Idaho Department of Water Resources

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

October 1, 2021 – September 30, 2022

McVay, Michael
February 15, 2023

Withdrawals

The combined total withdrawal in Stewart Gulch Ground Water District 63-S (WD 63-S) in Water Year 2022 (WY22) was 193.3 million gallons (mgal), which is a decrease of 2.2 (-1%) mgal from WY22 (Figure 1; Table 1).

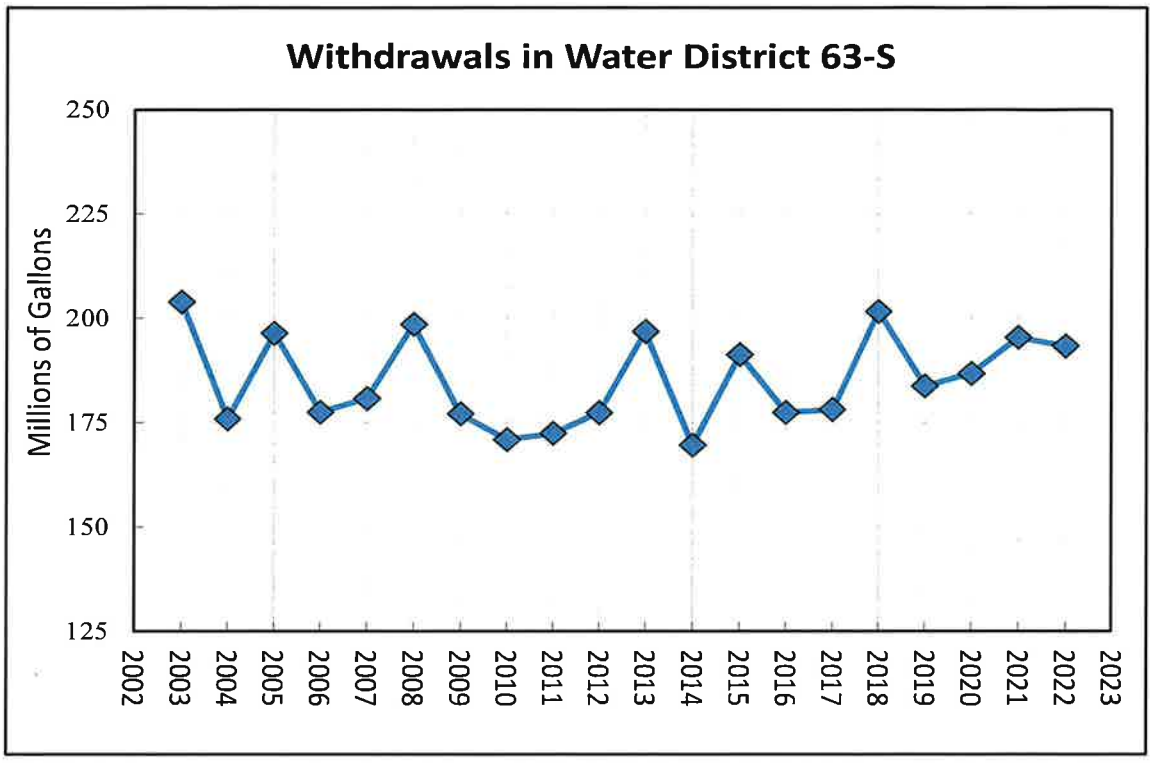

Figure 1. Low-temperature geothermal withdrawals in WD 63-S for the period WY03 – WY22.

Production Wells

Flow Meter Calibration Checks

The Boise Front Geothermal Aquifer Monitoring and Reporting Plan (IDWR, 2017) as well as the Final Order Regarding Petition to Implement Monitoring Plan, Water District 63-S, Stewart Gulch (IDWR,2009) require annual calibration of flow meters to ensure withdrawals are accurately monitored. The Terteling Company Inc. (TLP) and Quail Hollow Golf Course (Quail Hollow) hired SPF Engineering (SPF) to perform calibration checks in WY21, and Edwards Greenhouse (Edwards) hired Basin Wide Water, LLC to perform a calibration check on one of their meters in WY22.

TLP Calibration Checks and Production

SPF performed calibration checks on three TLP wells with magnetic flow meters (Terteling Ranch Pool, TLP Silkey, and TLP House), and one with a mechanical meter (Terteling Ranch Windsock) on 4/28/2021. SPF determined that the Silkey and House wells meet the IDWR minimum accuracy

requirements (IDWR, 2017b), and did not need to be recalibrated. The Silkey well decreased withdrawals by 4.2 mgal (-22%), and the House well decreased withdrawals by 1.4 mgal (-40%) from WY21 to WY22 (Table 1; Figure A-1).

