GEOSCIENCE

March 18, 2019 **DRAFT**

Mr. Mark Norton, PE, LEED AP, ENV SP
Water Resources & Planning Manager
Santa Ana Watershed Project Authority
11615 Sterling Ave.
Riverside, CA 92503

Re: Fifth Request for Budget Amendment for Consulting Services for Santa Ana River Waste Load Allocation Model Update

Dear Mark:

The purpose of this letter is to present the fifth budget amendment for the Santa Ana River (SAR) Waste Load Allocation Model (WLAM), per the request made at the March 6, 2019 technical review subcommittee meeting. GEOSCIENCE Support Services, Inc. (GEOSCIENCE) has submitted four previous budget amendments:

1. A first budget amendment on February 8, 2018 (draft dated January 5, 2018) to address out of scope work requested in comments received on the WLAM draft Technical Memorandums (TMs) No. 1 and 2. This first budget amendment also included a budget reduction arising from the Basin Management Program (BMP) Task Force's decision to forego Task 4 (Develop WLAM for Managed Recharge in Percolation Basins). The budget for Task 9 was also affected by this decision since it included a Draft TM No. 4 summarizing the results of Task 4.

2. GEOSCIENCE submitted a draft second budget amendment on July 26, 2018 in response to a request from the Regional Water Quality Control Board (Regional Board) to include an evaluation of the impacts of surface spreading at Corona Ponds and Redlands Basin on receiving groundwater and surface water. This work was originally covered under Tasks 4 and 9, but was cancelled during the October Task Force meeting. The remaining funds for this work were then used to cover a portion of the out of scope work proposed in the February budget amendment. The draft second budget amendment proposed reinstating a portion of Task 4 and the draft TM No. 4 under Task 9. However, in response to concerns raised by the City of Corona during the August 14, 2018 meeting, the Task Force requested that an amendment to reinstate work

related to the Corona Ponds and Redlands Basin be postponed until Corona and the Regional Board reached a consensus on how to proceed. Per the Regional Board, additional modeling conducted by the City of Corona provided sufficient information regarding the impact of waste water spreading. Therefore, the finalized second budget amendment only included additional expenses for extra meetings as a result of unforeseen project delay.

3. Per your request at the October 30, 2018 BMP Task Force meeting, GEOSCIENCE submitted a third budget amendment to account for requested additional modeling work with revised scenario assumptions and further analyses.

4. During the course of completing the work requested from the third budget amendment, the question of whether or not to account for stormwater diversions and spreading in off-channel recharge basins came up again. In response to Risk Science's letter presenting a rationale for restoring some elements of Task 4 in the WLAM scope of work (dated January 24, 2019), GEOSCIENCE was asked to prepare a fourth budget amendment. After discussing options for proceeding with the fourth budget amendment, the Task Force decided to pursue Option 1, which involved summarizing the volumes of diverted stormwater for spreading in recharge basins, along with the associated TDS and TIN concentrations, in the final study report as a series of tables.

A technical subcommittee meeting was held on March 6, 2019 to discuss the different approaches used for simulating rising water in the current and previous WLAMs, along with potential implications of those approaches. Following this discussion, GEOSCIENCE was asked to put together this fifth cost estimate to outline different modeling exercises which would evaluate the approach used to model rising water in the current 2017 WLAM HSPF and the effects on calculating streambed percolation in SAR Reach 4 overlying Riverside A groundwater management zone (GMZ). The additional scope of work and associated level of effort to for this work is outlined in the following sections.

1.0 PROPOSED ADDITIONAL SCOPE OF WORK

Task 2 – Update and Recalibrate the WLAM

Additional work under this task will be completed at the direction of the Task Force to answer unresolved questions and/or concerns about the modeling of rising water in the 2017 WLAM HSPF. Based on the discussion at the March 6, 2019 technical subcommittee meeting, several suggestions for additional modeling work were made. These are discussed in further detail below.

Task 2o – Recalibrate WLAM with Rising Water as Model Input and Compare Results

Currently, the 2017 WLAM HSPF uses a post-processing approach for rising water. For example, in the location of SAR Reach 3 and 4 downgradient of the RIX outfall but upgradient of the MWD Crossing streamflow gage (see Figure 1, below), the model is calibrated to observed streamflow at the MWD gage without considering additional flow in Reach 3 from rising water which is known to occur in this area. After the model is run to determine percolation in Reach 4 upgradient of MWD Crossing, assumed rising water volumes and concentrations are factored in during a post-processing stage. The amount of percolation in Reach 4 below the RIX outfall is therefore adjusted according to the volume of assumed rising water, which was estimated based on the groundwater flow model results from the existing Riverside-Arlington Groundwater Model developed by WRIME. This approach allows assumptions for rising water to be modified without recalibrating the WLAM. Another approach, which was used in previous versions of the WLAM, involves adding rising water as a model input.

This subtask would involve adding the current assumed volumes and concentrations of rising water into the 2017 WLAM HSPF as model inputs and recalibrating the streambed conductance in SAR Reach 4. Model-calculated percolation from the refined calibration run could then be compared to the percolation from the post-processing approach currently used by the 2017 WLAM HSPF to evaluate differences between the two approaches. Results will be presented at the monthly Task Force meeting and summarized in the Draft Study Report.

