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

**TWDB Contract Agreement 2100012474
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Progress Report 03**

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<u>Progress Report</u>

I. **Accomplishments to date**

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

We previously finalized an analysis of historical hydraulic fracturing (HF) water use and produced water volumes. Hydraulic fracturing water use volumes were sourced from the IHS database, which includes data from the FracFocus database, and produced water volumes were sourced from the IHS database. In our time-series analysis of HF water use, we imported the FracFocus data to our dataset to supplement the IHS data where necessary, but our analysis did not specifically track instances in which the FracFocus data were used. We tabulated the IHS results for 2015 alongside those of the 2015 USGS and TWDB mining water use estimates.

The TWDB provided their analysis of 2019 HF water use based only on the FracFocus database. We compared the TWDB analysis with the IHS database volumes and found substantial agreement between the two at the play level with relatively minor differences. The total 2019 state-wide HF water use determined from our IHS analysis was 316,816 ac-ft and from the TWDB FracFocus analysis was 317,885 ac-ft, a difference of only 0.34%

In the IHS analysis of historical HF water use, we examined water use intensity values (gal/ft) and proppant loading values (lbs/gal) to identify outliers, i.e., completed wells determined to have either under- or over-reported water volumes. For these wells, we substituted water volumes based on the total horizontal lateral well lengths multiplied by the median water use intensity values for the year in which a given well was completed.

Task 2. Identify the sources of water for hydraulic fracturing

We finalized relating wells listed as Fracking Supply, Rig Supply, and Industrial water use purpose attributes to aquifers in each of the plays using the Texas Submitted Drillers Reports database by the Texas Department of Licensing and Regulation. Aquifer assignments were made based on well depths and the aquifer depths from the Groundwater Availability Model grids for both major and minor aquifers. Where wells penetrate more than one aquifer, the producing aquifer is assumed to be the deepest aquifer.

We estimated percentages of fresh or brackish water quality for HF water use for each county/aquifer area in the major oil and gas plays of Texas based on kriged maps of Total Dissolved Solids (TDS).

We examined the FracFocus database for information regarding the source and/or type of water used, specifically fresh water, brackish water, saltwater, and produced water. We found that the vast majority of well reports did not include that level of specificity and the results were not useful.

We have not yet received the requested information from the Texas Oil and Gas Association regarding sources of hydraulic fracturing water use. We have received information from only six county/GCD entities, most which were located in regions with limited or no HF water use; therefore, these results were not included in the HF water use analysis.

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

We have completed quantifying projections of future water demand for the oil and gas industry in the major plays of Texas. We finalized the approach based primarily on Total Recoverable Resources (TRR) analyses of the major oil and gas plays in Texas to estimate the total number of hydraulic fracturing wells that will be drilled in each play at maturity. Projections for each play assume a constant rate of well completions per year until all hydraulic fracturing wells are completed. Water use intensity (gal/ft of well length) values were estimated from recent historical data and were distributed across each county in a given play based on the number of hydraulically fractured wells in each county.

The analysis includes projections for counties located in the Barnett (Ft Worth Basin), the Eagle Ford, the Haynesville, and the Midland and Delaware basins of the Permian Basin.

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

We have completed quantifying current and projected water use for lignite mining operations in Texas. Lignite mining in Texas has diminished substantially over the past few years. There are now only four operating lignite mines, each associated with a co-located power plant. One of those, the South Hallsville #1 mine and the associated Pirkey power plant, is scheduled to be decommissioned in late 2023. Coal supplies for Texas plants have shifted almost entirely to out-of-state sources, located primarily in the Powder River Basin in Wyoming.

None of the remaining mines or associated power plants have announced any deactivation plans. Future water use projections for the remaining open mines were based on the expected service lifetimes of the associated power plant generators.

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

We have completed quantifying current and projected water use for the aggregate mining industry operations in Texas. We used water use data from the TCEQ database and also survey results provided by TWDB. Efforts included cross-referencing between the two datasets to identify aggregate operation water use that was only contained within one or the other dataset. Approximately half of all operations listed in the datasets did not respond to either survey. We used Google imagery to examine activity at individual sites (i.e. active or abandoned with pits full of water) and determine if there was equipment that would suggest onsite water use. If similar facilities in the area in the county reported water use, we assigned similar water use to these active sites that had greater than about 10 acres of disturbed area.

Future water use projections were made at the county level based on assumed growth (or decline) rates in direct percentage proportion to the TWDB 2022 State Water Plan county populations.

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

We compiled data on water use for the mining category from USGS reports.

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

We have submitted the required deliverables to TWDB on time. 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 will submit a draft final project report on March 15, 2022 for review by TWDB.

III.   List any changes to lead project personnel and provide contact information.

No changes.