DOCKET NO. 51802

APPLICATION OF SOUTHWESTERN PUBLIC SERVICE COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**PUBLIC UTILITY COMMISSION OF TEXAS**

UPDATE TESTIMONY
of
RICHARD L. BELT

on behalf of

SOUTHWESTERN PUBLIC SERVICE COMPANY

(*Filename:* BeltRRUpdate.docx; *Total Pages:* 70)

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GLOSSARY OF ACRONYMS AND DEFINED TERMS

<u>**Acronym/Defined Term**</u>	<u>**Meaning**</u>
SPS	Southwestern Public Service Company, a New Mexico corporation
Tolk	Tolk Generating Station
WSP	WSP USA

LIST OF ATTACHMENTS

Attachment	**Description**
RLB-RR-U1	2020 Groundwater Modeling Results for Tolk Station Wellfield by WSP, dated December 2020 (*Filename*: RLB-RR-U1.pdf)

UPDATE TESTIMONY
OF
RICHARD L. BELT

I. WITNESS IDENTIFICATION

Q. Please state your name and business address.

A. My name is Richard L. Belt. My business address is 1800 Larimer Street, Denver, Colorado, 80202.

By whom are you employed and in what position?

A. I am employed by Xcel Energy Services Inc. as Director of the Chemistry and Water Resources group within the Environmental Services Department of Energy Supply, which is the generation operation and maintenance business unit of Xcel Energy Inc.

Q. On whose behalf are you testifying in this proceeding?

A. I am filing testimony on behalf of Southwestern Public Service Company, a New Mexico corporation ("SPS").

Q. Are you the same Richard L. Belt who filed direct testimony on behalf of SPS in this docket?

A. Yes.

II. <u>PURPOSE OF UPDATE TESTIMONY</u>

Q. Why are you filing update testimony?

A. One of the attachments to my direct testimony was a 2019 report describing the studies that WSP USA ("WSP") had undertaken to determine how much economically recoverable groundwater is available to operate the Tolk Generating Station ("Tolk"). At the time I filed my direct testimony, the 2019 report was the most recent WSP report available. Since that time, however, WSP has published its 2020 report. I am providing this update testimony to ensure that parties have access to the 2020 report.

Q. Does the 2020 WSP report require any changes to the recommendations in your direct testimony?

A. No. Based on the 2019 WSP study and other studies, I concluded in direct testimony that the economically recoverable groundwater available to operate Tolk is declining year-over-year, and that those groundwater levels will not allow SPS to continue operating Tolk as it has been operated in the past. Accordingly, I estimated that the Tolk generating units will have adequate groundwater to run until 2032 only under the seasonal operating scenario in which the units are economically dispatched during peak months. Under an alternative scenario in which the Tolk units were economically dispatched year-round, I estimated that the economically recoverable groundwater would be depleted by 2026.

The 2020 WSP report confirms that the economically recoverable groundwater available to operate Tolk is declining year-over-year, and that only seasonal economic dispatch will allow the generating units to continue operating until 2032. Thus, the 2020 WSP report validates SPS's decision to change the way it operates Tolk in order to extend the service lives of the Tolk generating units until 2032.

Q. Does this conclude your pre-filed update testimony?

A. Yes.

AFFIDAVIT

STATE OF COLORADO)
)
COUNTY OF LARIMER)

RICHARD L. BELT, first being sworn on her oath, states:

I am the witness identified in the preceding testimony. I have read the testimony and am familiar with the contents. Based upon my personal knowledge, the facts stated in the testimony are true. In addition, in my judgment and based upon my professional experience, the opinions and conclusions stated in the testimony are true, valid, and accurate.

RICHARD L. BELT

Subscribed and sworn to before me this 23rd day of March 2021 by RICHARD L. BELT.

BROCK WICKETT
Notary Public
State of Colorado
Notary ID # 20194004514
My Commission Expires 02-05-2023

Notary Public, State of Colorado

My Commission Expires: 02-05-2023

CERTIFICATE OF SERVICE

I certify that on the 25th day of March 2021, notice of the filing of the foregoing update testimony with the PUCT was served on all parties of record by electronic service and was posted to SPS's file sharing platform.

/s/ Jeremiah W. Cunningham

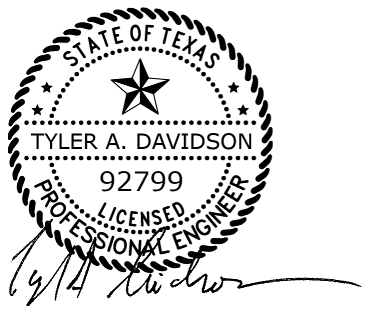
December 2020

2020 Groundwater Modeling Results

prepared for
Xcel Energy

prepared by
WSP USA
1101 S Capital of Texas Highway, Suite B220
Austin, Texas 78746

Professional Seal



2021-02-12

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1. Executive Summary

The groundwater flow model for the Xcel Energy (Xcel) water rights area (XWRA) for Tolk Station and Plant X in Lamb County, Texas was updated using the 2020 future production demand values. The model uses the MODFLOW-NWT modified code developed for the High Plains Aquifer System (HPAS) groundwater availability model (GAM) (Deeds and others, 2015), which allows for pumping to be constrained in gridblocks when the saturated thickness decreases to a preset value provided to the model. Two predictive scenario runs were performed: one used the typical demand production which is consistent with scenarios from previous years, and the other used the optimized demand production. Both scenarios used a saturated thickness level of 40 feet as the pumping reduction limit. The results from the predictive runs indicate that Xcel will likely have challenges meeting the average annual groundwater demands throughout both the scenarios.

The "typical demand" scenario produces more groundwater now and less later and the "optimized demand" scenario produces less groundwater overall but at a steadier rate (less production capacity loss through time). The annual Xcel production for each scenario is summarized in Table 1.

As with all models, the updated Xcel model and modeling approach has limitations. Generally, these limitations can be categorized into limits related to (1) supporting data, and (2) the modeling approach, implementation, and applicability. The primary limitations in supporting data for the model include limited water level targets both spatially and temporally, limited hydraulic conductivity and specific yield data, uncertain estimates of pumping by irrigators located close to the XWRA boundary, uncertain estimates of well capacity as water levels decline, and uncertainty about future wellfield operation practices. The limitations regarding the modeling approach include a larger mean error near the end of the historical pumping period than the mean error for the overall model, uncertainty with respect to total irrigation pumping in areas near the XWRA boundary, uncertainty regarding the assumptions of pumping curtailment at each well, and the limitations with respect to optimization imposed by these uncertainties.

2. Groundwater Model Updates and Revisions

2.1. Pumping Updates and Predictive Pumping Estimates

The groundwater model was updated to include estimated 2020 rates by copying over the rates from 2019 (monthly pumping rates were not provided this year). Figure 2-1 provides a schematic overview of the process in which total monthly production data from Xcel water rights area (red block) is broken down between the two major regions within the XWRA, Tolk (blue block) and Plant X (green block), then by section within those regions East, West, and Potable Tolk (light purple blocks) and North and South Plant X (dark purple blocks), and finally by individual wells (orange circles). Well pumping distribution process takes place by first determining the percent contribution to each region. Historical pumping usage in XWRA is about 80% production from

Tolk region and 20% from the Plant X region. To determine the sectional contribution to each region the 2015 monthly section pumping information is used to calculate the percent monthly contribution to each region. Looking at Figure 2-1 at the Plant X region to section we see a 100% contribution from the South Plant X and 0% from the North Plant X because in 2015 XWRA did not pump any water from North Plant X for that month. With the sectional contribution determined the individual well contributions come next. The individual well percent contributions are calculated as the total pumping test rates for the section divided by the individual wells pump test rate based on 2015 data. To perform the predictive scenario runs future pumping rates must be predicted. The approach used in last years report (WSP USA, 2019) was used again this year. In which this years estimated pumping rates (2020) were reused for each predictive year. This methodproduces the monthly high and low production periods, while also not over exaggerating the high and low productions periods Previous model assumptions remain the same as last years report and are detailed below.

The first assumption is that potential future wells (designated “P” wells) will be added to the eastern section of the Xcel property at one per year starting in 2021. These “P” wells will have a constant pumping rate set to the 1^{st} quartile pumping value of all Xcel wells for each month. Due to the addition of the nine new wells within the eastern section of Xcel property, many of the potential future wells were removed at or near the new well locations that were present in last years run. The next assumption is the horizontal well (“H” wells), which is represented by four vertical wells in the model, begins at the start of 2017 and each well is held constant at a pumping rate of 322 acre-feet per year (200 gallons per minute or gpm) or a total of 1,290 acre-feet per year (800 gpm). The third assumptionis any new wells will begin pumping on the year they were installed.Once all future pumping is set, there are a series of corrections and assumptions that are performed to insure pumping is the same as the total supply demand. The first assumption is that any well producing less than 45 gpm in the future will be turned off, or set to zero in the model well file. Any well after the final corrections or during the model run that are less than 45 gpm will still be active during the model run. The second correction is that the total pumping per year must equal the desired supply. In order to do this the total pumping is calculated per year during the predictive pumping portion and compared to the desired pumping, per scenario run, and a percent reduction or increase value is calculated. That percent value is then multiplied by all wells during that year to change the pumping to the correct amount. One assumption made during this process is that the horizontal wells will always produce at the constant rate of 1,290 acre-feet per year (800 gpm). Therefore, that amount is subtracted from the total estimated predictive pumping before the percent change is calculated. It is assumed that the horizontal well will not have the same issues as the vertical wells, and should be able to maintain its pumping rate through time.

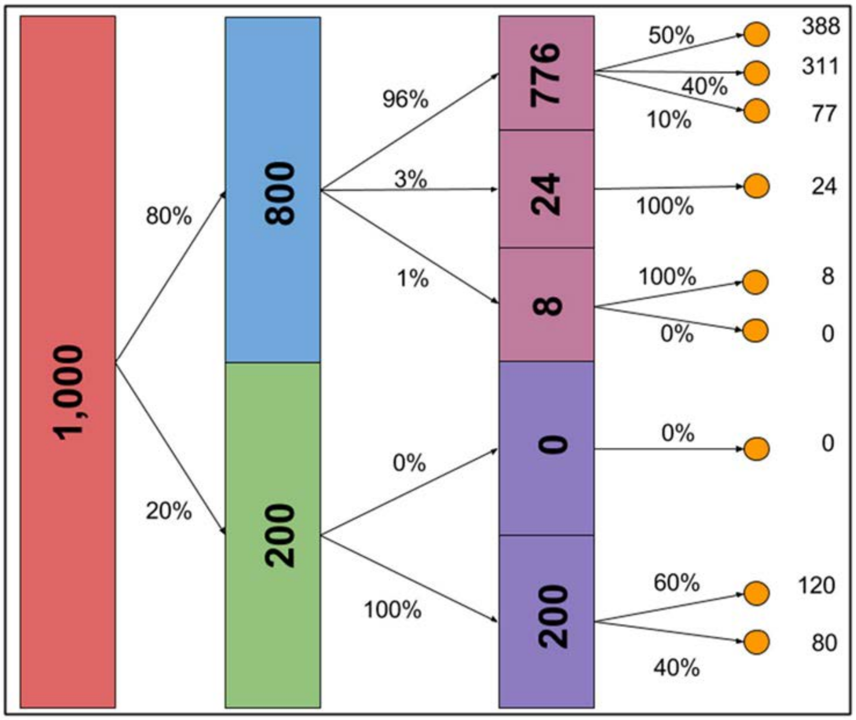


Figure 2-1. Schematic of pumping distribution, values do not represent actual pumping or distributions

Table 1. Xcel Pumping Demand for Typical and Optimized Scenarios

Year	Optimized Demand (Scenario 1) (AFY)	Typical Demand (Scenario 2) (AFY)
2020	11,100	13,100
2021	8,150	13,000
2022	8,150	13,000
2023	8,150	13,000
2024	8,150	13,000
2025	8,000	13,000
2026	7,600	12,500
2027	7,600	12,500
2028	7,600	12,500
2029	6,400	11,500
2030	6,000	11,000
2031	6,000	11,000
2032	6,000	11,000

2.2. Groundwater Flow Models

The code used to simulate groundwater flow was MODFLOW-NWT (Niswonger et al., 2011) as modified for the HPAS GAM. The modification allows for pumping in a gridblock to automatically be reduced when saturated thickness reaches a preset value in that gridblock. The saturated thickness cutback threshold is set globally for the entire model. As the simulation progresses, the saturated thickness in each gridblock is calculated at each time step and if the saturated thickness is below the cutback threshold, the pumping is reduced for a well in that gridblock as shown in Figure 2-2 (the values shown in the schematic are for illustrative purposes only). The modification was performed so that the entire model had the same saturated thickness cutoff value for pump curtailment, while the original MODFLOW-NWT could have variable saturated thickness cutoffs due to different aquifer thicknesses throughout the model (Deeds et al., 2015).

As with the previous Xcel model updates, the global saturated thickness threshold is set at 40 feet. The 40-foot threshold represents the saturated thickness at which large production wells may begin having challenges in maintaining their previous production capacity, irrespective of pumping equipment upgrades. The reduced saturated thickness typically results in lower specific capacity, and the combination of lower head and lower specific capacity is responsible for the decline in the well capacity. The model attempts to adjust for this change by reducing the pumping towards zero as the saturated thickness approaches zero, which is consistent with the observation that wells do not produce at their initial rates as water levels get lower. While the 40-foot threshold is a fixed value in the model where well production is decreased, that value likely varies from well to well in in the aquifer due to site-specific geology, well construction, pump characteristics, and other factors. The 40-foot threshold should be viewed as conservative average estimate as to when well production loss would begin to occur.

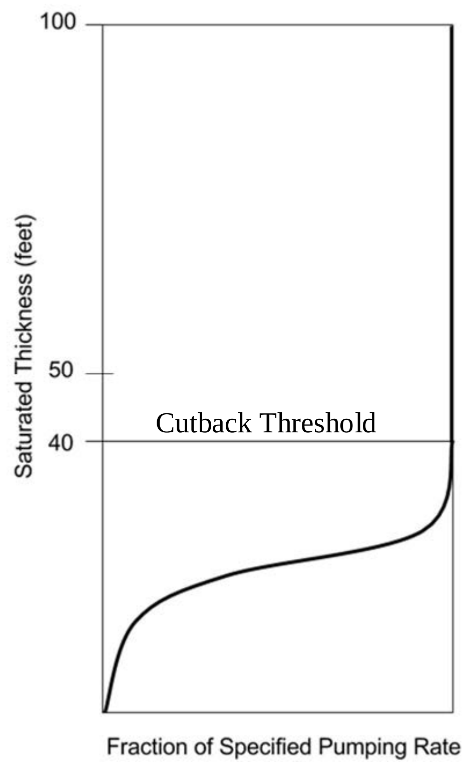


Figure 2-2. Schematic of how MODFLOW-NWT reduces pumping when water level in a gridblock drops below the cutback threshold in the modified HPAS GAM version of the code. Modified from Niswonger et al., 2011.

2.3. General Model Assumptions

As with any groundwater model, there are many assumptions and generalizations regarding aquifer characteristics that must be made to predict the future conditions of the aquifer. Predictive pumping rates must be estimated, and are based on historical use with correction factors to equal future demands in the predictive scenarios. Adding wells to the eastern portion of XWRA through time is also a major assumption in the model, as the future well locations and pumping rates are all estimated. Another key generalization is that pumping is held at a continuous rate for the entire monthly stress period. The model does not simulate the pumping cycles but rather assumes a constant production during the month. Lastly, the horizontal well is modeled as four individual vertical wells. This does a good job approximating the effects of pumping in the horizontal well over time and at the scale of the model, although the actual near-wellbore hydraulics of the horizontal well are different in some respects from vertical wells.

3. Results of Model Scenarios

Two pumping scenarios were simulated with the model in this update. Both scenarios use the same 40-foot pumping reduction threshold and the only difference in the scenarios is the pumping demand. Scenario 1 (Optimized Demand) has an overall reduction in pumping demand as compared to the Typical Demand scenario, as shown in Table 1. Scenario 2 (Typical Demand) used the typical production demand in XWRA, which is more consistent with the historical demands.

3.1. Groundwater Flow Model with 40 feet Saturated Thickness Cutoff

3.1.1 Scenario Modeled Supply Results

The optimized demand scenario production results are presented in Figure 3-1. The first curve (leftmost) is the desired production per month, or the amount that was requested from Xcel wells in the model to meet Xcel's future demand. The second curve (middle) is the amount of supply from the aquifer as simulated by the model. The middle curve is the pumping rate the model simulated based on the model's saturated thickness constraint and automatic curtailment of pumping as water levels drop.

The rightmost curve on Figure 3-1 shows the difference between the modeled supply from the aquifer and the requested demand. This curve illustrates the simulated shortfall from Xcel's wellfields on a monthly basis and indicates shortages throughout the year. Based on the simulated shortfall, Xcel's wellfields may begin to have challenges meeting peak demands in summer starting in 2020 and increase at a steady rate through to the end of the predictive period.

In Scenario 2 (typical demand) predicted production deficits begin around the same time (summer 2020), but show a much steeper increase in shortfall relative to the optimized demand scenario starting in 2021 (Figure 3-2). As stated previously, the typical demand scenario uses the same model and assumptions as the optimized demand scenario except that the production values are higher. Therefore, the results are directly comparable. As expected, the simulated production deficit is much greater in the typical demand scenario and begins earlier because the higher production causes the water levels to fall to the cutback threshold faster, which causes the pumping reduction to begin earlier. Figure 3-3 allows comparison of the demand-modeled supply difference curves from both model scenarios.

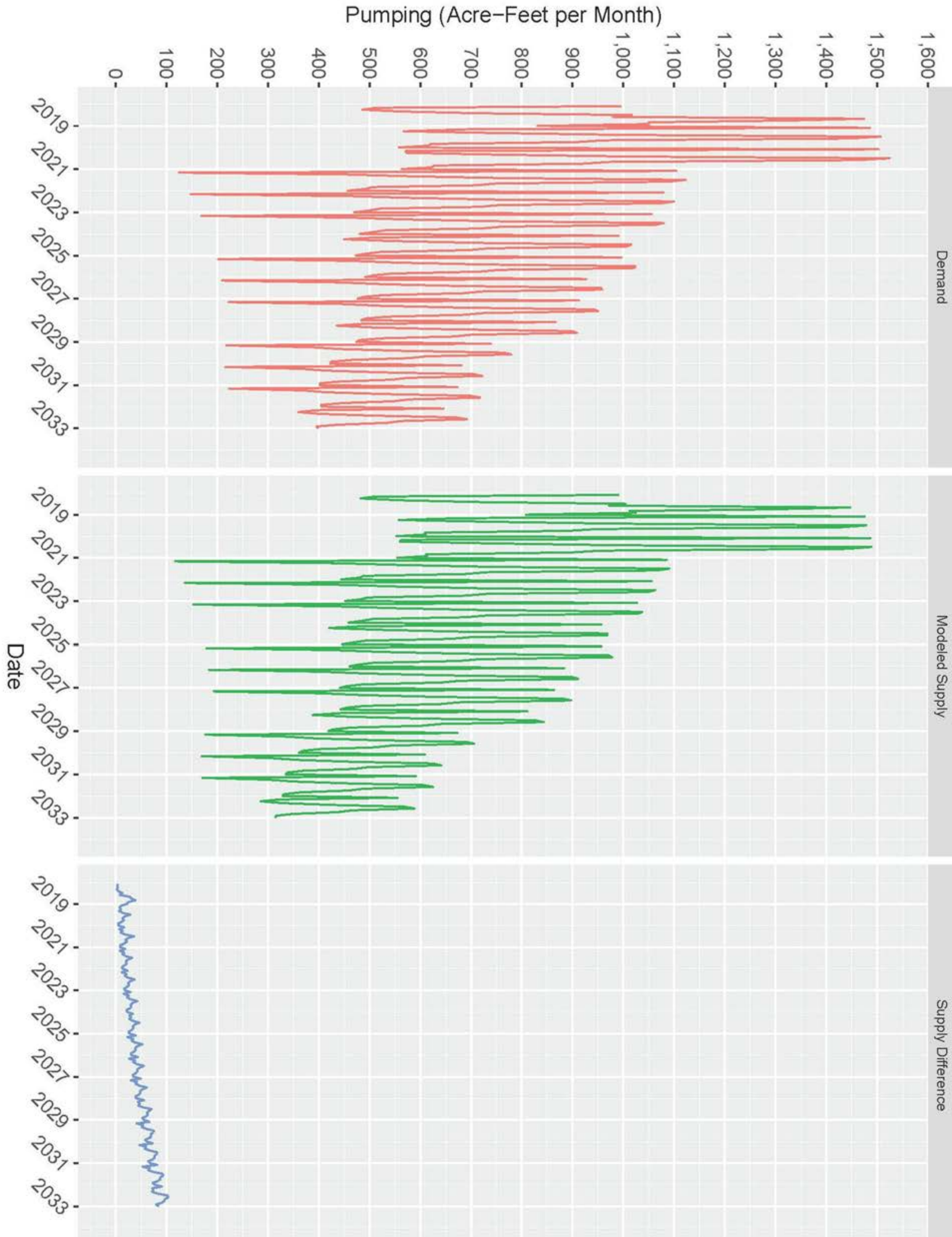


Figure 3-1. Optimized Demand Run Demand, Modeled Supply, and Difference for Xcel Wells

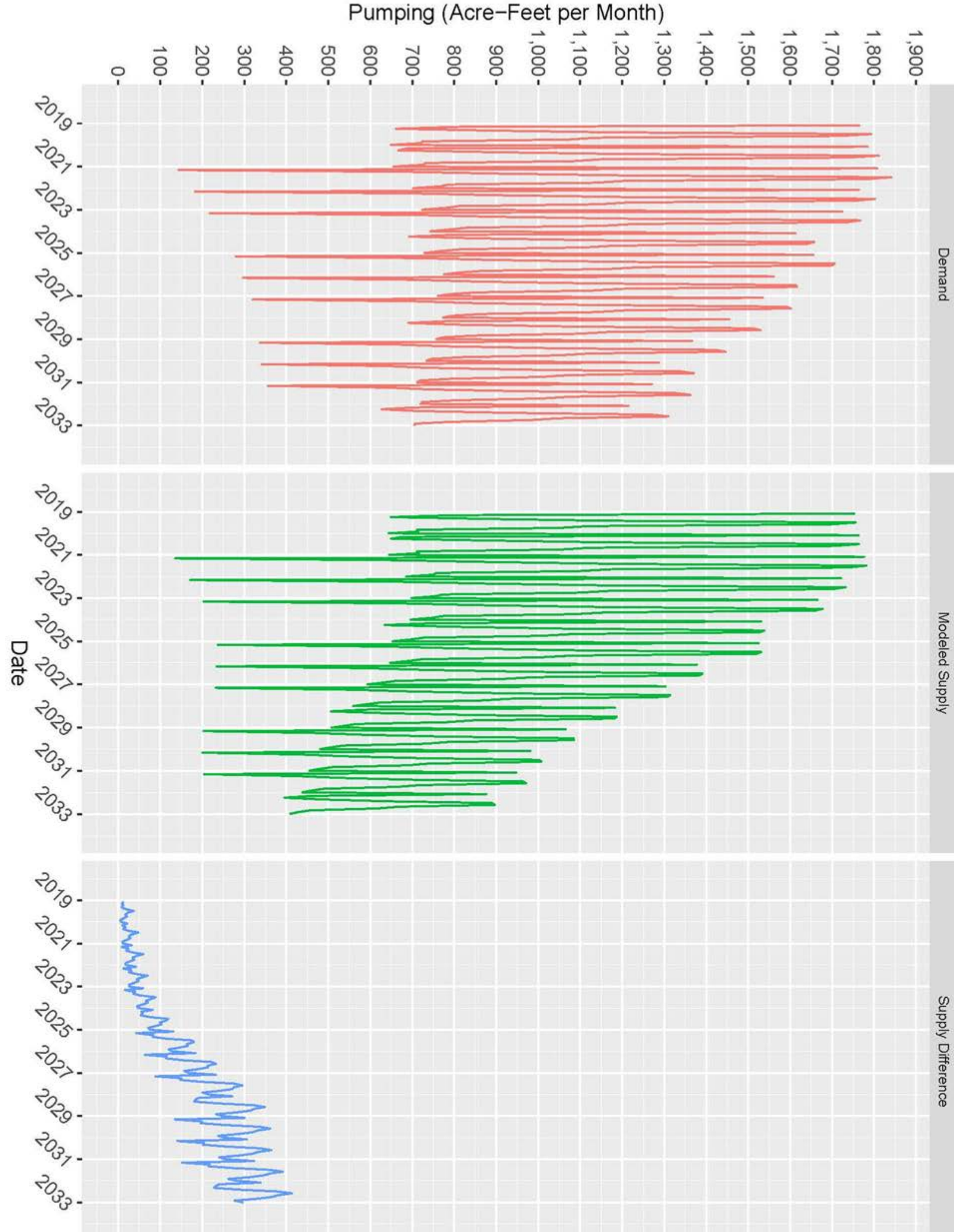


Figure 3-2. Typical Demand Run Demand, Modeled Supply, and Difference in Pumping for Xcel Wells.

