KG16-0313

TO: Bryan Bondy
UVRGA Executive Director

FROM: Kear Groundwater
P.O. Box 2601
Santa Barbara, CA 93120-2601

DATE: January 31, 2020

SUBJECT: *Report of Groundwater Level and Temperature data, spring 2017 to September 2019, Upper Ventura River Groundwater Basin*
Ventura County, California

This memorandum provides a summary of Kear Groundwater's (KG) data collection, summarization and review of groundwater level and temperature logging of six wells in the Upper Ventura River Groundwater Basin during the period of monitoring inception through September 2019 (Figure 1). This effort is a streamlined reporting to support the Upper Ventura River Groundwater Agency (UVRGA) and its data gap analysis tasks in preparation of a groundwater sustainability plan for the managed basin.

The network of six monitoring points, selected by UVRGA board members and their agencies' staffs in early 2017 contributes to Sustainable Groundwater Planning Grant (Grant) Task 1, with the objective to fill data gaps, including improved characterization of the hydrogeologic conditions to serve groundwater planning and management activities. Specifically, this report provides the second of three annual reports identified in Grant Task 1 – Establish well monitoring network. The first report to address this task represented data through summer 2018 only and was dated September 30, 2018; each report is intended to be a stand-alone document incorporating data from previous reporting efforts.