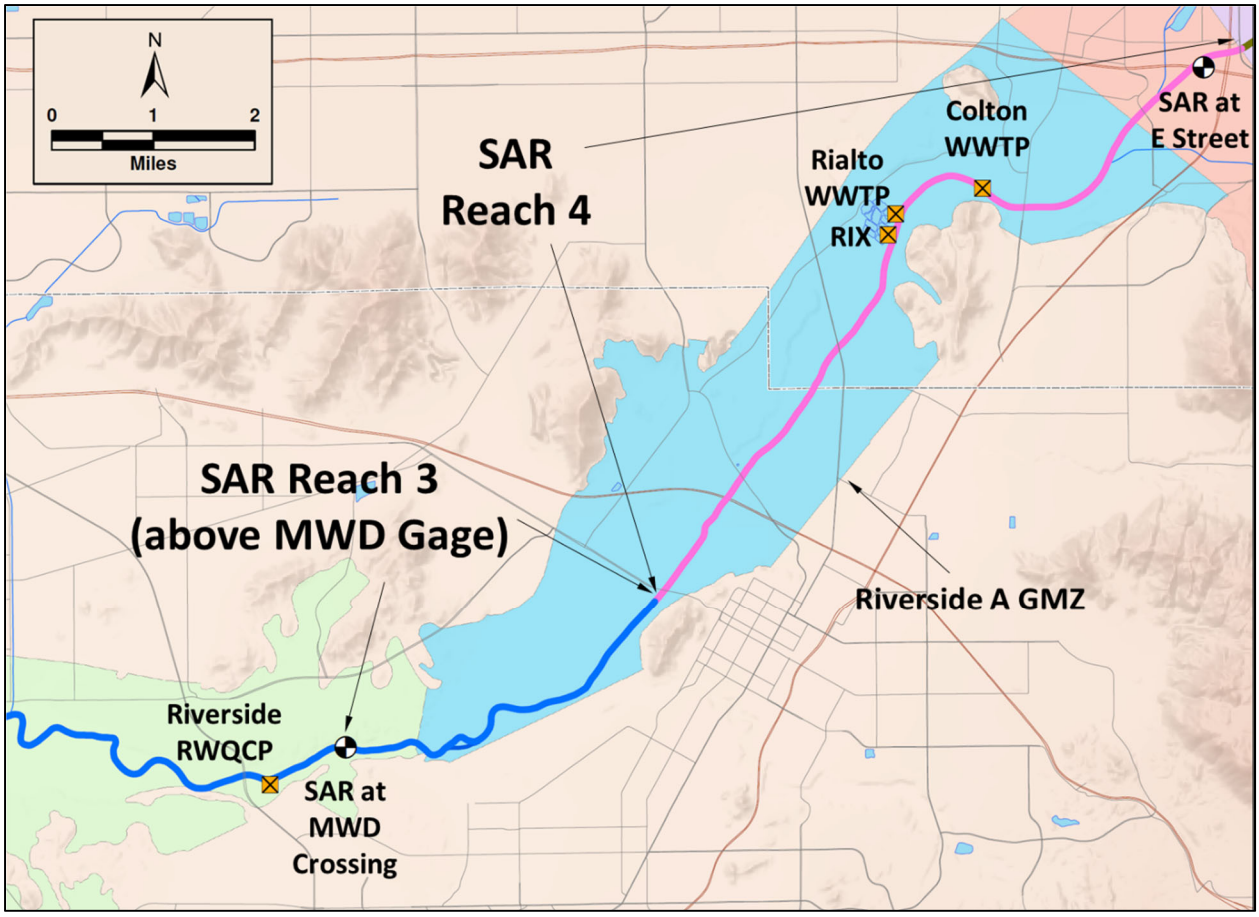


Figure 1. Santa Ana River Reach 3 and 4 above Riverside A Groundwater Management Zone

Task 2p – Sensitivity Run on Model Calibration with Reduced Rising Water

In the real world, the amount of rising water is largely dependent on underlying groundwater levels, which vary through time depending on hydrology and basin management. Since HSPF and other watershed models are limited in the fact that they are not able to simulate the interaction between groundwater and surface water, rising water – which affects the amount of model-calculated streambed percolation – represents a source of uncertainty. Given the potential for assumptions of rising water to impact policy interpretations, it was suggested that a sensitivity run be conducted to determine the effect of changes in rising water on model-calculated streambed recharge.

This subtask would involve assessing the sensitivity of the 2017 WLAM HSPF to changes in rising water. One sensitivity run will be made by reducing the assumed volume of rising water by 50% and recalibrating the streambed conductance in the WLAM. The model-calculated recharge (specifically in SAR Reach 3 and 4) from this sensitivity run will be compared to that calculated with the current rising

water assumptions (from Task 2o). Results from the sensitivity run will be summarized in the Draft Study Report in the section addressing sources of uncertainty in the 2017 WLAM HSPF.

Task 3 – Evaluate Waste Load Allocation Scenarios for Major Stream Segments

Task 3g – Use the Refined Calibration Version from Task 2o to Recalculate Streambed Recharge under Future Scenario Conditions (per model run)

Depending on the observed impact of using a different approach for rising water, the refined calibration version of the 2017 WLAM HSPF (created in Task 2o) can be used to recalculate streambed recharge under future scenario conditions (e.g., Scenario B: Average Expected Recharge in 2020). In this subtask, model-calculated recharge from the refined calibration under designated scenario conditions will be compared to that calculated by the 2017 WLAM HSPF using the existing post-processing approach. Additional model runs considering alternate scenario conditions may be run at the discretion of the Task Force.

