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

22 **BEFORE THE**

23 **CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

24 HEARING IN THE MATTER OF
25 CALIFORNIA DEPARTMENT OF WATER
26 RESOURCES AND UNITED STATES
27 BUREAU OF RECLAMATION
28 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**

1 I, Erik Ringelberg, do hereby declare:

2 I. INTRODUCTION

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

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

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

21
22 II. OVERVIEW OF TESTIMONY

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

1
2 **A. Project Salinity Influences--Summary**

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

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

13 **B. General Overview –Delta Salinity**

14 **1. Historic Delta Salinity**

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

23
24 **2. Current Delta Salinity**

25 Salinity levels in the Delta are tidally controlled-twice a day tidal signal from the Pacific,
26 through San Francisco Bay, Suisun, and up the rivers and sloughs. Relatively high energy tidal
27 flow upriver can dominate Sacramento River outflow and allow salinity to migrate (advect)

1 upriver. The salinity gradient is controlled by freshwater outflow, and changes constantly due to
2 tides (and monthly and seasonal tidal differences). This gradient movement from the San
3 Francisco Bay into the Delta is most obvious in droughts. We understand and track that salinity
4 through Electrical Conductivity (EC).

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

10 Using averages to describe the salinity at a given location is a compromise of
11 convenience. Since the tides changes daily, there are a range of salinity values expressed over a
12 day. A mean is the average of that range and does not, and is not, intended to describe the
13 ecological or agriculturally important salt concentration. For the ecology, the highest salt
14 concentration (not the average) relates the exceedance of the physiological tolerance range at the
15 organismal level or at the competitive success at the community level. For agriculture, the
16 highest concentration (not the average) of the water diverted for crop use, salinity control and
17 wildlife management can significantly impair productivity and lead to salt buildup. The average
18 can influence the total load of the salt and effect leaching, but it is the absolute instantaneous
19 concentration during irrigation that is critical, not the average.

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

24 25 **C. Proposed Project Operations**

26 Proposed operations are influenced by many factors, but it is physically controlled by
27 one, two or three north Delta intakes. These intakes can be operated over a range of flows until
28

1 that maximum can be reached, interoperation of the facilities North and South can occur, Delta
2 Cross Channel (DCC) can be open or closed. The project design, at the engineering level
3 however has a requirement for full 9,000 cfs diversion at low River flows (DWR-212, CER.
4 2014)

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

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

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

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

- 24 • 6,000 cfs, 300 cfs would be diverted, leaving 5,700 cfs in the river.
- 25 • 15,000 cfs, 3,000 cfs would be diverted, leaving 12,000 cfs in the river.
- 26 • 22,000 cfs, 9,000 cfs would be diverted, leaving 13,000 cfs in the river.

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

15 As validation of my conclusions regarding diversion flow rules, the scenarios that were
16 provided as illustration of the project modeling analysis archive to the same diversion rates as
17 the maximum diversion rules: 1978, which was also classified as a dry year is modeled with a
18 flow in the river of 14,000 cfs, and a 6,000 cfs diversion, leaving 8,000 cfs in the river with a
19 43% flow reduction. The same modeling shows that even in an above normal year (1993), at a
20 flow of 21,000 cfs, 9,000 cfs is diverted, leaving 12,000 cfs in the river, (DWR-5 errata, Pg 25-
21 6).

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

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

13 These same conclusions have already been drawn by independent researchers:

14
15 Withdrawing water from the system into an isolated water-conveyance facility,
16 such as the currently proposed twin tunnels, would also alter transport throughout
17 the delta. If built, net flows throughout the north and western Sacramento–San
18 Joaquin River Delta would be proportionately reduced by the amount withdrawn
19 into the conveyance facility, increasing the influence of the tides throughout the
20 delta. ...In the coming decades, the flow-station network can provide data that
21 address uncertainty concerning the location of proposed water-conveyance
22 facilities and that, after they are built, document the effects of these new water-
23 conveyance facilities, management actions, and habitat-restoration efforts.”
24 (USGS Fact Sheet 2015-3061. 2016)