SPF determined that the meters on the Terteling Ranch Pool and Windsock wells did not meet the IDWR minimum accuracy standard and needed to be recalibrated or replaced. The Pool meter was replaced in October 2021. The Windsock meter was replaced on 10/5/2020; however, it did not meet the IDWR minimum accuracy requirement for mechanical meters at the time of the SPF evaluation on 4/28/2021, and the Windsock meter was again replaced in April 2022. All Terteling meters currently meet the IDWR minimum accuracy requirement.

The total withdrawal from the Pool well decreased by 4.1 mgal (-18%), and the total withdrawal from the Windsock well increased by 16.4 mgal (+20%) from WY21 to WY22 (Table 1; Figure A-1).

Quail Hollow Calibration Checks and Calculated Production

Quail Hollow hired SPF to assess the performance of their flow meters, and calibration checks of the Quail Hollow Upper and Lower wells were performed on 2/27/2021. SPF determined that both meters needed to be replaced. Quail Hollow purchased new meters for both wells, but the meters were not installed during WY22.

Based on conversations with Quail Hollow staff, it has been assumed that the Upper well did not operate in WY22. Total withdrawal from the Upper well did not change because the well was not used during WY21 or WY22. Because the meter on the Lower well has not yet been replaced, the total WY22 withdrawal was calculated using the WY22 reported volume and the SPF calibration-check information to determine that total withdrawal from this well decreased by an estimated 2.3 mgal (-100%). The total withdrawal by Quail Hollow decreased by an estimated 2.3 mgal (-100%) from WY21 to WY22 (Table 1). Both Quail Hollow meters are scheduled to be replaced this spring.

Edwards and Niznik Production

One of the two meters on the Edwards well was checked for accuracy on 01/23/2023 by Basin Wide Water, LLC, and the meter met the IDWR minimum accuracy requirement. A calibration check on the second meter is scheduled to occur in February 2023. Flow past this meter accounts for approximately 3% of total Edwards production; therefore, it has been assumed that potential errors in measurement at this meter would not significantly change conclusions regarding Edwards total withdrawal. Based on the reported volumes, the total withdrawal from the Edwards Greenhouse (Edwards) well decreased by 6.9 mgal (-11%).

The Niznik wells were not tested for accuracy in WY22. The total withdrawal from the Niznik well increased by 0.5 mgal (+8%) from WY21 to WY22 (Table 1; Figure A-1).

Table 1. Withdrawals from WD 63-S well for Water Year 2022.

Well	Withdrawals (mgal)	Change from WY21 (mgal)	Percent Change from WY21
Terteling Ranch Pool	18.8	-4.1	-18%
Terteling Ranch Windsock	96.3	16.4	20%
TLP Silkey	15.3	-4.2	-22%
TLP House (Office)	2.2	-1.4	-40%
Edwards Greenhouse[1]	54.9	-6.9	-11%
Niznik (Whitehead)	5.9	0.5	8%
Quail Hollow #1 (Upper)	0.0	NA	NA
Quail Hollow #2 (Lower)	0.01	-2.28	-100%
Total[2]	**193.3**	**-2.1**	**-1%**

[1]Edwards withdrawals were underreported by 3.8 mgal in the WY21 report.
[2]Total withdrawals were underreported by 3.8 mgal in the WY21 report.

Withdrawal Centers

The locations of the wells allow them to be grouped into five withdrawal centers: 1) Terteling Ranch, 2) TLP, 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).