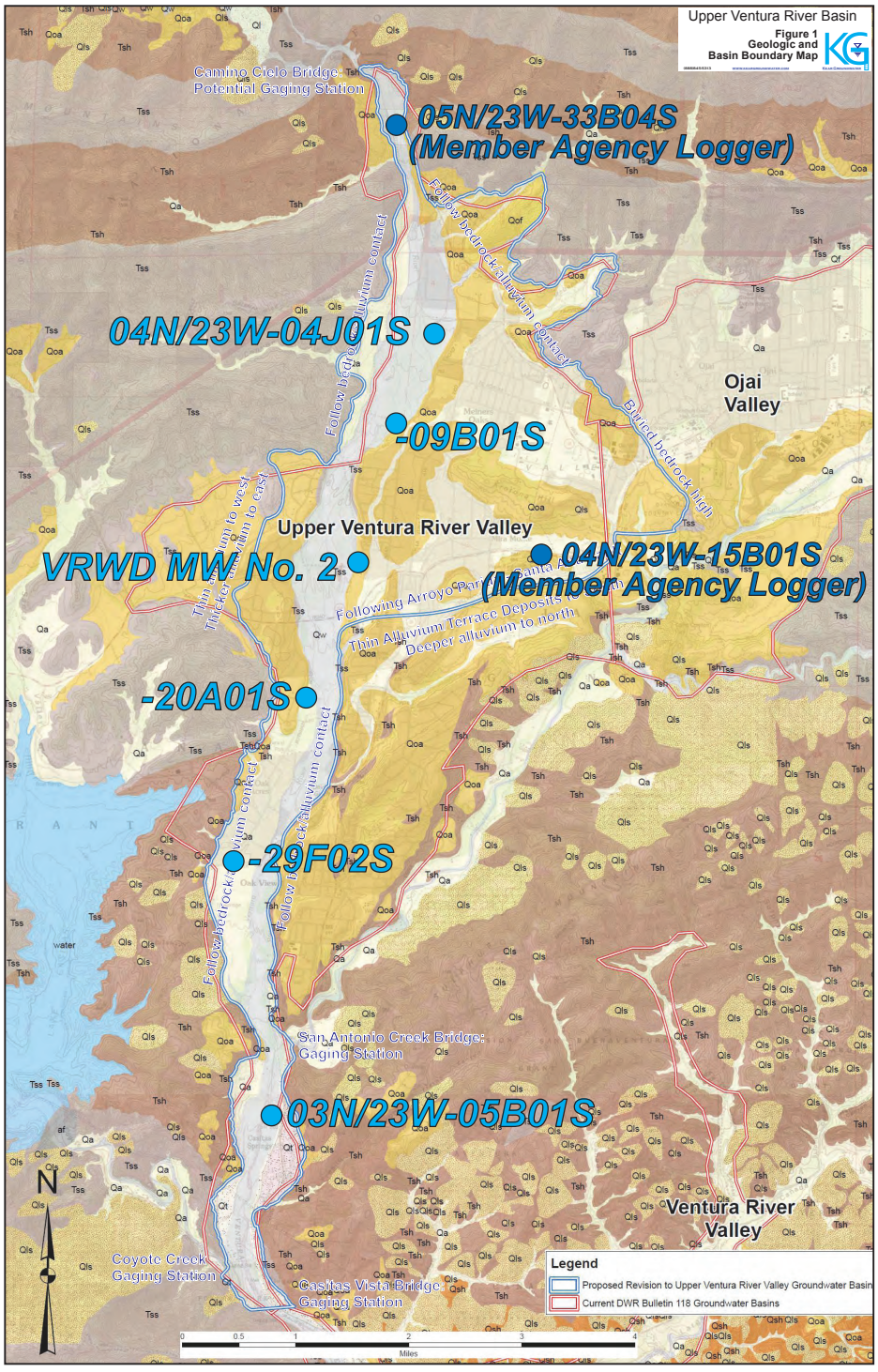

Figure 1. Locations of datalogger-equipped wells (light blue dots) monitored by the UVRGA and by member agencies (dark blue dots). Base geologic map shows 2016 UVRGA Basin Boundary (blue line). Note: in November 2019, loggers were deployed into two monitoring wells at Foster Park following the removal of the -05B01S well logger at owner's request.

KEAR GROUNDWATER

P.O. BOX 2601• SANTA BARBARA, CALIFORNIA • 93120 TELEPHONE: (805) 512-1516 JORDAN@KEARGROUNDWATER.COM

CALIFORNIA REGISTERED PROFESSIONAL GEOLOGIST N. 6960 CALIFORNIA CERTIFIED HYDROGEOLOGIST N. 749

The six monitored wells are described in the following table, and details of the water level and temperature hydrographs over the 30-month monitoring period are presented in the following graphics and discussions.

Table 1 – UVRGA Monitored Well Information

State Well Number	*Owner*	*Use*	*Casing Depth*	*Casing Diameter*
04N/23W-04J01S	MOWD (No. 8)	Municipal	144' (70-120' perf.) LINER: 136' (76-126' perf.)	16" LINER: 16"
04N/23W-09B01S	Private	Agricultural	180'	16"
N/A	VRWD (MW No. 2)	Monitoring	136' (66-126' perf.)	2"
04N/23W-20A01S	Private	Agricultural	101'	8"
04N/23W-29F02S	Private	Domestic and Agricultural	65'	12"
03N/23W-05B01S	Private	Inactive	70' (44-65' perf.)	24"

Procedures

Equipment installation was discussed in the first annual report (Kear Groundwater, 2018). Equipment was maintained and data downloaded in accordance with the Agency's Monitoring and Data Collection Protocols (UVRGA, 2018). Data specifically reported herein were downloaded from all dataloggers on October 9, 2019. After its permanent removal (at well owner's request), the logger deployed in the *-05B01S* well was downloaded again on November 19, 2019 and is reported herein.

Data Results

Raw Data graphs are presented on Figures 2A through 2F. Digested depth to water and groundwater elevation graphs are presented as Figure 3 and 4. Appendix A includes an excel file with raw and adjusted data sets.

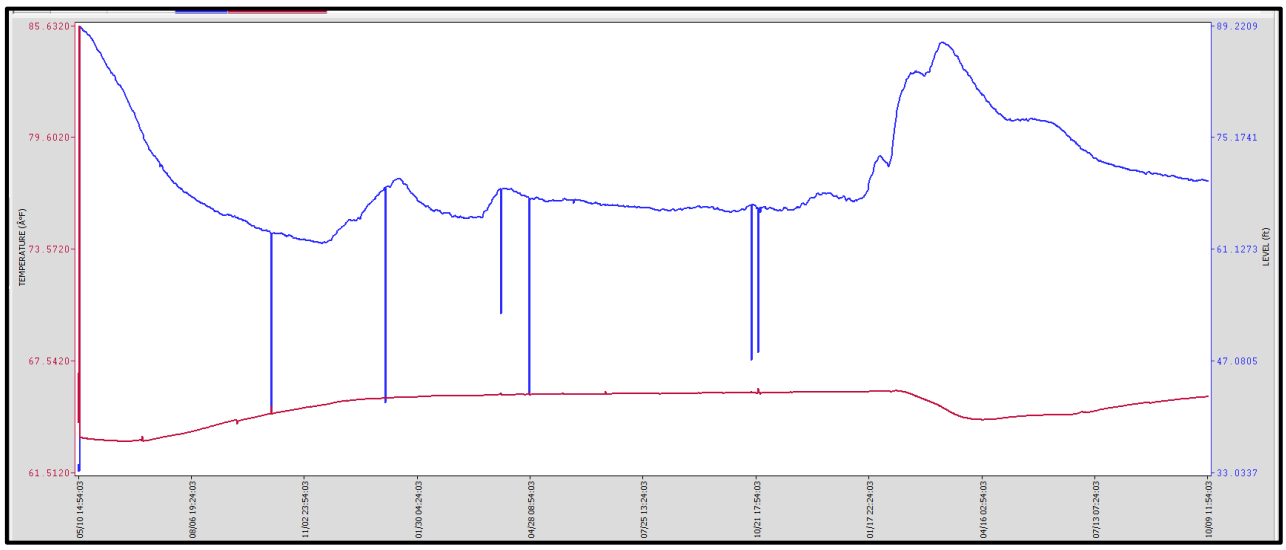

Figure 2A: Raw graph, 04N/23W-04J01S well logger, May 10, 2017 to October 9, 2019.

