

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 the Robertson County Water Supply Corporation Simsboro Well Aquifer Evaluation Report

DATE: April 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 Thornhill Group, Inc. (TGI) in support of a permit application from the Robertson County Water Supply Corporation (RCWSC) for a proposed new well screening sands in the Simsboro Aquifer with a withdrawal amount of 529 acre-feet per year (ac-ft/yr). The electronic copy of the report submitted to BVGCD has 'DRAFT' in the title, yet the report is signed, dated (March 24, 2023) and sealed by TGI personnel without mention of the version being a draft in the AER text. The AER was submitted to address BVGCD Rule 8.4(b)(7)(A) for wells capable of producing over 400 acre-feet per year but less than 800 acre-feet per year and discusses the potential impacts of groundwater production by the proposed new well from the Simsboro Aquifer.

The TGI AER identifies the RCWSC well with a maximum pumping rate of 1,000 gallons per minute (gpm) and is inconsistent on the requested annual permit allocation, with a value of 524 acre-feet shown on page 1 of the report and 518 acre-feet shown on page 2. After additional review by BVGCD, an annual permit allocation of 529 ac-ft/yr was finalized. The proposed well location is shown on Figure 1 below with the well located about 0.5-mile east-southeast of the intersection of Farm-to-Market Road 46 and Farm-to-Market Road 979 in central Robertson County.

AGS has evaluated the hydrogeological conditions, mapping of BVGCD permitted and registered Simsboro wells within one mile of the proposed RCWSC well and the water level drawdown estimates developed using analytical tools presented in the submitted AER.