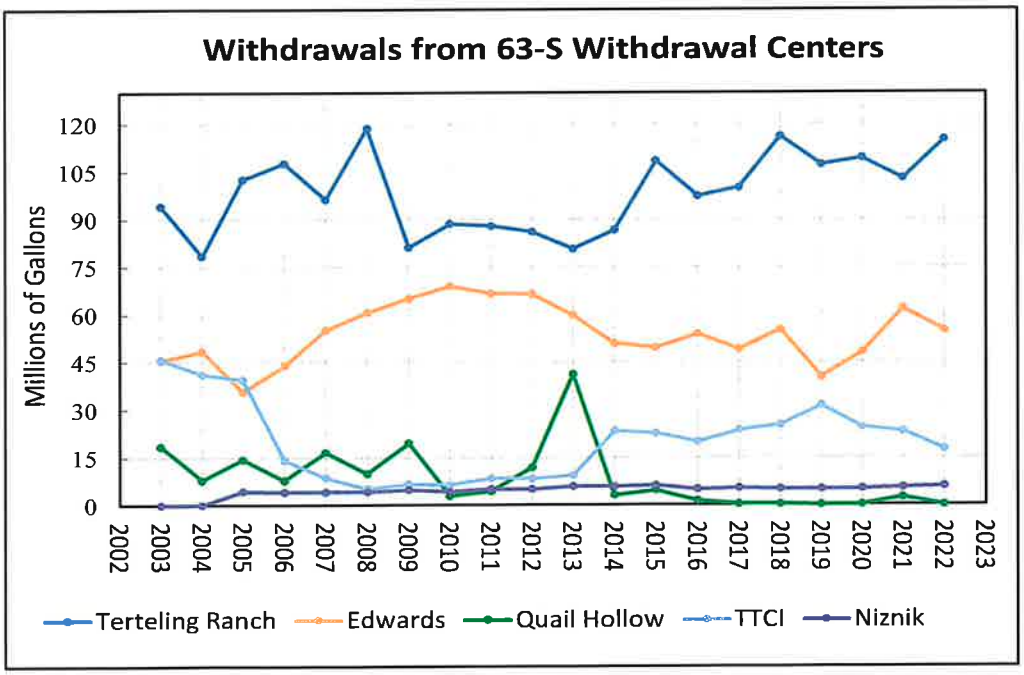

Figure 2. WD 63-S withdrawals grouped by withdrawal center for WY03-WY22.

Table 2. Five withdrawal centers in WD 63-S and changes from WY21 to WY22.

Withdrawal Center	Withdrawals (mgal)	Percent of WY22 District Withdrawals	Change from WY21 (mgal)
Terteling Ranch	115.1	60%	12.2
Edwards	54.9	28%	-6.9
TLP	17.4	9%	-5.6
Niznik	5.9	3%	0.5
Quail Hollow	0.0	NA	2.3

Terteling Ranch and Edwards were the two largest water users in WY22 and accounted for 60% and 28% of WD 63-S withdrawals, respectively. Combined withdrawals from TLP, Niznik, and Quail Hollow accounted for the remaining 12% 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 – WY22 trend in combined withdrawals for WD 63-S is 0.20 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 – WY22 withdrawal trend for the Terteling Ranch Windsock and Pool wells are 0.7 and 0.3 mgal/year, respectively. The Windsock well trend is not statistically significant, but the Pool well trend is statistically significant (Table 3).

The WY03 – WY22 withdrawal trends for the TLP Silkey and House wells are 0.4 and 0.1 mgal/year, respectively. Neither trend is statistically significant (Table 3).

The WY03 – WY22 withdrawal trend for Edwards is 0.14 mgal/year; however, the trend is not statistically significant (Table 3).

The WY03 – WY22 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 8 years, with total withdrawal of 0.03 mgal during the last 8 years; therefore, a withdrawal trend would be meaningless and has not been calculated. The WY03 – WY22 withdrawal trends for and 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 – WY22.

Well	Trend (mgal/year)[1]	p-value[2]	Statistically Significant
Terteling Windsock	0.7	0.14	NO
Terteling Pool	**0.3**	**0.03**	**YES**
TLP Silkey	0.4	0.54	NO
TLP House	0.1	0.22	NO
Edwards	0.1	0.90	NO
Niznik[3]	**0.1**	**0.00**	**YES**
Quail Hollow Upper[4]	**NA**	**NA**	**NA**
Quail Hollow Lower	-0.05	0.62	NO
Combined total WD 63-S	0.2	0.54	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 – WY22 to due lack of data.
[4]Well has not been used in 6 of the last 8 years, with total withdrawal of 0.03 mgal during the last 8 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, Edwards, and Quail Hollow Lower wells declined from WY21 to WY22 (Table 4); only the Quail Hollow Upper well exhibited a water-level rise.

Table 4. Peak water level changes in WD 63-S wells for WY21 – WY22.

Well	Water Level Change (ft)
Tiegs	-1.5
Edwards	-2.1
Quail Hollow Upper	3.2
Quail Hollow Lower	-2.1

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 fell 1.5 feet (ft) from WY21 to WY22 (Figure 3; Table 4).

