

**Final Report for the FY18 Surface Casing Estimator Site Project**

by

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*prepared for*

Railroad Commission of Texas

under Contract Project Number UTA17-001427

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August 2018

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## ABSTRACT

The Surface Casing Estimator Site is a website that provides estimates of possible surface-casing requirements for wells and related information. Work during FY18 for the Surface Casing Estimator Site project involved (1) scanning geophysical logs of the Q-log library for 12 counties, (2) constructing digital data sets composed of geologic information that relates to estimating surface-casing requirements and groundwater depths for 7 counties in West Texas and 1 county within the Texas Gulf Coastal Plain, and (3) merging/programming the new data with the website's existing data. The Estimator Site provides information on elevations and depths for the top and base of fresh water; the base of usable-quality water; the base of underground sources of drinking water; and the top and base of critical water-bearing stratigraphic units, aquifer names, geophysical logs, and well locations. The FY18 work has enabled about 700 additional geophysical logs in 8 Texas counties to be viewed through the Surface Casing Estimator Site.

## INTRODUCTION

The FY18 Surface Casing Estimator Site project continues work on (1) constructing a web-enabled estimator site with statewide coverage, and (2) scanning geophysical logs of the hard-copy Q-well log data files that are evaluated to make casing recommendations for wells drilled in Texas. Work for the Surface Casing Estimator Site, which began in 2004 with development of spatial and tabular data, has been displayed over the Internet (Arc IMS) for specific Texas counties, allowing oil and gas operators, Railroad Commission of Texas (RRC) staff, and other users to determine probable surface-casing requirements and view selected geophysical logs and other features such as land-survey boundaries, roads, and well locations. Since the initial success of the pilot project, a study of Brazos County in 2004, the project has interpreted and prepared estimator-site data sets for 86 counties and has scanned Q-well logs for 130 counties (figs. 1 and 2).

This project year's work involved three primary phases: (1) scanning of geophysical logs for 12 counties and initial study of RRC data for 8 counties to prepare data sets for addition to the Surface Casing Estimator Site, (2) interpretation of geologic data for estimator-site-study counties, and (3) construction and review of Surface Casing Estimator Site digital data sets for 8 counties. Project deliverables are digital TIFF images of the scanned Q-logs and study-area additions/updates to the web-enabled Surface Casing Estimator Site. More than 7,725 log scans were delivered during this project year. Data for the 8-county West Texas study area have been added to the Surface Casing Estimator Site at <http://www.beg.utexas.edu/research/areas/groundwater-studies/surface-casing-estimator>.

Scanning of the RRC Q-log library is an ongoing task that will continue for 12 additional counties into a new contract year, FY19, with the RRC. Data for 8 counties will be studied and added to the Surface Casing Estimator Site during FY19.

## GEOPHYSICAL LOG SCANNING

Required scanning during FY18 for 12 counties—Scurry, Brazoria, Montgomery, Waller, Crosby, Young, Jefferson, Archer, Hidalgo, Wichita, Stephens, and Nolan—was almost completed by the end of July; scanning continues during August. More than 7,725 scans of Q-well geophysical logs were made by the end of July. Scanning for 10 counties is fully completed, and work for 2 counties is scheduled to be completed by the end of August. In addition to the scanning work for these 12 counties, some relatively recent geophysical logs of the Q-well files were scanned for Reeves County, a county that had scanning work done several years ago. Selection of these 13 counties for the scanning of geophysical logs conforms to RRC needs and drilling activity. Scanning was conducted at the RRC Q-well log library and typically occurred 5 days a week during much of the work year. A summary of FY18 geophysical log scanning is as follows:

<u>County</u>	<u>Q-Log Folders</u>	<u>Scans of Logs</u>
Scurry	Q1 to Q692	690
Brazoria	Q1 to Q1,346	1,239
Montgomery	Q1 to Q446	437
Waller	Q1 to Q200	193
Crosby	Q1 to Q110	102
Young	Q1 to Q1,547	1,540
Jefferson	Q1 to Q836	827
Archer	Q1 to Q780	772
Hidalgo	Q1 to Q880	873
Wichita	Q1 to Q	scanning in progress
Stephens	Q1 to Q980	970
Nolan	Q1 to Q	scanning in progress
Reeves (additions)	Q647 to Q729	45

