Idaho Department of Water Resources

Watermaster's Report Water District 63-S (Stewart Gulch)

October 1, 2022 – September 30, 2023

McVay, Michael
February 16, 2024

Withdrawals

The combined total withdrawal in Stewart Gulch Ground Water District 63-S (WD 63-S) in Water Year 2023 (WY23) was 160.3 million gallons (mgal), which is a decrease of 33.0 (-17%) mgal from WY22 (Figure 1; Table 1). The reduction in District withdrawals is due to reduced usage in all Terteling wells.

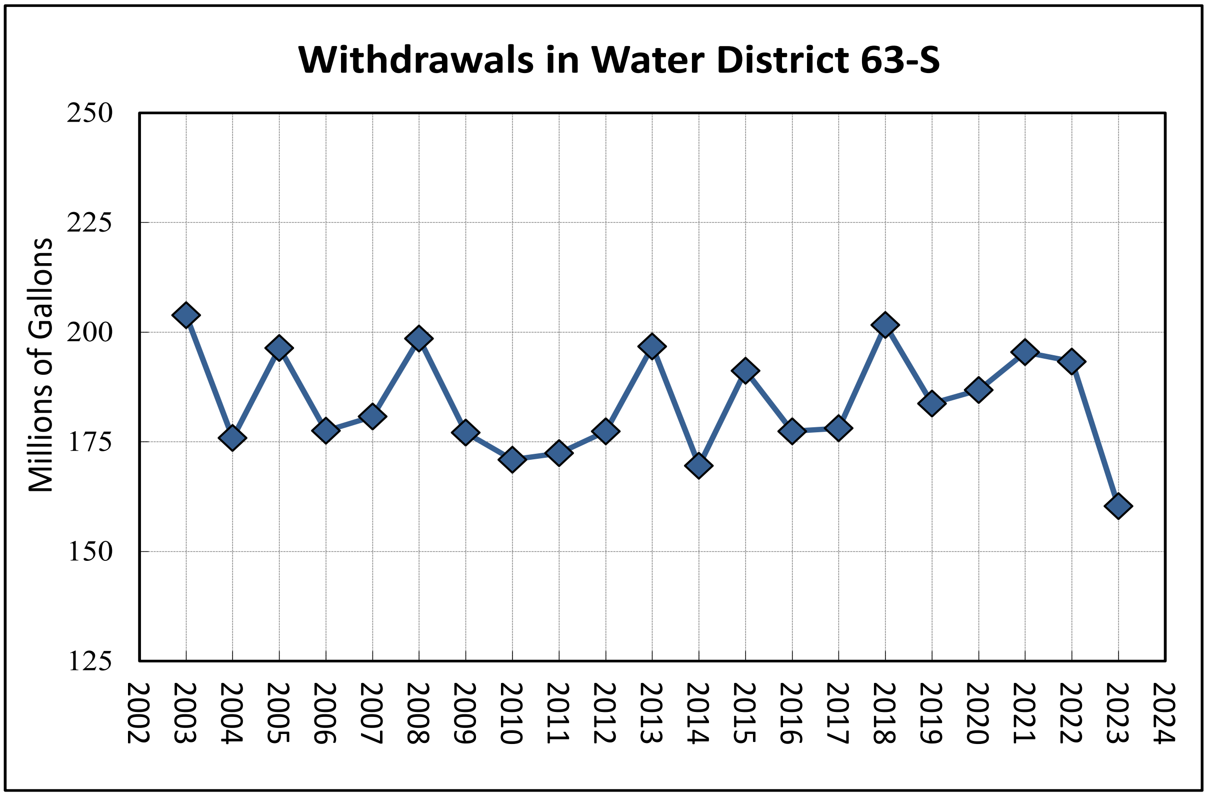

Figure 1. Low-temperature geothermal withdrawals in WD 63-S for the period WY03 – WY23.

Production Wells

TLP Production

All Terteling Company, Inc. (TLP) production wells reduced usage from WY22 to WY23, and the combined withdrawal decreased 41.8 mgal (-32%).

The TLP Garden wells both decreased withdrawals from WY22 to WY23. The Silkey well decreased withdrawals by 3.1 mgal (-20%), and the House well decreased withdrawals by 0.3 mgal (-12%) (Table 1; Appendix A).

The Terteling Ranch wells both decreased withdrawals from WY22 to WY23. The Pool well decreased withdrawals by 4.3 mgal (-23%), and the Windsock well decreased withdrawals by 34.1 mgal (-35%) (Table 1; Appendix A).

Quail Hollow Production
The meters on both the Upper and Lower wells were determined to be non-functional in February 2021 and were replaced in March 2023. Although the wells were not metered for the entirety of WY23, they are used as irrigation wells and any use before March is most likely negligible. Based on the reported production volumes, the total withdrawal by Quail Hollow decreased by an estimated 1.4 mgal from WY22 to WY23 (Table 1).

The total reported withdrawal from the Upper well increased from no usage to 1.7 mgal, and the total WY23 withdrawal from the Lower well increased by 0.03 mgal (+481%) from WY22 to WY23

Edwards and Niznik Production
The total withdrawal from the Edwards Greenhouse (Edwards) well increased by 6.9 mgal (+13%) from WY22 to WY23 (Table 1).

The total withdrawal from the Niznik well increased by 0.2 mgal (+3%) from WY22 to WY23.

Table 1. Withdrawals from WD 63-S well for Water Year 2023.

