

Appendix H

Ion Balance

Calculations

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Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-24S			SW-24S			SW-24S			SW-24S			SW-24S			SW-S1			
Date	5/9/2007			8/15/2007			10/31/2007			12/19/2007			3/11/2008			5/11/2007			
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Calcium	40.1	2	80.0	3.992	38.2	71.0	3.5429	38.0	56.0	2.7944	37.8	49.0	2.4451	38.0	63.0	3.1437	38.7	14.0	0.6986
Magnesium	24.3	2	56.0	4.6081	44.1	50.0	4.1144	44.1	41.0	3.3738	45.6	35.0	2.8801	44.8	45.0	3.7029	45.6	12.0	0.98745
Potassium	39.1	1	3.2	0.0818	0.8	2.8	0.0716	0.8	2.5	0.0639	0.9	2.4	0.0614	1.0	2.7	0.0691	0.9	0.9	0.02174
Sodium	23.0	1	17.0	0.7395	7.1	15.0	0.6525	7.0	15.0	0.6525	8.8	13.0	0.5655	8.8	15.0	0.6525	8.0	6.0	0.26099
Iron	55.8	2	27.0	0.9669	9.2	25.0	0.8953	9.6	13.0	0.4656	6.3	12.0	0.4297	6.7	14.0	0.5014	6.2	0.1	0.00301
Manganese	54.9	2	1.6	0.0582	0.6	1.5	0.0546	0.6	1.4	0.051	0.7	1.3	0.0473	0.7	1.3	0.0473	0.6	0.3	0.01056
Ammonia-N	14.0	1	0.1	0.0071	0.1	0.1	0.0044	0.0	0.0	0.0011	0.0	0.1	0.0042	0.1	0.0	0.0011	0.0	0.0	0.00243
Total Cations (meq/L)				10.5			9.3			7.4			6.4			8.1			1.98
Anions																			
Alkalinity, Total			540			450			400			340			400			92.0	
Carbonate	60.0	2	0.2406	0.008	0.1	0.2005	0.0067	0.1	0.1625	0.0054	0.1	0.2043	0.0068	0.1	0.2759	0.0092	0.1	0.1705	0.00568
Bicarbonate	61.0	1	658.31	10.79	95.1	548.59	8.992	94.6	487.67	7.9934	95.6	414.38	6.7922	92.0	487.44	7.9896	94.8	111.89	1.83404
Chloride	35.5	1	16.0	0.4513	4.0	14.0	0.3949	4.2	5.0	0.141	1.7	9.3	0.2623	3.6	5.0	0.141	1.7	4.4	0.12411
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.4	0.0314	0.3	0.5	0.0357	0.4	1.3	0.0928	1.1	2.0	0.1428	1.9	2.1	0.1499	1.8	2.7	0.19276
Sulfate	96.1	2	3.2	0.0666	0.6	3.7	0.077	0.8	6.3	0.1312	1.6	8.6	0.1791	2.4	6.8	0.1416	1.7	12.0	0.24985
Total Anions (meq/L)				11.3			9.5			8.4			7.4			8.4			2.41
Total Ions (meq/L)				21.8			18.8			15.8			13.8			16.5			4.4
Cation/Anion Ratio				0.92			0.98			0.89			0.87			0.96			0.82
Percent Difference				-4.1			-0.9			-6.1			-6.9			-1.9			-10
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				9.42		8.38			6.88			5.95			7.57			1.97	
Calcium					42.37		42.27		40.59			41.08			41.54				
Magnesium					48.91		49.09		49.00			48.39			48.93				
Sodium + Potassium					8.72		8.64		10.41			10.53			9.53				
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				11.32		9.47		8.27		7.24		7.24		8.28		8.28		2.21	
Sulfate					0.589		0.813		1.586			2.473			1.710				
Chloride					3.988		4.170		1.705			3.623			1.703				
Bicarbonate + Carbonate					95.423		95.017		96.709			93.904			96.587				

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID Date	MW	n	SW-S1 8/15/2007			SW-S1 10/31/2007			SW-S1 12/19/2007			SW-S1 3/12/2008			SW-S2 5/9/2007			mg/L	
			%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L		%(meq)
Calcium	40.1	2	35.2	15.0	0.7485	35.6	16.0	0.7984	38.1	16.0	0.7984	36.3	17.0	0.8483	37.4	92.0	4.5908	37.5	84.0
Magnesium	24.3	2	49.8	12.0	0.9875	47.0	12.0	0.9875	47.1	13.0	1.0697	48.7	13.0	1.0697	47.1	69.0	5.6778	46.4	64.0
Potassium	39.1	1	1.1	1.0	0.0248	1.2	0.9	0.0233	1.1	1.0	0.0246	1.1	1.0	0.0253	1.1	3.7	0.0946	0.8	3.3
Sodium	23.0	1	13.1	6.6	0.2871	13.7	6.5	0.2827	13.5	6.9	0.3001	13.7	7.3	0.3175	14.0	17.0	0.7395	6.0	16.0
Iron	55.8	2	0.2	0.2	0.0079	0.4	0.1	0.0027	0.1	0.1	0.0043	0.2	0.1	0.0036	0.2	25.0	0.8953	7.3	18.0
Manganese	54.9	2	0.5	1.1	0.04	1.9	0.0	0.0005	0.0	0.0	0.0003	0.0	0.2	0.0055	0.2	6.4	0.233	1.9	5.4
Ammonia-N	14.0	1	0.1	0.1	0.004	0.2	0.0	0.0011	0.1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.2	0.0164	0.1	0.1
Total Cations (meq/L)					2.1			2.1			2.2			2.3			12.2		
Anions																			
Alkalinity, Total				90			88			100			94			570			580
Carbonate	60.0	2	0.2	0.0713	0.0024	0.1	0.0607	0.002	0.1	0.4632	0.0154	0.6	0.2755	0.0092	0.4	0.3842	0.0128	0.1	0.183
Bicarbonate	61.0	1	76.2	109.66	1.7974	71.2	107.24	1.7577	74.9	121.06	1.9843	78.8	114.12	1.8705	77.2	694.62	11.385	86.7	707.23
Chloride	35.5	1	5.2	4.8	0.1354	5.4	4.6	0.1297	5.5	4.8	0.1354	5.4	4.6	0.1297	5.4	55.0	1.5513	11.8	55.0
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	8.0	3.3	0.2356	9.3	2.3	0.1642	7.0	1.3	0.0928	3.7	1.4	0.1	4.1	0.1	0.0057	0.0	0.0
Sulfate	96.1	2	10.4	17.0	0.354	14.0	14.0	0.2915	12.4	14.0	0.2915	11.6	15.0	0.3123	12.9	8.3	0.1728	1.3	6.7
Total Anions (meq/L)					2.5			2.3			2.5			2.4			13.1		
Total Ions (meq/L)					4.6			4.4			4.7			4.7			25.4		
Cation/Anion Ratio					0.83			0.89			0.87			0.94			0.93		
Percent Difference					-9.2			-5.6			-6.8			-3.2			-3.5		
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)					2.05			2.09			2.19			2.26			11.10		
Calcium			35.48			36.55			38.17			36.41			37.52			41.35	
Magnesium			50.16			48.22			47.20			48.78			47.31			51.14	
Sodium + Potassium			14.36			15.23			14.63			14.81			15.16			7.51	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					2.29			2.18			2.43			2.32			13.12		
Sulfate			11.287			15.463			13.365			12.012			13.451			1.317	
Chloride			5.606			5.915			5.949			5.579			5.588			11.822	
Bicarbonate + Carbonate			83.107			78.623			80.686			82.408			80.960			86.861	

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S2 3/15/2007			SW-S2 10/31/2007			SW-S2 12/19/2007			SW-S2 3/11/2008			SW-S2 7/16/2008			SW-S2 10/7/2008			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																			
Calcium	40.1	2	4.1916	37.8	83.0	4.1417	36.6	62.0	3.0938	37.7	84.0	4.1916	36.9	89.0	4.4411	37.9	93.0	4.6407	37.1
Magnesium	24.3	2	5.2664	47.5	66.0	5.431	48.1	47.0	3.8675	47.1	64.0	5.2664	46.3	68.0	5.5956	47.7	74.0	6.0893	48.7
Potassium	39.1	1	0.0844	0.8	3.4	0.087	0.8	3.0	0.0767	0.9	3.5	0.0895	0.8	3.5	0.0895	0.8	3.8	0.0972	0.8
Sodium	23.0	1	0.696	6.3	17.0	0.7395	6.5	14.0	0.609	7.4	18.0	0.783	6.9	17.0	0.7395	6.3	20.0	0.87	7.0
Iron	55.8	2	0.6446	5.8	19.0	0.6804	6.0	9.6	0.3438	4.2	23.0	0.8237	7.2	19.0	0.6804	5.8	18.0	0.6446	5.2
Manganese	54.9	2	0.1966	1.8	5.8	0.2111	1.9	5.4	0.1966	2.4	5.7	0.2075	1.8	4.6	0.1675	1.4	4.6	0.1675	1.3
Ammonia-N	14.0	1	0.0086	0.1	0.2	0.0107	0.1	0.4	0.0278	0.3	0.1	0.0086	0.1	0.1	0.0079	0.1	0.1	0.0054	0.0
Total Cations (meq/L)			11.1			11.3	99.9		8.2	99.7		11.4			11.7	99.9		12.5	
Anions																			
Alkalinity, Total					500			550			500			640			610		
Carbonate	60.0	2	0.0061	0.0	0.4145	0.0138	0.1	0.4159	0.0139	0.1	0.3294	0.011	0.1	0.3273	0.0109	0.1	0.2595	0.0087	0.1
Bicarbonate	61.0	1	11.592	87.2	609.16	9.9847	66.7	670.15	10.984	87.7	609.33	9.9875	86.2	780.13	12.787	87.4	743.67	12.19	87.6
Chloride	35.5	1	1.5513	11.7	170.0	4.7951	32.0	47.0	1.3257	10.6	48.0	1.3539	11.7	59.0	1.6642	11.4	55.0	1.5513	11.2
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0018	0.0	0.0	0.0018	0.0	0.4	0.0271	0.2	0.9	0.0643	0.6	0.0	0.0018	0.0	0.0	0.0018	0.0
Sulfate	96.1	2	0.1395	1.0	8.4	0.1749	1.2	8.3	0.1728	1.4	7.9	0.1645	1.4	8.4	0.1749	1.2	7.5	0.1562	1.1
Total Anions (meq/L)			13.3			15.0	100.0		12.5	100.0		11.6			14.6	100.0		13.9	
Total Ions (meq/L)			24.4			26.3			20.7			23.0			26.4			26.4	
Cation/Anion Ratio			0.83			0.75			0.66			0.98			0.80			0.90	
Percent Difference			-9.0			-14.0			-20.8			-0.9			-11.1			-5.3	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			10.24			10.40			7.65		10.33			10.87			11.70		
Calcium			40.94			39.83			40.46		40.58			40.87			39.67		
Magnesium			51.44			52.23			50.58		50.98			51.50			52.06		
Sodium + Potassium			7.62			7.95			8.97		8.45			7.63			8.27		
			100.0			100.0			100.0		100.0			100.0			100.0		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			13.29			14.97			12.50		11.52			14.64			13.91		
Sulfate			1.050			1.168			1.383		1.428			1.195			1.123		
Chloride			11.674			32.035			10.608		11.756			11.370			11.156		
Bicarbonate + Carbonate			87.276			66.797			88.009		86.816			87.436			87.721		
			100.0			100.0			100.0		100.0			100.0			100.0		

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID Date	SW-S2 1/7/2009			SW-S2 3/25/2009			SW-S2 7/14/2009			SW-S2 10/27/2009			SW-S2 2/4/2010			SW-S2 4/15/2010			
	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Cations																			
Calcium	40.1	2	80.0	3.992	38.2	74.0	3.6926	35.5	98.5	4.9152	36.6	95.3	4.7555	36.1	81.0	4.0419	33.4	87.6	4.3713
Magnesium	24.3	2	59.0	4.855	46.4	62.0	5.1018	49.1	82.1	6.7558	50.4	80.0	6.583	50.0	72.2	5.9412	49.1	68.2	5.612
Potassium	39.1	1	3.6	0.0921	0.9	3.5	0.0895	0.9	4.4	0.113	0.8	4.4	0.1128	0.9	3.9	0.0997	0.8	4.0	0.1018
Sodium	23.0	1	17.0	0.7395	7.1	18.0	0.783	7.5	19.4	0.8439	6.3	24.9	1.0831	8.2	22.0	0.9569	7.9	20.0	0.87
Iron	55.8	2	17.0	0.6088	5.8	16.0	0.573	5.5	15.2	0.5443	4.1	13.2	0.4727	3.6	24.4	0.8738	7.2	17.7	0.6339
Manganese	54.9	2	4.2	0.1529	1.5	3.9	0.142	1.4	4.3	0.1565	1.2	4.2	0.1522	1.2	3.8	0.1383	1.1	3.7	0.1362
Ammonia-N	14.0	1	0.2	0.0143	0.1	0.1	0.0079	0.1	1.2	0.0885	0.7	0.1	0.0084	0.1	0.6	0.0408	0.3	0.1	0.0071
Total Cations (meq/L)				10.5			10.4			13.4			13.2			12.1			11.7
Anions																			
Alkalinity, Total			490			510			539			554			481			469	
Carbonate	60.0	2	0.2085	0.0069	0.1	0.1979	0.0066	0.1	0.2633	0.0088	0.1	0.2006	0.0067	0.1	0.2143	0.0071	0.1	3E-08	9E-10
Bicarbonate	61.0	1	597.38	9.7916	91.2	621.80	10.192	96.1	657.04	10.77	86.1	675.47	11.072	87.0	586.38	9.6114	85.2	572.18	9.3786
Chloride	35.5	1	29.0	0.818	7.6	4.6	0.1297	1.2	53.2	1.5006	12.0	50.3	1.4188	11.1	52.2	1.4724	13.0	52.8	1.4893
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.0	0.0018	0.0	0.0	0.0018	0.0	0.0	0.0004	0.0	0.0	0.0008	0.0	0.0	0.0007	0.0	0.0	0.0012
Sulfate	96.1	2	5.8	0.1208	1.1	13.0	0.2707	2.6	10.9	0.2269	1.8	10.9	0.2269	1.8	9.3	0.193	1.7	12.4	0.2582
Total Anions (meq/L)				10.7			10.6			12.5			12.7			11.3			11.1
Total Ions (meq/L)				21.2			21.0			25.9			25.9			23.4			22.9
Cation/Anion Ratio				0.97			0.98			1.07			1.03			1.07			1.05
Percent Difference				-1.3			-1.0			3.5			1.7			3.5			2.6
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				9.68		9.67			12.63			12.53			11.04			10.96	
Calcium					41.25		38.20		38.92			37.94			36.61				
Magnesium					50.16		52.78		53.50			52.52			53.82				
Sodium + Potassium					8.59		9.03		7.58			9.54			9.57				
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				10.74		10.60			12.51			12.72			11.28			11.13	
Sulfate					1.125		2.554		1.815			1.784			1.710				
Chloride					7.618		1.224		11.999			11.150			13.048				
Bicarbonate + Carbonate					91.257		96.222		86.186			87.066			85.241				

