

Memorandum

To: Mr. Alan Day

From: Michelle Sutherland LLC and Allan Standen LLC

Date: 9/3/2018

Purpose: Brazos GCD (District) 3D Model Update Proposal, Tasks and Fixed Cost

Proposal

Michelle A Sutherland and Allan R Standen LLC propose to integrate the updated TWDB and TDLR water well datasets into the existing Brazos GCD 3 D model.

Task 1, The 2016 TDL water well dataset is illustrated in Figure 1 and consists of over 2,800 wells. Well attributes of this dataset includes; the state well tracking number, well owner, drilling company, completion date, all well construction information (which includes screen intervals), well depth, estimated well yield and/or pump tests (over 1,250 wells) and over 2,250 water levels measured when a well was completed. This dataset will be updated and integrated into the existing 3 D model.

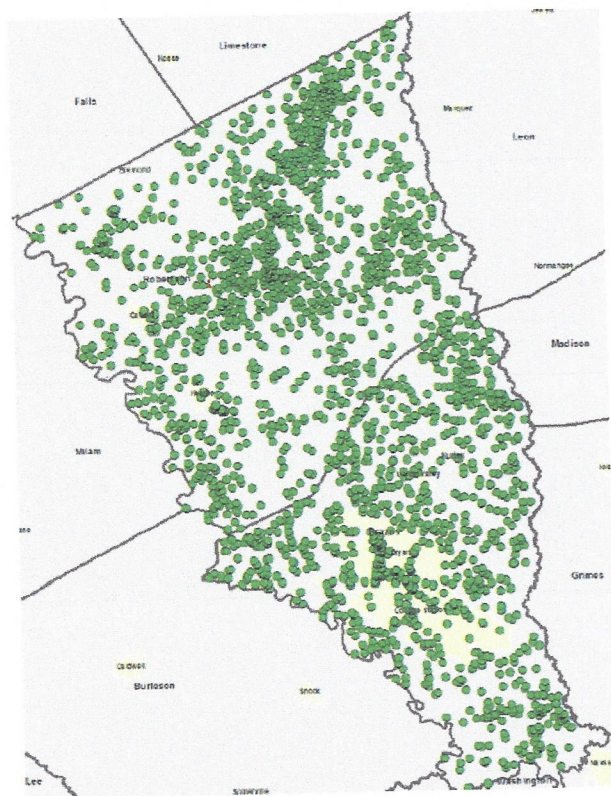


Figure 1, TDLR Water Wells, 2016

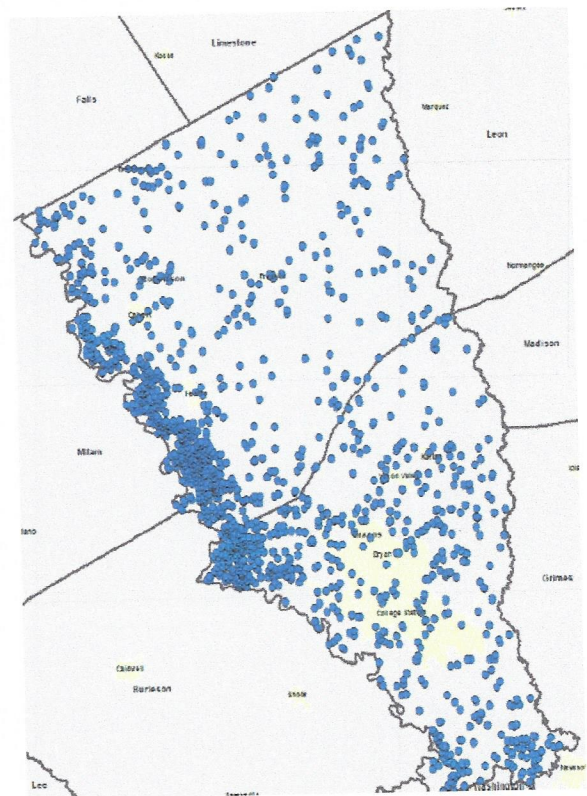
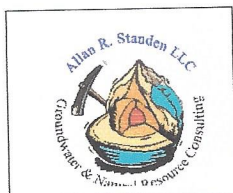


Figure 2, TWDB Water Wells, 2016



Task 2, Figure 2 is the 2016 TWDB water level dataset which consists of over 1,550 wells. The TWDB water well attributes includes: a state well tracking number, the well owner, well depth, screen intervals for over 135 wells, well yields and/or pump test for over 130 wells, 376 wells with various amounts of water quality information (cations, anions, metals, radionuclides, isotopes) and historical water level trends by decade. This dataset will be updated and integrated into the existing 3 D model.

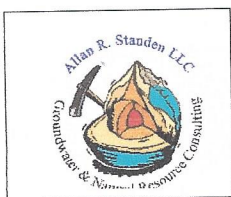
Task 3, Old (1930s to 1970s) oil and gas cable tool driller's reports and scout tickets are kept at the Bureau of Economic Geology. These driller's reports contain highly detailed drill cutting geological descriptions extremely useful for understanding the aquifers. The scout tickets provide formational top picks possibly that could be used to supplement the stratigraphic control in the existing GAM. Based on a records research, there are approximately 200 driller's reports and over 400 scout tickets that may be useful.

Task 4, It is highly recommended that there be a number of geographic reference surfaces built for the 3 D model to help the user look for localized well information or geology. These surfaces can be turned on or off by the user as needed. These reference surfaces include: state well grid, Texas survey, aerial imagery, latitude and longitude grid, and a labeled highway and road reference surface.

