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Diablo Vineyards and Brad Lange / Delta Watershed Landowner Coalition
Stillwater Orchards / Delta Watershed Landowner Coalition

BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING IN THE MATTER OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UNITED STATES BUREAU OF RECLAMATION REQUEST FOR A CHANGE IN POINT OF DIVERSION FOR CALIFORNIA WATER FIX

TESTIMONY OF ERIK RINGELBERG

Joint Case in Chief of: Islands, Inc., Delta Watershed Landowner Coalition, Bogle Vineyards, Diablo Vineyards, Stillwater Orchards and Local Agencies of the North Delta

I, Erik Ringelberg, do hereby declare:

I. INTRODUCTION

I am an environmental scientist with technical and managerial experience in developing, planning, and permitting large projects, assessing their environmental impacts, and, where necessary, developing mitigation measures. I have applied scientific experience in the assessment of water quality in both the field and in the laboratory, and have experience managing multi-disciplinary teams in the assessment of ecological baseline conditions and assessing the results of managed hydrologic regimes leading to water quality impacts.

As an environmental scientist, I have completed analyses of the Bay Delta Conservation Plan (BDCP) and its various permutations since 2008. Over those eight years, I have been asked to provide oral and written comments by the Local Agencies of the North Delta with particular emphasis on the technical considerations of project features that would impact water quality, terrestrial and aquatic ecology, and the rural agricultural community. Prior to those efforts, I provided support to the Pyramid Lake Pauite Tribe on its management of Pyramid Lake habitat and water quality. That work included managing sampling teams and a water quality laboratory that completed algal chlorophyll, nutrient, and other water quality analyses to assess the condition of the alkaline desert terminal lake.

My educational background and other qualifications are summarized in the Statement of Qualifications submitted concurrently herewith. Ex. II-22. My Powerpoint presentation Summary submitted concurrently herewith. Ex. II-24.

II. OVERVIEW OF TESTIMONY

My testimony is intended to provide scientific analysis and conclusions about the likely project impacts on water quantity and quality as it relates to the Sacramento River downstream of the proposed intakes within the Delta.

A. Project Salinity Influences--Summary

I was tasked to assess the proposed California Water Fix Petition for Change before the State Water Resources Control Board to identify from a scientific perspective if the project had potential to negatively affect beneficial uses from increased salinity in the Delta, and if so, what were those potential negative effects.

For most locations in the Delta, the beneficial uses relevant to project impacts to water quality related to salinity intrusion are identified in the Basin Plan as follows: Municipal and Domestic Supply; Recreation-Contact; Agriculture- Irrigation and Stock Watering, and also including, although not expanded upon in detail in this analysis, Freshwater Habitat- Warm and Cold, and Wildlife. (SWRCB-27, CVRWQCB, 2006) The following is an analysis of the Project's potential impacts on these beneficial uses related to salinity intrusion.

B. General Overview –Delta Salinity

1. Historic Delta Salinity

Contra Costa Water District (CCWD) has studied modern Delta salinity and its changes over time due to development at length. (See Exs. II-26 and II-27. CCWD 2009 and 2010 respectively) CCWD identifies in both summary form and in exhaustive detail how salinity patterns in the Delta have been altered over the modern development period and how physical changes to the system have both altered the geometry of the system, and the hydrology of the system. An important analysis created by the State identifies the sensitivity of the region to salinity intrusion and the commitments by the state to ensure that that does not happen. (II- 32, Bulletin 76.)

2. Current Delta Salinity

Salinity levels in the Delta are 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. The salinity gradient is controlled by freshwater outflow, and changes constantly due to tides (and monthly and seasonal tidal differences). This gradient movement from the San Francisco Bay into the Delta is most obvious in droughts. We understand and track that salinity through Electrical Conductivity (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 modern research correlates those responses to EC.

