CV-SALTS Technical Advisory Committee Meeting

When:  Friday, July 25, 2014 from 10:00 AM to 12:00 PM
Location:  Teleconference
Conference #:  (712) 432-0360 Participant Code: 927571#

Agenda

1. Welcome and Introductions
   a. Approve action notes from May 30, 2014

2. SSALTS Phase 2 DRAFT Report – Identification and Characterization of Selected Salt Treatment Options - Joe LeClaire, CDM Smith - 60 minutes
   DRAFT Report > This file is 6MB and is being provided as a link only.

3. International Salinity Forum – Discussion with Salinity Experts – Daniel Cozad, 30 minutes
   – Sustainable Soil Management Final

4. Other CV-SALTS Project/Contract Updates – As needed Status Updates - 15 minutes
   a. Phase II Conceptual Model – Richard Meyerhoff – Tech Project Status
      Task 3_Technical Memorandum_070814
      Task 3_Comment Response Summary_070814
   b. Tulare Lake MUN Archetype – Richard Meyerhoff
   c. SSALTS – Roger Reynolds
   d. MUN POTW – Jeanne Chilcott
   e. Lower San Joaquin River Committee – Mike Johnson

5. Next Meeting/Call  Preliminary Date: August, TBD

One or more Central Valley Regional Water Quality Control Board members may attend.
Convened: Friday, May 30, 2014 from 10:00 AM to 12:00 PM
Participants: Nigel Quinn (Chair), Roger Reynolds, David Cehrs, Daniel Cozad, Richard Meyerhoff, Diane Barclay, Vicki Kretsinger, Lacey Mount, Karen Ashby, Lysa Voight, Debbie Webster, Carolyn Geisler-Balasz, Jeanne Chilcott, Danielle Moss, Joe LeClaire, Karl Longley, John Dickey, Matt Zidar, Joe DiGiorgio, Mike Johnson

Agenda

Item 1: Welcome & Introductions
- Roger Reynolds moved to approve, and David Cehrs seconded, and the Meeting Action Notes from March 28th were approved.
- Nigel Quinn suggested that TAC members should be aware of some of the technical issues being worked on, and resolved, in the Lower San Joaquin River Committee. The LSJRC will begin forwarding some of the completed technical documents to the Technical Committee as informational items.

Item 2: SSALTS Phase 2 Project Update
- Joe LeClaire, CDM Smith, provided a progress update on Phase 2 of the SSALTS Project, Identification and Characterization of Selected Salt Treatment and Disposal/Storage Options
  - The draft Technical Memorandum is anticipated for completion in late June. There may be another presentation before the Technical Committee; and will be future opportunity for written comments.
- Nigel Quinn recommended Real Time Management be considered as an umbrella concept, rather than an option

Item 3: City of Dixon, Site-specific Boron Study – Request for Supplemental CV-SALTS Letter
- Joe DiGiorgio provided background for the request for a clarification letter regarding the City of Dixon study. Dixon was requesting clarification of Comment No. 4 in the original CV-SALTS letter approved by the Executive Committee at the 4/11/14 Admin Meeting.
  - After discussion, Roger Reynolds moved, and Debbie Webster seconded, and the Committee voted to move forward as follows:
    - Joe LeClaire and Richard Meyerhoff will draft a letter of clarification which quantifies the acceptable range of boron concentrations in irrigation water. Due to time constraints, the letter will be forwarded to the Technical Committee for review and comment via email; comments to be submitted to Richard Meyerhoff no later than 6/10. The clarification letter will be included in the 6/13 Executive Committee agenda for final approval. A copy of the draft letter will be provided to the permitting group in the interim.
    - There were two abstentions: Joe DiGiorgio and Jeanne Chilcott. Karl Longley was not present for this discussion and vote.

Item 4: EC/TDS Ratios
- Danielle Moss provided a summary of the Lower San Joaquin Committee Task 2B work to-date on EC/TDS Ratios. There will be a more substantial discussion of this Task at a later date.

Item 5: CV-SALTS Data Management Concept
- Richard Meyerhoff presented the recommendation from CDM Smith to use the ESRI Geoportal Software. Additionally CDM Smith recommends a pilot test of the ESRI software to ensure it will provide the necessary capability, and is fully compatible with the CV-SALTS website. It is estimated the pilot test would require approximately 10 hours of labor.
  - After discussion, Debbie Webster moved, and Roger Reynolds seconded, and by general acclamation the committee voted to recommend the Executive Committee further discuss whether they want to authorize the 10 hours to initiate the project.
Item 6: **Groundwater Quality Informational Item**
- David Cehrs briefed the committee on a situation in eastern Fresno County where the groundwater is becoming more bicarbonate rich. If more information becomes available, Nigel Quinn asked if David could give a future presentation to the committee.

Item 7: **Other CV-SALTS Project/Contract Updates**
  a) Phase II Conceptual Model/Richard Meyerhoff – LWA submitted first deliverable for Task 3. Project Committee is reviewing, when complete will come to the TAC for review.
  Task 4 – Management Zone Archetype. Kickoff meeting scheduled with stakeholders in Dinuba on 6/5.
  Task 5 – Draft Table of Contents for SNMP. Will meet 6/11 with Regional Board.
  b) Tulare Lake MUN Archetype/Roger Reynolds – Tulare Lake Drainage District met again with Regional Board to clarify concerns that arose early this week. Changes will be incorporated into report and resubmitted as soon as possible.
  c) MUN POTW/Jeanne Chilcott – Finished Water Quality Report. San Luis Canal Company will be the San Joaquin basin case study. Working with contractors now to update timeline for CEQA and Economic Review, should have update by next week.
  d) Lower San Joaquin River Committee/Mike Johnson – LWA team currently working on 3-4 tasks. Final Tech Memo delivered to committee yesterday. Results from Hoffman runs by Jim Brownell will be available at next committee meeting in June.