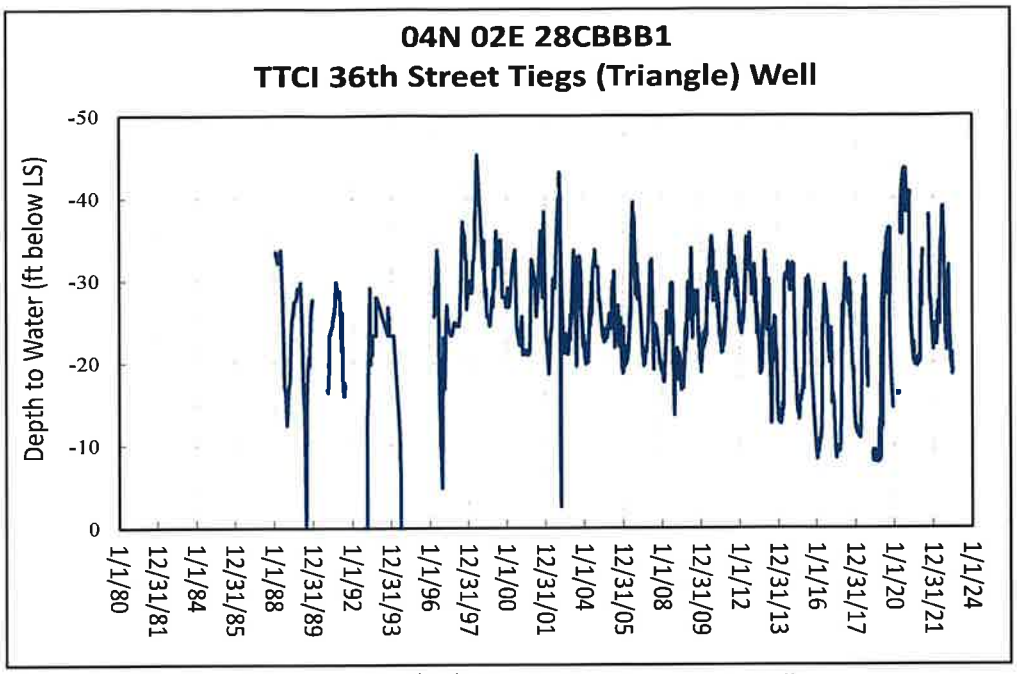

Figure 3. Water-levels in the TLP 36th Street Tiegs (Triangle) well.

Edwards Greenhouse Well

The peak water level in the Edwards well fell 2.3 ft from WY21 to WY22 (Figure 4; Table 4).

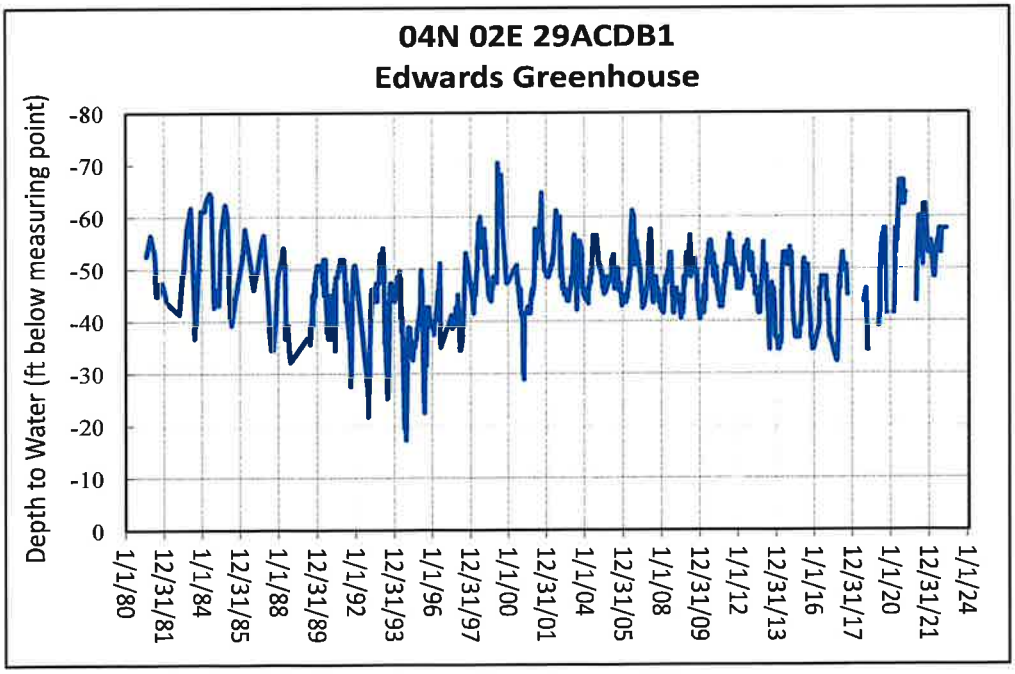

Figure 4. Water-levels in the Edwards Greenhouse well.