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 average of that range and does not, and is not, intended to describe the ecological or agriculturally important salt concentration. For the ecology, the highest salt concentration (not the average) relates the exceedance of the physiological tolerance range at the organismal level or at the competitive success at the community level. For agriculture, the highest concentration (not the average) of the water diverted for crop use, salinity control and wildlife management can significantly impair productivity and lead to salt buildup. The average can influence the total load of the salt and effect leaching, but it is the absolute instantaneous concentration during irrigation that is critical, not the average.

For example, it is the timing of the salinity during the agricultural growing season, pre-irrigation and salinity flushing that are important. 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).

C. Proposed Project Operations

Proposed operations are influenced by many factors, but it is physically controlled by one, two or three north Delta intakes. These intakes can be operated over a range of flows until that maximum can be reached, interoperation of the facilities North and South can occur, Delta Cross Channel (DCC) can be open or closed. The project design, at the engineering level however has a requirement for full 9,000 cfs diversion at low River flows (DWR-212, CER. 2014)

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.

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.

As explained in greater detail below, I have concluded that the proposed project diversion in the North Delta under certain project scenarios will establish essentially the equivalent of drought conditions, and their associated lower flows, in the Delta by removing significant flow of the Sacramento River during critical agricultural water use periods (for planting and maintenance during late spring and summer, and for salinity control and wetland management, fall) for salinity control.

From the limited summary flow data provided in the application, it appears that the flows immediately downstream of the intakes would be altered in the following manner (DWR-515 and DWR 5 errata, Pg 25-6):

- 6,000 cfs, 300 cfs would be diverted, leaving 5,700 cfs in the river.
- 15,000 cfs, 3,000 cfs would be diverted, leaving 12,000 cfs in the river.
- 22,000 cfs, 9,000 cfs would be diverted, leaving 13,000 cfs in the river.

These flow rules represent a flow reduction up to to 41%. Under these rules, the flow, for the vast majority of the time, would be constrained from 5,700 cfs to 13,000 cfs. These flows are directly equivalent to the range of flows at Freeport during critically dry year (mean 9,345 cfs 1922) to a dry year (mean 16,003 cfs 1989). (II-29, ICF 2016, Pg. 2-3). In plain language, the project rules create a drought-equivalent conditions on the Sacramento River. The project analysis in these same references essentially assert that these are simply operational rules and that the project would be managed dynamically. This is factually correct, but misleading. The operations are defined by the boundaries of the rules, that is why they exist. The operations themselves would be able to control the rate and timing of the new diversion. But the expressed project purposes are to use the new intakes as much as possible to improve water quality of the diverted water, and to minimize use of the existing pumps during periods with biological considerations. Operationally, then, there is every advantage from an export water quality and a delta smelt fisheries perspective to using the new point of diversion. Therefore, the operational rules described above are the only limitations on diversions at the new intakes.

As validation of my conclusions regarding diversion flow rules, the scenarios that were provided as illustration of the project modeling analysis ~~archive to~~ achieve the same diversion rates as the maximum diversion rules: 1978, which was also classified as a dry year is modeled with a flow in the river of 14,000 cfs, and a 6,000 cfs diversion, leaving 8,000 cfs in the river with a 43% flow reduction. The same modeling shows that even in an above normal year (1993), at a flow of 21,000 cfs, 9,000 cfs is diverted, leaving 12,000 cfs in the river, (DWR-5 errata, Pg 25-6).