Item 6: **Next Meeting/Call**
- The next Technical Advisory Committee Meeting is tentatively set for June 27th.
CV-SALTS Agronomist Salinity Expert Dialog
at International Salinity Forum 3
June 16, 2014

Attendees Included:

<table>
<thead>
<tr>
<th>Attendee Name</th>
<th>Organization/Specialty</th>
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<tbody>
<tr>
<td>Don Barnett, Colorado River Salinity</td>
<td>Karl Longley, CVRWQCB</td>
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<td>Chilcott, CVRWQCB</td>
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<tr>
<td>Jeanne Chilcott, CVRWQCB</td>
<td>Heather du Vallon, Australia –</td>
</tr>
<tr>
<td>Daniel Cozad, CVSC</td>
<td>Beef</td>
</tr>
<tr>
<td>John Dickey, CVSC</td>
<td>Carl Walters, GB CMA Australia</td>
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<tr>
<td>Peter Gibson, Australia – Dairy</td>
<td>Kevin Minogue, Australia - Dairy</td>
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<tr>
<td>Keith Knapp, UC Riverside</td>
<td>Ahmad Moradi, UC Davis</td>
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<td>Jessie Godfrey, UC Davis</td>
<td>Helen Murdoch, GB CMA</td>
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<tr>
<td>Juan Gonzalez, Cena University of</td>
<td>Don Suarez, US Salinity Laboratory USDA</td>
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<tr>
<td>Arizona, Tucson</td>
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<td>Stephen Grattan, UC Davis</td>
<td>Mark Potter, Murray Darling Basin Auth.</td>
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<tr>
<td>Daniel Isidoro, Spain</td>
<td>Blake Sanden, UCCE Kern County</td>
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<tr>
<td>Daniel Hillel, World Food Prize</td>
<td>Maciej Zwieniecki, UC Davis</td>
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<tr>
<td>Laureate, Author, Columbia University</td>
<td>Michelle Leinfelder-Miles, UCCE San Joaquin County</td>
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This description of the discussion and recommendations was supplied to all participants and all corrections and revisions were incorporated into this final version on July 14, 2014.

At the meeting, Daniel Cozad began with a brief overview of CV-SALTS. He described the large area and diverse complexity leading the questions for the evening. John Dickey added that the roots of questions are related to the core efforts in agriculture production, or how to keep growing crops and protect water quality. CV-SALTS focus on protecting water and soil resources within the regulatory context was explained, along with CV-SALTS need for guidance on technical concepts to help guide regulatory processes.

The Salinity Coalition is interested in these questions, created with support from Dennis Westcot, because CV-SALTS is working with stakeholders and the regulatory community to be able to rewrite regulation for the Central Valley that protects water quality for future use, while maintaining agriculture in the Central Valley in.

Notes were taken on discussion pertaining to questions 1 through 3, though much of this overlapped subject matter mentioned in later questions. Later questions received less explicit attention.

1. **During droughts and other times the target salinity values may be exceeded on an infrequent basis. How often can permanent crops endure salinity of the applied water exceeding the Mass and Hoffman threshold value by 10-50% during short periods for 1 or 2 years when a wet winter could follow the drought?**

   - Clarifying the questions, it was noted that water quality gets poorer when less water is available. The variety of crops that were identified in the Central Valley included trees, vines, almonds, walnuts, grapes, pistachios and stone fruits. Question is looking at water quality, significant loss of crop, and survival of the trees.

   - Mass-Hoffman numbers incorporate about 20 to 30% uncertainty in the yield response to root zone salinity (Suarez). Therefore, moving ECe 10% beyond a threshold for yield loss should not present any problem. However, concentrations 50% above the threshold are likely to have economic impacts. Crops could also tolerate a temporary boost in ECw above a threshold.
value without much increase in ECe due to the time lag of the effect of irrigation water salinity on soil salinity. You apply what you can or must to keep a crop alive during a drought; there are not really other options. In Australia, they use saline groundwater to keep crops alive during drought.

- Need to address specific ions too. Other key assumptions: 1) M-H assumes average 15% leaching fraction; since small reductions in ETc (during drought) dramatically change the LF (which is leaching water/(ETc+leaching water)), there is a built-in margin of safety; 2) With drip/microspray, the whole concept of LF changes. The root zone moves into the zone that is repeatedly wetted by the emitters. The LF is still defined as the % of water moving through this volume, but the frequent replenishment of water retains low salinity in the wetted volume. Temporal effects are important in this situation, and must be taken into account.

- If there is 20-30% uncertainty of the threshold value, how would you apply the 20-30% if you have to set water quality needed by irrigators growing sensitive crops with this water supply? Response: You need to look at specific crops and the specific information. Some crops have a lot of uncertainty in their response functions, some have varietal differences. Plants integrate soil salinity differently.

- At 50% stone fruit would be destroyed but it would not be at 10%

- Karl Longley asked if routinely flushing the salts out of the root zone is the assumption, what is the impact of that for modeling? Mass-Hoffman is defined as terms of the EC of the soil saturation extract, as a weighted average of root-zone water uptake. So in better years do you have to maintain lower EC? Yes, you maintain within the 10% threshold. Some of the best management practices suggest that you maintain the nutrients in the root zone by controlling leaching to a lower level, but this also can maintain salts in the root zone.

- When you leach, you run the risk of leaching nutrients as well as salt. Assumption these are average annual things root zone salinity is influenced by leaching whether it happens in January, March, or August. It is possible to leach at a time when you don’t have much mobile nitrogen. Leaching doesn’t always imply pushing nitrogen past the root zone; it depends on when/how you leach.

- Michelle Leinfelder-Miles mentioned that a 15% leaching fraction is not a good assumption as there are places in the Delta region that do not see a 15% LF. The Delta area is not, in large part, dealing with trees or vines, but rather mostly perennial alfalfa or annual field crops and vegetables. Shallow groundwater and low porosity soils contribute to the challenge in achieving a 15% LF.

- Under a drip irrigation concept of leaching, you are not talking about some uniform process, but rather pockets of soil that are wetted, with volumes of soil between the critical zones that remain saline or unaffected. The roots concentrate in that wetted zone under the drip. We lose the concept of uniformity and deal with these microzones and roots that concentrate within them. For Drip the entire wetted volume is called the root zone.
2. Most crop tolerance modeling has used annual averages for determining the plan responses to soil salinity or salinity in the irrigation water. Are there periods/stages in the crop growth cycle that are more critical and should therefore be a focus, in developing water quality protection criteria? How can the temporal variability be captured and use for regulatory limits?

- For annuals, sensitive periods are generally early in the crop cycle. In permanent crops, these periods are less well known. Perhaps flowering/fruit set? On regulatory standard setting: Defaulting to any number is perhaps less useful than looking at more flexible, creative regulatory approaches that allow farming to adjust to water type and timing. For example, in the Murray-Darling, programs were developed to improve water quality. It was more practical than regulating everything. Benefit-cost ratios associated with standards tend to drop exponentially as standards become increasingly stringent. For example, compliance with a standard like 0.7 dS/m in drainage water could be very costly, but deliver far less benefit. Australia did not so much reference plant sensitivity as the requirement. Rather, they co-designed a program where farmers & watershed authorities worked to meet attainable goals. They dealt with drought years, having a buffer for these. They developed, implemented, re-evaluated, and then adjusted the program. This resulted in actual water quality improvement.

- Yes, there are stages in the crop growth cycle that are more critical. Focus on lower salinity water for early germination, early period growth, setting of fruit. For tomatoes after initial growth they can take a lot more salt, but it has to be leached out of the soils. There hasn’t been a lot of work done on specific periods of sensitivity and salinization process to allow their use for standard setting. Additionally there are some crops that are more sensitive, so if you have a year where there are higher levels of salt, then you should not assume everyone will plant the salt sensitive crops during that year. Editorial note: clearly relevant to annuals.

