CALIFORNIA WATER FIX
RELIABLE. CLEAN. WATER.

DSM2 MODELING SURREBUTTAL
WATER QUALITY AND WATER LEVELS

OUTLINE

- **Antioch Water Quality (Antioch Exhibits 300 and 302)**
- **Stockton Water Quality (STKN- 26)**
- **South Delta (SDWA-257)**

ANTIOCH (EXHIBIT 302)

- **Water Quality at City of Antioch Intake Under H3, H4, and Boundary 2 Will Be Similar or Better Than NAA**
- **Water Quality changes under Boundary 1 compared to the NAA are mostly influenced by the lack of Fall X2**

ANTIOCH (EXHIBIT 302, PAGE 27)

- **Dr. Paulsen's Analysis is Mostly Focused on CWF Boundary 1 Scenario**

Table 4 Number of days in each water year that the D-1641 WQO of 250 mg/L chloride for Municipal and Industrial Beneficial Uses at CCPP#1 is not met, based on DWR model results.

Water Year	Water Year Type	Total Days	Number of Days 250 mg/L Chloride Threshold is Not Met at CCPP#1		
			EBC2[b]	NAA[a]	Boundary 1[a]
1976	Critical	366	37	0	0
1977	Critical	365	8	50	16
1978	Normal	365	10	87	105
1979	Normal	365	0	17	64
1980	Normal	366	87	57	44
1981	Dry	365	0	0	0
1982	Wet	365	3	12	10
1983	Wet	365	34	0	0
1984	Wet	366	0	0	0
1985	Dry	365	0	0	15
1986	Wet	365	23	26	6
1987	Dry	365	0	0	46
1988	Critical	366	1	4	14
1989	Dry	365	77	106	124
1990	Critical	365	40	60	25
1991	Critical	365	76	107	117
		Sum	396	526	586

WATER QUALITY AT CITY OF ANTIOCH INTAKE UNDER H3, H4, AND BOUNDARY 2 WILL BE SIMILAR OR BETTER THAN NAA

- **Number of days in each water year, where the 250 mg/l daily average chloride concentration is not met at the City of Antioch Intake**

WY	NAA	B1	H3	H4	B2
1976	262	356	250	244	161
1977	365	365	365	365	363
1978	196	198	174	173	163
1979	205	214	199	201	167
1980	189	203	168	164	148
1981	264	268	251	254	198
1982	119	150	108	107	99
1983	0	3	0	0	0
1984	90	148	84	81	80
1985	190	245	164	157	141
1986	182	209	183	183	147
1987	218	288	182	184	150
1988	288	313	311	311	271
1989	271	272	272	272	211
1990	313	314	297	296	281
1991	309	314	312	312	310
Total	3461	3860	3320	3304	2890

ANTIOCH (EXHIBIT 300)

- **CCWD Agreement Will Have Minimal Effect on Water Quality in the Delta**

ANTIOCH (EXHIBIT 300, PAGE 3)

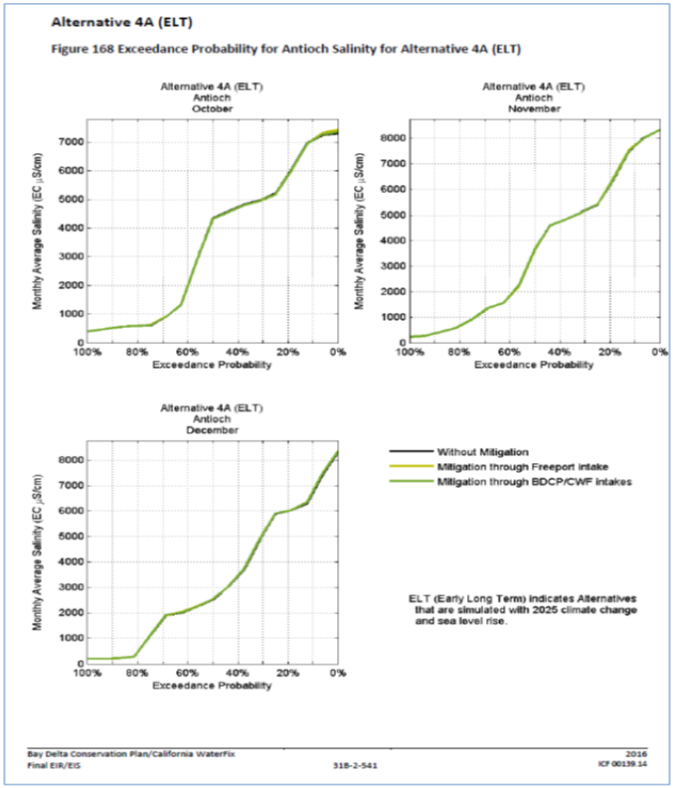
Rebuttal Opinion 1: The CCWD-DWR 2016 Agreement may have adverse impacts on water quality at Antioch's intake, but DWR's analysis is not sufficient to determine the magnitude or frequency of these impacts.

