



July 27, 2015

Mr. Daniel Cozad  
Central Valley Salinity Coalition  
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**SUBJECT: CENTRAL VALLEY SALT AND NITRATE MANAGEMENT PLAN  
REGION 5 UPDATED GROUNDWATER QUALITY ANALYSIS**

Dear Mr. Cozad:

In response to the request by the CV-SALTS Policy Committee at the conclusion of the June 18 meeting, Luhdorff & Scalmanini, Consulting Engineers (LSCE) has prepared this scope and budget on behalf of the LWA Team. Specifically, it was requested that a scope and budget be prepared to “provide additional higher resolution analysis for the SNMP, including the higher resolution volume-weighted production zone approach” (this was option “b” in the table titled “*Summary of Draft Policy Considerations and Questions*” provided as a handout for the June 18 Policy Committee meeting).

This letter is organized to provide brief background information followed by the scope and budget as requested.

**BACKGROUND**

The groundwater quality data collected, compiled, checked, and documented for CV-SALTS Phase I, the Initial Conceptual Model (ICM), were updated as part of the CV-SALTS Phase II Conceptual Model, Task 3. However, the current scope of work for the Phase II Conceptual Model does not include additional analyses to update the ICM results. Also, the Phase I analysis was limited in coverage extent to groundwater quality characterization within the Central Valley Floor, which does not include the portions of Region 5 outside the Valley Floor.

The ICM work involved defining zones (Initial Analysis Zones, or IAZs) for purposes of conducting the preliminary water, salt, and nitrate balances for the Central Valley. During the ICM work, it was reported that, in the context of groundwater sustainability for an aquifer system, no definition of assimilative capacity exists in the State Water Board Recycled Water Policy or elsewhere (ICM, 2013). Therefore, a preliminary definition for

assimilative capacity pertaining to groundwater was provided<sup>1</sup>. Correspondingly, an upper part of the aquifer system (20-year vertical travel depth in the saturated part of the aquifer system, i.e., called the *shallow zone* in the ICM) was also defined as the vertical boundary for this purpose. The ICM results for ambient groundwater quality and preliminary assimilative capacity are based on the aggregated scale of each IAZ shallow zone. Based on the preliminary definition of assimilative capacity for the ICM, the “shallow” zone constituted the “part of the aquifer system that provides actual or probable beneficial uses.” At that time, the focus was on the depth at which individual (private) water supply wells might typically be constructed. Since the ICM work, we understand that the Policy Committee’s interests related to the development of the Management Zone construct are moving towards extending the interpretation of the upper part of the aquifer system to be inclusive of additional groundwater uses.

In order to facilitate understanding of the aquifer system nomenclature (i.e., first encountered groundwater, 20-year travel depth, upper, lower, and production zones), attached is a schematic (**Figure 1**; prepared by Daniel Cozad and LSCE) along with definitions. This nomenclature is used below in the description of the proposed additional analyses.

## **CURRENT SCOPE AND PROPOSED ADDITIONAL ANALYSES**

The current scope of work for Phase II, and specifically the preparation of the Preliminary Draft Central Valley SNMP, relies on the following (excerpt from Task 2 Workplan SNMP Table of Contents):

- Aggregated scale of analysis of ambient groundwater quality (nitrate and TDS) for IAZ shallow zone<sup>2</sup>;
- Preliminary aggregated scale of analysis of assimilative capacity (nitrate and TDS) for IAZ shallow zone;
- An updated groundwater quality database (but no scope to conduct updated analyses); and
- Management Zone archetype analyses of ambient water quality and assimilative capacity for the Alta Irrigation District and surrounding groundwater flow model area.

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<sup>1</sup> The SWRCB Recycled Water Policy refers to assimilative capacity, however, an explicit definition is not provided in that guidance document. For ICM purposes, assimilative capacity is defined as the amount of a constituent (contaminant load) that can be discharged to the aquifer system (especially that part of the aquifer system that provides actual or probable beneficial uses) without exceeding water quality standards and/or Basin Plan water quality objectives. Additionally, this term describes the difference between the water quality standards/objectives and average ambient shallow groundwater quality in the basin/subbasin/IAZ/MZ (where shallow does not necessarily mean the uppermost part of the saturated zone directly at the water table, rather “shallow” means the part of the aquifer system that provides actual or probable beneficial uses).

<sup>2</sup> The ambient groundwater quality and preliminary assimilative capacity analyses are based on the ICM groundwater quality data with QA/QC concerns and data limitations identified at the time of the ICM work.