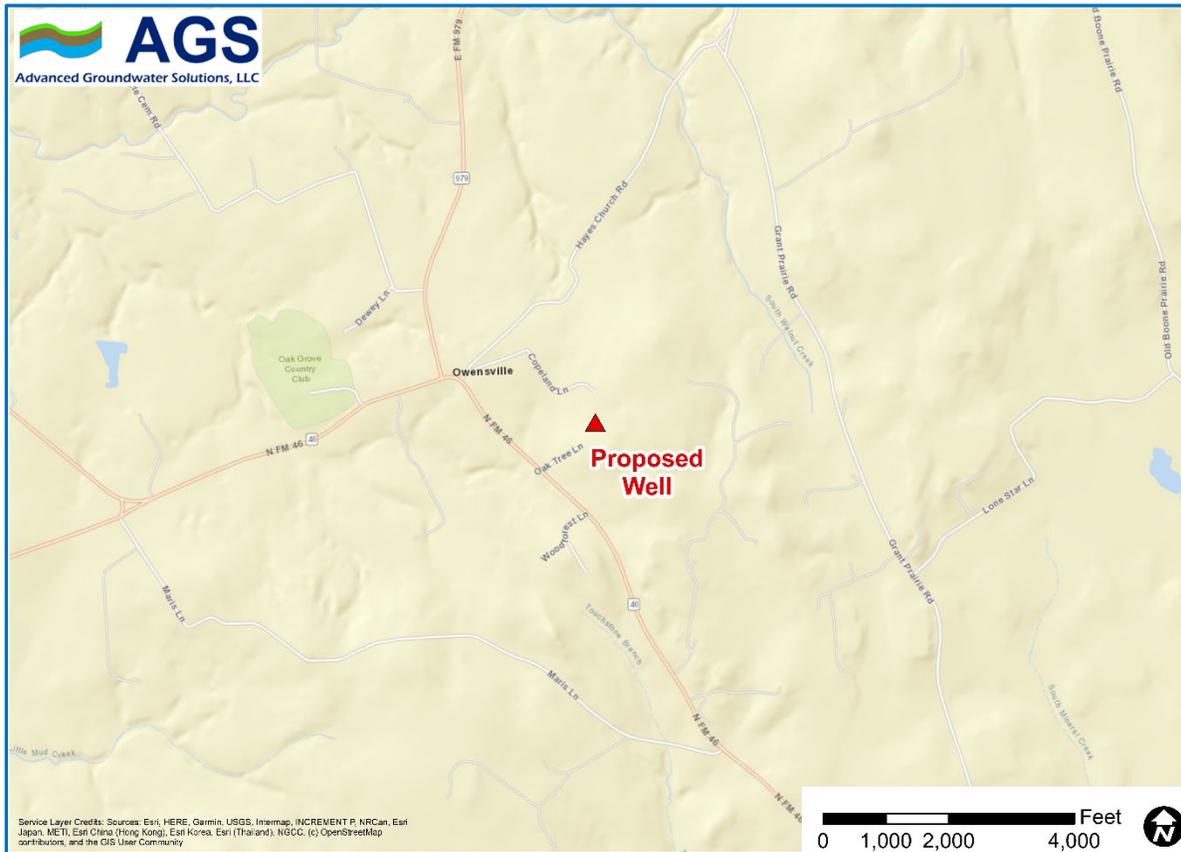


Figure 1. Well Location Map

Hydrogeologic Conditions

Rule 8.4(b)(7)(A)(1)

AGS has evaluated the hydrogeological conditions presented in the AER and generally agrees with the information presented in this section. Our comments regarding the hydrogeologic conditions at the subject property are included below.

The AER describes conflicting estimates of the top of the Simsboro formation. The AER references Texas Water Development Board (TWDB) Groundwater Availability Model (GAM) datasets and geologic maps and cross sections from the University of Texas Bureau of Economic Geology (BEG), which identify the top of the Simsboro Aquifer in the range of about -105 to -205 feet relative to sea level (rsl) across the subject property. The AER report includes the following statement: “based on geologic dip and land surface elevation, the depth to the top of the Simsboro Formation should range from 490 to 560 feet BGL (below ground level) across the subject property”. A third statement regarding the top of the Simsboro Aquifer likely ranging from approximately 650 to 750 feet below ground level near the proposed well is in agreement with top of Simsboro elevation estimates in the first estimate described in the AER. TGI estimates that the

net sand thickness of the Simsboro Aquifer ranges from 300 to 400 feet across the subject property. The proposed well screen interval was not discussed in the AER.

AGS reviewed two oil and gas geophysical logs within 3-miles of the proposed RCWSC well and estimates the depth to the top of the Simsboro Aquifer in the vicinity of the proposed well to be at a depth of about 742 feet below ground level (-200 feet, rsl) and the base of the Simsboro Aquifer at a depth of about 1,207 feet belowground level (-665 feet, rsl). Site specific information will be available once the test hole is drilled and logged for the proposed well.

TGI references two TWDB/BVGCD monitoring wells that are located near the City of Franklin and shows plots of the historical water level data on Figure 5. For clarification, Well 39-61-501 is the Twin Creek WSC New Baden Well 4R (BVHU-0022), which is located about 5.2 miles east-southeast of the proposed well location. TGI Figure 5 does not include an explanation identifying the wells on the figure and Twin Creek WSC New Baden Well 4R is the well that is shown with the longest water level history. Twin Creek WSC New Baden Well 4R was constructed in 2017 and screens a similar depth interval of the well it replaced, therefore the historical water level measurements were continued in the replacement well. Well 39-61-705 discussed in the TGI AER is the City of Franklin Well 3 (BVGO-0028) and is located about 3.4 miles south-southeast of the proposed RCWSC well. This well has the shorter water level history as shown on Figure 5 of the TGI report.

Simsboro Aquifer Wells Within 1-mile of the Proposed Wells

Rule 8.4(b)(7)(A)(2)

AGS has confirmed that there are no BVGCD permitted or registered wells completed in the Simsboro Aquifer within 1-mile of the proposed RCWSC well. Since there are no BVGCD permitted or registered wells within 1-mile of the proposed RCWSC well, the table described in BVGCD Rule 8.4(b)(7)(A)(4) is not required.