FEIR/EIS APPENDIX 31B CONTAINS DETAILED ANALYSIS ON THE EFFECTS OF CCWD-DWR AGREEMENT

- **Analysis provided for Antioch, Collinsville, Rock Slough, Port Chicago, Mallard Slough, Emmaton, Jersey Point and Rio Vista**
- **Conclusion: CCWD settlement agreement in the Alternative 4A has minimal to no effect on the salinity at these locations.**

MONTHLY EXCEEDANCE PLOTS BASED ON EXCEEDANCE PROBABILITY OF EC (ANTIOCH)

Figure 1a: Probability of exceedance of monthly salinity at Antioch for Alternative 4A (ELT) during October, November, and December.



STOCKTON (STKN-26)

- **Incorrect conclusions about Boundary 1 based on information presented from FEIR/EIS**
- **Dr. Paulsen overestimates chloride concentration at Buckley Cove and City of Stockton's intake**
- **Dr. Paulson's finger-printing analysis at Buckley Cove is flawed**

INCORRECT CONCLUSIONS ABOUT BOUNDARY 1 BASED ON INFORMATION PRESENTED FROM FEIR/EIS

- **STKN-26 page 31**

DWR found that Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9 would have significant adverse impacts with respect to chloride concentrations at the Contra Costa Pumping Plant #1 (FEIR/EIS Figure 8-0a). Only Alternatives 4A, 2D, and 5A were found to have no significant impact/no adverse effects (FEIR/EIS Figure 8-0a). Thus, operation of the Project to Boundaries 1 and 2, which DWR states are represented by scenarios 1A, 3, and 8, would also have significant/adverse impacts.

- All Alternatives cited by Dr. Paulsen (Except 4A, 2B and 5A) included 65,000 acres of Restoration and were simulated at LLT (2060 climate change, 45 cm sea level rise)
- FEIR/EIS clearly explains that the primary reason for the water quality degradation (especially in Western Delta) for these alternatives was the inclusion of the 65,000 acres of restoration

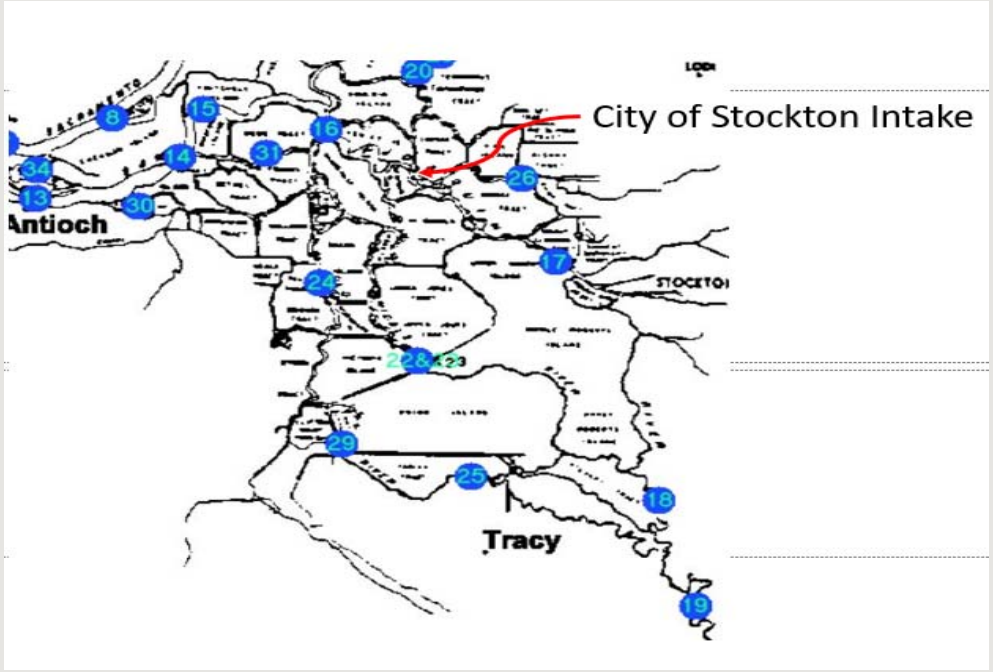
- Alternatives 4A, 2B, and 5A were simulated at ELT (2025 climate change, 15 cm sea level rise) with no restoration, consistent with modeling done for this petition
- These Alternatives do not show any significant impacts or adverse effects with respect to chloride concentrations at the Contra Costa Canal

