Northern Delta Salinity Responses

Project Implications on Flows and Salinity

Erik Ringelberg

Current Conditions

Northern Delta: Extending from Rio approximately to the City of Sacramento.

Figure 1. DWR 5 errata 25, DWR 515

Outflow Control

Tidally controlled-twice a day tidal signal from the Pacific, through San Francisco Bay, Suisun, and up the rivers and sloughs.

Relatively high energy tidal flow upriver can dominate Sacramento River outflow and allow salinity to migrate (advect) upriver. We understand and track that salinity through Electrical Conductivity (EC).

Salinity-EC

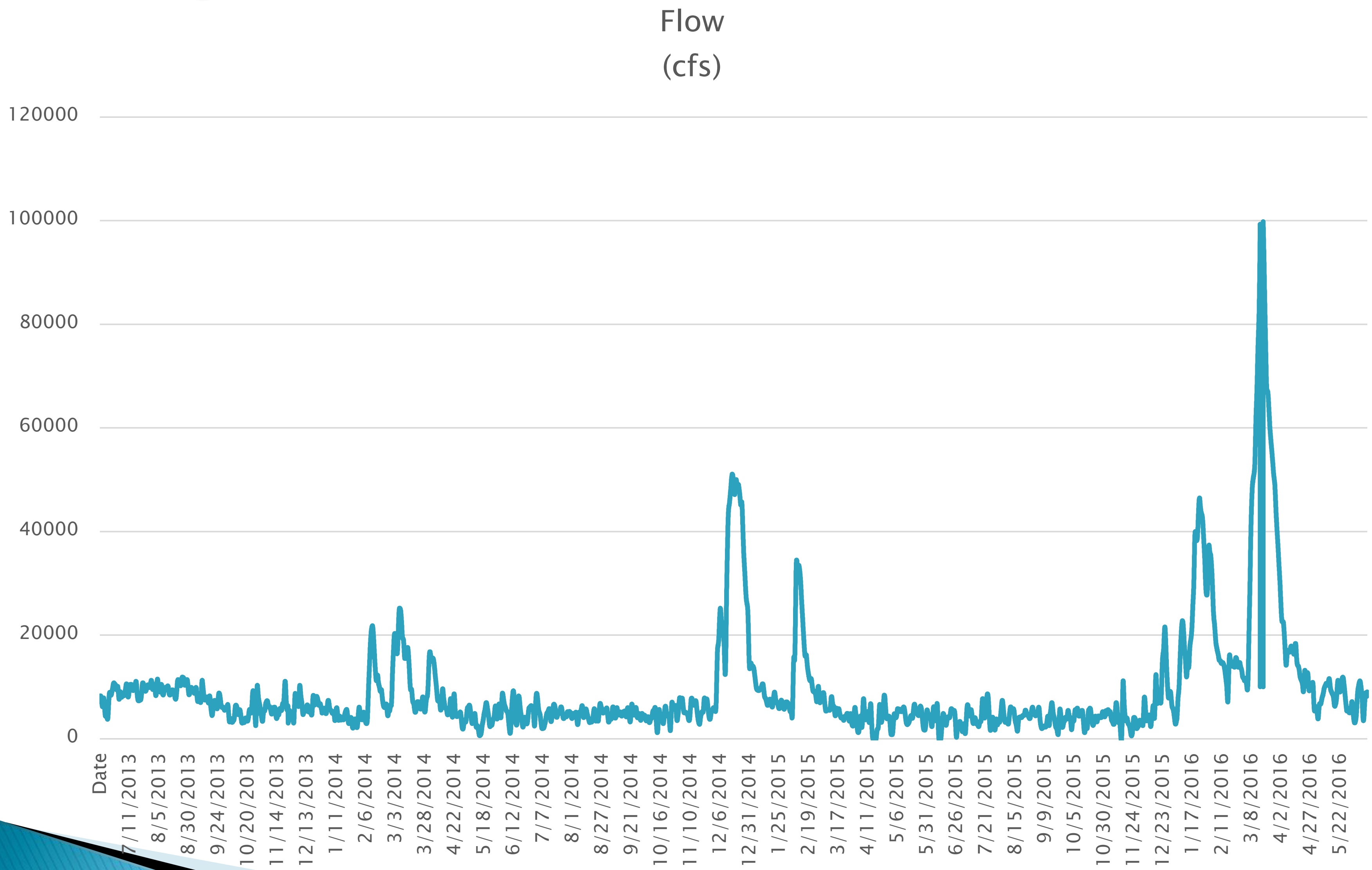
Instead of looking at just chloride (Cl) or the sum of soluble salts, we use a simple and easy to measure surrogate of Cl. EC is correlated to salinity and allows for field measurements in real time (no lab work) that can go from the river or slough, to the diversion, to the field ditch, and to the soils of that field. Hundreds of years of study have identified how soils and plants respond to salinity, and research correlates those responses to EC.