In the above graphs of the -*04J01S* well (MOWD No. 8), the water level is in feet above logger (plus about 33 feet for atmospheric pressure) in blue and referenced to right y-axis between 33 and 89 feet. Temperature, in red, references to the left y-axis and shows increase of just over 2 degrees F with recession of water levels in summer and fall 2017 then a plateau through winter 2017-18 when limited water level recovery is observed. The cooler temperatures again accompany winter 2018-19 recharge and water level increases, with a subsequent rise during the subsequent summer. This well is not typically pumped due to high nitrate issues.

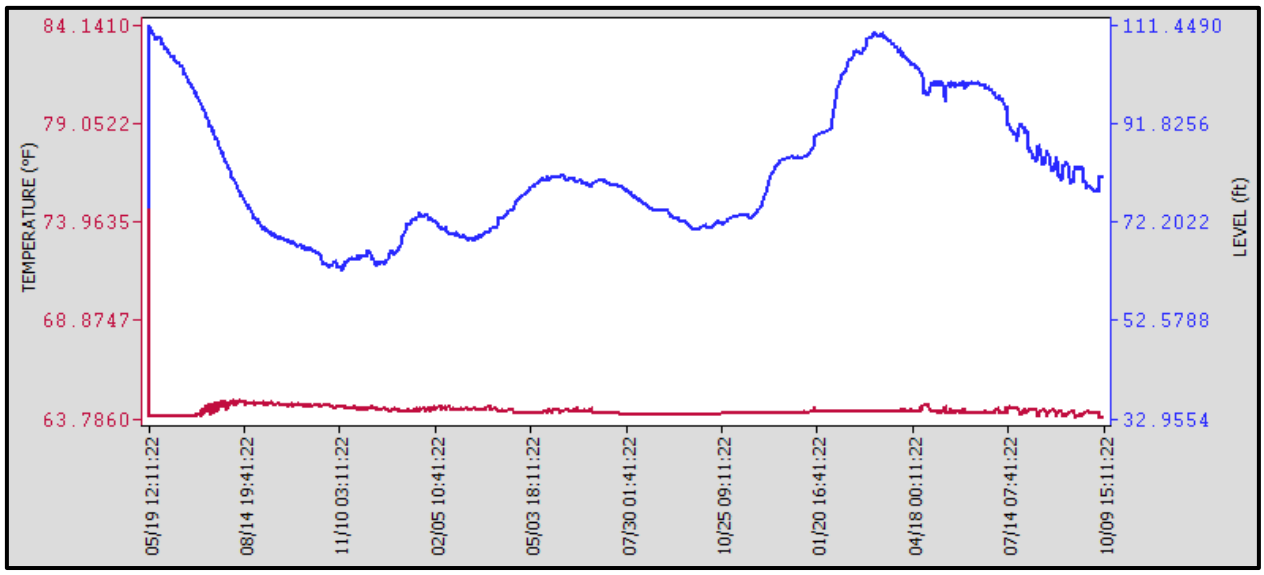

Figure 2B: Raw graph, 04N/23W-09B01SS well logger, May 19, 2017 to October 9, 2019.

In the above graphs for the *-09B01S* well, the water level is in feet above logger (plus 33 ft for atmospheric pressure) in blue and referenced to right y-axis between 33 and 111 feet. Temperature, in red, references to left y-axis and shows relatively stable water temperatures near 64 degrees. The well was only occasionally pumped until summer 2019, when regular pumping patterns are observed. The water level is affected to a lesser degree by proximal municipal supply wells.