DR. PAULSEN OVERESTIMATES CHLORIDE CONCENTRATION AT BUCKLEY COVE AND CITY OF STOCKTON'S INTAKE

- **Guivetchi (1986) (Antioch 205) (EC-Chloride Relationship)**

ANTIOCH 205 (PDF PAGE 6) (PARTIAL MAP)

- **There is no station available right at City of Stockton's Intake**



EC-CHLORIDE CONVERSIONS AT STATIONS 16 AND 17 ARE SUBSTANTIALLY DIFFERENT

- **Station 16 (Dr. Paulsen used)**

  CL= – 28.9 + 0.23647 x EC

- **Station 17 (Near Buckley Cove)**

  CL= - 17.07 + 0.182888 EC

Same value for EC can lead to largely different chloride values

In general stations closer to the Bay result in higher Chloride concentration for the same EC value due to higher contribution from sea water.

EXAMPLE EC = 650

- **Based on Station 16**

  CL = 124.8 mg/l

- **Based on Station 17**

  CL = 101.8 mg/l

Estimated chloride concentration based on Station 16 is 22% larger

This is important because Dr. Paulsen uses a threshold for Chloride concentration of 110 mg/l to show impact in water quality

- **Dr. Paulsen shows higher contribution from San Joaquin under Alternative 2 (STKN-26, page34)**

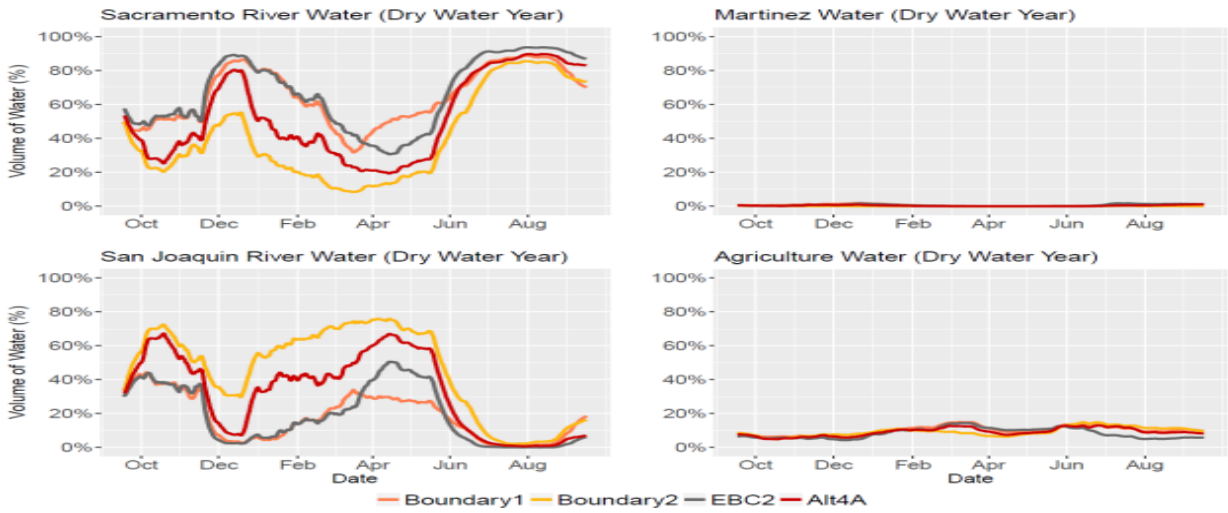
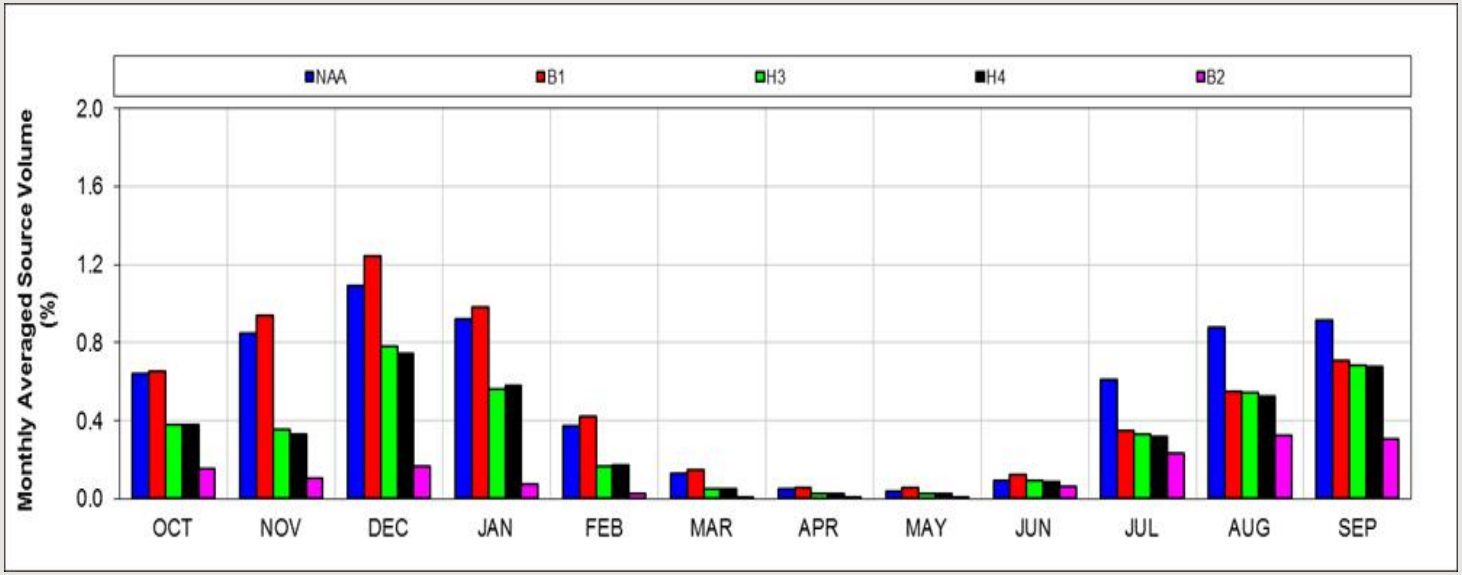