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID			SW-S2 8/12/2010			SW-S2 11/2/2010			SW-S3 5/11/2007			SW-S3 8/15/2007			SW-S3 10/30/2007			1	
Date	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L
Cations																			
Calcium	40.1	2	37.3	80.2	4.002	31.4	77.9	3.8872	34.6	36.0	1.7964	36.6	42.0	2.0958	37.5	35.0	1.7465	38.2	31.0
Magnesium	24.3	2	47.8	82.7	6.8052	53.4	69.4	5.7108	50.8	29.0	2.3863	48.6	34.0	2.7978	50.0	28.0	2.3041	50.4	26.0
Potassium	39.1	1	0.9	4.3	0.1107	0.9	4.3	0.1095	1.0	2.6	0.0665	1.4	2.7	0.0691	1.2	2.3	0.0588	1.3	2.3
Sodium	23.0	1	7.4	23.8	1.0352	8.1	19.3	0.8395	7.5	8.5	0.3697	7.5	9.6	0.4176	7.5	8.7	0.3784	8.3	8.3
Iron	55.8	2	5.4	18.9	0.6768	5.3	16.3	0.5837	5.2	5.3	0.1898	3.9	4.6	0.1647	2.9	1.8	0.0645	1.4	0.8
Manganese	54.9	2	1.2	3.1	0.1136	0.9	3.0	0.1092	1.0	2.1	0.0764	1.6	1.1	0.04	0.7	0.4	0.0157	0.3	0.3
Ammonia-N	14.0	1	0.1	0.1	0.0083	0.1	0.1	0.0068	0.1	0.3	0.0214	0.4	0.2	0.0107	0.2	0.1	0.0037	0.1	0.1
Total Cations (meq/L)				12.8			11.2			4.9			5.6			4.6			
Anions																			
Alkalinity, Total				541			466			250			290			250			210
Carbonate	60.0	2	0.0	0.1453	0.0048	0.0	0.0866	0.0029	0.0	0.1764	0.0059	0.1	0.1075	0.0036	0.1	0.125	0.0042	0.1	0.2954
Bicarbonate	61.0	1	84.3	659.72	10.814	87.3	568.34	9.3157	86.0	304.64	4.9934	93.5	353.58	5.7955	90.3	304.75	4.9951	89.9	255.60
Chloride	35.5	1	13.4	48.0	1.3539	10.9	47.4	1.337	12.3	6.4	0.1805	3.4	9.3	0.2623	4.1	7.2	0.2031	3.7	6.9
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.1	0.005	0.1	0.0	0.0018	0.0	0.0	0.0018	0.0	0.0
Sulfate	96.1	2	2.3	10.2	0.2124	1.7	8.5	0.1766	1.6	7.4	0.1541	2.9	17.0	0.354	5.5	17.0	0.354	6.4	19.0
Total Anions (meq/L)				12.4			10.8			5.3			6.4			5.6			
Total Ions (meq/L)				25.1			22.1			10.2			12.0			10.1			
Cation/Anion Ratio				1.03			1.04			0.92			0.87			0.82			
Percent Difference				1.5			1.9			-4.2			-6.8			-9.7			
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				11.95			10.55			4.62			5.38			4.49			
Calcium	39.90			33.48			36.86			38.89			38.95			38.92			
Magnesium	51.23			56.93			54.15			51.66			52.00			51.34			
Sodium + Potassium	8.87			9.59			9.00			9.44			9.04			9.74			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				12.38			10.83			5.33			6.42			5.56			
Sulfate	2.320			1.715			1.630			2.889			5.517			6.370			
Chloride	13.386			10.932			12.343			3.384			4.089			3.655			
Bicarbonate + Carbonate	84.294			87.353			86.027			93.727			90.394			89.975			

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S3 2/20/2007			SW-S3 3/11/2008			SW-S4 5/10/2007			SW-S4 8/16/2007			SW-S4 10/30/2007			SW-S4 12/19/2007			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																			
Calcium	40.1	2	1.5469	37.3	36.0	1.7964	37.7	35.0	1.7465	36.4	40.0	1.996	37.2	31.0	1.5469	35.6	27.0	1.3473	35.6
Magnesium	24.3	2	2.1395	51.6	30.0	2.4686	51.8	29.0	2.3863	49.7	33.0	2.7155	50.6	27.0	2.2218	51.1	23.0	1.8926	50.1
Potassium	39.1	1	0.0588	1.4	2.3	0.0588	1.2	2.9	0.0742	1.5	2.3	0.0588	1.1	2.4	0.0614	1.4	2.5	0.0639	1.7
Sodium	23.0	1	0.361	8.7	9.3	0.4045	8.5	8.9	0.3871	8.1	11.0	0.4785	8.9	8.1	0.3523	8.1	8.1	0.3523	9.3
Iron	55.8	2	0.0276	0.7	0.7	0.0233	0.5	0.1	0.0047	0.1	0.2	0.0057	0.1	0.1	0.0039	0.1	0.2	0.0079	0.2
Manganese	54.9	2	0.0095	0.2	0.3	0.0095	0.2	5.4	0.1966	4.1	3.0	0.1092	2.0	4.5	0.1638	3.8	3.1	0.1129	3.0
Ammonia-N	14.0	1	0.0037	0.1	0.1	0.0037	0.1	0.0	0.0025	0.1	0.0	0.0021	0.0	0.0	0.0011	0.0	0.0	0.0024	0.1
Total Cations (meq/L)			4.1			4.8			4.8			5.4			4.4	100.0		3.8	99.9
Anions																			
Alkalinity, Total					220			270			290			260			210		
Carbonate	60.0	2	0.0098	0.2	0.1262	0.0042	0.1	0.1413	0.0047	0.1	0.1553	0.0052	0.1	0.1878	0.0063	0.1	0.5008	0.0167	0.4
Bicarbonate	61.0	1	4.1895	87.4	268.14	4.3951	86.5	329.11	5.3945	91.4	353.48	5.7939	91.8	316.82	5.193	92.1	255.18	4.1827	88.0
Chloride	35.5	1	0.1946	4.1	6.6	0.1862	3.7	6.0	0.1692	2.9	6.2	0.1749	2.8	5.9	0.1664	3.0	5.8	0.1636	3.4
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0018	0.0	1.1	0.0785	1.5	1.5	0.1071	1.8	0.7	0.0478	0.8	0.6	0.0407	0.7	1.7	0.1214	2.6
Sulfate	96.1	2	0.3956	8.3	20.0	0.4164	8.2	11.0	0.229	3.9	14.0	0.2915	4.6	11.0	0.229	4.1	13.0	0.2707	5.7
Total Anions (meq/L)			4.8			5.1			5.9			6.3			5.6	100.0		4.8	100.0
Total Ions (meq/L)			8.9			9.8			10.7			11.7			10.0			8.5	
Cation/Anion Ratio			0.87			0.94			0.81			0.85			0.77			0.79	
Percent Difference			-7.2			-3.2			-10.3			-8.1			-12.9			-11.4	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			4.11			4.73			4.59			5.25			4.18			3.66	
Calcium				37.67			37.99		38.02			38.03			36.99			36.85	
Magnesium				52.10			52.21		51.94			51.74			53.12			51.76	
Sodium + Potassium				10.22			9.80		10.04			10.24			9.89			11.39	
															100.0			100.0	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			4.79			5.00			5.80			6.27			5.59			4.63	
Sulfate				8.259			8.325		3.951			4.652			4.094			5.841	
Chloride				4.063			3.722		2.919			2.791			2.975			3.531	
Bicarbonate + Carbonate				87.677			87.953		93.130			92.557			92.932			90.628	
															100.0			100.0	

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S4 3/13/2008			SW-S4 7/16/2008			SW-S4 10/7/2008			SW-S4 1/7/2009			SW-S4 3/23/2009			SW-S4 7/14/2009				
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																				
Calcium	40.1	2	26.0	1.2974	34.9	32.0	1.5968	35.8	44.0	2.1956	35.6	30.0	1.497	35.9	31.0	1.5469	34.4	49.5	2.4701	
Magnesium	24.3	2	23.0	1.8926	51.0	28.0	2.3041	51.7	39.0	3.2092	52.1	26.0	2.1395	51.3	29.0	2.3863	53.1	45.2	3.7194	
Potassium	39.1	1	2.4	0.0614	1.7	2.5	0.0639	1.4	3.2	0.0818	1.3	2.7	0.0691	1.7	2.7	0.0691	1.5	3.9	0.0992	
Sodium	23.0	1	8.5	0.3697	10.0	9.2	0.4002	9.0	11.0	0.4785	7.8	8.4	0.3654	8.8	9.2	0.4002	8.9	12.3	0.535	
Iron	55.8	2	0.1	0.0033	0.1	0.2	0.0072	0.2	0.2	0.0075	0.1	0.1	0.0031	0.1	0.1	0.0033	0.1	0.0	0.0008	
Manganese	54.9	2	2.4	0.0874	2.4	2.2	0.0801	1.8	5.0	0.182	3.0	2.5	0.091	2.2	2.5	0.091	2.0	3.8	0.1394	
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0032	0.1	0.1	0.005	0.1	0.0	0.0031	0.1	0.0	0.0011	0.0	0.0	0.003	
Total Cations (meq/L)				3.7			4.5	99.9		6.2			4.2			4.5			7.0	
Anions																				
Alkalinity, Total			170			250			340			230			240			347		
Carbonate	60.0	2	0.1173	0.0039	0.1	0.2272	0.0076	0.1	0.2692	0.009	0.1	0.126	0.0042	0.1	0.4057	0.0135	0.3	0.2685	0.009	
Bicarbonate	61.0	1	207.16	3.3956	84.7	304.54	4.9917	90.8	414.25	6.79	93.5	280.34	4.5951	90.3	291.98	4.7858	90.9	422.79	6.93	
Chloride	35.5	1	5.5	0.1551	3.9	6.6	0.1862	3.4	8.1	0.2285	3.1	6.2	0.1749	3.4	6.0	0.1692	3.2	6.7	0.1901	
Fluoride	19.0	1	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	0.0	0	
Nitrate-N	14.0	1	1.7	0.1214	3.0	0.0	0.0018	0.0	0.0	0.0018	0.0	0.0	0.0018	0.0	0.1	0.0056	0.1	0.0	0.0013	
Sulfate	96.1	2	16.0	0.3331	8.3	15.0	0.3123	5.7	11.0	0.229	3.2	15.0	0.3123	6.1	14.0	0.2915	5.5	11.6	0.2415	
Total Anions (meq/L)				4.0			5.5	100.0		7.3			5.1			5.3			7.4	
Total Ions (meq/L)				7.7			10.0			13.4			9.3			9.8			14.3	
Cation/Anion Ratio				0.93			0.81			0.85			0.82			0.85			0.95	
Percent Difference				-3.8			-10.5			-8.2			-9.9			-7.9			-2.8	
TRILINEAR DIAGRAM DATA																				
sum (Ca, Mg, Na+K)				3.62			4.36			5.97			4.07			4.40			6.82	
Calcium					35.83			36.58			36.81			36.77			35.14			
Magnesium					52.27			52.78			53.80			52.56			54.20			
Sodium + Potassium					11.91			10.63			9.39			10.67			10.66			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				3.89			5.50			7.26			5.09			5.26			7.37	
Sulfate					8.569			5.681			3.156			6.140			5.542			
Chloride					3.990			3.386			3.149			3.438			3.217			
Bicarbonate + Carbonate					87.441			90.933			93.695			90.422			91.241			
								100.0												

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID Date	MW	n	SW-S4 10/27/2009			SW-S4 1/29/2010			SW-S4 4/14/2010			SW-S4 8/11/2010			SW-S4 11/2/2010			mg/L	
			%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L		%(meq)
Cations																			
Calcium	40.1	2	35.5	57.0	2.8443	34.5	36.4	1.8164	34.9	41.0	2.0459	34.6	54.3	2.7096	31.6	46.8	2.3353	34.6	24.0
Magnesium	24.3	2	53.4	52.8	4.3448	52.7	33.8	2.7813	53.5	38.9	3.201	54.2	60.2	4.9537	57.7	44.5	3.6618	54.3	25.0
Potassium	39.1	1	1.4	4.2	0.1082	1.3	2.8	0.0721	1.4	3.3	0.0836	1.4	4.1	0.1041	1.2	4.0	0.101	1.5	2.4
Sodium	23.0	1	7.7	17.1	0.7438	9.0	10.7	0.4654	9.0	10.9	0.4741	8.0	16.3	0.709	8.3	12.6	0.5481	8.1	8.6
Iron	55.8	2	0.0	0.5	0.018	0.2	0.1	0.0029	0.1	0.0	0.001	0.0	0.1	0.0025	0.0	0.0	0.0007	0.0	0.3
Manganese	54.9	2	2.0	5.1	0.186	2.3	1.7	0.0601	1.2	2.8	0.1001	1.7	2.8	0.1005	1.2	2.6	0.095	1.4	0.1
Ammonia-N	14.0	1	0.0	0.0	0.0023	0.0	0.0	0.0017	0.0	0.0	0.0004	0.0	0.1	0.0053	0.1	0.0	0.0026	0.0	0.1
Total Cations (meq/L)					8.2			5.2			5.9			8.6			6.7		
Anions																			
Alkalinity, Total				381			247			320			343			365			200
Carbonate	60.0	2	0.1	0.1548	0.0052	0.1	0.2245	0.0075	0.1	0.0305	0.001	0.0	0.1637	0.0055	0.1	0.1075	0.0036	0.0	0.1444
Bicarbonate	61.0	1	94.0	464.51	7.6137	94.6	300.88	4.9318	91.8	390.34	6.398	93.8	418.13	6.8535	94.2	445.08	7.2953	94.9	243.71
Chloride	35.5	1	2.6	6.9	0.1943	2.4	6.0	0.1678	3.1	6.3	0.178	2.6	5.7	0.1619	2.2	5.5	0.154	2.0	5.2
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.0	0.0	0.001	0.0	0.3	0.0197	0.4	0.1	0.0052	0.1	0.2	0.0172	0.2	0.0	0.0004	0.0	1.0
Sulfate	96.1	2	3.3	11.2	0.2332	2.9	11.9	0.2478	4.6	11.5	0.2394	3.5	11.3	0.2353	3.2	11.3	0.2353	3.1	11.0
Total Anions (meq/L)					8.0			5.4			6.8			7.3			7.7		
Total Ions (meq/L)					16.3			10.6			12.7			15.9			14.4		
Cation/Anion Ratio					1.02			0.97			0.87			1.18			0.88		
Percent Difference					1.2			-1.7			-7.2			8.3			-6.5		
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)					8.04			5.14			5.80			8.48			6.65		
Calcium			36.20			35.37			35.37			35.25			31.97			35.14	
Magnesium			54.51			54.03			54.16			55.15			58.44			55.10	
Sodium + Potassium			9.29			10.60			10.47			9.61			9.59			9.77	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					8.05			5.35			6.82			7.26			7.69		
Sulfate			3.277			2.898			4.627			3.513			3.242			3.060	
Chloride			2.579			2.415			3.134			2.611			2.231			2.003	
Bicarbonate + Carbonate			94.144			94.687			92.239			93.876			94.526			94.937	

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S5 5/10/2007			SW-S5 8/16/2007			SW-S5 11/1/2007			SW-S5 12/18/2007			SW-S5 3/13/2008			SW-S5 7/16/2008			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																			
Calcium	40.1	2	1.1976	32.3	23.0	1.1477	32.4	24.0	1.1976	31.6	25.0	1.2475	31.0	26.0	1.2974	31.3	24.0	1.1976	30.8
Magnesium	24.3	2	2.0572	55.4	24.0	1.9749	55.7	26.0	2.1395	56.5	28.0	2.3041	57.2	29.0	2.3863	57.5	27.0	2.2218	57.1
Potassium	39.1	1	0.0614	1.7	2.2	0.0563	1.6	2.2	0.0563	1.5	2.5	0.0639	1.6	2.3	0.0588	1.4	2.4	0.0614	1.6
Sodium	23.0	1	0.3741	10.1	8.3	0.361	10.2	8.9	0.3871	10.2	9.3	0.4045	10.0	9.2	0.4002	9.6	9.2	0.4002	10.3
Iron	55.8	2	0.0115	0.3	0.1	0.0043	0.1	0.2	0.0057	0.2	0.1	0.0047	0.1	0.1	0.0033	0.1	0.2	0.0054	0.1
Manganese	54.9	2	0.0025	0.1	0.0	0.0006	0.0	0.0	0.0011	0.0	0.0	0.0005	0.0	0.0	0.0004	0.0	0.0	0.0012	0.0
Ammonia-N	14.0	1	0.0066	0.2	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			3.7			3.5			3.8			4.0			4.1			3.9	
Anions																			
Alkalinity, Total					190			200			210			200			200		
Carbonate	60.0	2	0.0048	0.1	0.1018	0.0034	0.1	0.1478	0.0049	0.1	0.2694	0.009	0.2	0.1148	0.0038	0.1	0.2135	0.0071	0.2
Bicarbonate	61.0	1	3.9946	89.9	231.59	3.796	92.0	243.70	3.9945	92.0	255.65	4.1904	91.6	243.77	3.9956	89.3	243.57	3.9923	90.6
Chloride	35.5	1	0.1467	3.3	3.4	0.0959	2.3	3.2	0.0903	2.1	3.6	0.1015	2.2	3.4	0.0959	2.1	3.8	0.1072	2.4
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0685	1.5	0.0	0.0018	0.0	0.1	0.0042	0.1	0.0	0.0018	0.0	1.2	0.0857	1.9	0.1	0.0079	0.2
Sulfate	96.1	2	0.229	5.2	11.0	0.229	5.6	12.0	0.2499	5.8	13.0	0.2707	5.9	14.0	0.2915	6.5	14.0	0.2915	6.6
Total Anions (meq/L)			4.4			4.1			4.3			4.6			4.5			4.4	
Total Ions (meq/L)			8.2			7.7			8.1			8.6			8.6			8.3	
Cation/Anion Ratio			0.84			0.86			0.87			0.88			0.93			0.88	
Percent Difference			-9.0			-7.6			-6.8			-6.4			-3.8			-6.2	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			3.69			3.54			3.78			4.02			4.14			3.88	
Calcium				32.45			32.42		31.68				31.03			31.32			30.86
Magnesium				55.75			55.79		56.59				57.31			57.60			57.25
Sodium + Potassium				11.80			11.79		11.73				11.65			11.08			11.89
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			4.38			4.12			4.34			4.57			4.39			4.40	
Sulfate				5.235			5.553		5.758				5.921			6.645			6.628
Chloride				3.352			2.325		2.080				2.221			2.186			2.437
Bicarbonate + Carbonate				91.413			92.122		92.162				91.858			91.169			90.935