Figure 2.

Current Conditions

Project ops mirror drought

Drought Flows (2013-6) @ Rio Vista



Outflow Control

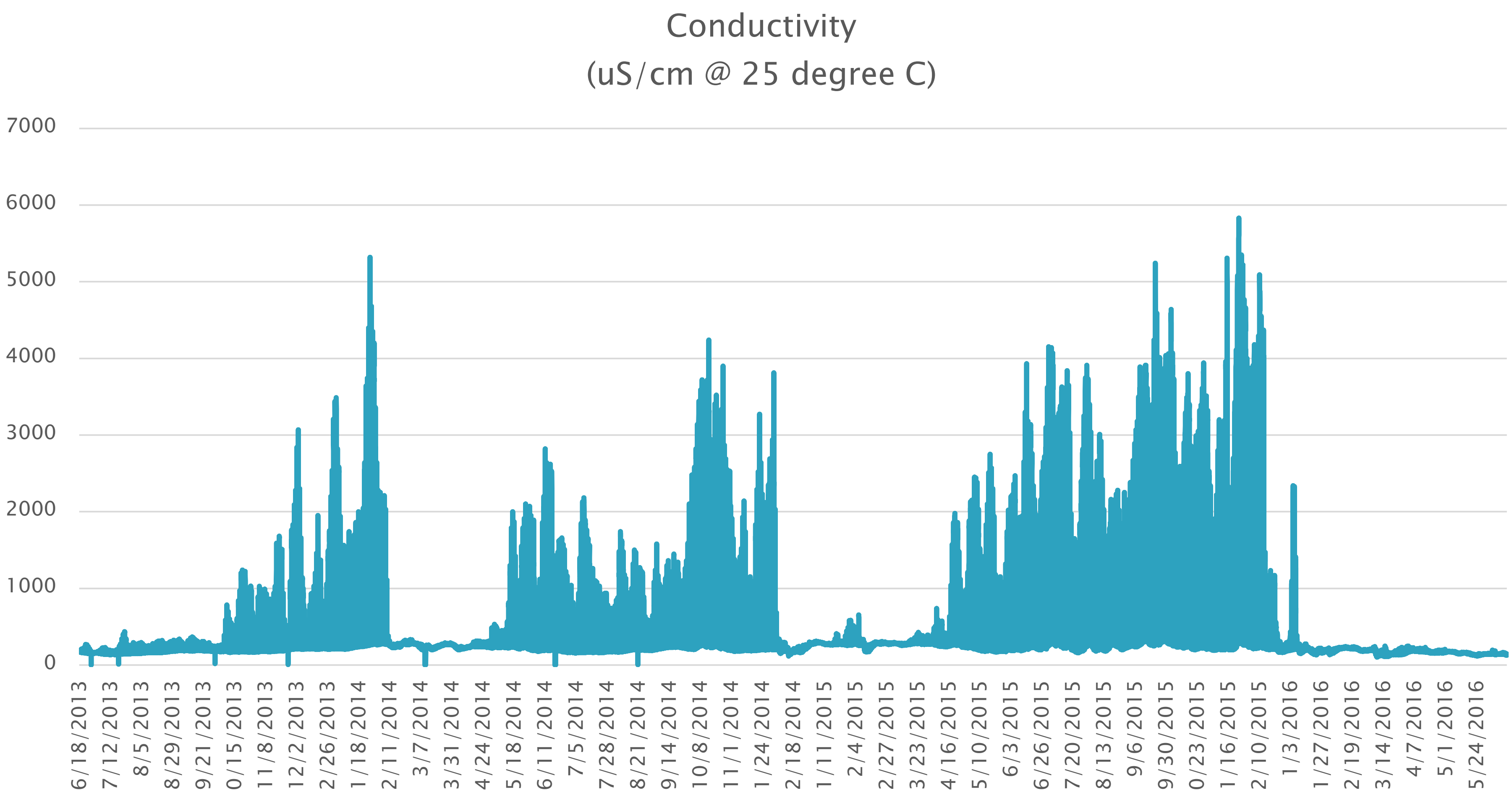
Salinity gradient is controlled by freshwater outflow, and changes constantly due to tides (and monthly and seasonal tidal differences). This is most obvious in droughts.