Figure 9. Source water fingerprint at Stockton's intake under the proposed California WaterFix Project scenarios during dry water year years (1981, 1985, 1987, and 1989)

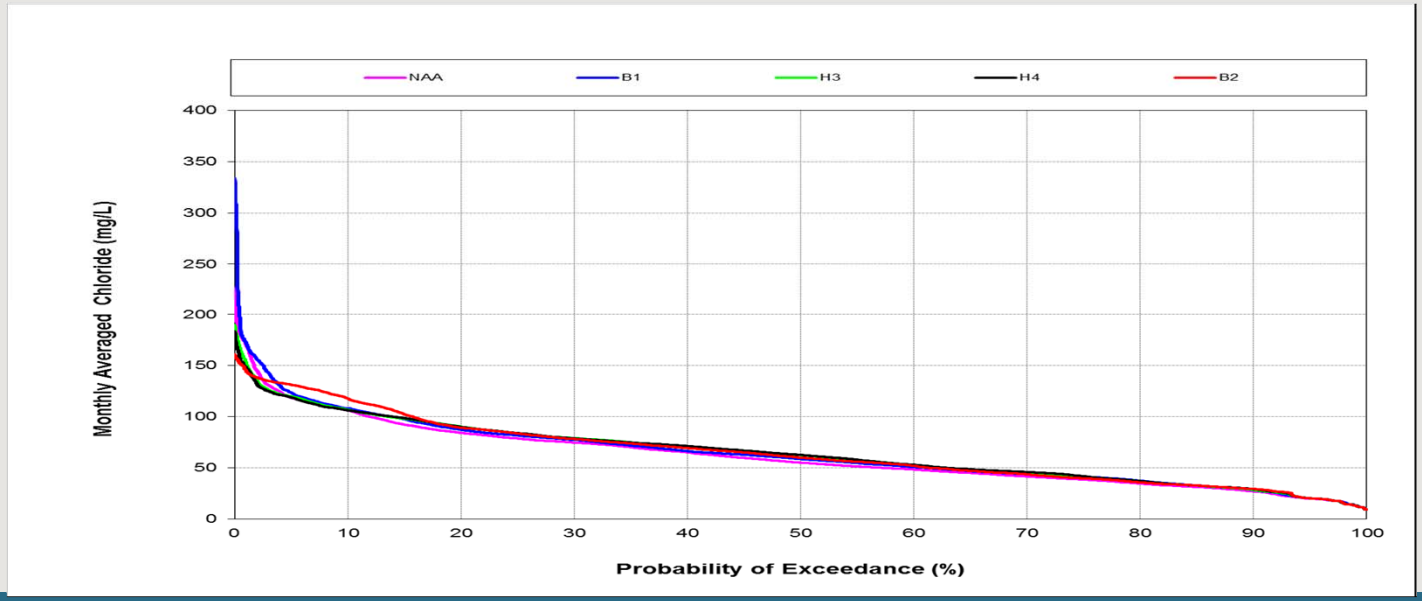
H3, H4 AND BOUNDARY 2 REDUCE OCEAN SALT AT CITY OF STOCKTON'S INTAKE