Task 10 – Monthly Project Meetings

In the fourth budget amendment request (dated February 12, 2019), additional scope of work and budget was included for monthly project meetings through April 2019, due to project delay. Since that amendment, GEOSCIENCE attended an unforeseen technical subcommittee meeting with Task Force members and Wildermuth Environmental, Inc. (WEI) to address concerns and provide additional information about modeling approaches used in the WLAM. Preparation for and attendance at this meeting (held on March 6, 2019) is also included in this fifth budget amendment.

Given the additional out of scope of work detailed above, it is anticipated that preparation for, and attendance at, additional meetings will be required – depending on which option the Task Force decides to pursue. For Option 1 (no Tasks 2o, 2p, or 3g), it is anticipated that one (1) additional meeting will be needed (i.e., May Task Force Meeting). Option 2 (with Tasks 2o, 2p, and 3g) is anticipated to need two (2) additional meetings (i.e., May and June Task Force Meetings).

2.0 PROPOSED BUDGET AMENDMENT

The estimated cost of the additional work described above is detailed in attached Table 1 and summarized below.

Proposed Budget for Additional Scope of Work

Option	TASK		Total Additional Hours	Total Additional Cost
2	2o	Recalibrate WLAM with Rising Water as Model Input and Compare Results	27	$3,530
2	2p	Sensitivity Run on Model Calibration with Reduced Rising Water	19	$2,530
2	3g	Use the Refined Calibration Version from Task 12.1 to Recalculate Streambed Recharge under Future Scenario Conditions (per model run)	19	$2,530
1	10.0	Option 1 (no Tasks 2o, 2p, or 3g): Prepare for and Participate in up-to-1 Half-Day Monthly Meeting and 6-Mar-19 Technical Subcommittee Meeting	36	$5,820
2	10.0	Option 2 (with Tasks 2o, 2p, and 3g): Prepare for and Participate in up-to-2 Half-Day Monthly Meetings and 6-Mar-19 Technical Subcommittee Meeting	48	$8,010
TOTAL (Option 1: no Tasks 2o, 2p, or 3g)			**36**	**$5,820**
TOTAL (Option 2: with Tasks 2o, 2p, and 3g)			**113**	**$16,600**

Budget Amendment Summary

TASK		Original Approved Budget (6-Jan-17)	1st Budget Amendment Request (8-Feb -18)	2nd Budget Amendment Request (15-Aug-18)	3rd Budget Amendment Request (12-Nov-18)	4th Budget Amendment Request (12-Feb-19)	5th Budget Amendment Request (18-Mar-19)	Total Project Budget
1.0	Update the Data Used in the Waste Load Allocation Model (WLAM)	$25,665	$4,600	-	-	-	-	$30,265
2.0	Update and Recalibrate the WLAM	$59,255	$30,255	-	-	-	Option 1: $0 Option 2: $6,060	Option 1: $89,510 Option 2: $95,570
3.0	Evaluate Waste Load Allocation Scenarios for Major Stream Segments	$33,150	-	-	$23,970	-	Option 1: $0 Option 2: $2,530	Option 1: $57,120 Option 2: $59,650
4.0	Develop WLAM for Managed Recharge in Percolation Basins	$16,070	$(12,374)	-	-	$3,530	-	$7,226
5.0	Estimate Off-Channel Recharge From Natural Precipitation	$6,385	-	-	-	-	-	$6,385
6.0	Run the WLAM in Retrospective Mode, Using Historical Discharge Data, to Estimate the Quantity and Quality of Recharge that Actually Occurred	$8,290	-	-	-	-	-	$8,290
7.0	Compile the WLAM into a Run-Time Software Simulation Package	$17,340	-	-	-	-	-	$17,340
9.0	Draft Task Reports, Draft and Final Report	$45,005	TM 2: $7,245 TM 4: $(5,760) Total:$1,485	-	-	-	-	$46,490
10.0	Monthly Project Meetings	$35,640	-	$11,480	$5,740	$9,150	Option 1: $5,820 Option 2: $8,010	Option 1: $67,830 Option 2: $70,020
11.0	Pilot Evaluation of the Doppler Data Compared to Precipitation Gauge Data	$3,000	-	-	-	-	-	$3,000
	TOTAL	**$249,800**	**$23,966**	**$11,480**	**$29,710**	**$12,680**	Option 1: **$5,820** Option 2: **$16,600**	Option 1: **$333,456** Option 2: **$344,236**

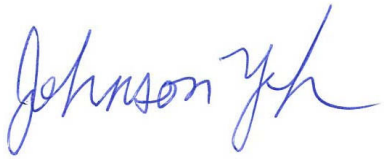
Our existing contract amount, which includes the February 12, 2019 budget amendment, is $327,636. The requested cost for this contract amendment is **$5,820** for Option 1 (no Tasks 2o, 2p, or 3g) and **$16,600** for Option 2 (with Tasks 2o, 2p, and 3g), which would increase the total contract amount to **$333,456** for Option 1 and **$344,236** for Option 2. Option 1 only includes one additional monthly meeting along with the March 6, 2019 technical subcommittee meeting ($5,820). Option 2 includes the cost of the additional work for recalibrating the model to include rising water ($3,530), conducting a sensitivity run with reduced rising water ($2,530), recalculating streambed recharge with the recalibrated model ($2,530 per model run), and attendance at two additional monthly meetings and the March technical subcommittee meeting ($8,010).