Well	Withdrawals (mgal)	Change from WY22 (mgal)	Percent Change from WY22
Terteling Ranch Pool	14.6	-4.3	-23%
Terteling Ranch Windsock	62.2	-34.1	-35%
TLP Silkey	12.1	-3.1	-20%
TLP House	1.9	-0.3	-12%
Edwards	61.7	+6.9	+13%
Niznik	6.0	+0.2	+3%
Quail Hollow #1 (Upper)	1.7	+1.7	NA
Quail Hollow #2 (Lower)	0.03	+0.03	+481%
Total	**160.3**	**-33.0**	**-17%**

Withdrawal Centers
The locations of the wells allow them to be grouped into five withdrawal centers: 1) Terteling Ranch, 2) TLP Garden, 3) Edwards, 4) Niznik, and 5) Quail Hollow (Appendix A). This is a useful approach for summarizing the withdrawals in localized areas within WD 63-S (Table 2) and allows for the visual assessment of the relative magnitude of withdrawals in the sub-district areas (Figure 2).

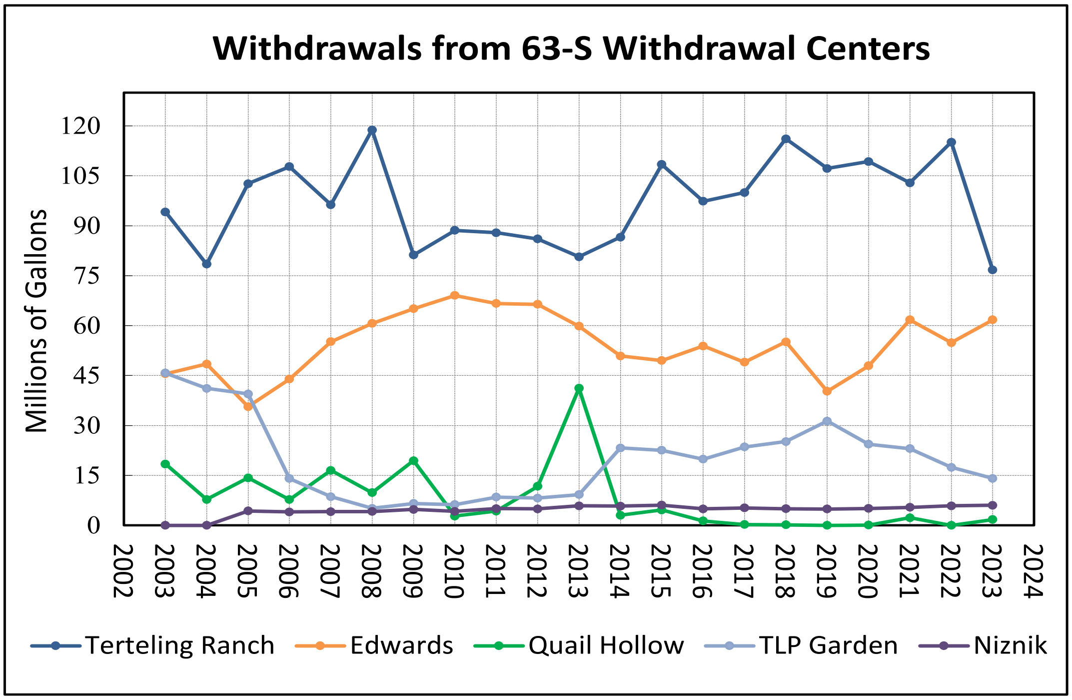

Figure 2. WD 63-S withdrawals grouped by withdrawal center for WY03-WY23.

Table 2. Five withdrawal centers in WD 63-S and changes from WY22 to WY23.

Withdrawal Center	Withdrawals (mgal)	Percent of WY23 District Withdrawals	Change from WY22 (mgal)
Terteling Ranch	76.7	48%	-38.4
Edwards	61.7	39%	+6.9
TLP Garden	14.1	9%	-3.3
Niznik	6.0	4%	+0.2
Quail Hollow	1.7	1%	+1.7

Terteling Ranch and Edwards were the two largest water users in WY23 and accounted for 48% and 39% of WD 63-S withdrawals, respectively. Combined withdrawals from TLP Garden, Niznik, and Quail Hollow accounted for the remaining 14% of total District withdrawals (Table 2).

Withdrawals Trends

Statistically significant trends provide a technically defensible assessment of changes over time. Statistical significance indicates that there is a non-zero trend in the data at the chosen confidence interval, and the calculated trend is assumed to be the best linear representation of changes over time. Lack of statistical significance indicates that the trend cannot be considered different than zero (at the chosen confidence interval), and the calculated trend does not represent changes over time. A confidence interval of 95% has been used to determine statistical significance for all WD 63-S trends.

The WY03 – WY23 trend in combined withdrawals for WD 63-S is -0.01 mgal/year; however, the trend is not statistically significant. Furthermore, the magnitude of the trend may be smaller than the uncertainty of the flow measurements (Table 3).

The WY03 – WY23 withdrawal trend for the Terteling Ranch Windsock and Pool wells are 0.5 and 0.2 mgal/year, respectively; however, neither trend is statistically significant (Table 3).

The WY03 – WY23 withdrawal trends for the TLP Silkey and House wells are 0.2 and 0.1 mgal/year, respectively; however, neither trend is statistically significant (Table 3).

The WY03 – WY23 withdrawal trend for Edwards is 0.2 mgal/year; however, the trend is not statistically significant (Table 3).