The work proposed in this document to be completed with the following scope of work includes:

- Combining the Phase II, Task 3 groundwater quality database with the additional Division of Drinking Water (DDW) database for purposes of the higher resolution analyses<sup>3</sup> ;
- Preparing basic statistical analyses<sup>4</sup> for the 41 groundwater basins/subbasins overlying the Central Valley Floor (and, as an option, for the other 85 basins/subbasins in Region 5 that are located outside the Central Valley Floor)<sup>5</sup>;
- Defining an upper and lower part of the groundwater system in the Central Valley Floor. For SNMP purposes, the upper zone together with the lower zone represent the production zone<sup>6</sup> where the majority of groundwater production occurs (**Figure 1**);
- Preparing high resolution ambient groundwater quality maps (nitrate and TDS) for the Central Valley (for three defined zones: upper, lower, and production zones; it is very important to develop the higher resolution detail for all three such that long-term strategies and interim measures can be developed and tracked<sup>7</sup>);
- Preparing high resolution assimilative capacity maps (nitrate and TDS) for the Central Valley (upper, lower, and production zones); and
- Updating the Preliminary Draft Central Valley SNMP with information that would serve as the programmatic basis for SNMP-related information for basins/subbasins in Region 5. The updated groundwater quality data analyses described in the bullets above also provide a basis for future assessment of data gaps, monitoring needs, and a basis for the work needed to complete and finalize the SNMP.

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<sup>3</sup> The State Water Board authorized use of the confidential well construction and accurate location information contained in the Division of Drinking Water database for purposes of the Alta Irrigation District archetype analyses. These data will improve the categorization of the groundwater quality data relative to their representation of groundwater quality for different parts of the aquifer system. Although the use of the data will greatly enhance the overall results, the confidentiality agreement will be maintained and the data will not be directly disclosed unless the team is otherwise directed by the State Water Board and the CV-SALTS Contract Administrator.

<sup>4</sup> Basic statistical analyses would include analyses such as minimum, maximum, average, and median values for nitrate and TDS.

<sup>5</sup> There are 84 unique groundwater basins in Region 5, and a total of 126 basins/subbasins (some basins do not have any subbasins). The entire Region 5 area covered by groundwater basins is about 24,100 square miles; the area of the 41 basins/subbasins in the Valley Floor is about 20,500 square miles. In terms of area covered, therefore, the groundwater basins/subbasins on the Valley Floor cover about 85% of the total groundwater basins/subbasins within Region 5.

<sup>6</sup> This would be determined based on DDW data and current CVHM information (as modeled through 2003) to assess typical well depths for wells used for beneficial use; see Subtask 6.2.

<sup>7</sup> The preparation of high resolution maps for the three defined groundwater zones will provide the characterization of the ambient groundwater quality and also assimilative capacity that will replace the aggregated IAZ/20-year shallow zone analysis that is currently the default for areas of the Central Valley that currently do not have their own SNMP. The high resolution detail of the three zones will allow for better regional management policies to be determined by CV-SALTS that can later be adapted by local entities interested in forming their own Management Zone.

## **SCOPE OF WORK**

The Phase II Conceptual Model Workplan contains five tasks. Accordingly, the scope of work below describes the work for Task 6 and the corresponding subtasks to complete the high resolution groundwater quality analysis.

### **TASK 6 HIGH RESOLUTION GROUNDWATER QUALITY AND OTHER ANALYSES**

#### **Subtask 6.1 Join CV-SALTS Database with DDW Data**

As part of Phase II, Task 3, the update and documentation of the groundwater quality database was completed in July, 2014 for nitrate and TDS tests in all of Region 5. Since that time, the State Water Board has authorized the use of a Division of Drinking Water (DDW) database that includes well information (i.e., well depth and, where available, the depth of screened intervals, as well as accurate xy coordinate data). The additional information contained in the DDW database for many (but not all public water supply wells) would greatly enhance categorization of the wells and their corresponding groundwater quality relative to the representation of those data of the aquifer system. Accordingly, the results of efforts to assess ambient groundwater quality and assimilative capacity in the Central Valley would be improved. This task involves joining the two databases and conducting additional quality control/quality assurance to remove duplicate entries and, to the extent practical, identify significant anomalies when the datasets are joined.

#### **Subtask 6.2 Define “Upper” and “Lower” Part of Groundwater System for Purposes of SNMP High Resolution Analyses**

Previously, for the ICM work, the upper part of the aquifer system was referred to as “shallow”. At the June 18 Policy Committee meeting, it was concluded that the term “shallow” may result in misunderstanding what part of the aquifer system is represented. This task involves assessing the dataset resulting from Subtask 6.1 along with information that is included in the U.S. Geological Survey Central Valley Hydrologic Model (CVHM)<sup>8</sup> to prepare a Memo that describes the proposed basis and approach for defining the “upper” and “lower” part of the aquifer system in the Central Valley Floor. As noted above, it is very important to differentiate current groundwater quality conditions and trends in the upper and lower zones to develop long-term salt and nitrate management strategies. The volume-weighted average for the production zone provides the regulatory flexibility within the Management Zone construct, while the development of actual “management” policies will require monitoring and tracking trends and conditions in the aquifer system to assess the performance of short and long-term strategies and ensure that the net result of projects (and discharges) approved within the Management Zone is improved groundwater quality. The proposed approach would also address how the presence of the Corcoran Clay unit would be handled, where its occurrence is a significant factor for subsequent analyses (e.g., analyses in Subtasks 6.4, 6.5, and 6.6). The draft Memo will be submitted to the Executive

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<sup>8</sup> CVHM provides estimates of pumping amounts by 1-mile cell for 10 vertical model layers – these estimates are based on an assessment of driller’s logs and well completions across the Central Valley Floor, which would provide insight and potential guidance for determining “upper” and “lower” zone delineations.