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

1 As shown in the provided exhibits, (Ringelberg Attachment A. to my testimony) flows at
2 Rio Vista had numerous very high EC values over the past 3 years, but because of the 14-day
3 running average under D-1641 (Figure 1.), and the TUCP, these were not considered to be
4 exceedances in many cases. For illustration, EC is provided for that period at USGS Station
5 11455420, followed by the same time period for flow (Figures 2 and 3 respectively). To put this
6 into perspective, each of the tributaries has a relative flow into the Delta, and the existing DCC
7 and the south Delta pump operations also contribute to variations in the relative contribution.
8 These contributions are “fingerprinted” which provides an understanding of the relative
9 contribution over time (Figure 4.).

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

17 **D. Defects of Project Analysis**

18 The project impacts on salinity are difficult to ascertain for a variety of reasons:

- 19 • Use of comparative rather than operational or predictive models to bound changes in EC.
- 20 • Use of model data for D-1641 compliance, not for operational impacts on agriculture.
- 21 • Use of averages, use of old data, and weak calibration, and known errors at low flows and
22 without correlation to contemporary drought conditions.
- 23 • Use of 14-day rolling averages as compliance, instead of actually assessing AGR
24 impairment, LF fraction.

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

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

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

7 The project can thus take significant flows in above normal, normal, dry and critically dry
8 years. The DCC can remain open for periods during that time, and that salinity would increase
9 through advection as a result of those lower flows, and increase to similar levels as were seen in
10 the last 3 years of the drought with Southern Delta operations. If operational constraints to
11 protect Delta smelt remain, and are indeed on of the project purposes, the sustained operation of
12 the North Delta diversions would institutionalize permanent drought-like flow conditions, and
13 therefore high EC levels in the Delta.

14 **III. Summary Conclusions**

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

21 The project's impacts associated with lower flows from the withdrawal of water in the
22 Freeport area, Delta Cross-channel operational impacts (lowering or influencing flows further in
23 the Sacramento River sloughs and Cache Slough complex) will change the circulation and
24 retention of salt, leading to complex interactions throughout the Delta. The project has failed to
25 provide fine scale modeling for key agricultural intake locations within the Delta in support of
26 its conclusions, and even the coarse scale modeling it did provide is insufficient to provide any
27

1 predictive ability to show that it does not harm beneficial uses and in particular agricultural
2 water users with sensitive crops.

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

10
11 I declare under penalty of perjury under the laws of the State of California that the foregoing
12 statements are true and correct.

13
14 Executed on the 1st Day of September at Rancho Cordova , California.

15
16
17
18 

19
20 _____
21 Erik Ringelberg

1 **CITED REFERENCES**

2
3 CVRWQCB [California Central Valley Regional Water Quality Control Board] 2006. The
4 Water Quality Control Plan (Basin Plan) for the California Regional \ Water Quality
5 Control Board Central Valley Region. Fourth Edition. Rev Apr. 2006. The Sacramento
6 River.

