Appendix S – Lookout Slough Tidal Habitat Restoration and Flood Improvement Project – Potential Salinity Impacts Assessment, Environmental Science Associates, April 2019.

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memorandum

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to David Urban, Ecosystem Investment Partners

from Matt Brennan, PE; Daniel Huang

subject Lookout Slough Tidal Habitat Restoration and Flood Improvement Project – Potential Salinity Impacts Assessment

The proposed Lookout Slough Tidal Habitat Restoration and Flood Improvement Project (Project) will restore approximately 3,000 acres of freshwater tidal marsh in the Cache Slough Complex of the Sacramento-San Joaquin River Delta (Delta). The purpose of this memorandum (memo) is to briefly summarize the effects of the Project on the salinity regime in the Delta predicted by hydrodynamic modeling results and to interpret the potential implications of those modeling results for the Environmental Impact Report (EIR) to be prepared for the Project.

The Delta is a tidal estuary which is influenced by salt from the Pacific Ocean, conveyed through San Francisco Bay and into the Delta because of the continuous tidal exchange. Diverters of water from the Delta – which include the State Water Project (SWP), Central Valley Project (CVP), the Contra Costa Water District (CCWD), and local agricultural users – depend on freshwater flows from the Sacramento and San Joaquin River to offset the extent of saltwater intrusion into the Delta. Flows in the Delta are managed via upstream reservoir releases, export pumping, and in-channel control structures (e.g., the Delta Cross Channel), in part to meet various water quality objectives, including salinity. Delta salinity levels are important to various Delta users: municipal, industrial, agricultural, and fish and wildlife. Salinity extends further into the Delta during drier seasons and years since low freshwater inflows into the Delta are diminished and less water is available to release from reservoirs to offset the salinity intrusion.

At Lookout Slough, the proposed Project would involve breaching and lowering existing levees and excavating a tidal channel network, thereby re-introducing daily tidal flows to the Project site. This restored tidal exchange would also change flow patterns in the Delta channels outboard of the Project site. Because these tidal flows also distribute salinity within the Delta, these alterations in flow patterns could affect salinity levels in the Delta. Salinity increases are a concern to various municipalities, industries, agricultural interests, and resources agencies that depend on the availability of freshwater to maintain existing beneficial uses.

As described in more detail below, salinity modeling predicts that the effects of the Project on salinity would be less than significant. This finding applies to impact analyses for drinking water quality, irrigation water quality for Delta agricultural users, and fish and wildlife habitat conditions from changes in salinity resulting from the

Project. Furthermore, the incremental impact of the Project on salinity would not be cumulatively significant when also considering other tidal marsh projects in the Delta being planned concurrently with the Project.

OVERVIEW OF SALINITY MODELING

Salinity is evaluated as the measure of total dissolved solids (TDS) concentration in water determined by passing a sample through a filter, evaporating the water, and determining the mass of the salts left behind. Because the analytical methods used to measure salinity are time-consuming and expensive when many samples are needed, direct electrical conductivity (EC) measurements coupled with region-specific relationships between EC and TDS are often used in place of direct salinity sampling. Delta water quality management regulations and compliance monitoring are based on EC. Because EC is the operational surrogate used for regulation and monitoring, Bay and Delta modeling typically provide predictions of EC, not salinity, as outputs.

Resource Management Associates, Inc. (RMA) was tasked with modeling the Project's effect on the Delta salinity regime using their RMA Bay-Delta model. This model simulates the flows in the Bay and Delta that are driven by ocean tides, riverine inputs, and water diversions. The model then uses these flows to predict the distribution of EC, as a surrogate for salinity. The modeling scenario for this study replicates all of 2009, which is representative of typical dry year conditions, when achieving Delta salinity standards is often a challenge.[1] RMA conducted salinity simulations for four scenarios: 1) existing conditions, 2) existing conditions with Project, 3) proposed regional restoration projects without Project, and 4) proposed regional restoration projects with Project. By comparing these runs in pairs, the modeling provides predictions of the potential EC changes due to the Project, both relative to existing conditions and cumulatively with other restoration projects.

In the next sections, after describing the likely CEQA thresholds of significance, the modeling results are interpreted in terms of CEQA impacts analysis.

CEQA THRESHOLDS OF SIGNIFICANCE

For CEQA purposes, a threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect. An effect will normally be determined to be "significant" by the CEQA lead agency when a project results in non-compliance with this threshold. Compliance means the effect normally will be determined to be "less than significant." As the CEQA lead agency, DWR can develop and publish their own thresholds of significance. However, DWR typically uses a slightly re-phrased version of the standard checklist questions included in Appendix G of the CEQA guidelines, by converting the language from Appendix G from interrogative sentences to declarative sentences. As such, with regards to assessing the effects of changes in salinity for CEQA, the most important significance criteria are "result in substantial adverse effects on beneficial uses of water" and "violate existing water quality standards, waste discharge requirements, or otherwise substantially degrade water quality." Based on how DWR has recently analyzed the impacts of tidal wetland restoration projects on salinity (e.g., Prospect Island, Winter Island, Decker Island), the determination of whether

1 Note: In wet years, salinity issues are generally not considered a problem; in critically dry years, freshwater supplies are often so limited that they constrain the ability to achieve salinity standards through management actions.

a change is considered "significant" depends on whether there would be an exceedance of a standard set forth in the State Water Resources Control Board's (SWRCB's) Bay-Delta Water Quality Control Plan (Bay-Delta Plan) and/or Water Rights Decision 1641 (D-1641)[2].

