Advanced Groundwater Solutions, LLC
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Technical Memorandum

TO: Mr. Alan Day, General Manager
Brazos Valley Groundwater Conservation District

FROM: Christopher Drabek, P.G., and James Beach, P.G.

SUBJECT: Review of Wickson Creek SUD Well 9 Simsboro Aquifer Evaluation Report

DATE: May 5, 2023

Introduction

On behalf of the Brazos Valley Groundwater Conservation District (BVGCD, District), Advanced Groundwater Solutions, LLC (AGS) has reviewed the Aquifer Evaluation Report (AER) prepared by Carollo Engineers (Carollo) in support of a permit application from Wickson Creek Special Utility District (SUD) for proposed Well 9 (Well 9) to be completed in the Simsboro Aquifer with a withdrawal amount of 1,879 acre-feet per year (ac-ft/yr). The AER was submitted to address BVGCD Rule 8.4(b)(7)(B) for wells capable of producing 800 or more acre-feet per year and discusses the potential impacts of groundwater production from the proposed well screening the Simsboro Aquifer in the north part of Brazos County.

The AER identifies Wickson Creek SUD Well 9 with a maximum pumping rate of 2,000 gallons per minute (gpm) and an annual permit allocation of 1,939 acre-feet. After additional review by BVGCD, an annual permit allocation of 1,879 ac-ft/yr was finalized. The proposed location of Well 9 is shown on Figure 1 below with the well located east of the intersection of FM 974 and FM 2776.

AGS has evaluated the hydrogeological conditions, mapping of BVGCD permitted and registered Simsboro wells within one mile of proposed Wickson Creek SUD Well 9 and the water level drawdown estimates developed using the Texas Water Development Board (TWDB) Groundwater Availability Model (GAM) presented in the submitted aquifer evaluation reports.