The WY03 – WY23 withdrawal trend for Niznik is 0.1 mgal/year and is statistically significant (Table 3).

The Quail Hollow Upper well has not been used in 6 of the last 9 years; therefore, a withdrawal trend would be misleading and has not been calculated. The WY03 – WY23 withdrawal trend for the Lower well is -0.05 mgal/year, but the trend is not statistically significant (Table 3).

Table 3. Withdrawal trends in WD 63-S for WY03 – WY23.

Well	Trend (mgal/year)[1]	p-value[2]	Statistically Significant
Terteling Windsock	0.5	0.41	NO
Terteling Pool	0.2	0.13	NO
TLP Silkey	0.2	0.65	NO
TLP House	0.2	0.33	NO
Edwards	0.2	0.65	NO
Niznik[3]	**0.1**	**0.00**	**YES**
Quail Hollow Upper[4]	**NA**	**NA**	**NA**
Quail Hollow Lower	-0.05	0.26	NO
Combined total WD 63-S	-0.01	1.0	NO

[1]Trends and significance have been calculated using the Mann-Kendall statistical test.
[2]P-values less than 0.05 indicate the trend is significant at the 95% confidence interval.
[3]Niznik trend calculated for WY05 – WY23 to due lack of data.
[4]Well has not been used in 6 of the last 9 years.

Water Levels

The shallowest (peak) water levels in a well are the best indication of the aquifer water levels because they are the least affected by local water use. Peak water levels in the Tiegs and Quail Hollow wells declined from WY22 to WY23 (Table 4); The peak water level did not change in the Edwards well.

Table 4. Peak water level changes in WD 63-S wells for WY22 – WY23.

Well	Water Level Change (ft)
Tiegs	-0.3
Edwards	0.0
Quail Hollow Upper	-5.2
Quail Hollow Lower	-2.8

Tiegs Well

The Tiegs well is used an indicator of WD 63-S aquifer conditions because it is unused and somewhat centrally located. The peak water level in the Tiegs well declined 0.3 feet (ft) from WY22 to WY23 (Figure 3; Table 4).

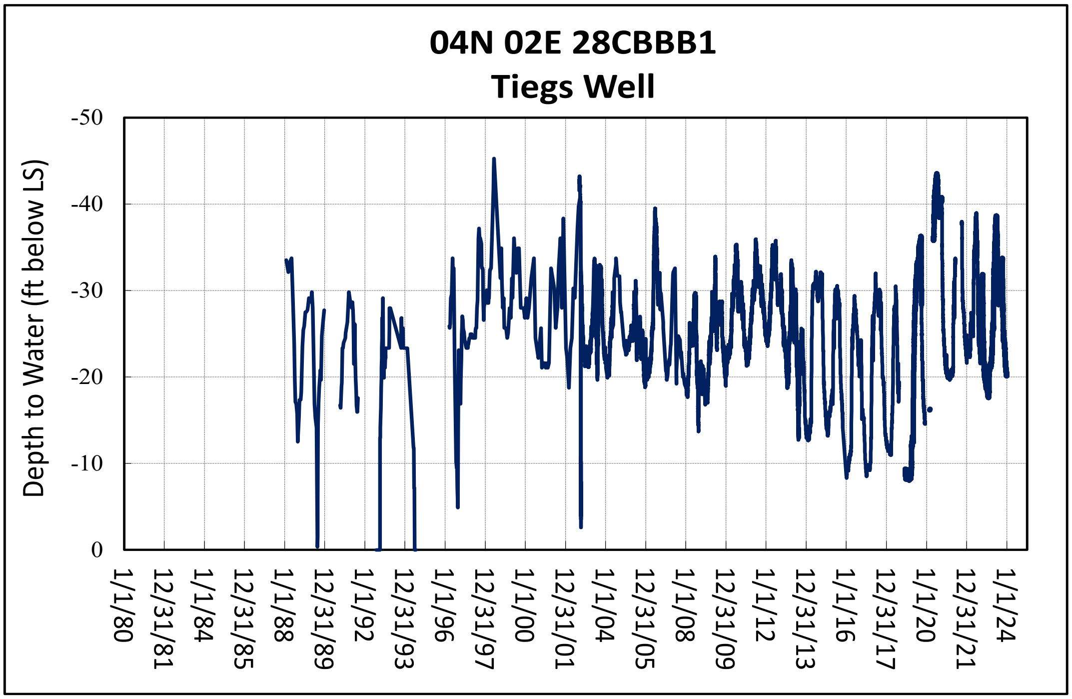

Figure 3. Water levels in the Tiegs well. Negative depths-to-water indicate the water level is above land surface.

Edwards Greenhouse Well

The peak water level in the Edwards well did not change from WY22 to WY23 (Figure 4; Table 4).