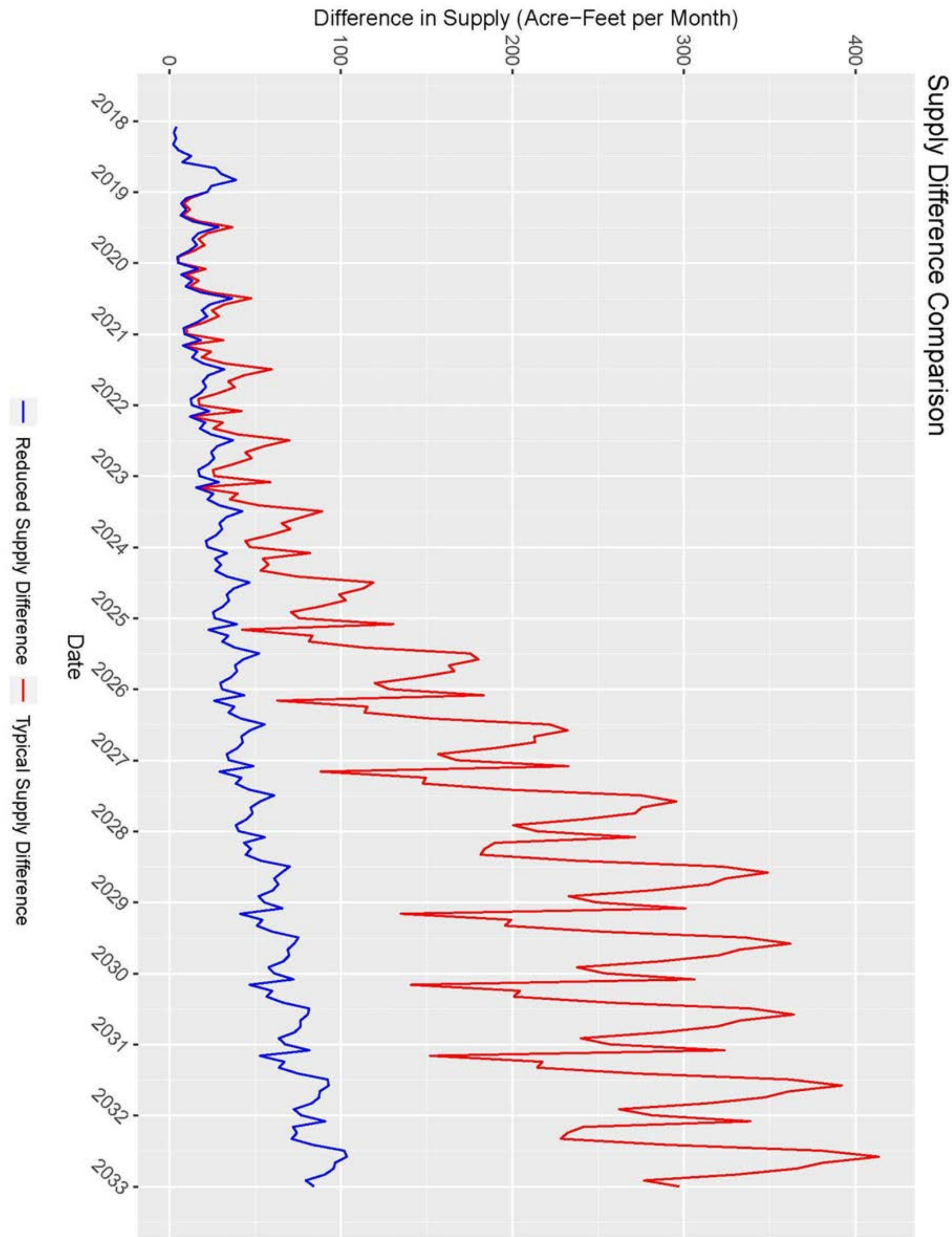


Figure 3-3. Comparison of Simulated Optimized and Typical Scenario Demand-Modeled Supply Deficit (Monthly values plotted)

Looking at the model area as a whole as in Figure 3-4 shows the same three curves as in Figures 3-1 and 3-2, except the values shown are for the area outside of XWRA. Xcel's reduction in pumping capacity is similar to what the rest of the surrounding area is likely to experience, in that projected demand is higher than the ability of the model to produce groundwater, and the deficits increase with time. However, the magnitude of production is much larger in the surrounding irrigation areas (up to 45 times greater) as are the predicted deficiencies. Starting immediately, the model cannot produce enough water for the surrounding irrigation production, with predicted deficits in irrigation production reaching large deficits starting in 2019. The model indicates deficits that are very much dependent on the cyclic nature of high pumping in the summer with recovery in the winter. Both the typical and optimized demand runs have very similar pumping trends outside of the XWRA.

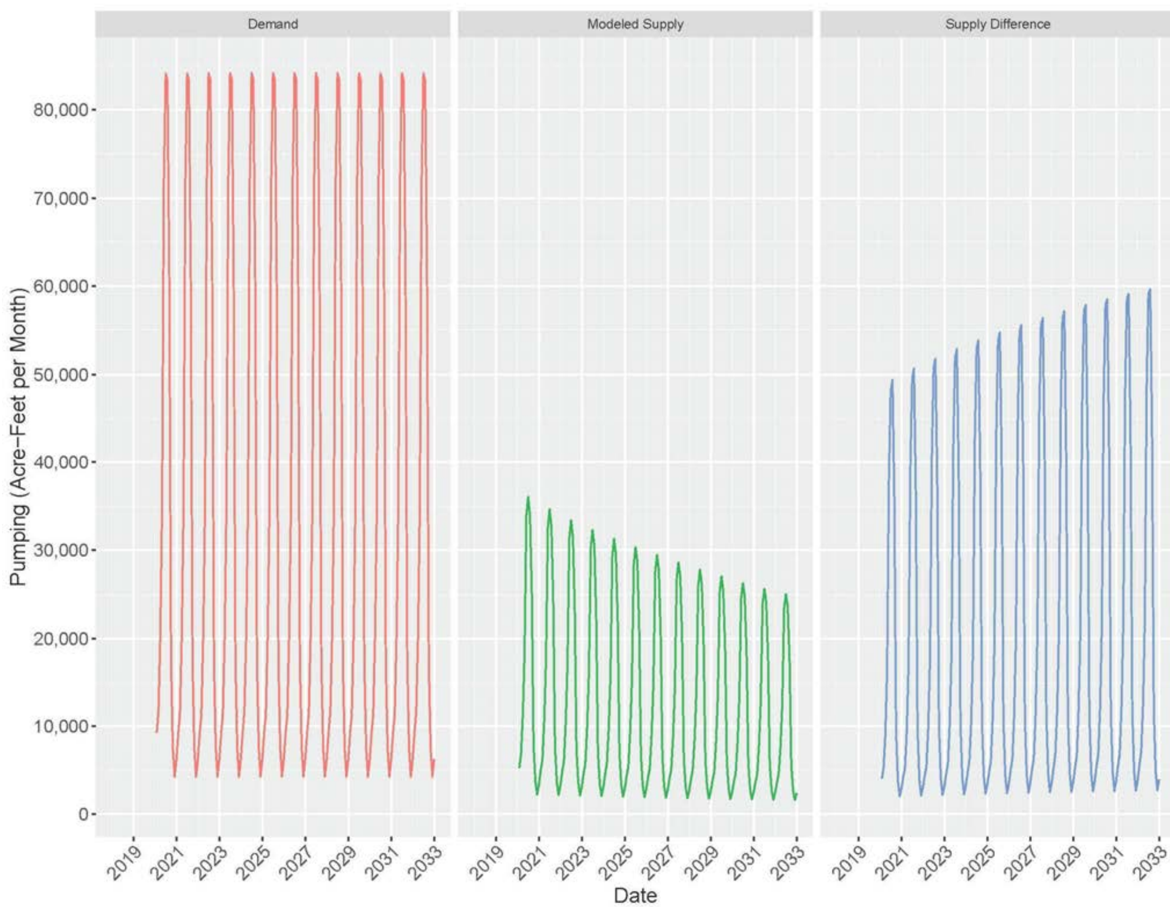


Figure 3-4. Graph of Demand, Modeled Supply, and Difference in Pumping for the Optimized Demand Run for Non-Xcel Wells.

3.1.2 Saturated Thickness Results

Saturated thickness within XWRA will diminish with time due to local and regional pumping, but with large variations depending on the location. Figure 3-5 and Figure 3-6 demonstrate this variation by plotting all the gridblocks within XWRA saturated thickness through time (grey lines) along with the average saturate thickness of XWRA through time (blue line). On average the saturated thickness will go from a high of 52 to 53 feet at the beginning of the model runs in 2019 to 34 feet and 30 feet in 2032 for the Optimized and Typical Scenarios, respectively. The variability in saturated thickness within the Xcel property can range from 70 feet or more, showing that certain areas of the Xcel property will be impacted less through time. Certain portions of the XWRA will have saturated thickness above the 40-foot threshold and still maintain well production, but not enough to make up for the lost production in areas that are below 40 feet.

Generally, the highest declines in water levels occur in the western portion of the Xcel property as seen in the change from the year 2020 saturated thickness map (Figure 3-7) to the year 2032 saturated thickness map (Figure 3-8). See Appendix A for well location maps and Appendix B for additional saturated thickness maps for the optimized demand scenario. Simulations indicate that pumping would be reduced first within the western properties, and then gradually decrease in the eastern portion of XWRA as saturated thickness values reach the 40-foot threshold. This holds true for both scenarios, but with the typical demand scenario, there are larger decreases in saturated thickness overall (Figure 3-9; Figure 3-10; See Appendix C for additional typical demand saturated thickness maps).

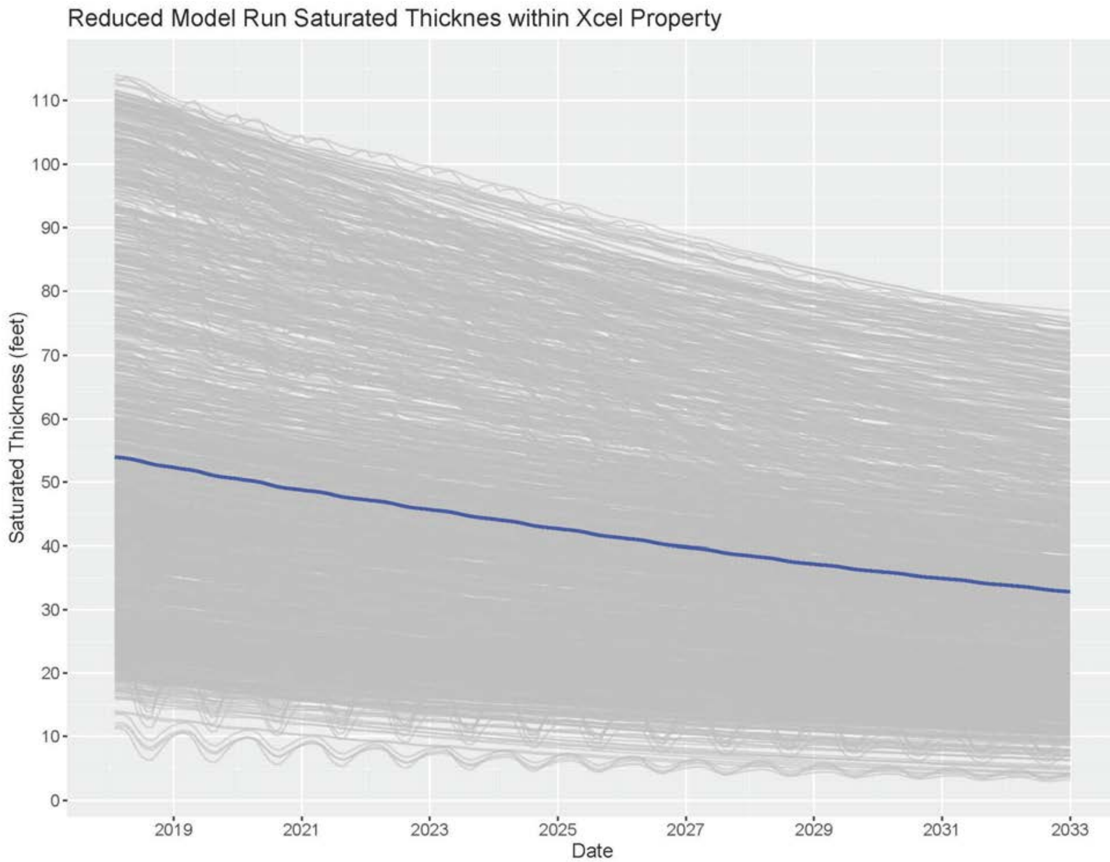


Figure 3-5. Saturated Thickness Results from Optimized Scenario for entire Xcel Property per Model Cell

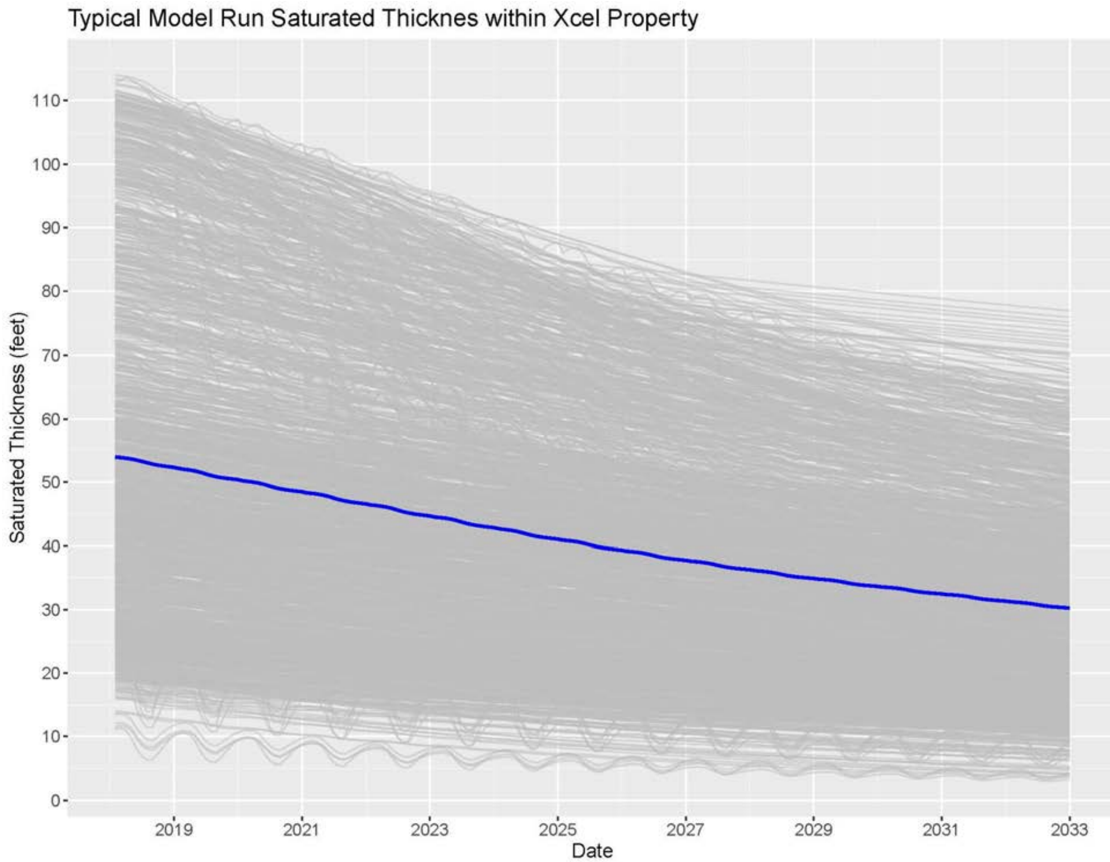


Figure 3-6. Saturated Thickness Results from Typical Scenario for entire Xcel Property per Model Cell

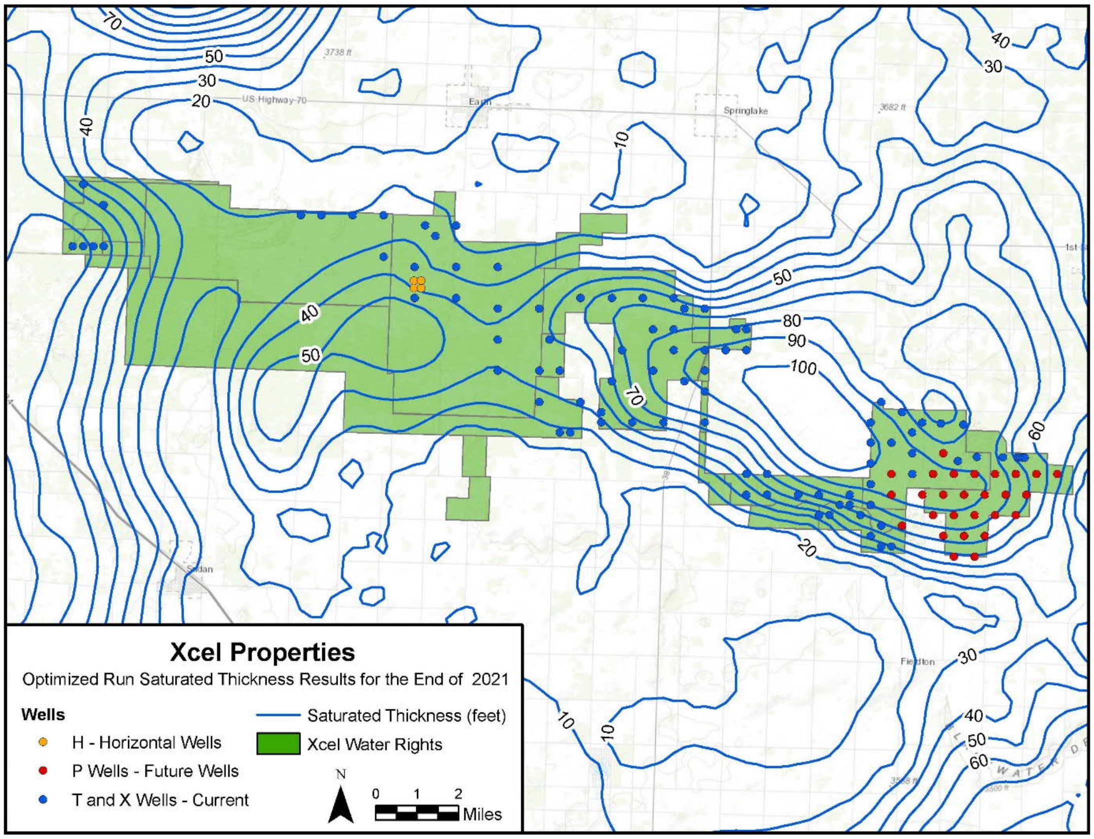


Figure 3-7. Map of Saturated Thickness Contours in 2021for the Optimized Demand Scenario.

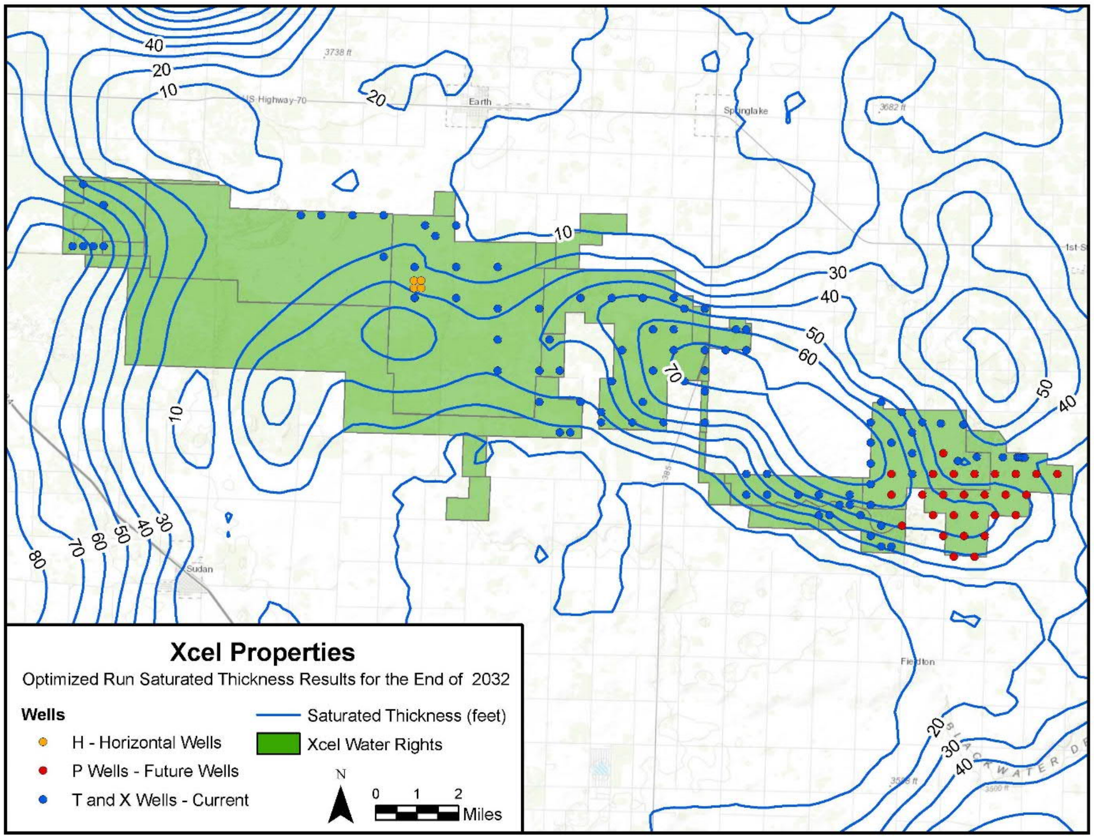


Figure 3-8. Map of Saturated Thickness Contours in 2032 for the Optimized Demand Scenario.

