Department of Conservation and Development

Water Agency

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Contra Costa County

John Kopchik
Director

April 11, 2018

Mr. Tripp Mizell
Senior Attorney, Office of the Chief Counsel
California Department of Water Resources
1416 Ninth Street, P.O. Box 942836
Sacramento, CA 94236-0001

Submitted via email

Re: DWR request for Contra Costa County-Solano County calculations

Dear Mr. Mizell:

During the California Department of Water Resources' (DWR) cross-examination of our expert witness, Dr. Richard Denton, on March 26, 2018, DWR requested that Contra Costa County and Solano County make available the spreadsheets of conversion calculations used to prepare the CCC-SC Exhibits for Part 2 of the California WaterFix Change Petition Hearing before the State Water Resources Control Board.

The requested spreadsheets are attached. They are the Excel spreadsheets used to calculate the conversion from specific electrical conductance (EC) to chloride concentration. The converted data in the attached spreadsheets were utilized in preparing CCC-SC 28 figures 1 through 5, and are referenced in Dr. Denton's written testimony, CCC-SC-3, at pages 29 through 33.

Dr. Denton utilized the following equations to make the attached calculations:

The calculation for converting from EC to chloride concentration in the vicinity of Old River at Bacon Island used the linear seawater intrusion equation in Exhibit DWR-509:

EC to Cl (µS/cm to mg/L) $Cl = 0.285\ EC - 50$

When seawater intrusion is very small, agricultural drainage dominates in the central and south Delta (i.e., when EC is less than 280µS/cm) and the chloride concentration is calculated using the agricultural drainage equation in DWR-509:

EC to Cl (µS/cm to mg/L) $Cl = 0.15\ EC - 12$

According to Dr. Denton, the equations above were calibrated over the historical range of EC and chloride concentrations in the vicinity of Old River at Bacon Island and the Intake to the

Contra Costa Canal at Pumping Plant No. 1, so they only apply for EC less than 1,200 µS/cm, approximately. For larger EC, such as the 2,781 µS/cm example given in CCC-SC-28 (Figure 5), a quadratic equation, such as the Mallard Island equation in DWR-509, is more appropriate and would normally be used. Using a linear equation underestimates the chloride concentration.

If you have any questions related to this response to your March 26, 2018 request, please contact Deputy County Counsel Kurtis Keller at (925) 335-1822.

Sincerely,

Ryan Hernandez
Contra Costa County Water Agency
On behalf of Contra Costa County, Contra Costa County Water Agency and Solano County

cc: Electronic Service
CWF Service List as of March 26, 2018

DWR-509 Linear Fits

Central and South Delta

Seawater	Ag Drainage
0.285	0.15
-50	-12

EC	Sea Cl	SJR Ag Cl
0		
50		
100		**3**
110		**5**
120		**6**
130		**8**
140		**9**
150		**11**
160		**12**
180		**15**
200		**18**
250	21	**26**
260	24	**27**
270	27	**29**
281.5	**30.2**	**30.2**
300	**36**	33
350	**50**	41
400	**64**	48
450	**78**	56
500	**93**	63
550	**107**	71
600	**121**	78
650	**135**	86
700	**150**	93
750	**164**	101
800	**178**	108
850	**192**	
900	**207**	
950	**221**	
1,000	**235**	
1,050	**249**	
1,100	**264**	
1,150	**278**	
1,200	**292**	
1,250	**306**	

Quadratic EC to Chloride Fit for Seawater

DWR-509	*Denton, Feb 2016*
2.50E-06	2.90E-06
0.294	0.285
-50	-50

EC	Mallard Cl	Mallard Cl
0		
50		
100		
110		
120		
130		
140		
150		
160		
180		
200		
250	24	21
260	27	24
270	30	27
281.5	33.0	30.5
300	38	36
350	53	50
400	68	64
450	83	79
500	98	93
550	112	108
600	127	122
650	142	136
700	157	151
750	172	165
800	187	180
850	202	194
900	217	209
950	232	223
1,000	247	238
1,050	261	252
1,100	276	267
1,150	291	282
1,200	306	296
1,250	321	311
1,300	336	325
1,350	351	340
1,400	367	355
1,500	397	384
1,600	427	413
1,700	457	443
1,800	487	472
1,900	518	502
2,000	548	532
2,200	609	591
2,400	670	651
2,600	731	711
2,781	**787**	**765**
3,000	855	831
4,000	1,166	1,136
5,000	1,483	1,448
6,000	1,804	1,764
8,000	2,462	2,416
10,000	3,140	3,090
12,000	3,838	3,788
14,000	4,556	4,508
16,000	5,294	5,252
18,000	6,052	6,020
19,000	6,439	6,412

http://www.baydeltalive.com/assets/588ee18bdb51ef1619ac6fd28b97f694/application/pdf/Denton_2015_Delta_Salinity_Constituents_Report.pdf

Delta Salinity Constituent Analysis

Richard A. Denton
Richard Denton & Associates
Oakland, California

Prepared for the
State Water Project Contractors Authority
February 2016

Conversion from EC to Cl using DWR-509 Linear Fits

0.285	
-50	
0.15	
-12	
Max of Sea and Ag Cl	
Cl (mg/L)	**Sea EC (µS/cm)**
100	526
150	702
250	1,053

0.285	
-50	
0.15	
-12	
	Max of Sea and Ag Cl
EC (µS/cm)	**Sea Cl (mg/L)**
2,781	**743**
526	**100**
702	**150**
1,053	**250**

Changes in EC and Chloride

For CCC-SC-28, Figure 1

OR Bacon March 16-yr Ave

338	**46**	NAA
366	**54**	BA PA
28	*8*	**Inc.**

OR Bacon March 82-yr Ave

304	**37**	NAA
401	**64**	BA PA
97	*28*	**Inc.**

CCC-SC-28, Figure 4
CCC-SC-3, Page 31, Line 17
BA PA and BA NAA on 2/26/1958

0.285	
-50	
0.15	
-12	
	Max of Sea and Ag Cl
EC (µS/cm)	**Sea Cl (mg/L)**

0.285			
-50			
0.15			
-12			
	Max of Sea and Ag Cl		
EC	**Sea Cl**	**Sea Cl**	**SJR Ag Cl**
0			
50			
100	**3**		3
110	**5**		5
120	**6**		6
130	**8**		8
140	**9**		9
150	**11**		11
160	**12**		12
180	**15**		15
200	**18**	7	18
250	**26**	21	26
260	**27**	24	27
270	**29**	27	29
281.5	**30.2**	30.2	30.2
300	**36**	36	33
350	**50**	50	41
400	**64**	64	48
450	**78**	78	56
500	**93**	93	63
550	**107**	107	71
600	**121**	121	78
650	**135**	135	86
700	**150**	150	93
750	**164**	164	101
800	**178**	178	108
850	**192**	192	
900	**207**	207	
950	**221**	221	
1,000	**235**	235	
1,050	**249**	249	
1,100	**264**	264	
1,150	**278**	278	
1,200	**292**	292	
1,250	**306**	306	

363	**53**	**NAA**
943	**219**	**PA**
580	*165*	**Inc.**