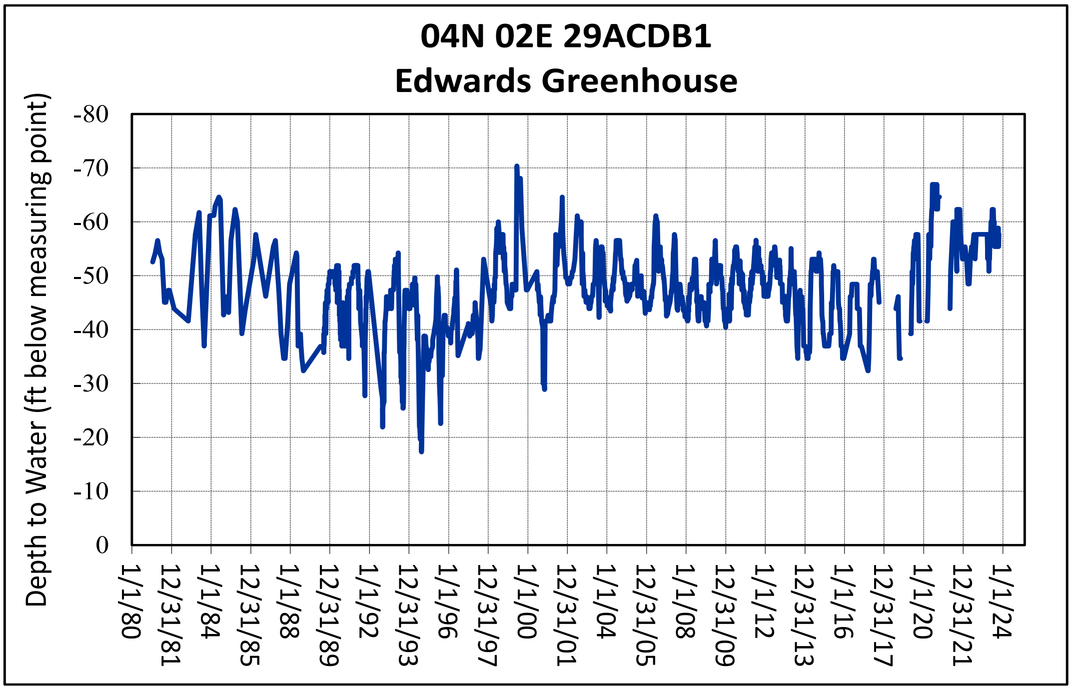

Figure 4. Water levels in the Edwards Greenhouse well. Negative depths-to-water indicate the water level is above land surface.

Quail Hollow Wells

The peak water level in the Upper well declined 5.2 ft from WY22 to WY23 (Figure 5).

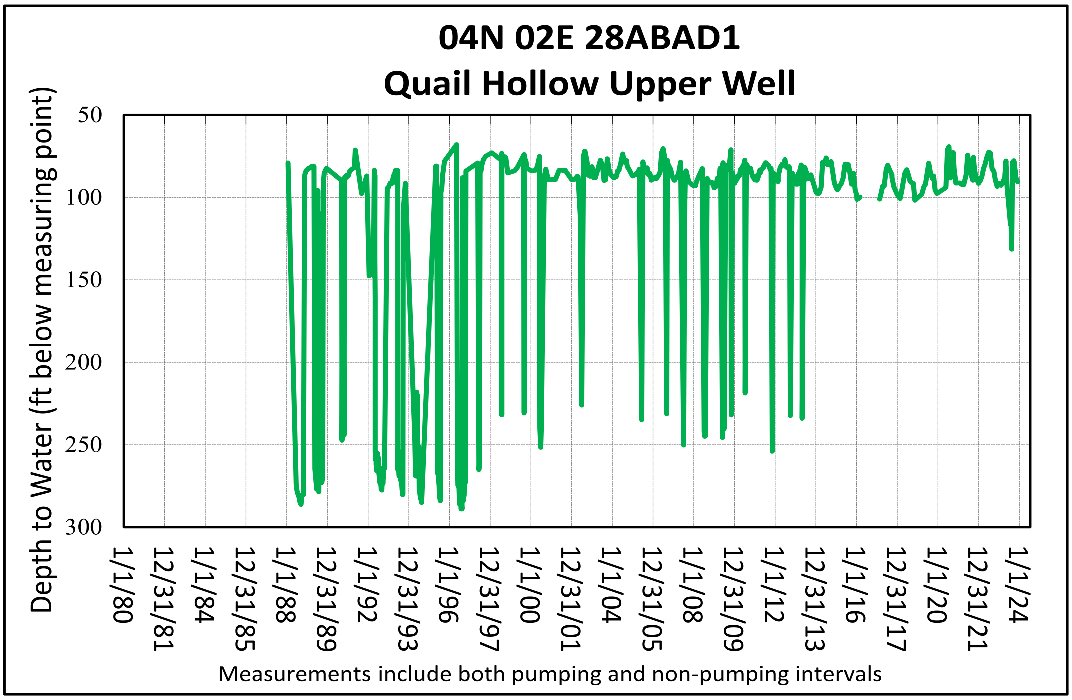

Figure 5**.** Water levels in the Quail Hollow Upper well.

The peak water level in the Lower well declined 2.8 ft from WY22 to WY23 (Figure 6).

