



April 8, 2018

Bruce Kuebler
Upper Ventura River Basin Groundwater Agency
PO Box 1779
Ojai, California 93024

**Re: *Proposed Professional Hydrogeologic Services
Monitor Ventura River Surface Water-Groundwater Interface Task 2.2***

Greetings Chair Kuebler:

Per our discussions and your request, Kear Groundwater (KG) has prepared this brief proposal to conduct various types of surface water flow monitoring and to map locations of daylighting groundwater such as at the north end of the live reach of the Ventura River. This proposal is prepared to meet the intent of Grant Subtask 2.2, summarized below.

As with many watersheds in arid and tectonically active regions, the Ventura River Watershed exhibits a very dynamic and mobile, ephemeral and intermittent network of streams. Surface flow from most streams exit the headwaters and infiltrate into the subsurface as the streams enter the groundwater basins, namely the Ojai Basin and the Upper Ventura River Groundwater Basin. Given the cobble and boulder substrate of the river beds, gauging the flow is difficult except for where bridges or impoundments exist and have created an engineered river bottom of planar concrete. A network of gauges exist at many bridge locations, but these are at areas where flow is often absent while the live reaches flow over areas where measuring the flow can be difficult and inaccurate due to the mobile river bed gravels.

To accommodate this phenomenon, KG and other researchers have been monitoring the southern edges of surface flow on the losing reaches and the northern edges of surface flow on the gaining reaches in this generally north-to south flowing system. By conducting this mapping on as frequently as a weekly basis using GPS tools, a long-term database is being constructed. By correlating the latitudes of the daylighting groundwater with measured flow, the latitudes can be used as a rating-shifted proxy for river and stream flow, without the uncertainty of measurements in the mobile substrate. Unique to each stream system, such a network can be used to graph the relationship between flow components and simplify the flow model of the stream system and interacting groundwater.

The southerly portion of Ventura River is usually a wet reach and the northerly portion a dry reach. When and where surface water ceases flowing in the dry reach and appears in the wet reach are important data for modeling the interaction of surface water and

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groundwater. Two water agencies on the UVRGA Board have been conducting regular on-the-ground river monitoring that includes 1) mapping the southern edge of the river's surface flow in the dry reach (begun in January 2014) and 2) noting at 100-meter intervals along the entire reach where the riverbed is wet, dry, or intermittent (begun in February 2008 for assessment of steelhead passage flows).

This task involves tracking the position of the river extent in the transition between the wet and dry reaches for three years, through the end of water year 2019. These monitoring data will be compiled, reconciled, and analyzed, along with data logger readings to help develop the hydrogeologic conceptual model and help calibrate the SWRCB surface water-groundwater model. This monitoring may continue beyond September 2019 as part of long-term monitoring.

A report will be developed describing the dynamic occurrence and movement of the surface water-groundwater interface.

KG proposes to support the UVRGA by conducting a weekly spot check of the northerly edge of surface flow in the live reach, and conduct a pressure-logger and GPS based survey of the migration of the northern edge of the live reach when it is in a conveniently measureable location (e.g., just south of Santa Ana Road) to better the understanding of the dynamic nature of the daylighting point.

Note that when surface flow is continuous across the basin, KG will measure flow near Santa Ana Road Bridge and/or Highway 150 bridge (as safely feasible) and compare to the Camino Cielo Bridge and Casitas Vista Bridge flow monitoring points. This is described separately in Task 2.6.

Task 2.2a: Weekly spot check:

When surface water flow is not continuous across the UVRGB, KG proposes to map the latitude and longitude of daylighting groundwater at the north end of the live reach on a weekly basis. Typically this will be on Friday afternoons when MOWD measures south end of surface flow at the losing reach of river to the north. We will accompany MOWD personnel on their checking when feasible.

Surface flow is considered continuous as measured up the river from the confluence of San Antonio Creek. The southernmost point at which this flow can no longer be seen will be mapped as the point of daylighting groundwater.

Task 2.2b: High Frequency survey (optional task):

To observe the north end of daylighting groundwater on a detailed, short-term, and high frequency basis, KG proposes to dedicate personnel on the north edge of surface flow and map (Via GPS and tape, as well as a datalogger in the downstream portion that will be saturated throughout this survey) its migration north and/or south to observe diurnal fluctuations over a 24-hour period. Field data will be recorded at 10-minute intervals along an estimated 300-ft north to south reach of the river where daylighting. Position of



daylighting flow, water temperature, latitude of northernmost flowing water will all be recorded. These data will be compared to logger data set in river in pool near the daylighting point. We will also compare to diurnal fluctuations in the groundwater levels at most proximal monitored well. Two 24 - hour surveys are proposed, one in late spring 2018 (estimate June) and another in autumn (estimate November) 2018.

Task 2.2c: Reporting

KG personnel will incorporate data collection, data review, logger data and incorporation into ongoing dataset and presentation. In accordance with the GSP Grant, KG will prepare a "Surface and Groundwater Interaction Report" that describes the dynamic occurrence and movement of the surface water-groundwater interface at both the north and south edges of the dry reach. This report will incorporate data collected by MOWD and be submitted in draft form following the end of water year 2018/2019 (September 30 2019 and finalized before January 1, 2020. KG will provide a map showing the results of the weekly spot check and a graph by the last day of each month. For budgeting purposes, we assume a more formal presentation to the Board every six months.

ESTIMATED FEE FOR PROFESSIONAL SERVICE
(FIELD WORK THROUGH SEPTEMBER 30, 2019):

Task 2.2a: Weekly spot check (\$200/week for 75 weeks):	\$15,000
[per week, 1 hour principal time at \$200/hour or 2 hours staff time at \$100/hour]:	
Task 2.2b: Two surveys with 10-min time point collection over 24 hours:	\$12,000
[30 hours principal time at \$200/hour and 60 hours staff time at \$100/hour]:	
Task 2.2c: Report preparation	\$5,000
[10 hours principal time at \$200/hour and 30 hours staff time at \$100/hour]:	
Total, all Tasks:	\$35,000
Total, excluding optional task:	\$20,000

Best Regards,

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