Interference Drawdown Estimates

Rule 8.4(b)(7)(A)(3)

BVGCD Rule 8.4(b)(7)(A)(3) requires an estimate of water level drawdown caused by the well pumping at the permitted rate for 1 year and 10 years at a distance of up to five miles from the well. The estimate can be developed using the Theis equation and aquifer transmissivity and storage parameters from the most recent TWDB approved of the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM (Version 3.02, INTERA Incorporated and others, 2020).

TGI used an analytical model based on the Theis non-equilibrium equation to estimate theoretical potentiometric head declines at and surrounding the proposed well. A transmissivity value of 40,000 gallons per day per foot (gpd/ft) and storage coefficient of 0.005 were simulated at the proposed well location to estimate drawdown after 1 and 10 years of pumping. A copy of the TGI 1-year and 10-year analytical simulated interference drawdown illustrations from the AER (TGI

Figures 6 and 7) are attached to this memorandum. TGI did not reference the well pumping rate used in the analytical modeling simulations and AGS was unable to replicate the TGI simulation results based on the information provided in the AER.

AGS performed analytical simulations using a Theis analytical model with a production rate derived from the requested allocation of 529 ac-ft/ year (328 gpm), a transmissivity of 40,000 gpd/ft and storage value of 0.0002 from the Central Portion of the Sparta, Queen City and Carrizo-Wilcox Aquifers GAM. The AGS simulations estimate less drawdown for the proposed well than shown in the TGI AER. TGI estimates that 59 feet of drawdown would occur at the proposed well after 1 year of pumping and 66 feet of drawdown after 10 years of pumping. The AGS simulations estimate about 22 of drawdown (at 1-foot from the proposed well) would result after pumping the proposed well for 1-year at a continuous pumping rate of 328 gpm and about 25 feet of drawdown (at 1-foot from the proposed well) would result after pumping the proposed well for 10-years at a continuous pumping rate of 328 gpm.

Figures 2 and 3 show the estimated AGS analytical modeling drawdown contours that result from pumping 529 ac-ft/yr for 1-year and 10-years, respectively. Simulated drawdown values in wells screening the Simsboro Aquifer within 1 to 5 miles of the proposed well are estimated to be less than 10 feet after pumping the proposed well at 529 ac-ft/yr for 1 year and 10 years.