Quail Hollow Wells

The peak water level in the Upper well rose 3.2 ft from WY21 to WY22 (Figure 5).

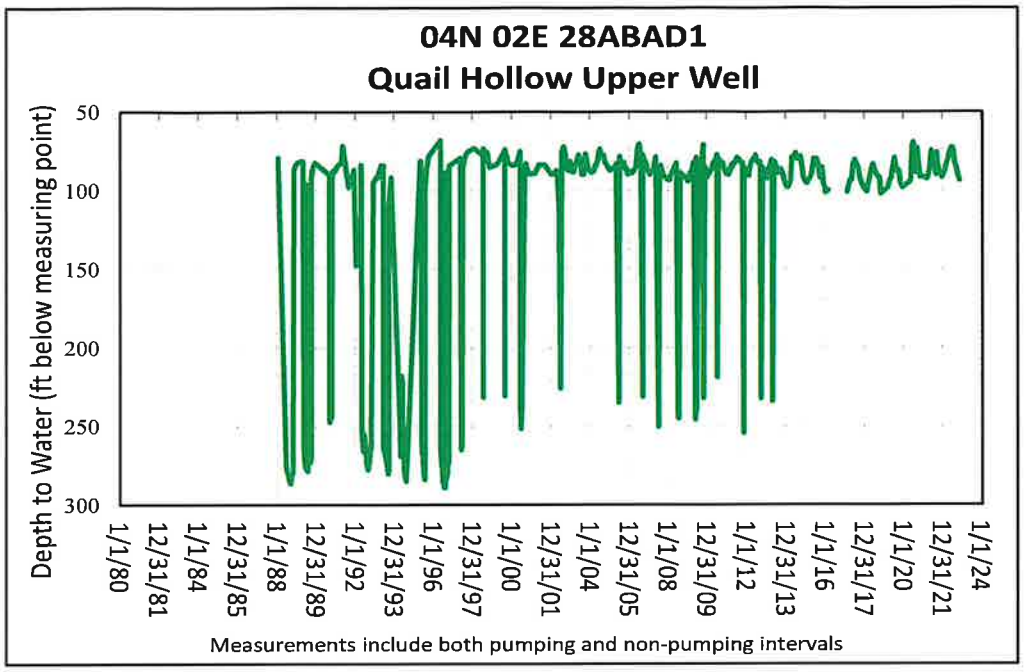

Figure 5. Water-levels in the Quail Hollow Upper well.

The peak water level in the Lower well fell 2.1 ft from WY21 to WY22 (Figure 6).

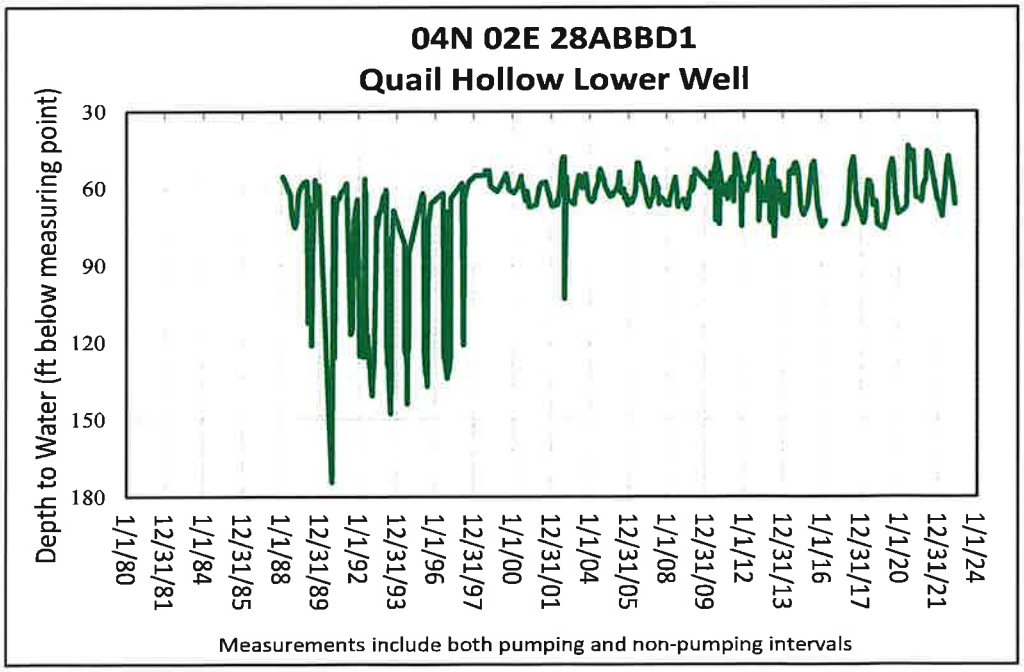

Figure 6. Water-levels in the Quail Hollow Lower well.

