

SURFACE CASING ESTIMATOR SITE, 2018–2019

by

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ABSTRACT

The Surface Casing Estimator Site (SCES), hosted at the Bureau of Economic Geology (Bureau), is an interactive website that provides depth and elevation estimates for select subsurface water-quality zones chosen by Groundwater Advisory Unit staff at the Railroad Commission of Texas (RRC). These depths enable users to estimate surface-casing needs for possible future drilling activity prior to obtaining a surface-casing determination from the RRC. Work during fiscal year 2019 (September 2018 to August 2019) for the SCES involved (1) scanning geophysical logs from 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 5 counties in the Texas Panhandle and 3 counties on the Texas Gulf Coastal Plain, (3) adding the newly interpreted counties to existing SCES data, (4) adding selected geophysical logs to the SCES, and (5) updating and revising the SCES as requested. For the panhandle counties, the SCES provides elevation and depth estimates for the base of usable-quality water (BUQW) and the base of underground sources of drinking water (USDW). For the coastal counties, the SCES provides depth and elevation estimates for the base of fresh water, the BUQW, and the base of USDW. Critical water-bearing stratigraphic units, aquifer names, geophysical logs, and well locations are also displayed. All depths and elevations are estimated on the basis of horizon picks provided by the RRC and on select supplemental geophysical well-log determinations. About 280 geophysical logs across 8 Texas counties were added to the SCES web portal during the FY2019 project year.

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INTRODUCTION

For FY2019, the Surface Casing Estimator Site (SCES) project continued work on (1) maintaining and expanding 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. Construction of the SCES began in 2004 with development of spatial and tabular data. Data are displayed over the web (using ArcGIS Server 10.4) for specific Texas counties, allowing oil and gas operators, Railroad Commission of Texas (RRC) staff, and other users to estimate surface-casing requirements and view selected geophysical logs and other features such as land-survey boundaries, roads, and well locations. Since the success of the pilot project for Brazos County in 2004, project staff have interpreted and prepared SCES data sets for 94 counties and have scanned Q-well logs for 142 counties (figs. 1 and 2).

Work in FY2019 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 SCES, (2) interpreting geologic data for SCES counties, (3) constructing and reviewing SCES digital data sets for 5 counties in the Texas Panhandle and 3 counties on the Texas coastal plain, and (4) maintaining, upgrading, and expanding the SCES web site to include 8 additional counties. Project deliverables are digital TIFF images of the scanned Q-logs and study-area additions and updates to the SCES web site. More than 7752 logs were scanned during this project year. Data for the 5-county panhandle study area and the 3-county coastal plain study area have been added to the SCES at <http://www.beg.utexas.edu/sce/>.

Scanning of the RRC Q-log library is an ongoing task that will continue for 12 additional counties into a new contract year, FY2020, with the RRC. Data for 8 counties will be studied and added to the SCES during FY2020.