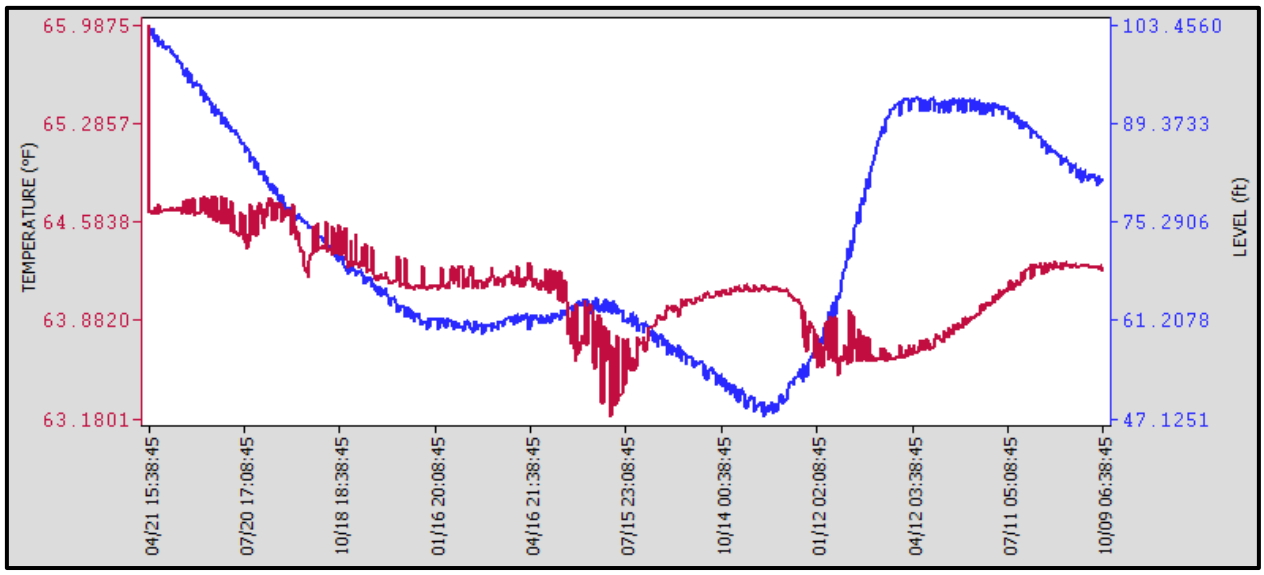

Figure 2C: Raw graph, Ventura River Water District MW No. 2, April 21, 2017 to October 9, 2019.

In the above graphs VRWD MW No. 2 (*no assigned SWN*), the water level is in feet above logger (plus 33 ft for atmospheric pressure) in blue and referenced to right y-axis between 47 and 103 feet. Temperature, in red, references to left y-axis and shows a slight decrease throughout the monitoring period. Well is not pumped as it is for monitoring only, but water levels therein are affected by pumping of proximal municipal supply wells.

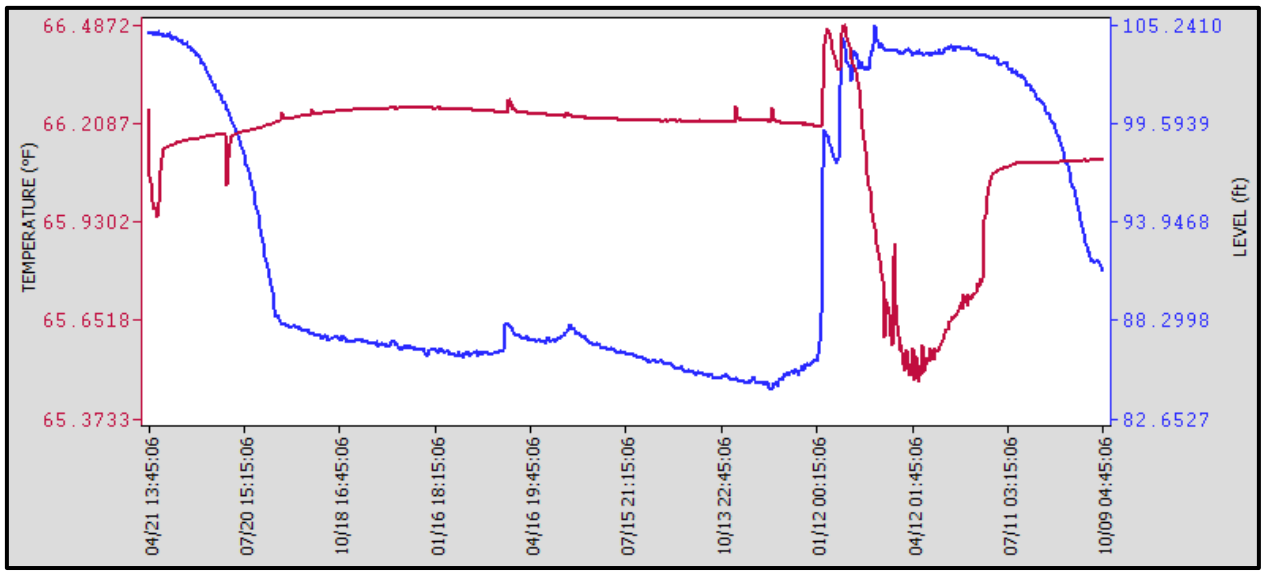

Figure 2D: Raw graph, 04N/23W-20A01S well logger, April 21, 2017 to October 9, 2019.