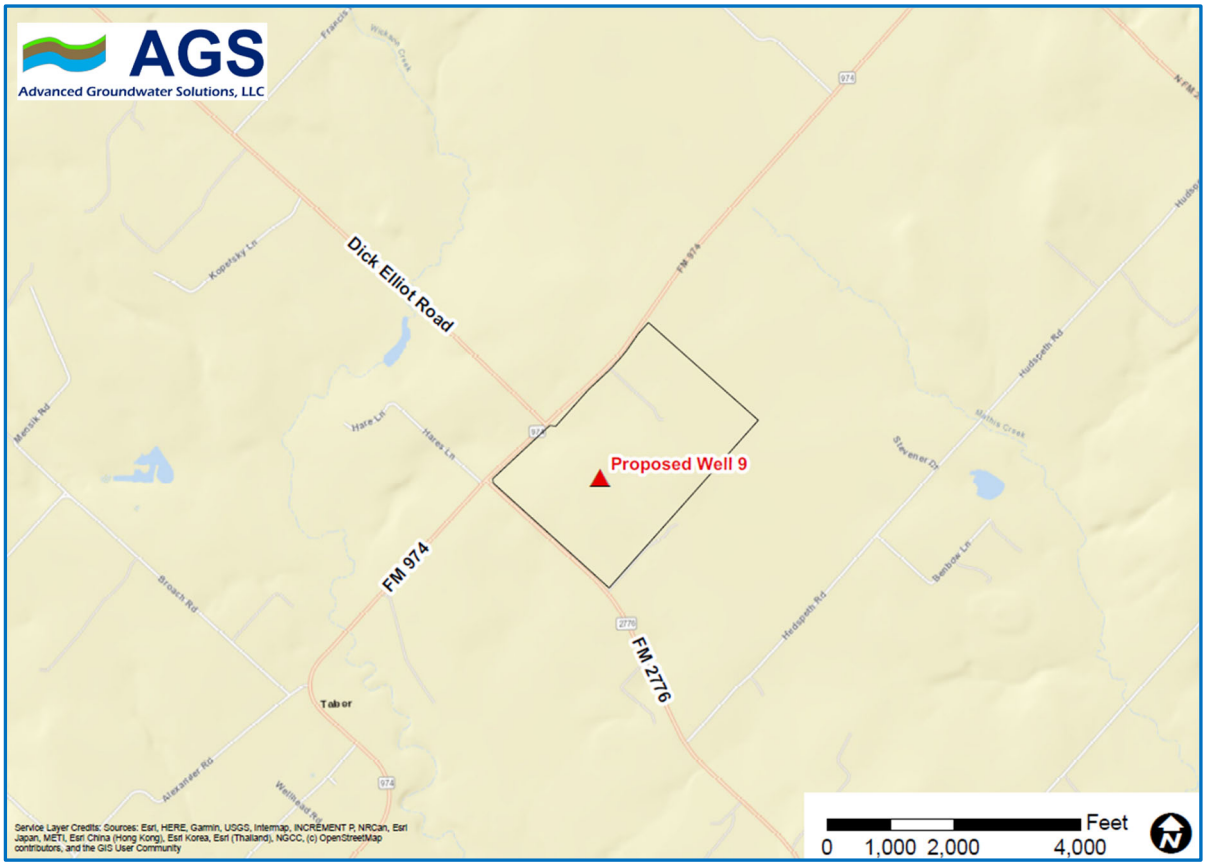


Figure 1. Well Location Map

Hydrogeologic Conditions

Rule 8.4(b)(7)(B)(1)

AGS has evaluated the hydrogeological conditions presented in the AER and generally agrees with the information presented in this section.

The AER identifies the top and bottom of the Simsboro Aquifer at proposed Well 9 to be about 2,628 and 3,005 feet below land surface (bls), respectively, or about -2,246 to -2,623 feet relative to sea level (rsl). Carollo estimates the total sand thickness of the Simsboro Aquifer at the Well 9 location to be about 380 feet. Review of local electric logs indicates that the Carollo estimated top and bottom of the Simsboro Aquifer in the vicinity of proposed Well 9 are reasonable.

Simsboro Aquifer Wells Within 1-mile of the Proposed Wells

Rule 8.4(b)(7)(B)(2)

Table 1.2 from the AER includes information on 10 wells identified within 1-mile of proposed Well 9. Wickson Creek SUD Well 8 (BVDO-0261) is the only BVGCD Simsboro permitted or registered well within 1-mile of proposed Well 9 and is located about 1,175 to 1,200 feet to the northeast of proposed Well 9. A map showing the location of proposed Well 9 and the existing

wells, including all BVGCD registered or permitted wells, within one mile of proposed Well 9 is included as Figure 1.2 in the AER.

Interference Drawdown Estimates

Rule 8.4(b)(7)(B)(3)

BVGCD Rule 8.4(b)(7)(B)(3) requires an estimate of water level drawdown caused by the well(s) pumping at the permitted rate for 1 year and 10 years at a distance of five miles from the well(s) using Version 3.02 of the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM (INTERA Incorporated and others, 2020). An estimate of the drawdown at locations of existing registered and permitted wells in the BVGCD database that are located within one mile and screen the same aquifer as the well(s) is required to be developed using an analytical tool.

Appropriate analytical models are generally used to provide estimates of pumping effects at or near the well(s) over shorter time horizons. Regional numerical models like the TWDB GAMs are generally used to account for regional variability in the aquifer such as changes in transmissivity and faulting as well as recharge, leakage between aquifers, stream-aquifer interaction, other pumping, and other factors impacting water levels. Appropriate numerical models can provide more reliable estimates of pumping effects on a more regional scale and over longer time horizons.

Groundwater Availability Model Simulation

Carollo GAM Simulations

Carollo used the TWDB Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifer GAM to estimate drawdown that results from continuously pumping the proposed well at 1,939 ac-ft/yr for 1-year and 10-years. Carollo isolated the pumping effects of proposed Well 9 by evaluating the differences in simulated water levels between the historical baseline scenario and the baseline scenario plus the proposed Well 9 pumping. AGS considers this to be a reasonable approach.