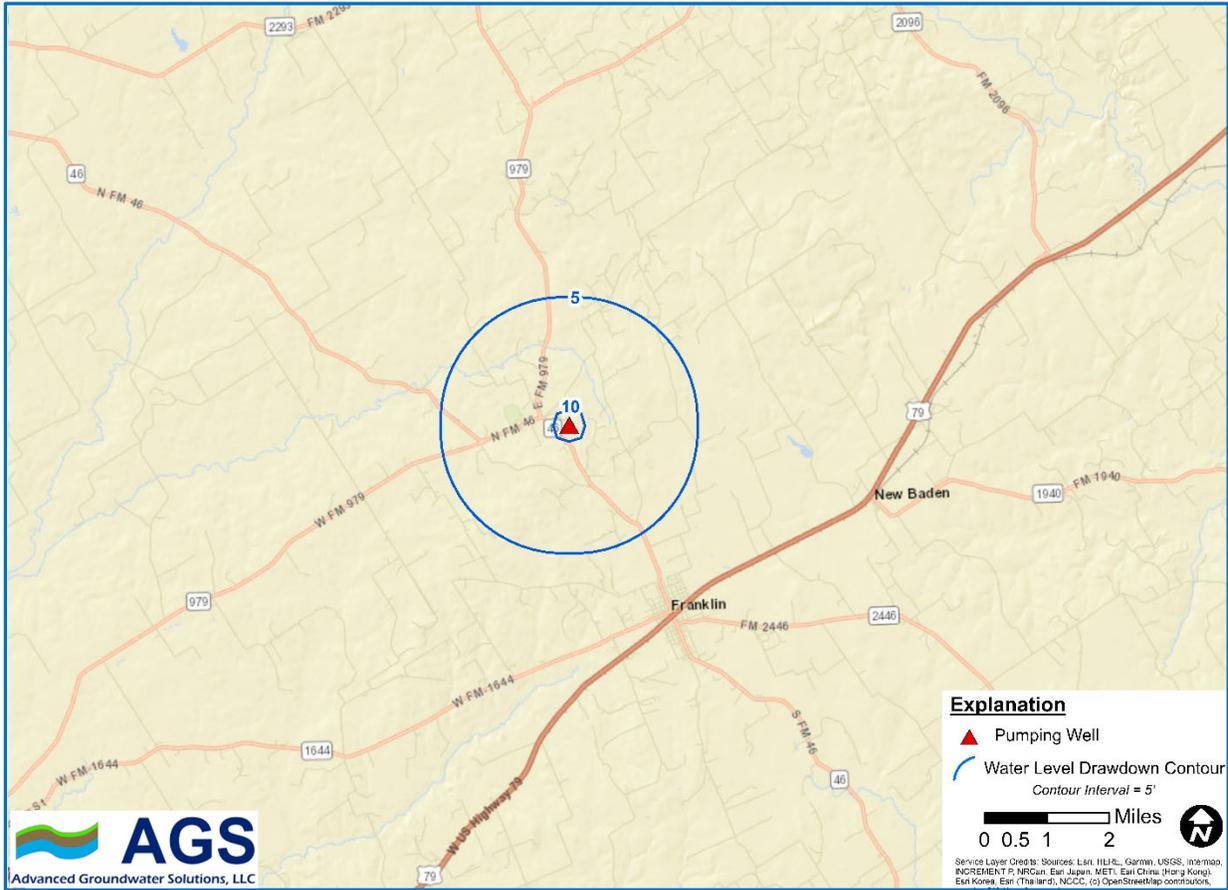


Figure 2. Analytical Simulated Drawdown Effects After Proposed Robertson County WSC Well Pumping of 529 ac-ft/yr for 1-Year