Attachment A. Ringelberg Testimony- Additional Salinity References

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

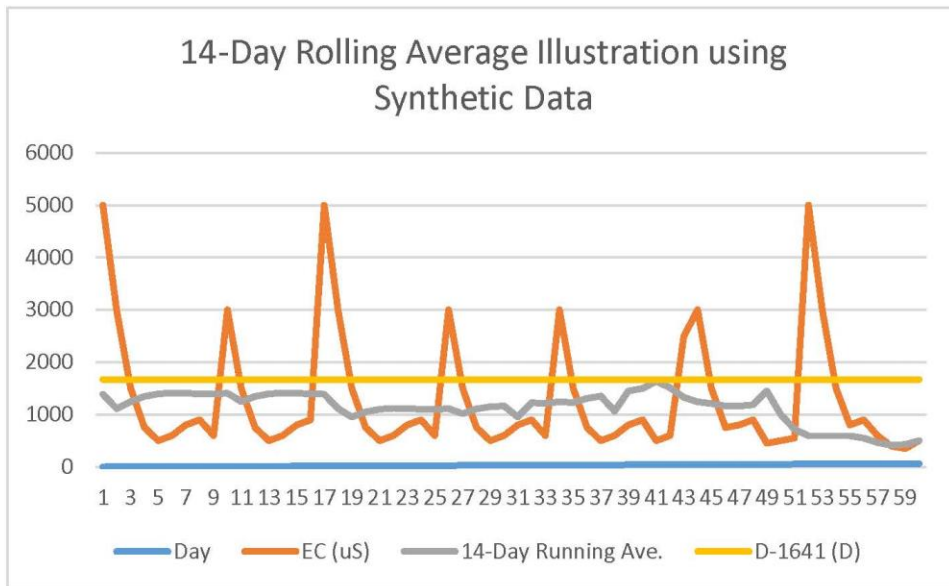