A copy of the Carollo 1-year and 10-year GAM simulated interference drawdown illustrations from the AER (Carollo Figures 1.4 and 1.5) are attached to this memorandum. Table 1.3 in the AER shows GAM simulated 1-year and 10-year drawdown estimates at Wickson Creek SUD Well 8 (BVDO-0261), which is the only BVGCD permitted and registered Simsboro well within 1-mile of the proposed well. BVGCD Rule 8.4(b)(7)(B)(3) requires 1-year and 10-year drawdown estimates for BVGCD permitted and registered wells completed in the same aquifer as the proposed well within a 5-mile radius. Wickson Creek SUD Well 1 (BVHU-0027) is the only additional Simsboro Aquifer well permitted or registered with BVGCD within 1-to5-miles of proposed Well 9 and is discussed in a subsequent section of this memorandum.

The finalized Well 9 annual permit allocation is 1,879 ac-ft/yr, which is less than the 1,939 ac-ft/yr used in the GAM simulations. The simulated pumping effects of proposed Well 9 pumping 1,879 ac-ft/yr would be slightly less than what is shown in the AER with the proposed well pumping

1,939 ac-ft/yr. AGS did not see a need to update the proposed Well 9 GAM simulation since the requested Well 9 permit allocation was decreased.

AGS GAM Verification

AGS performed GAM simulations to verify the Carollo GAM simulations and results show drawdown estimates that are consistent with results presented in the AER. AGS obtained similar drawdown estimates at Wickson Creek SUD Well 8 (BVDO-0261). Wickson Creek SUD Well 1 (BVHU-0027) is the only additional Simsboro Aquifer well permitted or registered with BVGCD within 1-to 5-miles of proposed Well 9. GAM estimated drawdown values of about 13 feet and 16 feet were simulated at Wickson Creek SUD Well 1 (BVHU-0027) after 1-year and 10-years of pumping proposed Well 9 at 1,939 ac-ft/yr.

AGS has reviewed this AER based on the hydrogeologic information available today, the information provided by the applicant, and the models and tools available at this time. New scientific or hydrogeologic information or updated models may change the findings of this review.

Analytical Model Simulation

The Carollo AER did not include an estimate of the drawdown developed with an analytical tool at locations of existing registered and permitted wells in the BVGCD database that are located within one mile and screen the same aquifer as the proposed well. It is our understanding that analytical model simulations may not have been performed in conjunction with GAM simulations in the past.

AGS estimated the drawdown at the pumping well using a Theis analytical model and estimated the drawdown at proposed Well 9 and at Wickson Creek SUD Well 8 (BVDO-0261). A transmissivity value of 46,368 gallons per day per foot (gpd/ft) and storativity value of 0.000123 from the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM Simsboro model cell corresponding to the proposed Well 9 location were used in the analytical simulation.

AGS simulated about 73 feet and 79 feet of drawdown at proposed Well 9 after pumping 1,939 ac-ft/yr for 1-year and 10-years, respectively. Resulting drawdown estimates of about 31 feet (1-year) and 37 feet (10-years) were observed at Wickson Creek SUD Well 8 (BVDO-0261). Figures 2 and 3 below show drawdown contours from the analytical model simulation.