- The 0.7 dS/m EC in the FAO was intended for use to protect irrigated agricultural in developing countries, to protect irrigators from too much salt in the water. Dischargers are regulated by Board to this number as it is embedded into regulation from the scientific community, and it is the only number that is universal that we have at this time. Dischargers, including agriculture, are regulated by the Regional Water Board. This impacts economics of agriculture as a discharger of water. We (the Regional Board) are asking for help to determine what the best approach or number should be, and this may not be the most conservative number. How do we adjust thresholds by the crop, season, drought scenario? What do we use as guidelines to determine these numbers?

- Colorado looked at what the current levels were in the water bodies and what quality farmers were using today, and then tried to regulate water to stay at or below the current levels, and to stop degradation. Colorado Basin states must equal existing annual flow concentrations. Thresholds are developed from averages over many years. Definition of the standard is not just a numeric value, but rather a numeric value and a plan for implementation. Both the number and plan are reviewed and approved every three years.

- In the Murray River (Australia), the standard was set at 0.9 dS/m EC annual average, as an achievable goal, and trading credits were allowed as tools to meet the standard. This annual average standard allowed trading and progressive improvement of water quality. The standard works to protect perennial crops (not annuals).
3. The steady-state model used by Ayers and Westcot assumed standard surface applied irrigations with a 2-3 week interval between irrigations which was standard irrigation practice 40 years ago. Is the present crop tolerance data (Mass and Hoffman) applicable under present irrigation practices? How important is irrigation timing in modeling crop tolerance under field conditions? Would levels of sensitivity to salinity in applied water differ significantly for drip and microspray, relative to surface irrigated fields?

- Spatial (intra-field) variability is substantial, and must be considered. Perhaps it is best dealt with at the farm or management zone level. Use conservative, but not crippling (e.g., 0.7 dS/m) assumptions to allow some flexibility along with protection. Again, the marginal benefit of such a rigid, 0.7 dS/m EC standard would approach zero. You need to somehow consider soil quality (especially texture, structure, and drainage). Transient models handle this better than steady-state models, but some of the steady-state models could be enhanced to consider the system more fully. This might be more achievable for planning-level analyses. For example, precipitation’s contribution to leaching, irrigation method, and water uptake decrease leading to more drainage (leaching) under saline stress and should be accurately reflected in modeling yield loss. Suarez’ slides showed the effect of not taking rainfall and other critical factors into account, attached.

- You may want to consider Letey’s steady-state model as it incorporates more factors. “No drainage can meet 0.7 dS/m.” If you limit discharge salinity to very low values, then this incites reduced water use efficiencies as dischargers seek to dilute (or not to concentrate) drainage to meet standard, consuming more water as they do. Modeling may be less productive than a negotiation that considers practicalities. In the real world, life is complicated.

- Quality of the soil is important. It is important to look at the quality of the soil: is it sandy, clay, well structured, layered? Does it have a tendency to disperse?. Most models do not consider spatial and temporal variability, or irrigation timing and frequency.

4. Most modeling of plant responses has used steady-state models for analysis. How good are the transient models? Is the amount of data needed for their analysis better suited to a smaller plot of land where the variables can be measured and recorded or can they be applied to widespread areas with variable field conditions? When data is available should CV-SALTS prefer transient models?

- Need to inject realism relative to a balance between interaction among salinity management, nitrate leaching, and water use efficiency (this also relates to Question 5). Transient models account for variables known to be important. Steady-state models can be modified to account for these, including consideration of some spatial and temporal variability, as well as irrigation timing/frequency. Other approaches could be considered to be equally valid as modeling conditions such as 0.5 dS/m EC above the source/ambient water salinity as a limit. Alternatively, you could pick a salinity threshold two or three times natural/ambient level.
5. Based on your practical experience, which factors are most critical for developing models for determining crop tolerance criteria under field condition present today in areas similar to the Central Valley of California and how would you suggest these be used to make regulatory decisions?

- Practical experience: In Australia we define this experience as the fact that practical decisions dictate whether I (the farmer) am going to make a living or not? Blake Sandon, talks to farmers about how they can best farm, asking them what kind of water are you dealing with, and reminding them to look at the dirt. You need to consider the architecture of how the dirt comes together and how irrigation will water that particular field. If they are ahead of the curve, they may have time for leaching before they get nailed with warmer temperatures and water logging that can cause problems at bloom. Then focus on optimizing root zone conditions, as possible.

- SBX7-7 process mandated water use efficiency reporting by irrigation districts – setting efficiency standards for approval of allocations. Eventually water rights may be impacted, but concentrations of salinity will go up if water use is reduced.

- Australia in 2005-06 had allocations of environmental water, and regularly dropped below 60% of the expected yield. They have now adjusted the program because they are government funded programs. They recommend you “Don’t make it complicated”.

- Make a living. Groundwater regulation will improve use and management of water; not controlling water use makes salinity almost impossible to deal with. Water use efficiency makes the assessment and implementation more difficult. Planning must include the source of water, consider end-of-basin standards. Support efforts to promote resource sharing.
Sustainable Soil Management Under Irrigation with Saline Waters

Donald Suarez
U.S. Salinity Laboratory
USDA-ARS Riverside CA
Why do we need to leach?

Evapotranspiration - concentrates salts added in the irrigation water. Plants typically take up 60 to 95% of the water applied and only 2 to 8% of the salts present in the water.
Current Issues

- Current fresh water use by irrigated agriculture in arid and semi arid regions is not sustainable.
- Irrigated agriculture cannot compete economically with the urban sector in a competitively priced water market.
Advantages of Water Reuse

• Tertiary water treatment, necessary for aquifer recharge is expensive
• Agricultural use of nutrients add value to irrigation water
• Agricultural use can reduce the drainage volume below that of an RO plant in one cycle and further reduce the volume with multiple uses (2% or less of initial volume)
Water Reuse

- Agriculture can utilize treated municipal waste waters, agricultural drainage waters and brackish ground waters.
- Water reuse by agriculture can reduce nutrient and contaminant discharge
Water Quality Concerns

• Recycled waters are elevated in salinity, SAR, and Mg/Ca. Many saline waters are also elevated in pH, alkalinity, and B.
Current Ocean Disposal

LA County Sanitation District 2004
363,500 acre ft/y (460 million m³) discharged
216,000 acre ft/year reclaimed

City of Los Angeles Hyperion Plant Discharge
average flow 500,000 acre ft/year
\[ \text{SAR} = \frac{[\text{Na}]}{[\text{Ca} + \text{Mg}]}^{0.5} \]

where concentrations are in mmol·L⁻¹
Cations ratio of soil structural stability (CROSS)

\[ ECR = \frac{(Na + 0.56K)}{([Ca + 0.6Mg]/2)^{\frac{1}{2}}} \]