## SURFACE CASING ESTIMATOR SITE

Data sets for the following 8 counties were added to the Surface Casing Estimator Site this work year: Culberson, Reeves, Loving, Pecos, Cochran, Hockley, and Irion of West Texas and Refugio of the Texas Gulf Coastal Plain. Work to construct the data sets involved (1) collection of available data and digital files for county surveys and abstracts, county boundaries, previous surface-casing recommendations, well-location maps, ground elevations, and subsurface and surface geology; (2) creation of a GIS project using standard ArcMap software; (3) creation of digital-elevation-model grids for ground elevations; (4) review of study-area geology and groundwater units with Surface Casing Team staff, and designation of critical stratigraphic intervals, horizons, and aquifers; (5) study of geologic data, geophysical logs, and location of wells, and construction of digital files for well locations; (6) construction of data spreadsheets and GIS attribute tables for study intervals, horizons, and aquifers; (7) construction of GIS contour grids for study intervals and of horizon and shapefile layers for well locations and aquifer-recommendation areas; and (8) review of data layers through evaluation of layer-overlap techniques and visual study.

Contour-grid image files and point and polygon shapefiles have been added and programmed into the Surface Casing Estimator Site using the ArcGIS Server so that this year's data could be merged with the site's existing data. This year's work for the estimator site also included upgrades related to the programming of data sets and to the website server, and routine maintenance.

The GIS contour grids of study-interval elevations for the 7 West Texas counties incorporates information from the RRC Groundwater Advisory Unit (GAU) data files, which include data from 761 Q-well records and geophysical logs as well as more than 1,200 records for surface-casing recommendations/protection depths (SCRPs), salt-water disposal (SWD), and Capitan Limestone depths. The estimator site also displays more than 600 geophysical logs of the Q-well collection for these 7 counties, which required study of different horizons because the areas span different parts of West Texas. Geologic horizons studied within parts of these counties include the following: bases of shallow aquifers (Ogallala, Cretaceous, and Liapan deposits); base of Cretaceous rocks; base of Santa Rosa Formation; top and base of Rustler Formation; top and base of Capitan Limestone; top and base of the San Andres Formation; and the base of underground sources of drinking water (USDW).

Geology of the 5-county study area comprising Pecos, Reeves, Loving, and Culberson Counties is complex, as evidenced within studies by Ogilbee and Wesselman (1962), Ashworth (1990), Standen and others (2009), Ewing and others (2012), and Meyer and others (2012). Structural complexities within the area's strata exist because of tectonism as well as possible local evaporate dissolution and related subsidence. Lateral stratigraphic complexities also exist because of facies changes within units. The estimator site meets its goal of providing estimated depths of important groundwater horizons based on the available RRC GAU data sets and images of representative geophysical logs, although there are areas where the data may not be abundant enough to completely address existing geologic complexities. Collecting

several estimates from the estimator site across an area of interest and viewing geophysical logs of nearby wells may aid in identifying areas of geologic complexity.