These models are simply intended to demonstrate compliance and are not predictive, but the Petition treats them as if they were de facto predictions of how the project would meet standards under operational conditions in particular water year types. They are not predictive, and it appears that they even fail from a comparative sense, given their baseline assumptions and a lack of sensitivity during low flow conditions, such as what are being proposed by the Petition. (II-30, Smith, 2014)

These rules and their associated modeling illustrate that the project's new point of diversion will reduce flows in the Sacramento River to the same flows as occur in droughts, namely critically dry and dry years. This reduction of flow to essentially drought conditions has profound effects on the entire Delta. The Central and South Delta currently gets Sacramento River flows from both the DCC operations, as well as Georgianna Slough, and from the draw of the existing southern diversion pumps when San Joaquin River flows are low. By taking the flow from the north, less flow is available for salinity control from the point of diversion to the south, and less freshwater from the Sacramento is drawn into the Delta in general. This allows the brackish water to radiate inward into the Delta, but also provides less flushing within the Delta to remove accumulated salts from irrigation, wetlands and wildlife management. That accumulation works in concert with reduced outflow salinity control by the Sacramento River to increase salinity throughout the Delta.

These same conclusions have already been drawn by independent researchers:

> Withdrawing water from the system into an isolated water-conveyance facility, such as the currently proposed twin tunnels, would also alter transport throughout the delta. If built, net flows throughout the north and western Sacramento–San Joaquin River Delta would be proportionately reduced by the amount withdrawn into the conveyance facility, increasing the influence of the tides throughout the delta. …In the coming decades, the flow-station network can provide data that address uncertainty concerning the location of proposed water-conveyance facilities and that, after they are built, document the effects of these new water-conveyance facilities, management actions, and habitat-restoration efforts."
> (USGS Fact Sheet 2015-3061. 2016)

Therefore, to understand what those institutionalized drought conditions would look like, we need to look at the flows and EC's at the most hydrologically "open" point of the Delta during the drought, Rio Vista. Rio Vista has a USGS water quality station with a long period of record, and it is centrally located where both the north and central Delta are influenced by river and slough connection to ocean-associated salinity.

As shown in the provided exhibits, (Ringelberg Attachment A. to my testimony) flows at Rio Vista had numerous very high EC values over the past 3 years, but because of the 14-day running average under D-1641 (Figure 1.), and the TUCP, these were not considered to be exceedances in many cases. For illustration, EC is provided for that period at USGS Station 11455420, followed by the same time period for flow (Figures 2 and 3 respectively). To put this into perspective, each of the tributaries has a relative flow into the Delta, and the existing DCC and the south Delta pump operations also contribute to variations in the relative contribution. These contributions are "fingerprinted" which provides an understanding of the relative contribution over time (Figure 4.).

The salinity intrusion created massive spikes in EC. Those spikes are readily diverted onto agricultural fields for use for irrigation water, ironically salinity control, and for wetland and wildlife management. The difference in salinity concentrations are not visible and the operator cannot readily tell that this condition is happening while it is being applied to the field. Once salt loading occurs in the field, it takes expensive and complicated techniques to assess the degree of impacts and means of mitigating it, if possible.

D. Defects of Project Analysis

The 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 known errors at low flows and without correlation to contemporary drought conditions.
- Use of 14-day rolling averages as compliance, instead of actually assessing AGR impairment, LF fraction.

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 over several years to do so, DWR still has not provided the necessary information. 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.

Despite those analytical defects, we can decipher some key elements from the overall analysis:

The project can thus take significant flows in above normal, normal, dry and 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 Delta smelt remain, and are indeed on of the project purposes, the sustained operation of the North Delta diversions would institutionalize permanent drought-like flow conditions, and therefore high EC levels in the Delta.

III. Summary Conclusions

Under several of the project scenarios (essentially all water year conditions with less flows than above normal), the proposed project diversion in the North Delta will establish essentially permanent drought conditions in portions of the North Delta by removing up to half of the equivalent normal flow of the Sacramento River under certain project scenarios, and significant fractions of the flow at other times, resulting in salinity intrusion from downstream sources.

The project's impacts associated with lower flows from the withdrawal of water in the Freeport area, Delta Cross-channel operational impacts (lowering or influencing flows further in the Sacramento River sloughs and Cache Slough complex) will change the circulation and retention of salt, leading to complex interactions throughout the Delta. The project has failed to provide fine scale modeling for key agricultural intake locations within the Delta in support of its conclusions, and even the coarse scale modeling it did provide is insufficient to provide any predictive ability to show that it does not harm beneficial uses and in particular agricultural water users with sensitive crops.