CEQA IMPACT ANALYSIS

The approach for how the salinity effects of the Project will be presented in the EIR will be influenced by public input received during public scoping meetings and via comment letters. This memo assumes that the EIR water quality section will include a discussion regarding how the Project's effects on salinity will affect drinking water quality and agricultural water use – and that the EIR biological resources section will include a discussion regarding how changes in salinity would affect Delta aquatic species. The following provides brief summaries of the RMA's salinity modeling results and its implications for these three topics. (Note that these summaries include some repetition, because we assume that they may be the basis for different, non-continuous sections of CEQA documentation).

Degradation of Drinking Water Quality Due to Alteration in Salinity Levels in Delta Waters

As a result of the restoration of tidal wetland habitat at the Lookout Slough Project site, the Project site will experience greater tidal exchange, and flows in the outboard Delta channels will be altered. These changes could alter the salinity regime in the Delta. Increased Delta salinities could negatively impact drinking water quality.

RMA analyzed the potential salinity impacts of the Project, using a modeling scenario based on calendar year 2009, representative of a dry year. By comparing EC for the existing conditions scenario with the Project conditions, the modeling provides a quantitative evaluation of the salinity changes.

D-1641 established multiple compliance monitoring stations to protect drinking water beneficial uses, which include: Contra Costa Canal at Pumping Plant 1 (C5), Clifton Court Forebay (C9), the Delta Mendota Canal entrance (DMC1), the North Bay Aqueduct at Barker Slough (SLBAR3), the City of Vallejo intake at Cache Slough (C19). Additionally RMA analyzed changes in salinity at the CCWD intakes at Mallard Slough, Old River, and Victoria Canal.

Given the dynamic nature of a tidal system, the effects of restoration on salinity at Delta drinking water intakes were expected to be small compared to other factors such as precipitation, Delta inflow, and tides. The RMA modeling backs up this assessment. The modeling predicts reduced EC at Barker Slough NBA intake (reductions up to 5 percent) and CCWD intake at Mallard Slough (reductions up to 1.2 percent). All the other stations are predicted to have increased EC of up to 1.6 percent for at least one month per year, with the largest increases

2 Water Rights Decision 1641 (D-1641) (SWRCB 2000) is part of SWRCB's implementation of the 1995 Bay-Delta Water Quality Control Plan (Bay-Delta Plan) and is considered the relevant water quality standards to assess salinity impacts. In D-1641, the State Water Board concluded that the exports in the south Delta were partially responsibility for salinity problems in the Delta as a result of hydrologic changes caused by export pumping. D-1641 includes water right permit terms and conditions to implement water quality objectives to protect beneficial uses. D-1641 contains flow and water quality objectives that must be measured at various compliance monitoring stations through the Delta.

typically occurring in the fall. The RMA modeling indicates that even for sites that would experience a slight increase in salinity as a result of the Project, the level of salinity would still be in compliance with D-1641 standards.

Therefore, based on the RMA modeling results, Project salinity changes would not result in substantial adverse effects on the beneficial use of Delta waters as a drinking water source; and there would be a less than significant effect on the degradation of water quality for drinking water due to alteration in salinity levels.

Degradation of Water Quality for in-Delta Agricultural Water Users Due to Alteration in Salinity Levels

The Project has the potential to affect water quality for in-Delta agricultural irrigation users by increasing salinity concentrations at their agricultural diversion intakes. Irrigation water that is more saline can negatively impact crop yields.

RMA analyzed the potential salinity impacts of the Project, using a modeling scenario based on calendar year 2009, representative of a dry year. By comparing EC for the existing conditions scenario with the Project conditions, the modeling provides a quantitative evaluation of the salinity changes.

The D-1641 stations for agricultural beneficial uses include Sacramento at Emmaton (D22) and San Joaquin at Jersey Point (D15).

The RMA modeling results for stations D22 and D15 indicate that under the 2009 modeling scenario, EC levels would be slightly reduced for most of the year compared to existing conditions. These slight EC reductions are largest during the months of August through October, when the reductions are still less than 5 percent. The only predicted increases in EC with the Project at D-1641 stations designated for agricultural beneficial uses occur in March for the D22 station and in May for station D15, although the net increases were very slight (<0.5 percent). Furthermore, these net short-term increases would not exceed any D-1641 compliance requirements that protect agricultural beneficial uses.