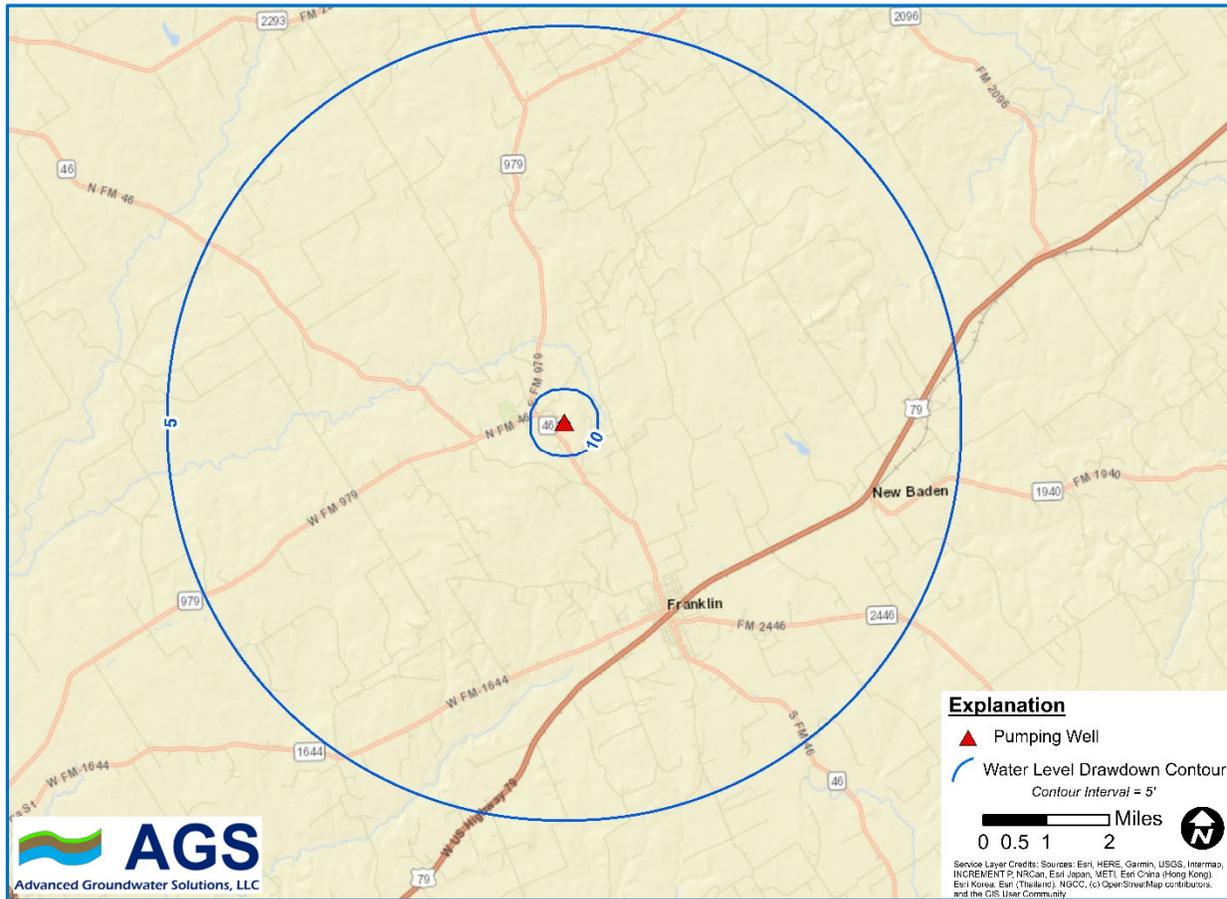


Figure 3. Analytical Simulated Drawdown Effects After Proposed Robertson County WSC Well Pumping of 529 ac-ft/yr for 10-Years

Estimated Long-term Impacts at the Proposed Robertson County WSC Well based on the GMA 12 2021 DFC Run

As a way of evaluating potential long-term estimated water level decline at the proposed RCWSC well, AGS plotted the simulated water level decline at the well location based on the 2021 Groundwater Management Area 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 RCWSC well, nor do they include all of the pumping from the Simsboro Aquifer that has been permitted in Robertson County 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).

