

Memorandum

Date: May 26, 2016

To: Parviz Nader-Tehrani

From: Subir Saha
Bay Delta Office
Department of Water Resources

Subject: **CCWD Agreement Study**

The goal behind this study was to determine the effects of the CCWD Settlement Agreement (Exhibit DWR-334), specifically and the transfer of the CCWD “Mitigation Water”, on the water quality at different locations within the Delta. Based on this agreement, a certain amount of water (Maximum 50 TAF annually) would be delivered to CCWD through either the East Bay Municipal Utility District’s (EBMUD) Freeport intake or the CWF conveyance facility. The actual amount will vary based on a number of factors including the total annual amount of water diverted from North Delta Diversion facility, total Delta SWP/CVP diversions, and total annual Sacramento River runoff.

In order to get an assessment of effects of this agreement on the water quality in the Delta, two 16 year (1976-1991) DSM2 studies were performed based on a “worst case analysis”. For the purposes of this study, it was assumed that the upstream reservoir operations would not change. As a result, it was assumed that we can rely on the existing CalSim II scenarios to develop the Delta inflows and project diversions. Both DSM2 studies included in this memo used results from CWF operational scenario H3 as input. In both scenarios, it was assumed that water is transferred from the Freeport facility to represent in the model, delivery either through the CWF or Freeport. Delivery was assumed at a rate of 150 cfs for a total of 5 months starting from November 1 and ending on March 31, resulting in a total annual transfer of over 45 TAF. This transfer was assumed constant for each water year, regardless of the water year type, thus making it a “worst case” scenario. CCWD Delta diversions were reduced by the same volume based on the following assumptions:

- 1- Scenario A- CCWD Delta diversions were reduced starting from November 1 by a similar amount (about 150 cfs) in order to reach about a similar total volume (45 TAF). The adjustment to CCWD Delta diversions took from 5 to 6 months depending on the water year types.
- 2- Scenario B- CCWD Delta diversions were reduced for three summer months starting from July 1, resulting in a total annual reduction of about 45 TAF.

Tables 1 and 2 illustrate the changes in monthly average EC as a result of the two operational scenarios above. Results for scenario A (See Table 1), show the largest change in EC is about 2 percent, mostly corresponding to areas in the Western Delta (Emmaton and Jersey Point). Other

areas in the Delta experience negligibly small changes. Results for scenario B (See Table 2), show mixed results. For the months of November through April, there is an increase in EC (maximum 4-5 percent) mostly in the Western Delta (Emmaton and Jersey Point), San Andreas Landing, and San Joaquin River at Prisoner's Point. For the months of July through October there is a reduction in EC of up to 10 percent mostly around the same areas. Looking at annual averages, there is a reduction in EC of up to 3 percent. The results for operation Scenario B are consistent with the assumptions for this operational scenario leading to a reduction in Delta Outflow for the months of November through March, however depending on the operational scenario, a slight modification in operations may need to be made in order to avoid this reduction. During these times the modeling shows a corresponding increase in net Delta outflow for the months of July through September. These changes do not occur at times when D-1641 water quality is controlling operations.

These scenarios illustrate two possible worst case operations representing two extreme implementations of the CCWD Agreement. The actual changes in water quality are expected to be lower than those shown in tables below and it is expected it would not affect the ability to meet D-1641 objectives.