Task 5, The oil and gas industry has drilled a few thousand wells in the District, most of these wells have geophysical logs available. The Bureau of Economic Geology (BEG) in Austin is the main warehouse for these geophysical logs. Geophysical logs measure the radioactivity, magnetic, density, conductivity, resistivity and other properties of the rocks with depth. The geophysical logs can be used to correlate formation surfaces (Groundwater Availability Models, GAMs) but can also be used to qualitatively to quantitatively measure the rocks water quality, porosity and possibly permeability with depth. This aquifer data can be used to improve the existing GAMs to make them more representative of the aquifer. The Texas Railroad Commission also has an electronic database of the more recent oil and gas geophysical logs.

Figure 3 illustrates the 850 geophysical logs available at the BEG, some of these geophysical logs start deeper than the deepest aquifer systems in the District. Figure 4 illustrates the more than 200 shallow geophysical logs that could be used to evaluate the aquifers in the District. Task 5 proposes to select 100 to 150 geophysical logs to be used for future analyses of the aquifers in the District. The hard and digital copies of these geophysical logs would be provided to the District to form a library.

These geophysical logs could be used to improve the spatial resolution of the GAMs aquifer surfaces, determine aquifer porosity (aquifer storage properties), determine water quality (SP and resistivity only) with depth and possibly improve groundwater flow estimates.



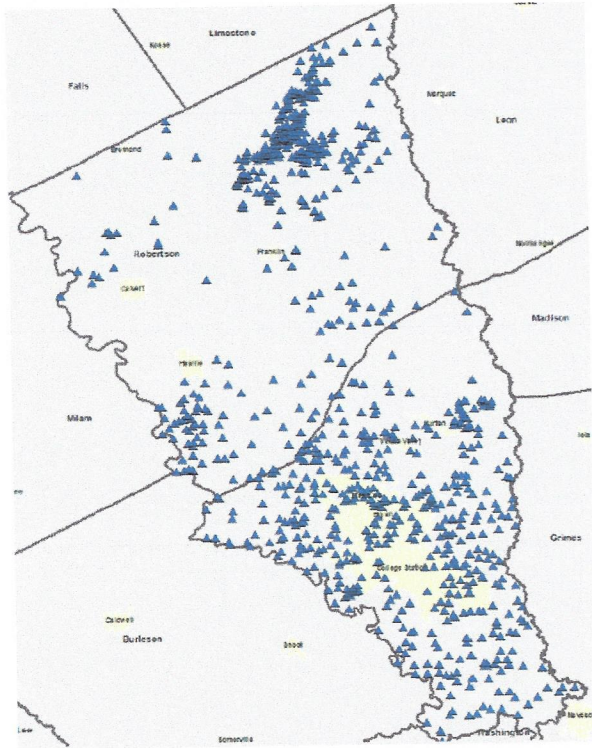


Figure 3, Available BEG Geophysical Logs

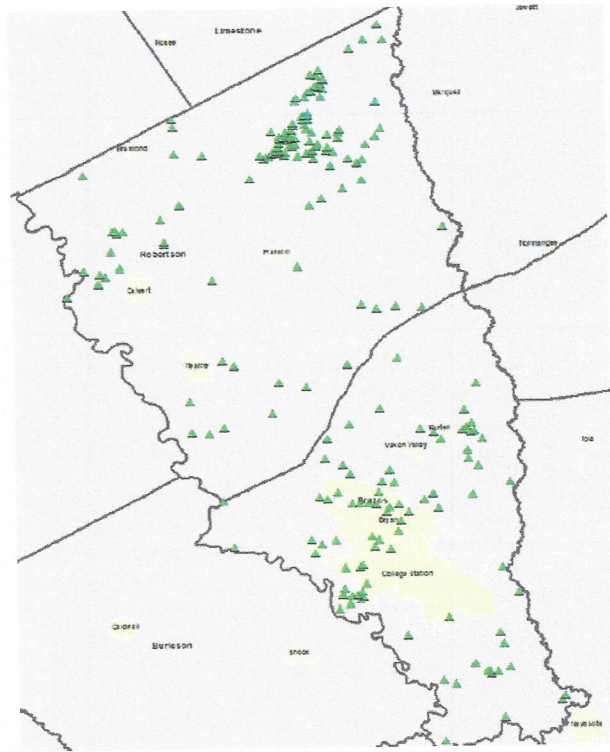


Figure 4, Shallow BEG Geophysical Logs

Task Deliverables, Time Required and Fixed Costs (Except Task 5)

The GAM surfaces already existing in Brazos 3 D model will not be updated. The screen intervals from the TWDB and TDLR wells may assist the District in understanding the designation of aquifer well completions, water quality changes with depth and possibly spatially understand well yield variability

Task 1, TDLR water well dataset

Update dataset and extract screen intervals, format for 3 D model, one month **\$5,000**

Task 2, TWD water well dataset

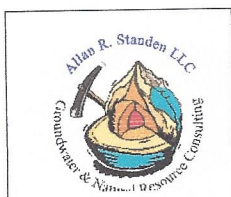
Update dataset and extract screen intervals, format for 3 D model, one month **\$5,000**

Task 3, District water well dataset

Capture all useful cable tool driller's reports and scout tickets, two weeks **\$5,000**

Task 4, Create reference surfaces for top of the 3 D Model

State well grid, survey, imagery, lat and long grid, road reference, one week **\$2,500**



Task 5, District reference geophysical log library

Add up to 100 new, geographically representative shallow geophysical logs to the District's datasets, include geophysical log locations and depths in 3D Model, two months

\$15,000

If you have any questions, please contact me at 512-731-6242 or at astanden@att.net



Allan R Standen LLC