Therefore, based on the RMA modeling results, there would be a less than significant effect on the degradation of water quality for agricultural irrigation purposes due to the Project.

Degradation of Water Quality for Fish and Wildlife Due to Alteration in Salinity Levels

D-1641 includes salinity standards as a part of suite of water quality conditions intended to protect a more natural distribution of species composition and wildlife habitats across the Suisun Marsh and Delta. These standards are intended to maintain water quality conditions to prevent the following: a) loss of biodiversity, b) conversion of brackish marsh to salt marsh habitat; c) decreased population abundance of wildlife species and/or loss of habitat from increased salinity, and d) significant reductions in plant stature or percent cover from soil salinity or other water quality issues.

RMA analyzed the potential salinity impacts of the Project using a modeling scenario based on calendar year 2009, representative of a dry year. By comparing EC for the existing conditions scenario with the Project conditions, the modeling provides a quantitative evaluation of the salinity changes.

The D-1641 stations for fish and wildlife beneficial uses are: D15 (San Joaquin at Jersey Point), D29 (San Joaquin at Prisoners Point), and C2 (Sacramento at Collinsville).

Based on the RMA modeling results, salinity at these three stations would change with the Project by at most 3 percent as compared to existing conditions. The largest changes are predicted to be decreased EC at D15 of about 3 percent during July and August. The largest EC increases, of about 2-3 percent, are predicted for D29 during September through November. The salinity changes projected for Station C2 include both increases and decreases, depending on the month, but remain less than 1 percent. When these changes are considered relative to D-1641 standards, the Project would not result in any exceedance of the EC standards that are protective of fish and wildlife beneficial uses.

X2 represents the distance, measured in kilometers upstream from the Golden Gate Bridge, to where salinity measured one meter off the estuary's bed is 2 parts per thousand (ppt). In the past, X2 has averaged around 74 kilometers inland from the Golden Gate, although when tides are stronger and/or downstream flows weaker, X2 may extend as far inland as Rio Vista. X2 demarcates the low salinity zone where freshwater transitions into brackish water. This zone is historically associated with higher primary productivity, zooplankton populations, and abundances of native estuarine species. When X2 is more inland, the low salinity zone is smaller due to the constriction at the confluence of the Sacramento and San Joaquin River channels. When X2 is more seaward, the low salinity zone is larger because it can spread out over more of the Suisun Bay and Marsh region. When X2 is lower in value, and hence more seaward, the populations of many aquatic species, such as fish, typically have increased abundances. D-1641 requires the location of X2 to be west of certain specific locations for a specified number of days each month (specifically, Collinsville, Chipps Island, and Port Chicago at 81 km, 75 km, and 64 km, respectively, from the Golden Gate).

Based on the salinity modeling RMA conducted, the Project would very slightly shift the position of X2 seaward for all months of 2009, as compared to existing conditions. The largest shift, less than 0.2 km (650 ft) seaward, is predicted for an October 2009 scenario with the Project in place. The shifts in X2 from the Project are seaward, the direction of X2 shift that is correlated with improved habitat conditions for many native Delta species. These shifts in X2 position are so slight they are unlikely to cause meaningful beneficial or adverse impacts for fish and wildlife habitat.

Overall, based on the RMA modeling results, there would be a less than significant effect on the degradation of water quality for fish and wildlife due to alteration in salinity levels from the Project.

Cumulative Impacts

CEQA requires an evaluation of a project's contribution to cumulative impacts, which are two or more individual effects that, when considered together, are considerable or increase other environmental impacts. The Project, when combined with other planned tidal wetland restoration projects in the Delta and Suisun Marsh, has the potential to cumulatively alter salinity patterns in the Delta.

As described previously, based on salinity modeling conducted by RMA, the Project would result in minor alterations in salinity under dry year conditions (modelled using calendar year 2009) at the vast majority of D-1641 monitoring compliance stations. At certain stations for specific months of the year, salinity may increase up to 3 percent with implementation of the Project (at station D29), however no compliance issues with D-1641 requirements are projected to occur.

Planned tidal wetland restoration efforts have the potential to collectively make changes in salinity more prominent. To account for these effects, RMA analyzed the effects of over a dozen other tidal wetland restoration projects in the Delta and Suisun Marsh planned for restoration concurrently with the proposed Project, including Winter Island, Wings Land, Tule Red, McCormack Williamson Tract, Lower Yolo, Dutch Slough, and Prospect Island. The combined effect of the Project on Delta EC in combination with other planned tidal wetland restoration project can at times of the year be appreciable for certain D-1641 monitoring compliance stations when compared to existing baseline conditions without these Delta restoration projects in place (e.g., greater than 8 percent increase in EC for an October 2009 scenario at Station D29); nevertheless, even with the combined effects of the Project with other restoration projects currently under planning, Delta salinities would remain in compliance with D-1641 requirements. Therefore, the Project's incremental effect on salinity in the Delta would not be considerable and the cumulative impact is less than significant.