MONTGOMERY & ASSOCIATES
Water Resource Consultants

Groundwater experts since 1984

TECHNICAL MEMORANDUM

DATE: April 19, 2024 **PROJECT #:** 1735.04

TO: Spencer Cruse, Nik Hunter
Kiewit-Fann Joint Venture

FROM: Andrew P. Feltman, CPG, P.G. and Andrew Platt, GIT

PROJECT: ADOT Temporary Construction Well

SUBJECT: Chander Well Water Level Monitoring and Impact Analysis Update

INTRODUCTION

Montgomery & Associates (M&A) has been contracted by Kiewit-Fann Joint Venture (Kiewit-Fann) to monitor the impact to the local unconfined alluvial aquifer from pumping in an Arizona Department of Transportation (ADOT) temporary construction well located in Black Canyon City, Arizona. This well has been registered with the Arizona Department of Water Resources (ADWR) with well registry ID 55-928413 (Chandler Well). The well was completed on November 17, 2022, and was planned to be used to provide construction water for 3 years during the I-17 improvement project.

The Chandler Well is located in Black Canyon City, Arizona. It is located in the SE quarter of the SW quarter of the SE quarter of Section 22, Township 9 North, Range 2 East of the Salt River Baseline and Meridian (A(9-2)22dcd). A location map is included as Figure 1.

This memorandum summarizes water level data collected at the Chandler Well from November 2022 to March 2024, with comparisons to water levels in nearby wells, precipitation data, and nearby stream gage data. A reanalysis of the Chandler Well's drawdown impact radius was also conducted, taking into account the actual volume pumped in 2023 and the anticipated remaining pumping planned for 2024.