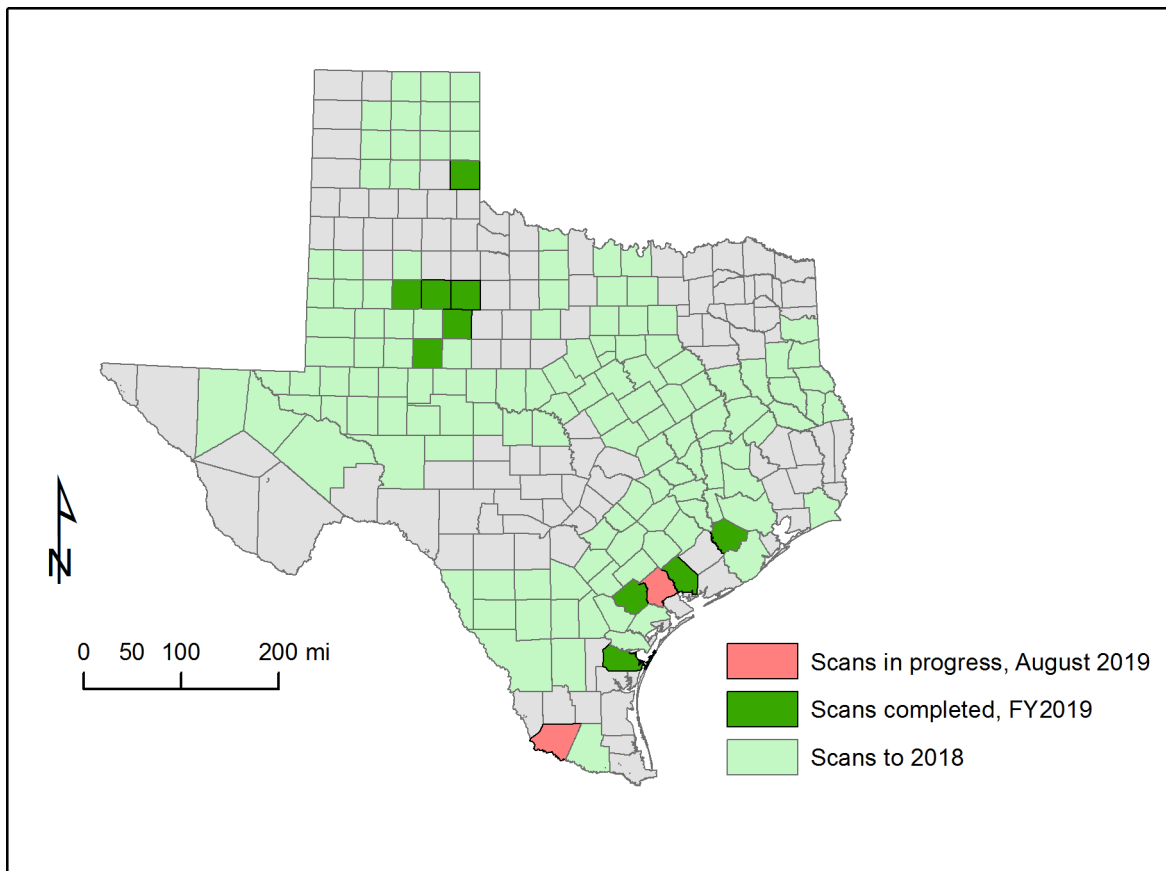


Figure 1. Status of Q-log scanning by county, including counties scanned in FY2019 and counties scanned during previous project years (2004 to 2018).

GEOPHYSICAL LOG SCANNING

Required scanning during FY19 for 12 counties—Collingsworth, Fisher, Fort Bend, Garza, Goliad, Jackson, Kent, Mitchell, Nueces, Starr, Stonewall, and Victoria—is ongoing as the project nears completion. More than 7,752 scans of Q-well geophysical logs were completed by late August. Scanning for 10 counties is fully complete, and scanning for 2 counties (fig. 1; table 1) is in progress and expected to be completed by the end of August or early September. Scanning was conducted at the RRC Q-well log library.