- **Monthly average Martinez volumetric contribution at City of Stockton's Intake**



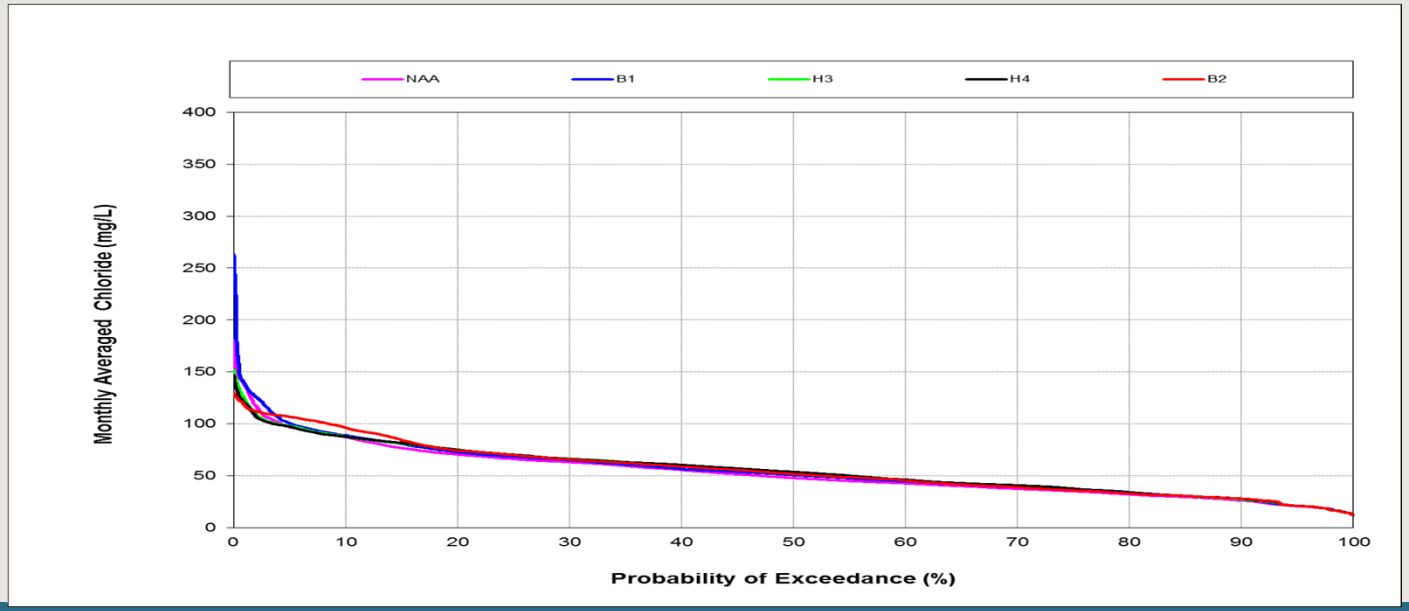
PROBABILITY OF EXCEEDANCE FOR DAILY AVERAGE CHLORIDE CONCENTRATION AT THE CITY OF STOCKTON'S INTAKE USING EC-CHLORIDE CONVERSION EQUATION FOR STATION 16

- **Shows 10-14% exceedance above City of Stockton's 110 mg/l preference**



PROBABILITY OF EXCEEDANCE FOR DAILY AVERAGE CHLORIDE CONCENTRATION AT THE CITY OF STOCKTON'S INTAKE USING EC-CHLORIDE CONVERSION EQUATION FOR STATION 17

- **Shows about 3% exceedance above City of Stockton's 110 mg/l preference**



- Given that ocean salt is reduced substantially under H3, H4, and more so on Boundary 2, Dr. Paulson's results based on EC-Chloride conversion for Station 16 are overestimated
- Results based on EC-Chloride concentration for station 17 better represents chloride concentrations under H3, H4 and Boundary 2 for Stockton's intake location
- CWF scenarios do not alter chloride at the city of Stockton's intake in comparison to the NAA