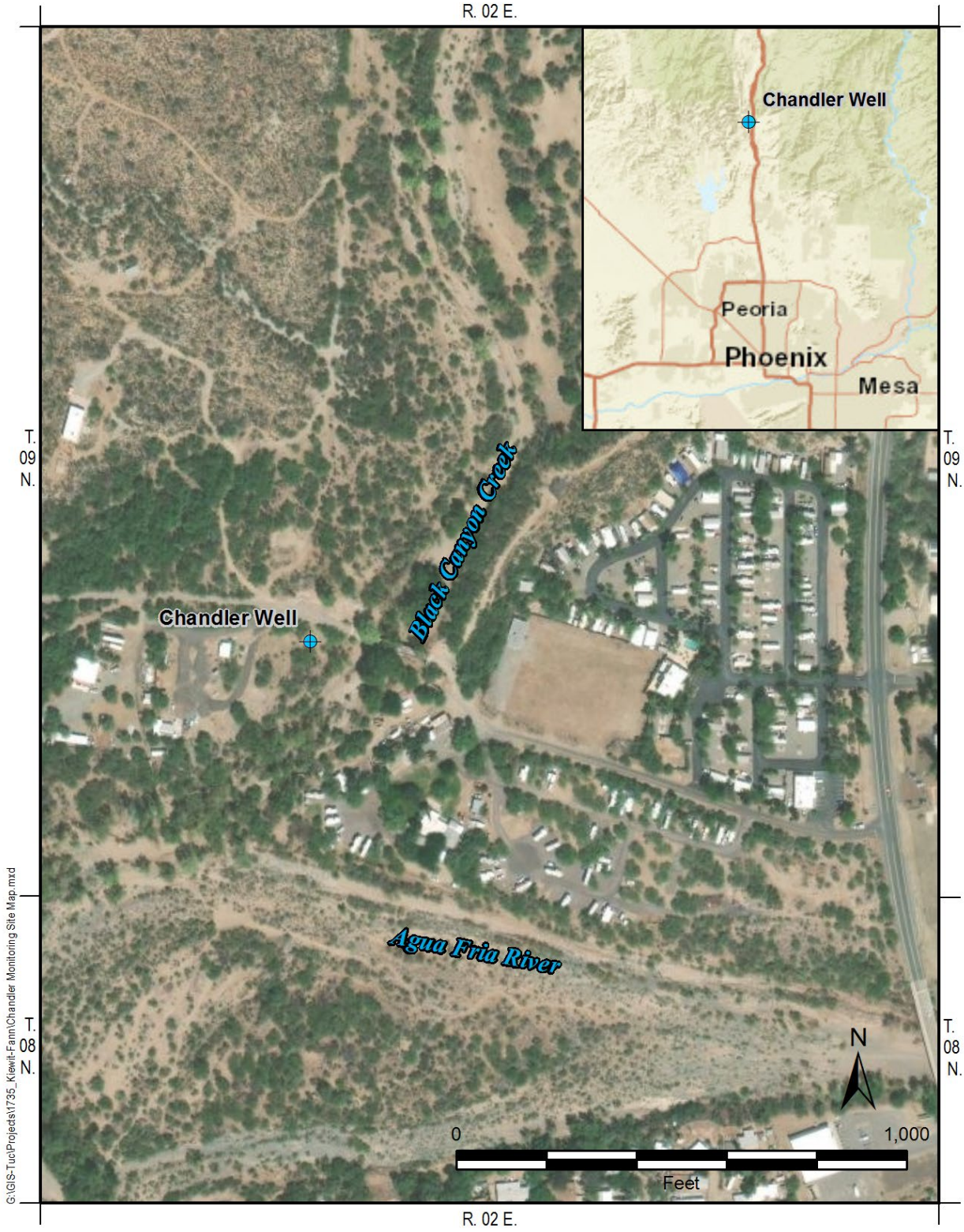


Figure 1. Chandler Well Location Map

FIELD INVESTIGATIONS AND DATA COLLECTION

The driller took a manual water level measurement at the Chandler Well shortly after it was constructed in November 2022. Manual water level measurements were then taken by M&A during a site visit in early January 2023, during the constant rate pumping test conducted in late January 2023, and prior to installation of a datalogging pressure transducer in early March 2023. Since March 10, 2023, the pressure transducer has been recording the water level at half-hour intervals.

The pumping rate at the Chandler Well was recorded during the constant-rate test and at each subsequent site visit if the pump was operating. The pumping rate during the constant-rate test and each site visit was approximately 49 gallons per minute (gpm). The pumping rate has not noticeably decreased with the decrease in pumping water level. The total volume of water pumped from the well is estimated using a combination of transducer data and periodic totalizer readings. To estimate the volume of water pumped at any given time between totalizer readings, transducer data is used to determine the number of minutes the pump was operating after the previous totalizer reading, which is multiplied by the average flow rate in gpm between totalizer readings, then added to the previous totalizer reading. Totalizer readings provided by KFJV and recorded by M&A are provided in Attachment 1.

Discharge data from the Agua Fria River and nearby precipitation data were obtained to compare with trends in the water level at the Chandler Well. Agua Fria River discharge measurements were obtained from USGS gaging station 9512800, which is downgradient and approximately 4 miles south of the Chandler Well. Daily precipitation totals were obtained from NOAA at station US1AZYV0005 near Mayer, Arizona (approximately 15 miles north of the Chandler Well) and at station USW00003184 at the Phoenix Deer Valley Airport (approximately 25 miles south of the Chandler Well).

Water level data in 7 nearby public supply wells (Big John 1, Big John 2, Oasis 1, Oasis 2, GOA 1, GOA 2, and GOA 3) were provided by the Black Canyon Water Improvement District (BCWID).

DATA ANALYSIS AND INTERPRETATION

Kiewit-Fann initially planned to pump approximately 40,000 gallons a day, 5 days per week, for a total of 32 acre-feet per year for 3 years, for a project total of 96 acre-feet. However, due to project demand, the well was pumped more continuous days than initially planned during 2023. Approximately 68.9 acre-feet of water was pumped from the Chandler Well between the start of pumping in January 2023 and March 5, 2024. The estimated pumping schedule provided by Kiewit-Fann for the remainder of the project in 2024 consists of continuous pumping during