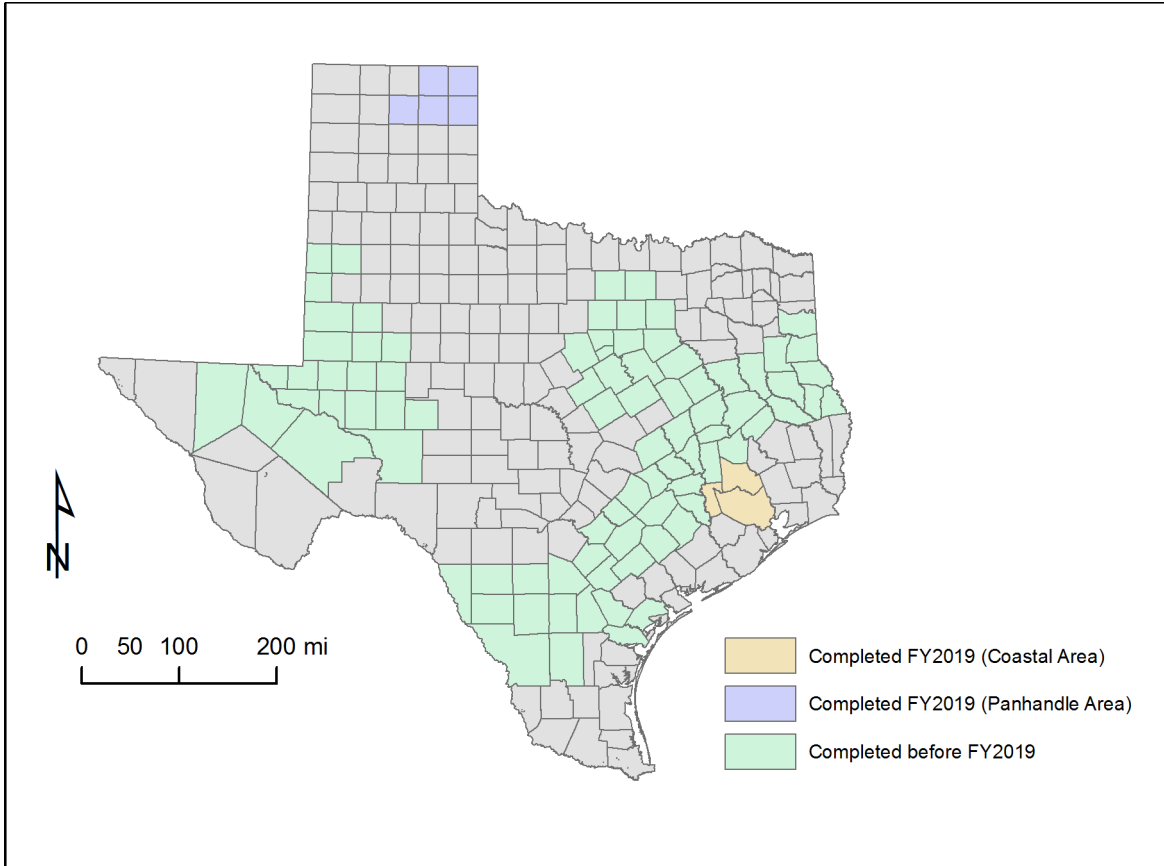


Figure 2. Counties completed for the SCES during FY2019 (coastal and panhandle study areas) and during previous project years (2004 to 2018).

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Table 1. Summary of geophysical Q-Log scanning during FY2019.

County	Q-Log Folders	Scans
Collingsworth	Q1 to Q130	129
Fisher	Q1 to Q892	883
Fort Bend	Q1 to Q726	720
Garza	Q1 to Q761	758
Goliad	Q1 to Q914	910
Jackson	Q1 to Q1462	1462
Kent	Q1 to Q432	429
Mitchell	Q1 to Q201	203
Nueces	Q1 to Q1529	1527
Starr		In progress, 8/29/2019
Stonewall	Q1 to Q737	731
Victoria		In progress, 8/29/2019

COUNTIES ADDED TO THE SCES

Data sets for 8 counties were added to the SCES this project year: Hemphill, Hutchinson, Lipscomb, Ochiltree, and Roberts counties in the Texas Panhandle, and Harris, Montgomery and Waller counties on the Texas Coastal Plain. Work to construct the data sets involved (1) collecting 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) creating a GIS project using ArcMap; (3) creating a Petra project using Petra software (IHS), importing Q-log wells, and adding and depth calibrating geophysical log images; (4) creating digital-elevation-model grids for ground elevations; (5) reviewing study-area geology and groundwater units with RRC Groundwater Advisory Unit staff, and designating critical stratigraphic intervals, horizons, and aquifers; (6) studying geologic data, geophysical logs, and location of wells, and constructing digital files for well locations; (7) constructing data spreadsheets and GIS attribute tables for study intervals, horizons, and aquifers; (8) interpreting critical horizons on Q-logs; (9) constructing GIS depth and elevation grids for study intervals

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and horizons and shapefile layers for well locations and aquifer-recommendation areas; and (10) reviewing data layers through evaluation of layer-overlap techniques and visual study.