Committee<sup>9</sup> for its review and comment. Subtasks 6.3 through 6.7 would proceed immediately upon approval of the Executive Committee of the proposed approach. Together, the upper and lower zones would constitute the “production zone”<sup>10</sup> (**Figure 1**).

### **Subtask 6.3 Basic Statistical Analyses to Characterize Groundwater Quality within the Central Valley Floor**

Using the combined groundwater quality database from Subtask 6.1, this task includes basic statistical analyses for the groundwater quality data in Region 5 for the area overlying the Central Valley Floor. For each groundwater basin/subbasin on the Central Valley Floor, the analyses would include minimum, maximum, average, and median values for nitrate and TDS, including the number of wells on which these statistics are based and the information known about these wells (i.e., the well types (domestic, public supply irrigation, etc.), number of wells in the combined database that have some type of construction information, and characteristics relating to the groundwater quality data (i.e., period of record, total number of nitrate and/or TDS tests, etc.).

GIS maps and tables will be presented that summarize the groundwater data in terms of availability for determining ambient groundwater quality and assimilative capacity for the upper and lower zones within the Central Valley Floor.

### **Subtask 6.4 Decluster Data; Determine “Upper” and “Lower” Part of Groundwater System Relative to Majority of Groundwater Production**

This task involves preparing the groundwater dataset for subsequent analyses within the Central Valley Floor. This includes spatial declustering of the data such that high well densities do not spatially bias the regional assessments to be conducted in Subtasks 6.5. Once the approach for determining the upper and lower zones of the Central Valley aquifer system has been approved, this work will be conducted. Once the zones are defined, these delineations (and approach for handling the occurrence of the Corcoran Clay) would be incorporated in Subtask 6.5.

### **Subtask 6.5 Perform Analyses and Prepare High Resolution Maps for Central Valley Floor (Upper, Lower and Production Zones; Nitrate and TDS)**

This task involves preparation of higher resolution maps for the basins/subbasins overlying the Central Valley Floor, including:

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<sup>9</sup> Based on the very involved discussions that have occurred in the Policy Committee meetings, which generally include the most if not all of the Executive Committee, but less complete representation of the Technical Advisory Committee members, it seems the Executive Committee would be better able to understand and appreciate the context of this task described in this Scope of Work.

<sup>10</sup> The production zone represents the part of the aquifer system (upper and lower zones) where the majority of groundwater production occurs in any given groundwater basin and/or subbasin. For example, where data allow, “majority” may be defined as 90 percent of the estimated groundwater production for all groundwater uses. Other approaches that have a hydrogeologic basis may also be applicable where the information needed to estimate groundwater production is not readily available. A production zone is not equivalent to the entire volume of groundwater in storage; the production zone is also not equivalent to the deepest well in a basin/subbasin.

- Ambient groundwater quality for nitrate and TDS for the upper, lower, and production zones (6 maps for the Central Valley Floor);
- Assimilative capacity for nitrate and TDS for the upper, lower, and production zones (6 maps for the Central Valley Floor);
- Basic trend analyses for nitrate and TDS for the upper, lower, and production zones (6 maps for the Central Valley Floor) that would indicate, on the same high resolution, areas where groundwater quality is improving, staying the same, or degrading; and
- Prediction of future groundwater quality based on historical observations for nitrate and TDS for the upper, lower, and production zones (6 maps for the Central Valley Floor).<sup>11</sup>

#### *Ambient Groundwater Quality*

This task includes a refined analysis of ambient groundwater quality, at a finer scale (no finer than 1 square mile) compared to the Phase I ICM IAZ aggregated scale of analysis, for the newly-defined upper and lower groundwater zones. Analysis of ambient groundwater quality for the production zone would also be determined as explained below. The ambient groundwater quality analysis would follow methodologies defined in Phase II Task 4, and presented at the June 18 Policy Committee meeting, while utilizing the combined groundwater data from Subtask 6.1 and the zone delineation from Subtask 6.4. This approach would be applied for upper and lower zone nitrate and TDS determinations.