BUCKLEY COVE

- **Dr. Paulsen uses the same EC-Chloride conversion for station 16 to compute chloride concentration at Buckley Cove, overestimating chloride**
- **In fact Buckley Cove is very close to Station 17, which is a better representation**

CHLORIDE CONCENTRATION AT BUCKLEY COVE IS OVERESTIMATED

- **All analysis based on Buckley Cove chloride estimates in Dr. Paulsen's testimony are considered questionable**

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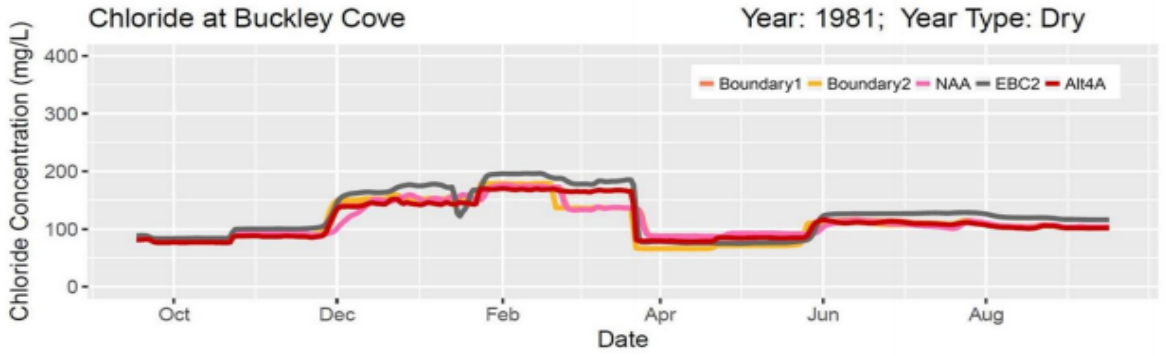


Figure 3. Daily mean concentration of chloride at Buckley Cove under various operational scenarios during water year 1981

FINGER-PRINTING ANALYSIS AT BUCKLEY COVE IS FLAWED

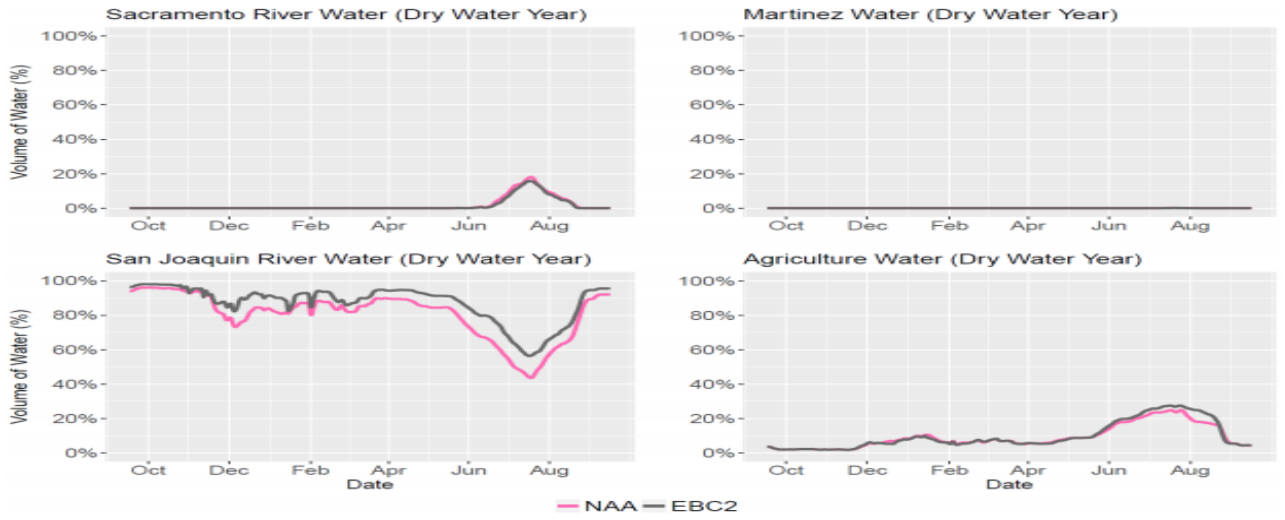


Figure 5. Source water fingerprint at Buckley Cove under the NAA and EBC2 baseline conditions during a dry water year

SOUTH DELTA (SDWA-257)

- **Water Levels in south Delta are not affected by the proposed north Delta diversion points**
- **Several Figures Mr. Burke uses are showing comparison of daily results and are considered to be an inappropriate use of DSM2 when used in conjunction with CalSim II**
- **Mr. Burke claims water quality effects but does not show a single water quality plot**

SOUTH DELTA (SDWA-257)

- **Mr. Burke's information about the use of Spring head of Old River barrier in the NAA is incorrect. Modeling for NAA does not include the operation of the Spring barrier**

SDWA-257 p.2

Table 2 Spring and Fall HORB Schedule In The NAA And PA as Incorporated In The CWF DSM2 Models.