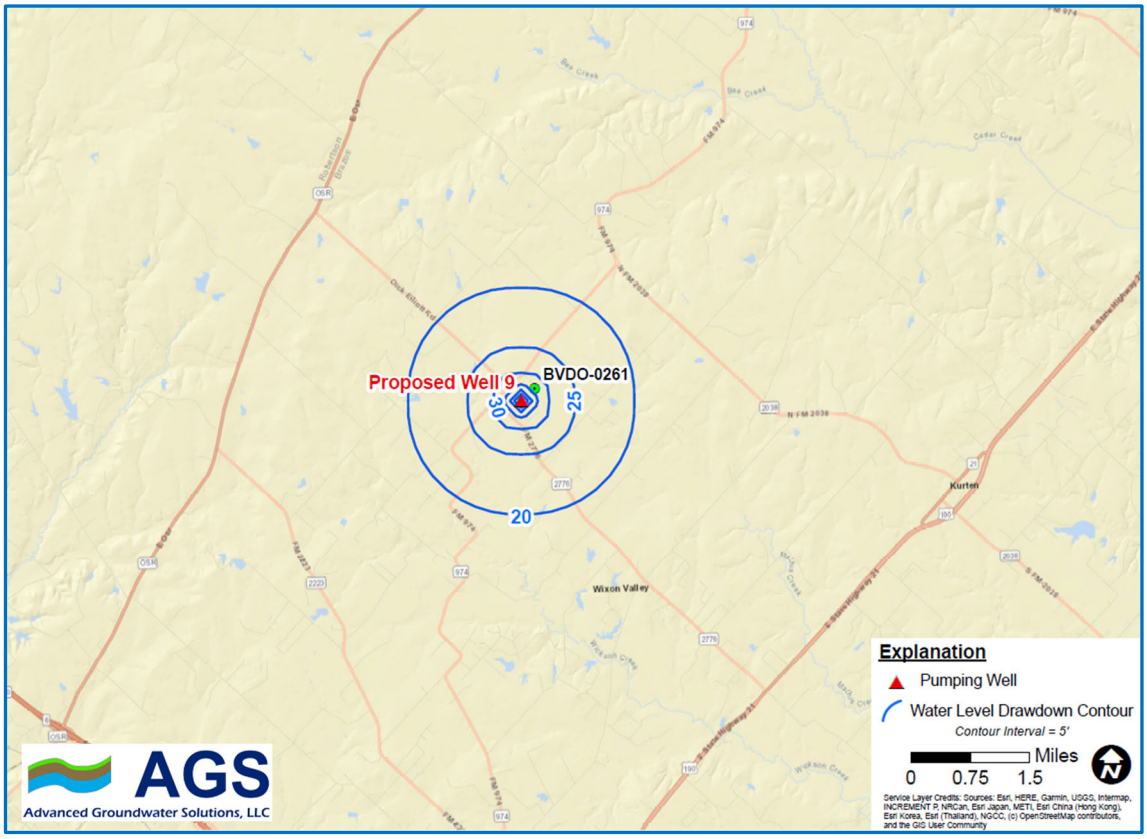


Figure 2. Analytical Simulated Drawdown Effects After Proposed Well 9 Pumping of 1,939 ac-ft/yr for 1-Year