Figure 2. June 2013-2016 Conductivity (EC) at USGS 11455420

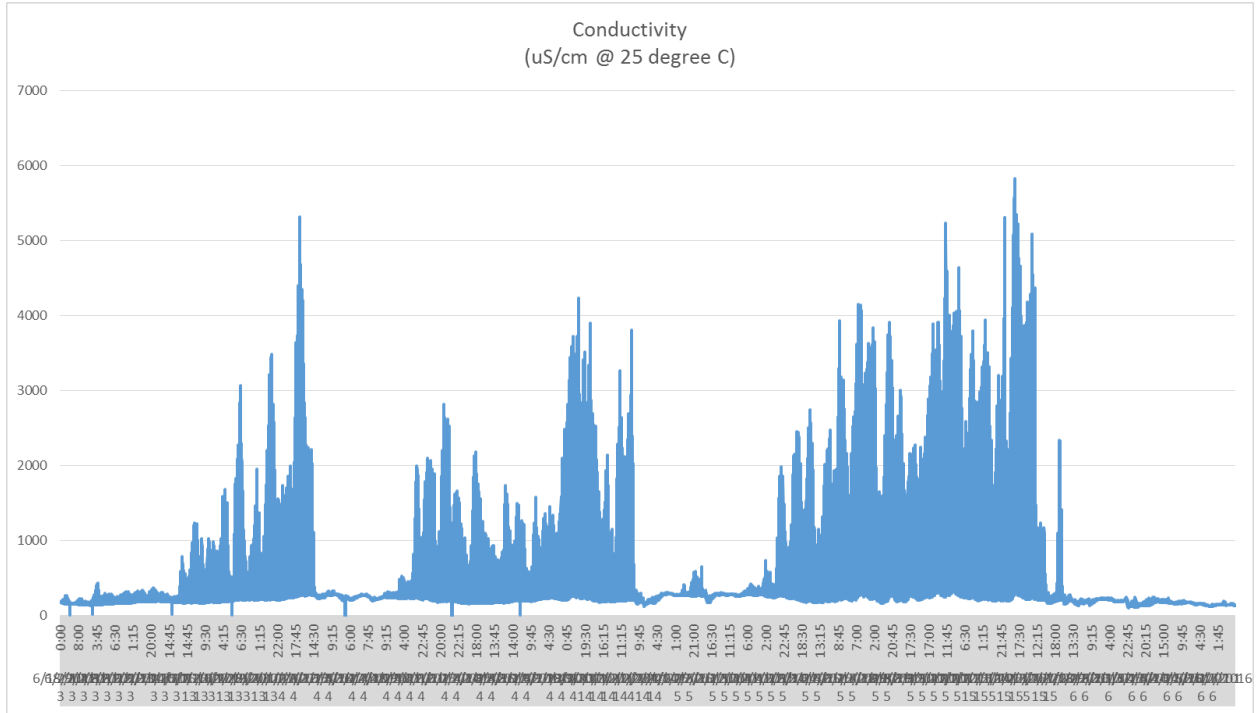
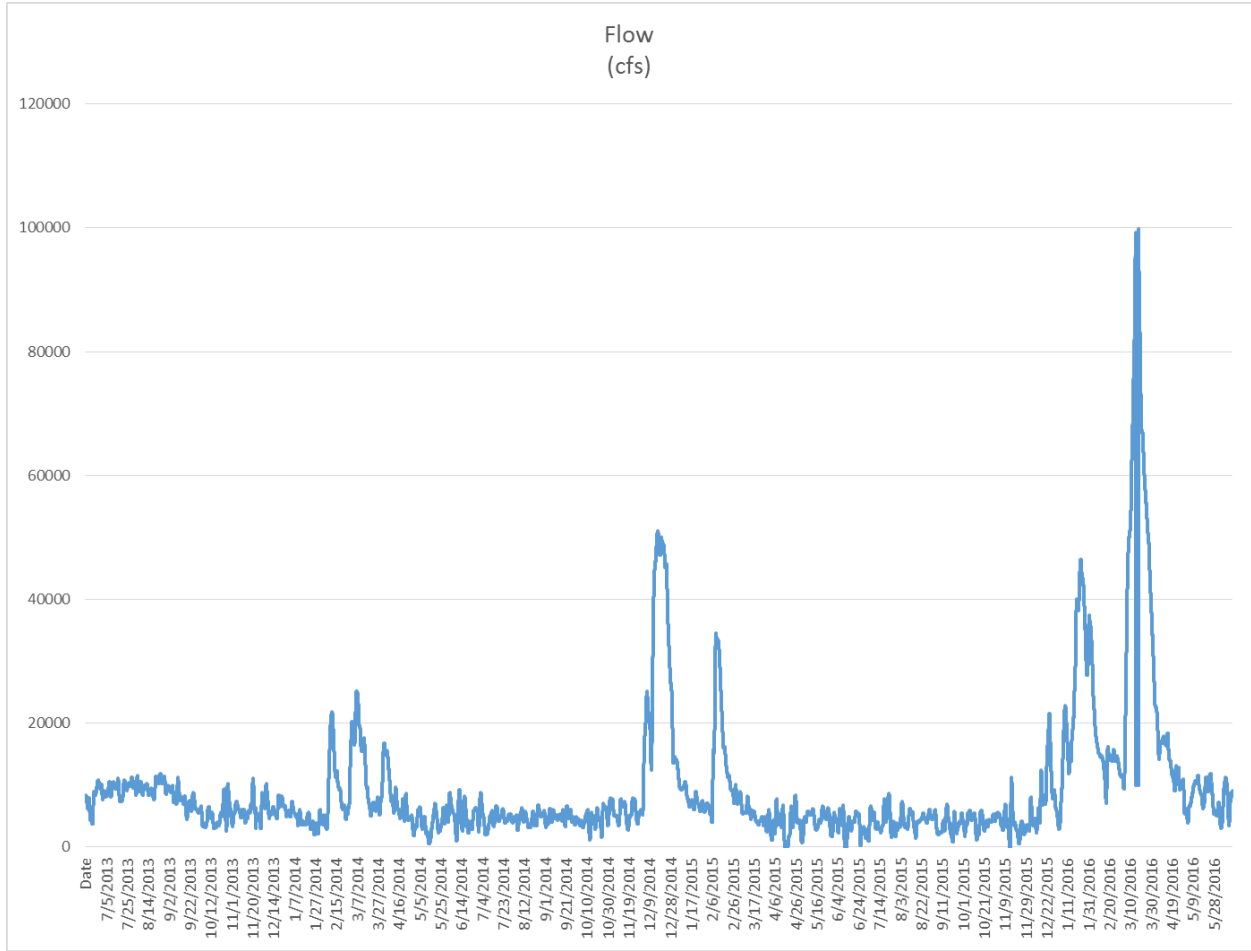