3.0 REVISED PROJECT SCHEDULE

A revised project schedule in response to delay associated with the additional work related to rising water is presented on Table 2. As shown, we anticipate finishing the Draft Study Report mid- to late-April 2019, and the Final Study Report mid- to late-May 2019 for Option 1 (no Tasks 2o, 2p, or 3g). Option 2 (with Tasks 2o, 2p, and 3g) will delay the project an additional month, meaning the Final Study Report is anticipated to be completed mid- to late-June 2019.

We appreciate the opportunity to provide our services on this important project. If you have any questions, please call us at (909) 451-6650.

Sincerely,



Dennis E. Williams, Ph.D., PG, CHG
President

Johnson Yeh, Ph.D., PG, CHG
Principal/Groundwater Modeler

encl.

Santa Ana Watershed Project Authority
Fifth Request for Budget Amendment for Consulting Services for Santa Ana River Waste Load Allocation Model Update

DRAFT
Table 1

ADDITIONAL COST ESTIMATE FOR CONSULTING SERVICES

Santa Ana River Waste Load Allocation Model Update

Task		Description	ADDITIONAL COST - THIRD BUDGET AMENDMENT									Original Budget (6-Jan-17)	First Amended Budget (8-Feb-18)	Second Amended Budget (15-Aug-18)	Third Amended Budget (12-Nov-18)	Fourth Amended Budget (12-Feb-19)	Fifth Amended Budget (18-Mar-19)
			Principal Hydrologist	Senior Geohydrologist	Project Geohydrologist	Staff Geohydrologist	Graphics	Clerical	Total Hours	Labor Cost	Reimbursable Expenses [1]	Additional Cost						
		Hourly Rate:	$285	$200	$165	$125	$110	$95										
1.0		**Update the Data Used in the Waste Load Allocation Model (WLAM)**																
	1a	Update Relevant Land Use Maps for the Region							0	$ -		$ -	$ 4,520	$ 4,520	$ 4,520	$ 4,520	$ 4,520	$ 4,520
	1b	Update the Stormwater Management Facility Maps							0	$ -		$ -	$ 4,520	$ 4,520	$ 4,520	$ 4,520	$ 4,520	$ 4,520
	1c	Update the Historical Precipitation Data for the Region							0	$ -		$ -	$ 2,530	$ 2,530	$ 2,530	$ 2,530	$ 2,530	$ 2,530
	1d	Review and Confirm the Operating Assumptions for Seven Oaks Dam and Prado Dam							0	$ -		$ -	$ 2,020	$ 2,020	$ 2,020	$ 2,020	$ 2,020	$ 2,020
	1e	Update and Consolidate the Flow Data Used in the WLAM							0	$ -		$ -	$ 3,530	$ 3,530	$ 3,530	$ 3,530	$ 3,530	$ 3,530
	1f	Update and Consolidate the Water Quality Data Used in the WLAM							0	$ -		$ -	$ 3,530	$ 3,530	$ 3,530	$ 3,530	$ 3,530	$ 3,530
	1g	Perform a Systematic QA/QC Review of All Data							0	$ -		$ -	$ 5,015	$ 5,015	$ 5,015	$ 5,015	$ 5,015	$ 5,015
	1h	Update and Consilidate Flow Data from Additional Discharge Sources Identified in the WLAM							0	$ -		$ -	$ -	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
	1i	Create Plots and Database Files of Model Input Data (to be included as appendices)							0	$ -		$ -	$ -	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200
		Task 1.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 25,665**	**$ 30,265**	**$ 30,265**	**$ 30,265**	**$ 30,265**	**$ 30,265**
2.0		**Update and Recalibrate the WLAM**																
	2a	Update the Estimate of Surface Water Runoff to Major Stream Segments							0	$ -		$ -	$ 24,800	$ 24,800	$ 24,800	$ 24,800	$ 24,800	$ 24,800
	2b	Update the Estimate of Stream Flow in Major Stream Segments							0	$ -		$ -	$ 10,685	$ 10,685	$ 10,685	$ 10,685	$ 10,685	$ 10,685
	2c	Update the Estimated Concentration of TDS in Major Stream Segments							0	$ -		$ -	$ 10,685	$ 10,685	$ 10,685	$ 10,685	$ 10,685	$ 10,685
	2d	Update the Estimated Concentration of TIN in Major Stream Segments							0	$ -		$ -	$ 5,885	$ 5,885	$ 5,885	$ 5,885	$ 5,885	$ 5,885
	2e	Estimate the Volume of Stream Flow Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone							0	$ -		$ -	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
	2f	Estimate the Average Daily Concentration and Mass of TDS Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone							0	$ -		$ -	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
	2g	Estimate the Average Daily Concentration and Mass of TIN Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone							0	$ -		$ -	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