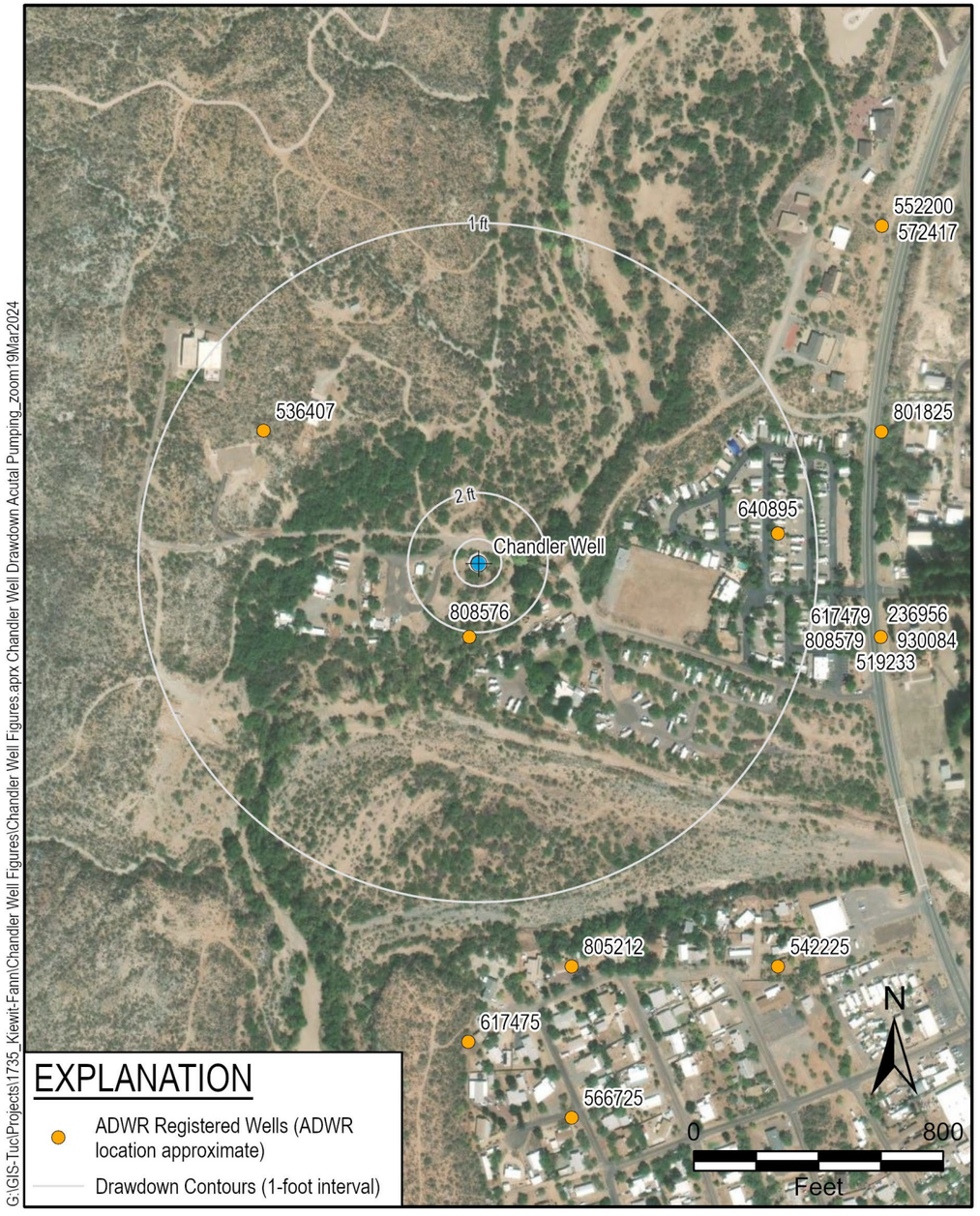
March and April, 5 days per week during May and June, 4 days per week during July and August, and a negligible amount the rest of the year. 2024. KFJV will reduce the number of hours or days pumping the Chandler well in order not to exceed their planned project total of 96 acre feet. M&A has been contracted by KFJV to continue monitoring pumping and provide updated totals to KFJV after each bi-monthly visit through September 2024.

A forward analytical solution was developed using the Theis (1935) non-equilibrium equation for pumping from a well in an unconfined aquifer. The aquifer testing software AQTESOLV (HydroSOLV, 2012) was used to estimate the water level drawdown as a function of radial distance from the well. The analysis was conducted to estimate drawdown at the end of August, which is the end of the planned pumping schedule. The AQTESOLV report for the analysis is included in Attachment 2.

The following criteria were used to conduct the drawdown analysis of the Chandler Well:

- Static depth to water was 11.76 feet below land surface (bls) on January 21, 2023.
- Saturated aquifer thickness (b) is estimated to be 76.24 feet based on the difference between the depth to water and total depth of the well.
- Hydraulic conductivity (K) was determined to be 20.66 feet per day based on analysis of the 8-hour constant rate pumping test (M&A, 2023).
- Transmissivity (T) was calculated to be 1,575 square feet per day based on the equation T=Kb.
- Storage coefficient was estimated to be 0.1 based on the relationship $S = S_s b + Sy$ for an unconfined aquifer.
- The analytical solution was calculated based on a total production of 96 acre feet, which comprises all pumping conducted during 2023, the 2024 pumping through February, and the pumping schedule proposed through August 30, 2024, with days of downtime between May and August included in the analysis.

