MPR1-0409

Seminole Integrated Wind-Water Demonstration System

Monthly Progress Report for April 2009

Submitted to

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1.0 INTRODUCTION AND OVERVIEW

1.1 Scope and Content This monthly 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, Entegrity 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 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 Not applicable since this is the initial report.

2.0 SUMMARY OF ACTIVITIES THIS PERIOD

2.1 Project Initiation and Site Visit Meeting A site visit and project initiation meeting was held in Seminole on 27 April Monday. The agenda is included as Appendix A. Attending were Travis Brown and Julie Hartley of ORCA; Sanjeev Kalaswad, Jorge Arroyo and x 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.

2.2 Project Organizational Structure The project organizational structure is shown in Fig. 1. The overall contract manager is Tommy Phillips, Seminole City Administrator, reporting to the two principal funding agencies, the Mayor and the City Council. Mr. Chapman will be responsible for project planning, management, execution and reporting, with support and advice from Mr. Phillips, appropriate city departments, Kay Howard, vendors and others. Contract administration and financial reporting will be handled by Ms. Howard with support from Mr. Phillips, the city's finance and accounting departments and Mr. Chapman.

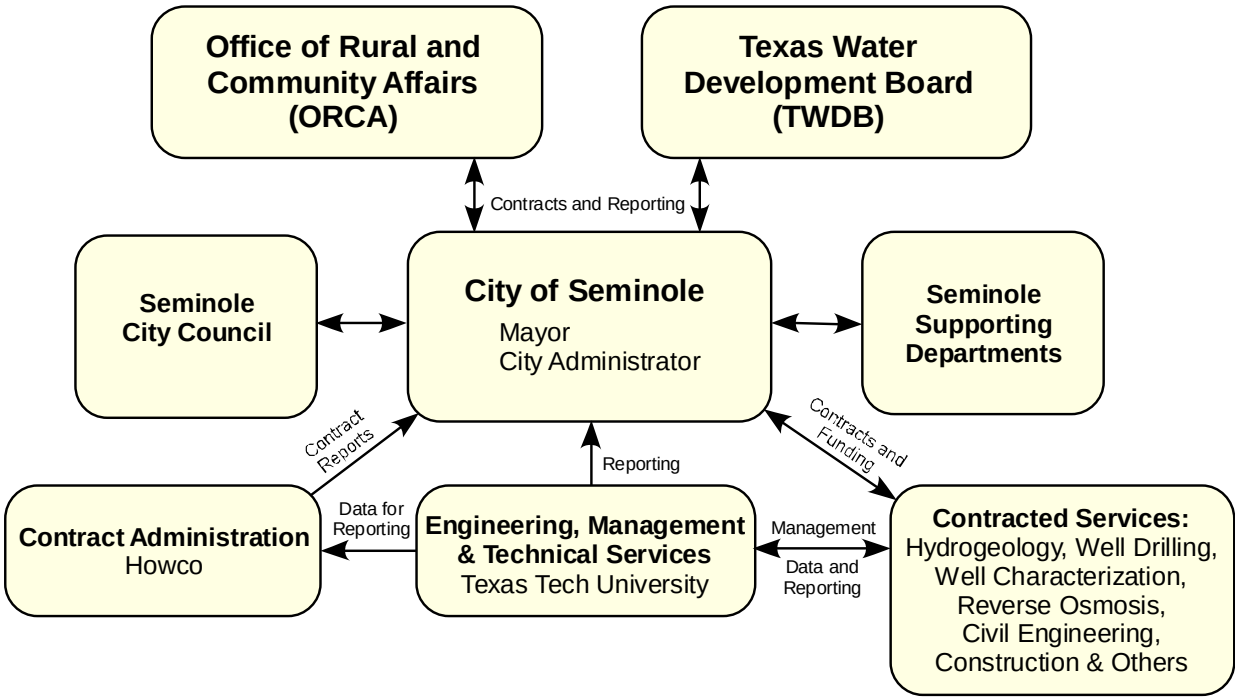

Fig. 1. Organizational and reporting structure for the Seminole integrated wind-water demonstration project.