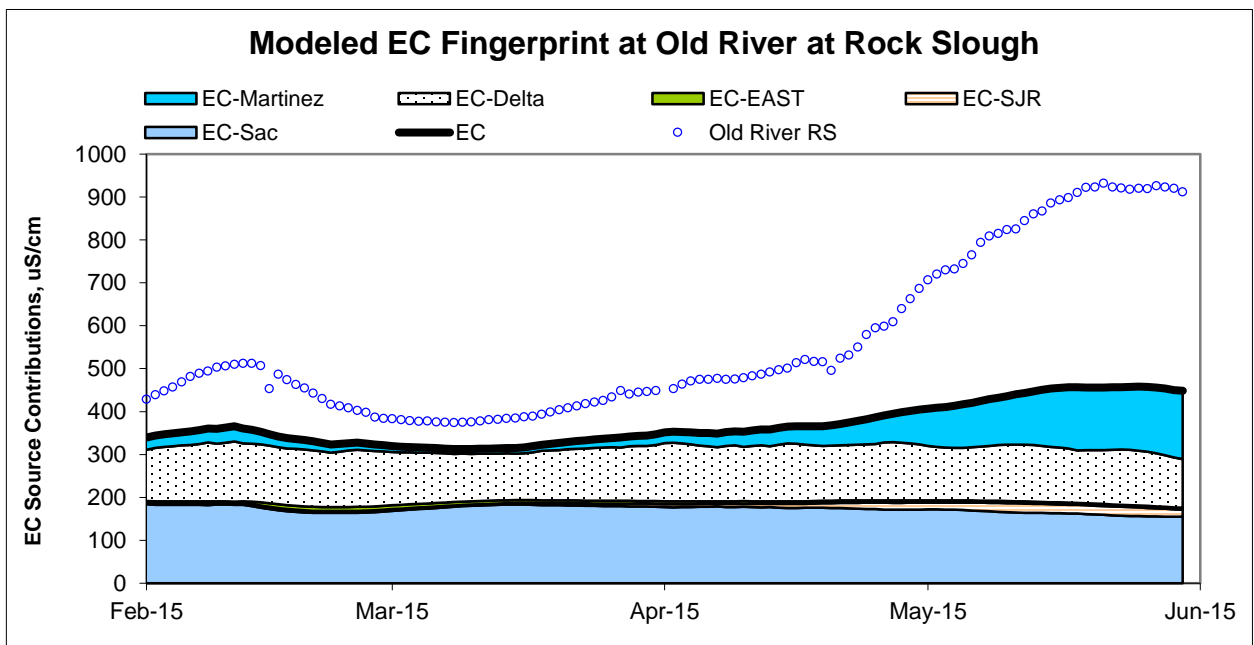
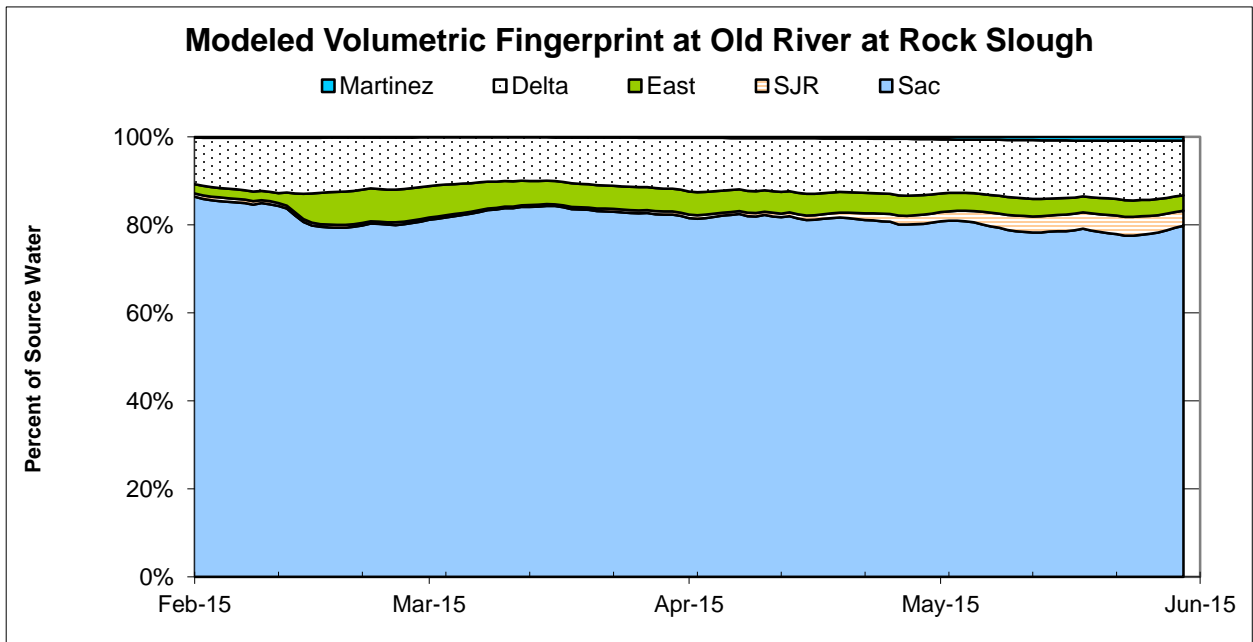
Figure 3. June 2013-2016 Flow (CFS) at USGS 11455420