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 WY22 peak water-level trend in the Tiegs well is 0.2 ft/year; however, it is not statistically significant (Figure 7 and Table 5).

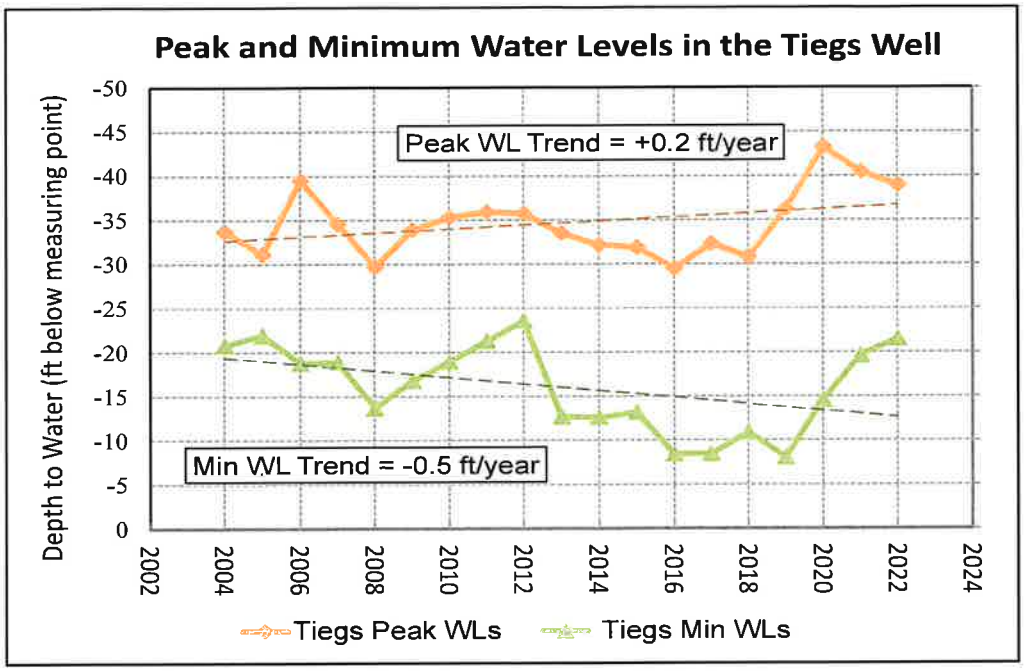

Figure 7. Water-year peak and minimum water levels in the Tiegs well.

Edwards Greenhouse Well Water-Level trends

Edwards Greenhouse well exhibits no peak water-level trend during the WY03 to WY22 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.