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 are being conducted. The investigation is utilizing well logs and other information from a number of sites and sources. Both investigations traverse E-W across Gaines County, one slightly to the north of the well site and the second nearer the well site. The investigations are being conducted by Judy Reeves of Cirrus Associates[1] under contract to Texas Tech University. It is expected that these investigations will be completed during May.

2.4 Well Site The water rights for the 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 about two miles SSE of Seminole. As shown in Fig. 2, 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. This parcel is not the location of the city's current Ogallala well field. In addition to the water rights, ownership of several acres for the project infrastructure, wind turbine and the evaporation pond have been acquired. As 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).

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. 2. 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.

2.5 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

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

being negotiated. It has always been agreed that the project would pay for the wind turbine foundation, installation and electrical infrastructure.

The specifications of the Entegrity EW-15 wind turbine are reproduced as Appendix B.

Fig. 2. Illustrating the positions of the originally-proposed Santa Rosa well location.

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 principally of drilling the Santa Rosa well but also for design and construction following completion of the well.

3.2 Completion of Hydro-Geological Studies The hydro-geological studies and preparation of the report are planned to be completed. The report will be more accessible and thus useful if it can be put into electronic form. Doing this for the textual body of the report is straightforward. The well logs and other large-format maps, worksheets and other useful information may require large-format scanning.

3.3 Coordination of Contract Procurement Regulations with Howco and ORCA To ensure compliance with applicable procurement rules associated with the ORCA contract funds and by extension, the TWDB contract funds, discussions will be held with Howco and ORCA contracts staff for clarification.

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

3.5 Coordination with Seminole Departments Initial coordination meetings with representatives from relevant Seminole departments and regional water district organizations will be held. The objectives are to review the project and benefit from their expertise and advice.

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

3.7 Qualification of Well Drillers A request for expressions of interest and qualifications for the drilling, logging and completion of the Santa Rosa well will be prepared and provided to known drillers. The availability of the document will be advertised in local and regional newspapers. The document will describe the well location, the expected range of depths and the availability of a hydro-geological study.

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3.8 Qualification of Engineering Design Firms A request for expressions of interest and qualifications for the engineering design, pre-drilling documentation and permitting of the well will be prepared and provided to known engineering firms. Expressions of interest and qualifications also will be requested for the construction aspects of the project, including specification and procurement of the RO and any pre- or post-treatment systems, test of the well-RO-Treatment system to qualify the well for TCEQ permitting and other matters.

The availability of the document will be advertised in local and regional newspapers. The document will describe the well location, the expected range of depths and the availability of a hydro-geological study.

APPENDIX A

Agenda of Project Initiation and Site Visit Meeting, 27 April 2009

City of Seminole Brackish Groundwater Desalination Demonstration Project: Kick-Off Meeting

Date: April 27, 2009

Time: 1:00 PM - 3:00 PM

Location: Seminole City Hall, Seminole, Texas

Core Team: City of Seminole (Funding Recipient)
Texas Tech University (Project Manager)
Office of Rural and Community Affairs (Funding Agency)
Texas Water Development Board (Funding Agency)
Entegrity (Project Participant)
Kay Howard (Project Consultant)

Agenda Items:

- Welcome and Project Overview — Jamie Chapman (Project Manager)
- Introductions: Roles and Responsibilities — All
- Goals of Project — Jamie Chapman (Project Manager)
- Project Approach — All
  - TWDB procedures — Sanjeev Kalaswad (TWDB)
  - ORCA contract rules/procedures — Julie Hartley (ORCA)
  - Discussion of ORCA procurement rules — All
- Stakeholder Commitments — All
- Next Steps/Action Items — Jamie Chapman (Project Manager)
- Site Visit — All

APPENDIX B

Specifications, Entegrity EW15 Wind Turbine

EW15 Specifications 50 kW, 50 or 60 Hz

SYSTEM

Type	Grid Connected
Configuration	Horizontal Axis
Rotor Diameter	15 m (49.2 ft)
Centerline Hub Height	25 m (82 ft)