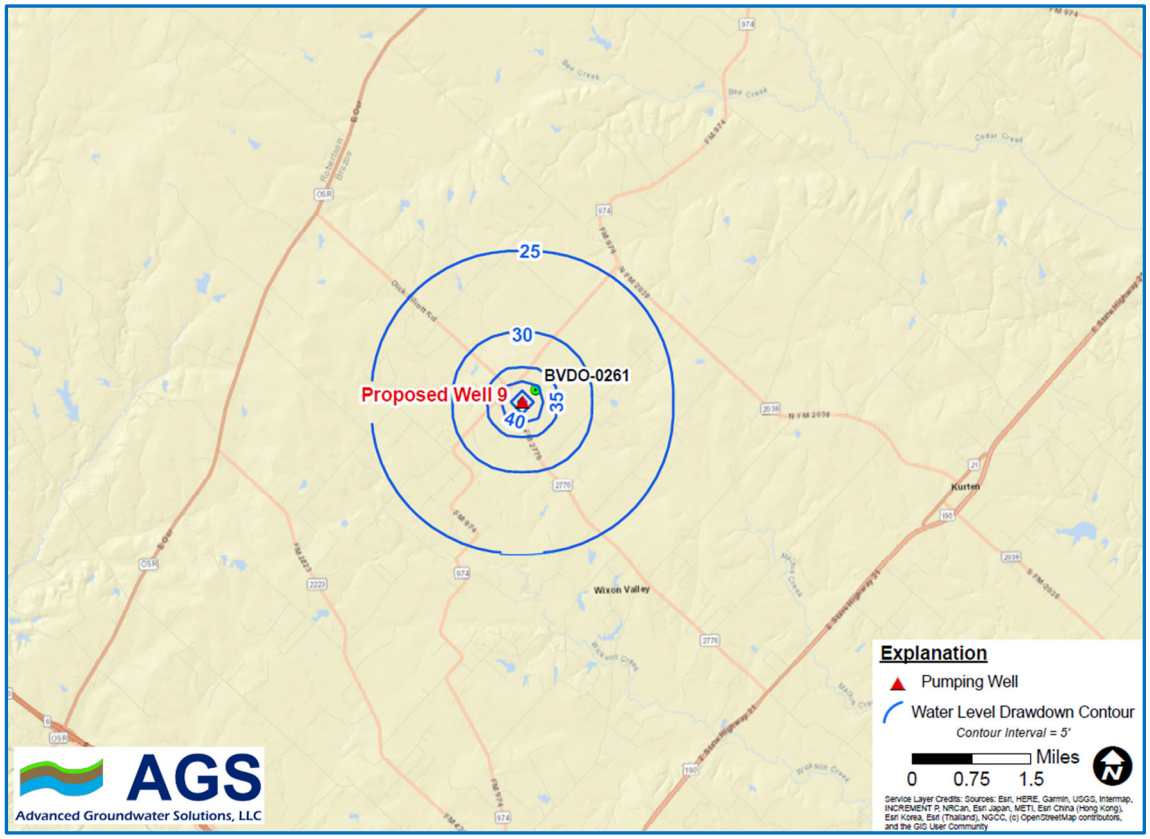


Figure 3. Analytical Simulated Drawdown Effects After Proposed Well 9 Pumping of 1,939 ac-ft/yr for 10-Years

Estimated Long-term Impacts at Proposed Well 9 Based on the GMA 12 2021 DFC Run

As a way of evaluating potential long-term estimated water level decline at the proposed Well 9, AGS plotted the simulated water level decline at the proposed well location based on the 2021 Groundwater Management Area 12 (GMA 12) Desired Future Conditions (DFC)/Modeled Available Groundwater (MAG) projections for the Simsboro Aquifer as shown in Figure 4 below. The water level projections shown in Figure 4 are from the TWDB approved DFC/MAG run known as GMA 12 "S-19", but do not include the local impacts from the proposed well, nor do they include all of the pumping from the Simsboro Aquifer that has been permitted in the area in the past year. The DFC run includes pumping estimates from the Groundwater Conservation Districts in GMA 12 as of about December 2021 that yield DFCs so that the TWDB can estimate the MAG. The detailed assumptions for the DFC simulation can be found in the GMA 12 Explanatory Report (Daniel B. Stephens & Associates and others, 2022) and documentation of the TWDB MAG run can be found in GAM Run 21-017 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 12 (Shi and Harding, 2022).