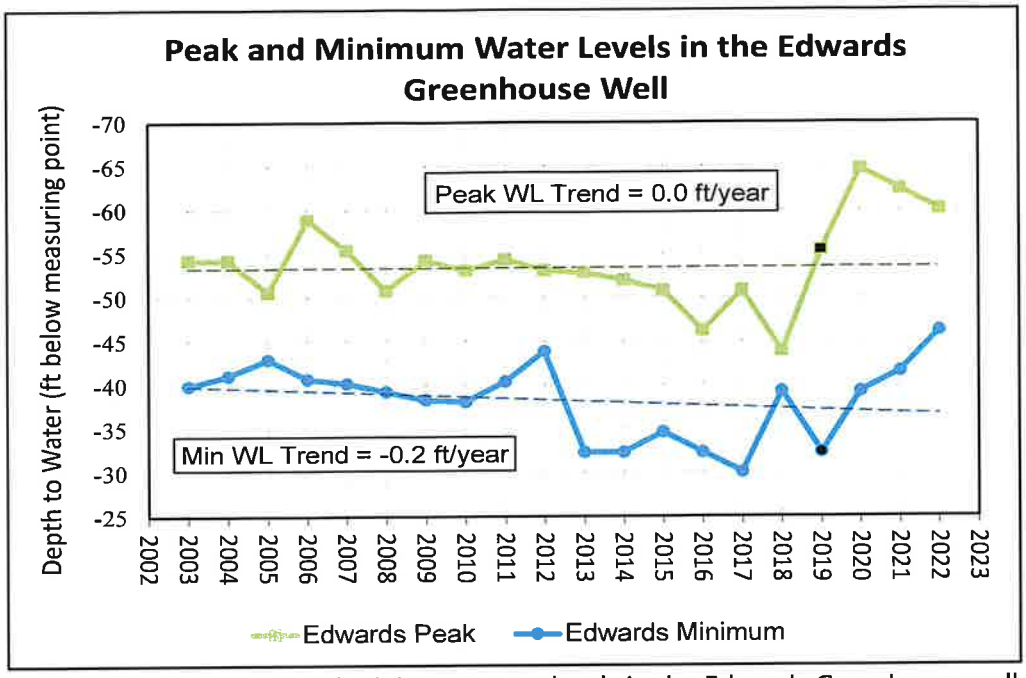

Figure 8. Water-year peak and minimum water levels in the Edwards Greenhouse well. The WY19 data points (black dots) may not represent the true peak and minimum water levels because of missing data.

Quail Hollow Upper and Lower Wells Water-Level Trends

The WY03 to WY22 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.

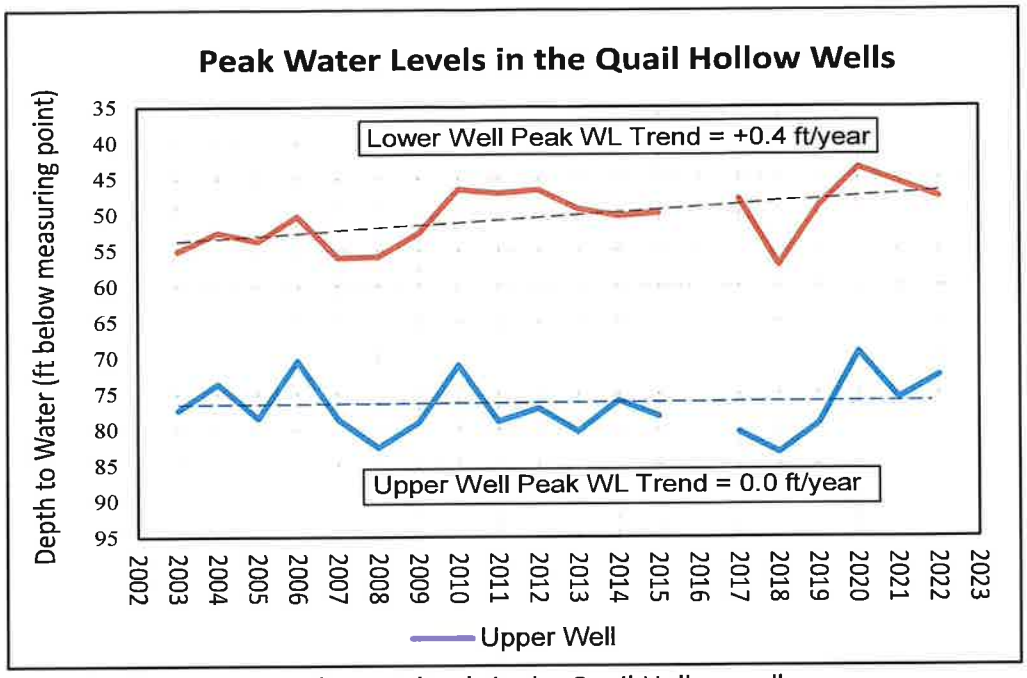

Figure 9. Water-year peak water levels in the Quail Hollow wells.

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 – WY22 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 – WY22.

Water Level	Trend (ft/year) [1]	p-value[2]	Statistically Significant
Tiegs Peak Water Levels	+0.2	0.38	NO
Tiegs Minimum Water Levels	-0.5	0.09	NO
Edwards Peak Water Levels	0.0	1.00	NO
Edwards Minimum Water Levels	-0.2	0.24	NO
Quail Hollow Upper Peak Water Levels[3]	0.0	0.89	NO
Quail Hollow Lower Peak Water Levels[3]	**+0.4**	**0.02**	**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 this inverse relationship between water-year withdrawals and peak water-year water levels.