In the above graphs for the -*20A01S* well, the water level is in feet above logger (plus 33 ft for atmospheric pressure) in blue and referenced to right y-axis between 82 and 105 feet. Temperature, in red, references to left y-axis and ranges within about one degree of variability in temperature throughout the year. The exaggerated scale highlights the slight rise in temperature and sharp decrease as recharge of the aquifers occurs in winter 2018-2019.

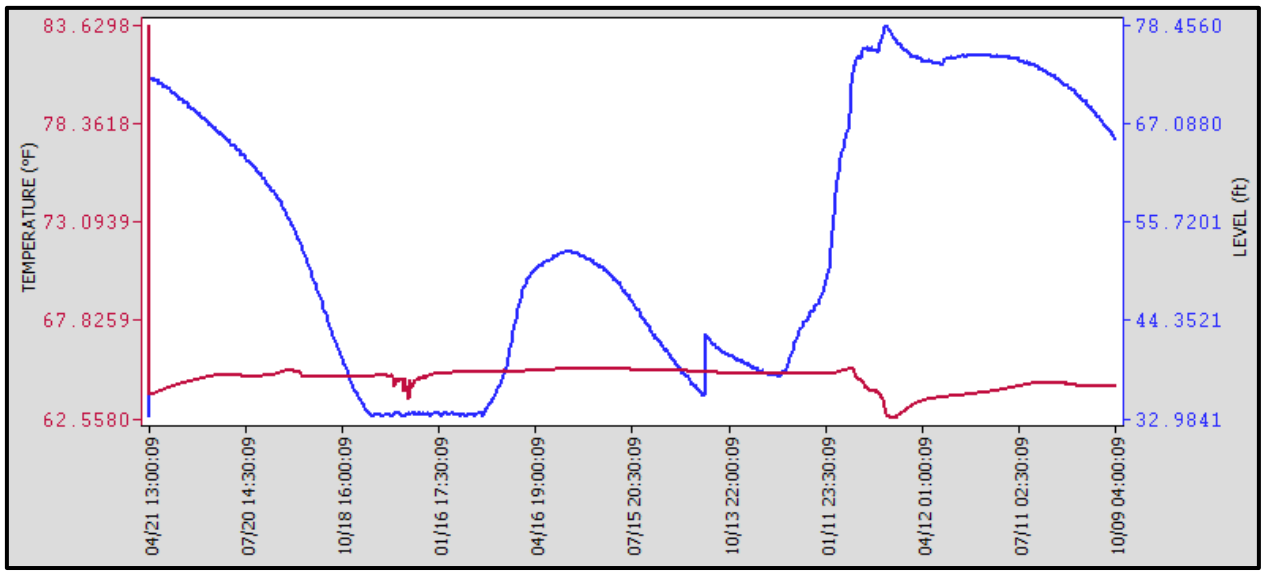

Figure 2E: Raw graph, 04N/23W-29F02S well logger, April 21, 2017 to October 9, 2019.

In the above graphs of the *-29F02S* well, the water level is in feet above logger (plus 33 ft for atmospheric pressure) in blue and referenced to right y-axis between 33 and 78 feet. Temperature, in red, references to left y-axis and shows a slight warming following the 2017 recharge period but relatively stable but for a lowering in early December 2017, with nearly 20 feet of recharge exhibited in 2018.

A September 2018 correction of the data set indicates that the logger may have been raised 7 feet and was not submerged between November 2017 and March 2018. Digested data were corrected in the first annual report for this mechanical anomaly (KG, 2018).