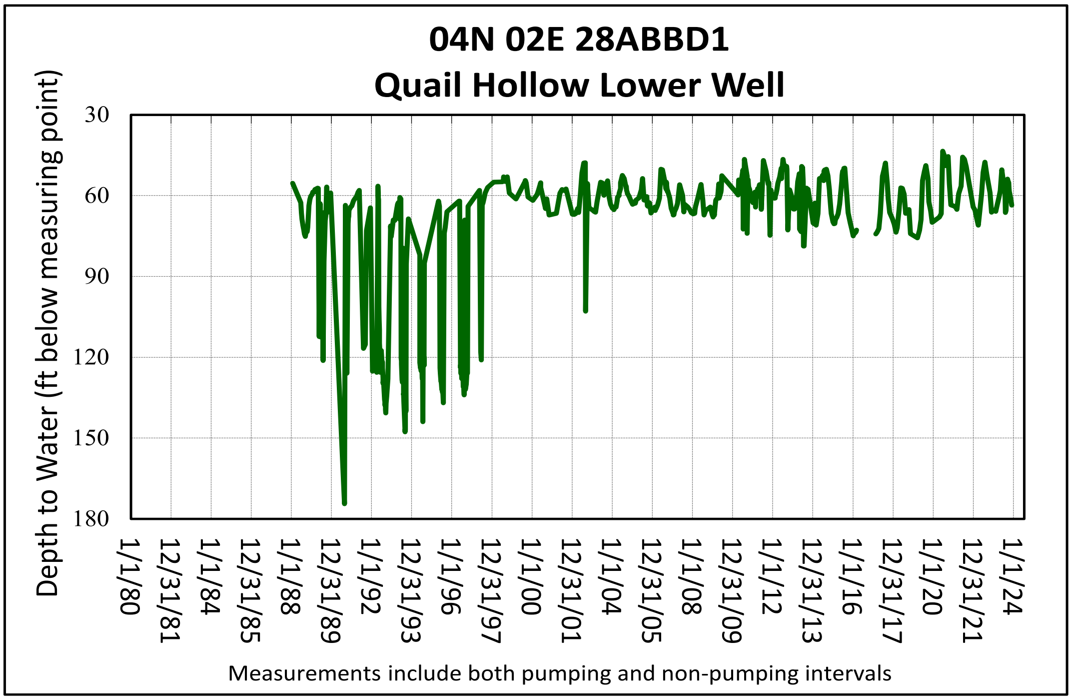

Figure 6**.** Water levels in the Quail Hollow Lower well.

Water-Level Trends

Calculating a linear trend for a set of water-level data is a simple way to describe the long-term water-level changes. However, a calculated trend is not always representative of the behavior if there are frequent and/or large water-level fluctuations, and/or if the calculated trend is small. Therefore, a statistical assessment of the calculated trend is an important step in determining the general water-level behavior over time. A statistically significant trend indicates that there is a non-zero trend in the data (at the chosen confidence interval), and the calculated trend is assumed to be the best linear representation of changes over time. Lack of statistical significance indicates that the trend cannot be considered different than zero, and the calculated trend does not adequately represent changes over time. A confidence interval of 95% has been used to determine statistical significance for all water-level trends.

Calculating a linear trend facilitates assessment of long-term changes independent of short-term water level fluctuations. However, it is difficult to calculate a trend that describes the state of the aquifer using all the data because some of the variability is due to local and/or short-term water use. As stated above section, peak water levels are the best indication of the aquifer water levels because they are the least affected by local water use; therefore, water-level trends have been calculated for the peak water levels in the wells. Minimum water levels may provide insight into how water use impacts the aquifer, and trends for the minimum water levels have been calculated for reference.

Tiegs Well Water-Level Trends

The Tiegs well is used an indicator well for WD 63-S because it is an unused well that is somewhat centrally located. The WY03 to WY23 peak water-level trend in the Tiegs well is 0.2 ft/year; however, it is not statistically significant (Figure 7 and Table 5).

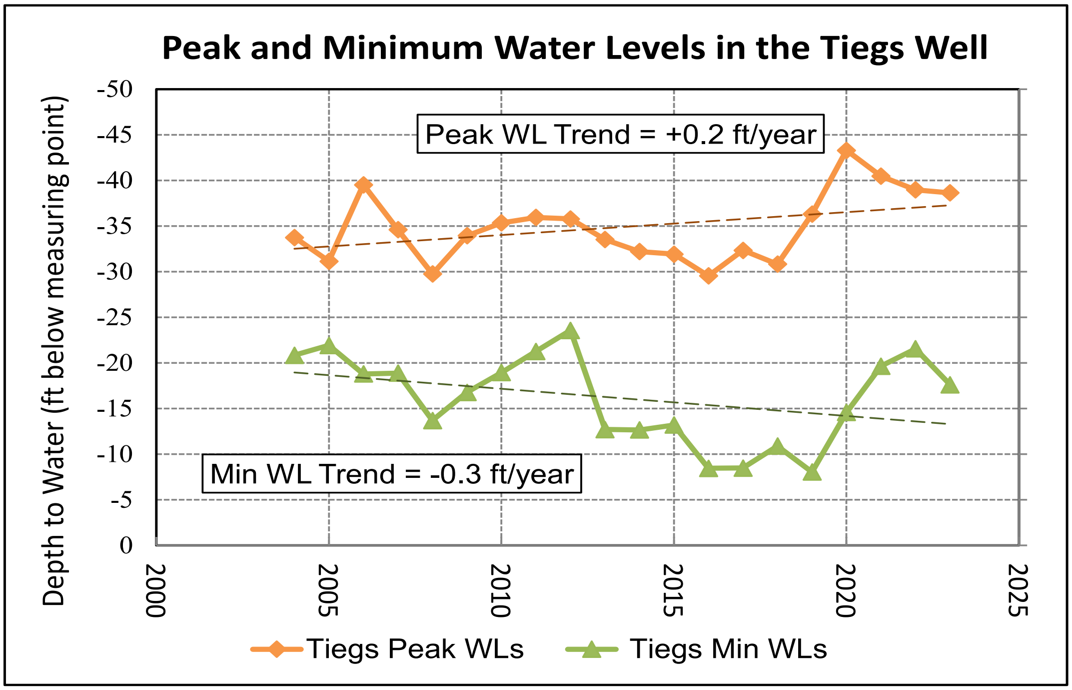

Figure 7. Water-year peak and minimum water levels in the Tiegs well. Negative depths-to-water indicate the water level is above land surface.