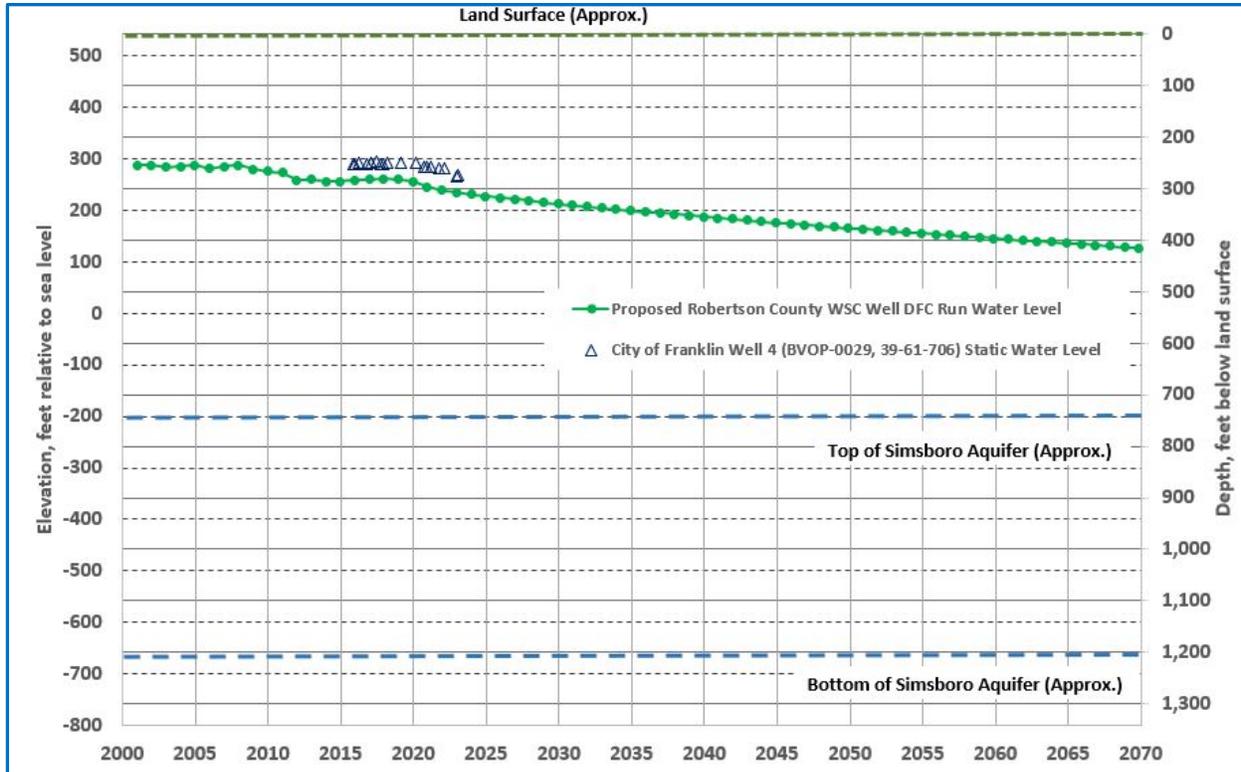


Figure 4. Projected GMA 12 2021 Planning Cycle DFC Water Level Decline at the Proposed Robertson County WSC Well

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 location of the proposed RCWSC well. Historical static water level measurements are also shown on Figure 4 for the City of Franklin Well 4 (BVOP-0029, State Well Number 39-61-706), which is located about 3 miles to the south-southeast of the proposed RCWSC well and screen sands of the Simsboro Aquifer in the depth interval of about 1,093 to 1,214 feet below land surface or approximately -644 to -765 feet rsl.

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)(A) for wells capable of producing over 400 acre-feet per year but less than 800 acre-feet per year.

The TGI AER did not include the pumping rate used in the AER analytical simulations. AGS could not replicate the model simulations with the information included in the TGI AER and performed analytical model simulations based on a pumping allocation of 529 ac-ft/yr for 1 year and 10 years. The TGI analytical modeling simulations appear to overestimate the pumping effects from the proposed RCWSC well.

AGS considers these differences to be worth mentioning but do not change our conclusions based on review of the 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.

