Development of Water Use Estimates and Projections in the Texas Mining and Oil and Gas Industries

TWDB Contract Agreement 2100012474
USGS Award Number G20AC00339
Progress Report 01

March 1 2021

Submitted by:

Bridget Scanlon
University of Texas, Bureau of Economic Geology
Pickle Research Campus, Bldg. 130, Univ. of Texas, 10100 Burnett Rd., Austin Texas 78758
512 471 8241 bridget.scanlon@beg.utexas.edu

Texas Mining Water Use Study
TWDB Contract Agreement 2100012474
Progress Report 01
March 1, 2021

Submitted to: Katie Dahlberg – Contract Manager, TWDB
Yun Cho – Manager, Economic and Demographic Analysis, TWDB

Submitted by: Bridget R Scanlon, - Senior Research Scientist UTBEG

Contract period: Dec 01, 2020 – Feb 28, 2021

Progress Report

I. Accomplishments to date

Task 1. Quantify current and historical water use for hydraulic fracturing and produced water volumes.

Progress:

We have applied the threshold water volume of 400,000 gallons to distinguish between conventional versus unconventional wells in the Permian Basin. Water volumes exceeding 400,000 gal is referred to as the hydraulic fracturing water volumes. We have quantified these volumes for all of the unconventional wells in the Permian Basin.

I presented at the virtual kick-off meeting on December 18, 2020.

We are coordinating with Texas Oil and Gas Association to survey oil and gas companies.

Technical Note:

Need to formalize/distinguish definitions of Conventional vs Unconventional – well completion methods vs reservoir classification.

There is a need to formally define the differences between "Conventional" and "Unconventional" oil and gas wells for the purposes of this report. The oil and gas industry generally distinguishes between these terms based on the nature of the hydrocarbon reservoir in which the well is completed, i.e. (conventional) porous media reservoirs vs (unconventional) tight or shale formations. We suggest that since this report is focused on water use that distinguishing between conventional and unconventional should rather be focused on water use as well, i.e. based on the volume of water used to complete a given well.

This approach has the advantage of accounting for many recent wells that have been completed in conventional reservoirs but that used large water volumes as compared to historical completions. There are also many wells that have been completed in unconventional reservoirs that used small water volumes. In several of our prior publications, we have used a reported water use of 400,000 gallons as a threshold value, i.e. ≤400,000 gallons defines a conventional well and >400,000 gallons defines an unconventional well. This is based on a dual mode distribution in the Permian Basin beginning in about the mid-2000's between historical conventional well development and early unconventional well development.

Task 2. Identify the sources of water for hydraulic fracturing

Progress:

Work has begun on tabulating aquifers and estimated water availability by county based on the Texas State Water Plan (SWAP) and Desired Future Conditions (DFCs).

Work has begun on tabulating wells by use and county in the Texas Submitted Drillers Reports (SDR) database required by the Texas Department of Licensing and Regulation (TDLR). This database contains information on all groundwater wells completed in Texas since about 2002. As of this analysis, the database contains approximately 550,000 groundwater wells. The TDLR database does not provide information about the producing aquifer(s) for a given well. Our efforts have thus far focused on assigning producing aquifers to wells located in the major oil and gas plays in the state, including the Permian Basin, Eagle Ford, Barnett, Haynesville-Bossier, Eagle Ford, and Permian Basin plays.

We have begun making aquifer assignments for all TDLR wells located in the plays that have Fracking Supply, Rig Supply, or Industrial intended water use purpose attributes. Aquifer assignments are being made based on the various Groundwater Availability Model (GAM) grids for the major and minor aquifers present in each region. In the Barnett, Haynesville-Bossier, and Eagle Ford plays, the elevations of the bottoms of the groundwater wells were determined by subtracting the reported well total depths from surface elevations derived from a Digital Elevation Model (DEM) of the ground surface. Elevations of the various aquifers present at a given well location were also assigned to each well based on the GAM elevations. Aquifers are being assigned to the wells based on the bottom-hole elevation relative to the GAM elevations, allowing from some depth variance (generally 50 to 100 ft). Component parts of some aquifers were combined (i.e. Upper, Middle, Lower parts of the Carrizo-Wilcox) when assigning aquifers to a well. All named aquifers present at a given well location were attached in their vertical sequence as attributes to that well.

Technical Note:

The producing aquifer assigned to each well is assumed to be the deepest named aquifer encountered. It was not practical to examine reported well screen intervals as these data are, for the most part, reported as variable and unformatted text-string attributes. While a more consistent, and usable format for well string information reporting in the database was recently created, only about 9,500 wells in the database currently report screened interval in this format. However, manual examination of several randomly sampled wells from this newer data set, while not exhaustive, generally supports the deepest aquifer assignment approach.

The bottom-hole elevation approach was also initially applied to the Permian Basin, but the results proved to be somewhat unwieldy due to the many overlapping aquifer models in the region and also the relatively large elevation changes across the region as compared to the other plays. Well-head elevations were derived from a DEM and the elevations of each aquifer present were attached to the wells as with the other plays. However, the elevations for the aquifers were then converted to depths relative to the ground surface. This made comparison of well depths with aquifer depths more straight-forward, particularly in complex areas where multiple aquifers are present.

In the Permian Basin region, in addition to the named aquifers in the GAMS, there is also the Permian strata beneath these aquifers that locally contain producible amounts of water. Many of the wells in the TDLR database extend well into the Permian and where this occurs the Permian was assigned as the aquifer.

Task 3. Develop projections of future water demand for oil and gas (2020–2080):

We are compiling data from previous projections for the Permian, Eagle Ford, Barnett and Haynesville plays. We are also evaluating the methodology used to develop these projections.

Task 4. Identify locations of operations and quantify current and projected future water use for coal and lignite mining:

We have plotted the locations of active coal and lignite mines in the state.

Task 5. Identify locations of operations and quantify current and projected future water use for aggregates:

We started to examine the TCEQ database on aggregates and began examining the data from the TCEQ database.

Task 6. Collaborate with USGS personnel on water use for the mining category:

We have started to evaluate the water use for the mining category in the USGS reports.

a. A comparison of accomplishments to the planned objectives and timeline for the progress period.

   The first deliverable is due on 11/30/2021; therefore, we are making good progress and should not have any problems meeting the deadlines for deliverables.

b. Reasons why any established goals were changed or not met. No goals were changed.

c. Additional pertinent information, including an explanation of cost overruns. NA

II. Anticipated activities and adjustments to the program during the next (6-month) progress period.

- We plan to continue the work initiated in this quarter.
- We will quantify water use for hydraulic fracturing in the major plays in the state using FracFocus and IHS databases.
- We will finalize the aquifer assignments to the rig and frac supply wells to determine the water source for hydraulic fracturing.
- We will continue to evaluate the projections of water demand for each of the major plays.
- We will work with TWDB on water use for coal and lignite mining and aggregate mining, including sand proppant mines in the Permian Basin.
- We will begin communicating with USGS on similarities and discrepancies in reporting of water use by TWDB and USGS to resolve any discrepancies.

III. List any changes to lead project personnel and provide contact information. No changes.