Projected drawdown radii for August 30, 2024, are shown with ADWR registered wells on Figure 2 and with BCWID well sites on Figure 3. Locations of ADWR wells are approximate, as locations obtained from ADWR are plotted within the center of a 10-acre square plot of land, and the well can be anywhere within the 10-acre area.



Reg. No.	Cadastral	Owner Name	Well Type	Comment
55-552200	A09002033DAD	GARDNER, ELIZABETH	EXEMPT	
55-572417	A09002033DAD	VERNON N SAND	EXEMPT	
55-801825	A09002033DDA	PHILLIP AND ERA JEANE ALBINS	EXEMPT	
55-640895	A09002033DD0	BLACK CANYON CITY COMMUNITY ASSOCIATION	EXEMPT	
55-617479	A09002033DDD	BLACK CANYON WATER	NON-EXEMPT	
55-519233	A09002033DDD	ALBINS, PHILLIP	NON-EXEMPT	
55-236956	A09002033DDD	BLACK CANYON CITY WATER IMPROVEMENT DISTRICT	NON-EXEMPT	Proposed
55-930084	A09002033DDD	BLACK CANYON WATER IMPROVEMENT DISTRICT	NON-EXEMPT	Proposed
55-805212	A08002004AAC	BMB PROPERTIES	EXEMPT	
55-542225	A08002004AAD	ADEQ	ENV-MONITOR	
55-617475	A08002004A00	BOOTH, THOMAS	NON-EXEMPT	
55-566725	A08002004ADB	DIANNA L KNOTHE	EXEMPT	
55-808576	A09002033DCD	EUGENE & JOYCE MCDANIELS	EXEMPT	
55-536407	A09002033DCB	CHANDLER, TONY	EXEMPT	

Figure 2. Drawdown Contours at the End of Proposed Pumping Schedule Along with ADWR Registered Wells

Figure 3. Drawdown Contours at the End of Proposed Pumping Schedule Along with BCWID Well Sites

The water level in the Chandler Well and the nearby wells is highly correlated with precipitation and discharge in the nearby Agua Fria River. When there is precipitation and/or an increase in discharge in the Agua Fria River, an increase in water level is observed in all wells. Conversely, when there is no precipitation and/or a decrease in discharge in the Agua Fria River, a decrease in water level is seen in all wells. This indicates there is significant hydrologic communication between surface water and the groundwater in this shallow aquifer. Heavy/prolonged precipitation events result in aquifer recharge, and prolonged periods without rain and warmer months when evapotranspiration rates are high result in a lowering of the water table. Depth to water in all wells and Agua Fria discharge with time can be seen on Figure 4. Depth to water in all wells and precipitation in Mayer, upstream of Black Canyon City, and Deer Valley, downstream of Black Canyon City, can be seen on Figure 5.

The static water level in the Chandler Well declined by approximately 5 feet from the start of pumping in January 2023 to the end of January 2024, then increased by about 5 feet in February 2024, recovering to the same elevation observed in January 2023, prior to any pumping. This water level recovery correlates with an increase in precipitation and flow in the Agua Fria. This same trend is observed in the water levels from the BCWID Oasis and GOA wells shown on Figure 4 and Figure 5, with little to no impact from pumping at the Chandler Well calculated in the impact analysis. Water level fluctuations seen in the Chandler Well and BCWID wells appear to be due to seasonal changes and precipitation occurrence, rather than the result of pumping at the Chandler Well. Impacts on the aquifer from pumping of the Chandler Well are probably less significant than the effect of regional recharge observed from seasonal precipitation.

Based on the actual pumping conducted in 2023 and the projected pumping in 2024, wells 55-536407 and 55-640895 are within the 1-foot drawdown contour, and well 55-808576 is on the 2-foot drawdown contour. According to the forward analysis, all other ADWR registered wells are outside the 1-foot drawdown contour and will have less than 1 foot of drawdown from pumping at the Chandler Well.

All BCWID well sites are outside of the 1-foot drawdown contour. The BCWID Big John well site is closest to the Chandler Well and is projected to have less than 1 foot of drawdown effect from pumping at the Chandler Well. Potential drawdown at the GOA and Oasis well sites from pumping at the Chandler Well is considered negligible.