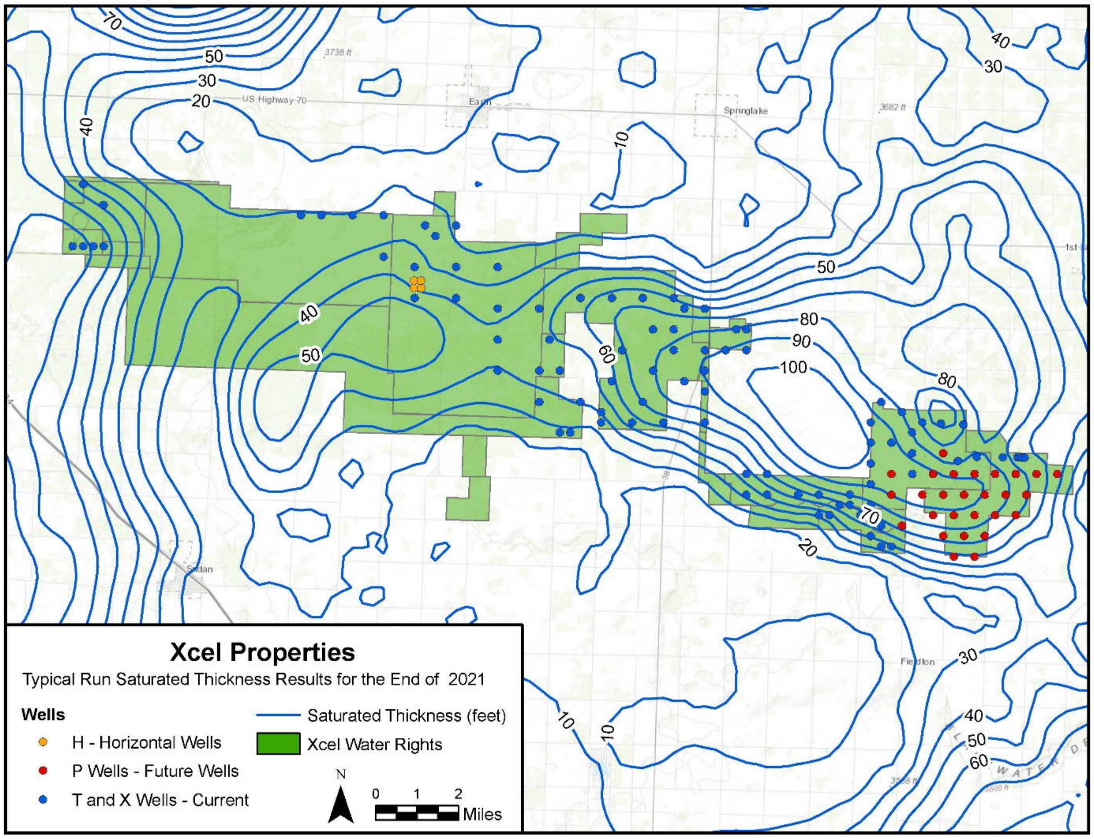


Figure 3-9. Map of Saturated Thickness Contours in 2021 for the Typical Demand Scenario.

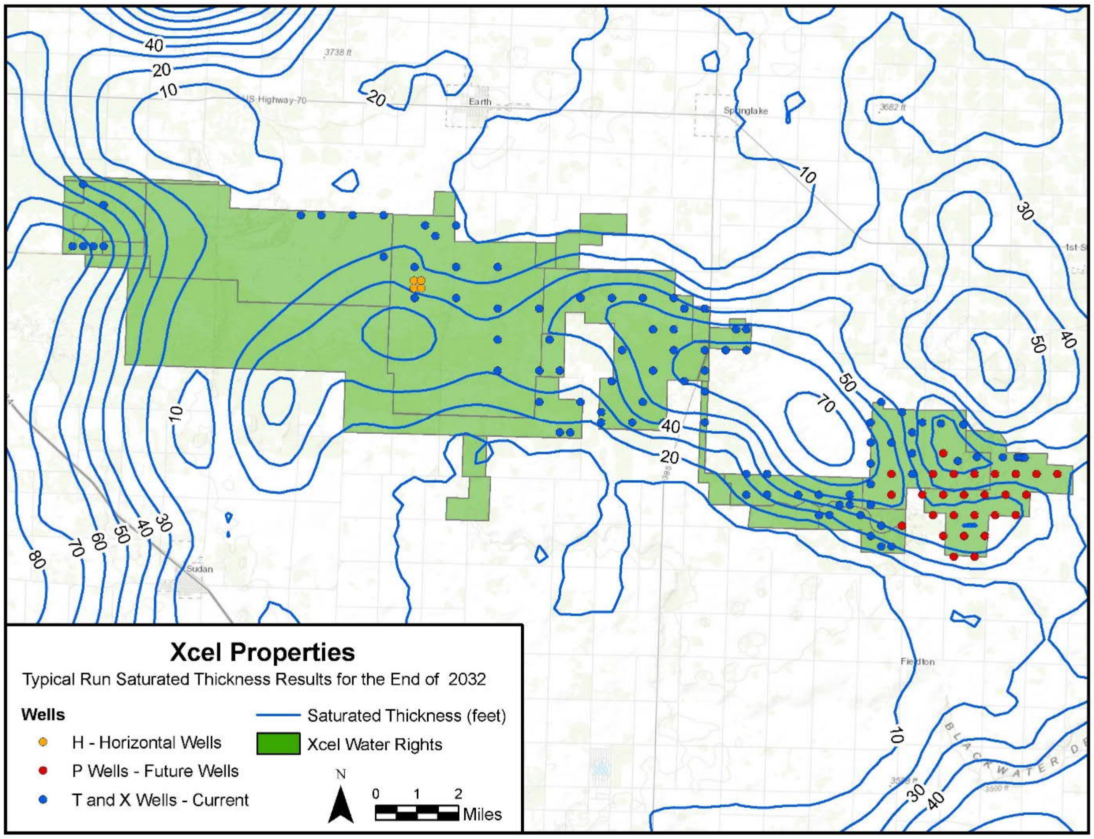


Figure 3-10. Map of Saturated Thickness Contours in 2032 for the Typical Demand Scenario.

3.1.3 Stored Groundwater

Figure 3-11 shows the simulated volume of water in the XWRA that is stored in the ground as available or unavailable. This graph shows the volume of groundwater below the simulated 40-foot saturated thickness threshold, which for this evaluation is assumed to be non-recoverable or unavailable. Figure 3-11 also shows the volume that is above that 40-foot threshold, which is assumed to be available for this evaluation.

As simulation time progresses, the portion of cells that have a simulated saturated thickness above 40 feet decreases, resulting in a decreased extractable volume with time. Comparison of the two scenarios (Figure 3-12, a and b) indicates that there is a noticeable gap between the scenarios with the optimized demand scenario having more available groundwater in storage relative to the typical demand scenario.

It's important to note the difference between what the model considers "unavailable" and what this volumetric calculation considers "unavailable". As shown in Figure 2-2, the model will continue to simulate groundwater production even when water levels drop below 40 feet, but at a decreased pumping rate. This volumetric calculation discussed above (and shown in Figures 3-11 and 3-12) assumes no extraction below the 40-foot threshold, so the simulated volume extracted by the model is greater than the estimated values shown in Figure 3-11.

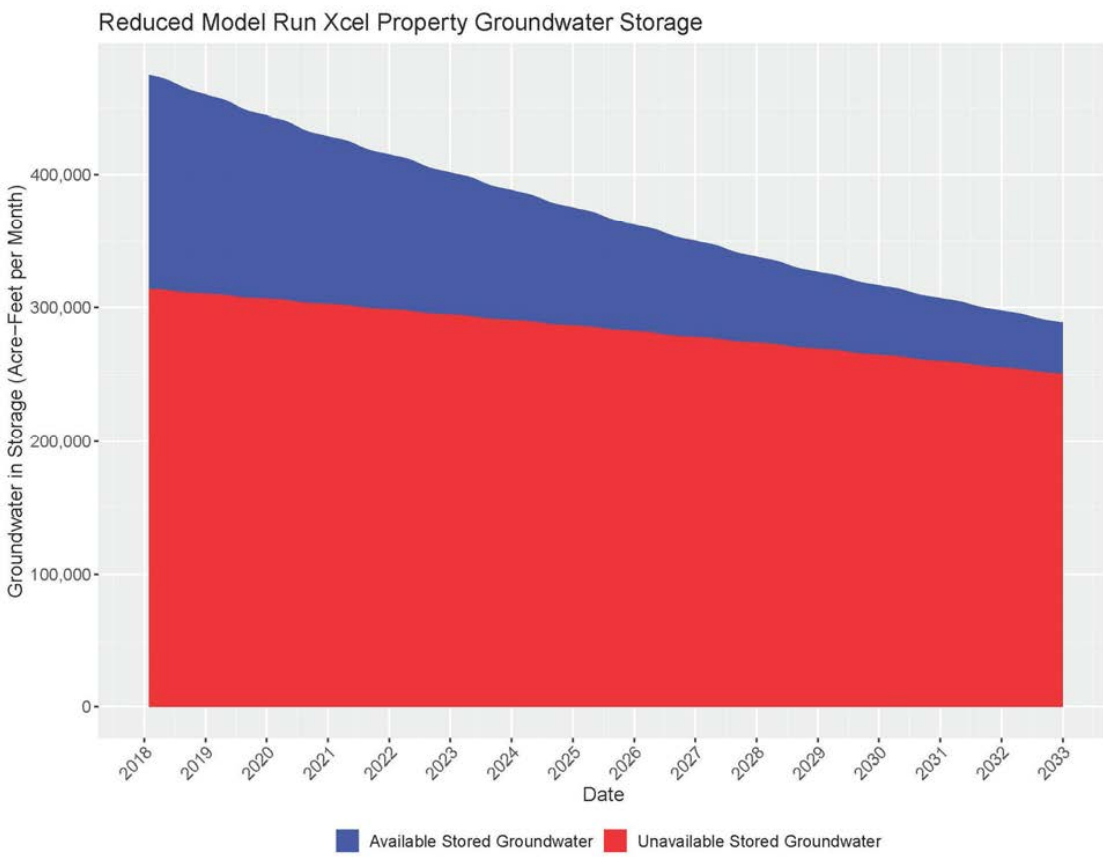


Figure 3-11. Available and Unavailable Stored Groundwater within Xcel Property Assuming No pumping below 40-foot Saturated Thickness for the Optimized Demand Scenario.

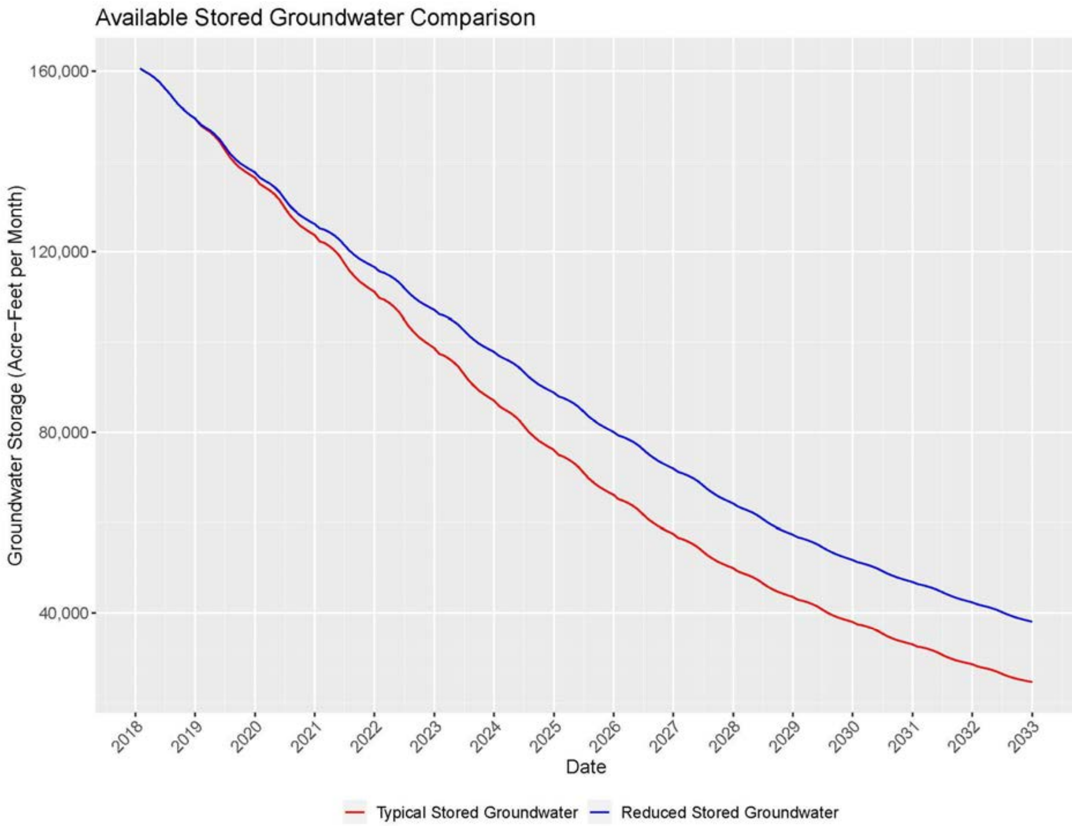


Figure 3-12. (a) Comparison of Groundwater in Storage (above 40-foot limit) for the Typical and Optimized Demand.

4. Conclusions and Recommendations

The 2019 groundwater model for Xcel was updated by simplifying the predictive pumping, incorporating the nine new wells into the model, and running the updated scenario demand values for the optimized and typical runs.

The results from the predictive runs indicate that Xcel will likely have challenges meeting the groundwater demands throughout both the scenarios. Of the two scenarios, the optimized demand scenario comes closer to meeting the average annual demand, with the predicted deficit rising slowly but steadily throughout the modeled period. However, even in the optimized demand scenario summer peak demands may pose challenges to the wellfields. In the typical demand scenario, the simulated deficit rises more rapidly than in the optimized scenario.

The major difference between the scenarios is that the optimized demand scenario will produce less groundwater through time, but will have smaller unmet demands through time. Because these deficits are relatively small, it may be easier to reduce them by optimization of future well placement, and by fine-tuning well production through time in the field operations. The typical demand will produce more groundwater through time because the water at the boundaries is not lost to competitive pumping and because a higher demand is consistently simulated in all areas, but will not meet typical production demands through the model run. The tradeoff between the two scenarios is to produce more groundwater now and less later, or produce less groundwater overall but at a steadier rate (less production capacity loss through time).

5. Limitations of Model and Study

As with all models, the current Xcel model and modeling approach has limitations that should be acknowledged. Generally, these limitations can be categorized into limits related to (1) supporting data, and (2) the modeling approach, implementation, and applicability.

5.1. Limitations of Supporting Data

The primary limitations in supporting data for the model include:

- limited water level targets both spatially and temporally
- limited hydraulic conductivity and specific yield data
- uncertain estimates of pumping by irrigators located close to the XWRA boundary
- uncertain estimates of well capacity as water levels decline
- uncertainty about future wellfield operation practices.

The primary type of calibration target used in most models, including this groundwater availability model, is water level data. Limits in the number of wells monitored and the water level measurements frequency leads to uncertainty in the model calibration and in turn, the predictive modeling results.

Pumping, which is the largest source of discharge from the model, is uncertain because estimates of pumping outside the XWRA are dependent on secondary sources, such as crop areas and application rates, which are themselves uncertain. While change in storage calculations are helpful in estimating long term pumping rates in an area, they also carry uncertainty due to the uncertainty both in regional water level surfaces and specific yield of the aquifer.

5.2. Limitations of Model Approach, Implementation, and Applicability

While the overall mean error of the model has been minimized through the calibration process that was described in the 2017 model (LBG-Guyton Associates, 2017), the mean error for some areas at the end of the historical period may be larger than the mean error. Because the Ogallala Aquifer is unconfined, the areas containing larger errors can translate to large volumes of water when estimating future availability. These errors also affect the predetermined pumping demands incorporated into the model, which might affect the predicted unmet demands estimated by the model with the approach used in this study.

A significant uncertainty in the model is the irrigation pumping near Xcel boundaries, which can have an impact on the predictions made with the model. One way to minimize the impacts of this uncertainty is to continue to update the model annually as water levels decline. As the water levels continue to decline, the amount of groundwater that can be taken from the XWRA becomes smaller due to the limited impact that competitive wells can have on hydraulic gradients near the boundary because of small saturated thickness.

As mentioned in Section 3, it is important to remember that future pumping demand in the model is pre-determined for each well before the simulation begins and is not adjusted throughout the simulation based on water levels and changes in well production capacity through time. As such, if the predetermined pumping demand for a given well in the future is estimated based on conditions that exist in 2019, the estimated pumping demand from a well might be higher or lower than the simulated well capacity due to simulated aquifer conditions. If the pre-determined pumping demand is higher than the simulated well capacity at that simulated time, then the model might be indicating a deficit that could actually be met by shifting pumping to other wells that can produce more than their predetermined pumping amount. In an ideal real-world wellfield, field operators could adjust pumping levels on a quarterly or annual basis to increase production from each well to meet overall demand. This real-time adjustment could possibly eliminate some of the smaller deficits in the early years of the simulated deficits. However, fine tuning the well production in this manner has limits in extending the overall life and production of the wellfield. Nonetheless, the approach used herein does not mean that the model is not helpful for management decisions and assessment of various scenarios.

6. References

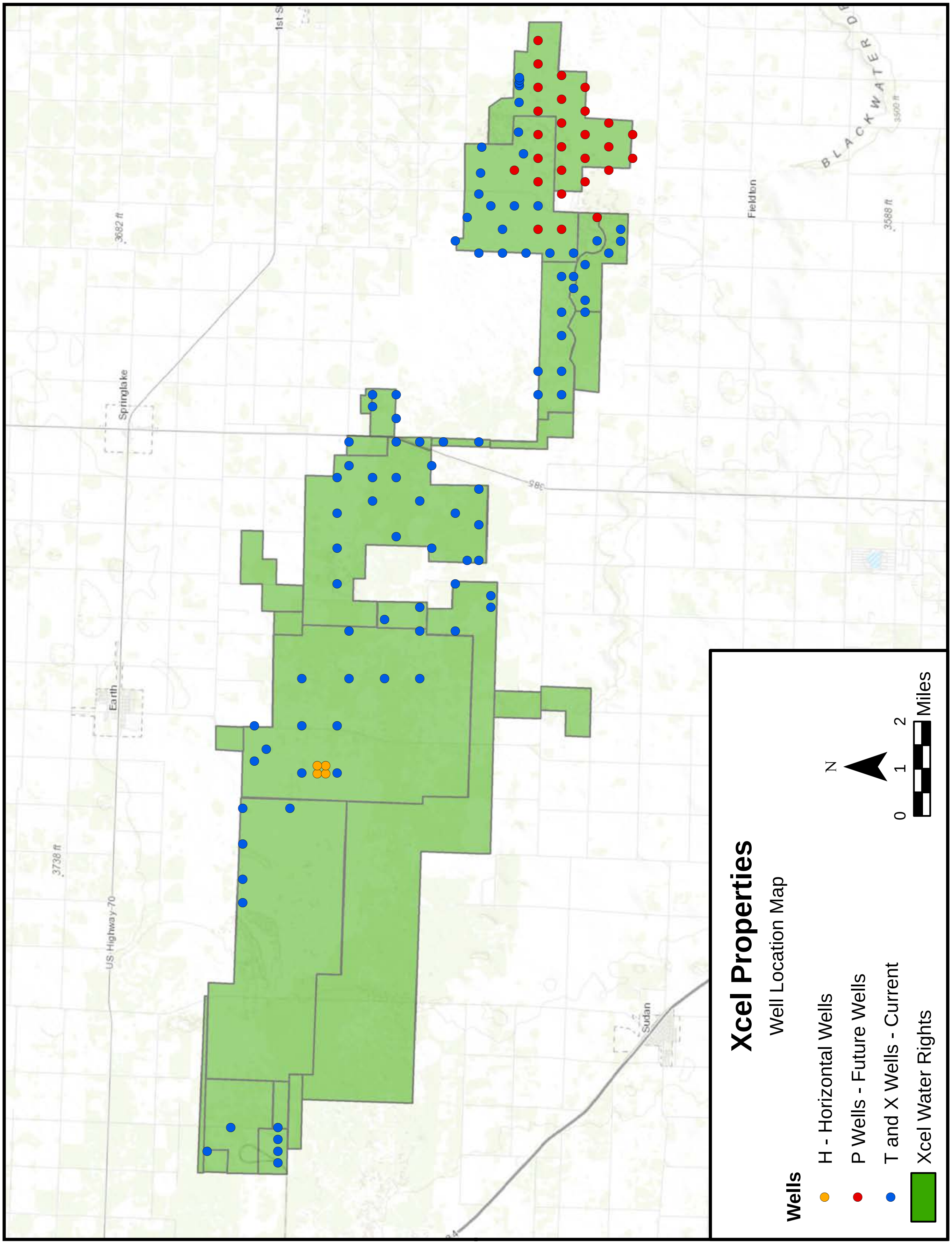
Deeds, Neil E. and Jigmond, Marius. 2015. *Numerical Model Report for the High Plains Aquifer System Groundwater Availability Model.* 2015. Prepared for TWDB.

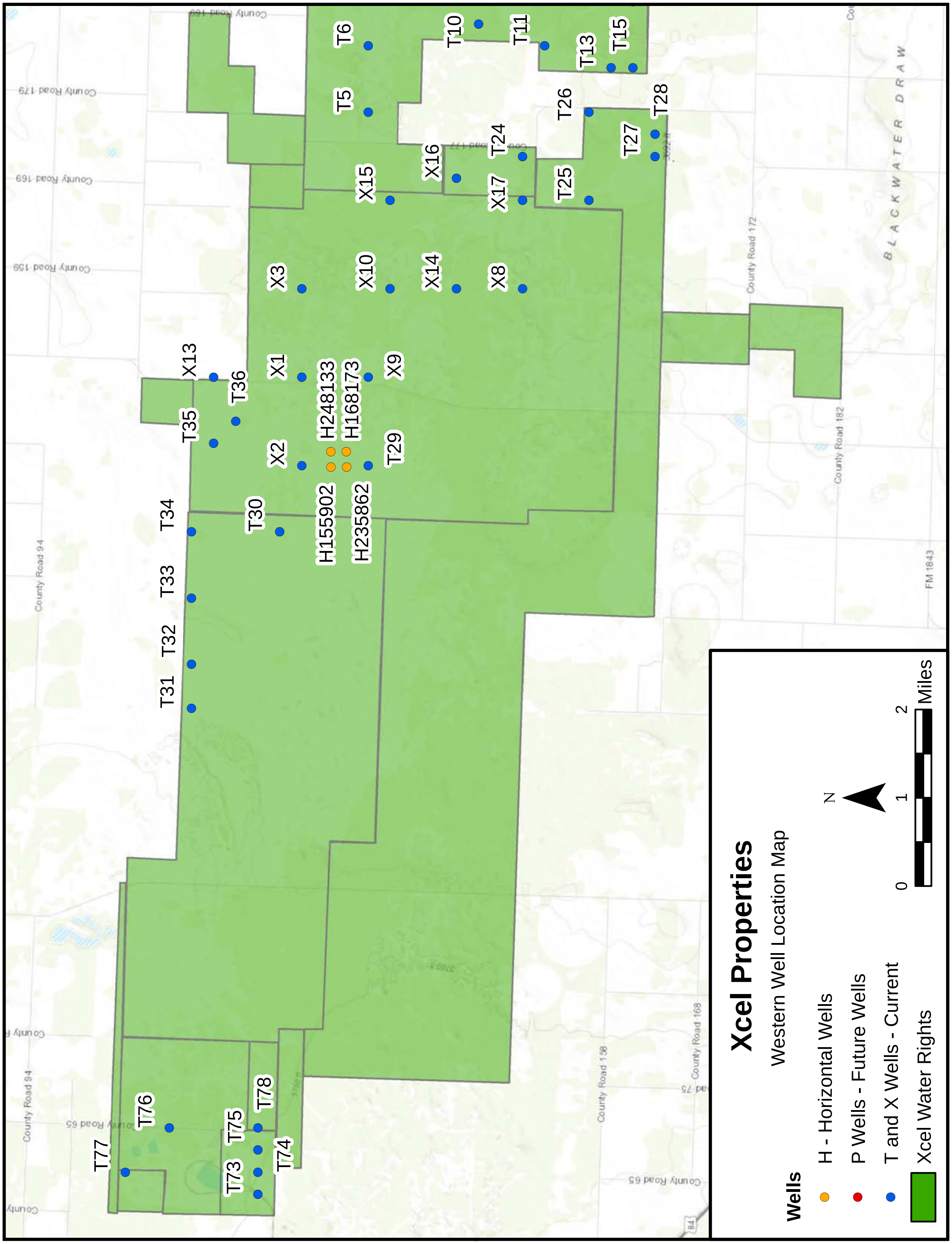
LBG-Guyton Associates. 2011. *Tolk Station/Plant X Groundwater Availability Modeling 2011.* Austin, Texas : LBG-Guyton Associates, 2011. Prepared for Xcel Energy.

