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Joseph Simi
Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

RE: Comments on the Salt Tolerance of Crops in the Lower San Joaquin River (Stanislaus to Merced River Reaches) Draft Report

Dear Mr. Simi;

We commend the Regional Board for acknowledging the need for sight specific salinity objectives and there efforts to evaluate salt tolerance in both the South Delta and the Lower San Joaquin River. Further, we are pleased to provide the following comments to the Salt Tolerance of Crops in the Lower San Joaquin River (Stanislaus to Merced River Reaches) Draft Report.

Page 6 Section 2.2.2 Sodicity

The second sentence is erroneous as written, and the first sentence does not apply to sodicity. Sodicity is a measure of exchangeable sodium in a soil relative to the entire cation exchange capacity of a soil, as opposed to salinity which is a measure of salt content. Further, sodic soils are characterized by an exchangeable sodium percentage greater than 15 percent.

Sodicity is a major concern with respect to soil structure and permeability as a result of dispersion of clay minerals and organic matter. These concerns led to the development of SAR by the USDA Salinity Laboratory to evaluate irrigation water for potential to cause sodicity in soils. Generally, the potential for sodicity increases when irrigation water SAR increases above 3. This context needs to be provided to interpret Table 2.0 water quality data, since the table does not report soil sodicity.

There are two forms sodium affected soils, typical *Sodic* soils which require cation replacement and *Saline Sodic* which may only require removal of soluble salts.

Page 11 4th and 5th line

Hydrologic group does not describe characteristics of a fully saturated soil, rather it is based on physical factors that affect hydraulic properties of a soil. The Ksat is hydraulic conductivity under saturated soil conditions.

Pages 13 – 16 Table 2.1.
Ksat values exceed typical ranges of these soils, even for surface horizons. Moreover, for purposes relevant to soil salinity, limiting layer (slowest) saturated hydraulic conductivity should be reported.

Page 28 first paragraph
The percentages are somewhat confusing, please clarify using total acres (i.e. not reduced for mixed cropping) planted to beans in each decade.

Page 34 Section 3.3.2
The depiction of saline and/or sodic soils appears to be a relic of the Soil Survey's used. Saline and sodic soils all occur in the Eastern Stanislaus Area Soil Survey, which was mapped prior to being published in 1964, and incorporated salinity classes into map units. The 1992 San Joaquin Soil Survey and 2002 Stanislaus County, Western Part Soil Survey did not incorporate salinity classes into the map units. The lack of salinity classes in the later survey's is largely attributable to high variability in the salinity of a soil series associated with irrigation water source and management (e.g. Fresno slightly saline vs. Fresno strongly saline, same soil different salinity) and to advances in surface water supply and engineered drainage in the area since the 1960's. Soil chemical data collected and provided with the later soil surveys should be reviewed to determine if there are potentially saline and/or sodic soils in this greater portion of the irrigation use area.

Many of the soils in the irrigation use area naturally have low permeability in the subsoil and are susceptible to poor drainage. Further, much of the area on the west side of the river requires artificial drainage to minimize salt build up in the root zone as well as prevent water logging the soil. Thus, soil salinity in the area is related to the quality of irrigation water, the San Joaquin River, and the need for subsurface drainage. Moreover, widespread use of San Joaquin River water and subsurface drainage has likely resulted in lower soil salinity in the use area.

In addition to being problematic, sodic soils are indicative of soil conditions susceptible to extreme salinization, either naturally or anthropogenically induced. Their presence in the use are indicates the need for a higher level of salt management, including the potential that irrigation water could have too low of salinity. It should be noted that sodic soils generally develop where drainage is limited and evapotranspiration exceeds water applied, and sodicity can occur even with very low sodium content and SAR waters.

Page 40 Section 3.4.2
Soil survey reference needs to be checked, as it appears the 2002 Stanislaus County, Western Part Soil Survey was also used. Based on Figure 3.9a, it appears that the 1964 Soil Survey was not used for this determination. Review of the coefficient of linear extensibility (COLE) for soils mapped in 1964 would allow for evaluation of shrink-swell potential.