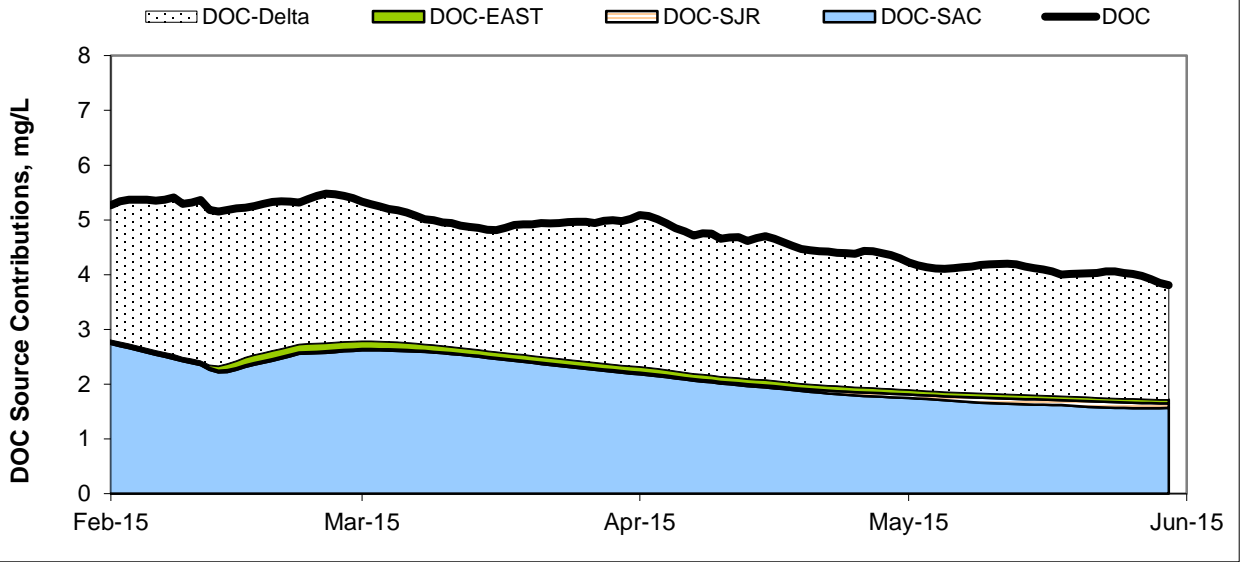
Figures 4--6 Modeled Volumetric, EC and DOC respectively

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



1 **STATEMENT OF SERVICE**

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

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

6
7 to be served by **Electronic Mail** (email) upon the parties listed in Table 1 of the **Current**
8 **Service List** for the California WaterFix Petition Hearing, dated July 11, 2016, posted by the
9 State Water Resources Control Board at
10 [http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfi](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/service_list.shtml)
11 [x/service_list.shtml](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/service_list.shtml)

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

14 Signature:  _____

15 Name: Mae Ryan Empleo

16 Title: Legal Assistant for Osha R. Meserve
17 Soluri Meserve, A Law Corporation

18 Party/Affiliation:

19 Local Agencies of the North Delta

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21 Diablo Vineyards and Brad Lange/DWLC

22 Stillwater Orchards/DWLC

23 Friends of Stone Lakes National Wildlife Refuge

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