Red text indicates a greater than 10 percent difference in Cation/Anion ratio

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID Date	MW	n	SW-S5 10/7/2008			SW-S5 1/7/2009			SW-S5 3/24/2009			SW-S5 7/16/2009			SW-S5 10/27/2009			SW-S5 1/29/2010	
			mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Cations																			
Calcium	40.1	2	22.0	1.0978	29.8	24.0	1.1976	32.5	21.0	1.0479	29.0	24.3	1.2126	30.2	23.9	1.1926	27.8	24.0	1.1976
Magnesium	24.3	2	26.0	2.1395	58.1	25.0	2.0572	55.8	26.0	2.1395	59.2	28.3	2.3287	58.0	31.3	2.5756	60.0	28.9	2.3781
Potassium	39.1	1	2.4	0.0614	1.7	2.5	0.0639	1.7	2.3	0.0588	1.6	2.9	0.0729	1.8	2.7	0.0701	1.6	2.6	0.0675
Sodium	23.0	1	8.6	0.3741	10.2	8.4	0.3654	9.9	8.4	0.3654	10.1	9.2	0.3993	9.9	10.3	0.448	10.4	9.9	0.4293
Iron	55.8	2	0.1	0.0031	0.1	0.1	0.0023	0.1	0.1	0.0021	0.1	0.1	0.002	0.0	0.1	0.0026	0.1	0.0	0.0002
Manganese	54.9	2	0.0	0.0006	0.0	0.0	0.0007	0.0	0.0	0.0005	0.0	0.0	0.0005	0.0	0.0	0.0003	0.0	0.0	2E-05
Ammonia-N	14.0	1	0.1	0.0036	0.1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004
Total Cations (meq/L)				3.7			3.7			3.6			4.0			4.3			4.1
Anions																			
Alkalinity, Total			200			190			190			170			169			182	
Carbonate	60.0	2	0.4993	0.0166	0.4	0.3067	0.0102	0.2	0.3286	0.011	0.3	0.0811	0.0027	0.1	0.1338	0.0045	0.1	0.1732	0.0058
Bicarbonate	61.0	1	242.98	3.9828	91.4	231.18	3.7892	90.0	231.13	3.7885	89.0	207.23	3.3968	89.3	205.91	3.375	89.4	221.69	3.6337
Chloride	35.5	1	3.4	0.0959	2.2	4.5	0.1269	3.0	4.9	0.1382	3.2	3.8	0.1075	2.8	3.7	0.1055	2.8	3.9	0.1094
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.2	0.0129	0.3	0.2	0.0143	0.3	0.1	0.0086	0.2	0.3	0.0193	0.5	0.2	0.0146	0.4	0.3	0.0221
Sulfate	96.1	2	12.0	0.2499	5.7	13.0	0.2707	6.4	15.0	0.3123	7.3	13.3	0.2769	7.3	13.2	0.2748	7.3	12.7	0.2644
Total Anions (meq/L)				4.4			4.2			4.3			3.8			3.8			4.0
Total Ions (meq/L)				8.0			7.9			7.9			7.8			8.1			8.1
Cation/Anion Ratio				0.84			0.88			0.85			1.06			1.14			1.01
Percent Difference				-8.4			-6.6			-8.2			2.7			6.4			0.5
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				3.67			3.68			3.61			4.01			4.29			4.07
Calcium					29.89			32.51			29.02			30.21			27.82		
Magnesium					58.25			55.84			59.24			58.02			60.09		
Sodium + Potassium					11.86			11.65			11.75			11.77			12.09		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				4.35			4.20			4.25			3.78			3.76			4.01
Sulfate					5.750			6.449			7.349			7.318			7.310		
Chloride					2.207			3.024			3.252			2.840			2.806		
Bicarbonate + Carbonate					92.043			90.527			89.399			89.842			89.884		

Red text indicates a greater than 10 percent difference in Cation/Ani

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S5 4/14/2010			SW-S5 8/11/2010			SW-S5 11/5/2010			SW-S6 5/10/2007			SW-S6 8/16/2007						
Date	MW	n	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L
Cations																			
Calcium	40.1	2	29.4	23.1	1.1527	30.5	22.4	1.1178	28.6	21.3	1.0629	28.5	32.0	1.5968	37.3	28.0	1.3972	36.0	26.0
Magnesium	24.3	2	58.4	26.6	2.1889	57.9	27.8	2.2876	58.5	26.5	2.1806	58.4	27.0	2.2218	52.0	25.0	2.0572	52.9	24.0
Potassium	39.1	1	1.7	2.3	0.0593	1.6	2.6	0.0665	1.7	2.5	0.0634	1.7	1.9	0.0486	1.1	1.9	0.0486	1.3	1.6
Sodium	23.0	1	10.5	8.8	0.3819	10.1	10.1	0.4393	11.2	9.7	0.4237	11.4	9.3	0.4045	9.5	8.7	0.3784	9.7	8.7
Iron	55.8	2	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.1	0.0033	0.1	0.1	0.0029	0.1	0.3
Manganese	54.9	2	0.0	0.0	8E-05	0.0	0.0	0.0002	0.0	0.0	8E-05	0.0	0.0	1E-04	0.0	0.0	0.0007	0.0	0.1
Ammonia-N	14.0	1	0.0	0.0	0.0004	0.0	0.0	0.0009	0.0	0.0	0.0004	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0
Total Cations (meq/L)					3.8			3.9			3.7			4.3			3.9		
Anions																			
Alkalinity, Total				200			179			187			230			140			180
Carbonate	60.0	2	0.1	0.0269	0.0009	0.0	0.0348	0.0012	0.0	0.0469	0.0016	0.0	0.1414	0.0047	0.1	0.0556	0.0019	0.1	0.0699
Bicarbonate	61.0	1	90.0	243.95	3.9985	90.7	218.31	3.5783	90.3	228.04	3.7379	90.7	280.31	4.5946	91.4	170.69	2.7977	84.9	219
Chloride	35.5	1	2.7	3.7	0.1038	2.4	3.0	0.0852	2.1	3.1	0.0886	2.1	5.2	0.1467	2.9	5.2	0.1467	4.4	5.4
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.5	0.5	0.0343	0.8	0.3	0.0228	0.6	0.4	0.0293	0.7	0.7	0.05	1.0	1.7	0.1214	3.7	1.0
Sulfate	96.1	2	6.6	13.0	0.2707	6.1	13.2	0.2748	6.9	12.7	0.2644	6.4	11.0	0.229	4.6	11.0	0.229	6.9	11.0
Total Anions (meq/L)					4.4			4.0			4.1			5.0			3.3		
Total Ions (meq/L)					8.2			7.9			7.9			9.3			7.2		
Cation/Anion Ratio					0.86			0.99			0.91			0.85			1.18		
Percent Difference					-7.6			-0.6			-5.0			-8.1			8.2		
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)					3.78			3.91			3.73			4.27			3.88		
Calcium	29.41					30.47			28.58			28.49			37.38			36.00	
Magnesium	58.39					57.86			58.49			58.45			52.01			53.00	
Sodium + Potassium	12.20					11.66			12.93			13.06			10.61			11.00	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					4.37			3.94			4.09			4.98			3.18		
Sulfate	6.589					6.188			6.976			6.461			4.604			7.213	
Chloride	2.727					2.373			2.162			2.164			2.948			4.619	
Bicarbonate + Carbonate	90.684					91.438			90.861			91.374			92.448			88.168	

anion ratio

Red text indicates a greater than 10 percent difference in (

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID	SW-S6 1/1/2007			SW-S6 7/16/2008			SW-S6 1/7/2009			SW-S6 10/27/2009			SW-S6 8/11/2010			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																
Calcium	40.1	2	1.2974	35.0	26.0	1.2974	34.7	26.0	1.2974	34.5	32.3	1.6118	32.4	30.3	1.512	32.8
Magnesium	24.3	2	1.9749	53.3	24.0	1.9749	52.9	25.0	2.0572	54.7	34.2	2.8142	56.5	31.1	2.5591	55.5
Potassium	39.1	1	0.0409	1.1	1.9	0.0486	1.3	1.9	0.0486	1.3	2.3	0.0588	1.2	2.3	0.0581	1.3
Sodium	23.0	1	0.3784	10.2	9.3	0.4045	10.8	8.1	0.3523	9.4	11.4	0.4959	10.0	11.1	0.4828	10.5
Iron	55.8	2	0.0118	0.3	0.1	0.0047	0.1	0.1	0.0033	0.1	0.0	0.0004	0.0	0.0	0.0002	0.0
Manganese	54.9	2	0.002	0.1	0.1	0.0019	0.1	0.0	1E-04	0.0	0.0	0.0001	0.0	0.0	1E-04	0.0
Ammonia-N	14.0	1	0.0011	0.0	0.0	0.0022	0.1	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			3.7		3.7			3.8			5.0			4.6		
Anions																
Alkalinity, Total					200			170			4.2			213		
Carbonate	60.0	2	0.0023	0.1	0.1584	0.0053	0.1	0.2132	0.0071	0.2	0.0032	0.0001	0.0	0.0672	0.0022	0.0
Bicarbonate	61.0	1	3.5971	88.8	244	3.9941	89.4	207	3.3924	88.3	5	0.0839	16.5	260	4.2571	90.5
Chloride	35.5	1	0.1523	3.8	6.0	0.1692	3.8	6.1	0.1721	4.5	5.6	0.1588	31.3	4.8	0.1365	2.9
Fluoride	19.0	1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Nitrate-N	14.0	1	0.0714	1.8	0.7	0.0493	1.1	1.0	0.0714	1.9	0.5	0.0363	7.1	0.7	0.048	1.0
Sulfate	96.1	2	0.229	5.7	12.0	0.2499	5.6	9.6	0.1999	5.2	11.0	0.229	45.1	12.4	0.2582	5.5
Total Anions (meq/L)			4.1		4.5			3.8			0.5			4.7		
Total Ions (meq/L)			7.8		8.2			7.6			5.5			9.3		
Cation/Anion Ratio			0.91		0.84			0.98			9.80			0.98		
Percent Difference			-4.5		-8.9			-1.1			81.5			-1.0		
TRILINEAR DIAGRAM DATA																
sum (Ca, Mg, Na+K)			3.69		3.73			3.76			4.98			4.61		
Calcium				35.14		34.83			34.55			32.36			32.78	
Magnesium				53.50		53.01			54.78			56.50			55.49	
Sodium + Potassium				11.36		12.16			10.68			11.14			11.73	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			3.98		4.42			3.77			0.47			4.65		
Sulfate				5.753		5.655			5.300			48.542			5.547	
Chloride				3.826		3.830			4.562			33.657			2.933	
Bicarbonate + Carbonate				90.420		90.515			90.138			17.801			91.519	

Cation/Anion ratio

Red text indicates a greater than 10 percent di

Appendix H.1- Seeps/Seepage Sampling Locations - Ion Balance Calculations

Site ID		
Date		
Cations	MW	n
Calcium	40.1	2
Magnesium	24.3	2
Potassium	39.1	1
Sodium	23.0	1
Iron	55.8	2
Manganese	54.9	2
Ammonia-N	14.0	1
Total Cations (meq/L)		
Anions		
Alkalinity, Total		
Carbonate	60.0	2
Bicarbonate	61.0	1
Chloride	35.5	1
Fluoride	19.0	1
Nitrate-N	14.0	1
Sulfate	96.1	2
Total Anions (meq/L)		
Total Ions (meq/L)		
Cation/Anion Ratio		
Percent Difference		
TRILINEAR DIAGRAM DATA		
sum (Ca, Mg, Na+K)		
Calcium		
Magnesium		
Sodium + Potassium		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)		
Sulfate		
Chloride		
Bicarbonate + Carbonate		

ifference in Cation/Anion ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID			SW-14E 5/9/2007			SW-W1 3/28/2007			SW-W1 5/9/2007			SW-W1 8/14/2007			SW-W1 11/1/2007			SW-W1 3/12/2008	
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Cations																			
Calcium	40.1	2	37.0	1.8463	38.3	16.0	0.7984	38.1	18.0	0.8982	38.9	17.0	0.8483	37.7	17.0	0.8483	36.5	17.0	0.8483
Magnesium	24.3	2	30.0	2.4686	51.2	12.0	0.9875	47.1	13.0	1.0697	46.3	13.0	1.0697	47.6	14.0	1.152	49.6	12.0	0.98745
Potassium	39.1	1	2.5	0.0639	1.3	0.9	0.0225	1.1	0.9	0.0233	1.0	0.9	0.0228	1.0	0.8	0.0215	0.9	0.9	0.02379
Sodium	23.0	1	10.0	0.435	9.0	6.4	0.2784	13.3	7.1	0.3088	13.4	6.7	0.2914	13.0	6.7	0.2914	12.5	6.8	0.29578
Iron	55.8	2	0.2	0.0054	0.1	0.2	0.0064	0.3	0.1	0.0043	0.2	0.1	0.0036	0.2	0.1	0.0043	0.2	0.2	0.00609
Manganese	54.9	2	0.1	0.0032	0.1	0.1	0.0024	0.1	0.1	0.0047	0.2	0.3	0.0106	0.5	0.1	0.0051	0.2	0.3	0.00983
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0011	0.1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.00107
Total Cations (meq/L)				4.8			2.1			2.3			2.2			2.3			2.17
Anions																			
Alkalinity, Total			240			90			90			100			98			96.0	
Carbonate	60.0	2	1.8358	0.0612	1.1	0.3097	0.0103	0.4	0.3394	0.0113	0.5	0.3213	0.0107	0.4	0.2873	0.0096	0.4	0.379	0.01263
Bicarbonate	61.0	1	289.07	4.7381	85.0	109.17	1.7894	77.1	109.11	1.7884	75.2	121.35	1.989	75.7	118.98	1.9501	77.8	116.35	1.90708
Chloride	35.5	1	18.0	0.5077	9.1	3.5	0.0987	4.3	4.8	0.1354	5.7	5.1	0.1439	5.5	4.2	0.1185	4.7	3.8	0.10718
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.6	0.0414	0.7	3.1	0.2213	9.5	2.7	0.1928	8.1	2.7	0.1928	7.3	1.9	0.1356	5.4	2.2	0.15706
Sulfate	96.1	2	11.0	0.229	4.1	9.7	0.202	8.7	12.0	0.2499	10.5	14.0	0.2915	11.1	14.0	0.2915	11.6	14.0	0.29149
Total Anions (meq/L)				5.6			2.3			2.4			2.6			2.5			2.48
Total Ions (meq/L)				10.4			4.4			4.7			4.9			4.8			4.6
Cation/Anion Ratio				0.86			0.90			0.97			0.86			0.93			0.88
Percent Difference				-7.2			-5.1			-1.4			-7.8			-3.8			-7
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			4.81			2.09			2.30			2.23			2.31			2.16	
Calcium				38.35			38.26			39.05			38.00			36.67			
Magnesium				51.28			47.32			46.51			47.92			49.80			
Sodium + Potassium				10.36			14.42			14.44			14.08			13.53			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			5.54			2.10			2.18			2.44			2.37			2.32	
Sulfate				4.137			9.615			11.435			11.971			12.301			
Chloride				9.171			4.700			6.196			5.908			4.999			
Bicarbonate + Carbonate				86.692			85.685			82.369			82.122			82.700			