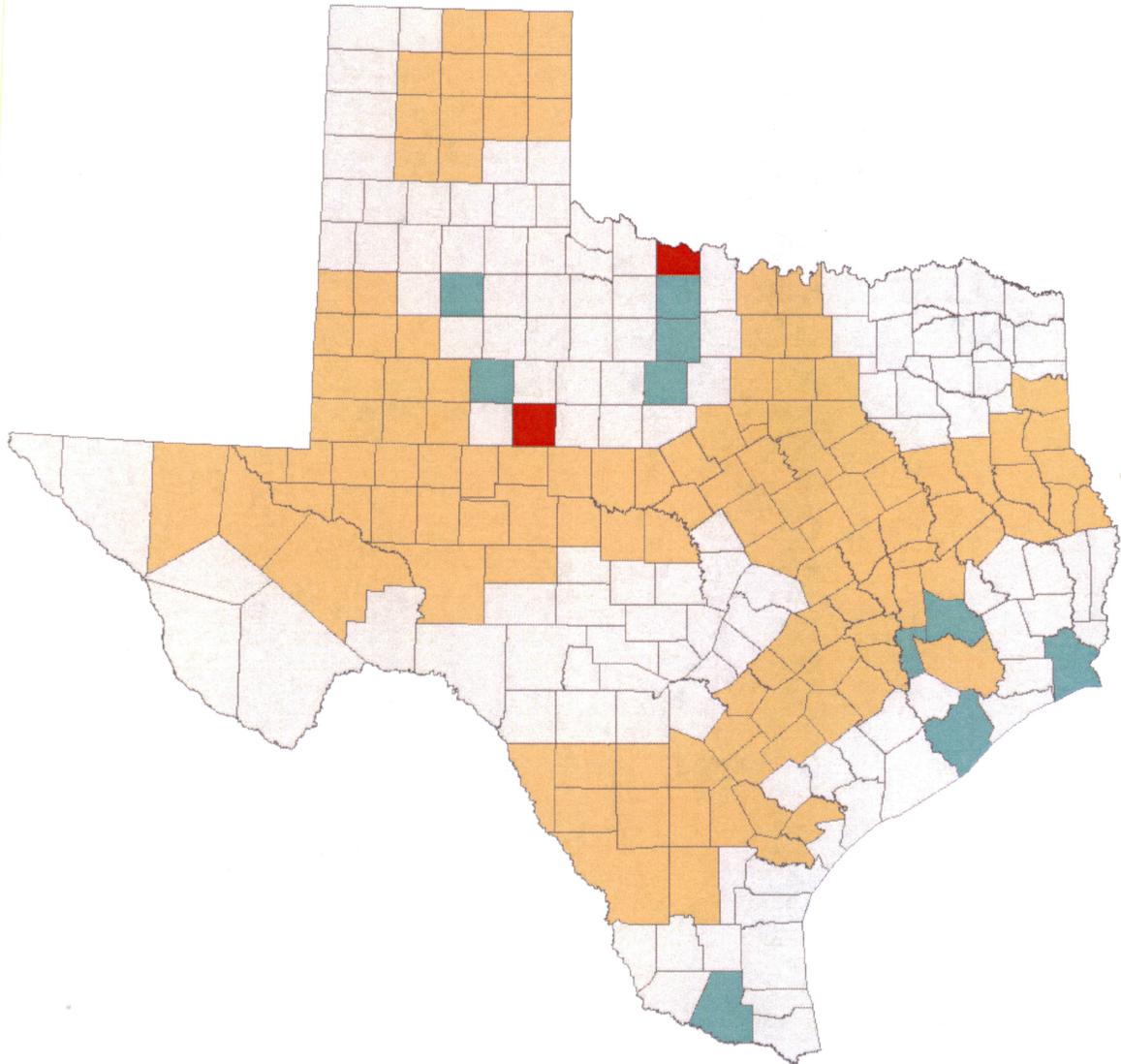
The GIS contour-elevation grids of the study intervals for Refugio County of the Texas Gulf Coastal Plain were constructed using RRC GAU data files from 154 Q-well records and geophysical logs, as well as 218 records for SCRP and SWD. The estimator site also displays 93 geophysical logs for this county. Study horizons for Refugio County include the bases of fresh water, usable-quality water, and USDW.