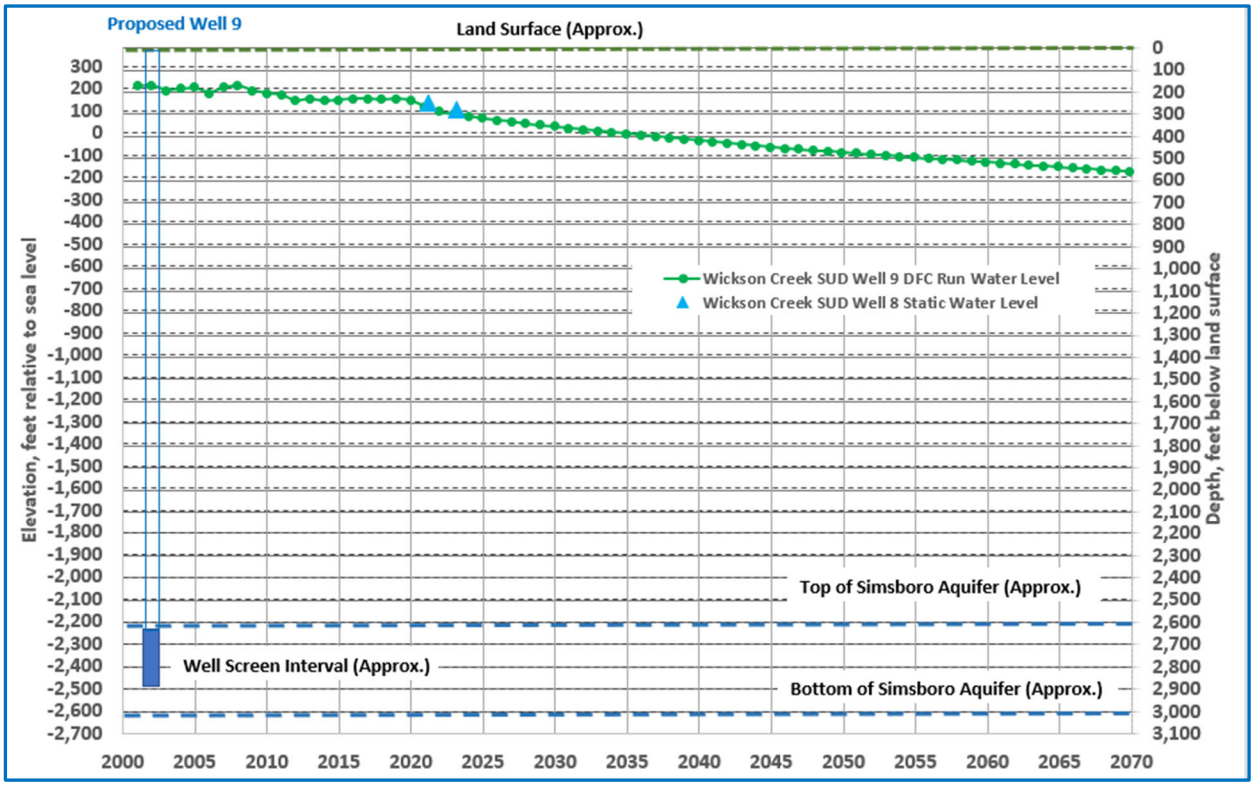


Figure 4. Projected GMA 12 2021 Planning Cycle DFC Water Level Decline at Proposed Well 9.

The graph illustrates the relationship between the land surface, estimated static water level through time, and the estimated top and bottom of the Simsboro Aquifer at the proposed Well 9 location. Static water level measurements are also shown on Figure 4 for Wickson Creek SUD Well 8 (BVDO-0261).

Available drawdown in wells in the Simsboro Aquifer will decline over time based on the DFC simulation. Although not evaluated or discussed in detail herein, these levels of water level decline in wells and artesian head decline in the aquifer will have some impact on vertical leakage, intercepted discharge, reduction in confined and unconfined storage, and potential flow directions in the aquifer.

Conclusions

The submitted AER generally addresses the requirements defined by BVGCD Rule 8.4(b)(7)(B) for wells capable of producing 800 or more acre-feet per year.

The AER did not include GAM simulated drawdown estimates for BVGCD permitted or registered Simsboro wells within a 5-mile radius of proposed Well 9. AGS estimated the 1-year and 10-year drawdown values at the one Simsboro well that is located within a 1-to-5-mile radius of proposed Well 9 as part of the GAM verification simulations. It is our understanding that analytical model

simulations may not have been performed in conjunction with GAM simulations in the past. AGS performed analytical model simulations to estimate the potential proposed Well 9 pumping effects. AGS considers these items to be worth mentioning but not overly consequential for the purposes of this report.

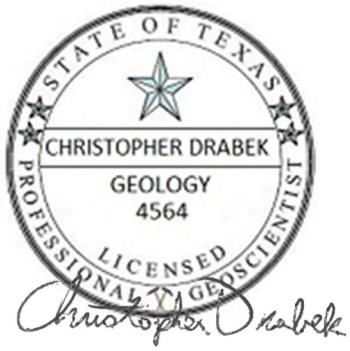
References

Daniel B. Stephens & Associates, INTERA Incorporated, and Ground Water Consultants, LLC, 2022, Desired Future Condition Explanatory Report for Groundwater Management Area 12, 859 p.

INTERA Incorporated, D.B. Stephens & Associates, and Ground Water Consultants, LLC, 2020, GMA 12 Update to the Groundwater Availability Model for the Central Portion of the Sparta, Queen City, Carrizo-Wilcox Aquifers: Update to Improve Representation of the Transmissive Properties of the Simsboro Aquifer in the Vicinity of the Vista Ridge Well Field, 30 p.