Existing Guidelines

USDA Handbook 60 (1954)
FAO Water Quality for Agriculture No. 29 rev. 1 (1985)
Agriculture Salinity Assessment and Management (1990)

All three consider ESP (or SAR) and salinity. Guidelines are simple and convenient, however they are not satisfactory for site specific recommendations.
Saline soil \( EC_e > 4 \text{ dSm}^{-1} \)
Sodic soil \( ESP > 15 \)
Saline-sodic soil \( EC_e > 4 \text{ dSm}^{-1} \) and \( ESP > 15 \)

These are soil classification criteria and are not useful for management purposes.
Water classification

- **Salinity hazard**
  - low \( EC < 0.25 \text{ dSm}^{-1} \)
  - medium \( EC \ 0.25 - 0.75 \text{ dSm}^{-1} \)
  - high \( EC \ 0.75 - 2.25 \text{ dSm}^{-1} \)
  - very high \( EC > 2.25 \text{ dSm}^{-1} \)

- **Sodium hazard**
  - low \( SAR < 10 \)
  - medium \( SAR \ 10 - 18 \)
  - high \( SAR \ 18 - 26 \)
  - very high \( SAR > 26 \)
# Flocculation of Clay Minerals

<table>
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<tr>
<th>Clay Type</th>
<th>Na(^+) mmol(_c) L(^{-1})</th>
<th>Ca(^{2+}) mmol(_c) L(^{-1})</th>
<th>Reference</th>
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<tr>
<td>montmorillonite</td>
<td>12</td>
<td>0.2</td>
<td>van Olphen (1977)</td>
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<tr>
<td>montmorillonite</td>
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<td>1.7</td>
<td>Goldberg (1990)</td>
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<td>illite</td>
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<td>kaolinite</td>
<td>&lt;0.2</td>
<td>&lt;0.1</td>
<td>Goldberg (1990)</td>
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Factors Affecting Water Infiltration and Crop Production

1. SAR
2. EC
3. pH
4. Ca/Mg ratio
5. Crop selection
6. Extent, timing and intensity of rainfall
7. Evapotranspiration
8. Soil texture and soil hydraulic characteristics
9. Irrigation system
10. Soil organic matter
11. Tillage
12. Residue management
13. Drainage system
14. Uniformity of irrigation
15. Leaching fractions
16. Extent of canopy cover
17. Soil fertility
18. Acceptable relative yield - an economic consideration
19. Toxic elements (B, Mo, Se, As)
20. Fe and Al oxide content
21. Clay mineralogy
The graph illustrates the relationship between aggregate stability and free Fe₂O₃ concentration. Three layers are distinguished: subsurface layers, surface sod layers, and surface cultivated layers. The stability decreases as the free Fe₂O₃ concentration increases.
Relationship of SAR with depth and quantity of rain infiltrated into Glendive loam and clay soil. The initial condition was based on earlier irrigation with water of EC = 1.0 dS m\(^{-1}\) and SAR = 10.

### Experimental Design

<table>
<thead>
<tr>
<th>Irrigation Water</th>
<th>Replicates</th>
<th>Soils</th>
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<tbody>
<tr>
<td>EC</td>
<td>SAR</td>
<td></td>
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<tr>
<td>1 and 2 dS m⁻¹</td>
<td>2, 4, 6, 8, 10</td>
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<tr>
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<tr>
<td>EC = 0.5 dS m⁻¹</td>
<td>SAR = 0.5</td>
<td>Glendive Sandy Loam</td>
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Alternating rain – irrigation events of 5 cm each. Rain applied in 0.25 cm intervals. Soils packed into 29 cm x 25 cm plastic containers. A vacuum of 50 kPa was applied to extractors at the bottom of the container.
Relationship between SAR and ln infiltration time; date is averaged across sampling periods

Pachappa Infiltration, Irrigation Water (with Rain)

Relative Infiltration (Final/Initial)

Infiltration rate as related to SAR of applied water. Disturbed (laboratory packed) cores of untreated loam soil.

(Suarez and Gonzalez, unpublished data)

Part I - Conclusions

- There is no threshold to the SAR relationship – any increase in SAR reduces the infiltration rate
- Even a small increase in pH reduces the infiltration rate
- As expected rain infiltration was slower than irrigation water infiltration
- The adverse effect of SAR on irrigation water infiltration is enhanced in systems that also receive rain
- Short-term experiments do not simulate the extent of SAR effects on infiltration rate observed in season-long experiments
• The relative reduction in hydraulic conductivity and infiltration rate as affected by SAR is not dependent on soil texture.

• Reductions in infiltration rate are critical for clay soils and usually not important for sandy soils.

• Canopy cover did not protect the soil from reduction in infiltration.

• There is no “threshold” for reductions in infiltration as related to SAR, however reductions of less than 20% might not be noticed (except clay soils)
UNSATCHEM 3.0 Model
Includes:

- Variably saturated water flow
- CO$_2$ production and gas and liquid transport
- Root water uptake and plant growth
- Multicomponent solute transport
- Chemical effects on hydraulic properties
Salt Stress (FAO 29)

Water applied = 210 cm

$ET_p = 200 \text{ cm}$

EC irrigation water = 6.2 dS/m

Drainage = 9 cm

Average root zone salinity = 44.8 dS/m

L.F. = 0.043

Relative yield = 2%
Salt Stress Calculation
(Using water uptake weighted salinity)

Water applied = 210 cm
EC irrigation water = 6.2 dS/m
ET\_p = 200 cm
Drainage = 9 cm
Water uptake weighted salinity = 23.3 dS/m
L.F. = 0.043
Relative yield = 13.4%
SWS Model Prediction of Salt Stress

Input
Water applied = 210 cm
$ET_p = 200$ cm
$EC_{iw} = 6.2$ dS/m

Results
$ET_a = 122$ cm
Drainage = 88 cm
L.F. = 0.42
Relative yield = 62%
Comparison of SWS model and Ayers and Westcot (1985) predicted crop relative yield as related to irrigation water EC, for a crop with an $h_{50} = -50$ m (-0.5 MPa), $ET_p = 200$ cm and 209 cm applied water.

Comparison of SWS model and Ayers and Westcot (1985) predicted leaching fraction as related to irrigation water EC, for a crop with an $h_{50} = -50$ m (-0.5 MPa) salt tolerance value, $ET_p = 200$ cm and 209 cm applied water.

Boron

Currently utilize the threshold slope response function for toxicity and a B leaching requirement approach is overly conservative in that it is steady state.

Waters deemed unsuitable may be used in certain scenarios.
Simulations of Irrigation with High B Concentration Water

- 120 day simulations
- Leaching fractions = 0.05 and 0.4
- Two soils: Bonsall sandy loam and Ryepatch clay
- ET = 0.6 cm/d
- B concentration = 0.5 mmol/L
Bonsall LF = 0.4

Profile Information: H₃BO₃

*Concentrations determined using predicted volumetric theta.

