Memorandum

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TO: Michael Johnson, LSJR Committee Manager

COPY TO: LSJR Committee

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SUBJECT: **Site-Specific Total Dissolved Solids (TDS) to Electrical Conductivity (EC) Ratios in the Lower San Joaquin River (LSJR)**

This memorandum is being submitted on behalf of the Larry Walker Associates (LWA) Team[1] to solicit input from the Lower San Joaquin River Committee (LSJRC) related to site-specific TDS to EC ratios that could be used to convert TDS to EC concentrations (or vice versa) associated with the performance of Tasks 2b, 3a, 3b, and 4 specified in the Scope of Work for Development of a Basin Plan Amendment (BPA) for Salt and Boron in the Lower San Joaquin River.

BACKGROUND

The relationship between TDS and EC is a function of the proportion of anions and cations in the water. Different mixtures of anions and cations in water of a certain origin will impart a specific TDS to EC ratio (TDS/EC) to the water. This ratio is not necessarily static and can change over time. In general, the TDS-EC relationship is described by the following equation:

$$TDS = r * EC$$

Where r is a variable that represents the ratio of TDS to EC

Researchers evaluating TDS/EC ratios in the San Joaquin River Basin have found that the ratios can change by up to 15 percent (Holm et. al., 2007). Members of the LSJRC have alerted the

[1] The LWA Team consists of the following firms: Larry Walker Associates, Carollo Engineers, Kennedy/Jenks Consultants, Systech Water Resources, PlanTierra, Luhdorff and Scalmanini Consulting Engineers, Ascent Environmental, and Dr. Richard Howitt.

LWA Team to the need to consider site-specific TDS/EC ratios in the LSJR salinity objectives project area as a means to convert TDS to EC (and vice versa) in a manner that appropriately recognizes the local water quality characteristics of a certain location on the LSJR.

The Watershed Analysis Risk Framework (WARMF)[2] model simulates each of the major component ions of TDS and then adds them to get a simulated TDS. WARMF does not simulate EC, it multiplies modeled TDS by 1.67 to arrive at an estimated EC associated with a particular modeled TDS result. The TDS/EC ratio of 0.6 was developed from concurrent TDS and EC data measured in the San Joaquin River near Vernalis.

However, modeled TDS can be converted to EC outside of WARMF in a post-processing step to calculate EC for a particular location on the LSJR using a site-specific TDS/EC ratio. Evaluation of salinity in terms of EC is useful in that the measurement of EC in water is easily achieved with *in situ* monitoring equipment (field meters and remote sensors). It is also the general understanding that the Central Valley Regional Water Quality Control Board is looking to establish EC objectives, among others, for the control of salt in the LSJR.

SOLICITATION OF INPUT

Members of the LSJRC have provided the LWA Team with some publications that note site-specific TDS/EC ratios relevant to the project area, as shown in **Table 1**. The LWA Team requests that the LSJRC review the site-specific EC/TDS ratios provided in **Table 1** and:

1) Confirm their validity;
2) Select the most appropriate ratio where more than one ratio is listed for a particular location (see locations in italics); and
3) Provide additional TDS/EC ratios as needed for other locations in the project area.

Table 1: Site-Specific TDS/EC Ratios in the Lower San Joaquin River Salinity Objectives Project Area.

Location	Site-Specific TDS/EC Ratio	Source
SJR at Lander Ave.	0.64	CVRWQCB, 2004 (Appendix A)
Salt Slough	0.68	Quinn & Holm, 2013; CVRWQCB, 2004
Mud Slough	*0.69*	Quinn & Holm, 2013; CVRWQCB, 2004
Mud Slough	*0.74*	Quinn et. al, 2013
Merced River	0.66	CVRWQCB, 2004 (Appendix A)
Tuolumne River	0.67	CVRWQCB, 2004 (Appendix A)
Stanislaus River	0.69	CVRWQCB, 2004 (Appendix A)
SJR near Vernalis	*0.61*	CVRWQCB, 2004 (Appendix A)
SJR near Vernalis	*0.60*	Systech WARMF Model

[2] WARMF will be used by the LWA Team to perform a baseline salt loading analysis to the LSJR, conduct a compliance evaluation of existing water quality with proposed salinity objectives, and conduct implementation planning for salinity control in the LSJR Basin.

NEXT STEPS

The LWA Team requests that the LSJRC review the information provided in **Table 1** and provide any corrections or additions. The TDS/EC ratio identified by the LSJRC as the most appropriate for a given location will be used by the LWA Team for converting TDS to EC on a site-specific basis, as necessary, during the course of carrying out the tasks specified in the Scope of Work for Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River.

REFERENCES

California Regional Water Quality Control Board, Central Valley Region (CVRWQCB). 2004. Technical TMDL Report for Salt and Boron in the Lower San Joaquin River: Appendix 1 – Draft Final Report. July.

Holm, L., S. Harader and P. Fernandez. 2007. Conceptual Model for Salinity in the Central Valley and the Sacramento-San Joaquin Delta. CALFED Bay-Delta Program, Water Quality Program.

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Quinn, N.W.T, J. Herr, K. Van Wekhoven, T. Connor, N. Borel, H. Bergstrom, and T. Murakami. 2013. Opportunistic Real-Time Management of Saline Drainage Conjoined with San Joaquin River Restoration – Final Report. October.