It is unlikely that the extent of shrink swell potential in the use area was overestimated. Shrink-swell potential is a factor of total clay content and clay mineralogy. Neither of which is anticipated to change significantly within a single soil series, such as the Capay. Further, the Capay is classified as a Vertisol, a soil order defined by shrink-swell processes.

Shrink-swell and bypass flow are a major process affecting water movement in the use area and needs to be addressed with respect to irrigation and soil salinity management. There is potential that high shrink-swell potential soils may require increased leaching fractions when compared to low shrink-swell soils to allow for leaching salts from the entire root zone. However, bypass flow in soil cracks may actually be beneficial to controlling soil salinity (see Crescimanno and Garofalo, 2006. Soil Science Society of America Journal 70:1774-1787).

Page 42 Table 3.5
Check Ksat values presented.

Page 46 Section 3.5.2
Based on widespread shrink swell potential in the use area, there is great potential that initial rainy season storms will be largely ineffective in providing moisture to the root zone. Additionally, high clay content and low hydraulic conductivities of the soils may increase surface runoff and reduce effective precipitation. Further, subsurface drains may remove precipitation that would otherwise be stored in the root zone.

Figure 3.11 shows at least five years where Png is below the Es, and several years have Png below 10 inches, the level necessary to reduce irrigation requirement by 4 inches.

Page 50 Section 3.6.2
The area irrigated by furrow irrigation is not shown in Table 3.7. However, based on the preponderance of gravity irrigation and the types of crops grown, furrow irrigation is widespread across the use area.

Page 53 Section 3.10.2
It should be noted that during May and June, crop salinity stress is potentially greater in Patterson than in Riverside. This would likely have a considerable effect on early stage growth of bean; However, little is known about salt tolerance of bean throughout the growing season.

Page 58 Section 3.11.2
The WATSUIT model was developed by the USDA salinity lab and is public domain available at http://www.ars.usda.gov/services/software/download.htm?softwareid=107

With respect to salinity, water quality of the San Joaquin River at Maze is better than at Patterson and Crows Landing. Further, water quality at Mossdale is generally better than Maze. The minor increase in salinity may affect precipitation and dissolution.

It should be noted that the dissolution of salts in the soil will increase the salinity of drainage waters discharged back to the San Joaquin River.

Page 59 Section 3.12.2
Well level data from the DWR is collected from wells with several purposes, and generally the wells are used for production. A production well will likely be screened at deeper interval than that associated with shallow groundwater. Therefore, data from these wells may not reflect the depth to shallow groundwater.

Page 64 Section 3.13.2
It appears that 11 of the 20 drains are within 1 mile of the San Joaquin River. Drains are primarily west of the San Joaquin River in areas presented as "not saline" in Figure 3.7a. There is no discussion with respect to depth of groundwater (Figure 3-17) nor the design or depth of the drains.

What basis is there for the higher (0.7 dS/m) and lower (0.5 dS/m) salinity irrigation water in calculating the leaching fraction?

Unless Hoffman reviewed the calculated leaching fractions for the LSJR and discussed them in his 2010 Report, the last sentence should be modified to present the range of Lr's in the South Delta, which are similar to those found for the LSJR.

Section 4
Nothing new or site specific is added to this section beyond the Hoffman Report.

Page 79 Section 5.1.4
Surface evaporation would be reduced when soil surface is dry and there is no precipitation (i.e. August, September, and potentially October), which would increase Peff and decrease the resultant soil salinity.

Bypass flow and surface (or sub surface) run off would reduce Peff and increase soil salinity.

Page 123 Section 7
Additional future evaluations should include the following:

1. Field studies of bean should be accompanied by comparison of uptake models to determine if one more closely predicts bean water uptake.
2. Potential leaching fractions should be evaluated as well as actual leaching fractions in the LSJR area to determine possible potential salinity control measures.

3. The extent of subsurface drains in the LSJR area should be evaluated, since several soils could not be properly managed for salinity if artificial drainage was not provided.
4. Further, the effects of soil salinity management on LSJR salinity should be evaluated.

Once again thank you for the opportunity to comment on the Draft Report. Please feel free to contact us to discuss this letter and the report. We look forward to a comprehensive report on salt tolerance in the Lower San Joaquin River.

Respectfully,

ECO:LOGIC

James Witty, CPSS
Soil Scientist