PERFORMANCE PARAMETERS

Rated Electrical Power	50 kW @11.3 m/s (25.3 mph)
Wind Speed Ratings	
cut-in	4.6 m/s (10.2 mph)
shut-down (high wind)	22.4 m/s (50 mph)
design speed	59.5 m/s (133 mph)
Calculated Annual Output	
@ 100 % availability	5.4 m/s (12 mph) 87,000 kWh
	6.7 m/s (15 mph) 153,000 kWh
	8.0 m/s (18 mph) 215,000 kWh

ROTOR

Type of Hub	Fixed Pitch
Rotor Diameter	15 m (49.2 ft)
Swept Area	177 m² (1902 ft²)
Number of Blades	3
Rotor Solidity	0.077
Rotor Speed @ rated wind speed	65 rpm
Location Relative to Tower	Downwind
Cone Angle	6°
Tilt Angle	0°
Rotor Tip Speed	51 m/s (114 mph) @ 60 Hz
Design Tip Speed	6.1

BLADE

Length	7.2 m (23.7 ft)
Material	Epoxy /glass fibre
Blade Weight	150 kg (330 lbs) approximate

GENERATOR

Type	3 phase/4 pole asynchronous
Frequency	(Hz) 60 Hz
Voltage	3 phase @ 60 Hz, 400-600 V
kW @ Rated Wind Speed	50 kW
kW @ Peak Continuous	66 kW
Insulation	Class F
Enclosure	Totally Enclosed Air Over
Options	Arctic low temp. shafting -40°c

TRANSMISSION

Type	Planetary
Housing	Ductile iron
Ratio (rotor to gen. speed)	1 to 28.25 (60 Hz)
Rating, output horse power	88
Lubrication	Synthetic gear oil/non toxic
Heater (option)	Arctic version, electric

YAW SYSTEM

Normal	Free, passive
Optional	Yaw damp
Electrical	Twist Cable

TOWER

Type	Free standing galvanized bolted lattice
Tower Height	24.4 m (80 ft)
Options	30.5 m (100 ft),
Tilt down 24.4 m (80 ft)	

FOUNDATION

Type	Concrete pad, pier or special

CONTROL SYSTEM

Type	PLC based
Communications	Serial link to central computer for energy monitor and maintenance dispatch (optional)
Enclosures	NEMA 1, NEMA 4 (optional)
Soft Start	Optional

ROTOR SPEED CONTROL

Running	Passive stall regulation
Start up	Aerodynamic
Shut-down	Aerodynamic tip brake and electrodynamic braking. Parking brake for servicing.

BRAKE SYSTEM CONTROL
Fail-safe aerodynamic, electrodynamic, and parking brakes.

APPROXIMATE SYSTEM DESIGN WEIGHTS

Tower	3,210 kg (7,080 lb)
Rotor & Drive train	2,420 kg (5,340 lb)
Weight on Foundation	5,630 kg (12,420 lb)

DESIGN LIFE: 30 Years
DESIGN STANDARDS: Applicable Standards, AWEA, EIA and IEC
DOCUMENTATION: Installation Guide and Operation & Maintenance Manual
SCHEDULED MAINTENANCE: Semi-annual or after severe events.

NOTE 1: Entegrity Wind Systems Inc. is constantly working to improve their products; therefore, product specifications are subject to change without notice.

NOTE 2: Power curves show typical power available at the controller based on a combination of measured and calculated data. Annual energy is calculated using power curves and a Rayleigh wind speed distribution.
Energy production may be greater or lesser dependent upon actual wind resources and site conditions, and will vary with wind turbine maintenance, altitude, temperature, topography and the proximity to other structures including wind turbines.

NOTE 3: For design options to accommodate severe climates or unusual circumstances please contact the technical and sales office in Prince Edward Island, CANADA.

NOTE 4: For integration into high penetration wind-diesel and village electrification schemes contact the technical & sales office in Prince Edward Island, CANADA for technical support and systems design.

Revised January 2005