Edwards Greenhouse Well Water-Level trends

Edwards Greenhouse well exhibits no peak water-level trend during the WY03 to WY23 period, and the trend is not statistically significant (Figure 8 and Table 5). This does not mean that water levels aren't changing, it means that no real conclusions can be made by looking at the trend in peak water levels.

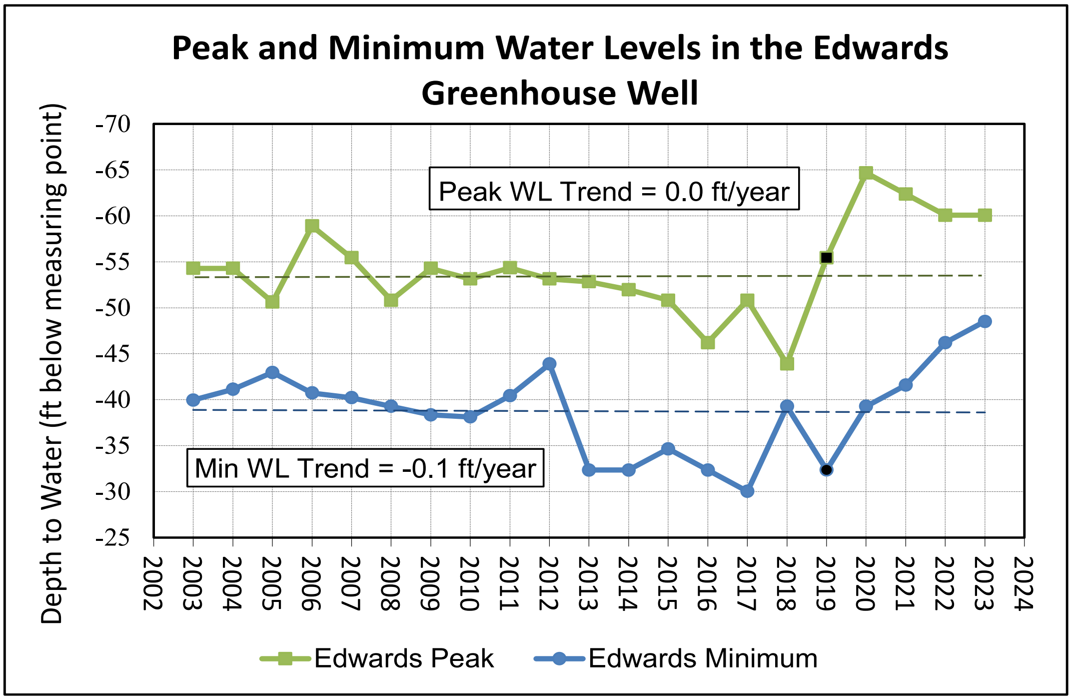

Figure 8. Water-year peak and minimum water levels in the Edwards Greenhouse well. The WY19 data points (black dots) may not represent the true peak and minimum water levels because of missing data.

Quail Hollow Upper and Lower Wells Water-Level Trends

The WY03 to WY23 peak water-level trends in the Quail Hollow Upper and Lower wells are 0.0 and 0.4 ft/year, respectively. However, only the trend in the Lower well is statistically significant (Figure 9 and Table 5). No conclusions about water-level changes can be made using the Upper well trend.

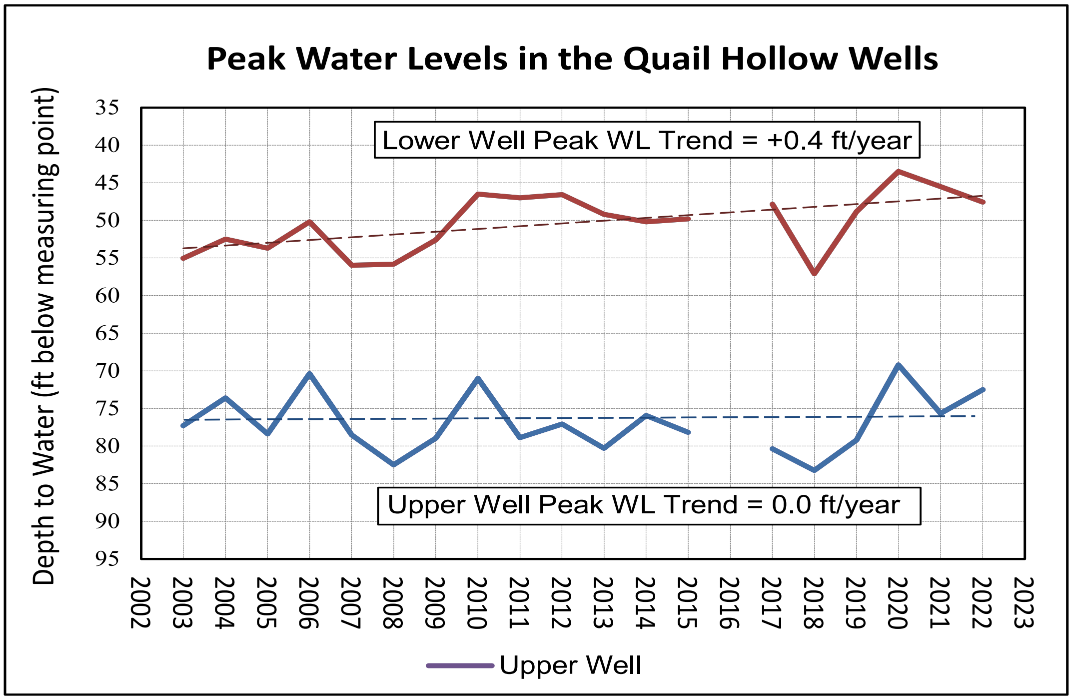

Figure 9. Water-year peak water levels in the Quail Hollow wells.