The GIS contour grids of study-interval elevations for the 5 Texas panhandle counties cover Hemphill, Hutchinson, Lipscomb, Ochiltree, and Roberts counties. They incorporate information from the RRC Groundwater Advisory Unit (GAU) data files, which include data from 78 Q-well records and geophysical logs, as well as 5701 records for surface-casing recommendations and protection depths (SCRIP), and 748 records for salt-water disposal (SWD), supplemented by the interpretation of 135 Q-logs. The estimator site also displays about 120 geophysical logs of the Q-well collection for these 5 counties. Geologic and groundwater horizons studied within parts of these counties include the following: base of the shallow aquifer (Ogallala Aquifer) or the top of Permian (red beds), the top of the Blaine Formation, the base of usable quality water (BUQW), and the base of underground sources of drinking water (BUSDW). Queries to the SCES return estimates of BUQW and BUSDW depths and elevations.

The GIS contour-elevation grids of the study intervals for Harris, Montgomery, and Waller counties of the Texas Coastal Plain were constructed using RRC GAU data files from 687 Q-well records and geophysical logs, 1694 SCRIP records, and 604 SWD records. These were supplemented by 217 depth interpretations from Q-logs. The SCES also displays 153 geophysical logs for these 3 counties. Study intervals and horizons in the coastal counties include shallow aquifers of the Gulf Coast Aquifer system (Chicot and Evangeline aquifers) and the base of fresh water, BUQW, and BUSDW. Queries to the SCES return estimates of base of fresh water, BUQW, and BUSDW.

SCES MODIFICATIONS AND UPGRADES

In addition to adding the 8 panhandle and coastal counties to the SCES, several other upgrades and modifications were made during the project year, some of which were in response to suggestions from GAU staff and the public. These include:

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1. Replacing piecemeal and inconsistent land survey information with statewide data from the 2014 RRC version of the Original Texas Land Survey (OTLS).
2. Adding the ability to copy the web link to a specific casing query and paste it into other applications.
3. Adding the ability to download the original (tiff) log scan for the wells shown on the SCES.
4. Adding an RRC logo (with a hyperlink to the RRC website) adjacent to the Bureau logo on the SCES web interface.
5. Adding a temporary marker at a click location on the SCES map that displays for a few seconds after clicking on the map.
6. Revising the log scan display to show larger images (png format).
7. Revising the map display to more clearly indicate which counties have been completed. Only the completed counties are highlighted with a dimmable fill; other counties have no highlighting.

FUTURE WORK

Proposed work for FY2020 includes scanning of geophysical Q-logs for 12 counties: Clay, Dickens, Grayson, Hardin, Jim Wells, Kleberg, Liberty, Palo Pinto, Polk, San Patricio, Smith, and Wharton. The counties to be interpreted during FY20 include: Brown, Coleman, Comanche, Culberson, Pecos, Reeves, Winkler, and Ward. The 8 counties are grouped into two study areas: central Texas and west Texas. In central Texas, Brown, Coleman, and Comanche counties are adjacent to each other and will be studied as a group. Interpretation in the 5 counties in west Texas will update previously completed interpretations to include Capitan Reef geology from the current GAU Capitan Reef GIS dataset. Scheduling to determine which counties will have data interpreted and which will have logs scanned should be kept flexible to meet changes in priorities

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that may occur during a work year. Upgrades, revisions, and updates to the SCES website and server are also periodic tasks.

ACKNOWLEDGMENTS

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REFERENCES

- Bruun, B., Jackson, K., Lake, P., and Walker, J., 2016, Texas Aquifers Study – Groundwater quantity, quality, flow, and contributions to surface water: Texas Water Development Board.
- Handford, C.R., and Bassett, R.L., 1987, Permian facies sequences and evaporite depositional styles, Texas Panhandle: SEPM Special Publication.
- Irwin, J.H., and Morton, R.B., 1969, Hydrogeologic information on the Glorieta Sandstone and the Ogallala Formation in the Oklahoma Panhandle and adjoining areas as related to underground waste disposal: US Geological Survey, No. 630.
- Mace, R.E., Davidson, S.C., Angle, E.S., and Mullican, W.F., 2006, Aquifers of the Gulf coast of Texas: Texas Water Development Board, Report No. 365.