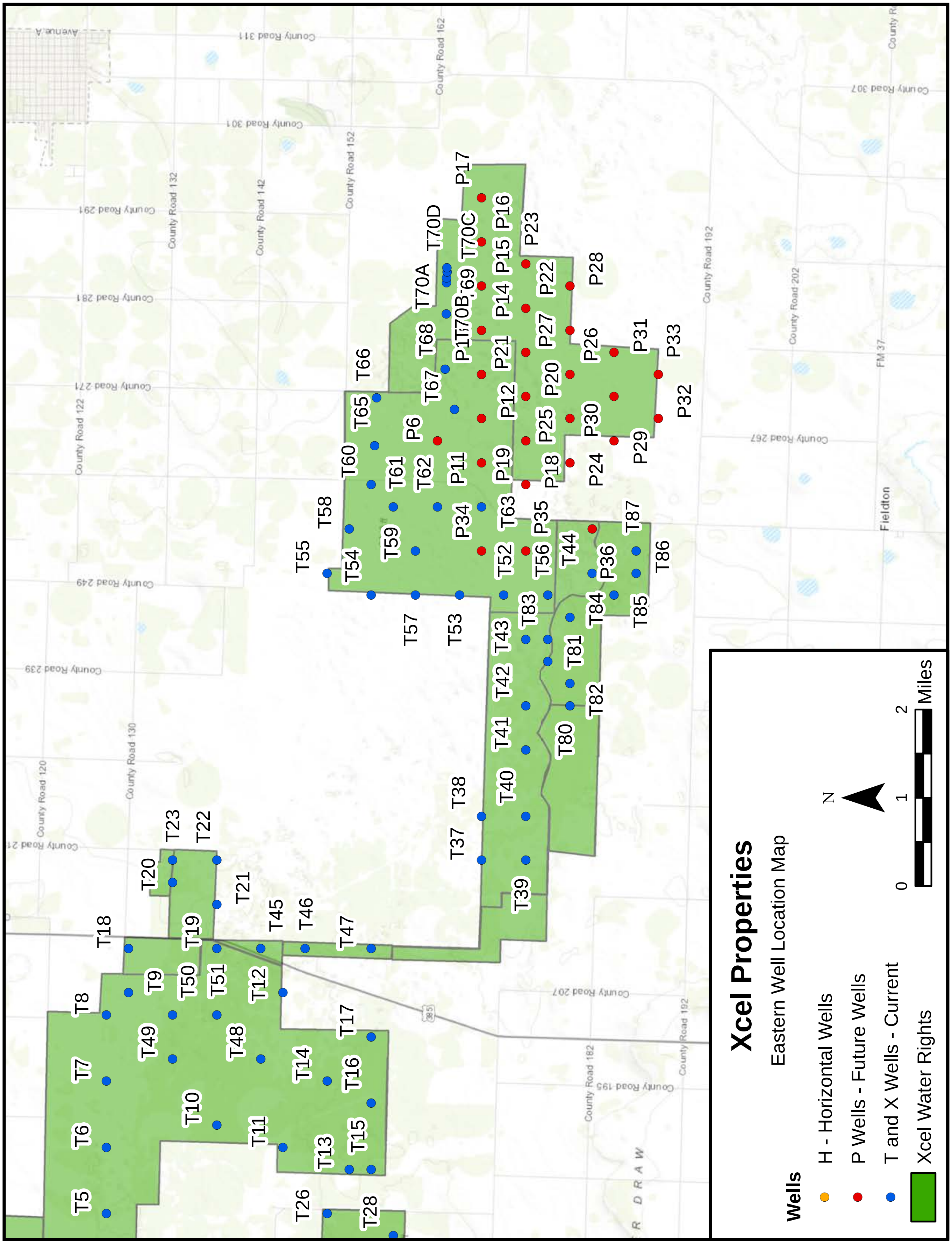
Niswonger, R. G., Panday, S. and Ibaraki, M. 2011. *MODFLOW-NWT, a Newton formulation for MODFLOW-2005.* 2011. United States Geological Survey, Techniques and Methods 6-A37.

WSP USA. 2019. *2019 Groundwater Modeling Results.* 2019. Prepared for Xcel Energy.

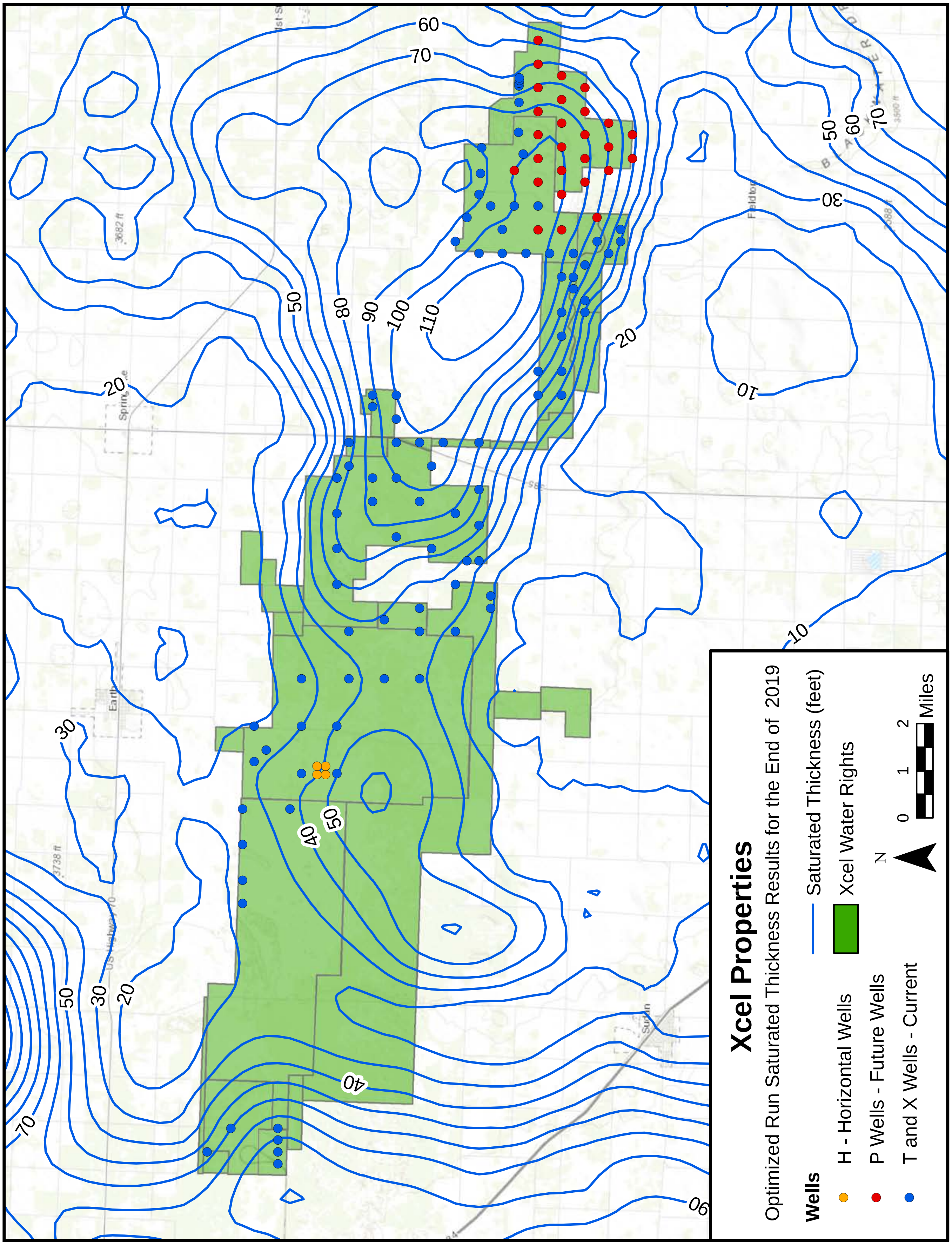
Appendix A —
Xcel Overview Maps

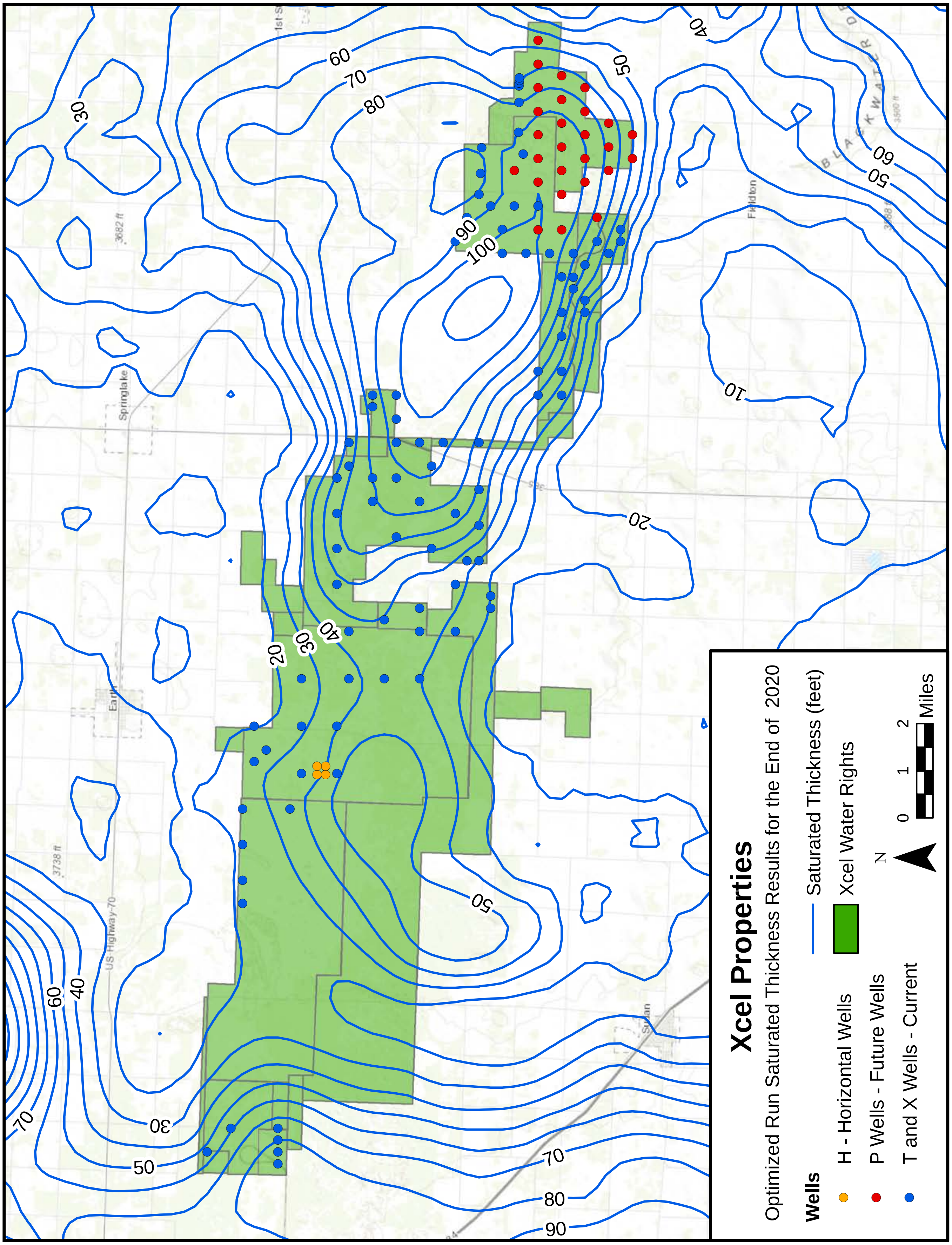

Xcel Properties
Well Location Map
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
3682 ft
3738 ft
3588 ft
385

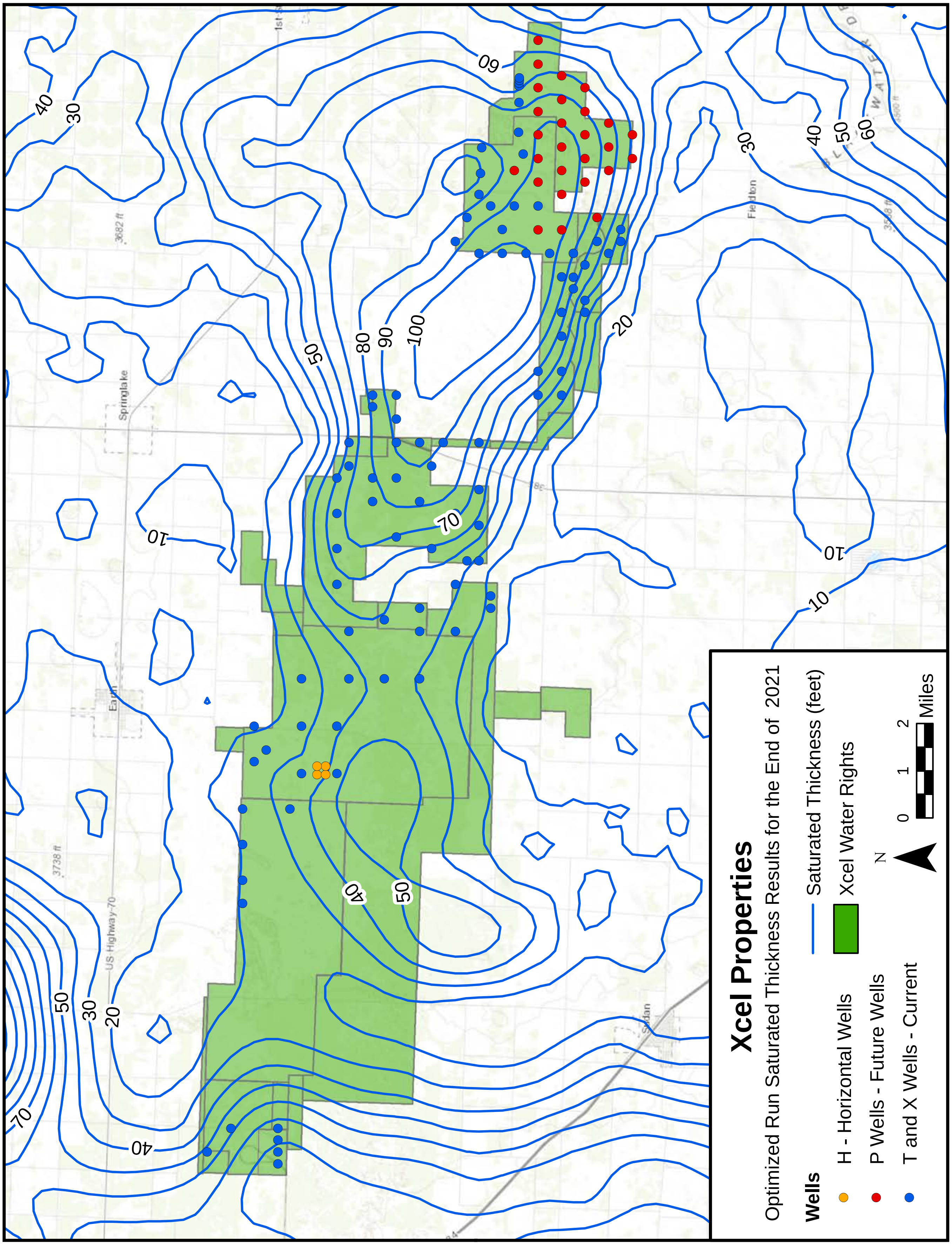

Xcel Properties
Western Well Location Map
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Xcel Water Rights
N
0
1
2
Miles
T5
T6
T10
T11
T13
T15
T24
T25
T26
T27
T28
T29
T30
T31
T32
T33
T34
T35
T36
T73
T74
T75
T76
T77
T78
X1
X2
X3
X8
X9
X10
X13
X14
X15
X16
X17
H248133
H168173
H155902
H235862
County Road 94
County Road 159
County Road 169
County Road 179
County Road 172
County Road 182
County Road 158
County Road 168
County Road 65
FM 1843
BLACKWATER DRAW

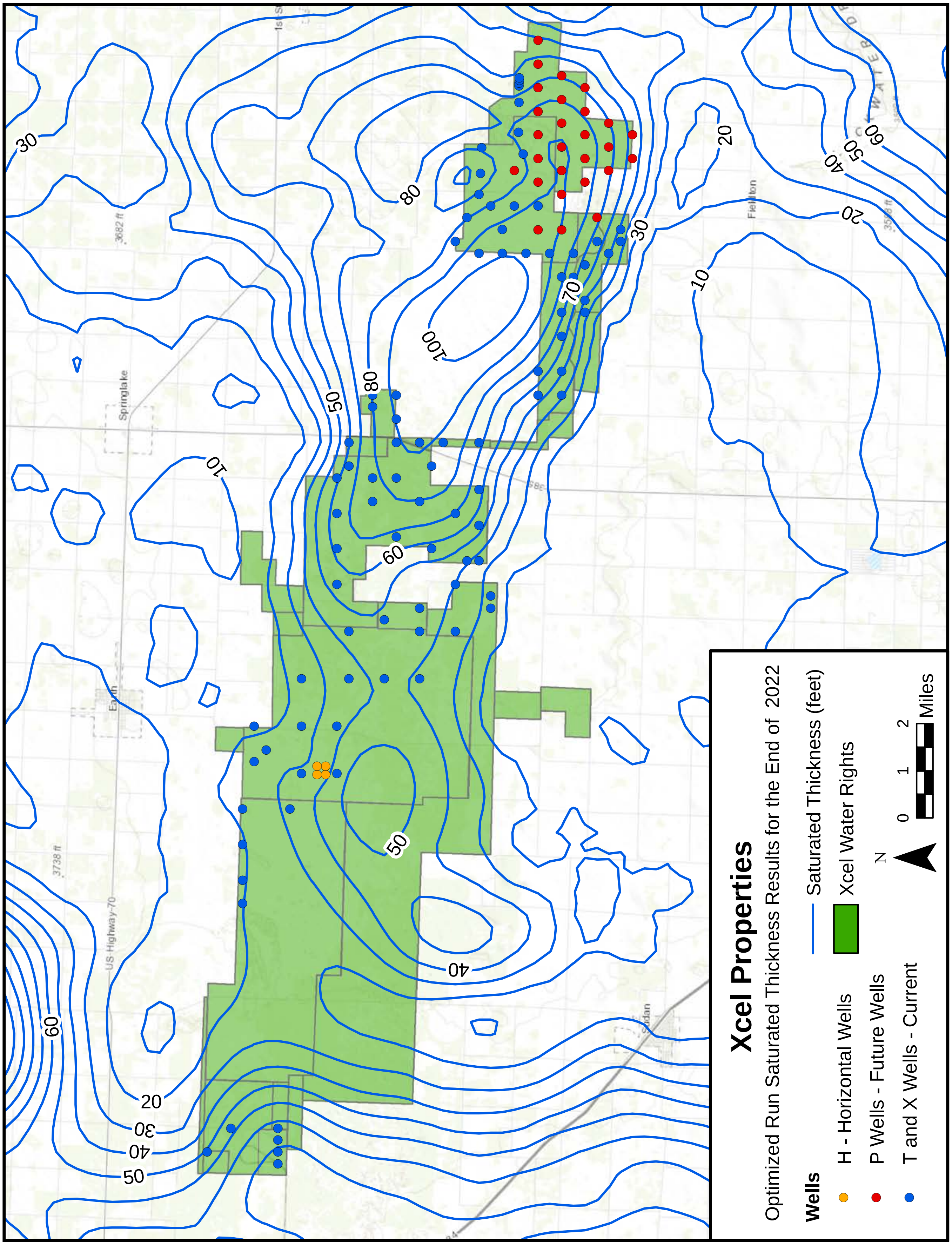

Xcel Properties
Eastern Well Location Map
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Xcel Water Rights
N
0
1
2
Miles

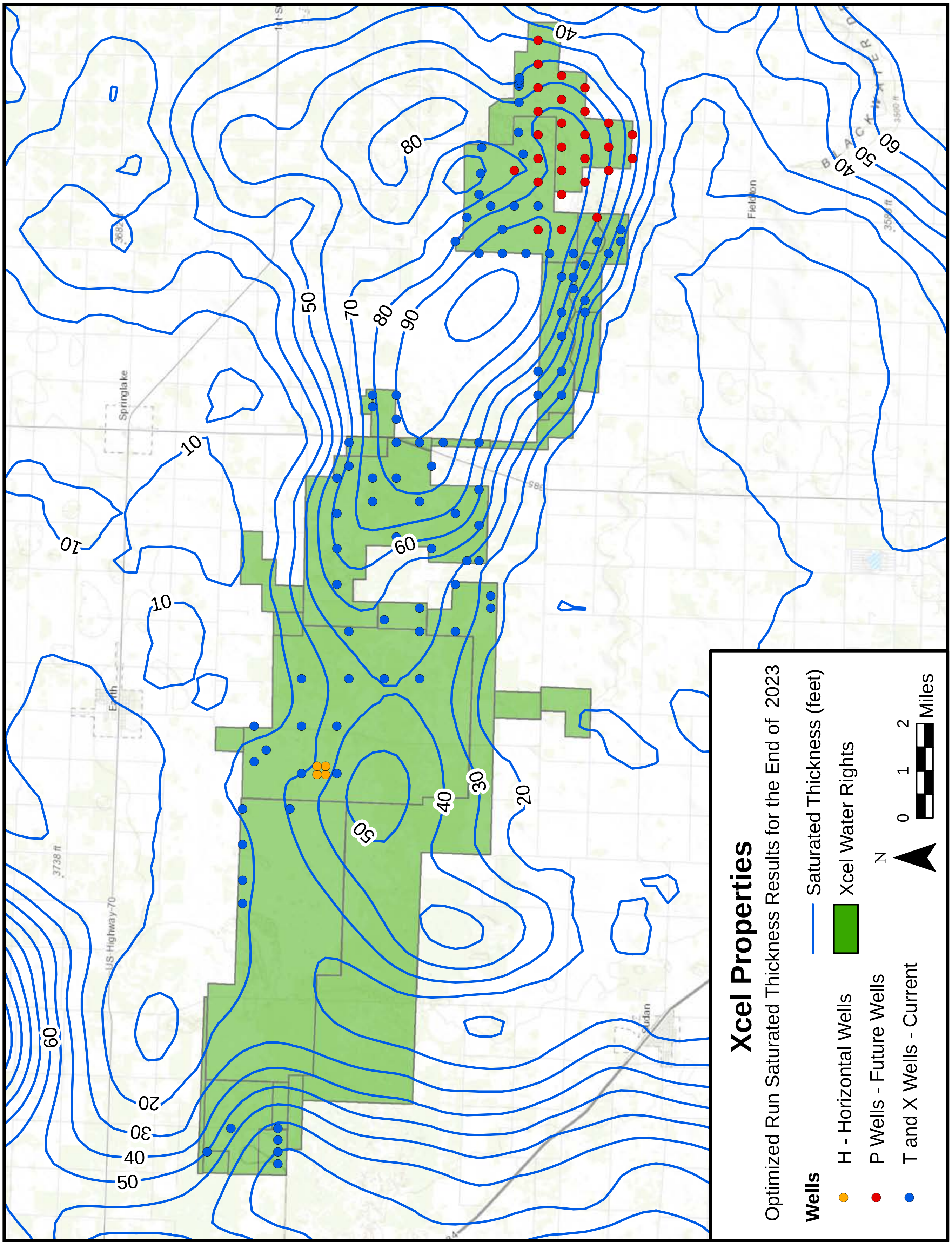
Appendix B —
Saturated Thickness Maps for Optimized Demand Scenario