To determine the ambient groundwater quality of the production zone (combining the upper and lower zones, refer to **Figure 1**), a volume-weighted average approach is proposed. This approach utilizes the ambient groundwater quality high resolution analyses discussed above for the upper and lower zones. In order to combine these two zones, the volume of water in each zone must be calculated. The volume-weighted average would be calculated using the volume of the upper zone and ambient groundwater quality of the upper zone, and with the volume of the lower zone and ambient groundwater quality assigned to the lower zone. This will provide an overall ambient groundwater quality for the “production zone” on a 1-mile by 1-mile higher resolution scale for the entire Central Valley Floor. This provides for finer resolution of the areas determined to be potentially impaired relative to those parts of the aquifer system that have better groundwater quality. Accordingly, this information also provides a refined basis for determining assimilative capacity. By using this refined approach, more IAZs (and correspondingly future Management Zones [MZ]) would have increased opportunity and regulatory flexibility for creating programs within which discharges could be permitted while at the same time identifying appropriate offsets that contribute to overall enhancement of groundwater quality.

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<sup>11</sup> The ICM results for nitrate and TDS future trends are based on multiple simulations involving estimated loading due to varying land management practices for a 20-year period. The work proposed here involves use of actual historical observations and trends computed to already be occurring (or not occurring) to assess where nitrate and TDS concentrations may increase (or stay the same or decrease) in the future based on past practices. This information semi-quantitatively incorporates some consideration of loading (or lack thereof) based on actual data. This task then helps inform the design of short and long-term strategies directed towards overall groundwater quality management.

#### *Assimilative Capacity*

The assimilative capacity would be determined using the methods developed as part of Phase II Task 4 and as described at the June 18 Policy Committee meeting. Similar to the ambient groundwater quality, the assimilative capacity would be determined for nitrate and TDS for the upper, lower, and [volume weighted] production zone<sup>12</sup>. Specifically, assimilative capacity for the upper zone is computed for each 1-mile square cell by subtracting the ambient water quality determined above for each cell from the water quality objective for nitrate or TDS. A similar method is used for the lower zone. The volume-weighted assimilative capacity for the production zone is computed for each 1-mile square cell by subtracting the volume-weighted ambient water quality determined above for each cell from the water quality objective for nitrate or TDS.

#### *Trend Analyses*

Trends in nitrate and TDS in the basins/subbasin overlying the Central Valley Floor would be determined using the methods developed as part of Phase II Task 4 and as described at the June 18 Policy Committee meeting. This basic analysis uses actual measured data (rather than simulated model results) to determine areas where groundwater quality is currently improving, remaining stable, or degrading. Similar to the above analyses, trends would be determined for nitrate and TDS for the upper, lower, and [volume weighted] production zone.

#### *Prediction of Future Groundwater Quality Based on Historical Observations*

Historical groundwater quality data in the basins/subbasin overlying the Central Valley Floor would be used to determine the future quality using the methods developed as part of Phase II Task 4 and as described at the June 18 Policy Committee meeting. Similar to the above analyses, future groundwater quality would be determined for nitrate and TDS for the upper, lower, and [volume weighted] production zone. As noted above in Task 6.2, it is very important to differentiate groundwater quality conditions and trends in the upper and lower zones to develop long-term strategies and identify areas within the Central Valley Floor that may be a priority for salt and nitrate management. Within the Management Zone construct, the volume-weighted average for the production zone provides the regulatory flexibility to the Regional Board. Actual “management” of salt and nitrate will be conducted by the Management Zone entity; this includes monitoring and tracking trends and conditions in the aquifer system to assess the performance of short and long-term strategies that ensure the projects (and discharges) approved within the Management Zone will result in improved groundwater quality.

#### *Central Valley High Resolution Maps*

This task would result in approximately 24 higher resolution GIS maps covering the basins/subbasins that constitute the Central Valley Floor. This information would provide a basis for future assessment of data gaps and monitoring needs not only for the Central Valley SNMP but also for work by entities for purposes of future Management Zone

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<sup>12</sup> Because there are insufficient well construction data linked to groundwater quality data, it is not recommended to attempt a volume-weighted well-by-well approach for analyzing the assimilative capacity within the upper and lower zones.

development and implementation and also for coordinated use by Groundwater Sustainability Agencies related to monitoring needs for Groundwater Sustainability Plans. In addition to inclusion of the maps in the Central Valley SNMP, the maps will be provided as GIS shapefiles; this will allow use of the resulting information in any geographical area defined by future entities (e.g., MZs, GSAs, etc.).

**Subtask 6.6 Augment Preliminary Draft SNMP Report New Information and New Appendix**

The approach, methods and results of Subtasks 6.1 through 6.5 will be incorporated in the Preliminary Draft Central Valley SNMP being developed as part of Phase II Task 5. Specifically, the new work will replace the ICM preliminary IAZ-scale aggregated results; SNMP Sections 3, 5, and 6 will be updated. Note, a small delay in preparing these sections will be necessary to accommodate the inclusion of the more up-to-date and higher resolution results of this work (see discussion under Schedule below), but this delay is not considered to be significant.