Bonsall LF= 0.05

Profile Information: H₃BO₃

*Concentrations determined using predicted volumetric theta.
Ryepatch LF = 0.4

Profile Information: H3BO3

H3BO3 [meq/L] *

Print Time
0  10  30  50  70  120

z [cm]

*Concentrations determined using predicted volumetric theta.

Ryepatch LF = 0.05

Profile Information: H3BO3

H3BO3 [meq/L] *

Print Time
0  20  40  60  80  100

z [cm]

*Concentrations determined using predicted volumetric theta.
Soil Solution

Boron Concentration

Water Uptake Weighted

Boron Concentration (mmol/L)

Time (days)

- Bonsal 0.4 LF
- Bonsal 0.05 LF
- RyePatch 0.4 LF
- RyePatch 0.05 LF
Technical Project Status Updates – as of July 21, 2014

- **Phase II Conceptual Model**
  - Task 3 is complete.
    - Attached to the meeting agenda are (a) Final Technical Memorandum - *Groundwater Data Refinements & Updates to Support Salt, Nitrate, and Water Balance Estimates for Archetype Area, SNMP, and Future Work*; and (b) Comment/Response table based on Project Committee review.
    - These documents were accepted by the Executive Committee at the July 11 meeting
  - Task 4 – Management Zone Archetype (Alta Irrigation District area)
    - Stakeholder kickoff meeting held on June 5 in Dinuba. LWA team continues to coordinate with Kings River Conservation District.
    - LWA team is currently primarily working on the subtask that involves characterization of the Management Zone area (surface/groundwater data, land use, etc.)
  - Task 5 – Preliminary SNMP development; a draft Table of Contents was drafted and revised based on Project Committee input. A final draft was approved by the Executive Committee with a request for a few targeted edits. Once these are complete, the document will be posted to the website

- **Tulare Lake Bed MUN Archetype**
  - Revised draft technical report reviewed by Fresno Regional Board staff; revised report includes recommendations for delisting boundaries for both MUN and AGR uses.
  - Meeting between Tulare Lake Drainage District (TLDD) team and Fresno Regional Board staff was held on July 7 to discuss Board staff comments and determine next steps.
  - MUN delisting - General agreement reached on proposed MUN delisting boundary pending final review of well log data being provided by TLDD to Board staff.
  - AGR delisting – Currently, the proposed AGR delisting boundary is the same as the proposed MUN delisting boundary. The proposed AGR boundary is being reconsidered based on outcome of July 7 meeting; final proposed AGR delisting boundary will likely be different (i.e., somewhat smaller) than proposed MUN delisting boundary.
  - CEQA scoping –
    - TLDD team would like to have one CEQA process for MUN and AGR delisting; therefore, CEQA process is on hold pending revisions to address Board staff comments on AGR delisting proposal.
    - CV-SALTS has funded the CEQA process for MUN de-listing; however, funding to support costs associated with CEQA process for AGR de-listing need to be identified/discussed
This memorandum is being submitted on behalf of the LWA team and fulfills the Task 3 requirement of the CV-SALTS Phase II Conceptual Model Workplan (Workplan). The purpose of this memorandum is to discuss revisions and additional data gathered to update the groundwater quality database that was developed as part of the CV-SALTS Phase I Initial Conceptual Model (ICM) workplan. The ICM adopted the use of 22 Initial Analysis Zones, or IAZs, covering the Central Valley floor for purposes of the conceptual scale water, salt, and nitrate balance calculations. The data collected for the Phase I ICM groundwater quality database included not only the 22 IAZs, but the entirety of the Central Valley Regional Water Quality Control Board (RWQCB) Region 5 jurisdiction. Updates to the database have focused on the entirety of Region 5 for all time periods.

The data used in the CV-SALTS groundwater quality database originate from five sources:

- RWQCB Waste Discharge Requirements (WDR) data per the Dairy CARES program (Dairy);
- California Department of Public Health (CDPH);
- Department of Water Resources (DWR);
- the United States Geological Survey’s (USGS) National Water Information System (NWIS) program; and
- Geotracker Groundwater Ambient Monitoring and Assessment (GAMA) program.
These source databases contain publicly available salinity and nitrate test data from wells throughout Region 5. Updates to the groundwater quality database included re-acquiring Geotracker GAMA data (to correct systematic errors discovered in the raw data gathered from the Geotracker GAMA online database, identified in Phase I\(^2\)), and updating database sources (USGS NWIS, DWR, and CDPH) with data current to 2014. This included adding any additional test results that the source databases contained, current to 2014. The RWQCB WDR Dairy data were not updated\(^3\).

The groundwater quality database consists of nitrate (as nitrogen) (NO\(_3\)-N) and total dissolved solids (TDS) test results of groundwater samples from wells. Types of groundwater wells include domestic, public supply, industrial, monitoring, irrigation, and stock wells. Records that provided test results of these exact analyte results were preferentially selected; however, test results of nitrate (as nitrate) (NO\(_3\)-NO\(_3\)), electrical conductivity (EC), and specific conductivity (SC) were also acquired. NO\(_3\)-NO\(_3\) was converted to NO\(_3\)-N by dividing NO\(_3\)-NO\(_3\) by 4.4268, and EC or SC was converted to TDS by multiplying the results by 0.64, a commonly used multiplier\(^4\).

**QA/QC**

A systematic approach was used for quality assurance/quality control (QA/QC) of assembled groundwater quality database to filter out any erroneous records, identify non-detections, and filter out duplications of test results between and within databases. The sources of data report test results differently and various qualifiers, remarks, and comments are used to provide additional information. When assembling the database, care was taken to include as many tests as possible; however, any conversions and assumptions have been noted to aid in using the database appropriately.

**Non-Detections**

A non-detection indicates when a laboratory method was not able to detect a concentration for a particular analyte. The detection limit of a constituent is not always reported or clear. In the compiled database for CV-SALTS, non-detections for nitrate are assigned the value of 0.225 mg/L NO\(_3\)-N (2 mg/L NO\(_3\)-NO\(_3\), which is the “Detection Limit for Purposes of Reporting (DLR)” used by CDPH and the SWRCB\(^5\)). A value of 10 mg/L TDS was used for non-detections of TDS and EC/SC.

**Estimated Concentrations**

Some records in the source databases indicated the reported concentration is an estimate. In the USGS NWIS database, an “E” for estimated is used as a remark code, or a “value extrapolated at low end” qualifier is used to indicate the reported concentration is an estimate. In these cases, the

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\(^2\) A large number of well tests for nitrate and TDS were discovered to have reported in the wrong units (nitrate as N instead of nitrate as nitrate, and mg/L TDS instead of µg/L TDS). See CV-SALTS Initial Conceptual Model (ICM) Phase I, Tasks 7 and 8 Final Report (2013) section 3.1 for more detail.