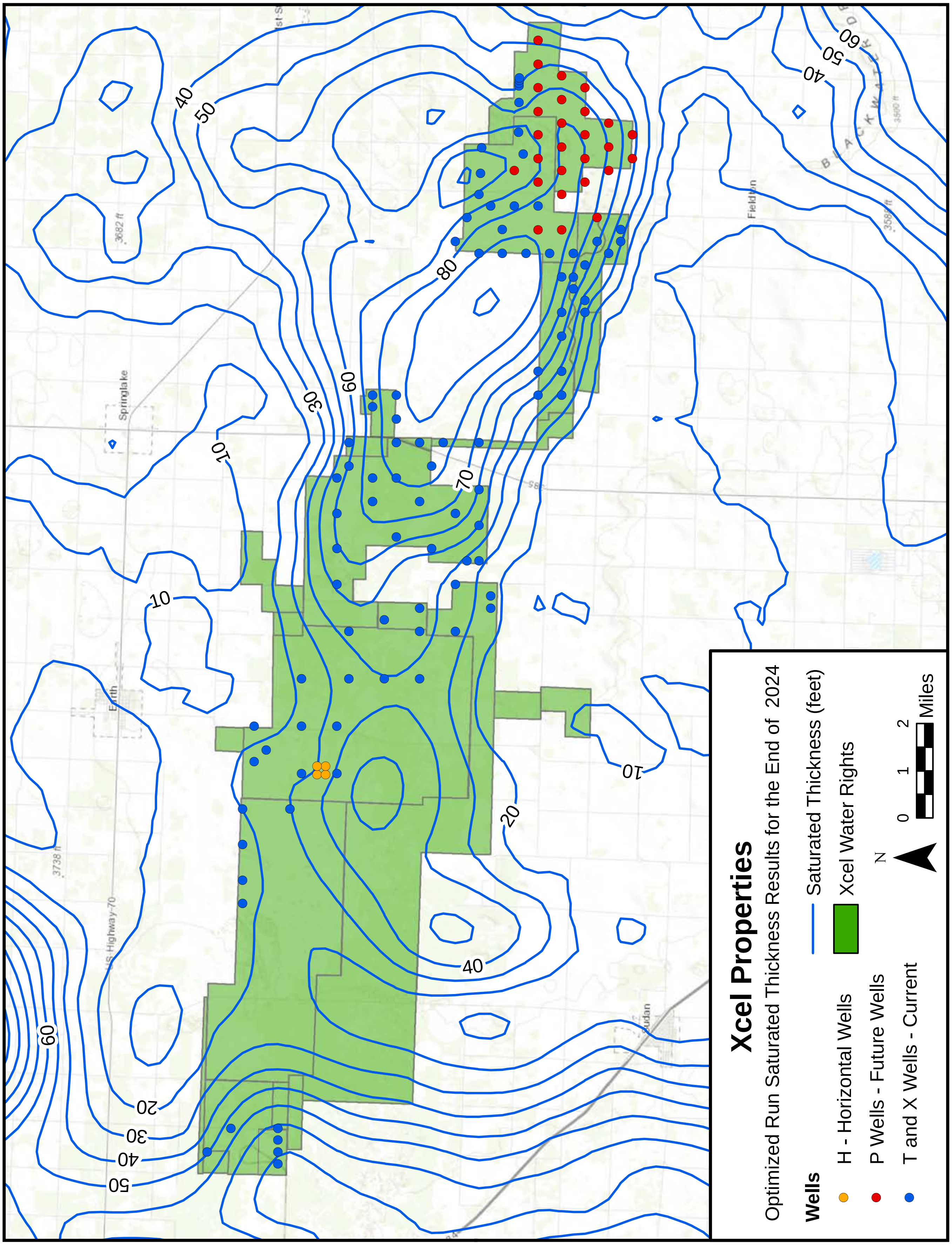

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2019
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles

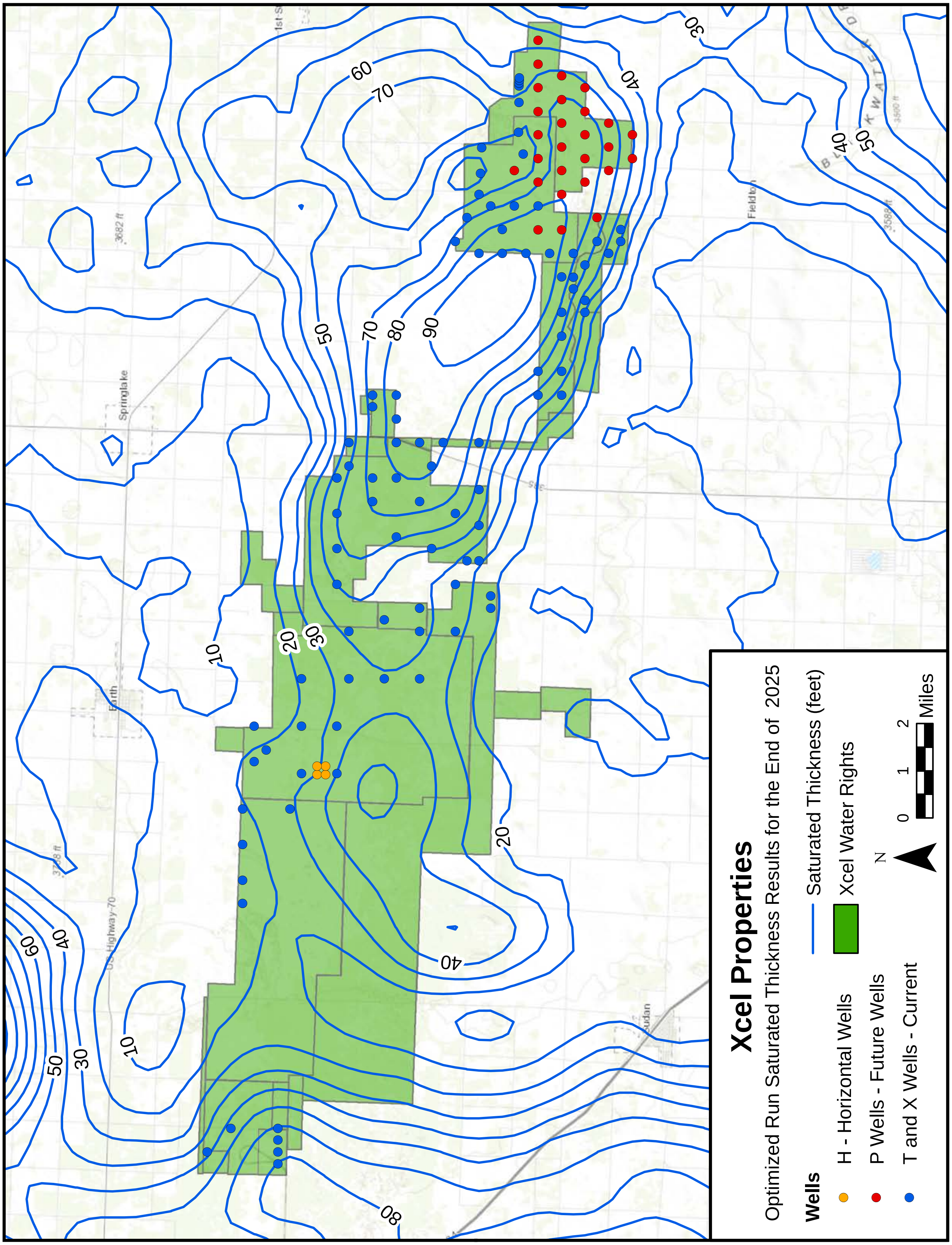

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2020
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

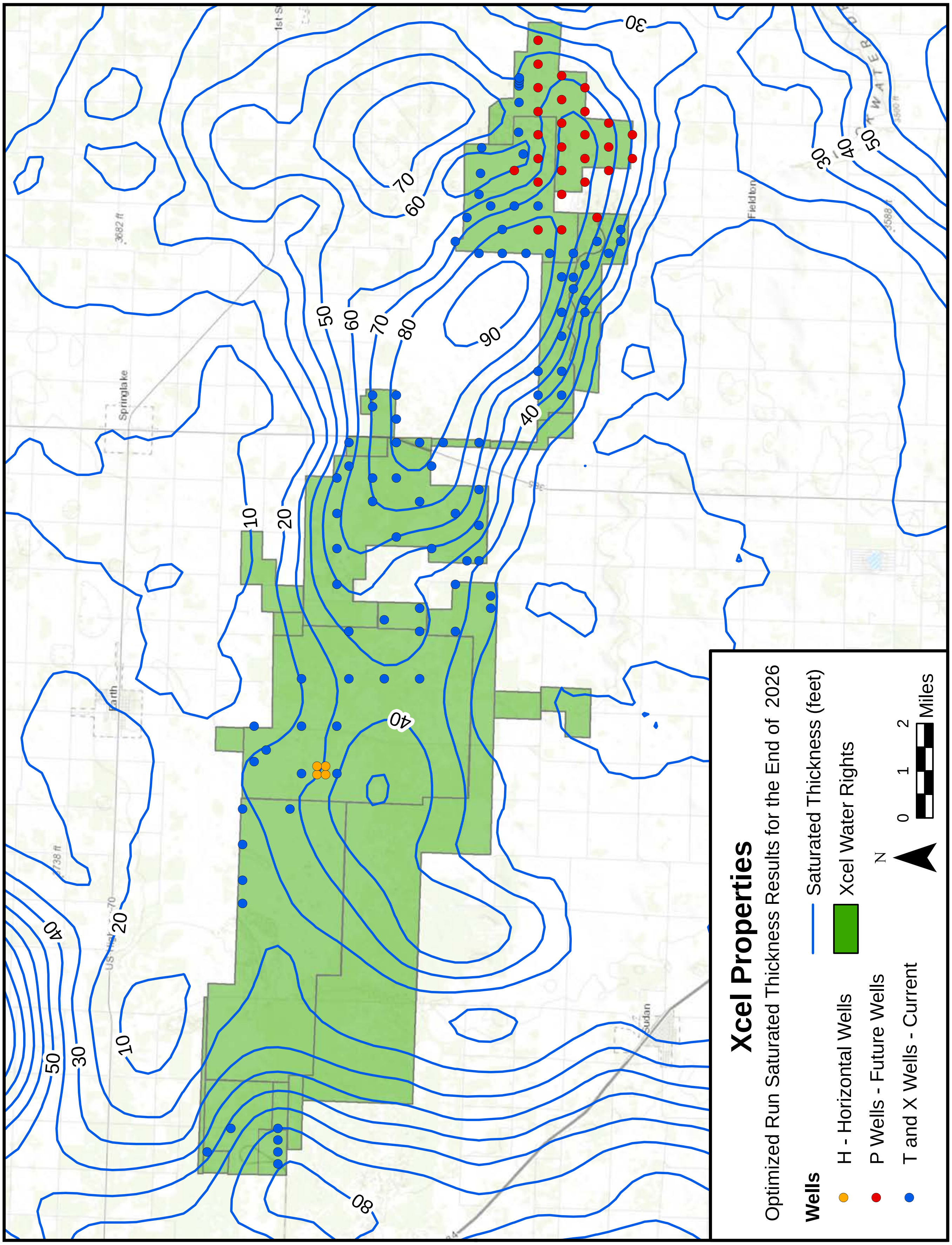

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2021
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80
90
100

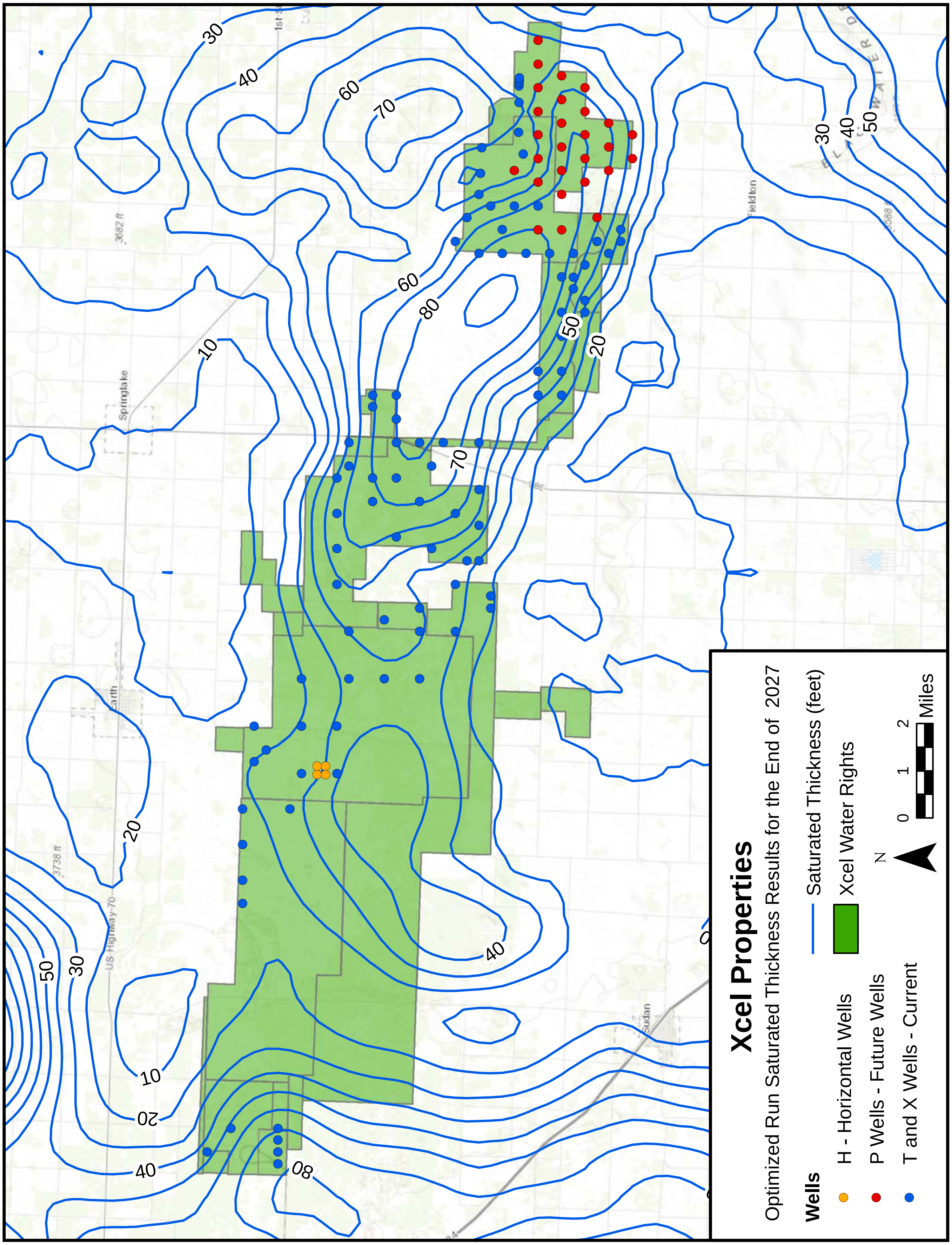

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2022
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80
100

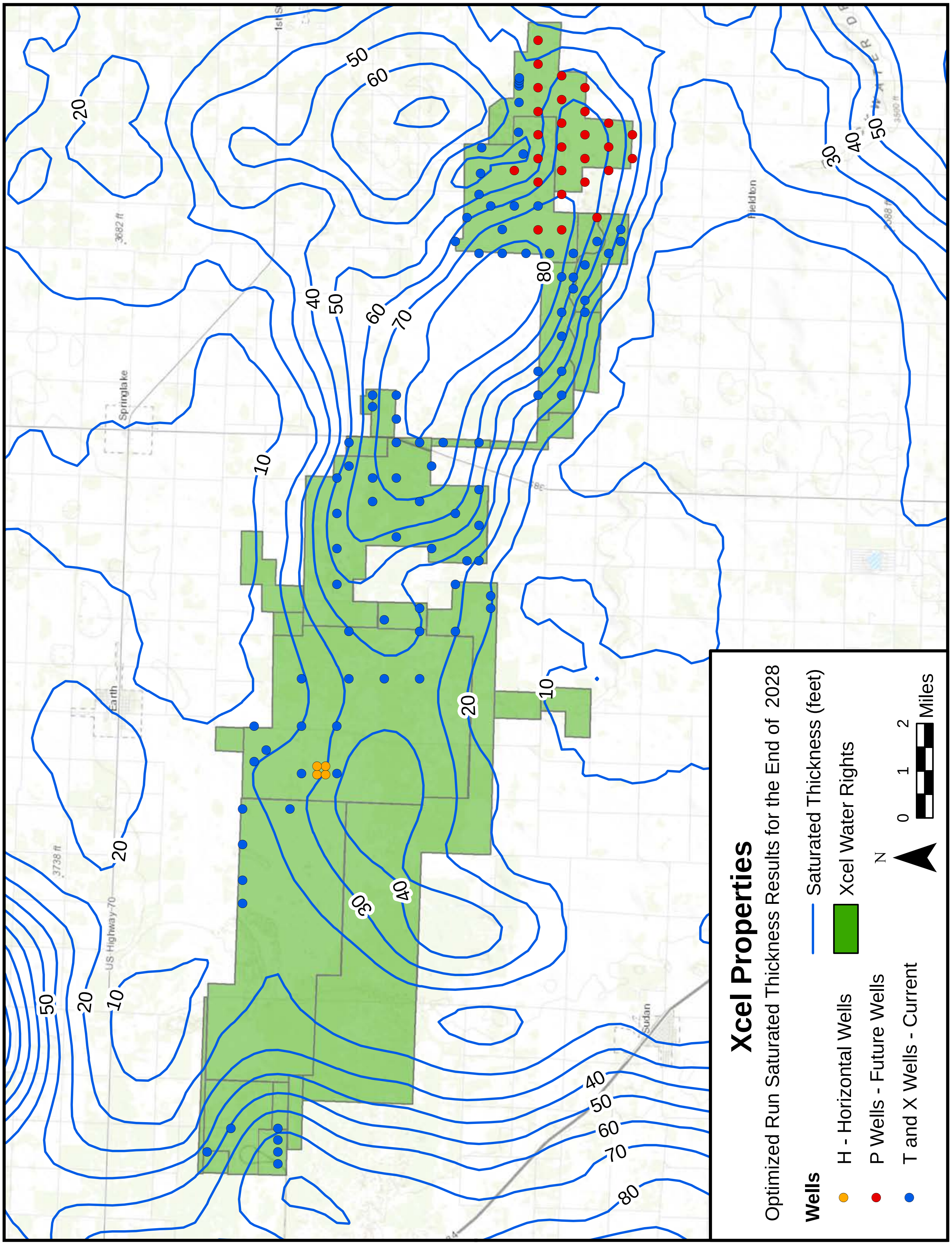

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2023
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
10
20
30
40
50
60
70
80
90
Springlake
Earth
Sudan
Fieldton
US Highway-70

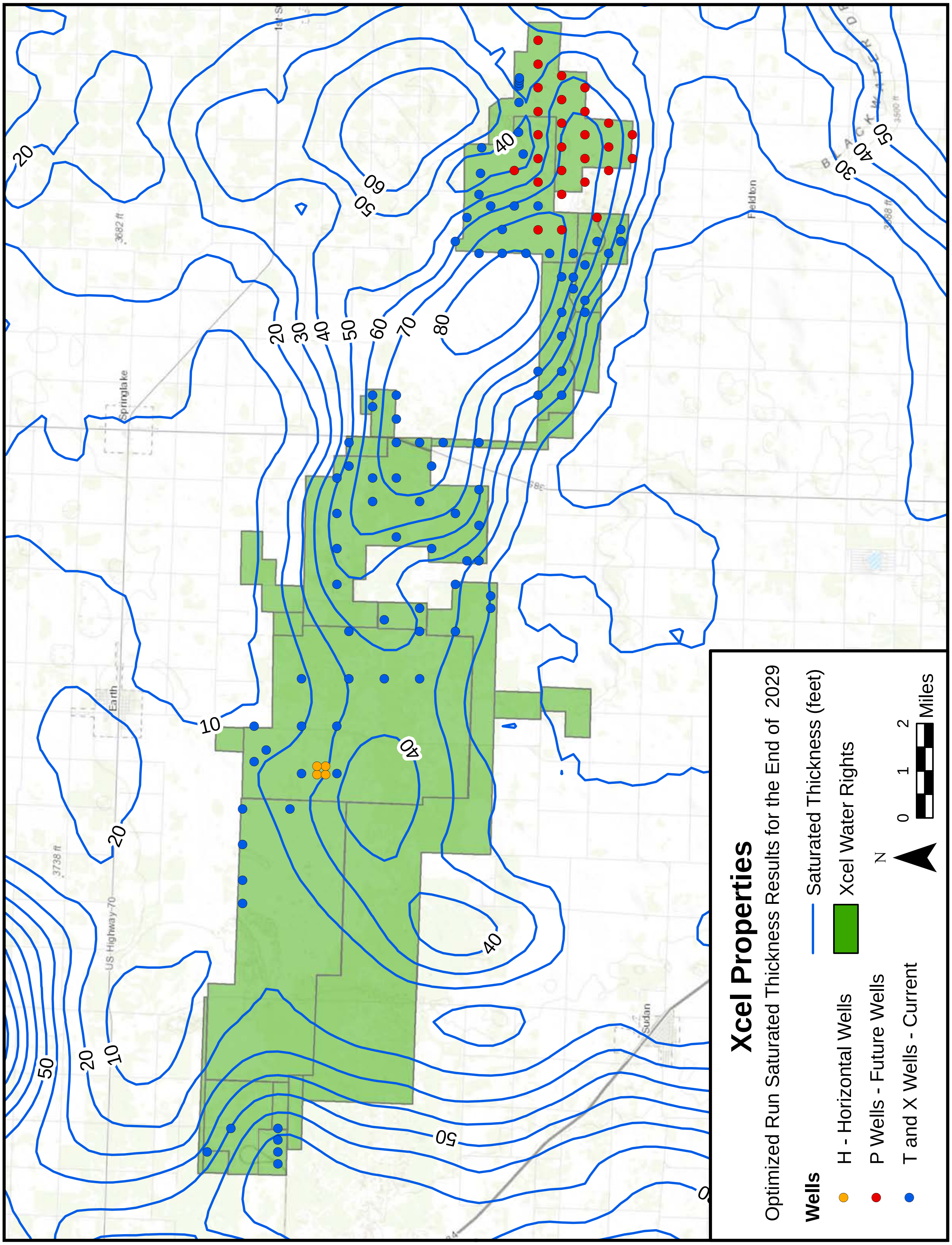

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2024
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Fieldton
US Highway-70
10
20
30
40
50
60
70
80