Shi, J. and Harding, J., 2022, GAM RUN 21-017 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 12, 36 p.

Geoscientist's Seal:



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by Christopher Drabek, P.G. 4564 on 5/5/2023.
Advanced Groundwater Solutions, LLC
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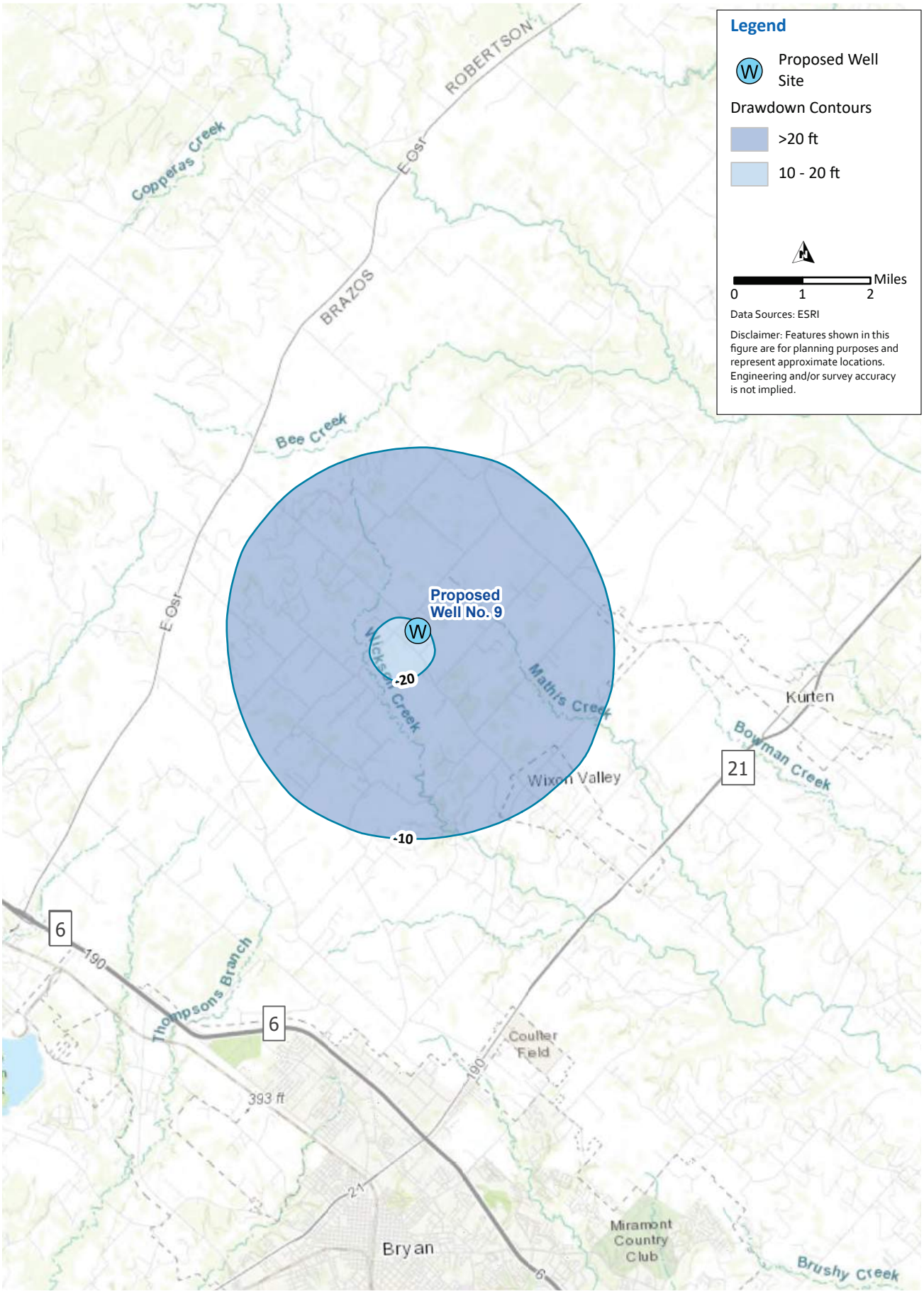