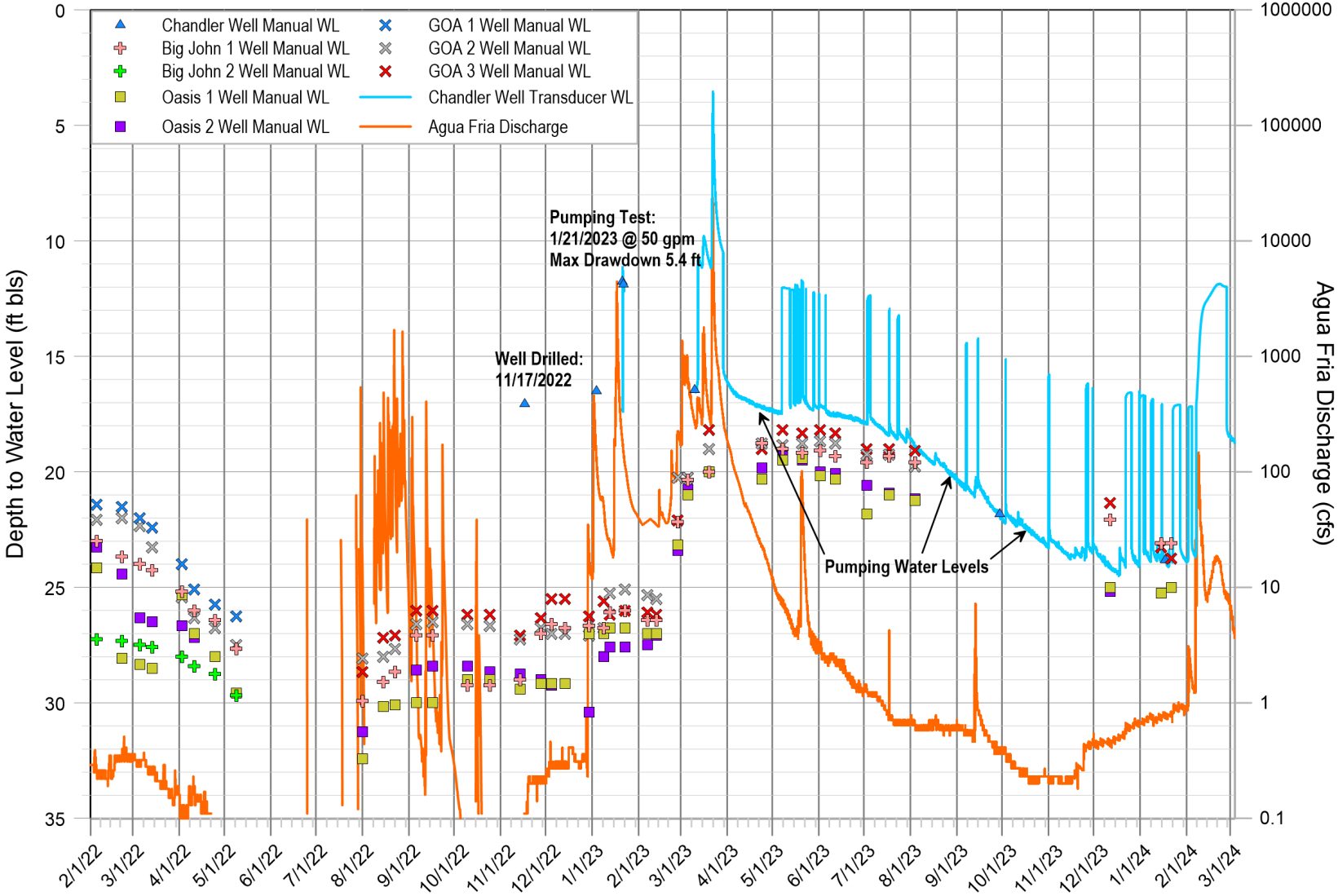


Figure 4. Discharge in the Agua Fria River and Water Level in the Chandler Well and Nearby Wells