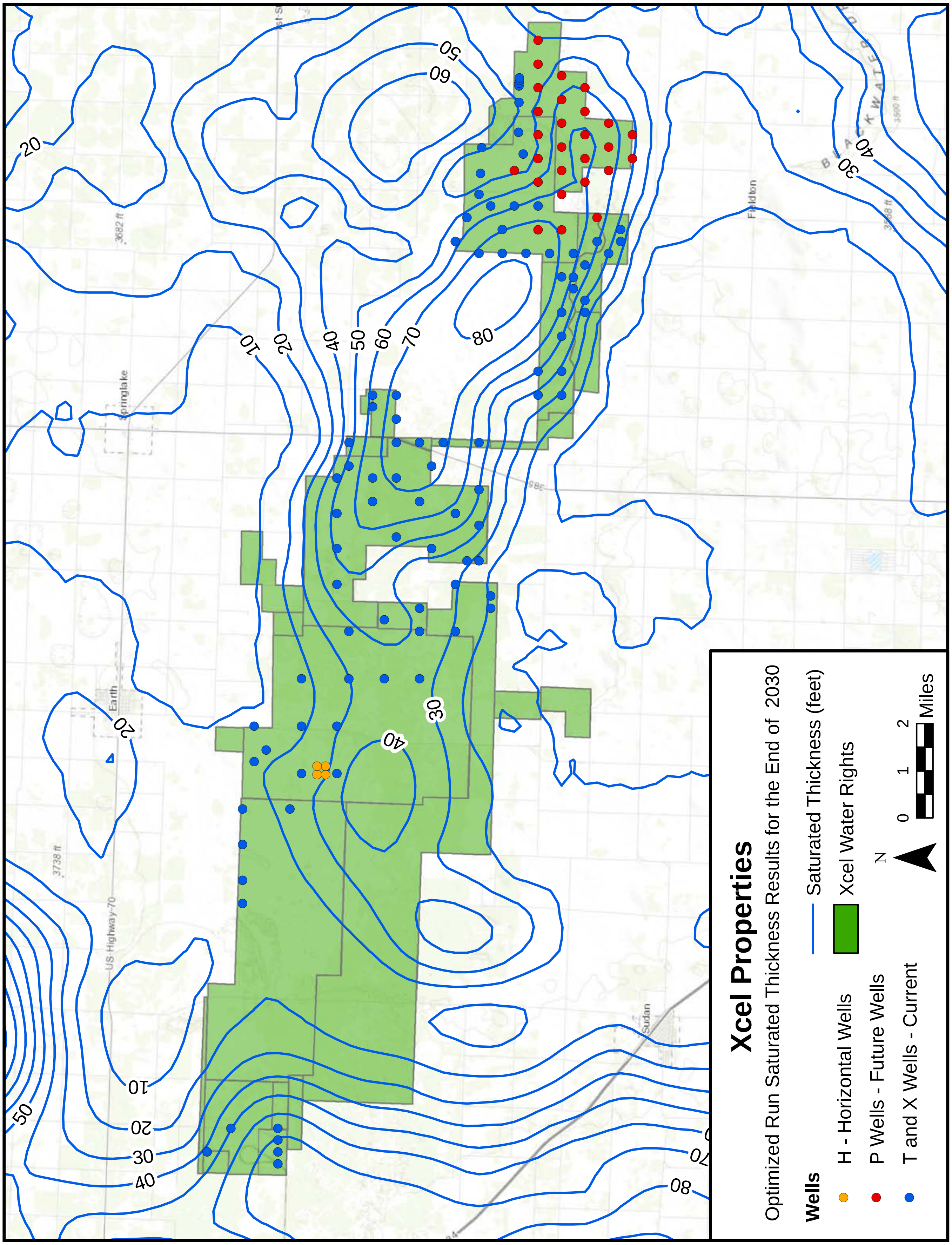

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2025
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

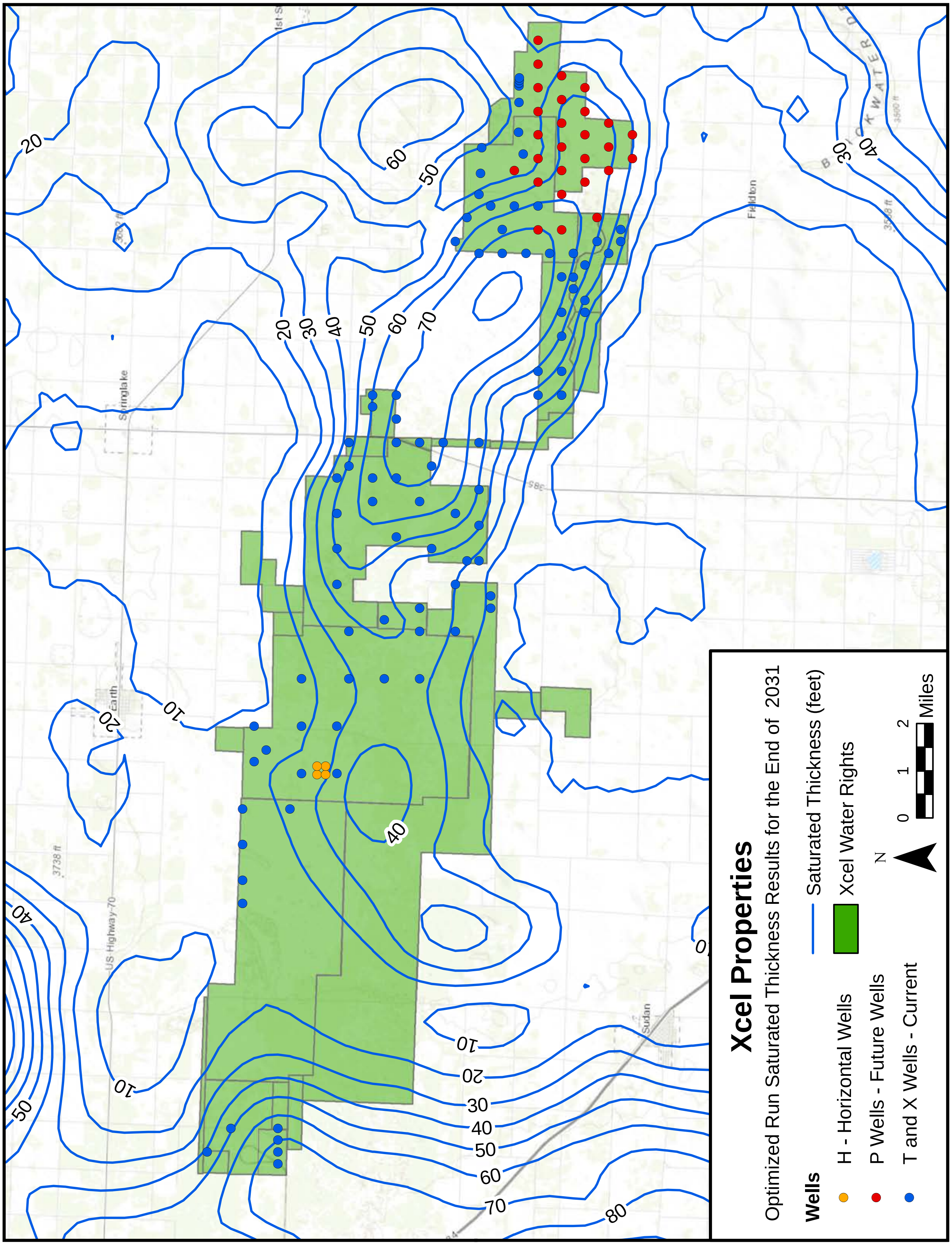

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2026
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
10
20
30
40
50
60
70
80
90

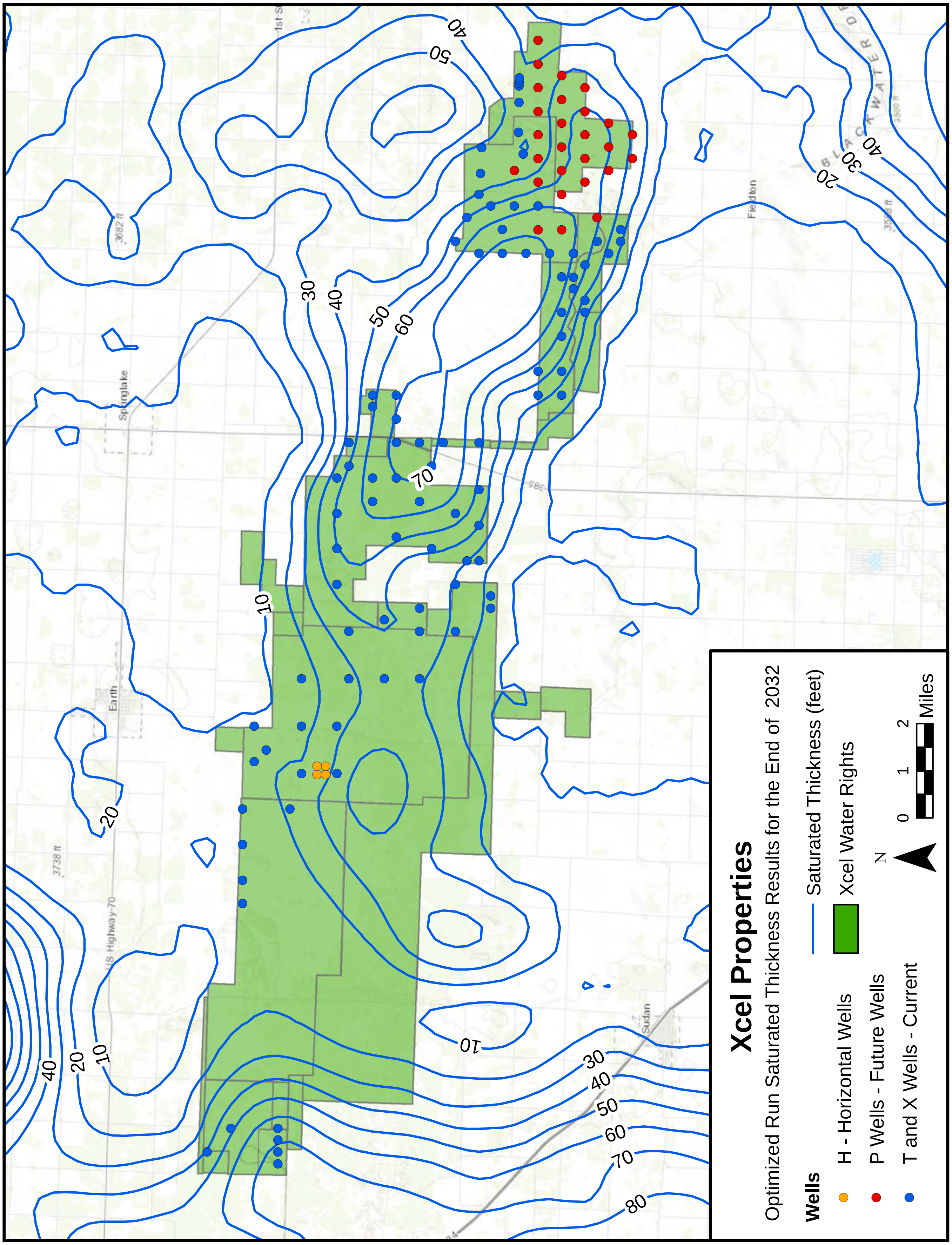

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2027
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80


Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2028
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

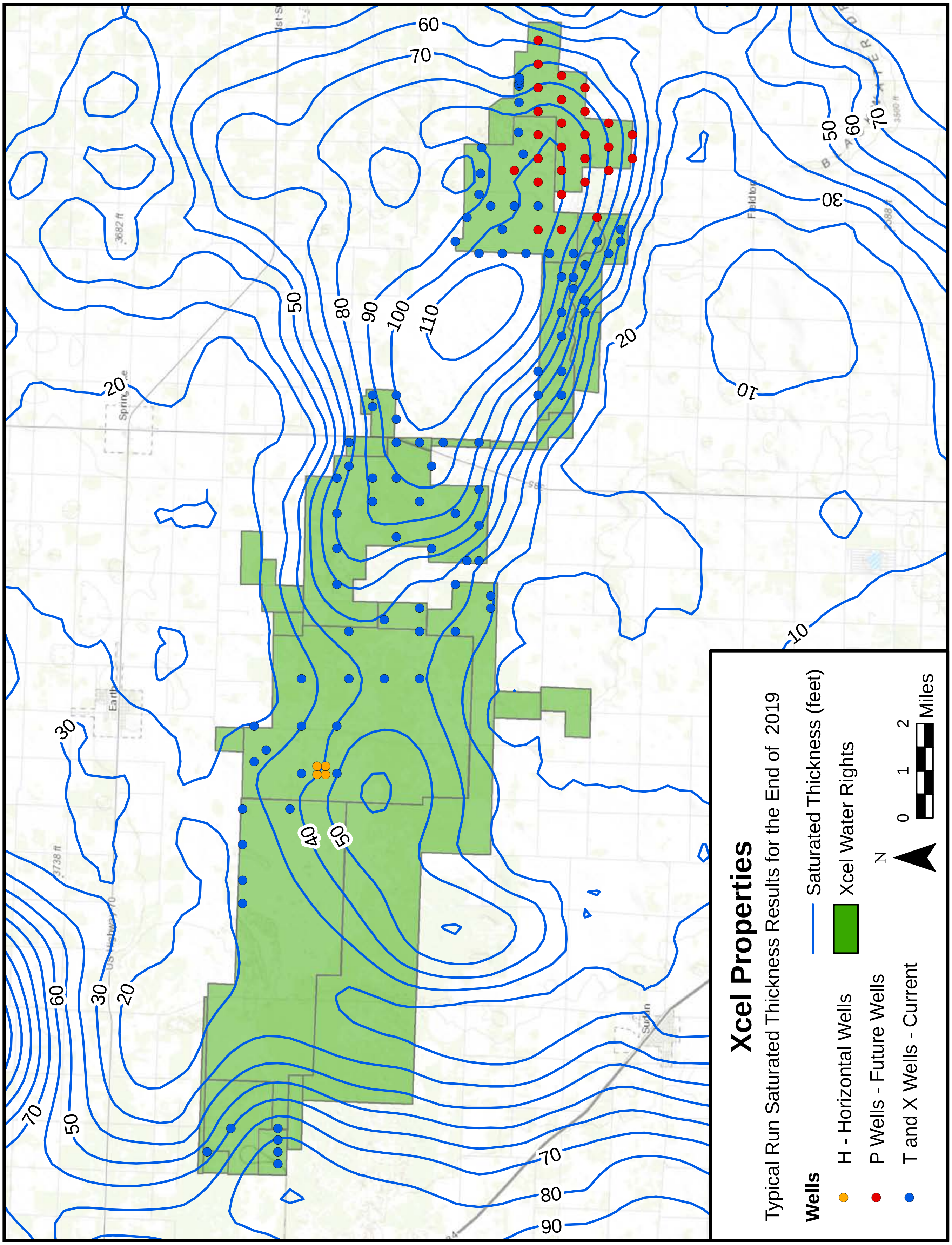

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2029
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

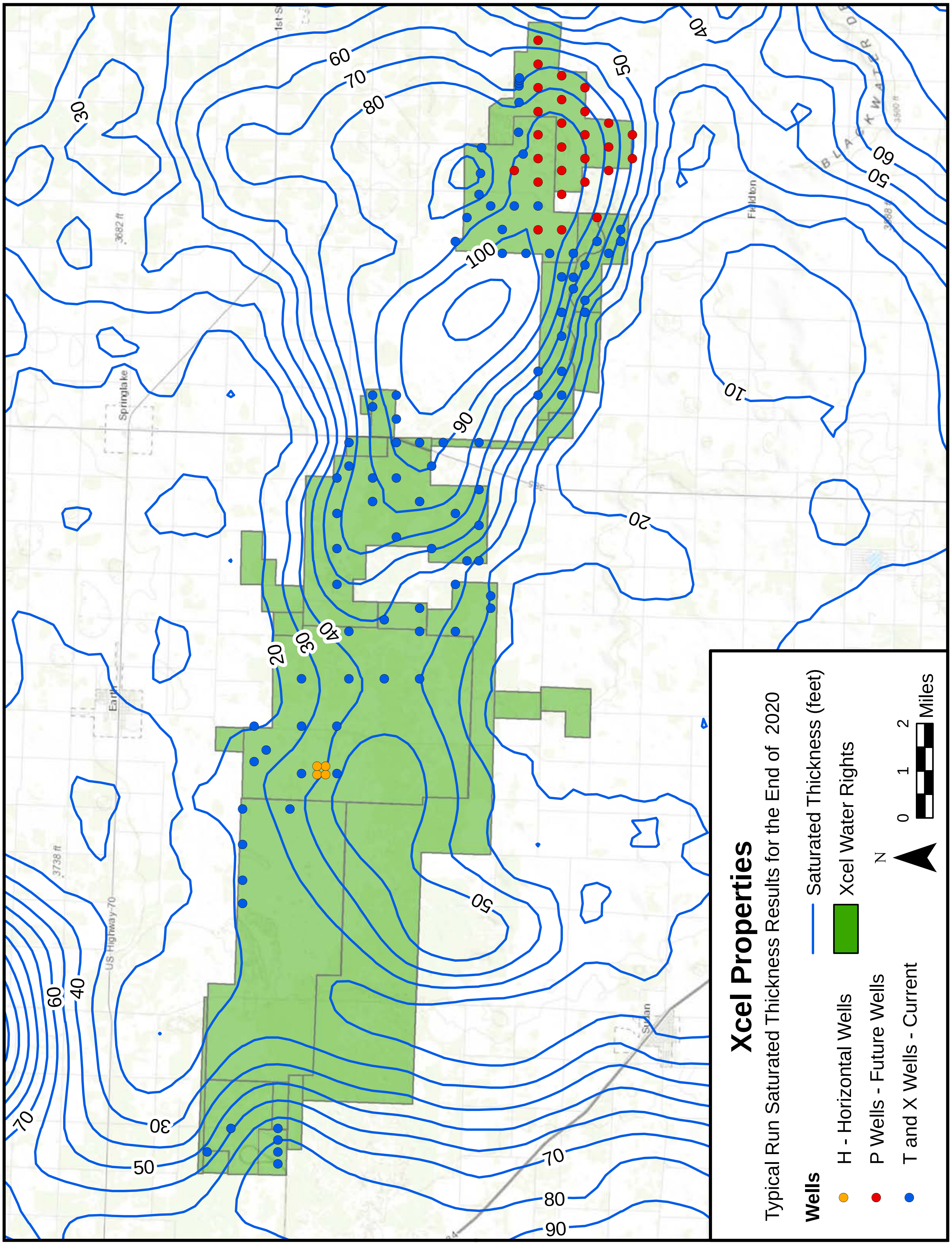

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2030
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

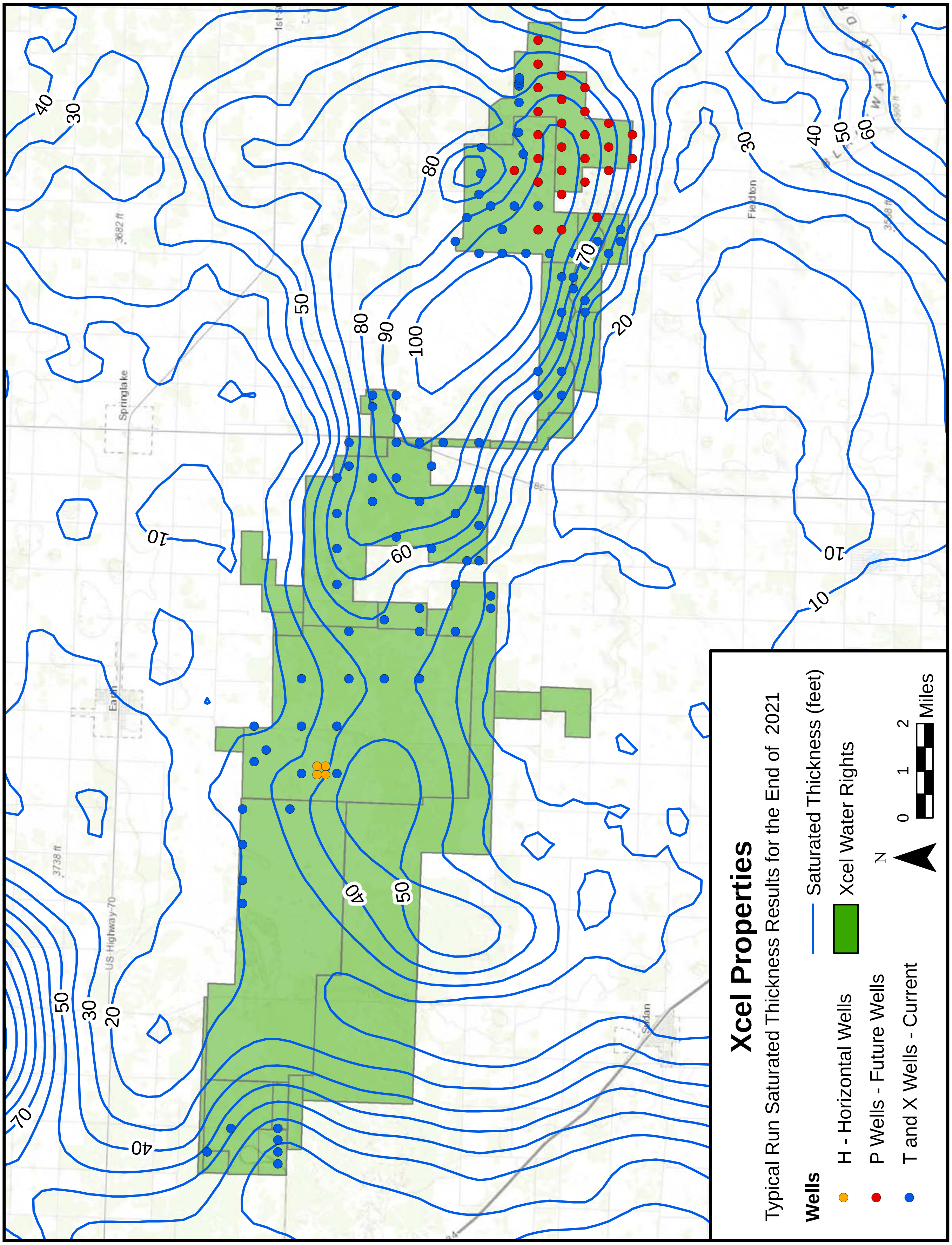

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2031
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

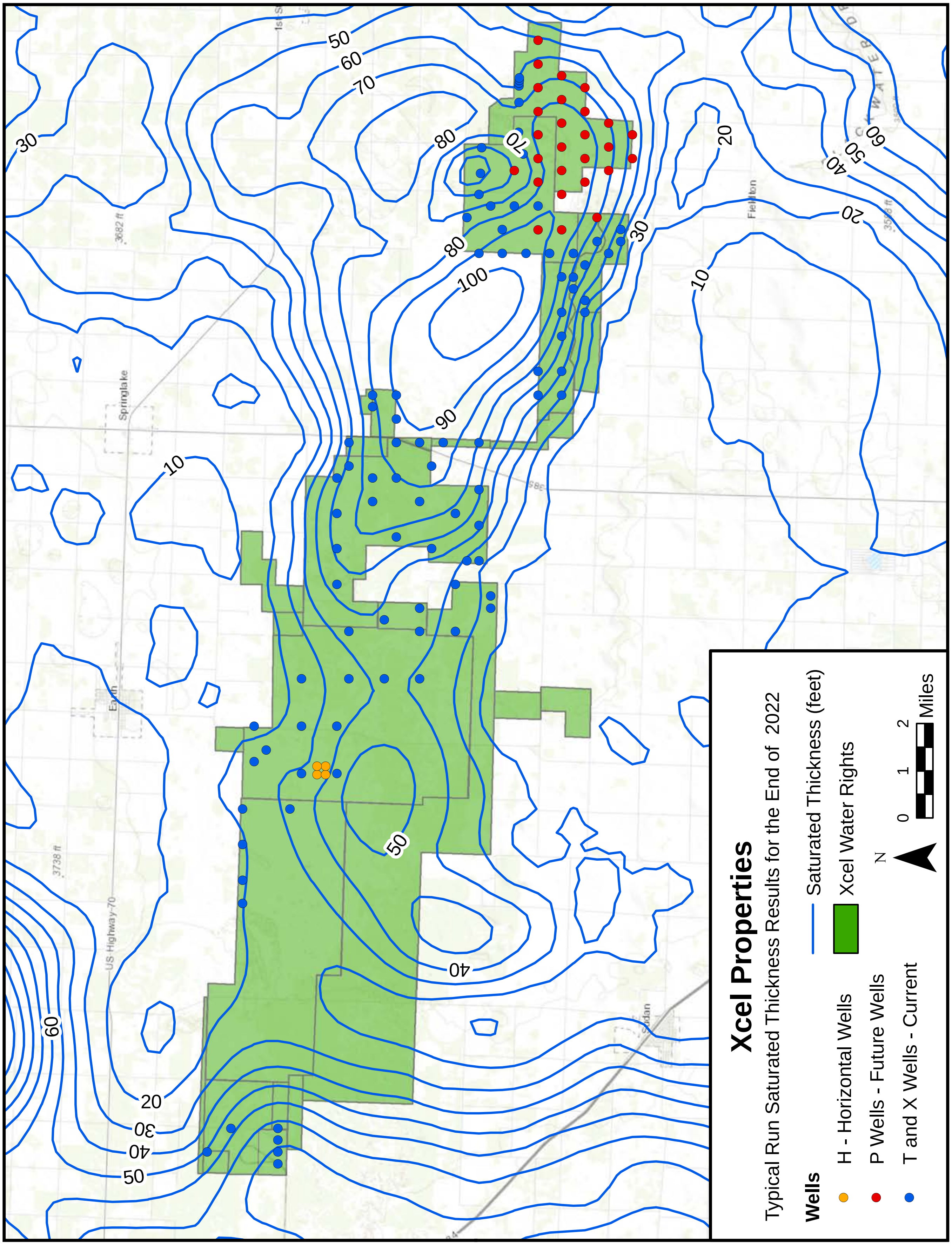

Xcel Properties
Optimized Run Saturated Thickness Results for the End of 2032
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80