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	Date	MW	n	SW-W1 7/15/2008			SW-W1 10/6/2008			SW-W1 3/26/2009			SW-W1 7/13/2009			SW-W1 10/20/2009			mg/L	
Cations				%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L
Calcium		40.1	2	39.1	17.0	0.8483	36.3	19.0	0.9481	35.7	18.0	0.8982	34.4	18.3	0.9132	35.4	16.7	0.8333	34.3	14.9
Magnesium		24.3	2	45.5	14.0	1.152	49.3	16.0	1.3166	49.6	16.0	1.3166	50.4	14.6	1.2014	46.6	13.0	1.0697	44.0	12.4
Potassium		39.1	1	1.1	1.1	0.0281	1.2	1.3	0.0332	1.3	0.2	0.0038	0.1	1.4	0.0368	1.4	1.3	0.0327	1.3	1.2
Sodium		23.0	1	13.6	6.9	0.3001	12.8	7.6	0.3306	12.4	8.0	0.348	13.3	7.8	0.341	13.2	7.4	0.3223	13.3	6.7
Iron		55.8	2	0.3	0.1	0.0034	0.1	0.1	0.0039	0.1	0.7	0.0265	1.0	0.9	0.0338	1.3	1.4	0.0512	2.1	0.2
Manganese		54.9	2	0.5	0.1	0.0044	0.2	0.5	0.0186	0.7	0.5	0.0193	0.7	1.3	0.0462	1.8	3.2	0.1158	4.8	0.4
Ammonia-N		14.0	1	0.0	0.0	0.0011	0.0	0.1	0.0044	0.2	0.0	0.0011	0.0	0.1	0.0052	0.2	0.1	0.0065	0.3	0.0
Total Cations (meq/L)						2.3			2.7			2.6			2.6			2.4		
Anions																				
Alkalinity, Total					110			120			110			106			108			92.6
Carbonate		60.0	2	0.5	0.5334	0.0178	0.7	0.1142	0.0038	0.1	1.7339	0.0578	2.2	0.2968	0.0099	0.4	0.4463	0.0149	0.6	0.1084
Bicarbonate		61.0	1	77.0	133.12	2.1819	81.6	146.17	2.3958	84.8	130.67	2.1419	81.3	128.72	2.1098	82.3	130.85	2.1448	81.2	112.75
Chloride		35.5	1	4.3	4.6	0.1297	4.9	4.6	0.1297	4.6	4.5	0.1269	4.8	5.3	0.1484	5.8	4.9	0.1385	5.2	4.7
Fluoride		19.0	1	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	0.0	0.0
Nitrate-N		14.0	1	6.3	0.8	0.0535	2.0	0.4	0.025	0.9	1.4	0.1	3.8	0.3	0.0238	0.9	0.2	0.0175	0.7	2.2
Sulfate		96.1	2	11.8	14.0	0.2915	10.9	13.0	0.2707	9.6	10.0	0.2082	7.9	13.0	0.2707	10.6	15.7	0.3269	12.4	10.9
Total Anions (meq/L)						2.7			2.8			2.6			2.6			2.6		
Total Ions (meq/L)						5.0			5.5			5.2			5.1			5.1		
Cation/Anion Ratio						0.87			0.94			0.99			1.01			0.92		
Percent Difference						-6.7			-3.1			-0.4			0.3			-4.2		
TRILINEAR DIAGRAM DATA																				
sum (Ca, Mg, Na+K)						2.33			2.63			2.57			2.49			2.26		
Calcium				39.36			36.43			36.07			35.00			36.64			36.90	
Magnesium				45.81			49.47			50.09			51.30			48.20			47.37	
Sodium + Potassium				14.83			14.10			13.84			13.71			15.16			15.72	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)						2.62			2.80			2.53			2.54			2.63		
Sulfate				12.573			11.122			9.667			8.214			10.662			12.453	
Chloride				4.623			4.951			4.634			5.007			5.844			5.276	
Bicarbonate + Carbonate				82.804			83.928			85.700			86.779			83.494			82.272	

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W1		SW-W1			SW-W1			SW-W1			SW-W2			SW-W2				
Date	1/21/2010		4/19/2010			8/16/2010			11/9/2010			3/28/2007			5/9/2007				
Cations	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	0.7435	35.3	14.9	0.7435	32.4	16.6	0.8283	32.9	13.6	0.6786	32.2	58.0	2.8942	37.5	68.0	3.3932	38.5
Magnesium	24.3	2	1.0204	48.4	14.3	1.1767	51.3	14.7	1.2096	48.1	13.4	1.1027	52.3	50.0	4.1144	53.4	56.0	4.6081	52.3
Potassium	39.1	1	0.0302	1.4	1.1	0.0284	1.2	1.4	0.0358	1.4	1.2	0.0315	1.5	2.9	0.0742	1.0	3.4	0.087	1.0
Sodium	23.0	1	0.2901	13.8	7.3	0.318	13.9	8.0	0.3497	13.9	6.5	0.2819	13.4	14.0	0.609	7.9	16.0	0.696	7.9
Iron	55.8	2	0.0082	0.4	0.3	0.0111	0.5	1.0	0.0362	1.4	0.1	0.0043	0.2	0.3	0.0097	0.1	0.2	0.0079	0.1
Manganese	54.9	2	0.0145	0.7	0.4	0.0137	0.6	1.4	0.0513	2.0	0.2	0.0071	0.3	0.2	0.0058	0.1	0.3	0.0098	0.1
Ammonia-N	14.0	1	0.0015	0.1	0.0	0.0013	0.1	0.0	0.003	0.1	0.0	0.0012	0.1	0.0	0.0011	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			2.1			2.3			2.5			2.1			7.7			8.8	
Anions																			
Alkalinity, Total					92.8			105			83.4			400			440		
Carbonate	60.0	2	0.0036	0.2	0.0718	0.0024	0.1	0.1046	0.0035	0.1	0.0224	0.0007	0.0	5.2675	0.1756	2.1	5.1765	0.1726	1.7
Bicarbonate	61.0	1	1.8481	78.2	113.07	1.8533	77.2	127.89	2.0962	83.5	101.70	1.667	76.5	477.29	7.8232	95.6	526.27	8.6261	87.2
Chloride	35.5	1	0.132	5.6	5.4	0.1532	6.4	5.1	0.1441	5.7	4.8	0.1354	6.2	0.5	0.0141	0.2	33.0	0.9308	9.4
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.1535	6.5	2.1	0.1506	6.3	0.6	0.0455	1.8	2.3	0.1635	7.5	0.2	0.0157	0.2	0.2	0.0107	0.1
Sulfate	96.1	2	0.2269	9.6	11.6	0.2415	10.1	10.6	0.2207	8.8	10.2	0.2124	9.7	7.4	0.1541	1.9	7.5	0.1562	1.6
Total Anions (meq/L)			2.4			2.4			2.5			2.2			8.2			9.9	
Total Ions (meq/L)			4.5			4.7			5.0			4.3			15.9			18.7	
Cation/Anion Ratio			0.89			0.95			1.00			0.97			0.94			0.89	
Percent Difference			-5.7			-2.3			0.1			-1.7			-3.0			-5.8	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			2.08			2.27			2.42			2.09			7.69			8.78	
Calcium				35.67			32.80			34.18			32.40			37.63			38.63
Magnesium				48.96			51.92			49.91			52.64			53.49			52.46
Sodium + Potassium				15.37			15.28			15.91			14.96			8.88			8.91
				100.0			100.0			100.0			100.0						
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			2.21			2.25			2.46			2.02			8.17			9.89	
Sulfate				10.266			10.732			8.955			10.537			1.887			1.580
Chloride				5.971			6.806			5.848			6.717			0.173			9.416
Bicarbonate + Carbonate				83.763			82.462			85.196			82.746			97.941			89.005
				100.0			100.0			100.0			100.0						

Red Text Indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID Date	SW-W2 8/14/2007			SW-W2 10/30/2007			SW-W2 12/18/2007			SW-W2 3/12/2008			SW-W2 7/15/2008			SW-W2 10/6/2008			
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Calcium	40.1	2	63.0	3.1437	37.0	63.0	3.1437	37.7	59.0	2.9441	38.3	63.0	3.1437	38.8	60.0	2.994	37.2	67.0	3.3433
Magnesium	24.3	2	56.0	4.6081	54.2	54.0	4.4435	53.3	49.0	4.0321	52.5	51.0	4.1967	51.7	53.0	4.3612	54.1	60.0	4.9373
Potassium	39.1	1	3.2	0.0818	1.0	3.0	0.0767	0.9	2.9	0.0742	1.0	4.0	0.1023	1.3	3.0	0.0767	1.0	3.3	0.0844
Sodium	23.0	1	15.0	0.6525	7.7	15.0	0.6525	7.8	14.0	0.609	7.9	15.0	0.6525	8.0	14.0	0.609	7.6	17.0	0.7395
Iron	55.8	2	0.2	0.0082	0.1	0.5	0.0172	0.2	0.3	0.0118	0.2	0.2	0.0082	0.1	0.3	0.0118	0.1	0.2	0.0086
Manganese	54.9	2	0.2	0.0087	0.1	0.3	0.0091	0.1	0.2	0.0069	0.1	0.2	0.0066	0.1	0.1	0.0047	0.1	0.2	0.0076
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011
Total Cations (meq/L)				8.5			8.3			7.7			8.1			8.1	100.0		9.1
Anions																			
Alkalinity, Total			460			430			400			410			460			480	
Carbonate	60.0	2	4.9441	0.1648	1.6	3.9442	0.1315	1.4	4.9231	0.1641	1.8	6.609	0.2203	2.4	5.5353	0.1845	1.8	5.6471	0.1882
Bicarbonate	61.0	1	551.15	9.0338	87.2	516.58	8.4672	88.2	477.99	7.8347	87.6	486.76	7.9785	87.2	549.94	9.0141	86.9	574.12	9.4103
Chloride	35.5	1	36.0	1.0154	9.8	30.0	0.8462	8.8	26.0	0.7334	8.2	26.0	0.7334	8.0	36.0	1.0154	9.8	37.0	1.0436
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.1	0.0079	0.1	0.1	0.0079	0.1	0.4	0.03	0.3	0.4	0.025	0.3	0.1	0.0093	0.1	0.1	0.0061
Sulfate	96.1	2	6.8	0.1416	1.4	7.3	0.152	1.6	8.7	0.1811	2.0	9.2	0.1916	2.1	7.0	0.1457	1.4	7.2	0.1499
Total Anions (meq/L)				10.4			9.6			8.9			9.1			10.4	100.0		10.8
Total Ions (meq/L)				18.9			17.9			16.6			17.3			18.4			19.9
Cation/Anion Ratio				0.82			0.87			0.86			0.89			0.78			0.84
Percent Difference				-9.9			-7.0			-7.6			-6.0			-12.5			-8.4
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				8.49			8.32			7.66			8.10			8.04			9.10
Calcium					37.05			37.80			38.44			38.83			37.23		
Magnesium					54.30			53.43			52.64			51.84			54.24		
Sodium + Potassium					8.65			8.77			8.92			9.32			8.53		
																	100.0		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				10.36			9.60			8.91			9.12			10.36			10.79
Sulfate					1.367			1.584			2.032			2.099			1.407		
Chloride					9.806			8.817			8.228			8.038			9.802		
Bicarbonate + Carbonate					88.827			89.599			89.740			89.862			88.792		
																	100.0		

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID			SW-W2 1/6/2009			SW-W2 3/26/2009			SW-W2 7/13/2009			SW-W2 10/20/2009			SW-W2 1/21/2010				
Date	MW	n	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L
Cations																			
Calcium	40.1	2	36.7	56.0	2.7944	38.6	65.0	3.2435	37.4	66.5	3.3184	36.7	67.4	3.3633	36.6	64.3	3.2086	37.8	57.9
Magnesium	24.3	2	54.1	46.0	3.7852	52.3	57.0	4.6904	54.1	59.1	4.8632	53.8	60.9	5.0113	54.5	54.6	4.4929	53.0	58.3
Potassium	39.1	1	0.9	3.0	0.0767	1.1	1.2	0.0307	0.4	4.1	0.1036	1.1	3.4	0.0877	1.0	3.0	0.076	0.9	3.3
Sodium	23.0	1	8.1	13.0	0.5655	7.8	16.0	0.696	8.0	17.1	0.7438	8.2	16.8	0.7308	7.9	16.1	0.7003	8.3	16.8
Iron	55.8	2	0.1	0.2	0.0057	0.1	0.3	0.009	0.1	0.0	0.0005	0.0	0.0	0.0015	0.0	0.0	0.0006	0.0	0.0
Manganese	54.9	2	0.1	0.1	0.0031	0.0	0.0	0.0015	0.0	0.1	0.0024	0.0	0.1	0.0024	0.0	0.0	0.0013	0.0	0.0
Ammonia-N	14.0	1	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0008	0.0	0.0
Total Cations (meq/L)				7.2	100.0		8.7			9.0			9.2			8.5			
Anions																			
Alkalinity, Total				390		420				415			392			390			399
Carbonate	60.0	2	1.7	3.3419	0.1114	1.2	5.4077	0.1803	1.9	0.6548	0.0218	0.2	2.4431	0.0814	0.9	1.0194	0.034	0.4	2.1198
Bicarbonate	61.0	1	87.1	469.00	7.6874	86.1	501.40	8.2185	88.4	504.97	8.2769	87.7	473.27	7.7574	86.4	473.73	7.7648	88.3	482.47
Chloride	35.5	1	9.7	32.0	0.9026	10.1	26.0	0.7334	7.9	34.4	0.9703	10.3	33.1	0.9336	10.4	28.0	0.7898	9.0	32.6
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.1	0.3	0.0193	0.2	0.2	0.015	0.2	0.1	0.0067	0.1	0.1	0.0047	0.1	0.2	0.0146	0.2	0.2
Sulfate	96.1	2	1.4	10.0	0.2082	2.3	7.0	0.1457	1.6	7.8	0.1624	1.7	9.5	0.1974	2.2	9.0	0.1882	2.1	9.3
Total Anions (meq/L)				8.9	100.0		9.3			9.4			9.0			8.8			
Total Ions (meq/L)				16.2			18.0			18.5			18.2			17.3			
Cation/Anion Ratio				0.81			0.93			0.96			1.02			0.96			
Percent Difference				-10.5			-3.5			-2.2			1.2			-1.8			
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				7.22		8.66				9.03			9.19			8.48			
Calcium	36.72			38.69		37.45				36.75			36.58			37.85			
Magnesium	54.23			52.41		54.16				53.86			54.51			53.00			
Sodium + Potassium	9.05			8.89		8.39				9.39			8.90			9.16			
				100.0															
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				8.91		9.28				9.43			8.97			8.78			
Sulfate	1.389			2.337		1.571				1.722			2.201			2.145			
Chloride	9.670			10.131		7.904				10.288			10.409			8.998			
Bicarbonate + Carbonate	88.941			87.532		90.525				87.990			87.391			88.857			
				100.0															

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W2		SW-W2			SW-W2			SW-W3			SW-W3			SW-W3				
Date	11/19/2010		8/16/2010			11/9/2010			3/28/2007			5/9/2007			8/14/2007				
Cations	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	2.8892	34.0	61.4	3.0639	33.2	55.0	2.7445	38.9	27.0	1.3473	38.4	30.0	1.497	38.8	33.0	1.6467	41.1
Magnesium	24.3	2	4.7974	56.4	63.6	5.2335	56.8	44.4	3.6536	51.8	21.0	1.728	49.3	23.0	1.8926	49.1	23.0	1.8926	47.3
Potassium	39.1	1	0.0852	1.0	3.8	0.0969	1.1	3.3	0.0847	1.2	1.8	0.046	1.3	2.0	0.0512	1.3	2.1	0.0537	1.3
Sodium	23.0	1	0.7308	8.6	18.8	0.8178	8.9	13.1	0.5698	8.1	8.5	0.3697	10.6	9.2	0.4002	10.4	9.0	0.3915	9.8
Iron	55.8	2	0.0004	0.0	0.0	0.0014	0.0	0.1	0.002	0.0	0.2	0.0057	0.2	0.1	0.0039	0.1	0.1	0.0039	0.1
Manganese	54.9	2	0.0007	0.0	0.1	0.0023	0.0	0.1	0.0023	0.0	0.2	0.0066	0.2	0.3	0.0098	0.3	0.4	0.0131	0.3
Ammonia-N	14.0	1	0.0008	0.0	0.0	0.0007	0.0	0.0	0.0004	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			8.5			9.2			7.1			3.5			3.9			4.0	
Anions																			
Alkalinity, Total					428			323			180			180			190		
Carbonate	60.0	2	0.0707	0.8	1.4394	0.048	0.5	0.7882	0.0263	0.4	1.4085	0.047	1.2	1.286	0.0429	1.0	1.3269	0.0442	1.0
Bicarbonate	61.0	1	7.9081	86.9	519.23	8.5107	88.7	392.46	6.4328	87.8	216.74	3.5525	88.0	216.99	3.5566	86.5	229.10	3.7552	86.2
Chloride	35.5	1	0.9195	10.1	30.7	0.8659	9.0	24.7	0.6967	9.5	6.8	0.1918	4.7	8.5	0.2398	5.8	9.6	0.2708	6.2
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0114	0.1	0.1	0.0071	0.1	0.1	0.0044	0.1	0.7	0.0521	1.3	0.6	0.0414	1.0	0.5	0.0386	0.9
Sulfate	96.1	2	0.1934	2.1	8.1	0.1686	1.8	8.1	0.1676	2.3	9.4	0.1957	4.8	11.0	0.229	5.6	12.0	0.2499	5.7
Total Anions (meq/L)			9.1			9.6			7.3			4.0			4.1			4.4	
Total Ions (meq/L)			17.6			18.8			14.4			7.5			8.0			8.4	
Cation/Anion Ratio			0.93			0.96			0.96			0.87			0.94			0.92	
Percent Difference			-3.4			-2.0			-1.9			-7.1			-3.2			-4.3	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			8.50			9.21			7.05			3.49			3.84			3.98	
Calcium				33.98			33.26		38.92			38.59		38.97			41.33		
Magnesium				56.42			56.81		51.80			49.50		49.27			47.50		
Sodium + Potassium				9.60			9.93		9.28			11.91		11.75			11.17		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			9.09			9.59			7.32			3.99		4.07			4.32		
Sulfate				2.127			1.758		2.289			4.909		5.630			5.783		
Chloride				10.114			9.026		9.513			4.811		5.893			6.268		
Bicarbonate + Carbonate				87.759			89.216		88.198			90.280		88.477			87.949		