It is my opinion that the petitioners have not adequately analyzed the project impacts as they relate to salinity intrusion and chronic salinity loading and the impacts that these conditions would create for legal users of water in this part of the Delta. That analysis is possible, but the Petitioners failed to do so. Furthermore it is clear that the petitioners have not substantively addressed the project operational impacts and the potential for individual and aggregate impacts to farms and municipal uses through their diversion of this water should the Waterfix be approved as described.

I declare under penalty of perjury under the laws of the State of California that the foregoing statements are true and correct.

Executed on the 1st Day of September at Rancho Cordova , California.

____

Erik Ringelberg

CITED REFERENCES

CVRWQCB [California Central Valley Regional Water Quality Control Board] 2006. The Water Quality Control Plan (Basin Plan) for the California Regional \ Water Quality Control Board Central Valley Region. Fourth Edition. Rev Apr. 2006. The Sacramento River.

Attachment A. Ringelberg Testimony- Additional Salinity References

Figure 1. 14-day Synthetic Running Average D-1641

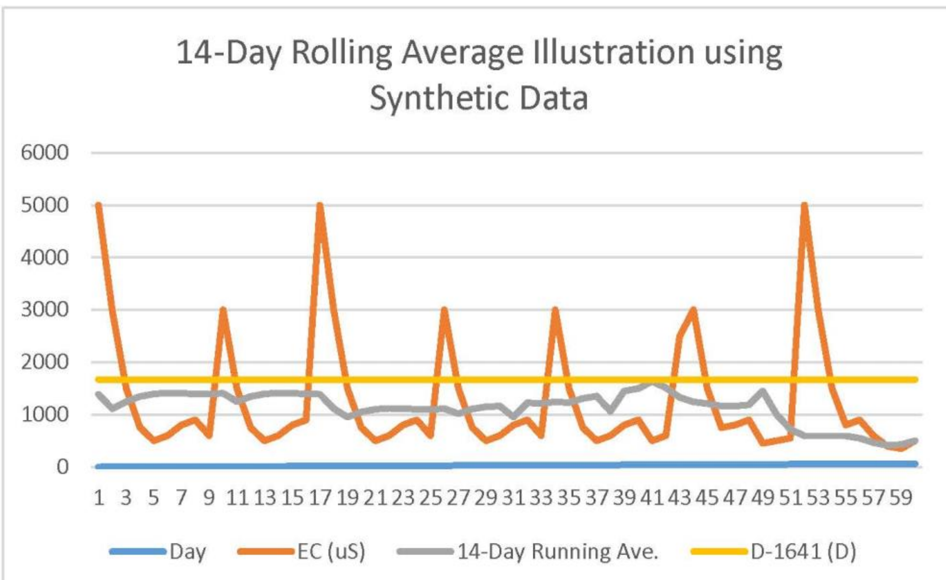


Figure 2. June 2013-2016 Conductivity (EC) at USGS 11455420

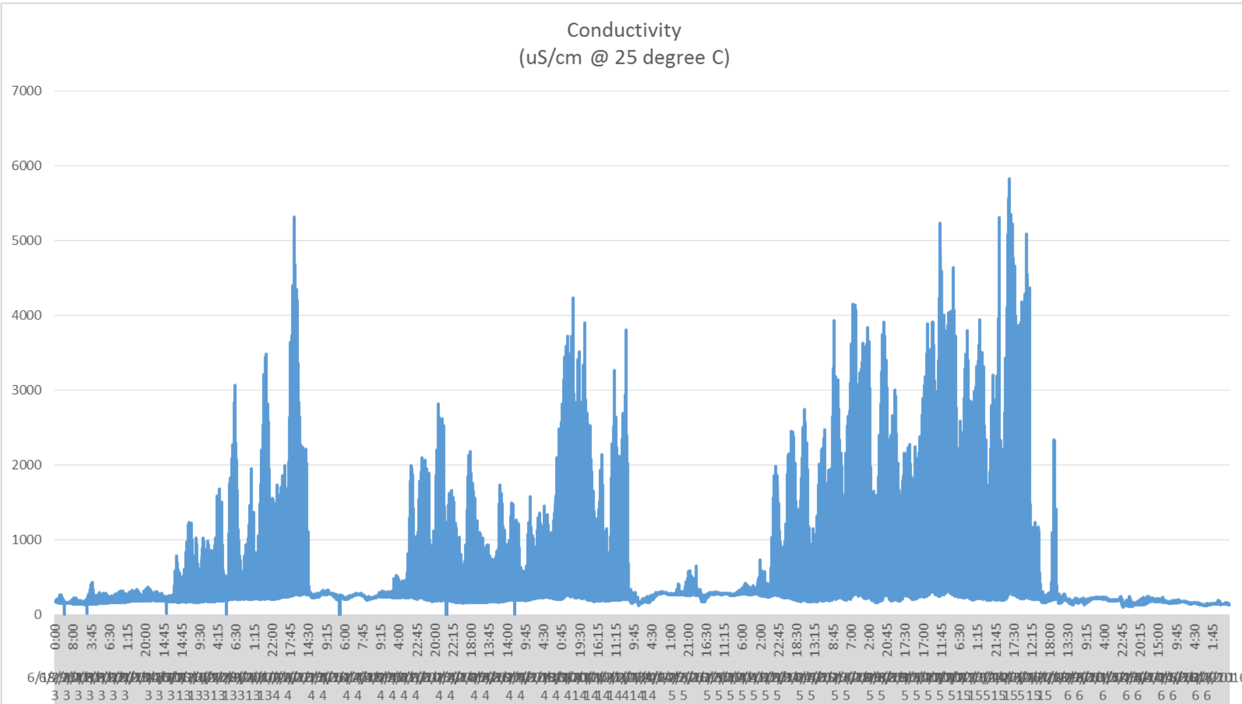
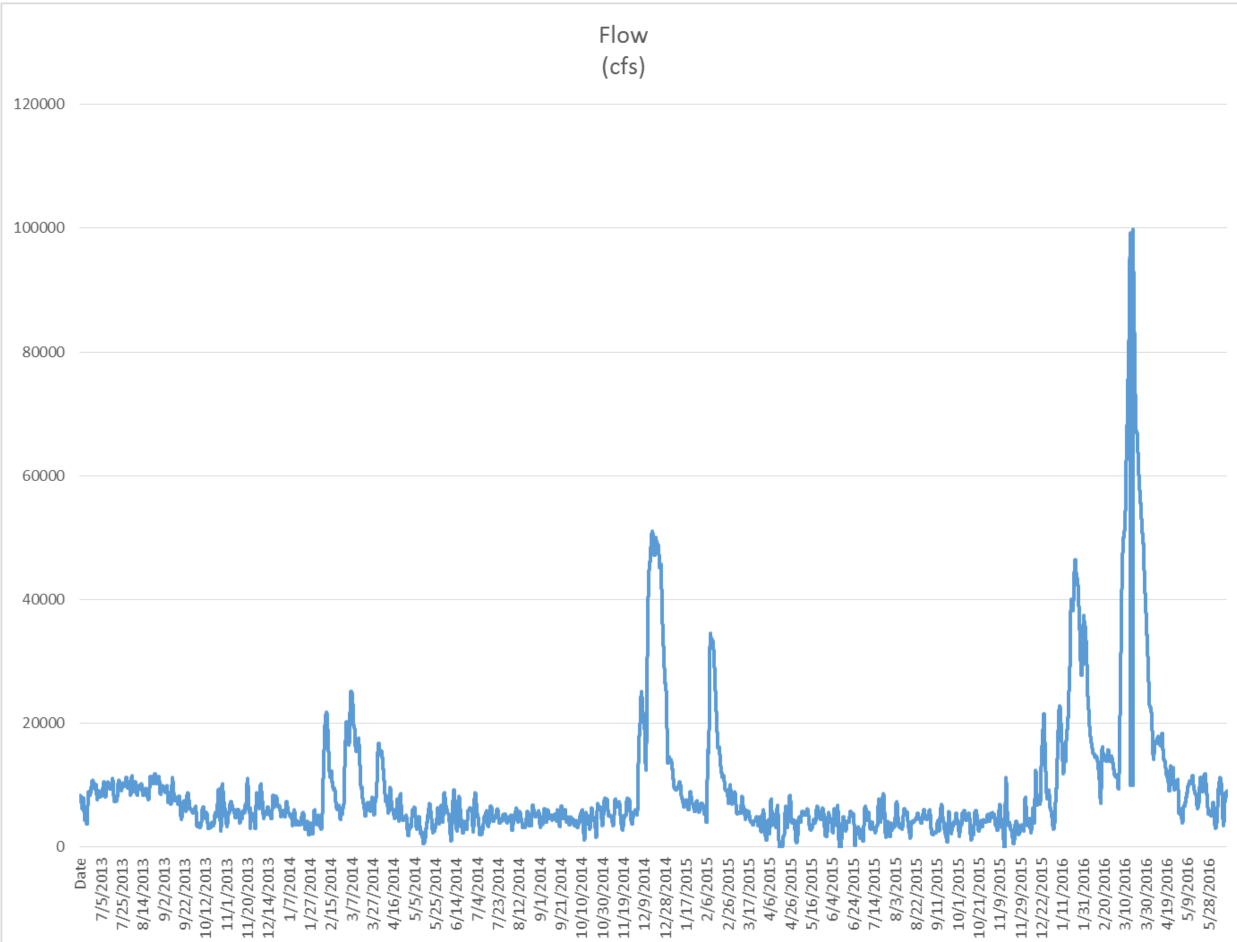
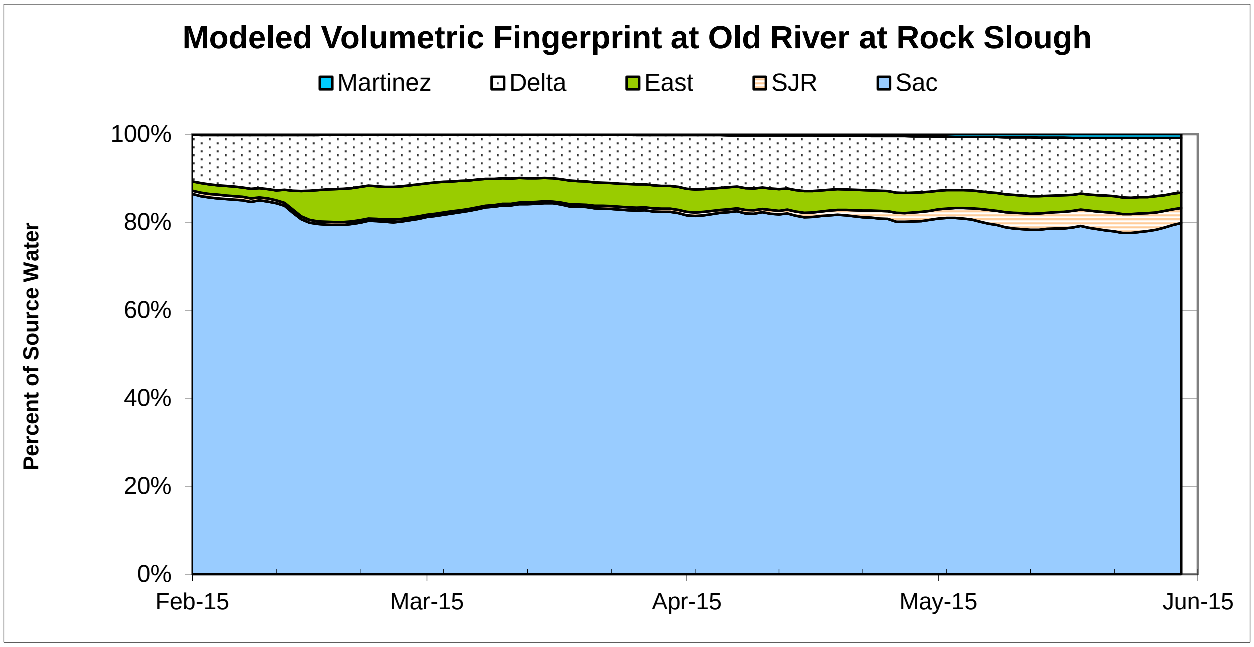