#### **FUTURE WORK**

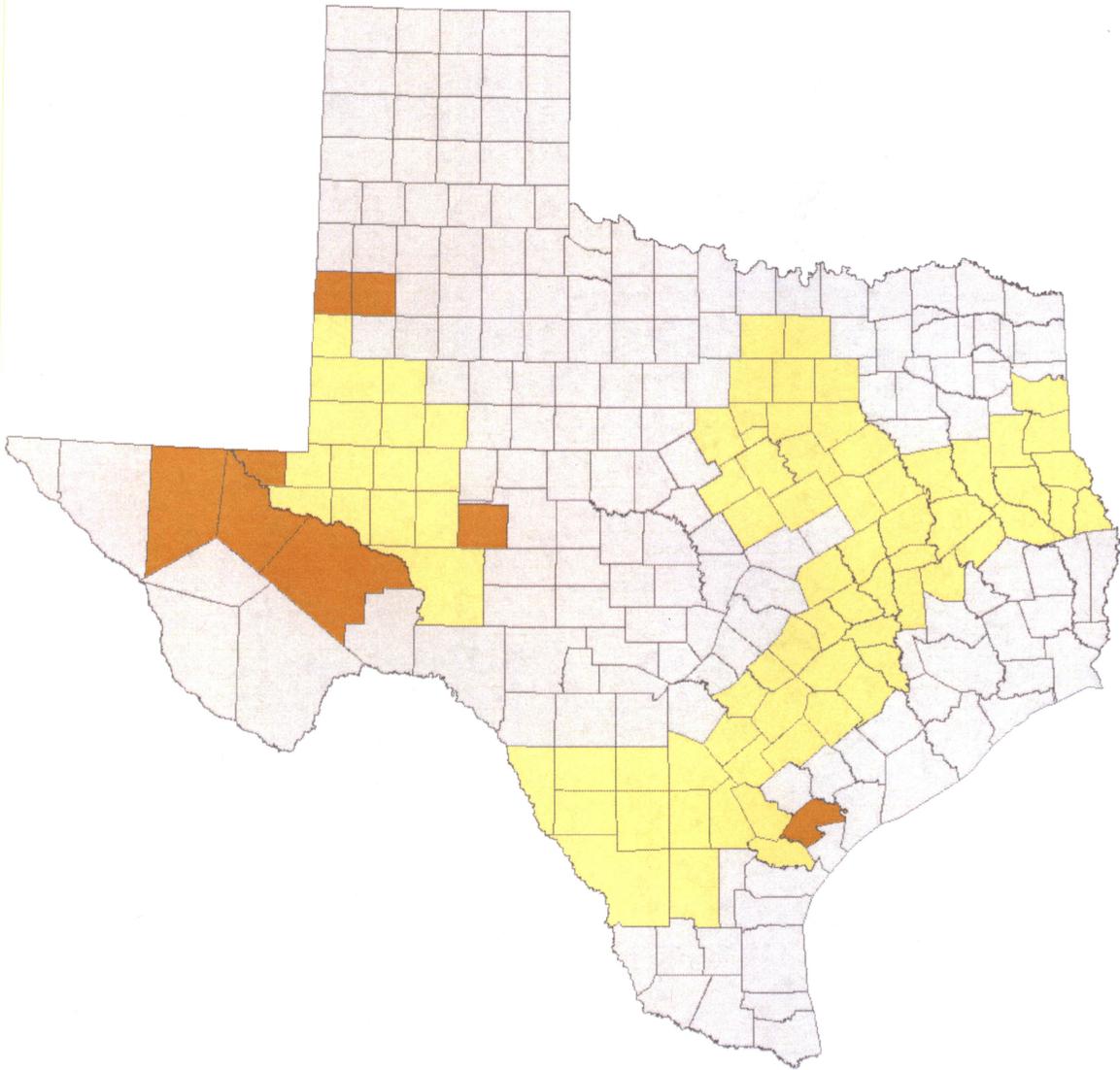
Future work includes scanning of geophysical Q-logs for 12 counties: Collingsworth, Fisher, Fort Bend, Garza, Goliad, Jackson, Kent, Mitchell, Nueces, Starr, Stonewall, and Victoria. The Bureau will also need to scan Q-well logs for Hemphill County, one of the counties to be interpreted. Planned interpretive work for Surface Casing Estimator Site data sets involves 8 counties within different parts of the state: Harris, Hemphill, Hutchinson, Lipscomb, Montgomery, Ochiltrie, Roberts, and Waller. Scheduling to determine which counties will have data interpreted and which will have logs scanned should be kept flexible to meet changes in priorities that may occur during a work year. Upgrades to the website and server are also periodic tasks.

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**Figure 1.** Counties with Q-logs scanned during FY18 (green) and during previous work years (orange). Counties with scanning to be completed by August 2018 are shown in red.



**Figure 2.** Counties completed for Surface Casing Estimator Site during FY18 study (orange) and during previous work years (yellow).