\(^3\) The RWQCB WDR Dairy dataset was not scoped to be updated for the entirety of Region 5 in Phase II, due to the amount of effort involved in acquiring, compiling, determining well locations, and performing quality control/quality assurance. Instead, the previous RWQCB WDR Dairy dataset established for Dairy CARES was used.

\(^4\) EC and SC data were collected and transformed to TDS using the ratio TDS = EC*0.64 for wells without TDS data (Tchobanoglous and Burton,1991.). It should be noted that this ratio is a common approximation, and can change depending on local conditions. Converted SC/EC tests are indicated in the database in the comment field.

\(^5\) GROUNDWATER INFORMATION SHEET: Nitrate http://www.waterboards.ca.gov/gama/docs/coc_nitrate.pdf
Some USGS records do not provide a concentration but state: “presence verified but not quantified”. These records were not kept as the description is too vague to assign a concentration value. In the USGS NWIS and Geotracker GAMA (specifically the Electronic Data File (EDF) portion) databases, some test concentrations are reported with a “>” sign, indicating that the actual concentration is greater than the reported concentrations. The USGS NWIS database also uses a qualifier code of “d” meaning a “diluted sample: method hi range exceeded”. This can happen when the laboratory method determines a concentration above the limit of the method used. It is assumed that the actual concentration is higher. In these cases, the reported value was kept in the database as is (or converted to NO₃-N or TDS if appropriate).

**Other Data Qualifiers**

The USGS uses a qualifier “V” indicating a “value affected by contamination”. This occurred in a few instances only for TDS concentrations. While contamination of a sample could be very important for some analytes, it was assumed that the results of a potentially contaminated sample analyzed for TDS would not result in a significantly different value; therefore, these records were kept.

Records with a qualifier stating that the results were inaccurate or questionable were not kept.

Additional characters appear in the remark or data qualifier fields which do not have a definition and are assumed to have been entered in error. Characters such as “-” and “.” in CDPH’s database are not defined, so there is no compelling reason to remove them from the dataset, therefore, these records were accepted as is.

**Data Quality Field**

A field was added to the groundwater quality database to indicate the quality of the data entered for each water quality sample entry. If the reported concentration had no qualifiers indicating that the result was inaccurate, or no assumptions were made about the test result, it was given the highest data quality value. If a test was reported as a non-detection and a concentration was assumed, or if the concentration was an estimated value, contaminated sample, or the concentration exceeded the limits of the laboratory method used, that entry received a lower quality value ranking. Table 1 shows how these categories were assigned a 1, 2, or 3.
Table 1. Definitions of Data Quality Value Field in Database

<table>
<thead>
<tr>
<th>Data Quality Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concentration is reported without a qualifier that indicated that the result was inaccurate. Concentration kept as is or converted to NO₃-N or TDS if needed.</td>
</tr>
<tr>
<td>2</td>
<td>Concentration is reported as ND, concentration = 0, or qualifier = &lt;; 10 mg/L TDS or 0.225 NO₃-N mg/L assumed. The only exception is for USGS test results for TDS as a summation of its constituents that contained a “&lt;” qualifier.</td>
</tr>
<tr>
<td>3</td>
<td>Value is reported with “&gt;” sign (indicating that the concentration exceeded the laboratory method and that the concentration is higher than what is reported), or that the concentration was estimated (for example by extrapolation of a diluted sample), or the sample may have been contaminated (only applies to TDS results). These records were included as is or converted to NO₃-N or TDS if necessary.</td>
</tr>
</tbody>
</table>

WELL LATITUDE/LONGITUDE LOCATION REFINEMENTS

Precise locations for wells can greatly improve assessments of ambient conditions, especially at the local scale. Unfortunately, many of the publicly available online databases do not provide exact coordinates for wells due to confidentiality/security and/or lack of data. For example, DWR locates their wells using the State Well Number (SWN) which, at best, can only be located within a quarter-quarter section. CDPH wells, reported within the Geotracker GAMA database, are purposefully obfuscated up to a mile in any direction for security reasons. For large scale studies, such as the Phase I ICM work, imprecise locations are not as important when performing analyses over very large regions. However, for localized studies that attempt to refine ambient conditions on a higher resolution, the imprecise accuracy of the well locations may affect how ambient conditions are understood at a local scale. The following describes the data and methods used to assign latitude/longitude coordinates to wells.

The USGS, Geotracker GAMA, and previous RWQCB WDR Dairy datasets all contained latitude and longitude values for each well with salt and nitrate data. The USGS reports accurate latitude and longitude values for each of their reported wells, but the USGS does not provide well types or water uses. Geotracker GAMA only provides accurate locations for monitoring wells at regulated sites; all other locations for supply wells are approximated to within one-mile of the actual location for CDPH wells or within ½ mile of the actual location for GAMA wells (reported by SWRCB, Lawrence Livermore National Laboratory (LLNL), or USGS). The CDPH database does not include well locations. Therefore, a hierarchy of methods was used to assign locations to CDPH wells. The methods for assigning spatial locations to CDPH wells are listed below, with priority given to methods highest on the list when possible.

1. Use CDPH systems in Geotracker GAMA (locations obfuscated 1-mile in any direction).
2. Use systems in Phase I CV-SALTS database that had been geo-located previously.
3. Use an average of other wells in the same water system that have latitude/longitude locations.

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⁶ USGS parameter code 70301 is used for TDS results, where the reported concentration is the sum of the measured constituents. If at least one of the constituents measured resulted in a non-detect, than the “<” qualifier is carried through for the TDS result. This does not mean that there was a non-detection for TDS, but only for 1 or more of the constituents. In this case, the original concentration was kept, but was assigned the data quality value of 2.
4. Use the latitude/longitude of the centroids of the water system boundaries provided by the Environmental Health Investigations Branch (EHIB)\(^7\) of CDPH.

5. Use the address of the Water System Headquarters and geocode the location based on street address, then city (if no street provided).
   a. This had to be checked to make sure the water system headquarters was in the same county as the primary station code indicates (first two numbers of primary station code e.g., the water system headquarters might be listed as somewhere in the Bay area, but the well primary station code indicates the well is located in a county somewhere in the Sierra Nevada mountains).

6. Additional systems that were unable to be located by the above methods were located using an online search engine for the water system name and attempts to locate the area of the well through various websites.

   DWR wells were provided with latitude/longitude, but upon investigation it appeared that some wells were located incorrectly. A systematic approach was used to re-assign locations to DWR wells. Section and quarter-quarter shapefiles available from the U.S. Bureau of Land Management (BLM)\(^8\) were used to check locations. The BLM shapefile of township/range/section/quarter-quarter does not cover the entire Region 5 area. The list below shows the priority of actions used to assign locations for wells with salt and nitrate data from DWR.