	2h	Create an Impoundment for the Prado Wetlands to Account for Evapotranspiration and Changes in Water Quality							0	$ -		$ -	$ -	$ 6,485	$ 6,485	$ 6,485	$ 6,485	$ 6,485
	2i	Re-Estimate Stream Flow in Major Stream Segments after Incorporating Additional Discharge Data							0	$ -		$ -	$ -	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400
	2j	Re-Estimate Concentration of TDS in Major Stream Segments after Incorporating Additional Discharge Data and Effects of the Prado Wetlands							0	$ -		$ -	$ -	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400
	2k	Re-Estimate Concentration of TIN in Major Stream Segments after Incorporating Additional Discharge Data and Effects of the Prado Wetlands							0	$ -		$ -	$ -	$ 3,400	$ 3,400	$ 3,400	$ 3,400	$ 3,400
	2l	Tabulate the Differences between WLAM Versions							0	$ -		$ -	$ -	$ 7,370	$ 7,370	$ 7,370	$ 7,370	$ 7,370
	2m	Tabulate the Average Mass Balance (by Source) for Flow, TDS, and TIN in Each Major Stream Segment							0	$ -		$ -	$ -	$ 3,800	$ 3,800	$ 3,800	$ 3,800	$ 3,800
	2n	Conduct Formal Outlier Analyses for Areas of High Model Over/Underestimation (i.e., greater than two orders of magnitude)							0	$ -		$ -	$ -	$ 2,400	$ 2,400	$ 2,400	$ 2,400	$ 2,400
	2o	Recalibrate WLAM with Rising Water as Model Input and Compare Results		1	2	24			27	$ 3,530		$ 3,530	$ -	$ -	$ -	$ -	$ -	$ 3,530
	2p	Sensitivity Run on Model Calibration with Reduced Rising Water		1	2	16			19	$ 2,530		$ 2,530	$ -	$ -	$ -	$ -	$ -	$ 2,530
		Task 2.0 Subtotal Hours and Costs	**0**	**2**	**4**	**40**	**0**	**0**	**46**	**$ 6,060**	**$ -**	**$ 6,060**	**$ 59,255**	**$ 89,510**	**$ 89,510**	**$ 89,510**	**$ 89,510**	**$ 95,570**
3.0		**Evaluate Waste Load Allocation Scenarios for Major Stream Segments**																
	3a	Specify the Range of Probable Discharge Conditions							0	$ -		$ -	$ 6,720	$ 6,720	$ 6,720	$ 6,720	$ 6,720	$ 6,720
	3b	Use WLAM to Analyze Six Scenarios							0	$ -		$ -	$ 15,040	$ 15,040	$ 15,040	$ 15,040	$ 15,040	$ 15,040
	3c	Report Results of the WLAM Scenario Analyses							0	$ -		$ -	$ 11,390	$ 11,390	$ 11,390	$ 11,390	$ 11,390	$ 11,390
	3d	Revise Assumptions for the Six WLAM Scenarios and Rerun							0	$ -		$ -	$ -	$ -	$ -	$ 7,780	$ 7,780	$ 7,780
	3e	Conduct Additional Analyses on the Results from the Six WLAM Scenarios							0	$ -		$ -	$ -	$ -	$ -	$ 5,060	$ 5,060	$ 5,060
	3f	Conduct Sensitivity Runs or Mass Balance Analyses to Understand Key Issues							0	$ -		$ -	$ -	$ -	$ -	$ 11,130	$ 11,130	$ 11,130
	3g	Use the Refined Calibration Version from Task 2o to Recalculate Streambed Recharge under Future Scenario Conditions (per model run)		1	2	16			19	$ 2,530		$ 2,530	$ -	$ -	$ -	$ -	$ -	$ 2,530
		Task 3.0 Subtotal Hours and Costs	**0**	**1**	**2**	**16**	**0**	**0**	**19**	**$ 2,530**	**$ -**	**$ 2,530**	**$ 33,150**	**$ 33,150**	**$ 33,150**	**$ 57,120**	**$ 57,120**	**$ 59,650**
4.0		**Develop WLAM for Managed Recharge in Percolation Basins**																
	4a	Identify the Percolation Ponds and Recharge Basins to be Evaluated							0	$ -		$ -	$ 3,720	$ 3,720	$ 3,720	$ 3,720	$ 3,720	$ 3,720
	4b	Characterize the Volume and Quality of Water Recharged to Groundwater							0	$ -		$ -	$ 6,720	$ 6,720	$ 6,720	$ 6,720	$ 6,720	$ 6,720
	4c	Summarize the Results of Task 4b by Groundwater Management Zone							0	$ -		$ -	$ 2,815	$ 2,815	$ 2,815	$ 2,815	$ 2,815	$ 2,815
	4d	Integrate Results from Task 4c with the Results from Task 3c							0	$ -		$ -	$ 2,815	$ 2,815	$ 2,815	$ 2,815	$ 2,815	$ 2,815
		Remove Costs for Task 4 (minus $3,696.25 for work already completed)							0	$ -		$ -	$ -	$ (12,374)	$ (12,374)	$ (12,374)	$ (12,374)	$ (12,374)
	4e	Summarize Stormwater Diversion and Spreading							0	$ -		$ -	$ -	$ -	$ -	$ -	$ 3,530	$ 3,530
		Task 4.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 16,070**	**$ 3,696**	**$ 3,696**	**$ 3,696**	**$ 7,226**	**$ 7,226**
5.0		**Estimate Off-Channel Recharge from Natural Precipitation**																
		Estimate the Volume and Quality of Natural Rainfall that Percolates to The Underlying Groundwater Basin							0	$ -		$ -	$ 6,385	$ 6,385	$ 6,385	$ 6,385	$ 6,385	$ 6,385
		Task 5.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 6,385**	**$ 6,385**	**$ 6,385**	**$ 6,385**	**$ 6,385**	**$ 6,385**