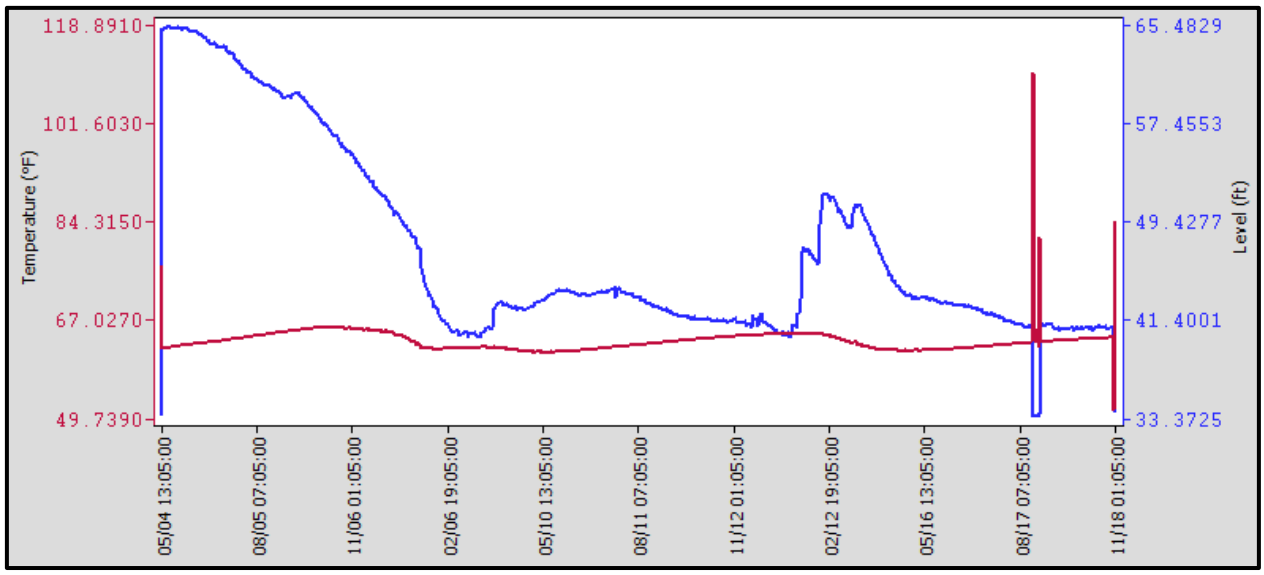

Figure 2F: Raw graph, 03N/23W-05B01S well logger, May 4, 2017 to November 19, 2019.

In the above graph for the well at the *-05B01S* well, the water level is in feet above logger (plus 33 ft for atmospheric pressure) in blue and referenced to right y-axis between 33 and 65 feet. Temperature, in red, references to left y-axis and shows the most variability of any of the wells with nearly 3 degrees over recharge and discharge patterns. The well may have been pumped occasionally and the logger was removed and set out of the well (by others) for a brief period in August 2019. The well is adjacent west to the transition zone into the "southern gaining reach" of the Ventura River, where groundwater daylights and flows as surface water. The logger was permanently removed from this well on November 19, 2019.