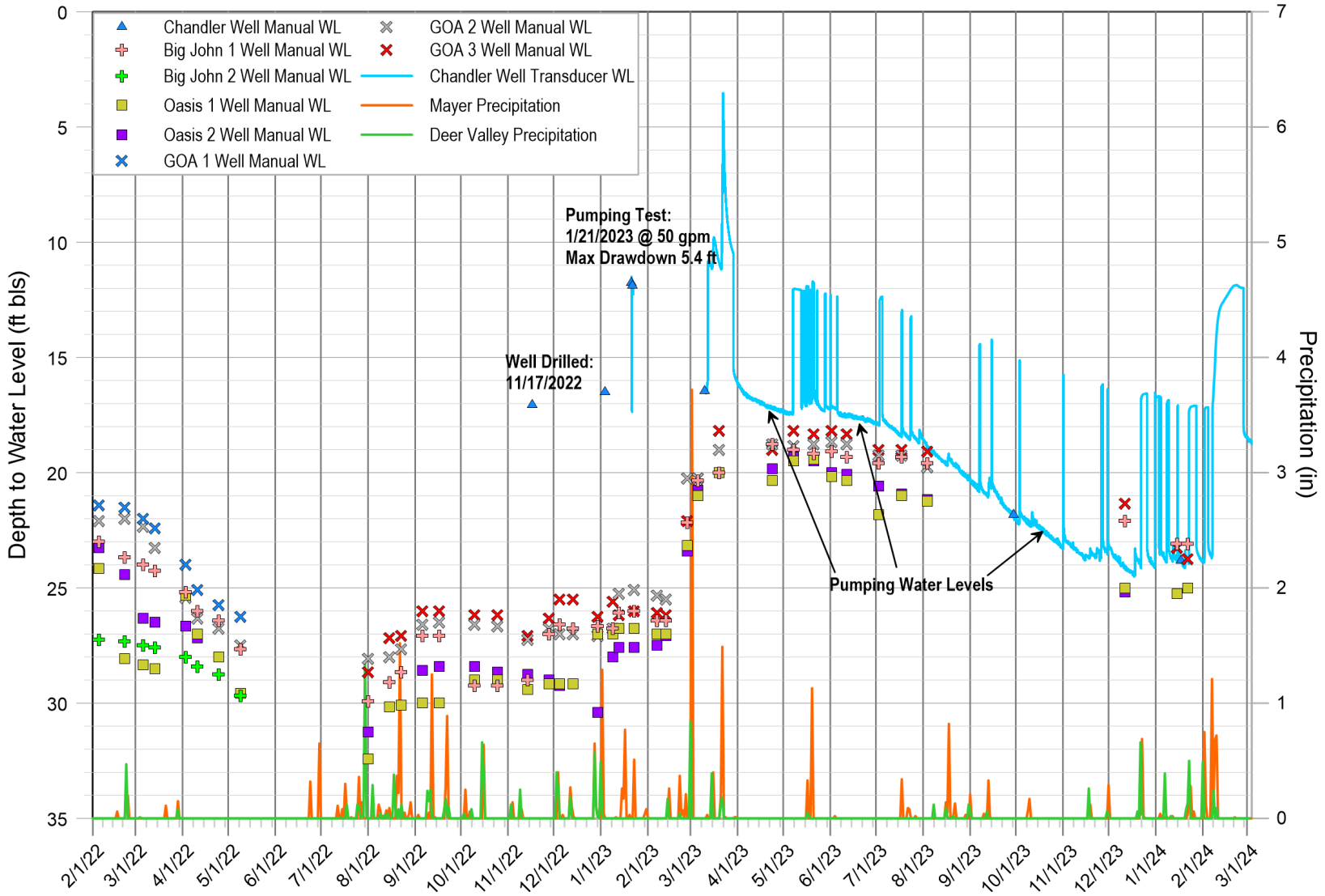


Figure 5. Precipitation in Mayer and Deer Valley and Water Level in the Chandler Well and Nearby Well

REFERENCES

HydroSOLVE, Inc., 2012, AQTESOLV for Windows 95/98/NT/2000/XP/Vista: HydroSOLVE, Inc., Reston, Virginia, version 4.51.002 – Professional.

Montgomery & Associates, 2023, Chandler Well Pumping Test and Updated Well Impact Analysis. Prepared for Kiewit-Fann Joint Venture, February 27.

Theis, C.V., 1935. The relationship between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage, American Geophysical Union.