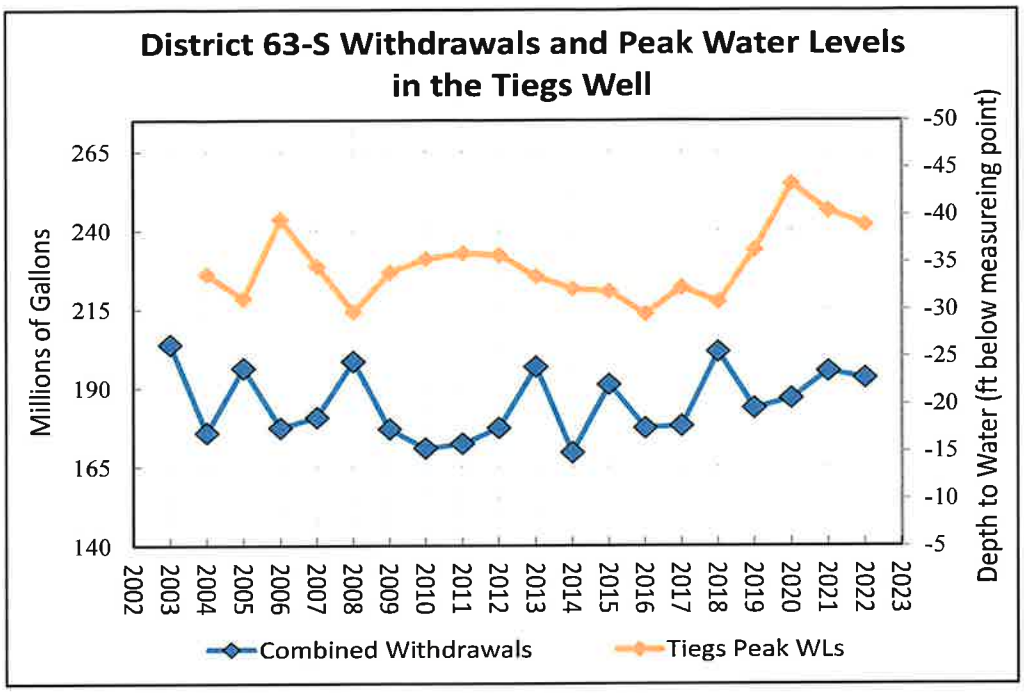

Figure 10. WY03 – WY22 water-year combined 63-S withdrawals compared to peak water levels in the Tiegs well.

The inverse relationship between withdrawals and Tiegs water levels is plainly visible from WY03 to WY13, and WY21. The relationship is less direct from WY13 to WY20, and WY22. 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 – WY22 trend in the combined withdrawal volume is 0.2 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 – WY22 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 193.3 mgal in WY22, which is a decrease of 1%; however, the WY03 – WY22 trend in combined withdrawals is not statistically significant, indicating withdrawals have not changed appreciably over this period.

All peak water levels in WD 63-S, except for the Quail Hollow Upper well, fell from WY21 to WY22. Despite the WY21 – WY22 water-level decrease, only the Quail Hollow Lower well exhibits a statistically significant increasing peak water-level trend for the WY03 – WY22 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.

IDWR, 2017b. IDWR Minimum Acceptable Standards and Requirements for Open Chanel and Closed Conduit Measuring Devices. Minimum Acceptable Standards for Open Channel and Closed Conduit Measuring Devices (idaho.gov)

IDWR, 2021. Idaho Department of Water Resources Lit of Approved Closed Conduit Meters. Approved-flow-meter-list-v3.7_11_8_2021-1.pdf (idaho.gov)

Respectfully submitted,

Michael McVay, Water District 63-S Watermaster

WATERMASTER'S ANNUAL REPORT

From: 10/1/2021 To: 9/30/2022

Water District Number: 63-S

Water District Name: Stewart Gulch

Name of Watermaster: Mike McVay

Mailing Address: 322 W Front Street, Boise ID, 83702

AFFIDAVIT OF WATERMASTER

As the appointed watermaster of water district no. 63-S, I hereby certify that the information contained in this report is true and correct to the best of my knowledge.

Watermaster signature: Mike W. McVay Date: 2-16-23

Table 1. Water Year 2022 withdrawals.

Water Right Owner	Water Right Number	Diversion Description	Volume (AF)
TLP LLC - Terteling	63-12; 63-13; 63-15; 63-31052	Well	473.3
Edwards	63-14	Well	195.9
City of Boise Parks & Recreation	63-4037	Well	0.04
Niznik	63-5195	Well	21

Pursuant to Section 42-606 Idaho Code, this Watermaster's Annual Report shall be filed prior to the end of the watermaster's appointment for the current year, and kept in the office of the Idaho Department of Water Resources (IDWR). The Watermaster's Daily Diversion Records should be attached to this report if those records are not submitted electronically to IDWR.