Peak water-levels in WD 63-S exhibit flat to slightly rising trends (Figures 3 – 9, Table 5); however, only the Quail Hollow Lower well exhibits a statistically significant peak water-level trend for the WY03 – WY23 period. Minimum water levels exhibit decreasing trends during the same period, but none are statistically significant.

Table 5. Water-level trends in district 63-S wells for the period WY03 – WY23.

Water Level	Trend (ft/year) [1]	p-value[2]	Statistically Significant
Tiegs Peak Water Levels	+0.2	0.24	NO
Tiegs Minimum Water Levels	-0.3	0.10	NO
Edwards Peak Water Levels	0.0	0.67	NO
Edwards Minimum Water Levels	-0.1	0.63	NO
Quail Hollow Upper Peak Water Levels[3]	0.0	0.92	NO
Quail Hollow Lower Peak Water Levels[3]	**+0.4**	**0.04**	**YES**

[1]Trends and significance have been calculated using the Mann-Kendall statistical test (Hirsch and Slack, 1984).

[2]P-values less than 0.05 indicate the trend is significant at the 95% confidence interval.

[3]Only peak water levels were analyzed due to pumping impacts to the minimum water levels.

Analysis of Withdrawals and Water Levels

Water levels have cycled up and down over the past 20 years, with higher withdrawal rates generally coinciding with deeper peak water levels in the Tiegs well. Figure 10 illustrates the relationship between water-year withdrawals and peak water-year water levels.

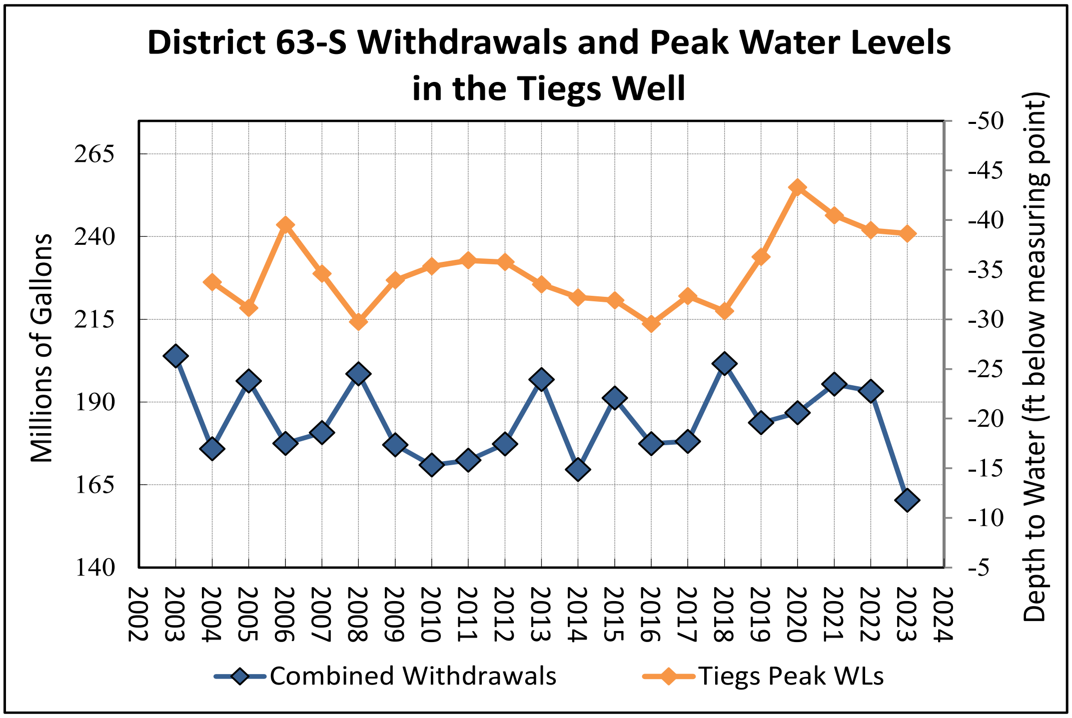

Figure 10. WY03 – WY23 water-year combined 63-S withdrawals compared to peak water levels in the Tiegs well.

The inverse relationship between withdrawals and Tiegs water levels is plainly visible from WY03 to WY13, and WY22. The relationship is less direct from WY13 to WY20, WY23, and WY24. The change in this relationship may be due to:

- Timing of local or regional withdrawals that result in peak water levels which are not reflective of regional water-year production,
- Spatial changes in the relative magnitudes of withdrawals between the withdrawal centers (e.g., an increase in withdrawals at one or more of the withdrawal centers in combination with a decrease in withdrawals at one or more withdrawal centers),
- Monitoring equipment issues,
- Changes in withdrawals from hydraulically connected wells that are unidentified or located outside of the district, or
- A combination of the above listed factors.

