Table H.1. Control column tracer study without flowcells #1.

Control **No Flowcell #1**

K	Time	Conductance (mMhos)	Account for Meter setting	Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve	Flow rate
(mMhos/cm)	hr	Conductivity (mMhos/cm)	conductance * 10		(mg/L)	S/area under curve of S	(ml/min)
1	0.0250	1.40	14.00				2.63
	0.2500	1.36	13.60	0.00	-19.1667		
	0.4167	1.36	13.60	0.00	-19.1667		
	0.5833	1.37	13.70	0.10	36.3889		
	0.7500	1.37	13.70	0.10	36.3889		
	1.0000	1.36	13.60	0.00	-19.1667		
	1.0919	1.36	13.60	0.00	-19.1667		
	1.1756	1.37	13.70	0.10	36.3889		
	1.2592	1.36	13.60	0.00	-19.1667		
	1.3428	1.36	13.60	0.00	-19.1667		
	1.4264	1.43	14.30	0.70	369.7222	0.0082	
	1.4600	1.48	14.80	1.20	647.5000	0.0144	
	1.4769	1.62	16.20	2.60	1425.2778	0.0316	
	1.4939	1.90	19.00	5.40	2980.8333	0.0662	
	1.5108	2.67	26.70	13.10	7258.6111	0.1611	
	1.5278	3.08	30.80	17.20	9536.3889	0.2117	
	1.5447	4.11	41.10	27.50	15258.6111	0.3387	
	1.5617	6.26	62.60	49.00	27203.0556	0.6038	
	1.5786	7.10	71.00	57.40	31869.7222	0.7074	
	1.5956	8.03	80.30	66.70	37036.3889	0.8221	
	1.6000	8.56	85.60	72.00	39980.8333	0.8875	
	1.6333	8.97	89.70	76.10	42258.6111	0.9380	
	1.6500	8.94	89.40	75.80	42091.9444	0.9343	
	1.6667	9.00	90.00	76.40	42425.2778	0.9417	
	1.6833	8.95	89.50	75.90	42147.5000	0.9356	
	1.7000	8.74	87.40	73.80	40980.8333	0.9097	
	1.7167	8.65	86.50	72.90	40480.8333	0.8986	

Control **No Flowcell #1** Table H.1. Control column tracer study without flowcells #1. (con't)

Flow rate 2.63

K	Time	Conductance (mMhos)	Account for Meter setting	Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
(mMhos/cm)	hr	Conductivity (mMhos/cm)	conductance * 10		(mg/L)	S/area under curve of S
	1.7333	8.57	85.70	72.10	40036.3889	0.8887
	1.7667	8.39	83.90	70.30	39036.3889	0.8665
	1.7833	8.41	84.10	70.50	39147.5000	0.8690
	1.8000	8.30	83.00	69.40	38536.3889	0.8554
	1.8222	8.20	82.00	68.40	37980.8333	0.8431
	1.8375	8.08	80.80	67.20	37314.1667	0.8283
	1.8500	8.05	80.50	66.90	37147.5000	0.8246
	1.8667	7.99	79.90	66.30	36814.1667	0.8172
	1.8847	7.93	79.30	65.70	36480.8333	0.8098
	1.9014	7.85	78.50	64.90	36036.3889	0.7999
	1.9181	7.72	77.20	63.60	35314.1667	0.7839
	1.9333	7.41	74.10	60.50	33591.9444	0.7456
	1.9500	7.36	73.60	60.00	33314.1667	0.7395
	1.9667	7.27	72.70	59.10	32814.1667	0.7284
	1.9833	7.25	72.50	58.90	32703.0556	0.7259
	2.0000	7.17	71.70	58.10	32258.6111	0.7160
	2.0333	7.02	70.20	56.60	31425.2778	0.6976
	2.0667	6.85	68.50	54.90	30480.8333	0.6766
	2.1000	6.66	66.60	53.00	29425.2778	0.6532
	2.1333	6.33	63.30	49.70	27591.9444	0.6125
	2.1667	6.13	61.30	47.70	26480.8333	0.5878
	2.2000	5.98	59.80	46.20	25647.5000	0.5693
	2.2333	5.79	57.90	44.30	24591.9444	0.5459
	2.2667	5.59	55.90	42.30	23480.8333	0.5212
	2.3000	5.38	53.80	40.20	22314.1667	0.4953
	2.3333	5.28	52.80	39.20	21758.6111	0.4830
	2.3667	5.04	50.40	36.80	20425.2778	0.4534
	2.4000	4.91	49.10	35.50	19703.0556	0.4374