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Table 1

ADDITIONAL COST ESTIMATE FOR CONSULTING SERVICES

Santa Ana River Waste Load Allocation Model Update

Task		Description	ADDITIONAL COST - THIRD BUDGET AMENDMENT									Original Budget (6-Jan-17)	First Amended Budget (8-Feb-18)	Second Amended Budget (15-Aug-18)	Third Amended Budget (12-Nov-18)	Fourth Amended Budget (12-Feb-19)	Fifth Amended Budget (18-Mar-19)
			Principal Hydrologist	Senior Geohydrologist	Project Geohydrologist	Staff Geohydrologist	Graphics	Clerical	Total Hours	Labor Cost	Reimbursable Expenses [1]	Additional Cost						
		Hourly Rate:	$285	$200	$165	$125	$110	$95										
6.0		**Run the WLAM in Retrospective Mode, Using Historical Discharge Data, to Estimate the Quantity and Quality of Recharge that Actually Occurred**																
		Run the Most Current Version of the WLAM Produced in the RFP Task 2 After It Has Been Finalized (Calibrated and Validated) to Estimate the Actual Volume and Quality of Water Recharged to the Six GMZ's Named in Task 5 for the 12-Year Period Commencing in January of 2005 and Ending in December of 2016.							0	$ -		$ -	$ 6,385	$ 6,385	$ 6,385	$ 6,385	$ 6,385	$ 6,385
		Prepare a Summary Comparing the Estimated Actual Values to the WLAM Projects for the Same GMZs.							0	$ -		$ -	$ 1,905	$ 1,905	$ 1,905	$ 1,905	$ 1,905	$ 1,905
		Task 6.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 8,290**	**$ 8,290**	**$ 8,290**	**$ 8,290**	**$ 8,290**	**$ 8,290**
7.0		**Compile the WLAM into a Run-Time Software Simulation Package**																
		Develop a Simple Windows-Based Graphical User Interface for the WLAM	The proposed WinHSPF computer code is a Windows-Based Graphic User Interface						0	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Prepare a Standardized Input File Specifying the Key Input Variables for Each Wastewater Discharge							0	$ -		$ -	$ 6,600	$ 6,600	$ 6,600	$ 6,600	$ 6,600	$ 6,600
		Prepare a User Manual* and Training for up to 15 Staff Members on How to Analyze Scenarios, Run and Retrieve Results From the WLAM.							0	$ -		$ -	$ 6,480	$ 6,480	$ 6,480	$ 6,480	$ 6,480	$ 6,480
		Prepare and Submit Model Documentation Suitable for Peer Review							0	$ -		$ -	$ 4,260	$ 4,260	$ 4,260	$ 4,260	$ 4,260	$ 4,260
		Task 7.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 17,340**	**$ 17,340**	**$ 17,340**	**$ 17,340**	**$ 17,340**	**$ 17,340**
9.0		**Draft Task Reports, Draft and Final Report**																
		Prepare Draft Task Report for Task 1 Documenting the Results of Task 1							0	$ -		$ -	$ 4,380	$ 4,380	$ 4,380	$ 4,380	$ 4,380	$ 4,380
		Prepare Draft Task Report for Task 2 Documenting the Results of Task 2							0	$ -		$ -	$ 9,680	$ 9,680	$ 9,680	$ 9,680	$ 9,680	$ 9,680
		Prepare Second Draft Task Report for Task 2 Documenting the Results of Task 2							0	$ -		$ -	$ -	$ 7,245	$ 7,245	$ 7,245	$ 7,245	$ 7,245
		Prepare Draft Task Report for Task 3 Documenting the Results of Task 3							0	$ -		$ -	$ 5,760	$ 5,760	$ 5,760	$ 5,760	$ 5,760	$ 5,760
		Prepare Draft Task Report for Task 4 Documenting the Results of Task 4							0	$ -		$ -	$ 5,760	$ 5,760	$ 5,760	$ 5,760	$ 5,760	$ 5,760
		Remove Costs for Draft Task Report for Task 4 Documenting the Results of Task 4							-	$ -		$ -	$ -	$ (5,760)	$ (5,760)	$ (5,760)	$ (5,760)	$ (5,760)
		Prepare Draft Task Report for Task 5 Documenting the Results of Task 5							0	$ -		$ -	$ 3,440	$ 3,440	$ 3,440	$ 3,440	$ 3,440	$ 3,440
