horizon is not homogeneous, but rather consists of three to five sandstone beds⁴ that are separated by thinner mudstone or shale layers. The sandstone beds range in thickness from 20 to 80 feet thick and are separated by thinner mudstone/shale beds up to 50 feet thick.

Typical porosity of sandstone is up to 30%, whereas, mudstone/shale layers have typical porosities of up to 10%, and therefore have limited storage capacity in the pore spaces. Therefore, the sandstone beds are expected to have the highest potential for well yield. Although porosity is an important property of an aquifer, the ability of the proposed well to support a municipal water supply well will depend on additional factors, such as hydraulic conductivity, which is the capacity of a porous medium to transmit water. The geophysical logs used in this study, indicate zones of higher porosity that may be suitable for well placement, but the geophysical logs do not provide information about hydraulic

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

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conductivity.

This study suggests a potential saturated zone of over 250 feet in the lower Dockum sediments. This saturated thickness should support a municipal water supply well, but regionally recognized problems with well yield and water quality in the Dockum aquifer must be recognized. Sustainability and water quality will be unknown until placement of a test well.

It is also important to note that recharge to the Dockum aquifer is expected to be minimal, if any, in this part of the Dockum basin, and therefore water withdrawn through a well will result in mining the aquifer.

Recommendations

The geophysical logs, coupled with knowledge of the general geology of the region and typical geophysical signatures for different lithologies, provide useful pre-drilling planning information that can improve the probability of success in placement of a water supply well.

A test well should be placed in the location of the proposed water supply well to further evaluate the lower Dockum aquifer (i.e., Santa Rosa Formation) which, based on evaluation of geophysical log data, appears to be most favorable to support a public water supply well. Because of potential water bearing units in the upper Dockum section, the upper Dockum units should be evaluated while drilling.

2.4 Design and Permitting of the Santa Rosa Well A planning meeting was held with Mr John Kelly, a principal in the civil engineering consulting firm Parkhill, Smith and Cooper. The subject was the permitting and design of the Santa Rosa well. During the conversation the advisability of doing a test well was broached. It was suggested that the cost might be affordable within the constraints of the TWDB contract and also could reduce risk as perceived by the well drillers. Mr. Kelly was provided with paper copies of the two Cirrus reports and requested to provide a quote for the design, permitting of the test and production wells. The PSC quote is provided as Appendix A. No action has been taken on this quote yet, pending resolution of funding sources.

2.5 Coordination with Seminole Water Department A project coordination meeting was held with the Seminole Water Department.

2.6 Entegriy Wind Turbine The wind turbine to be utilized as the principal electrical energy source is a 50 kW unit to be supplied by Entegriy Wind Systems, with offices in Boulder, Colorado. The availability and use of this wind turbine for a period of two years has

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been committed by Entegriy 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 Entegriy 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.

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3.0 PLANNED ACTIVITIES DURING THE NEXT PERIOD

3.1 Overview The following activities are planned initiation and/or completion during the forthcoming period. They are in preparation for the design and permitting of the Santa Rosa well and other project preparation.

3.2 Sources of Funds for the Well Design and Permitting Work With the hydro-geological studies and report in hand and with the PSC quote, we will determine the sources of funding. The potential sources include the TWDB contract and the US Department of Energy contract with Texas Tech. For the former, Texas Tech must coordinate with Seminole, Howco, the TWDB and ORCA. For the latter, Texas Tech must coordinate with the DOE to ensure that the work would be in scope.

3.3 Land Purchase Negotiations continue with ORCA regarding the purchase of the small acreage for the well site and infrastructure. This parcel is within the 520 acres to which Seminole has water rights.

3.4 Entegritty Lease Work will continue on the lease of the Entegritty wind turbine for use in this project. Intellectual property agreements between Seminole, Texas Tech University and Entegritty also will be pursued.

3.5 Coordination with TCEQ Initial meetings with TCEQ officials will be held to review the project and receive their advice and guidance.