Table 1- Changes in monthly average EC under operational Scenario A

Electrical Conductivity			OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Annual Avg. Change
ALT H3 CCWD V1	Location	Location	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3
Western Delta	Sac. R at Emmaton	ALL	0 (-0%)	12 (1%)	10 (1%)	7 (1%)	6 (1%)	4 (1%)	-3 (-1%)	-4 (-1%)	-1 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	3 (0%)
		DROUGHT	0 (-0%)	21 (1%)	14 (1%)	6 (1%)	6 (1%)	6 (2%)	-1 (-0%)	-2 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	4 (0%)
	SJR at Jersey Point	ALL	0 (-0%)	-7 (-1%)	-11 (-1%)	-2 (-0%)	3 (1%)	2 (1%)	-2 (-1%)	-2 (-1%)	-1 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	-2 (-0%)
		DROUGHT	0 (-0%)	-9 (-0%)	-16 (-1%)	-9 (-1%)	-1 (-0%)	3 (1%)	-1 (-0%)	-1 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	-3 (-0%)
Interior Delta	S. Fork Mok. R. Term	ALL	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)
		DROUGHT	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)
	SJR at San And. Landing	ALL	0 (-0%)	1 (0%)	-2 (-0%)	-1 (-0%)	2 (1%)	1 (1%)	1 (1%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (0%)
		DROUGHT	0 (-0%)	2 (0%)	-2 (-0%)	-4 (-1%)	2 (1%)	2 (1%)	2 (1%)	1 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)
Southern Delta	SJR at Vernalis	ALL	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		DROUGHT	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	SJR at Brandt Bridge	ALL	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)
		DROUGHT	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Old River at Middle River	ALL	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)
		DROUGHT	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (0%)
	Old River at Tracy Bridge	ALL	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (0%)
		DROUGHT	0 (0%)	0 (0%)	1 (0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
SJR	SJR at Prisoners Point	ALL	0 (-0%)	0 (0%)	-2 (-0%)	-1 (-0%)	3 (1%)	2 (1%)	3 (1%)	1 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)	1 (0%)
		DROUGHT	0 (-0%)	0 (0%)	-3 (-0%)	-3 (-1%)	4 (1%)	3 (1%)	5 (1%)	2 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	1 (0%)

Table 2- Changes in monthly average EC under operational Scenario B

Electrical Conductivity			OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Annual Avg. Change
ALT H3 CCWD V2	Location	Location	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3	ALT H3
Western Delta	Sac. R at Emmaton	ALL	-63 (-3%)	30 (2%)	52 (4%)	22 (4%)	12 (3%)	7 (2%)	2 (1%)	0 (0%)	0 (0%)	-64 (-4%)	-125 (-6%)	-138 (-5%)	-22 (-2%)
		DROUGHT	-102 (-4%)	43 (2%)	90 (4%)	34 (5%)	22 (4%)	10 (3%)	2 (1%)	0 (0%)	0 (0%)	-110 (-5%)	-178 (-7%)	-232 (-6%)	-35 (-2%)
	SJR at Jersey Point	ALL	-59 (-5%)	13 (1%)	48 (4%)	26 (4%)	10 (2%)	5 (2%)	2 (1%)	1 (0%)	0 (0%)	-72 (-7%)	-131 (-9%)	-143 (-8%)	-25 (-3%)
		DROUGHT	-97 (-6%)	20 (1%)	77 (4%)	41 (4%)	17 (4%)	7 (2%)	2 (1%)	1 (0%)	0 (0%)	-122 (-8%)	-198 (-10%)	-247 (-9%)	-42 (-3%)
	S. Fork Moke. R. Term	ALL	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		DROUGHT	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Interior Delta	SJR at San And. Landing	ALL	-23 (-5%)	1 (0%)	16 (3%)	11 (3%)	4 (1%)	2 (1%)	1 (0%)	0 (0%)	0 (0%)	-11 (-3%)	-29 (-7%)	-43 (-8%)	-6 (-2%)
		DROUGHT	-40 (-7%)	1 (0%)	28 (4%)	19 (4%)	7 (2%)	2 (1%)	1 (0%)	0 (0%)	0 (0%)	-21 (-5%)	-51 (-9%)	-80 (-10%)	-11 (-2%)
Southern Delta	SJR at Vernalis	ALL	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		DROUGHT	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	SJR at Brandt Bridge	ALL	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)
		DROUGHT	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (-0%)	0 (-0%)
	Old River at Middle River	ALL	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		DROUGHT	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Old River at Tracy Bridge	ALL	-7 (-1%)	-5 (-1%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	-1 (-0%)	-7 (-1%)	-7 (-1%)	-2 (-0%)
		DROUGHT	-11 (-2%)	-9 (-1%)	0 (0%)	0 (-0%)	0 (-0%)	0 (0%)	0 (0%)	0 (-0%)	0 (0%)	-2 (-0%)	-17 (-3%)	-16 (-3%)	-5 (-1%)
SJR	SJR at Prisoners Point	ALL	-20 (-4%)	-3 (-1%)	12 (2%)	11 (2%)	4 (1%)	2 (0%)	1 (0%)	0 (0%)	0 (0%)	-7 (-2%)	-24 (-6%)	-35 (-8%)	-5 (-1%)
		DROUGHT	-35 (-6%)	-4 (-1%)	20 (3%)	18 (3%)	8 (2%)	3 (1%)	1 (0%)	1 (0%)	1 (0%)	-15 (-4%)	-45 (-9%)	-67 (-10%)	-10 (-2%)