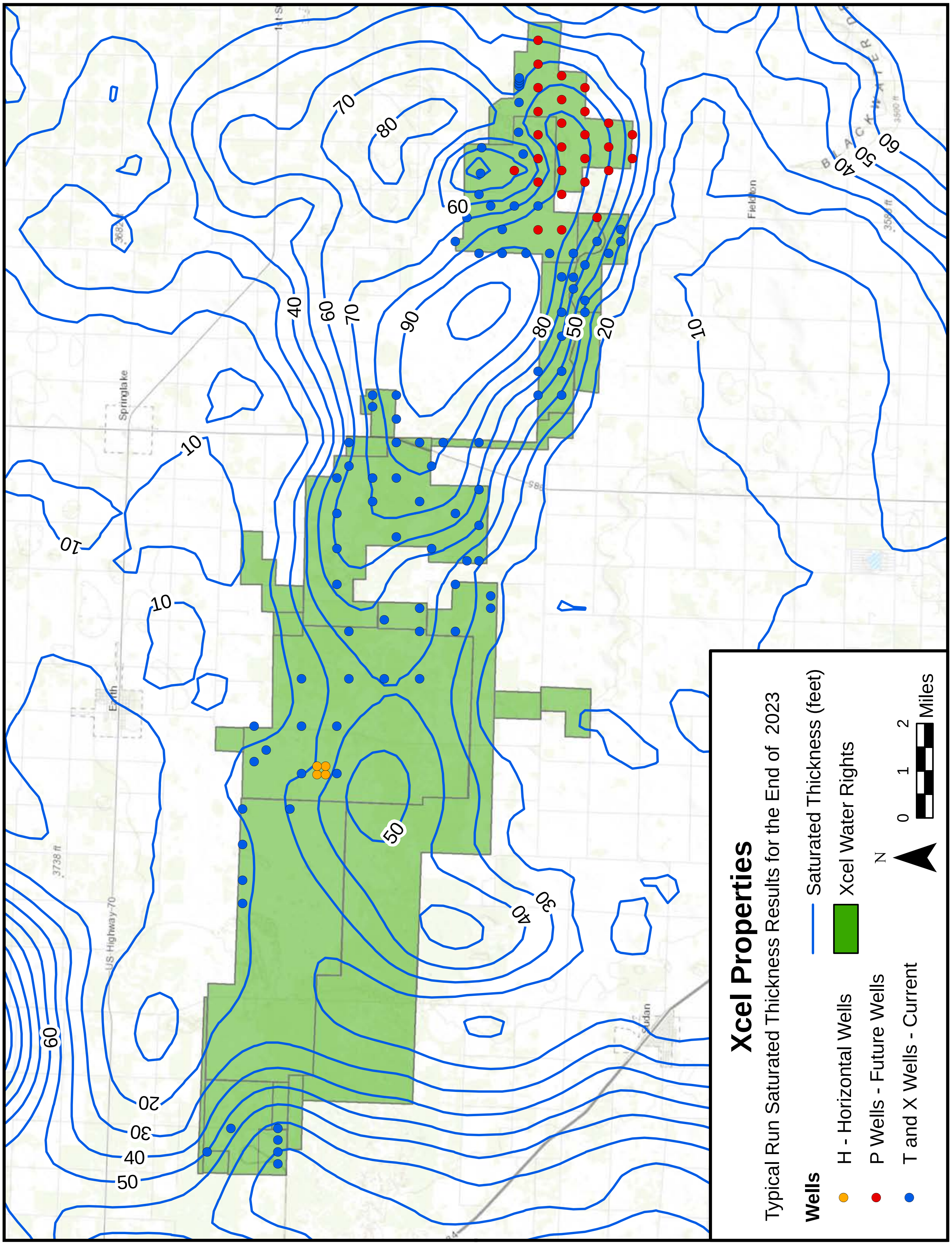
Appendix C —
Saturated Thickness Maps for Typical Demand Scenario

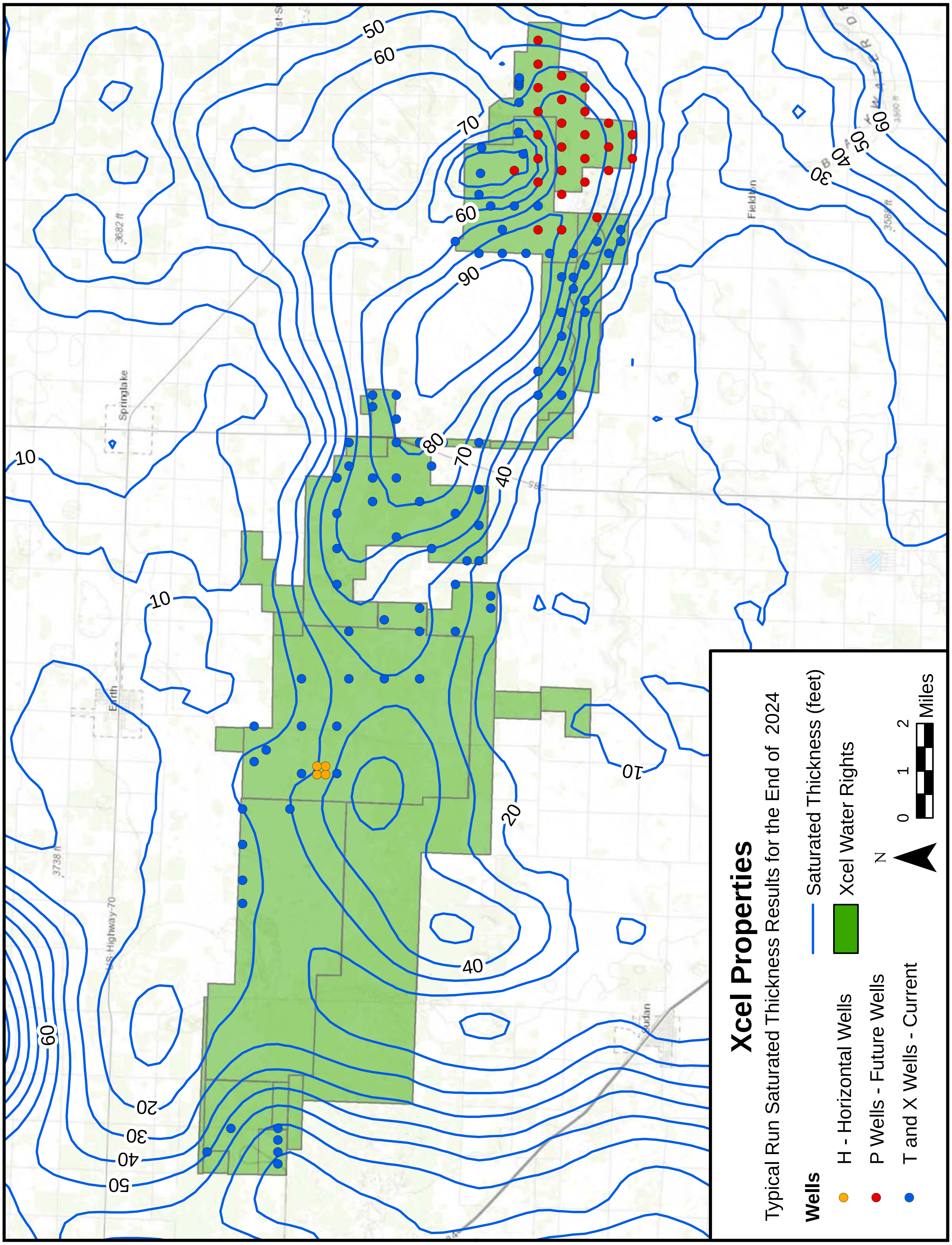

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2019
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles

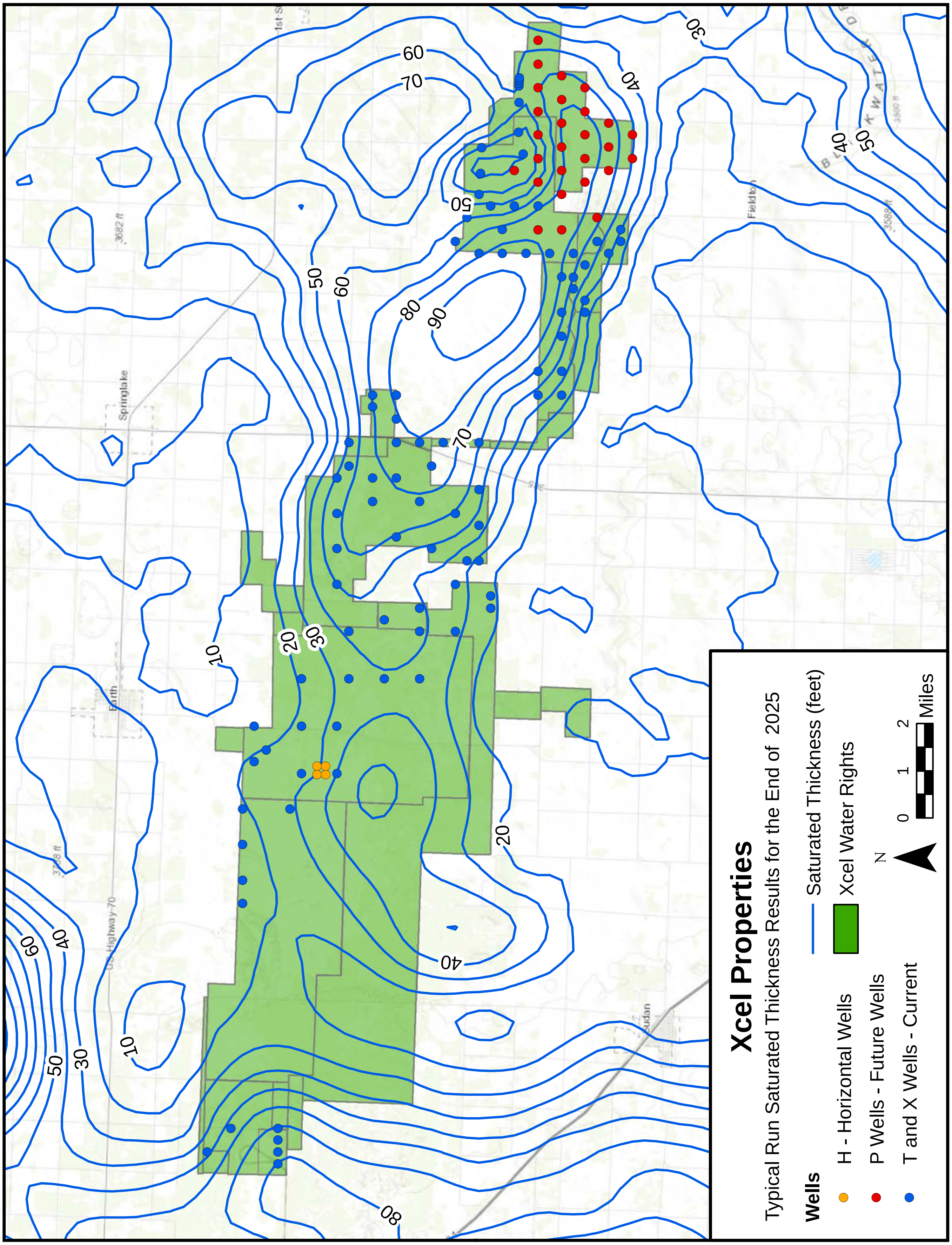

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2020
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Fieldton
US Highway-70

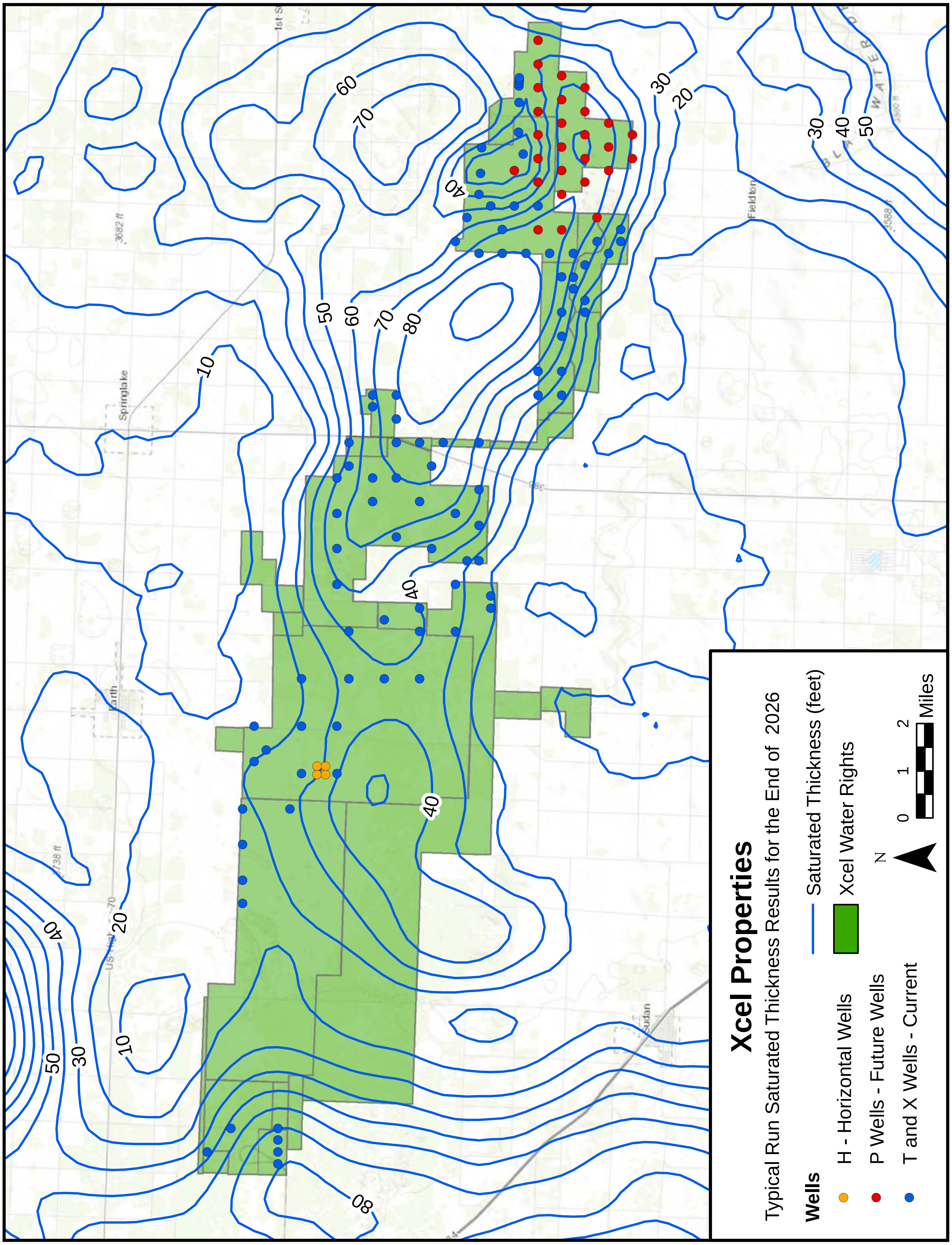

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2021
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80
90
100

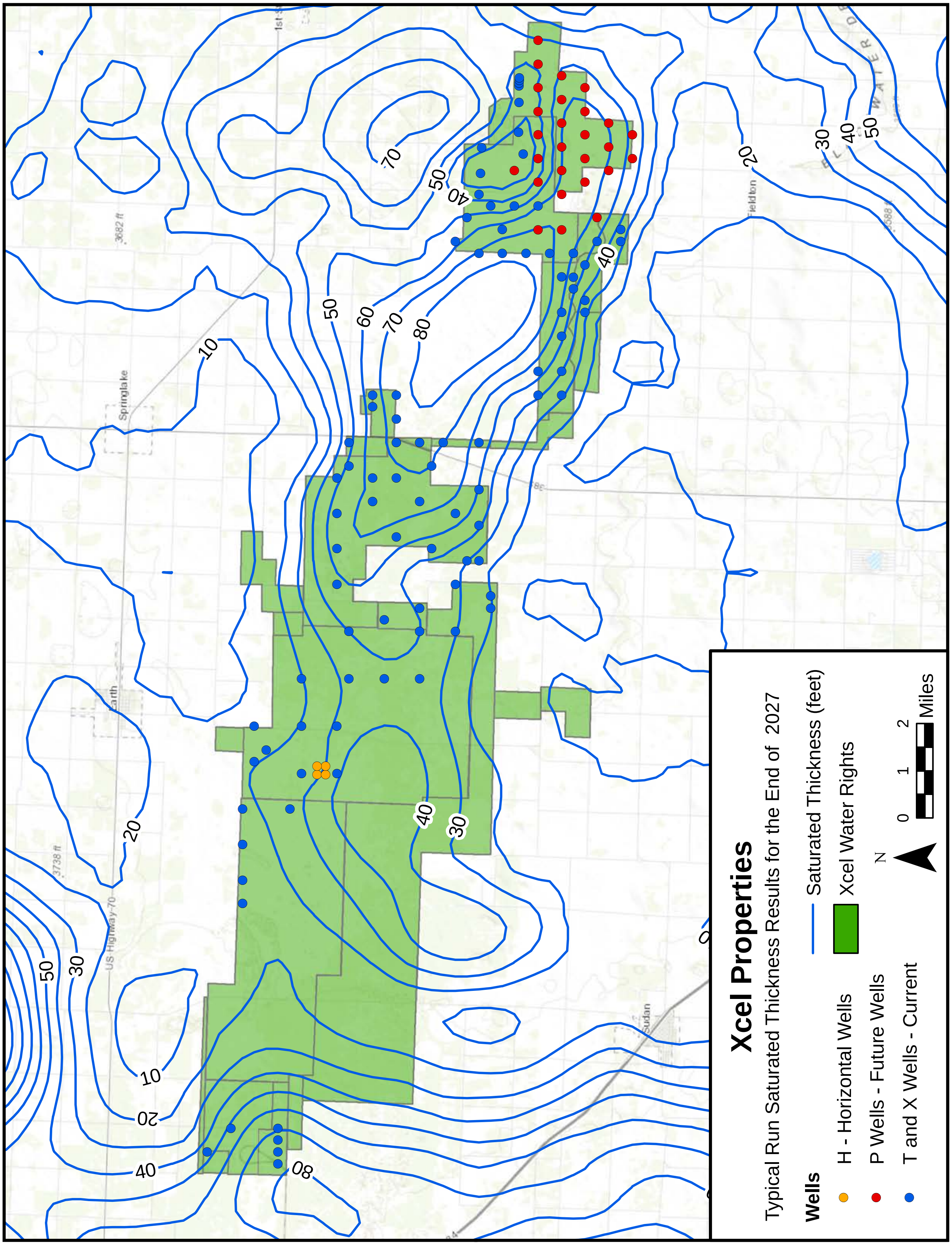

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2022
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
US Highway-70
Sudan
Fieldton

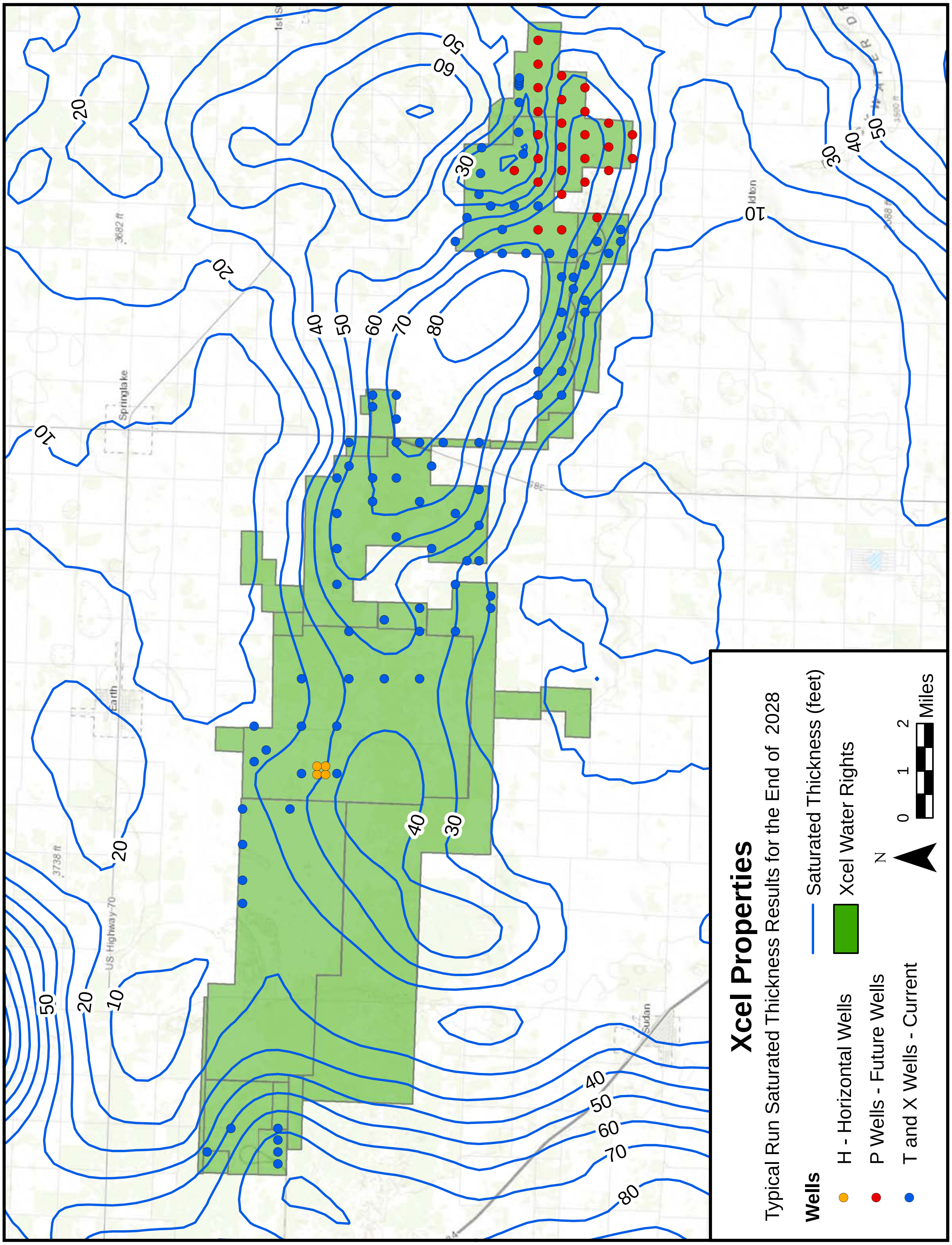

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2023
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80
90