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W3 10/30/2007			SW-W3 12/18/2007			SW-W3 3/12/2008			SW-W3 7/15/2008			SW-W3 10/6/2008			SW-W3 1/6/2009	
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	
Cations																	
Calcium	40.1	2	28.0	1.3972	38.2	26.0	1.2974	38.4	27.0	1.3473	40.2	28.0	1.3972	37.5	31.0	1.5469	37.5
Magnesium	24.3	2	22.0	1.8103	49.5	20.0	1.6458	48.8	19.0	1.5635	46.7	23.0	1.8926	50.8	25.0	2.0572	49.9
Potassium	39.1	1	2.0	0.0512	1.4	1.8	0.046	1.4	1.9	0.0486	1.5	2.1	0.0537	1.4	2.7	0.0691	1.7
Sodium	23.0	1	8.8	0.3828	10.5	8.4	0.3654	10.8	8.6	0.3741	11.2	8.4	0.3654	9.8	10.0	0.435	10.5
Iron	55.8	2	0.2	0.0057	0.2	0.2	0.0064	0.2	0.1	0.0047	0.1	0.2	0.0054	0.1	0.1	0.0047	0.1
Manganese	54.9	2	0.3	0.0124	0.3	0.4	0.0127	0.4	0.3	0.0113	0.3	0.3	0.0113	0.3	0.3	0.0124	0.3
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0032	0.1	0.0	0.0011	0.0
Total Cations (meq/L)				3.7	100.0		3.4			3.4	100.0		3.7			4.1	
Anions																	
Alkalinity, Total			180			170			180			200			200		
Carbonate	60.0	2	0.7438	0.0248	0.5	1.4902	0.0497	1.3	1.4085	0.047	1.1	0.6425	0.0214	0.5	0.2749	0.0092	0.2
Bicarbonate	61.0	1	218.09	3.5747	77.2	204.37	3.3498	84.9	216.74	3.5525	85.8	242.69	3.978	87.7	243.44	3.9902	88.5
Chloride	35.5	1	30.0	0.8462	18.3	8.6	0.2426	6.1	8.1	0.2285	5.5	9.4	0.2651	5.8	9.3	0.2623	5.8
Fluoride	19.0	1	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
Nitrate-N	14.0	1	0.5	0.0336	0.7	0.8	0.0543	1.4	0.6	0.04	1.0	0.3	0.02	0.4	0.3	0.0186	0.4
Sulfate	96.1	2	7.3	0.152	3.3	12.0	0.2499	6.3	13.0	0.2707	6.5	12.0	0.2499	5.5	11.0	0.229	5.1
Total Anions (meq/L)				4.6	100.0		3.9			4.1	100.0		4.5			4.5	
Total Ions (meq/L)				8.3			7.3			7.5			8.3			8.6	
Cation/Anion Ratio				0.79			0.86			0.81			0.82			0.92	
Percent Difference				-11.7			-7.8			-10.5			-9.7			-4.4	
TRILINEAR DIAGRAM DATA																	
sum (Ca, Mg, Na+K)			3.64			3.35			3.33			3.71			4.11		3.18
Calcium				38.37			38.68			40.42			37.67			37.65	
Magnesium				49.71			49.06			46.90			51.03			50.08	
Sodium + Potassium				11.92			12.26			12.68			11.30			12.27	
				100.0			100.0			100.0			100.0			100.0	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			4.60			3.89			4.10			4.51			4.49		3.67
Sulfate				3.306			6.420			6.604			5.535			5.100	
Chloride				18.405			6.233			5.574			5.873			5.841	
Bicarbonate + Carbonate				78.289			87.348			87.822			88.592			89.059	
				100.0			100.0			100.0			100.0			100.0	

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID			SW-W3 3/26/2009			SW-W3 7/13/2009			SW-W3 10/20/2009			SW-W3 1/21/2010			SW-W3 4/19/2010				
Date	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L
Cations																			
Calcium	40.1	2	37.5	29.0	1.4471	37.3	29.3	1.4621	36.7	25.5	1.2725	34.5	25.0	1.2475	36.0	24.3	1.2126	34.1	27.7
Magnesium	24.3	2	49.0	24.0	1.9749	51.0	24.4	2.0078	50.4	23.1	1.9008	51.5	21.5	1.7692	51.0	22.7	1.8679	52.5	25.8
Potassium	39.1	1	2.2	0.2	0.0038	0.1	2.6	0.066	1.7	2.4	0.0604	1.6	2.1	0.0524	1.5	2.3	0.0575	1.6	2.6
Sodium	23.0	1	10.8	10.0	0.435	11.2	10.1	0.4393	11.0	10.2	0.4437	12.0	8.9	0.3889	11.2	9.5	0.4132	11.6	11.1
Iron	55.8	2	0.2	0.1	0.0047	0.1	0.0	0.0006	0.0	0.0	0.001	0.0	0.0	0.0018	0.1	0.0	0.001	0.0	0.0
Manganese	54.9	2	0.3	0.2	0.0087	0.2	0.2	0.0087	0.2	0.3	0.0113	0.3	0.2	0.0079	0.2	0.2	0.0074	0.2	0.2
Ammonia-N	14.0	1	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0
Total Cations (meq/L)					3.9			4.0			3.7			3.5			3.6		
Anions																			
Alkalinity, Total				170			182			180			154			165			178
Carbonate	60.0	2	0.1	0.5717	0.0191	0.5	1.1087	0.037	0.9	0.1186	0.004	0.1	1.0276	0.0343	1.0	82.878	2.7626	72.4	0.0602
Bicarbonate	61.0	1	85.7	206.24	3.3804	88.0	219.79	3.6025	86.3	219.36	3.5955	86.7	185.79	3.0453	85.2	32.78	0.5373	14.1	217.04
Chloride	35.5	1	6.6	7.2	0.2031	5.3	9.0	0.255	6.1	9.1	0.2564	6.2	7.7	0.2166	6.1	8.4	0.2372	6.2	8.6
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	1.5	0.5	0.0378	1.0	0.3	0.0207	0.5	0.3	0.0244	0.6	0.5	0.035	1.0	0.4	0.0291	0.8	0.3
Sulfate	96.1	2	6.1	9.6	0.1999	5.2	12.4	0.2582	6.2	12.9	0.2686	6.5	11.7	0.2436	6.8	12.1	0.2519	6.6	11.7
Total Anions (meq/L)					3.8			4.2			4.1			3.6			3.8		
Total Ions (meq/L)					7.7			8.2			7.8			7.0			7.4		
Cation/Anion Ratio					1.01			0.95			0.89			0.97			0.93		
Percent Difference					0.5			-2.3			-5.9			-1.5			-3.5		
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)					3.86			3.98			3.68			3.46			3.55		
Calcium			37.70			37.48			36.78		34.60			36.08			34.14		
Magnesium			49.22			51.15			50.51		51.69			51.16			52.60		
Sodium + Potassium			13.07			11.37			12.71		13.71			12.76			13.26		
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					3.80			4.15			4.12			3.54			3.79		
Sulfate			6.234			5.257			6.217		6.512			6.882			6.649		
Chloride			6.679			5.341			6.140		6.216			6.120			6.260		
Bicarbonate + Carbonate			87.087			89.402			87.642		87.271			86.998			87.091		

Red Text indicates greater than 10 percent difference in the Cation/Anion Ratio

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W3 8/16/2010			SW-W3 11/9/2010			SW-W4 5/10/2007			SW-W4 8/14/2007			SW-W4 10/31/2007			SW-W4 12/18/2007			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																			
Calcium	40.1	2	1.3822	34.0	22.4	1.1178	36.0	17.0	0.8483	34.2	16.0	0.7984	32.8	17.0	0.8483	32.8	16.0	0.7984	32.8
Magnesium	24.3	2	2.123	52.3	18.9	1.5552	50.0	16.0	1.3166	53.1	16.0	1.3166	54.1	17.0	1.3989	54.2	16.0	1.3166	54.2
Potassium	39.1	1	0.0657	1.6	2.2	0.0568	1.8	2.0	0.0512	2.1	1.8	0.046	1.9	1.7	0.0435	1.7	1.7	0.0435	1.8
Sodium	23.0	1	0.4828	11.9	8.5	0.3689	11.9	5.9	0.2566	10.3	6.1	0.2653	10.9	6.5	0.2827	10.9	6.1	0.2653	10.9
Iron	55.8	2	0.0009	0.0	0.1	0.0042	0.1	0.1	0.0043	0.2	0.2	0.0057	0.2	0.2	0.0075	0.3	0.1	0.005	0.2
Manganese	54.9	2	0.0073	0.2	0.1	0.005	0.2	0.1	0.0032	0.1	0.1	0.0023	0.1	0.0	0.0011	0.0	0.0	0.0006	0.0
Ammonia-N	14.0	1	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			4.1			3.1			2.5			2.4	100.0		2.6			2.4	
Anions																			
Alkalinity, Total					138			120			130			120			120		
Carbonate	60.0	2	0.002	0.0	0.0952	0.0032	0.1	0.5073	0.0169	0.6	0.3989	0.0133	0.4	0.4323	0.0144	0.5	0.8574	0.0286	1.0
Bicarbonate	61.0	1	3.5575	87.4	168.17	2.7564	86.3	145.37	2.3827	85.5	157.79	2.5863	86.4	145.52	2.3852	85.2	144.66	2.3711	84.0
Chloride	35.5	1	0.2437	6.0	7.6	0.2155	6.7	4.8	0.1354	4.9	4.9	0.1382	4.6	5.2	0.1467	5.2	5.3	0.1495	5.3
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0218	0.5	0.4	0.0266	0.8	0.0	0.0018	0.1	0.1	0.0044	0.1	0.1	0.0039	0.1	0.0	0.0018	0.1
Sulfate	96.1	2	0.2436	6.0	9.2	0.1911	6.0	12.0	0.2499	9.0	12.0	0.2499	8.4	12.0	0.2499	8.9	13.0	0.2707	9.6
Total Anions (meq/L)			4.1			3.2			2.8			3.0	100.0		2.8			2.8	
Total Ions (meq/L)			8.1			6.3			5.3			5.4			5.4			5.3	
Cation/Anion Ratio			1.00			0.97			0.89			0.81			0.92			0.86	
Percent Difference			-0.1			-1.3			-5.8			-10.3			-4.0			-7.4	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			4.05			3.10			2.47			2.43			2.57			2.42	
Calcium				34.10			36.07			34.31			32.91			32.96			32.94
Magnesium				52.37			50.19			53.25			54.26			54.36			54.32
Sodium + Potassium				13.53			13.74			12.45			12.83			12.68			12.74
													100.0						
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			4.05			3.17			2.78			2.99			2.80			2.82	
Sulfate				6.020			6.037			8.972			8.363			8.935			9.599
Chloride				6.022			6.806			4.862			4.626			5.246			5.302
Bicarbonate + Carbonate				87.958			87.157			86.167			87.011			85.819			85.100
													100.0						

Red Text indicates greater than 10 percent difference in the Cation/Anion F

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W4 3/12/2008			SW-W5 5/10/2007			SW-W5 8/14/2007			SW-W5 10/30/2007			SW-W5 12/18/2007			SW-W5 3/12/2008			
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Calcium	40.1	2	16.0	0.7984	31.7	18.0	0.8982	34.0	18.0	0.8982	33.9	19.0	0.9481	35.4	17.0	0.8483	32.7	19.0	0.9481
Magnesium	24.3	2	17.0	1.3989	55.5	17.0	1.3989	53.0	17.0	1.3989	52.8	17.0	1.3989	52.2	17.0	1.3989	54.0	19.0	1.5635
Potassium	39.1	1	1.7	0.0435	1.7	2.0	0.0512	1.9	2.0	0.0512	1.9	1.9	0.0486	1.8	2.0	0.0512	2.0	2.0	0.0512
Sodium	23.0	1	6.3	0.274	10.9	6.6	0.2871	10.9	6.8	0.2958	11.2	6.4	0.2784	10.4	6.5	0.2827	10.9	7.3	0.3175
Iron	55.8	2	0.1	0.0033	0.1	0.1	0.0023	0.1	0.1	0.0027	0.1	0.1	0.0028	0.1	0.2	0.0079	0.3	0.1	0.005
Manganese	54.9	2	0.0	0.0006	0.0	0.0	0.0004	0.0	0.0	0.0007	0.0	0.0	0.0005	0.0	0.0	0.0005	0.0	0.0	0.0004
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011
Total Cations (meq/L)				2.5			2.6			2.6			2.7			2.6			2.9
Anions																			
Alkalinity, Total			110			130			140			130			130			130	
Carbonate	60.0	2	0.734	0.0245	0.9	0.8875	0.0296	1.0	0.5919	0.0197	0.6	0.7066	0.0236	0.8	0.0696	0.0023	0.1	0.4372	0.0146
Bicarbonate	61.0	1	132.71	2.1752	82.2	156.80	2.57	84.6	169.60	2.7799	86.5	157.16	2.5761	86.3	158.46	2.5973	85.8	157.71	2.585
Chloride	35.5	1	4.6	0.1297	4.9	4.5	0.1269	4.2	4.4	0.1241	3.9	4.2	0.1185	4.0	4.7	0.1326	4.4	4.3	0.1213
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.1	0.0057	0.2	0.3	0.0193	0.6	0.3	0.0186	0.6	0.3	0.0178	0.6	0.4	0.0257	0.8	1.6	0.1142
Sulfate	96.1	2	15.0	0.3123	11.8	14.0	0.2915	9.6	13.0	0.2707	8.4	12.0	0.2499	8.4	13.0	0.2707	8.9	14.0	0.2915
Total Anions (meq/L)				2.6			3.0			3.2			3.0			3.0			3.1
Total Ions (meq/L)				5.2			5.7			5.9			5.7			5.6			6.0
Cation/Anion Ratio				0.95			0.87			0.82			0.90			0.86			0.92
Percent Difference				-2.5			-7.0			-9.6			-5.4			-7.8			-4.0
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)				2.51			2.64			2.64			2.67			2.58			2.88
Calcium					31.75		34.08			33.97			35.46			32.87			
Magnesium					55.63		53.08			52.91			52.32			54.20			
Sodium + Potassium					12.63		12.83			13.12			12.23			12.94			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				2.64			3.02			3.19			2.97			3.00			3.01
Sulfate					11.822		9.658			8.473			8.418			9.014			
Chloride					4.912		4.206			3.885			3.992			4.415			
Bicarbonate + Carbonate					83.266		86.136			87.641			87.590			86.571			

ratio

Red Text indicates greater than 10 percent difference in the Cation

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	Date	MW	n	% (meq)	SW-W5 7/15/2008			SW-W5 10/6/2008			SW-W5 1/6/2009			SW-W5 3/23/2009			SW-W5 7/10/2009			1	
Cations					mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	meq/L	% (meq)	mg/L	
Calcium		40.1	2	32.8	19.0	0.9481	33.8	21.0	1.0479	34.0	20.0	0.998	34.0	17.0	0.8483	32.7	18.8	0.9381	31.6	19.0	
Magnesium		24.3	2	54.2	18.0	1.4812	52.7	20.0	1.6458	53.4	19.0	1.5635	53.3	17.0	1.3989	53.9	19.8	1.6293	54.9	16.5	
Potassium		39.1	1	1.8	2.0	0.0512	1.8	2.2	0.0563	1.8	2.3	0.0588	2.0	1.9	0.0486	1.9	2.3	0.0596	2.0	2.2	
Sodium		23.0	1	11.0	7.4	0.3219	11.5	7.6	0.3306	10.7	7.1	0.3088	10.5	6.8	0.2958	11.4	7.8	0.3388	11.4	7.1	
Iron		55.8	2	0.2	0.1	0.0029	0.1	0.1	0.0025	0.1	0.1	0.0024	0.1	0.1	0.0029	0.1	0.0	0.0002	0.0	0.0	
Manganese		54.9	2	0.0	0.0	0.0005	0.0	0.0	0.0008	0.0	0.0	0.0003	0.0	0.0	0.0002	0.0	0.0	0.0004	0.0	0.0	
Ammonia-N		14.0	1	0.0	0.0	0.0023	0.1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	
Total Cations (meq/L)					2.8			3.1			2.9			2.6			3.0				
Anions																					
Alkalinity, Total					140			150			130			140			123			124	
Carbonate		60.0	2	0.5	0.9777	0.0326	1.0	0.7613	0.0254	0.7	0.8675	0.0289	0.9	0.226	0.0075	0.2	0.1615	0.0054	0.2	0.2194	
Bicarbonate		61.0	1	82.7	168.81	2.767	85.3	181.45	2.9742	87.2	156.84	2.5707	84.1	170.34	2.792	85.9	149.73	2.4542	85.1	151	
Chloride		35.5	1	3.9	4.7	0.1326	4.1	4.3	0.1213	3.6	5.5	0.1551	5.1	4.9	0.1382	4.2	4.6	0.1297	4.5	4.7	
Fluoride		19.0	1	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	0.0	0.0	
Nitrate-N		14.0	1	3.7	0.3	0.02	0.6	0.3	0.0186	0.5	0.4	0.0314	1.0	0.3	0.0228	0.7	0.2	0.0172	0.6	0.2	
Sulfate		96.1	2	9.3	14.0	0.2915	9.0	13.0	0.2707	7.9	13.0	0.2707	8.9	14.0	0.2915	9.0	13.3	0.2769	9.6	14.0	
Total Anions (meq/L)					3.2			3.4			3.1			3.3			2.9				
Total Ions (meq/L)					6.1			6.5			6.0			6.8			5.9				
Cation/Anion Ratio					0.87			0.90			0.96			0.80			1.03				
Percent Difference					-7.2			-5.0			-2.1			-11.2			1.4				
TRILINEAR DIAGRAM DATA																					
sum (Ca, Mg, Na+K)					2.80			3.08			2.93			2.59			2.97				
Calcium				32.92			33.83			34.02			34.07			32.73			31.63		
Magnesium				54.28			52.86			53.42			53.38			53.98			54.94		
Sodium + Potassium				12.80			13.31			12.56			12.55			13.29			13.43		
																100.0					
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					3.22			3.39			3.03			3.23			2.87				
Sulfate				9.676			9.042			7.981			8.947			9.027			9.661		
Chloride				4.026			4.112			3.576			5.128			4.280			4.527		
Bicarbonate + Carbonate				86.297			86.845			88.443			85.926			86.694			85.812		
																100.0					