1. If the provided latitude/longitude placed the well in the correct quarter-quarter section, the latitude/longitude entry was unchanged.
2. If the provided latitude/longitude placed the well in the incorrect quarter-quarter section, but the quarter-quarter section is available on the BLM shapefile, the well was moved to centroid of the correct quarter-quarter section.
3. If the provided latitude/longitude places it in the correct section, and no quarter-quarter exists in the BLM shapefile, the latitude/longitude entry was unchanged.
4. If the provided latitude/longitude placed the well in a different section, and no quarter-quarter exists in the BLM shapefile, the well was moved to the centroid of the correct section.

**SUMMARY**

The types and numbers of wells collected for each source database is shown in Table 2, and Figure 1 shows the number of wells by source and decade. The data record spans from 1909 to 2014, however, the majority of the well test data are from the 1950s to present. The earlier data (1940s-1970s) are largely from the DWR and USGS databases, with small amounts of data from the other sources. The later time period (1980s to present) contains data from all five sources, however, the GAMA and CDPH databases make up the majority. Well test data from the RWQCB WDR Dairy database is primarily in the 2000s, with a small amount of data in 1990s. Figure 2 is a map showing the spatial coverage (locations) of each well in the entire groundwater quality dataset compiled for CV-SALTS Phase II Conceptual Model, Task 3 by data source.

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\(^7\) CDPH Environmental Health Investigations Branch (EHIB) http://www.ehib.org/page.jsp?page_key=762

\(^8\) Public Land Survey System (PLSS) http://www.geocommunicator.gov/Geocommm/lsis_home/home/index.htm
The updated database contains an additional 2,743 wells from DWR (314 within the Central Valley Floor), and an additional 2,252 wells from CDPH (142 within the Central Valley Floor). Additional duplicate wells between DWR and USGS were identified due to higher scrutiny of the data. This resulted in the identification of 10,675 duplicate wells between DWR and USGS NWIS, and a net reduction of 2,198 wells from the USGS NWIS database. In the Geotracker GAMA database, test results from the USGS NWIS database and CDPH database are identified. Instead of attempting to match-up well codes, between USGS NWIS, CDPH, and Geotracker GAMA (as was performed in the Phase I ICM database\footnote{It was assumed that CDPH and USGS NWIS databases contained the latest and most accurate data. Often times well IDs can change through time, depending on reporting methods, updates to databases, changes in management, etc. Therefore the identification of duplicate records can often lead to incomplete identification of duplicate records and wells between the databases. For this reason, the original CDPH and USGS NWIS sources were considered the most up-to-date and were used in lieu of CDPH and USGS NWIS records contained within the Geotracker GAMA database.}) all records within the Geotracker GAMA database that were indicated to have come from the USGS NWIS and CDPH source databases were removed. The assumption was made that any records from CDPH and USGS NWIS that were included in the Geotracker GAMA database would be included in the databases obtained directly from the CDPH and USGS NWIS databases. This resulted in a large refinement of the Geotracker GAMA data, with a net reduction of 7,554 wells overall, but only a reduction of 620 wells within the Central Valley Floor.

For the database as a whole, there was a net reduction of 4,538 wells. Within the Central Valley Floor, there was only a net reduction of 912 wells. This is due to the identification of duplicate wells through increased scrutiny of the data, and by using only the most up-to-date databases from original sources.
Table 2. Well Types and Number of Wells for each Data Source

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Types of Wells</th>
<th>Entire Database</th>
<th>Within IAZs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWR</td>
<td>Domestic, Industrial, Public Supply, Agricultural, Monitoring/Observation/Test</td>
<td>17,150</td>
<td>13,452</td>
</tr>
<tr>
<td>USGS</td>
<td>Not Reported</td>
<td>7,850</td>
<td>3,620</td>
</tr>
<tr>
<td>Geotracker</td>
<td>Public Supply, Domestic, Monitoring</td>
<td>7,293</td>
<td>5,482</td>
</tr>
<tr>
<td>GAMA</td>
<td>Monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDPH</td>
<td>Public Supply</td>
<td>9,806</td>
<td>5,682</td>
</tr>
<tr>
<td>RWQCB WDR (Dairy Data)</td>
<td>Monitoring, Domestic, Agricultural</td>
<td>4,179</td>
<td>4,157</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>45,940</td>
<td>32,393</td>
</tr>
</tbody>
</table>

Figure 1. Number of Wells With a Nitrate or TDS Test by Decade and by Source

At the time this Technical Memorandum was written, additional data from DWR are expected to be incorporated into the database upon receipt.

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10 At the time this Technical Memorandum was written, additional data from DWR are expected to be incorporated into the database upon receipt.
Figure 2. Map of Well Locations by Data Source
DATA SOURCES

<table>
<thead>
<tr>
<th>DATA SOURCE</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geotracker GAMA</td>
<td><a href="http://geotracker.waterboards.ca.gov/gama/">http://geotracker.waterboards.ca.gov/gama/</a></td>
</tr>
<tr>
<td>USGS NWIS</td>
<td><a href="http://nwis.waterdata.usgs.gov/ca/nwis/qwdata">http://nwis.waterdata.usgs.gov/ca/nwis/qwdata</a></td>
</tr>
<tr>
<td>DWR Water Data Library</td>
<td><a href="http://www.water.ca.gov/waterdatalibrary/waterquality/index.cfm">http://www.water.ca.gov/waterdatalibrary/waterquality/index.cfm</a></td>
</tr>
<tr>
<td></td>
<td>(and request from Eric Senter <a href="mailto:eric.senter@water.ca.gov">eric.senter@water.ca.gov</a>)</td>
</tr>
<tr>
<td>CDPH</td>
<td><a href="http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx">http://www.cdph.ca.gov/certlic/drinkingwater/Pages/EDTlibrary.aspx</a></td>
</tr>
<tr>
<td>RWQCB WDR Dairy Data</td>
<td>Personal Communication with the Central Valley Regional Board</td>
</tr>
</tbody>
</table>