**Subtask 6.7 Provide Presentation to CV-SALTS Policy Committee (additional material related to presentation of Draft Report)**

As part of Phase II Task 5, a presentation will be made to the Policy Committee. This task involves preparation and presentation of the additional results to be presented to the Policy Committee in conjunction with the draft Central Valley SNMP presentation.

***Subtask 6.8 (optional) Basic Statistical Analyses to Characterize Groundwater Quality in Region 5 Outside the Central Valley Floor***

This task involves similar work as Subtask 6.3, but this task would include basic statistical analyses<sup>13</sup> for groundwater in the area outside the Central Valley Floor. The characterization of groundwater quality data would be performed for groundwater basins outside the Central Valley Floor, potentially including the delineation of upper and lower aquifer portions, pending data availability and appropriateness. This optional task would also include valuable and pertinent documentation for the draft Central Valley SNMP, which currently does not incorporate any analysis of groundwater quality in areas outside the Central Valley Floor.

**BUDGET**

The estimated cost to conduct Subtasks 6.1 through 6.7 is summarized in **Table 1. Table 2** (attached) contains a detailed breakdown of the estimated hours and costs for each task, including optional Subtask 6.8. The costs are based on the same hourly rates as the current Phase II work.

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<sup>13</sup> Basic statistical analyses such as minimum, maximum, average, and median values for nitrate and TDS would be included.



**Table 1**  
**Cost Estimate for Updated Groundwater Quality Analyses**

<b>Item</b>	<b>Subtask Description</b>	<b>Cost Estimate</b>
6.1	Join CV-SALTS Database with DDW Data	\$2,830
6.2	Define "Upper" and "Lower" Part of Groundwater System for Purposes of SNMP High Resolution Analyses <sup>1</sup>	\$2,160
6.3	Basic Statistical Analyses to Characterize Groundwater Quality within the Central Valley Floor	\$4,050
6.4	Decluster Data; Determine "Upper" and "Lower" Part of Groundwater System Relative to Majority of Groundwater Production <sup>2</sup>	\$3,780
6.5	Perform Analyses and Prepare High Resolution Maps for Central Valley Floor (Upper, Lower and Production Zones; Nitrate and TDS)	\$22,540
6.6	Augment Preliminary Draft SNMP Report with New Information <sup>3</sup> and New Appendix	\$12,190
6.7	Provide Presentation to CV-SALTS Policy Committee (additional material related to presentation of Draft Report)	\$5,030
<b>Total Estimated Cost (Subtasks 6.1 through 6.7)</b>		<b>\$52,580</b>

1. Provide very brief Memo to Executive Committee for review and approval of upper and lower zone delineation; following approval, complete Subtasks 6.3-6.7 (and optional Subtask 6.8, if authorized).
2. Based on DDW data and current CVHM information (as modeled through 2003).
3. The work conducted as part of this scope will be included in SNMP Sections 3, 5 and 6. This new work will update the ICM work and will replace the ICM preliminary IAZ-scale aggregated results.

The estimated cost for Tasks 6.1 through 6.7 is \$52,580. The estimated cost for optional Task 6.8 is \$5,380 (see **Table 2**, attached).

As requested, we have also prepared budget estimates for review of the Task 6.2 draft Memo by the Technical Advisory Committee (TAC) and a separate presentation of the results of the additional work to the TAC; the estimated costs for these additions is \$13,310. We do not recommend the TAC review of the Task 6.2 Memo in addition to the Executive Committee's review for the reason noted above. Specifically, the Executive Committee is very familiar with the discussion of the concepts presented in this proposal and most of the Executive Committee was in attendance at the June 18 presentation of the methodologies. Some Technical Advisory Committee members were not present at the June 18 meeting and are likely much less familiar with the Management Zone construct and less likely to understand and appreciate the context of this task. Most importantly, additional review time by the TAC will substantially alter the schedule below.

## **SCHEDULE**

The work on Subtask 6.1 would begin immediately upon approval of the proposed scope and budget. **Table 3** shows the estimated timeline following approval. Subtasks 6.6 and 6.7 would be coordinated with completion of Phase II Task 5. Note, a small delay in the

completion of Phase II Task 5 will be necessary to accommodate the inclusion of the more up-to-date and higher resolution results of this work.

**Table 3**  
**Estimated Timeline**  
**Weeks Following Authorization**

Subtask	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Subtask 6.1 Join Database	X									
Subtask 6.2 Define Zones		X								
Review of Subtask 6.2 Memo			X	X						
Subtask 6.3 Statistical Analysis					X	X				
Subtask 6.4 Decluster Data						X	X			
Subtask 6.5 High Res Analyses & Maps							X	X	X	
Subtask 6.6 New Writing in SNMP								X	X	X
Subtask 6.7 Presentation										X
Subtask 6.8 (optional) Analyses Outside CV Floor					X	X	X			

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We would be pleased to address any questions about the above scope, budget, and schedule.