The WY03 – WY23 trend in the combined withdrawal volume is -0.1 mgal/year; however, the trend is not statistically significant (Table 3), and the magnitude of the trend may be smaller than the uncertainty in flow measurements. Peak water level trends in the Tiegs, Edwards, and Quail Hollow wells range from 0.0 to 0.4 ft/year, but only the trend in the Quail Hollow Lower well is statistically significant (Figures 7- 9 and Table 5). The WY03 – WY23 trends in peak water levels do not exhibit an inverse relationship with the trend in combined WD 63-S withdrawals; however, none of the trends are statistically significant, and no real conclusions can be made by comparing the trends.

Summary

Combined district withdrawals were 160.3 mgal in WY23, which is a decrease of 17%; however, the WY03 – WY23 trend in combined withdrawals is very small and not statistically significant, indicating withdrawals have not changed appreciably over this period.

All peak water levels in WD 63-S, except for the Edwards well, declined from WY22 to WY23. Despite the WY22 – WY23 water-level decrease, only the Quail Hollow Lower well exhibits a statistically significant increasing peak water-level trend for the WY03 – WY23 period.

References

Hirsch, R.M., and Slack, J.R., 1984. A nonparametric trend test for seasonal data with serial dependence: Water Resources Research v. 20, p. 727–732.

IDWR, 2017a. Stipulated Agreement In the Matter of the City of Boise Application for Water Right Permit 63-34326, Exhibit C.

Respectfully submitted,

Michael McVay, Water District 63-S Watermaster

APPENDIX A

WD 63-S LOCATION MAP

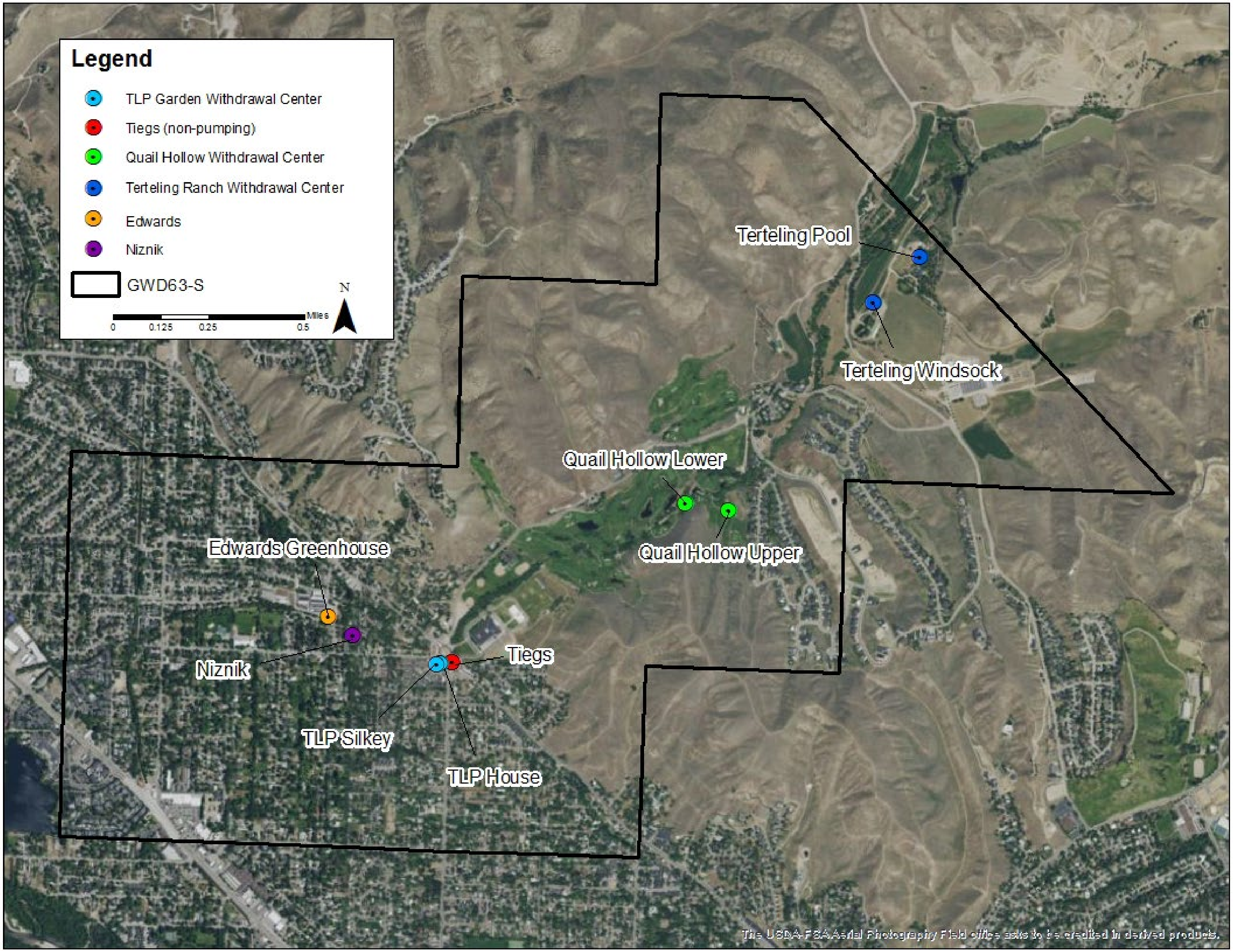

Figure A-1. Well locations within WD 63-S