Figure 1.4 Additional Drawdown in the Simsboro Formation a ter 1 year

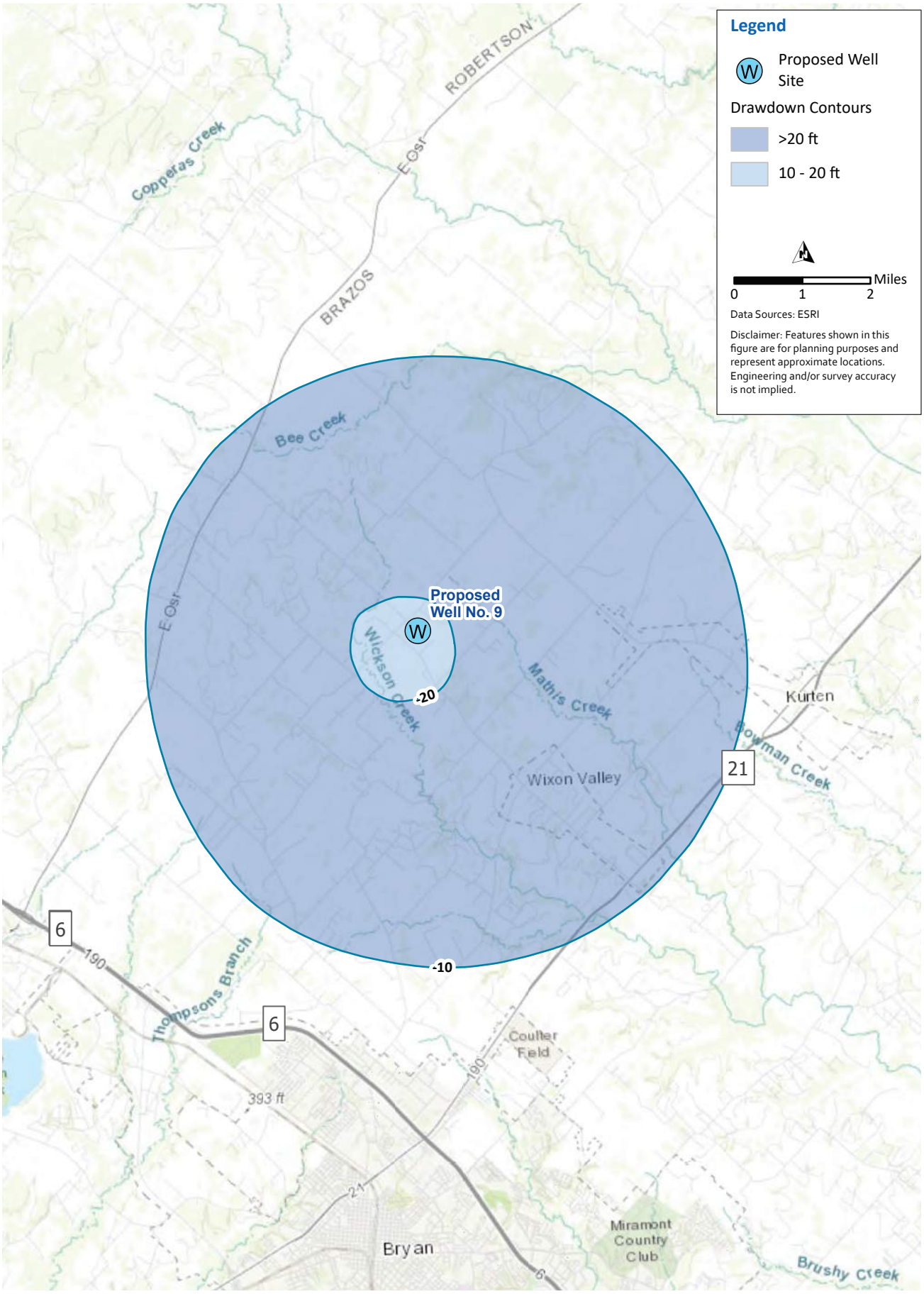

Figure 1.5 Additional Drawdown in the Simsboro Formation a ter 10 years