Sincerely,

LUHDORFF & SCALMANINI  
CONSULTING ENGINEERS



Vicki Kretsinger Grabert  
Senior Principal Hydrologist, LSCE

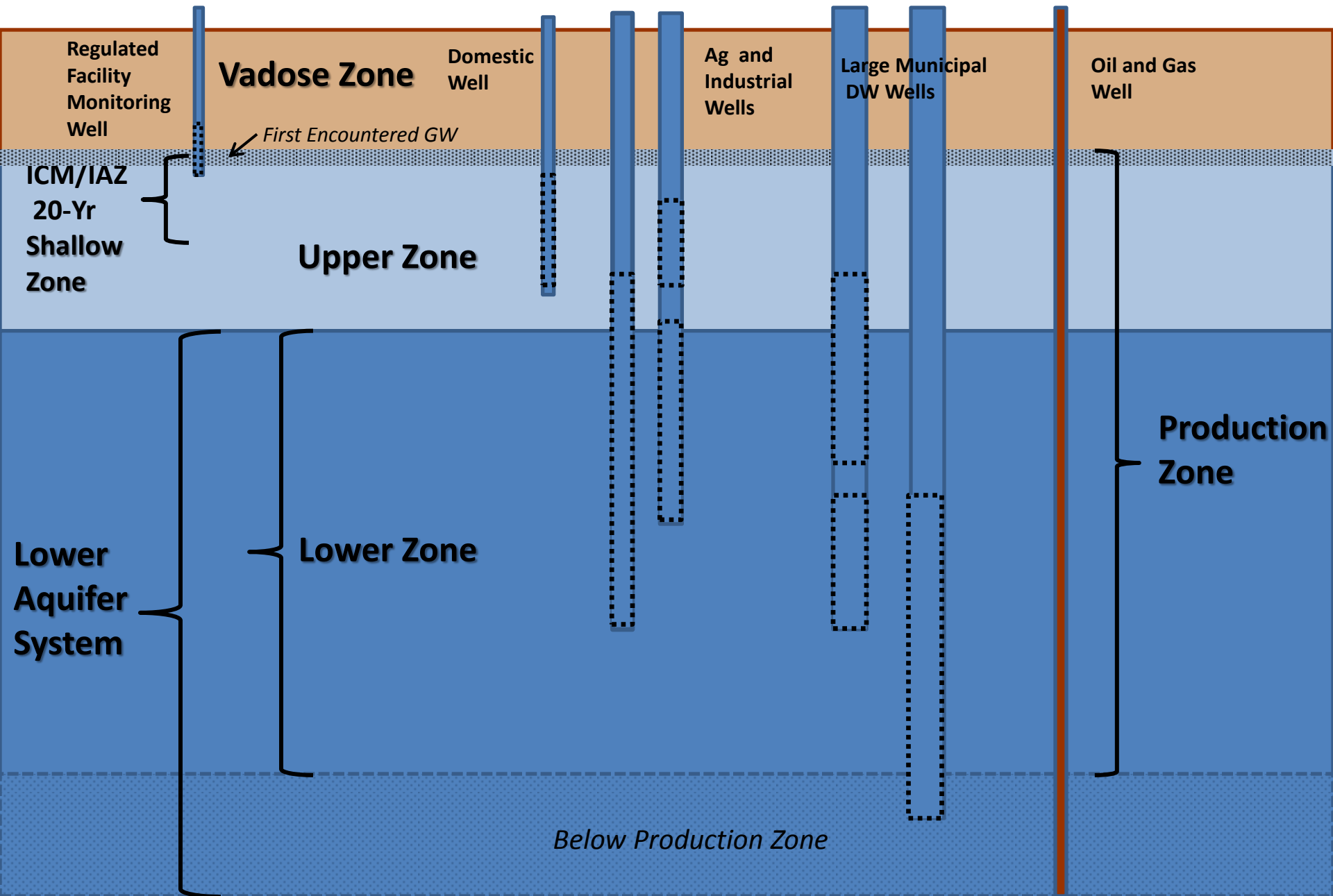


Barbara Dalgish, P.G.  
Senior Hydrogeologist, LSCE

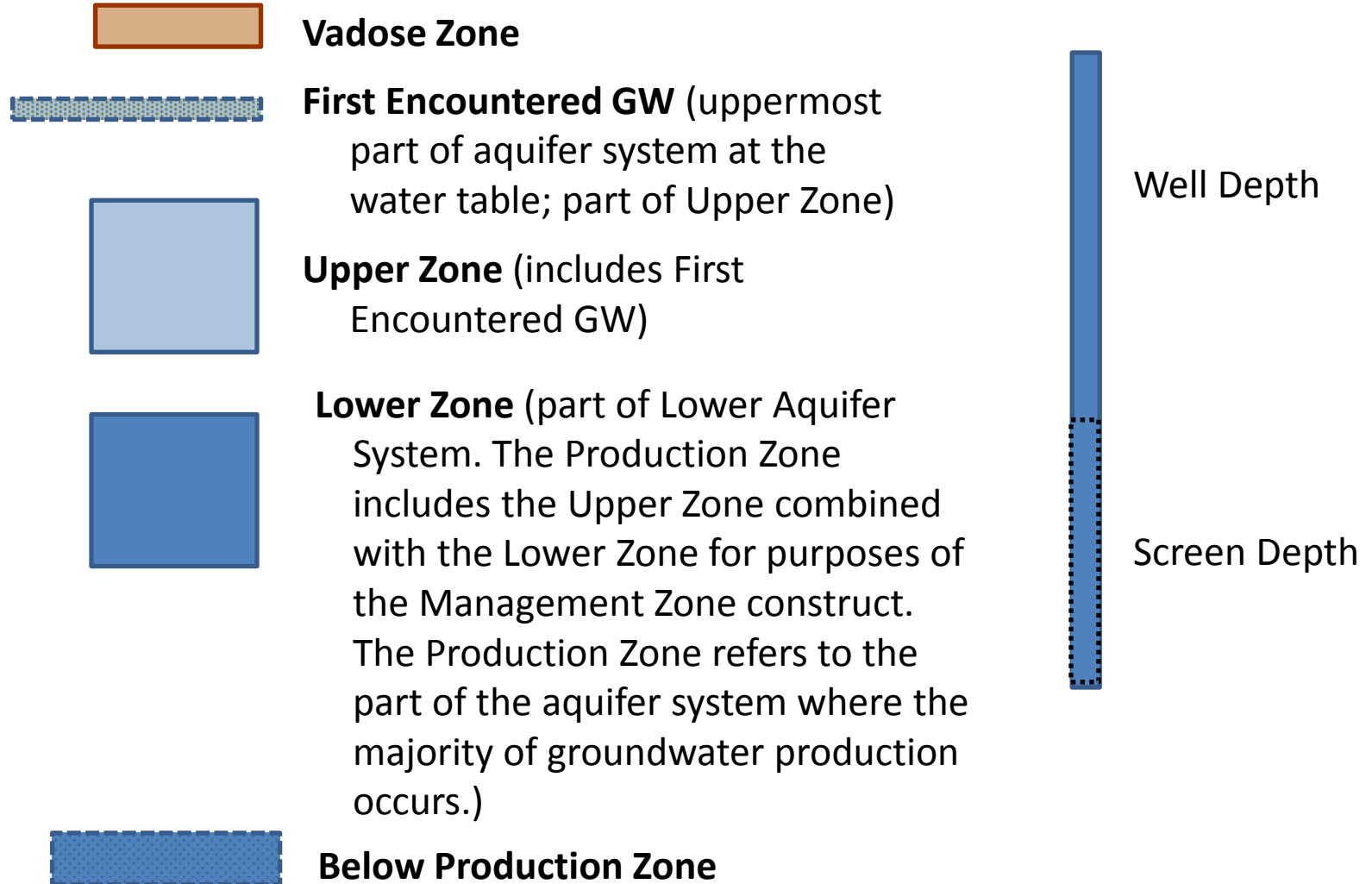
cc: Richard Meyerhoff, Technical Program Manager  
Karen Ashby, LWA Team Project Manager

Attachment: Table 2 Detailed Cost Breakdown

# Figure 1 — Schematic of Aquifer System



# Explanation of Terms



If well depth is unknown, well types are categorized by:

Upper Zone – Regulated Facility Monitoring Wells; Domestic Wells

Lower Zone – Ag Wells, Industrial Wells, Public Supply Wells

**CV-SALTS Table 2  
Fee Proposal Estimate for Central Valley SNMP Higher Resolution Groundwater Quality Data Analysis**

Task	Job Title/ Classification CV-SALTS Phase II Rates	Luhdorff & Scalmanini					Larry Walker Associates <sup>1</sup>				Estimated Fee Proposal		
		Vicki Kretsinger Principal Hydrologist	Barb Dalgish Senior Hydrogeologist	Dylan Boyle Staff Hydrogeologist	Aaron King Engineer	Other Direct Costs	Tom Grovhoug Principal	Karen Ashby Principal	Other Direct Costs	Sub-Total			
		\$195	\$165	\$125	\$125		\$275	\$255					
<b>Subtask 6.1 Join CV-SALTS Database with DDW Data</b>	<b>Assumptions</b>												
	We already have these databases in-house			6	6		\$ 1,500				\$ -	\$ 1,500	
	QA/QC of combined database		2	8			\$ 1,330				\$ -	\$ 1,330	
<b>Subtask 6.2 Define "Upper" and "Lower" Part of Groundwater System for Purposes of SNMP High Resolution Analyses</b>	<b>Assumptions</b>												
	Prepare draft Memo for Executive Committee review and comment; Memo to describe approach for determining upper and lower zones of groundwater system in Central Valley	2	6	2			\$ 1,630	1	1		\$ 530	\$ 2,160	
<b>Subtask 6.3 Basic Statistical Analyses to Characterize Groundwater Quality within the Central Valley Floor</b>	<b>Assumptions</b>												
	Characterize Data for Central Valley Floor, including nitrate and TDS tests for upper and lower zones	2	4	24			\$ 4,050				\$ -	\$ 4,050	
<b>Subtask 6.4 Decluster Data; Determine "Upper" and "Lower" Part of Groundwater System Relative to Majority of Groundwater Production</b>	<b>Assumptions</b>												
	Decluster data in Central Valley Floor			4			\$ 500				\$ -	\$ 500	
	Determine upper and lower zones in groundwater system in Central Valley; address complexity with Corcoran Clay in some areas	2	16	2			\$ 3,280				\$ -	\$ 3,280	
<b>Subtask 6.5 Perform Analyses and Prepare High Resolution Maps for Central Valley Floor (Upper, Lower and Production Zones; Nitrate and TDS)</b>	<b>Assumptions</b>												
	Existing Ambient Groundwater Quality, nitrate and TDS in upper, lower, and volume weighted production zone for Central Valley Floor	2	4	80			\$ 11,050				\$ -	\$ 11,050	
	Existing assimilative capacity, nitrate and TDS in upper, lower, and volume weighted production zone for Central Valley Floor	2	4	24			\$ 4,050				\$ -	\$ 4,050	
	Trend analyses, nitrate and TDS in upper, lower, and volume weighted production zone for Central Valley Floor	2	2	24			\$ 3,720				\$ -	\$ 3,720	
	Prediction of future groundwater quality based on historical observations, nitrate and TDS in upper, lower, and volume weighted production zone for Central Valley Floor	2	2	24			\$ 3,720				\$ -	\$ 3,720	
<b>Subtask 6.6 Prepare Preliminary Draft SNMP Report New Sections and New Appendix</b>	<b>Assumptions</b>												
	Prepare relevant draft parts of Sections 3, 5 and 6 with new approaches, methods and results	8	8	24			\$ 5,880	3	3		\$ 1,590	\$ 7,470	
	Finalize relevant parts of Sections 3,5, and 6	6	6	12			\$ 3,660	2	2		\$ 1,060	\$ 4,720	
<b>Subtask 6.7 Provide Presentation to CV-SALTS Policy Committee (additional material related to presentation of Draft Report)</b>	<b>Assumptions</b>												
	Prepare additional presentation materials related to new work and results	12	4	12			\$ 4,500	1	1		\$ 530	\$ 5,030	
<b>TOTAL (SUBTASKS 6.1 THROUGH 6.7)</b>		<b>40</b>	<b>58</b>	<b>246</b>	<b>6</b>	<b>0</b>	<b>\$ 48,870</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>\$ 3,710</b>	<b>\$ 52,580</b>	
<b>OPTIONAL Subtask 6.8 Basic Statistical Analyses to Characterize Groundwater Quality in Region 5 Outside the Central Valley Floor</b>	<b>Assumptions</b>												
	Characterize Data for basins outside the Central Valley Floor including potentially defining upper and lower aquifer portions, pending data availability and appropriateness	4	4	8			\$ 2,440				\$ -	\$ 2,440	
	Provide descriptions in relevant parts of draft Central Valley SNMP	4	4	12			\$ 2,940				\$ -	\$ 2,940	
<b>TOTAL (SUBTASKS 6.1 through 6.7, including optional SUBTASK 6.8)</b>		<b>48</b>	<b>66</b>	<b>266</b>	<b>6</b>	<b>0</b>	<b>\$ 54,250</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>\$ 3,710</b>	<b>\$ 57,960</b>	

<b>OPTIONAL (NOT RECOMMENDED): Provide TAC with Task 6.2 Memo and Presentation</b>	<b>Assumptions</b>												
	Assumes more explanation needed for TAC and prep and participation on conference call; <b>WILL SUBSTANTIALLY ALTER SCHEDULE</b>	8	8	8			\$ 3,880	3	3		\$ 1,590	\$ 5,470	
	Assumes differences between presentation for Policy Committee due to different venue and different assumption from above	12	8	8			\$ 4,660	6	6		\$ 3,180	\$ 7,840	
<b>TOTAL (SUBTASKS 6.1 through 6.7, including optional SUBTASK 6.8 and TAC)</b>		<b>68</b>	<b>82</b>	<b>282</b>	<b>6</b>	<b>0</b>	<b>\$ 62,790</b>	<b>16</b>	<b>16</b>	<b>0</b>	<b>\$ 8,480</b>	<b>\$ 71,270</b>	