Scenario	Jan		Feb		March		April		May		June	
	Week 1-2	Week 3-4	Week 1-2	Week 3-4	Week 1-2	Week 3-4	Week 1-2	Week 3-4	Week 1-2	Week 3-4	Week 1-2	Week 3-4
CWF PA	Spring Barrier											
CWF NAA								Spring Barrier				

HEAD OF OLD RIVER SPRING BARRIER HAS BEEN INSTALLED IN 14 YEARS SINCE 1992

DWR-942

Year	Spring Head of Old River					
	Installation			Removal		
	Started	Closed	Completed	Started	Breached	Completed
1987						
1988						
1989						
1990						
1991						
1992	15-April boat port on		23-April @ 4 ft 26-April @ 6 ft 01-May	02-Jun		08-Jun
1993						
1994	21-April boat port on		23-April @ 10 ft 01-May	18-May		20-May
1995			(vii)			
1996	6-May		11-May	16-May		03-Sep (iv)
1997	9-Apr		16-Apr	15-May		19-May
1998	(vii)					
1999	(vii)					
2000	5-Apr		16-Apr	19-May		2-Jun
2001	17-Apr		26-Apr	23-May		30-May
2002	2-Apr		18-Apr	22-May	24-May	7-Jun
2003	1-Apr	15-Apr	21-Apr	16-May	18-May	3-Jun
2004	1-Apr	15-Apr	21-Apr	19-May	24-May	10-Jun
2005	(xi)	(xi)	(xi)	(xi)	(xi)	(xi)
2006	(xi)	(xi)	(xi)	(xi)	(xi)	(xi)
2007	11- Apr	20- Apr	26- Apr	19- May	22- May	6- Jun
2008	(xiv)	(xiv)	(xiv)	(xiv)	(xiv)	(xiv)
2009	(xv)	(xv)	(xv)	(xv)	(xv)	(xv)
2010	5-Apr (xv)	(xv)	16-Apr (xv)	(xv)	(xv)	(xv)
2011	(xvii)	(xvii)	(xvii)	(xvii)	(xvii)	(xvii)
2012	15-Mar	1-Apr	11-Apr	1-Jun	4-Jun	20-Jun
2013	(xxii)	(xxii)	(xxii)	(xxii)	(xxii)	(xxii)
2014	25-Mar	8-Apr	11-Apr	28-May	9-Jun	26-Jun
2015	16-Mar	3-Apr	8-Apr	27-May	1-Jun	8-Jun
2016	10-Mar	1-Apr	4-Apr	27-May	1-Jun	14-Jun

TEMPORARY AGRICULTURAL BARRIERS

- **Typically installed April to November**
- **Increase water levels**
- **Mr. Burke shows stage difference probability plots at locations throughout South Delta. These plots excludes June 15-September 15.**
- **This is the time water levels are protected by the agricultural barriers.**