		Prepare Draft Task Report for Task 6 Documenting the Results of Task 6							0	$ -		$ -	$ 3,440	$ 3,440	$ 3,440	$ 3,440	$ 3,440	$ 3,440
		Prepare a Draft Study Report, Reflecting a Compilation of the Draft Reports and Addressing All Comments Received from SAWPA and Members of the Task Force on the Previous Drafts							0	$ -		$ -	$ 8,720	$ 8,720	$ 8,720	$ 8,720	$ 8,720	$ 8,720
		Prepare a Final Study Report in Electronic Format for Distribution to SAWPA							0	$ -		$ -	$ 3,825	$ 3,825	$ 3,825	$ 3,825	$ 3,825	$ 3,825
		Task 9.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 45,005**	**$ 46,490**	**$ 46,490**	**$ 46,490**	**$ 46,490**	**$ 46,490**
10.0		**Monthly Project Meetings**																
		Prepare For and Participate in up-to-18 Half-Day Monthly Meetings Where GSSI will Describe Project Status and/or Present Draft and Final Results to the BMPTF and/or Regional or State Water Boards							0	$ -		$ -	$ 35,640	$ 35,640	$ 35,640	$ 35,640	$ 35,640	$ 35,640
		Prepare For and Participate in up-to-4 Half-Day Monthly Meetings Where GSSI will Describe Project Status and/or Present Draft and Final Results to the BMPTF and/or Regional or State Water Boards							0	$ -		$ -	$ -	$ -	$ 11,480	$ 11,480	$ 11,480	$ 11,480
		Prepare For and Participate in up-to-2 Half-Day Monthly Meetings Where GSSI will Describe Project Status and/or Present Draft and Final Results to the BMPTF and/or Regional or State Water Boards							0	$ -		$ -	$ -	$ -	$ -	$ 5,740	$ 5,740	$ 5,740
		Prepare For and Participate in up-to-2 Half-Day Monthly Meetings and 21-Jan-19 Meeting with IEUA, CBWM, and WEI							0	$ -		$ -	$ -	$ -	$ -	$ -	$ 9,150	$ 9,150
		Option 1 (no Tasks 2o, 2p, and 3g): Prepare For and Participate in up-to-1 Half-Day Monthly Meeting and 6-Mar-19 Technical Subcommittee Meeting		12	12	8	4		36	$ 5,820		$ 5,820	$ -	$ -	$ -	$ -	$ -	$ 5,820
		Option 2 (with Tasks 2o, 2p, and 3g): Prepare For and Participate in up-to-2 Half-Day Monthly Meetings and 6-Mar-19 Technical Subcommittee Meeting		18	18	8	4		48	$ 8,010		$ 8,010	$ -	$ -	$ -	$ -	$ -	$ 8,010
		Task 10.0 Subtotal Hours and Costs (Option 1: no Tasks 2o, 2p, and 3g)	**0**	**12**	**12**	**8**	**4**	**0**	**36**	**$ 5,820**	**$ -**	**$ 5,820**	**$ 35,640**	**$ 35,640**	**$ 47,120**	**$ 52,860**	**$ 62,010**	**$ 67,830**
		Task 10.0 Subtotal Hours and Costs (Option 2: with Tasks 2o, 2p, and 3g)	**0**	**18**	**18**	**8**	**4**	**0**	**48**	**$ 8,010**	**$ -**	**$ 8,010**	**$ 35,640**	**$ 35,640**	**$ 47,120**	**$ 52,860**	**$ 62,010**	**$ 70,020**
11.0		**Pilot Evaluation of the Doppler Data Compared to Precipitation Gauge Data**																
		Pilot Evaluation of the Doppler Data Compared to Precipitation Gauge Data							0	$ -		$ -	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000
		Task 11.0 Subtotal Hours and Costs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$ -**	**$ -**	**$ -**	**$ 3,000**	**$ 3,000**	**$ 3,000**	**$ 3,000**	**$ 3,000**	**$ 3,000**
		TOTAL HOURS AND COST (Option 1: no Tasks 2o, 2p, and 3g)	**0**	**12**	**12**	**8**	**4**	**0**	**36**	**$ 5,820**	**$ -**	**$ 5,820**	**$ 249,800**	**$ 273,766**	**$ 285,246**	**$ 314,956**	**$ 327,636**	**$ 333,456**
		TOTAL HOURS AND COST (Option 2: with Tasks 2o, 2p, and 3g)	**0**	**21**	**24**	**64**	**4**	**0**	**113**	**$ 16,600**	**$ -**	**$ 16,600**	**$ 249,800**	**$ 273,766**	**$ 285,246**	**$ 314,956**	**$ 327,636**	**$ 344,236**