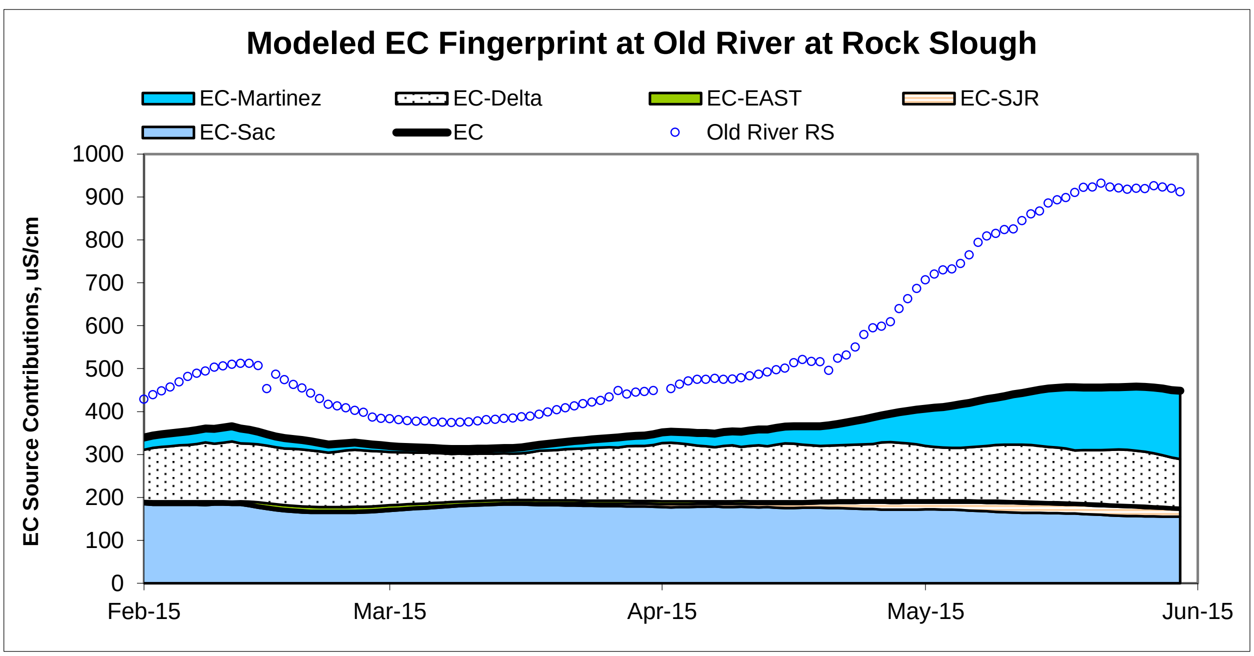
Figure 3. June 2013-2016 Flow (CFS) at USGS 11455420