LOCATION OF ANALYSIS POINTS
SDWA-257, FIGURE 1, PAGE 5

SDWA Exhibit - 257

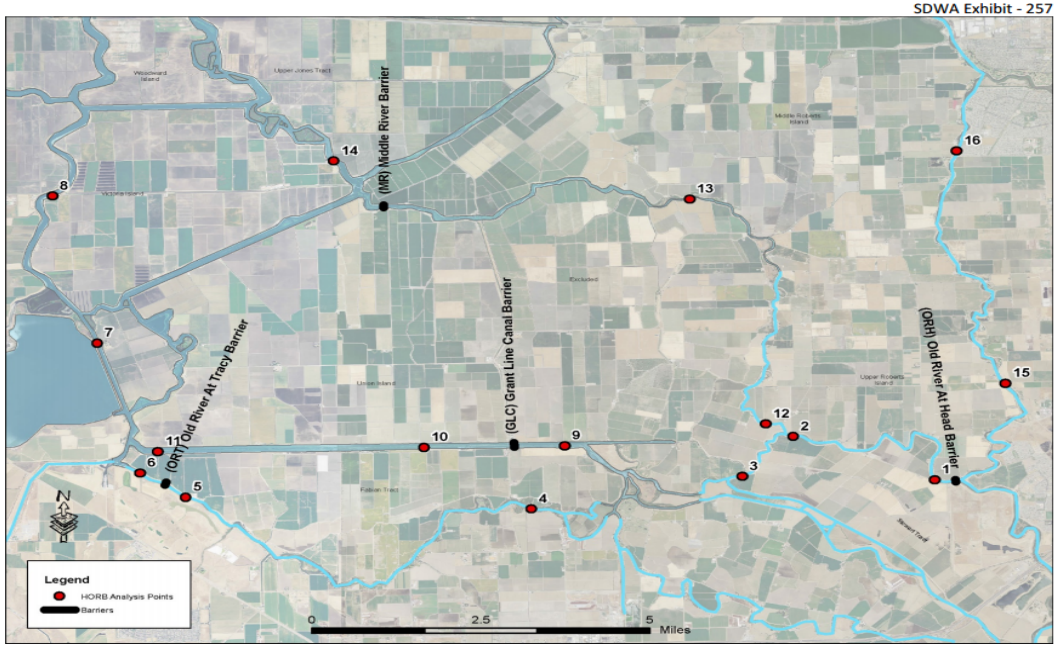
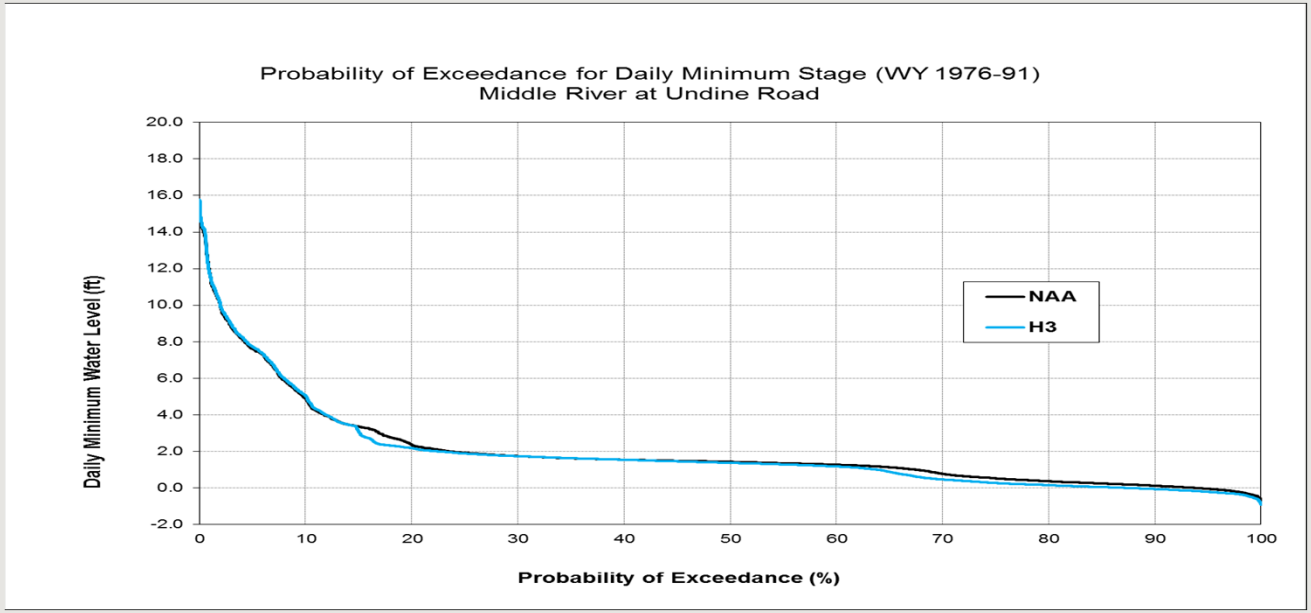


Figure 1 Location of Analysis Points

HORB Impact Analysis Page 5

PROBABILITY OF EXCEEDANCE FOR DAILY MINIMUM STAGE AT MIDDLE RIVER AT UNDINE ROAD



PROBABILITY OF EXCEEDANCE FOR DAILY MINIMUM STAGE AT MIDDLE RIVER AT UNDINE ROAD (JUNE-NOVEMBER) WATER LEVELS ARE MAINTAINED BY THE AGRICULTURAL BARRIERS

- **Only some reduction during higher flows**
- **Minimum water levels are 1 ½ foot higher**