/Anion Ratio

Red Text indicates greater than 10 percent difference in th

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W6		SW-W5			SW-W6			SW-W6			SW-W6			SW-W6				
Date	0/19/2009		8/12/2010			8/14/2007			3/12/2008			3/24/2009			1/22/2010				
Cations	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	0.9481	35.5	18.2	0.9082	30.9	17.0	0.8483	31.5	19.0	0.9481	32.9	18.0	0.8982	31.8	17.0	0.8483	29.0
Magnesium	24.3	2	1.3577	50.8	19.8	1.6293	55.4	18.0	1.4812	55.0	19.0	1.5635	54.2	19.0	1.5635	55.4	20.5	1.6869	57.7
Potassium	39.1	1	0.0558	2.1	2.2	0.057	1.9	2.0	0.0512	1.9	1.8	0.046	1.6	1.7	0.0435	1.5	2.1	0.0537	1.8
Sodium	23.0	1	0.3084	11.5	7.9	0.3449	11.7	7.1	0.3088	11.5	7.4	0.3219	11.2	6.9	0.3001	10.6	7.7	0.3345	11.4
Iron	55.8	2	0.0004	0.0	0.0	0.0002	0.0	0.1	0.0028	0.1	0.1	0.0031	0.1	0.3	0.0107	0.4	0.0	0.0002	0.0
Manganese	54.9	2	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0002	0.0	0.2	0.0058	0.2	0.0	1E-04	0.0
Ammonia-N	14.0	1	0.0004	0.0	0.0	0.0009	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0
Total Cations (meq/L)			2.7			2.9			2.7			2.9			2.8			2.9	
Anions					128			140			150			150			128		
Alkalinity, Total																			
Carbonate	60.0	2	0.0073	0.3	0.0685	0.0023	0.1	0.5526	0.0184	0.6	0.7442	0.0248	0.7	0.4819	0.0161	0.5	0.0903	0.003	0.1
Bicarbonate	61.0	1	2.4723	84.7	156	2.5573	86.0	170	2.7812	87.5	181	2.9747	84.9	182	2.9835	86.6	156	2.5566	86.3
Chloride	35.5	1	0.1337	4.6	4.0	0.1134	3.8	3.8	0.1072	3.4	4.0	0.1128	3.2	5.2	0.1467	4.3	4.3	0.1221	4.1
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0151	0.5	0.2	0.0142	0.5	0.3	0.0236	0.7	1.7	0.1214	3.5	0.4	0.0278	0.8	0.4	0.0319	1.1
Sulfate	96.1	2	0.2915	10.0	13.7	0.2852	9.6	12.0	0.2499	7.9	13.0	0.2707	7.7	13.0	0.2707	7.9	12.0	0.2499	8.4
Total Anions (meq/L)			2.9			3.0			3.2			3.5			3.4			3.0	
Total Ions (meq/L)			5.6			5.9			5.9			6.4			6.3			5.9	
Cation/Anion Ratio			0.91			0.99			0.85			0.82			0.82			0.99	
Percent Difference			-4.4			-0.5			-8.3			-9.7			-9.9			-0.7	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			2.67			2.94			2.69			2.88			2.81			2.92	
Calcium				35.51			30.90			31.54			32.93			32.02			29.02
Magnesium				50.85			55.43			55.07			54.30			55.73			57.70
Sodium + Potassium				13.64			13.68			13.39			12.78			12.25			13.28
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			2.90			2.96			3.16			3.38			3.42			2.93	
Sulfate				10.035			9.642			7.915			8.001			7.922			8.523
Chloride				4.603			3.833			3.396			3.335			4.293			4.166
Bicarbonate + Carbonate				85.363			86.525			88.689			88.664			87.786			87.311

e Cation/Anion Ratio

Red Text indicates greater than 10 percent difference

Appendix H.2 - Streams / Weir Sampling Locations - Ion Balance Calculations

Site ID	SW-W6			SW-W7				
Date	11/1/2010			11/1/2007				
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	13.7	0.6836	30.8	19.0	0.9481	32.7
Magnesium	24.3	2	14.6	1.2014	54.0	19.0	1.5635	54.0
Potassium	39.1	1	3.1	0.0803	3.6	1.8	0.046	1.6
Sodium	23.0	1	5.8	0.2532	11.4	7.6	0.3306	11.4
Iron	55.8	2	0.1	0.0038	0.2	0.2	0.0068	0.2
Manganese	54.9	2	0.0	0.0005	0.0	0.0	0.0001	0.0
Ammonia-N	14.0	1	0.0	0.0004	0.0	0.0	0.0011	0.0
Total Cations (meq/L)				2.2			2.9	
Anions								
Alkalinity, Total			89.2			130		
Carbonate	60.0	2	0.0251	0.0008	0.0	0.972	0.0324	1.1
Bicarbonate	61.0	1	109	1.7829	86.3	157	2.5672	83.5
Chloride	35.5	1	3.8	0.1083	5.2	4.7	0.1326	4.3
Fluoride	19.0	1	0.0	0	0.0	0.0	0	0.0
Nitrate-N	14.0	1	0.4	0.0286	1.4	1.0	0.0714	2.3
Sulfate	96.1	2	7.0	0.1447	7.0	13.0	0.2707	8.8
Total Anions (meq/L)				2.1			3.1	
Total Ions (meq/L)				4.3			6.0	
Cation/Anion Ratio				1.08			0.94	
Percent Difference				3.7			-3.0	
TRILINEAR DIAGRAM DATA								
sum (Ca, Mg, Na+K)				2.22			2.89	
Calcium					30.82			32.83
Magnesium					54.15			54.13
Sodium + Potassium					15.03			13.04
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				2.04			3.00	
Sulfate					7.105			9.014
Chloride					5.318			4.415
Bicarbonate + Carbonate					87.577			86.571

nce in the Cation/Anion Ratio

Appendix H.3 - Cc2 Perched Zone Monitoring Wells - Ion Balance Calculations

Site ID	MW-2			MW-2			MW-2			MW-2			MW-5D			MW-5D			
Date	5/12/2008			2/20/2009			11/17/2009			8/3/2010			2/6/2007			11/1/2007			
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Calcium	40.1	2	33.0	1.6467	32.7	35.0	1.7465	31.2	33.2	1.6567	29.9	35.8	1.7864	31.6	34.0	1.6966	33.5	35.0	1.7465
Magnesium	24.3	2	35.0	2.8801	57.2	40.0	3.2915	58.8	40.3	3.3162	59.9	40.0	3.2915	58.2	24.0	1.9749	39.0	24.0	1.9749
Potassium	39.1	1	2.5	0.0639	1.3	2.6	0.0665	1.2	2.6	0.067	1.2	2.7	0.0698	1.2	2.6	0.0665	1.3	2.5	0.0639
Sodium	23.0	1	10.0	0.435	8.6	11.0	0.4785	8.6	11.2	0.4872	8.8	11.5	0.5002	8.8	13.0	0.5655	11.2	14.0	0.609
Iron	55.8	2	0.2	0.0061	0.1	0.1	0.005	0.1	0.0	0.0002	0.0	0.0	0.0002	0.0	20.0	0.7162	14.1	16.0	0.573
Manganese	54.9	2	0.1	0.004	0.1	0.1	0.0044	0.1	0.1	0.0041	0.1	0.1	0.0041	0.1	1.1	0.04	0.8	1.2	0.0437
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.1	0.0043	0.1	0.1	0.0041
Total Cations (meq/L)				5.0			5.6			5.6			5.7			5.1			5.0
Anions																			
Alkalinity, Total			260			270			265			245			270			240	
Carbonate	60.0	2	0.0839	0.0028	0.1	0.0892	0.003	0.1	0.1128	0.0038	0.1	0.0689	0.0023	0.0	0.0813	0.0027	0.0	0.0588	0.002
Bicarbonate	61.0	1	317.03	5.1964	93.1	329.22	5.3962	93.3	323.07	5.2954	92.3	298.76	4.897	91.9	329.23	5.3965	95.6	292.68	4.7973
Chloride	35.5	1	3.4	0.0959	1.7	4.0	0.1128	2.0	4.2	0.1196	2.1	3.1	0.0883	1.7	3.6	0.1015	1.8	2.9	0.0818
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	0.2	0.0157	0.3	0.3	0.0214	0.4	0.4	0.0316	0.6	0.3	0.0242	0.5	0.0	0.0018	0.0	0.0	0.0018
Sulfate	96.1	2	13.0	0.2707	4.8	12.0	0.2499	4.3	13.7	0.2852	5.0	15.3	0.3186	6.0	6.9	0.1437	2.5	6.8	0.1416
Total Anions (meq/L)				5.6			5.8			5.7			5.3			5.6			5.0
Total Ions (meq/L)				10.6			11.4			11.3			11.0			10.7			10.0
Cation/Anion Ratio				0.90			0.97			0.96			1.06			0.90			1.00
Percent Difference				-6.1			-1.7			-1.8			2.9			-5.4			-0.1
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			5.03			5.58			5.53			5.65			4.30			4.39	
Calcium				32.77			31.28			29.97			31.63			39.42			
Magnesium				57.31			58.96			60.00			58.28			45.89			
Sodium + Potassium				9.93			9.76			10.03			10.09			14.69			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			5.57			5.76			5.70			5.31			5.64			5.02	
Sulfate				4.863			4.336			5.001			6.004			2.545			
Chloride				1.723			1.958			2.097			1.664			1.799			
Bicarbonate + Carbonate				93.414			93.706			92.903			92.333			95.656			

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.3 - Cc2 Perched Zone Monitoring Wells - Ion Balance Calculations

Site ID	MW-5D 8/7/2008			MW-5D 5/12/2009			MW-5D 2/11/2010			MW-5D 11/2/2010			MW-9 8/10/2007						
Date	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L
Cations																			
Calcium	40.1	2	34.8	31.0	1.5469	34.9	31.0	1.5469	30.8	39.0	1.9461	39.8	29.7	1.482	32.9	12.0	0.5988	37.0	13.0
Magnesium	24.3	2	39.4	21.0	1.728	38.9	26.2	2.1559	43.0	26.3	2.1642	44.2	21.7	1.7856	39.6	9.2	0.757	46.7	10.0
Potassium	39.1	1	1.3	2.3	0.0588	1.3	2.8	0.0716	1.4	2.8	0.0719	1.5	2.9	0.0734	1.6	1.9	0.0486	3.0	2.1
Sodium	23.0	1	12.1	13.0	0.5655	12.7	15.3	0.6655	13.3	13.4	0.5829	11.9	14.4	0.6264	13.9	4.9	0.2131	13.2	5.9
Iron	55.8	2	11.4	14.0	0.5014	11.3	15.1	0.5408	10.8	2.5	0.0877	1.8	14.1	0.505	11.2	0.0	0.0017	0.1	0.3
Manganese	54.9	2	0.9	0.9	0.032	0.7	0.8	0.0307	0.6	1.1	0.0408	0.8	0.8	0.0284	0.6	0.0	2E-05	0.0	0.0
Ammonia-N	14.0	1	0.1	0.1	0.0042	0.1	0.0	0.0032	0.1	0.0	0.0018	0.0	0.0	0.0035	0.1	0.0	0.0011	0.1	0.0
Total Cations (meq/L)						4.4			5.0			4.9			4.5			1.6	
Anions																			
Alkalinity, Total				240			230			267			209			72			68
Carbonate	60.0	2	0.0	0.0615	0.0021	0.0	0.0469	0.0016	0.0	0.099	0.0033	0.1	0.1475	0.0049	0.1	0.1274	0.0042	0.2	0.1176
Bicarbonate	61.0	1	95.5	292.67	4.7972	94.5	280.50	4.5977	93.4	325.54	5.3359	92.8	254.68	4.1745	93.0	87.58	1.4355	76.3	82.72
Chloride	35.5	1	1.6	3.6	0.1015	2.0	4.4	0.1227	2.5	5.7	0.1602	2.8	3.8	0.1069	2.4	4.4	0.1241	6.6	4.3
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.0	0.0	0.0018	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.4	0.0264	1.4	0.1
Sulfate	96.1	2	2.8	8.4	0.1749	3.4	9.6	0.2005	4.1	11.9	0.2478	4.3	9.7	0.2009	4.5	14.0	0.2915	15.5	15.0
Total Anions (meq/L)						5.1			4.9			5.7			4.5			1.9	
Total Ions (meq/L)						9.5			9.9			10.6			9.0			3.5	
Cation/Anion Ratio						0.87			1.02			0.85			1.00			0.86	
Percent Difference						-6.7			0.9			-8.0			0.2			-7.5	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)						3.90			4.44			4.77			3.97			1.62	
Calcium			39.74				39.67			34.84			40.84			37.35			37.02
Magnesium			44.94				44.32			48.56			45.42			45.01			46.80
Sodium + Potassium			15.31				16.01			16.60			13.74			17.64			16.18
sum (SO ₄ , Cl, HCO ₃ +CO ₃)						5.08			4.92			5.75			4.49			1.86	
Sulfate			2.819				3.446			4.073			4.311			4.478			15.711
Chloride			1.629				2.001			2.493			2.788			2.382			6.689
Bicarbonate + Carbonate			95.553				94.554			93.434			92.901			93.140			77.600

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.3 - Cc2 Perched Zone Monitoring Wells - Ion Balance Calculations