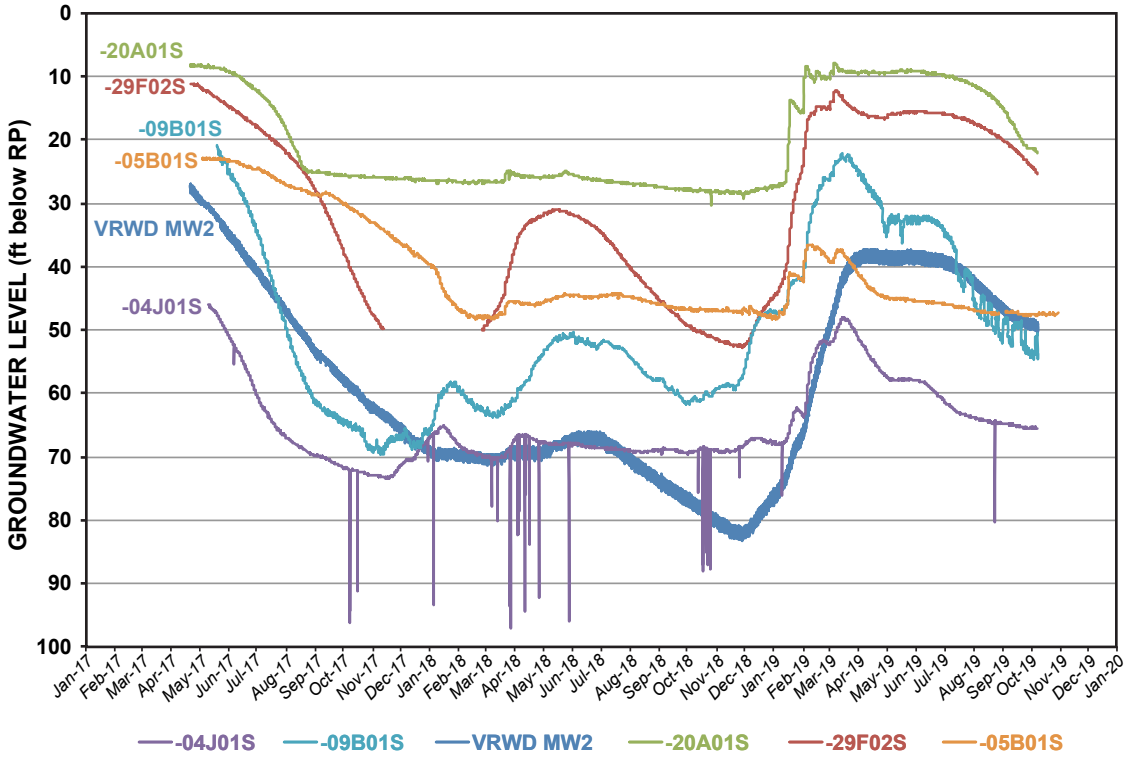

Figure 3. Depths to water below reference/observation points, which are tops of sounding tubes or well casings (+6.00 ft above ground surface at -04J01S, +4.31 ft at -09B01S, +0.35 ft at VRWD MW No. 2, +0.74 ft at -20A01S, +2.05 ft at -29F02S, and +2.47 ft at -05B01S, per KG measurements), Spring 2017 to October 2019. Note: unsubmerged/atmospheric only data removed; at -04J01S, the short-lived water level declines likely correspond to punctuated pumping events.

Figures 3 and 4 graphically present the logger level data, generated in feet above loggers, as the depths to water below reference points and the groundwater level elevations, respectively.

Depths to water ranged from spring highs in 2017 and winter 2019 of between 10 and 47 feet below reference points. Summer 2017 nadirs were between 28 and 73 feet, while fall 2018 nadirs were between 29 and 83 feet. Water year 2018-2019 recharge was indicated with an increase in water levels between 10 and 43 feet, though distribution was variable.

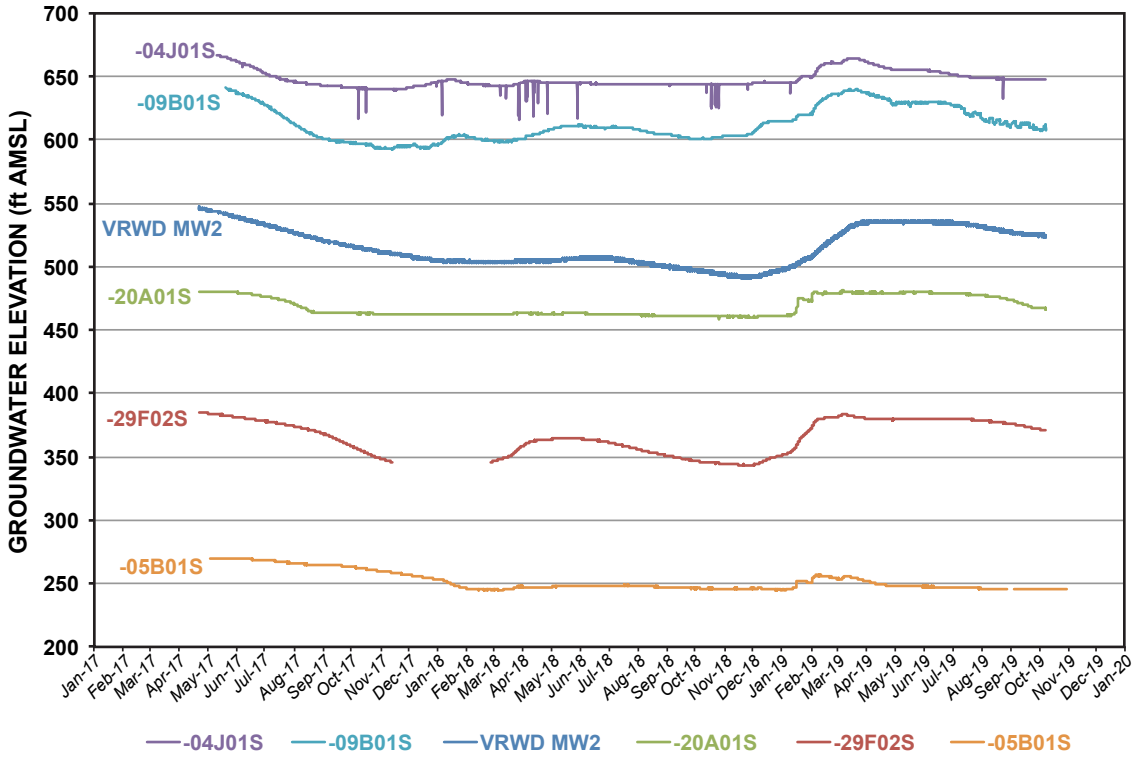

Figure 4. Groundwater elevations at six monitoring points in the UVRGB (based on reference point elevations per VCWPD of +713.0 ft above mean sea level at -04J01S, +662.3 ft AMSL at -09B01S, +488.9 ft AMSL at -20A01S, +396.0 ft AMSL at -29F02S, and +293.2 ft AMSL at -05B01S; +574.0 ft AMSL at VRWD MW No. 2 per Google Earth), Spring 2017 to October 2019. Note: unsubmerged/atmospheric only data removed; at -04J01S, the short-lived water level declines likely correspond to punctuated pumping events.