Current Conditions

Project ops mirror drought

EC LIMITS 700 1000

Drought EC@ Rio Vista



Averages and Reality

Using averages to describe the salinity at a given location is a compromise of convenience. Since the tides changes daily, there are a range of salinity values expressed over a day. A mean is the midpoint of that range and does not and is not intended to describe the ecological or agriculturally important salt concentration.

For the ecology it is the exceedance of the physiological tolerance range at the organismal level or at the competitive success at the community level. For agriculture it means that the water diverted for crop use, salinity control and wildlife management can significantly impair productivity and lead to salt buildup.

Averages and Reality

For agriculture, it is the timing of the salinity during the agricultural growing season, pre-irrigation and salinity flushing. The important level in both these cases is the peak salinity, and for the season, the area under the curve that leads to the seasonal loading, which is the sum total of the salinity load (net).

DWR 5, last 2 calsim exhib

Proposed Project

Diversion of Sacramento River flows according to some bounds, no more than 9,000 cfs, typically xxx, and 900 cfs constant pumping. Operations influenced by many factors, but one, two or three north Delta intakes can beoperated over a range of flows until that maximum can be reached, essentially interoperation of the facilities North and South can occur, Delta Cross Channel (DCC) can be open or closed.

In addition to those general factors, the temporary barriers can be installed on sloughs, the Yolo Bypass can flow, and of course salinity standards and/or points of compliance can be modified. Each of these factors influence circulation of water within the Delta and have direct and indirect effects on salinity.

Proposed Project

For example, flow routing through the DCC, and dam operations yield lower salinity in portions of the South Delta, while at times creating reverse flows that draw in greater flows from Suisun into the western Delta. Delta diversions and exports to the San Joaquin Valley can result in greater San Joaquin flows, which have a higher salinity concentration in their return flows. Agriculture, wetlands, stormwater runoff and simple evaporation can result in salinity within the Delta.

Project Salinity

Project impacts on salinity are difficult to ascertain for a variety of reasons:

- Use of comparative rather than operational or predictive models to bound changes in EC.
- Use of model data for D-1641 compliance, not for operational impacts on agriculture.
- Use of averages, use of old data, and weak calibration and correlation to contemporary drought conditions.
- Use of rolling averages as compliance.

Project Salinity

The Project could complete the type of modeling that would demonstrate predictive impacts under operational scenarios that bound the project maximum salinity impacts to the North Delta, but despite repeated requests overs several years to do so, still not provided.

A bounding scenario would be the months of July-November, king tide, dry and very dry water year, third and fourth years of drought, Winter Salmon Run temperature protection, 0/1/2 barriers installed. These are not hyperbolic bounds, but are exactly what occurred in the last two years in the Delta.

Salinity Conclusions

What can we infer from what was provided by the Project?

The project can take flows at xx cfs in Dry years and xx cfs in critically dry years. The DCC can remain open for periods during that time, and that
salinity would increase through advection as a result of those lower flows, and increase to similar levels as were seen in the last 3 years of the drought with Southern Delta operations. If operational constraints to protect Central/South Delta fish remain, and are indeed on of the project purposes, the sustained operation of the North Delta diversions would institutionalize drought-like flow conditions, and therefore EC in the Delta.

Questions?