Site ID	MW-9 5/8/2008			MW-9 2/4/2009			MW-9 11/5/2009			MW-9 8/9/2010			MW-21 5/1/2007			MW-21 2/5/2008			
Date	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																			
Calcium	40.1	2	0.6487	36.2	15.0	0.7485	34.6	11.1	0.5539	36.0	12.7	0.6337	36.1	26.0	1.2974	34.3	26.0	1.2974	33.1
Magnesium	24.3	2	0.8229	45.9	13.0	1.0697	49.4	8.8	0.7208	46.8	10.1	0.8311	47.4	23.0	1.8926	50.1	25.0	2.0572	52.5
Potassium	39.1	1	0.0537	3.0	2.3	0.0588	2.7	2.0	0.0499	3.2	1.9	0.0491	2.8	2.1	0.0537	1.4	2.2	0.0563	1.4
Sodium	23.0	1	0.2566	14.3	6.1	0.2653	12.3	4.9	0.214	13.9	5.5	0.2401	13.7	9.8	0.4263	11.3	10.0	0.435	11.1
Iron	55.8	2	0.0104	0.6	0.1	0.0024	0.1	0.0	0.0002	0.0	0.0	0.0002	0.0	2.1	0.0752	2.0	1.4	0.0501	1.3
Manganese	54.9	2	8E-05	0.0	0.5	0.0197	0.9	0.0	2E-05	0.0	0.0	2E-05	0.0	0.9	0.0317	0.8	0.6	0.0229	0.6
Ammonia-N	14.0	1	0.0011	0.1	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0011	0.0	0.0	0.0011	0.0
Total Cations (meq/L)			1.8			2.2			1.5			1.8			3.8	100.0		3.9	100.0
Anions																			
Alkalinity, Total					100			65.2			69.7			220			230		
Carbonate	60.0	2	0.0039	0.2	0.1092	0.0036	0.1	0.1077	0.0036	0.2	0.0481	0.0016	0.1	0.098	0.0033	0.1	0.0852	0.0028	0.1
Bicarbonate	61.0	1	1.3559	75.2	121.78	1.9961	78.5	79.33	1.3002	77.0	84.94	1.3922	76.1	268.20	4.3961	92.9	280.43	4.5965	93.0
Chloride	35.5	1	0.1213	6.7	5.9	0.1664	6.5	4.1	0.1159	6.9	4.4	0.1241	6.8	2.8	0.079	1.7	3.3	0.0931	1.9
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.01	0.6	0.0	0.0018	0.1	0.2	0.0112	0.7	0.2	0.0142	0.8	0.0	0.0018	0.0	0.0	0.0018	0.0
Sulfate	96.1	2	0.3123	17.3	18.0	0.3748	14.7	12.4	0.2582	15.3	14.3	0.2977	16.3	12.0	0.2499	5.3	12.0	0.2499	5.1
Total Anions (meq/L)			1.8			2.5			1.7			1.8			4.7	100.0		4.9	100.0
Total Ions (meq/L)			3.6			4.7			3.2			3.6			8.5			8.9	
Cation/Anion Ratio			0.99			0.85			0.91			0.96			0.80			0.79	
Percent Difference			-0.3			-8.0			-4.6			-2.1			-11.2			-11.6	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			1.78			2.14			1.54			1.75			3.67			3.85	
Calcium			36.40			34.94			36.00			36.13			35.35			33.74	
Magnesium			46.18			49.93			46.85			47.38			51.57			53.49	
Sodium + Potassium			17.42			15.13			17.15			16.49			13.08			12.77	
															100.0			100.0	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			1.79			2.54			1.68			1.82			4.73			4.94	
Sulfate			17.415			14.750			15.387			16.399			5.284			5.055	
Chloride			6.763			6.550			6.909			6.836			1.670			1.883	
Bicarbonate + Carbonate			75.822			78.701			77.704			76.766			93.045			93.061	
															100.0			100.0	

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.3 - Cc2 Perched Zone Monitoring Wells - Ion Balance Calculations

Site ID	MW-21			MW-21			MW-21				
Date	11/3/2008			8/11/2009			5/5/2010				
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	31.0	1.5469	31.4	34.8	1.7365	30.0	29.6	1.477	28.9
Magnesium	24.3	2	34.0	2.7978	56.9	41.6	3.4232	59.1	36.8	3.0282	59.3
Potassium	39.1	1	2.6	0.0665	1.4	3.2	0.0806	1.4	2.6	0.0675	1.3
Sodium	23.0	1	10.0	0.435	8.8	11.7	0.5089	8.8	11.3	0.4915	9.6
Iron	55.8	2	1.6	0.0573	1.2	0.9	0.0306	0.5	0.8	0.0295	0.6
Manganese	54.9	2	0.4	0.0157	0.3	0.3	0.012	0.2	0.4	0.0144	0.3
Ammonia-N	14.0	1	0.0	0.0011	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0
Total Cations (meq/L)				4.9	100.0		5.8			5.1	
Anions											
Alkalinity, Total			290			262			260		
Carbonate	60.0	2	0.1384	0.0046	0.1	0.0949	0.0032	0.1	0.082	0.0027	0.0
Bicarbonate	61.0	1	353.52	5.7945	93.5	319.45	5.236	92.4	317.03	5.1965	91.7
Chloride	35.5	1	5.0	0.141	2.3	4.6	0.1297	2.3	5.0	0.1396	2.5
Fluoride	19.0	1	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Nitrate-N	14.0	1	0.1	0.0063	0.1	0.1	0.0098	0.2	0.2	0.0124	0.2
Sulfate	96.1	2	12.0	0.2499	4.0	13.9	0.2894	5.1	15.3	0.3186	5.6
Total Anions (meq/L)				6.2	100.0		5.7			5.7	
Total Ions (meq/L)				11.1			11.5			10.8	
Cation/Anion Ratio				0.79			1.02			0.90	
Percent Difference				-11.5			1.1			-5.2	
TRILINEAR DIAGRAM DATA											
sum (Ca, Mg, Na+K)			4.85			5.75			5.06		
Calcium				31.92			30.20			29.17	
Magnesium				57.73			59.54			59.80	
Sodium + Potassium				10.35			10.25			11.04	
				100.0							
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			6.19			5.66			5.66		
Sulfate				4.036			5.115			5.631	
Chloride				2.278			2.293			2.468	
Bicarbonate + Carbonate				93.685			92.592			91.901	
				100.0							

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-12 4/27/2007			MW-12 8/2/2007			MW-12 11/2/2007			MW-12 2/11/2008			MW-12 11/13/2008			MW-12 2/4/2009	
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	
Cations																	
Calcium	40.1	2	9.3	0.4641	36.2	8.7	0.4341	35.0	9.1	0.4541	35.8	9.1	0.4541	35.7	9.7	0.484	35.5
Magnesium	24.3	2	7.0	0.576	44.9	7.0	0.576	46.4	7.0	0.576	45.5	7.0	0.576	45.3	7.6	0.6254	45.8
Potassium	39.1	1	1.5	0.0384	3.0	1.5	0.0384	3.1	1.4	0.0358	2.8	1.4	0.0358	2.8	1.5	0.0384	2.8
Sodium	23.0	1	4.6	0.2001	15.6	4.4	0.1914	15.4	4.5	0.1957	15.4	4.7	0.2044	16.1	4.9	0.2131	15.6
Iron	55.8	2	0.1	0.0024	0.2	0.0	0.0009	0.1	0.1	0.0043	0.3	0.0	0.0012	0.1	0.1	0.0024	0.2
Manganese	54.9	2	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0
Ammonia-N	14.0	1	0.0	0.0011	0.1	0.0	0.0011	0.1	0.0	0.0011	0.1	0.0	0.0011	0.1	0.0	0.0011	0.1
Total Cations (meq/L)				1.3			1.2			1.3			1.3			1.4	
Anions																	
Alkalinity, Total			56			56			54			60			66		58
Carbonate	60.0	2	0.0521	0.0017	0.1	0.0735	0.0025	0.2	0.0526	0.0018	0.1	0.0806	0.0027	0.2	0.1469	0.0049	0.3
Bicarbonate	61.0	1	68.21	1.1181	76.2	68.17	1.1174	76.7	65.77	1.0781	76.7	73.04	1.1971	78.6	80.22	1.3149	79.3
Chloride	35.5	1	2.9	0.0818	5.6	2.8	0.079	5.4	2.7	0.0762	5.4	2.7	0.0762	5.0	2.7	0.0762	4.6
Fluoride	19.0	1	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
Nitrate-N	14.0	1	0.8	0.0571	3.9	0.8	0.0535	3.7	0.8	0.0535	3.8	0.8	0.0543	3.6	0.8	0.0557	3.4
Sulfate	96.1	2	10.0	0.2082	14.2	9.8	0.204	14.0	9.4	0.1957	13.9	9.3	0.1936	12.7	9.9	0.2061	12.4
Total Anions (meq/L)				1.5			1.5			1.4			1.5			1.7	
Total Ions (meq/L)				2.7			2.7			2.7			2.8			3.0	
Cation/Anion Ratio				0.87			0.85			0.90			0.84			0.82	
Percent Difference				-6.7			-7.9			-5.2			-9.0			-9.7	
TRILINEAR DIAGRAM DATA																	
sum (Ca, Mg, Na+K)				1.28			1.24			1.26			1.27			1.36	
Calcium					36.30			35.01			35.99			35.75			35.57
Magnesium					45.05			46.46			45.66			45.34			45.95
Sodium + Potassium					18.65			18.53			18.35			18.91			18.48
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				1.41			1.40			1.35			1.47			1.60	
Sulfate					14.768			14.545			14.479			13.176			12.866
Chloride					5.802			5.630			5.634			5.182			4.754
Bicarbonate + Carbonate					79.430			79.825			79.887			81.642			82.380

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-12			MW-12			MW-12			MW-12			MW-12			mg/L			
Date	5/13/2009			8/4/2009			11/2/2009			2/5/2010			5/6/2010						
Cations	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L			
Calcium	40.1	2	35.5	9.8	0.491	35.2	9.9	0.493	33.6	9.9	0.493	36.0	9.9	0.4925	34.2	9.0	0.4476	32.5	9.2
Magnesium	24.3	2	46.2	7.8	0.641	45.9	8.5	0.6962	47.4	7.6	0.6213	45.3	8.2	0.6756	46.9	8.1	0.6649	48.2	8.4
Potassium	39.1	1	2.9	1.7	0.0422	3.0	1.8	0.0448	3.0	1.6	0.0419	3.1	1.7	0.0425	2.9	1.6	0.0404	2.9	1.7
Sodium	23.0	1	15.3	5.1	0.2218	15.9	5.4	0.2345	16.0	4.9	0.2144	15.6	5.3	0.2305	16.0	5.2	0.2249	16.3	5.2
Iron	55.8	2	0.1	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0
Manganese	54.9	2	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0
Ammonia-N	14.0	1	0.1	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0
Total Cations (meq/L)						1.4			1.5			1.4			1.4			1.4	
Anions																			
Alkalinity, Total				57.2			52.5			63.4			58.9			57.6			57.4
Carbonate	60.0	2	0.2	0.1364	0.0045	0.3	0.0658	0.0022	0.2	0.1657	0.0055	0.3	0.154	0.0051	0.3	0.0615	0.002	0.1	0.1975
Bicarbonate	61.0	1	77.4	69.51	1.1393	76.6	63.92	1.0476	74.4	77.01	1.2623	78.2	71.54	1.1727	76.7	70.15	1.1498	76.1	69.63
Chloride	35.5	1	5.1	3.0	0.0857	5.8	3.1	0.0866	6.2	3.1	0.0886	5.5	3.1	0.0869	5.7	3.2	0.0894	5.9	2.8
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	3.6	0.7	0.0534	3.6	0.8	0.0548	3.9	0.6	0.0441	2.7	0.7	0.0513	3.4	0.8	0.0535	3.5	0.7
Sulfate	96.1	2	13.7	9.8	0.2043	13.7	10.4	0.2165	15.4	10.3	0.2145	13.3	10.2	0.2124	13.9	10.4	0.2165	14.3	10.4
Total Anions (meq/L)						1.5			1.4			1.6			1.5			1.5	
Total Ions (meq/L)						2.9			2.9			3.0			3.0			2.9	
Cation/Anion Ratio						0.94			1.04			0.85			0.94			0.91	
Percent Difference						-3.1			2.1			-8.2			-2.9			-4.6	
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)						1.40			1.47			1.37			1.44			1.38	
Calcium			35.54			35.17			33.58			35.97			34.18			32.49	
Magnesium			46.26			45.92			47.41			45.33			46.88			48.26	
Sodium + Potassium			18.20			18.91			19.01			18.71			18.94			19.26	
															100.0			100.0	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)						1.43			1.35			1.57			1.48			1.46	
Sulfate			14.169			14.245			16.005			13.652			14.378			14.854	
Chloride			5.289			5.980			6.400			5.638			5.882			6.134	
Bicarbonate + Carbonate			80.542			79.774			77.595			80.709			79.740			79.013	
															100.0			100.0	

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-12		MW-12			MW-19			MW-19			MW-19			MW-19				
Date	9/28/2010		11/9/2010			1/30/2007			4/27/2007			8/10/2007			11/16/2007				
Cations	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	0.4601	32.3	9.1	0.4546	32.7	13.0	0.6487	32.9	14.0	0.6986	34.7	14.0	0.6986	34.5	14.0	0.6986	36.5
Magnesium	24.3	2	0.6937	48.7	8.1	0.6674	48.0	12.0	0.9875	50.1	12.0	0.9875	49.0	12.0	0.9875	48.8	11.0	0.9052	47.3
Potassium	39.1	1	0.0427	3.0	1.7	0.0445	3.2	2.2	0.0563	2.9	2.2	0.0563	2.8	2.3	0.0588	2.9	2.2	0.0563	2.9
Sodium	23.0	1	0.2266	15.9	5.2	0.2244	16.1	5.9	0.2566	13.0	5.7	0.2479	12.3	5.9	0.2566	12.7	5.4	0.2349	12.3
Iron	55.8	2	0.0002	0.0	0.0	0.0002	0.0	0.1	0.0026	0.1	0.1	0.0039	0.2	0.1	0.0025	0.1	0.0	0.0017	0.1
Manganese	54.9	2	2E-05	0.0	0.0	2E-05	0.0	0.5	0.0186	0.9	0.5	0.0182	0.9	0.5	0.0186	0.9	0.4	0.0157	0.8
Ammonia-N	14.0	1	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0011	0.1	0.0	0.0025	0.1	0.0	0.0011	0.1	0.0	0.0011	0.1
Total Cations (meq/L)			1.4		1.4		1.4	2.0		2.0	2.0		2.0	2.0		1.9			
Anions																			
Alkalinity, Total					55.7			82			86			89			86		
Carbonate	60.0	2	0.0066	0.4	0.1328	0.0044	0.3	0.2459	0.0082	0.4	0.2353	0.0078	0.4	0.3133	0.0104	0.5	0.317	0.0106	0.5
Bicarbonate	61.0	1	1.1412	76.3	67.68	1.1094	75.8	99.54	1.6316	73.8	104.44	1.7119	76.4	107.94	1.7693	76.6	104.28	1.7092	76.5
Chloride	35.5	1	0.0795	5.3	3.1	0.0874	6.0	5.4	0.1523	6.9	5.1	0.1439	6.4	5.4	0.1523	6.6	4.9	0.1382	6.2
Fluoride	19.0	1	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	0.0
Nitrate-N	14.0	1	0.0525	3.5	0.7	0.0533	3.6	0.0	0.0018	0.1	0.0	0.0018	0.1	0.0	0.0018	0.1	0.0	0.0018	0.1
Sulfate	96.1	2	0.2165	14.5	10.0	0.2082	14.2	20.0	0.4164	18.8	18.0	0.3748	16.7	18.0	0.3748	16.2	18.0	0.3748	16.8
Total Anions (meq/L)			1.5		1.5		1.5	2.2		2.2	2.2		2.2	2.3		2.2			
Total Ions (meq/L)			2.9		2.9		2.9	4.2		4.2	4.3		4.3	4.3		4.1			
Cation/Anion Ratio			0.95		0.95		0.89		0.90		0.88		0.86						
Percent Difference			-2.5		-2.5		-5.7		-5.3		-6.6		-7.7						
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			1.42		1.39		1.95		1.99		2.00		1.89						
Calcium			32.33		32.68		33.28		35.10		34.90		36.87						
Magnesium			48.74		47.98		50.66		49.61		49.34		47.77						
Sodium + Potassium			18.93		19.34		16.05		15.28		15.76		15.37						
			100.0																
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			1.44		1.41		2.21		2.24		2.31		2.23						
Sulfate			14.997		14.772		18.855		16.743		16.246		16.786						
Chloride			5.509		6.204		6.897		6.427		6.603		6.190						
Bicarbonate + Carbonate			79.495		79.024		74.248		76.830		77.151		77.024						
			100.0																