MONTGOMERY & ASSOCIATES

ATTACHMENT 1

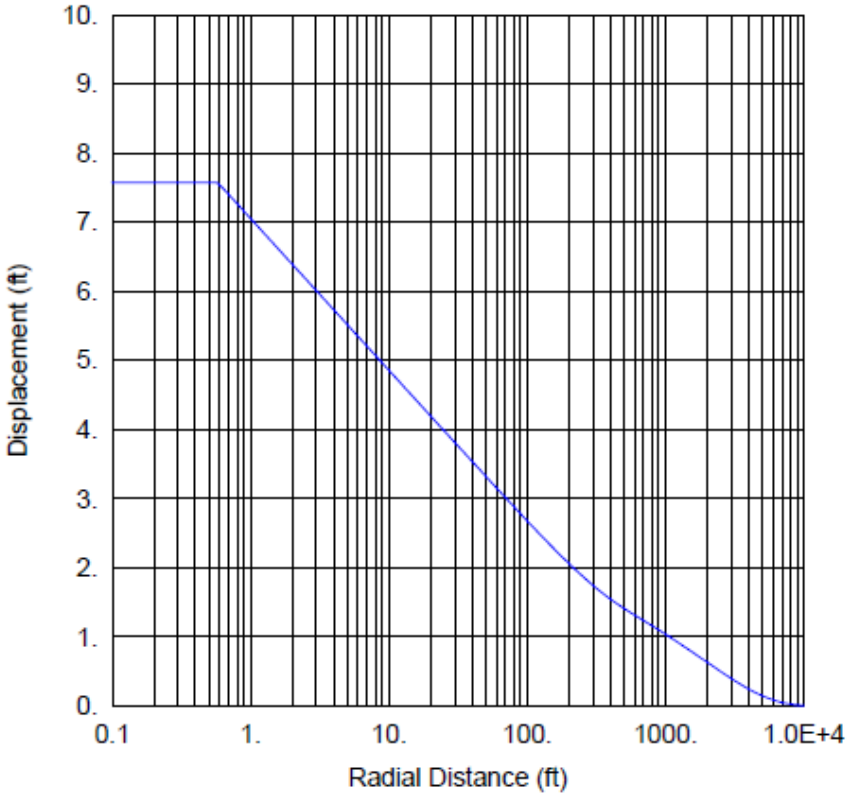
All recorded manual water level measurements and totalizer readings are shown below. The total amount pumped is the estimated amount pumped based on the number of filled water trucks (380,000 gallons) plus the totalizer reading.

Date	Totalizer Reading (gallons)	Totalizer Reading (acre-feet)	Depth to Water Level (feet bls)	Source
11/17/2022			17.07[b]	Drill-Tech
1/4/2023			16.50[b]	M&A
1/20/2023	380,000[a]	1.17		KFJV
1/21/2023	75,571	0.23	11.76[b]	M&A
1/22/2023			11.88[b]	M&A
2/27/2023	1,731,300	5.31		KFJV
3/10/2023			16.45[c]	M&A
3/16/2023	1,936,000	5.94		KFJV
4/17/2023	3,045,800	9.35		KFJV
5/15/2023	4,458,700	13.68		KFJV
6/14/2023	6,366,700	19.54		KFJV
7/1/2023	8,000,000	24.55		KFJV
8/1/2023	10,000,000	30.69		KFJV
8/8/2023	10,045,500	30.83		M&A
9/20/2023	13,047,100	40.04		KFJV
9/29/2023	13,692,900	42.02	21.82[c]	M&A
10/19/2023	15,101,300	46.34		KFJV
10/26/2023	15,589,100	47.84		KFJV
11/20/2023	17,399,300	53.40		KFJV
12/15/2023	18,988,200	58.27		KFJV
1/15/2024	20,609,700	63.25		KFJV
1/17/2024	20,702,100	63.53	23.82[c]	M&A
3/5/2024	22,080,500	67.76	12.23[b]	M&A

[a] Estimated amount of water pumped based on number of filled water trucks
[b] Static water level measurement
[c] Pumping water level measurement

ATTACHMENT 2

AQTESOLV analysis report



CHANDLER WELL - 607 DAY SIMULATION

Data Set: P:\...\Chandler Well Fwd Analysis Actual and Proposed Pumping_rev.aqt
Date: 03/20/24 Time: 07:51:46

PROJECT INFORMATION

Company: Montgomery & Associates
Client: ADOT
Location: Black Canyon, AZ
Test Well: 55-928413

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Chandler	627363	1117609

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Chandler	627363	1117609

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis/Hantush

T = 1575. ft^2/day
Kz/Kr = 1.
S = 0.1
b = 76.24 ft