Note

[1] Reimbursable expenses include report reproduction.

Santa Ana Watershed Project Authority
Fifth Request for Budget Amendment for Consulting Services for Santa Ana River Waste Load Allocation Model Update

DRAFT
Table 2

REVISED PROJECT SCHEDULE

Task		Description	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19
1		**Update the Data Used in the Waste Load Allocation Model (WLAM)**																													
	1a	Update Relevant Land Use Maps for the Region																													
	1b	Update the Stormwater Management Facility Maps																													
	1c	Update the Historical Precipitation Data for the Region																													
	1d	Review and Confirm the Operating Assumptions for Seven Oaks Dam and Prado Dam																													
	1e	Update and Consolidate the Flow Data Used in the WLAM																													
	1f	Update and Consolidate the Water Quality Data Used in the WLAM																													
	1g	Perform a Systematic QA/QC Review of All Data																													
	1h	Update and Consolidate Flow Data from Additional Discharge Sources Identified in the WLAM																													
	1i	Augment TIN Water Quality Data																													
	1j	Create Plots and Database Files of Model Input Data (to be included as appendices)																													
2		**Update and Recalibrate the WLAM**																													
	2a	Update the Estimate of Surface Water Runoff to Major Stream Segments																													
	2b	Update the Estimate of Stream Flow in Major Stream Segments																													
	2c	Update the Estimated Concentration of TDS in Major Stream Segments																													
	2d	Update the Estimated Concentration of TIN in Major Stream Segments																													
	2e	Estimate the Volume of Stream Flow Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone																													
	2f	Estimate the Average Daily Concentration and Mass of TDS Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone																													
	2g	Estimate the Average Daily Concentration and Mass of TIN Recharging from Each Major Stream Segment to the Underlying Groundwater Management Zone																													
	2h	Create an Impoundment for the Prado Wetlands to Account for Evapotranspiration and Changes in Water Quality																													
	2i	Re-Estimate Stream Flow in Major Stream Segments after Incorporating Additional Discharge Data																													
	2j	Re-Estimate Concentration of TDS in Major Stream Segments after Incorporating Additional Discharge Data and Effects of the Prado Wetlands																													
	2k	Re-Estimate Concentration of TIN in Major Stream Segments after Incorporating Additional Discharge Data and Effects of the Prado Wetlands																													
	2l	Tabulate the Differences between WLAM Versions																													
	2m	Tabulate the Average Mass Balance (by Source) for Flow, TDS, and TIN in Each Major Stream Segment																													
	2n	Conduct Formal Outlier Analyses for Areas of High Model Over/Underestimation (i.e., greater than two orders of magnitude)																													
	2o	Recalibrate WLAM with Rising Water as Model Input and Compare Results																													
	2p	Sensitivity Run on Model Calibration with Reduced Rising Water																													
3		**Evaluate Waste Load Allocation Scenarios for Major Stream Segments**																													
	3a	Specify the Range of Probable Discharge Conditions																													
	3b	Use WLAM to Analyze Six Scenarios																													
	3c	Report Results of the WLAM Scenario Analyses																													
	3d	Revise Assumptions for the Six WLAM Scenarios and Rerun																													
	3e	Conduct Additional Analyses on the Results from the Six WLAM Scenarios																													
	3f	Conduct Sensitivity Runs or Mass Balance Analyses to Understand Key Issues																													
	3g	Use the Refined Calibration Version from Task 2o to Recalculate Streambed Recharge under Future Scenario Conditions (per model run)																													
4		**Develop WLAM for Managed Recharge in Percolation Basins**																													
	4a	Identify the Percolation Ponds and Recharge Basins to be Evaluated																													
	4b	Characterize the Volume and Quality of Water Recharged to Groundwater																													
	4c	Summarize the Results of Task 4b by Groundwater Management Zone																													
	4d	Integrate Results from Task 4c with the Results from Task 3c																													
	4e	Option 1: Summarize Stormwater Diversion and Spreading																													
5		**Estimate Off-Channel Recharge from Natural Precipitation**																													
		Estimate the Volume and Quality of Natural Rainfall that Percolates to The Underlying Groundwater Basin																													
6		**Run the WLAM in Retrospective Mode, Using Historical Discharge Data, to Estimate the Quantity and Quality of Recharge that Actually Occurred**																													
		Run the Most Current Version of the WLAM Produced in the RFP Task 2 After It Has Been Finalized (Calibrated and Validated) to Estimate the Actual Volume and Quality of Water Recharged to the Six GMZ's Named in Task 5 for the 12-Year Period Commencing in January of 2005 and Ending in December of 2016.																													
		Prepare a Summary Comparing the Estimated Actual Values to the WLAM Projects for the Same GMZs.																													
7		**Compile the WLAM into a Run-Time Software Simulation Package**																													
		Develop a Simple Windows-Based Graphical User Interface for the WLAM	The proposed WinHSPF computer code is a Windows-Based Graphic User Interphase																												
		Prepare a Standardized Input File Specifying the Key Input Variables for Each Wastewater Discharge																													
		Prepare a User Manual and Training for up to 15 Staff Members on How to Analyze Scenarios, Run and Retrieve Results From the WLAM.																													
		Prepare and Submit Model Documentation Suitable for Peer Review	TO BE DETERMINED																												
9		**Draft Task Reports, Draft and Final Report**																													
		Prepare Draft Task Report for Task 1 Documenting the Results of Task 1																													
		Prepare Draft Task Report for Task 2 Documenting the Results of Task 2																													
		Prepare Draft Task Report for Task 3 Documenting the Results of Task 3																													
		Prepare Draft Task Report for Task 4 Documenting the Results of Task 4																													
		Prepare Draft Task Report for Task 5 Documenting the Results of Task 5																											Opt. 1	Opt. 2	
		Prepare Draft Task Report for Task 6 Documenting the Results of Task 6																											Opt. 1	Opt. 2	
		Prepare a Draft Study Report, Reflecting a Compilation of the Draft Reports and Addressing All Comments Received from SAWPA and Members of the Task Force on																											Opt. 1	Opt. 2	
		Prepare a Final Study Report in Electronic Format for Distribution to SAWPA																												Opt. 1	Opt. 2
10		**Monthly Project Meetings**																													
		Prepare For and Participate in Half-Day Monthly Meetings Where GSSI will Describe Project Status and/or Present Draft and Final Results to the BMPTF and/or Regional or																													Opt. 2
11		**Pilot evaluation of the Doppler Data Compared to Precipitation Gauge Data**																													
		Pilot evaluation of the Doppler Data Compared to Precipitation Gauge Data																													

Original GEOSCIENCE Working Period
Revised GEOSCIENCE Working Period (Option 1: no Tasks 2o, 2p, and 3g)
Revised GEOSCIENCE Working Period (Option 2: with Tasks 2o, 2p, and 3g)
Deliverable Date
Meeting / Workshop
Note

* The dates of the Regional and State Water Board hearings have not yet been determined