When the water levels are presented relative to sea level and placed on the same scale, the effects of water level change is muted, and the north-to south flow is clearly predominant and consistent. A gradient of 400 ft per the 30,600 feet of linear length calculates to a southward gradient of 0.013 ft/ft, which mimics topography in the area and is relatively steep compared to many other groundwater basins.

Closing

In keeping with the groundwater sustainability planning, the existing network of logging wells should continue and be augmented with additional wells to increase the area with continuous water level coverage. Fire effects on groundwater system may be better understood by comparing 2018 to subsequent water years with the detailed temporal monitoring currently being collected.

As of this writing, KG has installed two additional loggers in monitoring wells at Foster Park, with cooperation from the City of Ventura, and removed the logger from the *-05B01S* well (at owner's request). It is recommended that the Agency investigate a replacement monitoring location for the *-05B01S* well, located at Casitas Springs within the transition zone at the northern portion of Ventura River's southern gaining reach. Discussions of adding the Ojai Valley Land Conservancy well near the San Antonio Creek Confluence Preserve (04N/23W-32K03) and one other private well (targeting 04N/23W-32C01, -32C02, or -32C03) are ongoing. Additionally, MOWD has agreed to provide logger level data for its Well No. 2 (*05N/23W-33B04S*) and VRWD for its Well No. 5 (*04N/23W-15B01S*). Both loggers were deployed by the member agencies in 2019; water level data will be provided in future reporting.

Data presented herein were collected and reviewed in accordance with the UVRGA protocols; interpretation of data are based on reference point elevations that are subject to change both by updated elevation survey data and by earth movement. KG strongly recommends that the reference point elevations for all wells with deployed data loggers be surveyed by a licensed land surveyor for optimal accuracy.

We look forward to our continued involvement with the monitoring program and interpretation of the results to affect an increase in basin understanding and management.

Please do not hesitate to contact us with any questions.

Best Regards,

Jordan Kear
Principal Hydrogeologist
Professional Geologist No. 6960
California Certified Hydrogeologist No. 749

References

Kear Groundwater, 2018. Report of Groundwater Level and Temperature data, spring 2017 to summer 2018, Upper Ventura River Groundwater Basin, Ventura County, California. September 30, 2018. 15 p. *ex appendices*,

UVRGA, 2018. Monitoring and data collection protocols - Final Draft 5-3-18

Attachment: Field Data Sheets

Appendix A: Excel file containing time-normalized and raw/RP-fitted logger data (.xls)
Appendix B: Raw levelogger files (*.xle)

ATTACHMENT: Field Data Sheets

Upper Ventura River GROUNDWATER AGENCY SUSTAINABLE MANAGEMENT

GROUNDWATER LEVEL MEASUREMENT FIELD DATA SHEET

A	B	C	D	E	F	G	H
WELL ID	DATE	TIME	RPE (FT AMSL)	RPH (FT AGL)	DTW (FT)	GWE (FT AMSL)	NOTES
Researched	Record	Record	Researched	Measured	Measured	D-F	
CARITAS MHP	1/25/18	230PM			45.86		
VEGA	1/25/18	295PM			64.27*		offset, corrected in dataset
1000 Buenaventura	1/25/18	300PM			45.01*		offset, corrected in dataset
VRWD MW2	1/25/18	318PM			69.96		
Grantham 9B1	1/25/18	400PM			58.55		
MOWD 8	1/25/18	500PM			67.06		
CARITAS/MHP	7/25/18	1015AM			44.35		
VEGA	7/26/18	245PM			53.22*		offset, corrected in dataset
1000 Buenaventura	7/26/18	320PM			45.18*		offset, corrected in dataset
VRWD MW2	7/26/18	215PM			69.96		
MOWD 8	7/26/18	130PM			68.87		
Grantham 9B1	7/26/18	350PM			53.08		
CARITAS MHP	9/21/18	1:00PM			45.89		
1000 Buenaventura	9/21/18	10:30AM			27.63		
VEGA	9/21/18	10:55AM			47.59		CABLE REPLACED
MOWD 8	10/9/19	359P			65.58		Data Downloaded
GRANTHAM	10/9/19	312P			53.42		Data Downloaded
VRWD MW2	10/9/19	1:27P			51.21		Data Downloaded
BUENAVENTURA	10/9/19	1:05P			22.15		Data Downloaded
VEGA	10/9/19	12:49P			25.79		Data Downloaded
CMHP	10/9/19	12:22P			47.48		Data Downloaded