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APPENDIX A

PS&C Quote for Santa Rosa Well Design and Permitting



PARKHILLSMITH&COOPER

July 27, 2009

Mr. Jamie Chapman
Wind Science and Engineering Research Center
Texas Tech University
P.O. Box 41023
Lubbock, Texas 79409

Re: Seminole Wind / Water Project

Dear Mr. Chapman:

We appreciate being given the opportunity to propose engineering design and construction phase services for the Seminole Wind / Water project. As requested, we have prepared a scope and fee for your review pertaining to the production well. We are proposing a lump sum contract for the proposed scope of engineering services. Attached to this letter are the following Exhibits for your review:

- Exhibit A – Scope of Services
- Exhibit B – Fee Structure
- Exhibit C – Contract Agreement

Payment for design, bid and construction phase services will be made to Parkhill, Smith & Cooper, Inc. for the proposed scope of services on a lump sum basis. Payment for subcontract costs associated with logging of the well will be on a reimbursable basis.

This letter is being sent in duplicate so that you may retain one copy for your records. You may indicate your authorization for these services by returning one signed copy of the contract agreement including the letter and all attachments to our office.

We look forward to working with you on this project.

Sincerely,

PARKHILL, SMITH & COOPER, INC.

By 
John S. Kelley, P.E.
Firm Principal

IN DUPLICATE

Amarillo
El Paso
Lubbock
Midland

JSK/lf
Enclosures
R:\Clerical\AGREE\2009\TTU\Seminole Wind Water\Trans Ltr.docx

4222 85th Street Lubbock, Texas 79423 806.473.2200 Fax 806.473.3500

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Exhibit A

Scope of Engineering Design Services Seminole, Texas Wind / Water Project

Project Summary

Texas Tech University Wind Science and Engineering Research Center is coordinating the development of a wind powered water treatment demonstration project using groundwater produced from the Dockum aquifer as the supply source. Parkhill, Smith, & Cooper, Inc. will be providing sub-consultant professional services to the Wind Science and Engineering Research Center regarding the design and construction of the pilot hole and subsequent production well.

Proposed Scope of Services

PSC proposes to provide engineering services to include design of an approximately 1,700 foot deep pilot hole, along with coordination of the logging of the pilot hole through a sub-consultant. The pilot hole will be plugged and abandoned immediately after logging. Following the successful drilling and logging of the pilot hole, PSC will provide engineering services related to the permitting and design of the production well at the same location.

PSC proposes the following scope of engineering services:

Task 1 – Project Management

1. Setup & maintain project design file system.
2. Setup work breakdown structure.
3. Budget tracking / Invoicing

Task 2 – Pilot Hole

1. Initial meeting to discuss project.
2. Preliminary coordination with Llano Estacado Underground Water Conservation District (LEUWCD) and Texas Commission on Environmental Quality (TCEQ)
3. Preparation of pilot hole and production hole construction basic details
4. Review details with LEUWCD and TCEQ
5. Identify specific logging requirements
6. Preliminary design of pilot hole and production well
7. Prepare Opinion of Probable Cost
8. Review with TTU
9. Assist in solicitation of bids for pilot hole
10. On-site observation of pilot hole drilling

Task 3 – Production Well

1. Prepare application submittal to LEUWCD, TCEQ
2. Review with TTU
3. Submit to LEUWCD, TCEQ
4. Prepare final design plans and specifications

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5. Prepare bid package
6. Contact potential bidders
7. Answer questions during bidding
8. Review of bids received
9. Recommendation of award
10. Attend Preconstruction meeting
11. Review schedules and submittals
12. Make periodic site visits during well construction (5)
13. Review of pay requests
14. Project close-out activities

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Exhibit B

7/27/2009

Fee Structure

Pilot Hole

Staff	Manhours	Rate	Cost
Principal	14	\$161.00	\$2,254.00
PM	45	\$105.00	\$4,725.00
EIT	56	\$89.00	\$4,984.00
CAD	44	\$69.00	\$3,036.00
Clerical	6	\$63.00	\$378.00

Labor	\$15,377
Other Direct Costs	\$1,011
Profit on Directs (15%)	\$152
Subtotal	\$16,540

Reimbursable Fee

Logging of Pilot Hole

	\$5,000
Profit on Reimbursable (15%)	\$750
Subtotal	\$5,750

Production Well

Staff	Manhours	Rate	Cost
Principal	5	\$161.00	\$805.00
PM	63	\$105.00	\$6,615.00
EIT	106	\$89.00	\$9,434.00
CAD	4	\$69.00	\$276.00
Clerical	5	\$63.00	\$315.00

Labor	\$17,445
Other Direct Costs	\$1,100
Profit on Directs (15%)	\$165
Subtotal	\$18,710