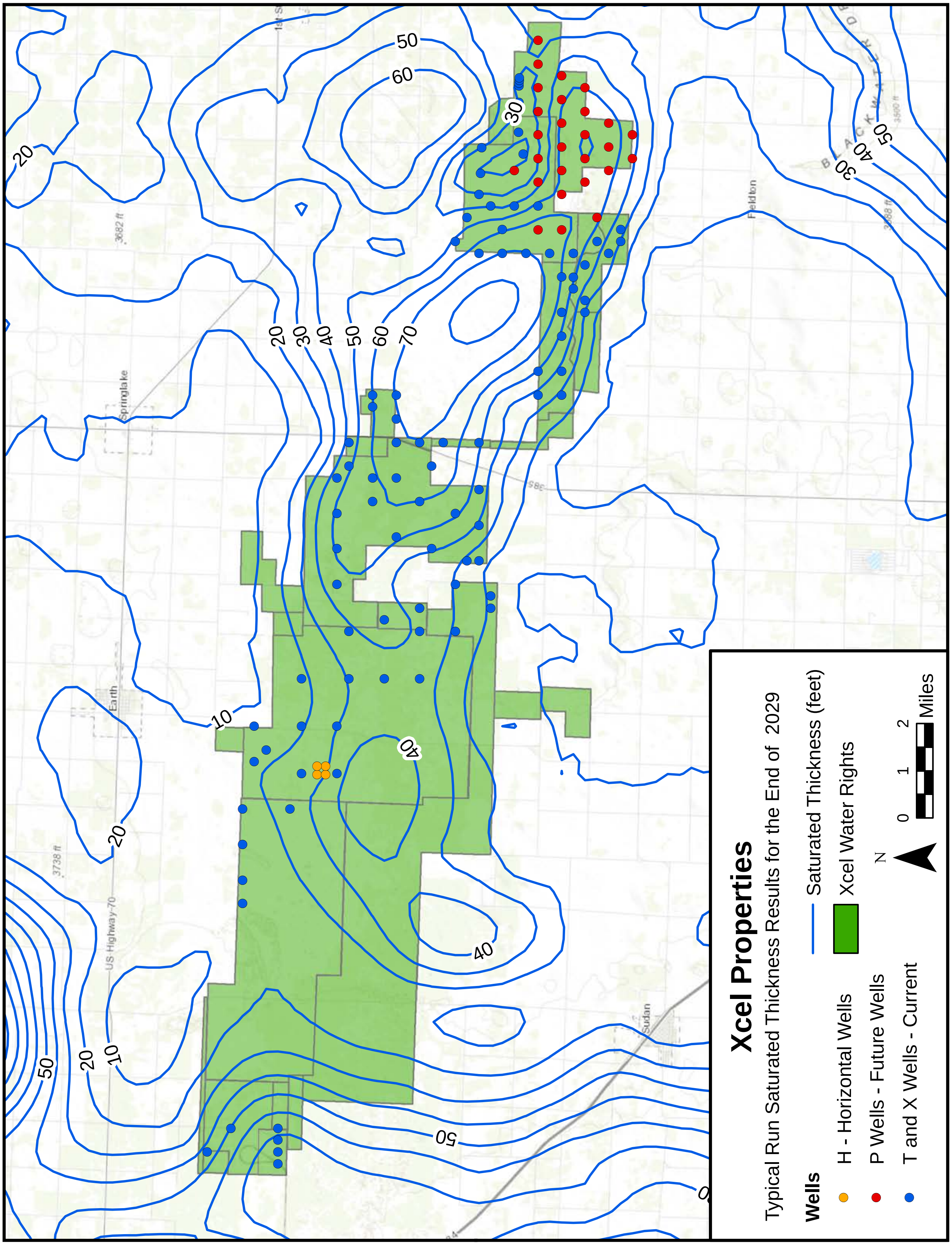

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2024
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
US Highway-70
Fieldton
10
20
30
40
50
60
70
80
90

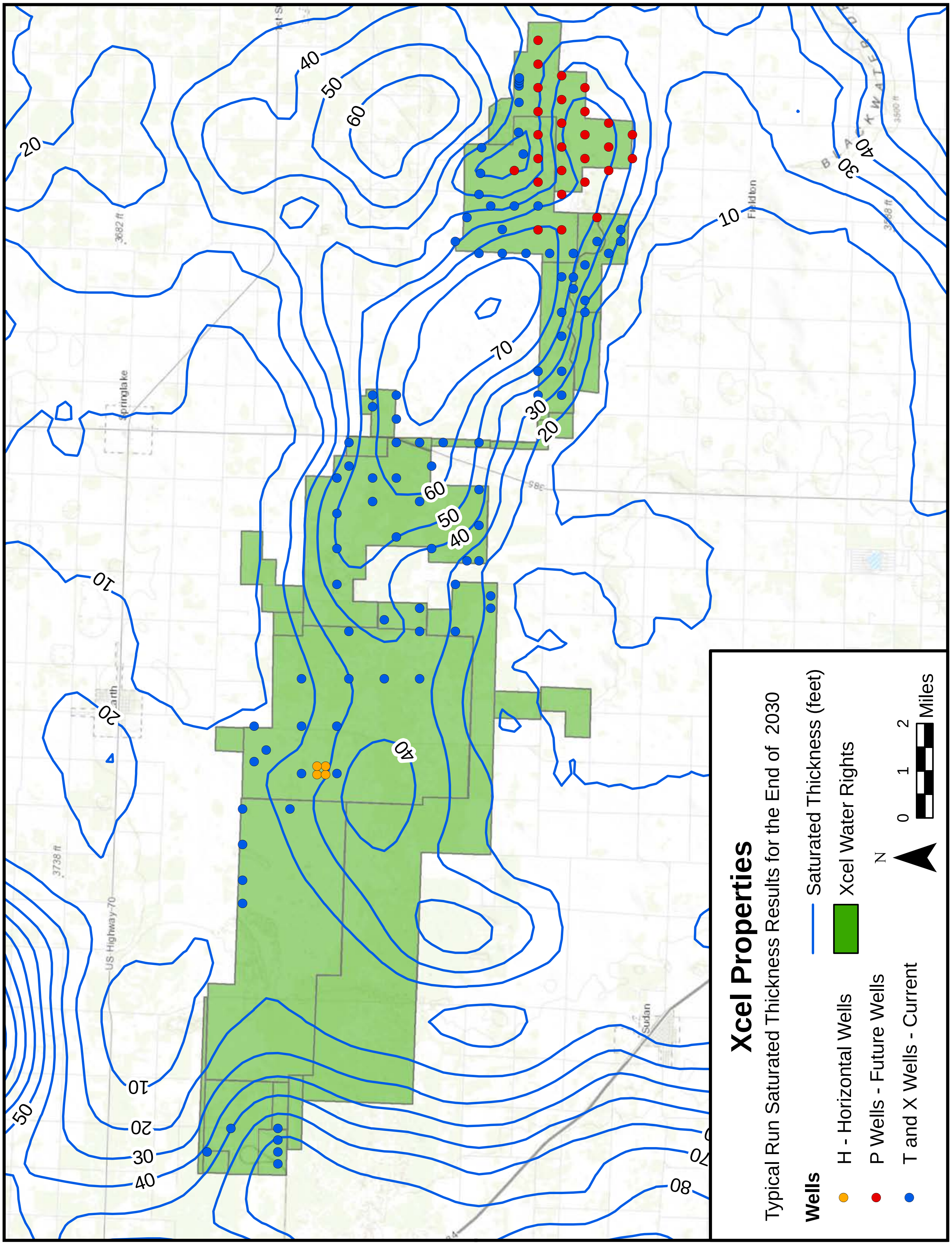

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2025
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

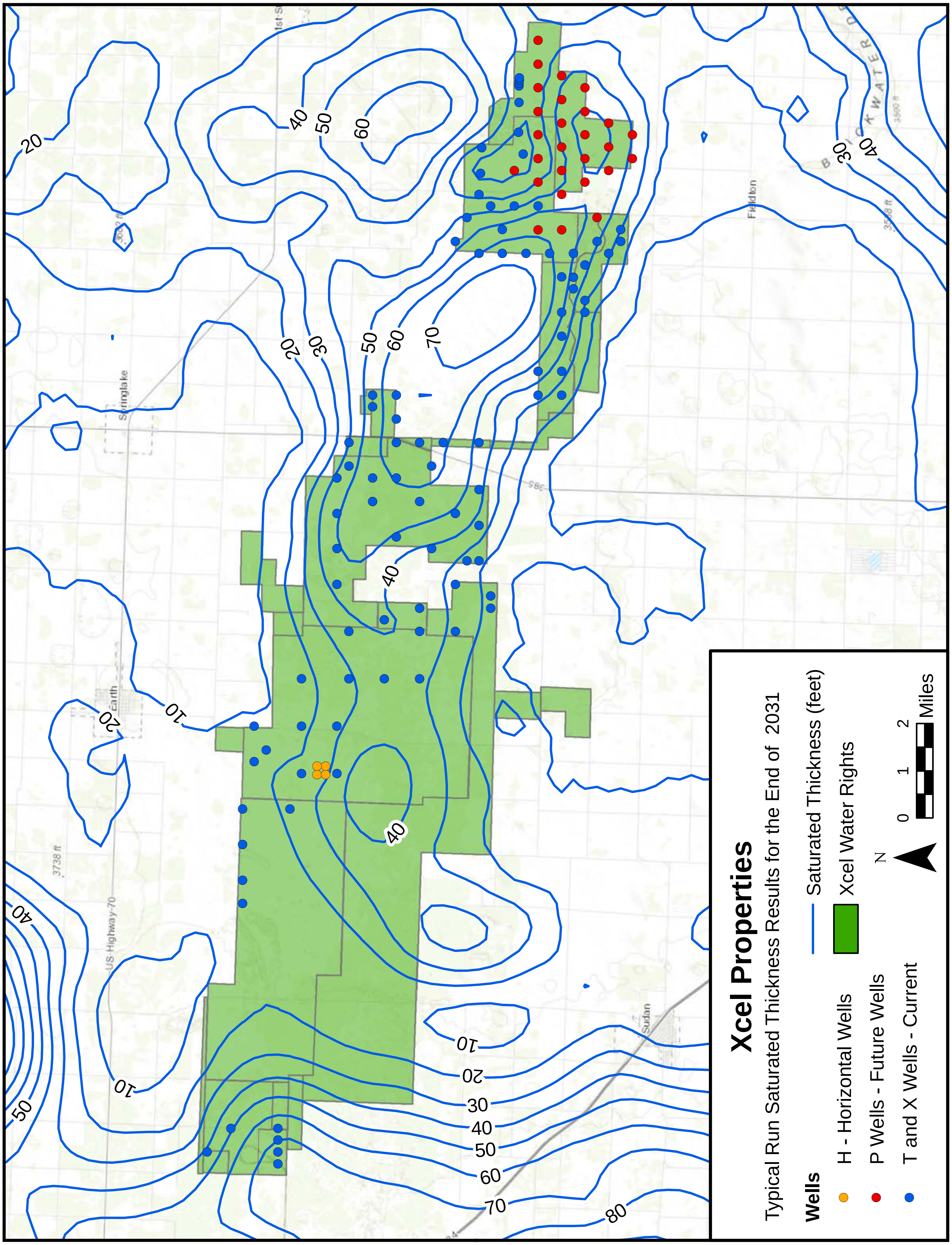

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2026
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
10
20
30
40
50
60
70
80

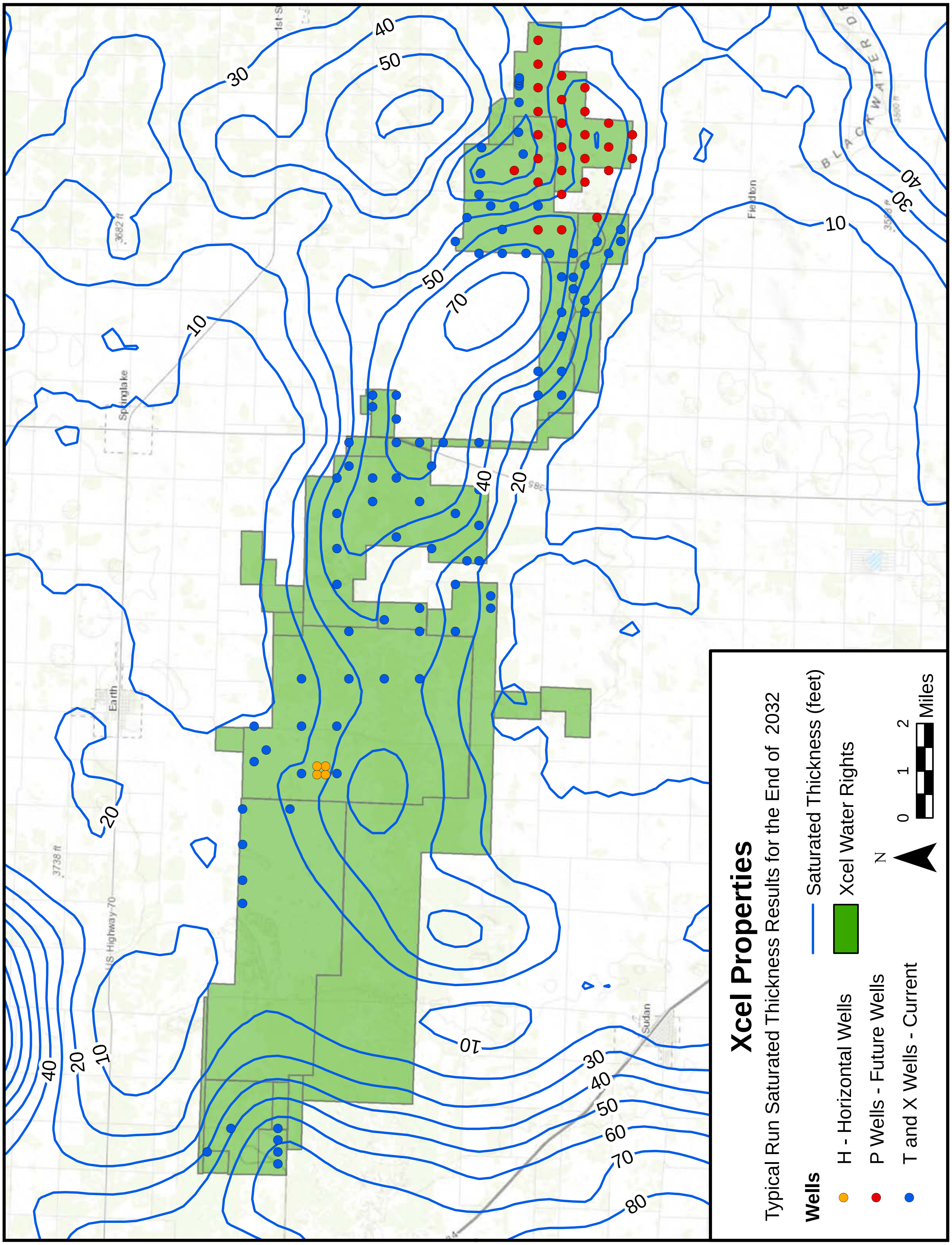

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2027
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway 70


Xcel Properties
Typical Run Saturated Thickness Results for the End of 2028
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
US Highway-70


Xcel Properties
Typical Run Saturated Thickness Results for the End of 2029
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

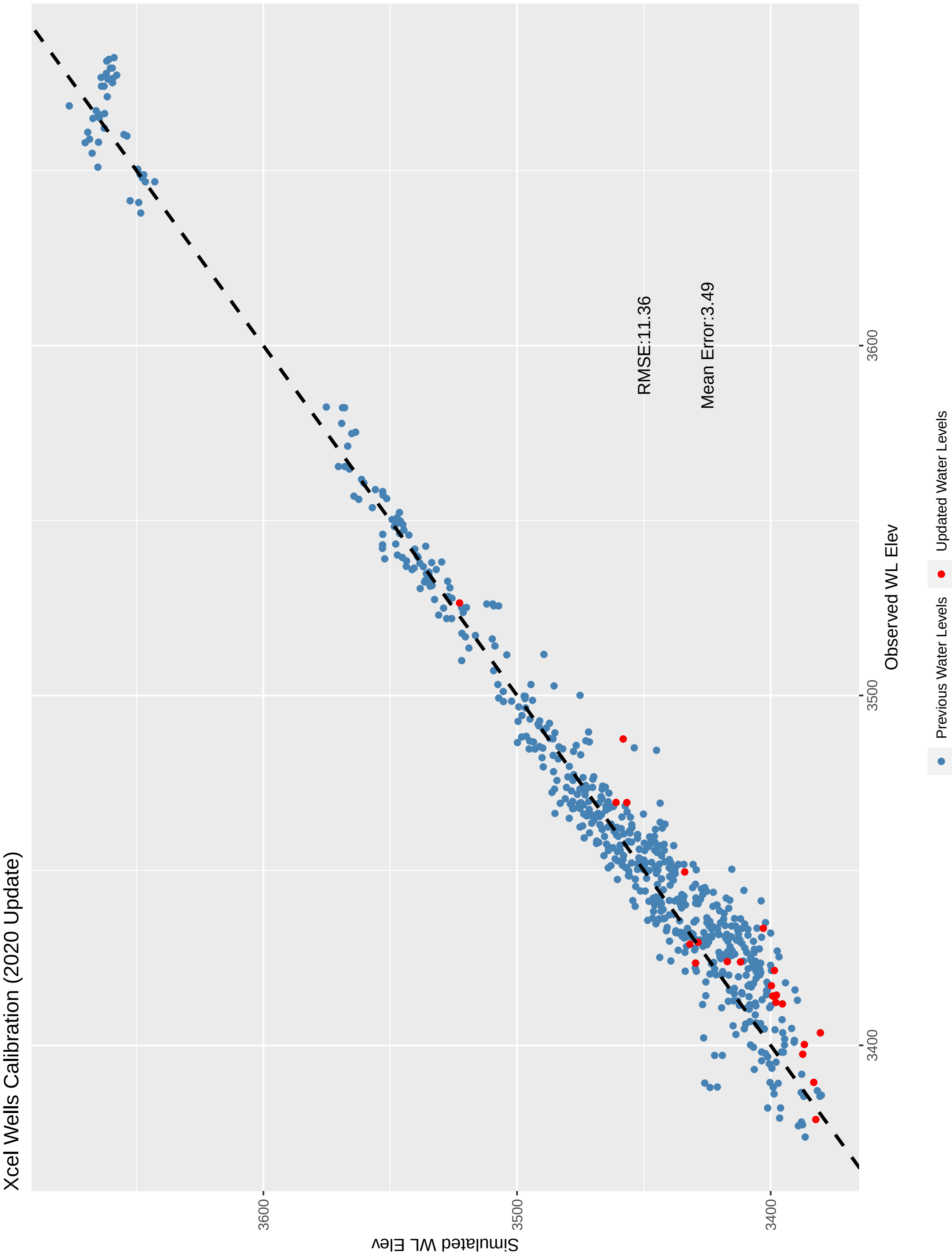

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2030
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0 1 2 Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70

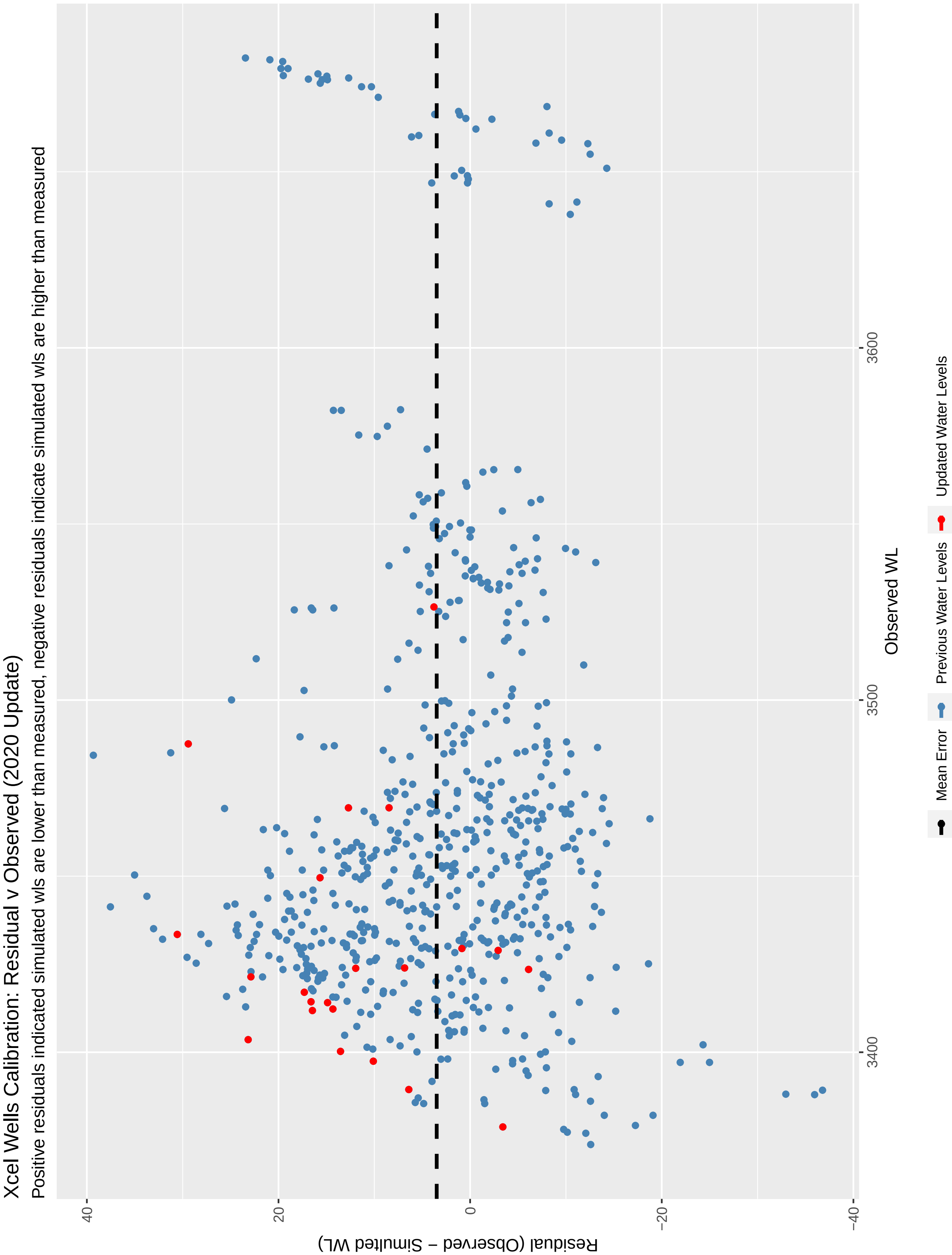

Xcel Properties
Typical Run Saturated Thickness Results for the End of 2031
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70


Xcel Properties
Typical Run Saturated Thickness Results for the End of 2032
Wells
H - Horizontal Wells
P Wells - Future Wells
T and X Wells - Current
Saturated Thickness (feet)
Xcel Water Rights
N
0
1
2
Miles
Springlake
Earth
Sudan
Fieldton
US Highway-70
10
20
30
40
50
60
70
80

Appendix D –

Water Level Calibration Results


Xcel Wells Calibration (2020 Update)
RMSE:11.36
Mean Error:3.49
Simulated WL Elev
Observed WL Elev
3400
3500
3600
Previous Water Levels
Updated Water Levels


Xcel Wells Calibration: Residual v Observed (2020 Update)
Positive residuals indicated simulated wls are lower than measured, negative residuals indicate simulated wls are higher than measured
Residual (Observed – Simulted WL)
40
20
0
−20
−40
3400
3500
3600
Observed WL
Mean Error
Previous Water Levels
Updated Water Levels