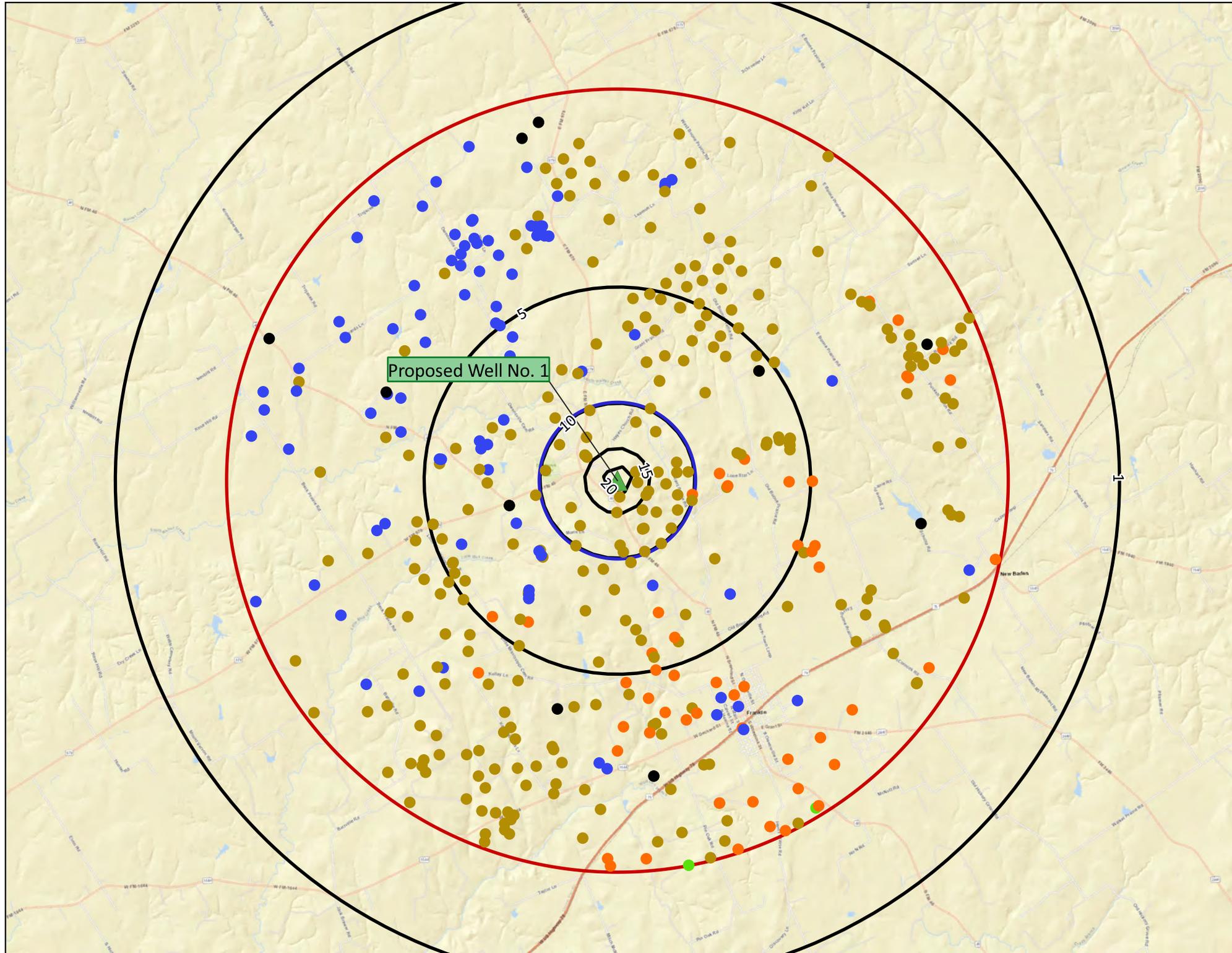
INTERA Incorporated, D.B. Stephens & Associates, and Ground Water Consultants, LLC, 2020, GMA 12 Update to the Groundwater Availability Model for the Central Portion of the Sparta, Queen City, Carrizo-Wilcox Aquifers: Update to Improve Representation of the Transmissive Properties of the Simsboro Aquifer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



The seal appearing on this document was authorized by Christopher Drabek, P.G. 4564 on 4/5/2023.
Advanced Groundwater Solutions, LLC
TBPB Firm Registration No. 50639



Explanation

- ▲ Proposed Well
- BVGCD Registered or Permitted Well Within 5 Miles of Proposed Well by Aquifer
- Queen City
- Carrizo
- Calvert Bluff
- Simsboro
- Unknown
- 1 Mile Radius
- 5 Mile Radius
- 1 Year Simulated Drawdown Contour Interval = 5 Feet