REFERENCES


<table>
<thead>
<tr>
<th>No.</th>
<th>Date Received</th>
<th>Comment Source</th>
<th>Deliverable</th>
<th>Comment</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/03/14</td>
<td>Jeanne Chilcott</td>
<td>Draft Tech Memo</td>
<td>Clarify total number of wells evaluated and the percent reduction by removing 4,000+ from the database and whether the removals were random throughout the region or left a specific gap of data in a certain area (e.g. IAZ). I’ve forwarded the information to Clay and Rob since they were part of the initial project team.</td>
<td>The total number of well IDs from each source totals 64,355. Approximately 25% of these are duplicate wells (wells that appeared in more than one publicly available dataset). In Phase 1, we attempted to match IDs between databases, however this is problematic in that IDs and tests are sometimes updated in the original databases, making identification of duplicates difficult. In Phase 2 we decided that if the wells’ origin came from one particular dataset, that original dataset was maintained and the duplicate appearing in the non-original dataset was removed. For example, GeotrackerGAMA identifies which tests originate from the DWR database. If DWR updated their database with more current information, that information would not be also updated in the GeotrackerGAMA database. We therefore eliminated the tests from GeotrackerGAMA that indicated that they were from DWR, and brought it in the entire DWR database. The reasoning for this is that we wanted to include data from its original source, rather than relying on GeotrackerGAMA (for example) to have the most up to date information from DWR. The Phase II Task 3 TM broadly identified where net groundwater data reductions occurred as a result of the Phase II QA/QC work. Specifically, the TM noted that “Within the Central Valley Floor, there was only a net reduction of 912 wells.” (this is compared to 32,393 wells in the IAZs, and 45,940 wells in all of Region 5). So there was a 2.8% reduction of the wells on the Central Valley Floor. As part of Phase I, we described the number of wells in each of the IAZs with various statistics relating to the nature of the wells (e.g., shallow, deep, unknown completion, number of wells with tests by decade, number of wells from various data sources, etc.). Essentially data gaps of different types were highlighted in the Task 7/8 report and during many of the team presentations. The Phase II Task 3 TM shows some of these statistics more broadly. Additional analysis of the data relative to each IAZ was not part of the Phase II scope (this type of analysis was suggested as part of the proposed Work Plan Task 6, which was decided by CV-SALTS not to be conducted at this time).</td>
</tr>
<tr>
<td>2</td>
<td>06/06/14</td>
<td>Roger Reynolds</td>
<td>Draft Tech Memo</td>
<td>The second sentence of the second paragraph on page 2 states, &quot;Types of groundwater wells include domestic, public supply, industrial, monitoring, irrigation, and stock wells.” The end of the second paragraph on page 2 concludes with the statement “…EC or SC was converted to TDS by multiplying the results by 0.64, a commonly used multiplier.” Comment: At last week’s TAC meeting there was a discussion on EC/TDS Ratios which for some subsurface drainage waters on the west side varied from 0.64 to 0.80. The resulting sensitivity analysis prepared by LWA determined salt loading to the SJ River could be greater than estimated with a larger ratio. If the water quality data for groundwater wells includes in the ICM analysis “monitoring wells” which measure shallow groundwater, then the conversion to TDS using the common 0.64 multiplier may not be correct. It would appear an added footnote or description on this issue related should be provided.</td>
<td>The second sentence of the second paragraph on page 2 states, &quot;Types of groundwater wells include domestic, public supply, industrial, monitoring, irrigation, and stock wells.” The end of the second paragraph on page 2 concludes with the statement “…EC or SC was converted to TDS by multiplying the results by 0.64, a commonly used multiplier.” Comment: At last week’s TAC meeting there was a discussion on EC/TDS Ratios which for some subsurface drainage waters on the west side varied from 0.64 to 0.80. The resulting sensitivity analysis prepared by LWA determined salt loading to the SJ River could be greater than estimated with a larger ratio. If the water quality data for groundwater wells includes in the ICM analysis “monitoring wells” which measure shallow groundwater, then the conversion to TDS using the common 0.64 multiplier may not be correct. It would appear an added footnote or description on this issue related should be provided. The footnote: EC and SC data were collected and transformed to TDS using the ratio TDS = EC*0.64 for wells without TDS data (Tchobanoglous and Burton 1993). It should be noted that this ratio is a common approximation, and can change depending on local conditions. Converted SC/EC tests are indicated in the database in the comment field.</td>
</tr>
<tr>
<td>3</td>
<td>06/06/14</td>
<td>Roger Reynolds</td>
<td>Draft Tech Memo</td>
<td>Regarding Page 3, Other Data Qualifiers – Comment: It is understandable that there are different qualifiers in the different data files. The second paragraph indicates some of the qualifiers used by CDPH were not defined in their database. Was there any follow up with CDPH to encourage them to clarify uncertain or unclear qualifiers in the future?</td>
<td>Regarding Page 3, Other Data Qualifiers – Comment: It is understandable that there are different qualifiers in the different data files. The second paragraph indicates some of the qualifiers used by CDPH were not defined in their database. Was there any follow up with CDPH to encourage them to clarify uncertain or unclear qualifiers in the future? We followed-up with one CDPH employee who had not been made aware of one particular data qualifier (the “&lt;” sign on the recent data qualifier field). No further attempt was made to clarify that qualifier. There was also a period “.&quot; data qualifier under XMOD, and this undefined qualifier was ignored.</td>
</tr>
<tr>
<td>4</td>
<td>06/06/14</td>
<td>Roger Reynolds</td>
<td>Draft Tech Memo</td>
<td>Figure 1 page 7, Number of Wells with Nitrate or TDS Test by Decade and by Source – Comment: This Figure graphically shows that the number of wells monitored by CDPH are increasing while the wells monitored by DWR and USGS have been decreasing over the last 20 years or so. It may just be a budget issue, but why have the number of groundwater quality analyses from DWR and USGS been decreasing? It seems to mean that other than the groundwater quality data obtained under Dairy program that we are not maintaining an ongoing groundwater quality database in the other areas of Region 5.</td>
<td>Figure 1 page 7, Number of Wells with Nitrate or TDS Test by Decade and by Source – Comment: This Figure graphically shows that the number of wells monitored by CDPH are increasing while the wells monitored by DWR and USGS have been decreasing over the last 20 years or so. It may just be a budget issue, but why have the number of groundwater quality analyses from DWR and USGS been decreasing? It seems to mean that other than the groundwater quality data obtained under Dairy program that we are not maintaining an ongoing groundwater quality database in the other areas of Region 5. Interesting comment. It is outside the scope of this task to determine the ongoing nature of groundwater quality data collection by the various entities.</td>
</tr>
</tbody>
</table>
CV-SALTS Meeting Calendar

2014

### January
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### February
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### March
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### April
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### May
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### June
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### July
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### August
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### September
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### October
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### November
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

### December
1. **Sun**
2. **Mon**
3. **Tue**
4. **Wed**
5. **Thu**
6. **Fri**
7. **Sat**

**Notes**
- 2nd or 3rd Thursdays
- Dark Green Exec Comm Policy
- RWQCB Update **Bold Underline**
- Light Red conflicts
- Lt. Green Hatch Exec Comm Admin
- First or Second Friday
- Yellow Salty 5
- Lower San Jaquin River Committee
- TAC Meeting
- Dark in July & December for Policy
- **State Board Presentation 1/21/14**
- May 15 move to 22nd for CVCWA
- Nov 13 vs 20 due to Thanksgiving