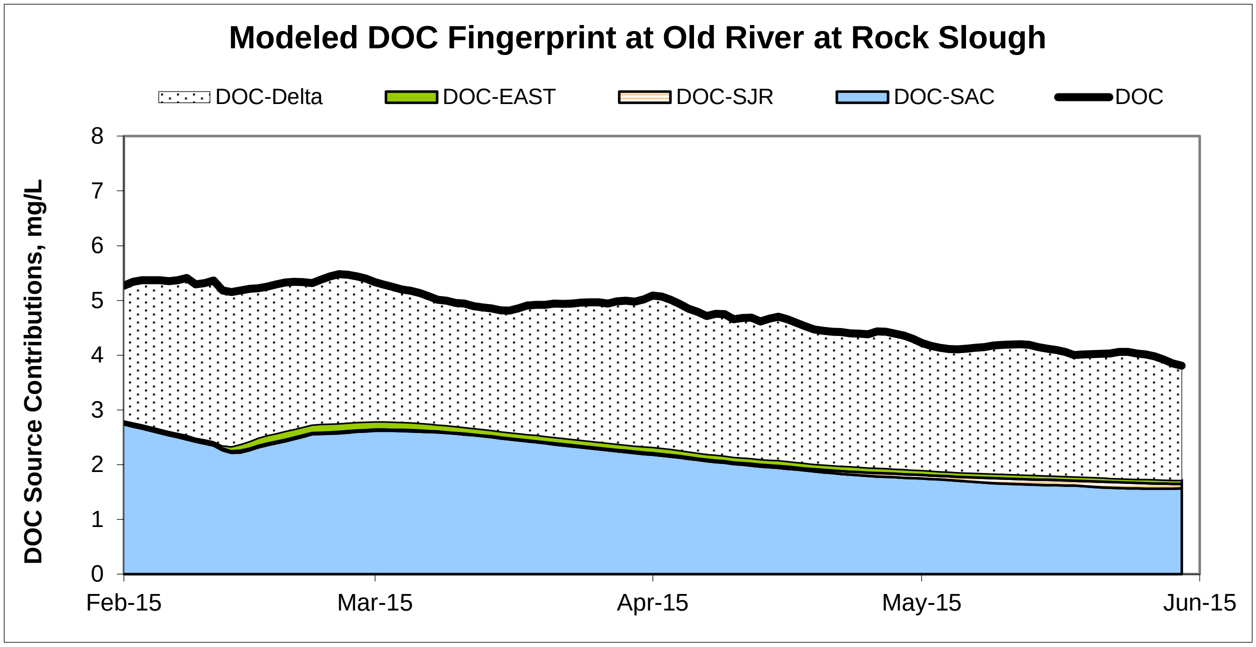


Figures 4--6 Modeled Volumetric, EC and DOC respectively

2015 DWR. 2014-2015 Rock Slough Fingerprint. Excel and Figures
http://www.water.ca.gov/waterquality/drinkingwater/public_docs/Archive%20Delta%20Fingerprints/







Modeled DOC Fingerprint at Old River at Rock Slough
DOC-Delta
DOC-EAST
DOC-SJR
DOC-SAC
DOC
DOC Source Contributions, mg/L
0
1
2
3
4
5
6
7
8
Feb-15
Mar-15
Apr-15
May-15
Jun-15

STATEMENT OF SERVICE

CALIFORNIA WATERFIX PETITION HEARING
Department of Water Resources and U.S. Bureau of Reclamation (Petitioners)

I hereby certify that I have this day submitted to the State Water Resources Control Board and caused a true and correct copy of the following document(s):

to be served **by Electronic Mail** (email) upon the parties listed in Table 1 of the **Current Service List** for the California WaterFix Petition Hearing, dated July 11, 2016, posted by the State Water Resources Control Board at http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/service_list.shtml

I certify that the foregoing is true and correct and that this document was executed on July 12, 2016.

Signature: ______________________
Name: Mae Ryan Empleo
Title: Legal Assistant for Osha R. Meserve
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Party/Affiliation:
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