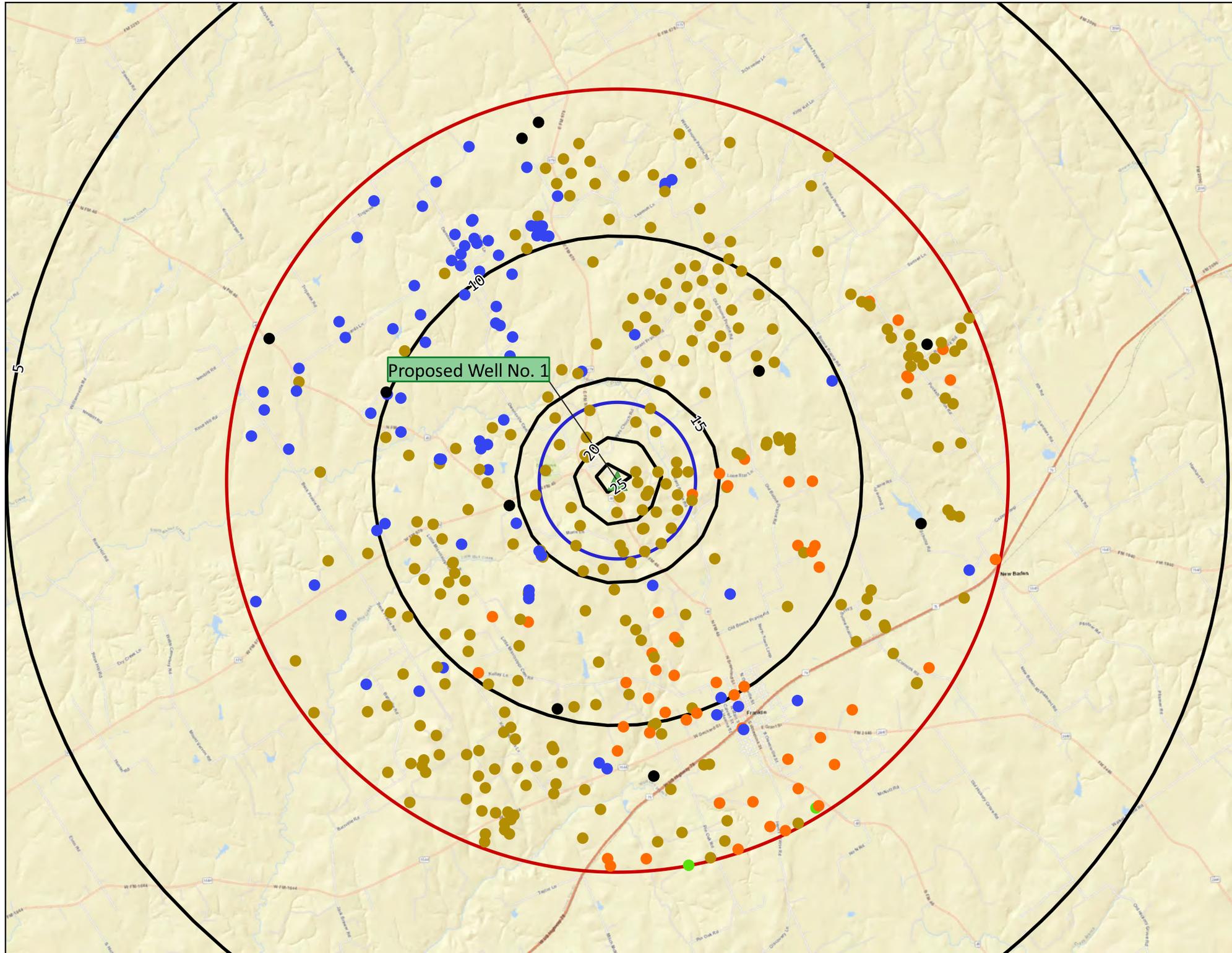
Analytical model was used to simulate drawdown using the Theis equation. Transmissivity = 40,000 gpd/ft, Storage = 0.005, Time = 1 year.



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Figure 6 - Theis - Simulated Drawdown After 1 Year





Explanation

- ▲ Proposed Well
- BVGCD Registered or Permitted Well Within 5 Miles of Proposed Well by Aquifer
- Queen City
- Carrizo
- Calvert Bluff
- Simsboro
- Unknown
- 1 Mile Radius
- 5 Mile Radius
- 10 Year Simulated Drawdown Contour Interval = 5 Feet

Analytical model was used to simulate drawdown using the Theis equation. Transmissivity = 40,000 gpd/ft, Storage = 0.005, Time = 10 year.



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Figure 7 - Theis - Simulated Drawdown After 10 Year