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-19 2/7/2008			MW-19 5/7/2008			MW-19 8/6/2008			MW-19 2/4/2009			MW-19 5/4/2009			MW-19 7/31/2009				
Date	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Cations																				
Calcium	40.1	2	14.0	0.6986	34.7	16.0	0.7984	34.2	15.0	0.7485	34.5	10.0	0.499	34.5	16.2	0.8084	33.1	16.1	0.8034	
Magnesium	24.3	2	12.0	0.9875	49.0	14.0	1.152	49.3	13.0	1.0697	49.4	8.4	0.6912	47.8	15.1	1.2425	50.9	14.2	1.1685	
Potassium	39.1	1	2.1	0.0537	2.7	2.5	0.0639	2.7	2.1	0.0537	2.5	1.7	0.0435	3.0	2.6	0.0673	2.8	2.7	0.0688	
Sodium	23.0	1	5.8	0.2523	12.5	6.8	0.2958	12.7	6.1	0.2653	12.2	4.8	0.2088	14.5	6.9	0.2997	12.3	6.4	0.2797	
Iron	55.8	2	0.2	0.0054	0.3	0.2	0.0054	0.2	0.2	0.0061	0.3	0.0	0.0013	0.1	0.0	0.001	0.0	0.1	0.0019	
Manganese	54.9	2	0.5	0.0175	0.9	0.5	0.0178	0.8	0.5	0.0197	0.9	0.0	2E-05	0.0	0.5	0.0194	0.8	0.7	0.0257	
Ammonia-N	14.0	1	0.0	0.0011	0.1	0.0	0.0033	0.1	0.1	0.0038	0.2	0.0	0.0011	0.1	0.0	0.0026	0.1	0.0	0.0031	
Total Cations (meq/L)				2.0			2.3			2.2			1.4			2.4			2.4	
Anions																				
Alkalinity, Total			96			90			96			64			90			99.3		
Carbonate	60.0	2	0.2879	0.0096	0.4	0.2578	0.0086	0.4	0.1699	0.0057	0.2	0.133	0.0044	0.3	0.2299	0.0077	0.3	0.1926	0.0064	
Bicarbonate	61.0	1	116.53	1.9101	78.1	109.28	1.7911	76.2	116.77	1.914	77.2	77.81	1.2754	77.6	109.33	1.7921	77.0	120.75	1.9793	
Chloride	35.5	1	5.3	0.1495	6.1	6.2	0.1749	7.4	6.5	0.1833	7.4	3.7	0.1044	6.4	6.1	0.1712	7.4	6.2	0.1752	
Fluoride	19.0	1	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	0.0	0	
Nitrate-N	14.0	1	0.0	0.0018	0.1	0.0	0.0018	0.1	0.0	0.0018	0.1	0.1	0.0086	0.5	0.0	0.0004	0.0	0.0	0.0011	
Sulfate	96.1	2	18.0	0.3748	15.3	18.0	0.3748	15.9	18.0	0.3748	15.1	12.0	0.2499	15.2	17.1	0.356	15.3	18.4	0.3831	
Total Anions (meq/L)				2.4			2.4			2.5			1.6			2.3			2.5	
Total Ions (meq/L)				4.5			4.7			4.6			3.1			4.8			4.9	
Cation/Anion Ratio				0.82			0.99			0.87			0.88			1.05			0.92	
Percent Difference				-9.6			-0.3			-6.7			-6.4			2.4			-4.0	
TRILINEAR DIAGRAM DATA																				
sum (Ca, Mg, Na+K)				1.99			2.31			2.14			1.44			2.42			2.32	
Calcium					35.07		34.56			35.02			34.59			33.43				
Magnesium					49.57		49.87			50.05			47.92			51.39				
Sodium + Potassium					15.36		15.57			14.93			17.49			15.18				
sum (SO ₄ , Cl, HCO ₃ +CO ₃)				2.44			2.35			2.48			1.63			2.33			2.54	
Sulfate					15.335		15.952			15.125			15.291			15.300				
Chloride					6.117		7.444			7.399			6.387			7.358				
Bicarbonate + Carbonate					78.549		76.604			77.476			78.323			77.342				

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-19			MW-19			MW-19			MW-19			MW-19						
Date	11/5/2009			2/4/2010			5/3/2010			8/9/2010			11/8/2010						
Cations	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L
Calcium	40.1	2	34.2	15.8	0.7884	32.8	16.7	0.8333	32.4	14.8	0.7385	31.3	18.1	0.9032	33.9	15.9	0.7934	31.0	12.0
Magnesium	24.3	2	49.7	14.9	1.2261	51.0	16.2	1.3331	51.8	15.1	1.2425	52.6	16.1	1.3248	49.7	16.2	1.3331	52.1	9.3
Potassium	39.1	1	2.9	2.5	0.0627	2.6	2.6	0.0657	2.6	2.3	0.0593	2.5	2.6	0.0655	2.5	2.6	0.0657	2.6	1.2
Sodium	23.0	1	11.9	6.9	0.2984	12.4	7.3	0.3167	12.3	6.8	0.2971	12.6	7.3	0.3162	11.9	7.0	0.3062	12.0	5.3
Iron	55.8	2	0.1	0.0	0.0017	0.1	0.0	0.0015	0.1	0.0	0.0015	0.1	0.1	0.0036	0.1	0.2	0.0068	0.3	0.0
Manganese	54.9	2	1.1	0.6	0.0209	0.9	0.6	0.0203	0.8	0.5	0.0179	0.8	1.4	0.0491	1.8	1.3	0.047	1.8	0.0
Ammonia-N	14.0	1	0.1	0.1	0.0038	0.2	0.0	0.0026	0.1	0.0	0.0033	0.1	0.1	0.005	0.2	0.1	0.0067	0.3	0.0
Total Cations (meq/L)					2.4			2.6			2.4			2.7			2.6		
Anions																			
Alkalinity, Total				105			109			104			107			105			62
Carbonate	60.0	2	0.3	0.3613	0.012	0.5	0.3345	0.0111	0.4	0.1972	0.0066	0.2	0.2029	0.0068	0.3	0.3222	0.0107	0.4	0.0219
Bicarbonate	61.0	1	77.8	127.37	2.0876	78.6	132.30	2.1685	79.2	126.48	2.0731	78.8	130.13	2.1329	80.2	127.44	2.0889	79.0	75.60
Chloride	35.5	1	6.9	6.7	0.189	7.1	6.2	0.1754	6.4	6.2	0.1743	6.6	5.6	0.1577	5.9	6.3	0.178	6.7	4.3
Fluoride	19.0	1	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	0.0	0.0
Nitrate-N	14.0	1	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0014	0.1	0.0	0.0028	0.1	4.8
Sulfate	96.1	2	15.1	17.6	0.3664	13.8	18.4	0.3831	14.0	18.1	0.3769	14.3	17.3	0.3602	13.5	17.4	0.3623	13.7	7.9
Total Anions (meq/L)					2.7			2.7			2.6			2.7			2.6		
Total Ions (meq/L)					5.1			5.3			5.0			5.3			5.2		
Cation/Anion Ratio					0.90			0.94			0.90			1.00			0.97		
Percent Difference					-5.0			-3.1			-5.4			0.2			-1.6		
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)					2.38			2.55			2.34			2.61			2.50		
Calcium			34.62			33.19			32.70			31.59			34.61			31.76	
Magnesium			50.36			51.61			52.30			53.16			50.77			53.36	
Sodium + Potassium			15.02			15.20			15.00			15.25			14.63			14.89	
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					2.66			2.74			2.63			2.66			2.64		
Sulfate			15.059			13.802			13.991			14.324			13.554			13.723	
Chloride			6.885			7.118			6.407			6.626			5.933			6.742	
Bicarbonate + Carbonate			78.055			79.081			79.602			79.050			80.513			79.535	

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.4 - Cc3 and Regional Aquifer Monitoring Wells - Ion Balance Calculations

Site ID	MW-27		MW-27			MW-27			MW-27			MW-27				
Date	8/6/2007		5/1/2009			8/11/2009			11/5/2009			8/10/2010				
Cations	MW	n	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	0.5988	36.8	12.8	0.6387	34.6	12.8	0.6387	34.4	12.9	0.6437	36.0	12.2	0.6088	33.1
Magnesium	24.3	2	0.7653	47.0	10.9	0.8969	48.6	11.0	0.9052	48.7	10.3	0.8476	47.4	11.0	0.9052	49.2
Potassium	39.1	1	0.0307	1.9	1.4	0.035	1.9	1.4	0.0353	1.9	1.4	0.0353	2.0	1.3	0.0343	1.9
Sodium	23.0	1	0.2305	14.2	6.3	0.2732	14.8	6.4	0.2779	15.0	6.0	0.2623	14.7	6.7	0.2923	15.9
Iron	55.8	2	0.0014	0.1	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0
Manganese	54.9	2	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0	0.0	2E-05	0.0
Ammonia-N	14.0	1	0.0011	0.1	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0
Total Cations (meq/L)			1.6			1.8			1.9			1.8			1.8	
Anions																
Alkalinity, Total					69.5			68.5			71.4			65.7		
Carbonate	60.0	2	0.0007	0.0	0.0332	0.0011	0.1	0.0291	0.001	0.1	0.0201	0.0007	0.0	0.0147	0.0005	0.0
Bicarbonate	61.0	1	1.2391	66.3	84.72	1.3887	72.6	83.51	1.3688	72.5	87.07	1.4271	73.3	80.12	1.3133	70.6
Chloride	35.5	1	0.1213	6.5	5.0	0.1422	7.4	5.2	0.1461	7.7	5.3	0.1498	7.7	4.5	0.1275	6.9
Fluoride	19.0	1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Nitrate-N	14.0	1	0.3427	18.3	2.3	0.1635	8.6	2.2	0.1592	8.4	2.1	0.1521	7.8	3.4	0.2413	13.0
Sulfate	96.1	2	0.1645	8.8	10.4	0.2165	11.3	10.2	0.2124	11.3	10.5	0.2186	11.2	8.5	0.1768	9.5
Total Anions (meq/L)			1.9			1.9			1.9			1.9			1.9	
Total Ions (meq/L)			3.5			3.8			3.7			3.7			3.7	
Cation/Anion Ratio			0.87			0.96			0.98			0.92			0.99	
Percent Difference			-6.9			-1.8			-0.8			-4.2			-0.5	
TRILINEAR DIAGRAM DATA																
sum (Ca, Mg, Na+K)			1.63			1.84			1.86			1.79			1.84	
Calcium				36.84			34.64			34.39			35.98			33.08
Magnesium				47.08			48.64			48.74			47.38			49.18
Sodium + Potassium				16.07			16.72			16.87			16.64			17.74
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			1.53			1.75			1.73			1.80			1.62	
Sulfate				10.782			12.384			12.288			12.171			10.925
Chloride				7.950			8.130			8.454			8.339			7.879
Bicarbonate + Carbonate				81.268			79.485			79.258			79.490			81.196

Red text indicates a greater than 10 percent difference in cation/anion ratio

Appendix H.5 - Western Hillslope Monitoring Wells - Ion Balance Calculations

Site ID	MW-30			MW-30			MW-30			MW-30			MW-31			MW-31			
Date	1/26/2010			4/29/2010			8/17/2010			11/9/2010			1/28/2010			4/22/2010			
Cations	MW	n	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L
Calcium	40.1	2	24.4	1.2176	36.2	24.8	1.2375	35.4	26.2	1.3074	36.7	24.3	1.2126	36.5	22.1	1.1028	33.1	18.6	0.92814
Magnesium	24.3	2	19.5	1.6046	47.7	20.7	1.7034	48.7	20.5	1.6869	47.4	19.2	1.5799	47.5	22.8	1.8762	56.3	22.3	1.83501
Potassium	39.1	1	1.3	0.0332	1.0	1.4	0.0348	1.0	1.5	0.0379	1.1	1.4	0.0366	1.1	0.7	0.0178	0.5	0.6	0.01581
Sodium	23.0	1	11.6	0.5046	15.0	11.9	0.5176	14.8	12.1	0.5263	14.8	11.3	0.4915	14.8	7.6	0.331	9.9	8.3	0.35886
Iron	55.8	2	0.0	0.0002	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0	0.1	0.002	0.1	0.0	0.0015	0.0	0.0	0.00018
Manganese	54.9	2	0.1	0.0032	0.1	0.1	0.0021	0.1	0.0	0.0006	0.0	0.0	0.0002	0.0	0.0	0.0015	0.0	0.0	0.00023
Ammonia-N	14.0	1	0.0	0.0015	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.0	0.00036
Total Cations (meq/L)				3.4			3.5			3.6			3.3			3.3			3.14
Anions																			
Alkalinity, Total			124			134			140			139			138			142.0	
Carbonate	60.0	2	0.0391	0.0013	0.0	0.0377	0.0013	0.0	0.0335	0.0011	0.0	0.0196	0.0007	0.0	0.0829	0.0028	0.1	0.0428	0.00143
Bicarbonate	61.0	1	151.20	2.4783	70.5	163.40	2.6783	74.2	170.73	2.7985	78.0	169.54	2.7789	77.2	168.19	2.7568	82.9	173.15	2.83815
Chloride	35.5	1	8.2	0.2304	6.6	8.2	0.2307	6.4	5.8	0.1642	4.6	6.5	0.1836	5.1	4.7	0.1337	4.0	3.6	0.10154
Fluoride	19.0	1	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	0.0	0
Nitrate-N	14.0	1	6.9	0.4933	14.0	4.7	0.3384	9.4	4.4	0.3148	8.8	4.6	0.327	9.1	1.1	0.0764	2.3	1.5	0.10423
Sulfate	96.1	2	15.1	0.3144	8.9	17.4	0.3623	10.0	14.9	0.3102	8.6	14.8	0.3081	8.6	17.1	0.356	10.7	9.3	0.19301
Total Anions (meq/L)				3.5			3.6			3.6			3.6			3.3			3.24
Total Ions (meq/L)				6.9			7.1			7.1			6.9			6.7			6.4
Cation/Anion Ratio				0.96			0.97			0.99			0.92			1.00			0.97
Percent Difference				-2.2			-1.6			-0.4			-4.0			0.1			-2
TRILINEAR DIAGRAM DATA																			
sum (Ca, Mg, Na+K)			3.36			3.49			3.56			3.32			3.33			3.14	
Calcium				36.24			35.43			36.74			36.52			33.14			
Magnesium				47.76			48.76			47.41			47.58			56.38			
Sodium + Potassium				16.01			15.81			15.85			15.90			10.48			
sum (SO ₄ , Cl, HCO ₃ +CO ₃)			3.02			3.27			3.27			3.27			3.25			3.13	
Sulfate				10.395			11.070			9.476			9.420			10.957			
Chloride				7.619			7.050			5.014			5.613			4.115			
Bicarbonate + Carbonate				81.986			81.880			85.510			84.967			84.928			

Appendix H.5 - Western Hillslope Monitoring Wells - Ion Balance Calculations

Site ID	MW-31			MW-31			MW-32			MW-32					
Date	8/20/2010			11/8/2010			2/25/2010			11/9/2010					
Cations	MW	n	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)	mg/L	meq/L	%(meq)
Calcium	40.1	2	29.6	23.1	1.1527	32.4	18.3	0.9132	30.3	47.1	2.3503	41.8	42.3	2.1108	38.2
Magnesium	24.3	2	58.5	24.7	2.0325	57.2	20.5	1.6869	56.0	30.6	2.518	44.7	32.1	2.6414	47.8
Potassium	39.1	1	0.5	0.7	0.0186	0.5	0.7	0.0186	0.6	2.5	0.0642	1.1	2.8	0.0726	1.3
Sodium	23.0	1	11.4	8.0	0.3489	9.8	9.1	0.395	13.1	15.7	0.6829	12.1	16.1	0.7003	12.7
Iron	55.8	2	0.0	0.0	0.0004	0.0	0.0	0.0006	0.0	0.0	0.0002	0.0	0.0	0.0002	0.0
Manganese	54.9	2	0.0	0.0	0.0001	0.0	0.0	6E-05	0.0	0.0	0.0001	0.0	0.0	0.0002	0.0
Ammonia-N	14.0	1	0.0	0.0	0.0004	0.0	0.0	0.0004	0.0	0.2	0.0116	0.2	0.0	0.0004	0.0
Total Cations (meq/L)					3.6			3.0			5.6			5.5	
Anions															
Alkalinity, Total				160			119			246			286		
Carbonate	60.0	2	0.0	0.0553	0.0018	0.1	0.0495	0.0016	0.1	0.9491	0.0316	0.5	0.5809	0.0194	0.3
Bicarbonate	61.0	1	87.6	195.09	3.1977	92.1	145.08	2.378	76.2	298.19	4.8876	83.5	347.74	5.6998	90.4
Chloride	35.5	1	3.1	3.2	0.0908	2.6	4.7	0.1323	4.2	8.7	0.2462	4.2	5.6	0.1591	2.5
Fluoride	19.0	1	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Nitrate-N	14.0	1	3.2	0.1	0.0048	0.1	5.5	0.3955	12.7	1.32	0.0942	1.6	0.4	0.0294	0.5
Sulfate	96.1	2	6.0	8.5	0.1774	5.1	10.3	0.2145	6.9	28.5	0.5934	10.1	19.1	0.3977	6.3
Total Anions (meq/L)					3.5			3.1			5.9			6.3	
Total Ions (meq/L)					7.0			6.1			11.5			11.8	
Cation/Anion Ratio					1.02			0.97			0.96			0.88	
Percent Difference					1.2			-1.7			-2.0			-6.6	
TRILINEAR DIAGRAM DATA															
sum (Ca, Mg, Na+K)					3.55			3.01			5.62			5.53	
Calcium			29.58			32.45			30.30			41.85			38.20
Magnesium			58.48			57.21			55.98			44.84			47.81
Sodium + Potassium			11.94			10.34			13.72			13.30			13.99
sum (SO ₄ , Cl, HCO ₃ +CO ₃)					3.47			2.73			5.76			6.28	
Sulfate			6.158			5.116			7.866			10.304			6.337
Chloride			3.240			2.619			4.852			4.276			2.535
Bicarbonate + Carbonate			90.602			92.265			87.282			85.420			91.129