Control **No Flowcell #1**

Table H.1. Control column tracer study without flowcells #1. (con't)

Time	Conductance (mMhos)	Account for Meter setting	Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
hr	Conductivity (mMhos/cm)	conductance * 10		(mg/L)	S/area under curve of S
2.4333	4.80	48.00	34.40	19091.9444	0.4238
2.4667	4.56	45.60	32.00	17758.6111	0.3942
2.5000	4.43	44.30	30.70	17036.3889	0.3782
2.5333	4.29	42.90	29.30	16258.6111	0.3609
2.5667	4.18	41.80	28.20	15647.5000	0.3473
2.6500	3.85	38.50	24.90	13814.1667	0.3066
2.7375	3.59	35.90	22.30	12369.7222	0.2746
2.8250	3.34	33.40	19.80	10980.8333	0.2437
2.9000	3.16	31.60	18.00	9980.8333	0.2215
2.9833	2.94	29.40	15.80	8758.6111	0.1944
3.0667	2.76	27.60	14.00	7758.6111	0.1722
3.1500	2.62	26.20	12.60	6980.8333	0.1550
3.2333	2.51	25.10	11.50	6369.7222	0.1414
3.3167	2.39	23.90	10.30	5703.0556	0.1266
3.4833	2.24	22.40	8.80	4869.7222	0.1081
3.6500	2.07	20.70	7.10	3925.2778	0.0871
3.8167	1.98	19.80	6.20	3425.2778	0.0760
3.9833	1.90	19.00	5.40	2980.8333	0.0662
4.2333	1.82	18.20	4.60	2536.3889	0.0563
4.4833	1.75	17.50	3.90	2147.5000	0.0477
4.7417	1.70	17.00	3.40	1869.7222	0.0415
4.9833	1.65	16.50	2.90	1591.9444	0.0353
5.2333	1.63	16.30	2.70	1480.8333	0.0329
5.4833	1.59	15.90	2.30	1258.6111	0.0279
5.7333	1.57	15.70	2.10	1147.5000	0.0255
6.0667	1.55	15.50	1.90	1036.3889	0.0230
6.4000	1.50	15.00	1.40	758.6111	0.0168
6.7333	1.47	14.70	1.10	591.9444	0.0131
7.1000	1.45	14.50	0.90	480.8333	0.0107
7.5667	1.44	14.40	0.80	425.2778	0.0094

Table H.1. Control column tracer study without flowcells #1. (con't)

Polynomial #1

Time (hr)	5	4	3	2	1		Area Under Curve
					241806	**-353281**	
1.43					247234.5447	-505191.83	-257957.3
1.65					329158.4175	-582913.65	-253755.2
							4202.053

Polynomial #2

		131.32	**-3223**	**29056**	**-114311**	**167227**	
1.65		321.203738	-5972.224036	43507.728	-155605.8488	275924.55	158175.4
7.57		652890.3765	-2645963.398	4201479.13	-3275290.212	1265908.39	199024.3
							40848.88

NaCl added (mg/L) 58650

Total Area	**45050.93**
% Recovered	**76.93123**

Time (hr)	**E**	**dt**	**height**	**area**	**t**	**dt*h*t**
1.4600	0.0144	0.0508	0.0877	0.0045	1.4854	0.0066
1.5108	0.1611	0.0508	0.3825	0.0194	1.5363	0.0299
1.5617	0.6038	0.0383	0.7456	0.0286	1.5808	0.0452
1.6000	0.8875	0.0500	0.9109	0.0455	1.6250	0.0740
1.6500	0.9343	0.0500	0.9220	0.0461	1.6750	0.0772
1.7000	0.9097	0.0667	0.8881	0.0592	1.7333	0.1026
1.7667	0.8665	0.0333	0.8609	0.0287	1.7833	0.0512
1.8000	0.8554	0.0500	0.8400	0.0420	1.8250	0.0766
1.8500	0.8246	0.0514	0.8122	0.0417	1.8757	0.0783
1.9014	0.7999	0.0486	0.7697	0.0374	1.9257	0.0721
1.9500	0.7395	0.0500	0.7278	0.0364	1.9750	0.0719
2.0000	0.7160	0.0667	0.6963	0.0464	2.0333	0.0944
2.0667	0.6766	0.0333	0.6649	0.0222	2.0833	0.0462
2.1000	0.6532	0.0667	0.6205	0.0414	2.1333	0.0882
2.1667	0.5878	0.0333	0.5785	0.0193	2.1833	0.0421
2.2000	0.5693	0.0667	0.5453	0.0364	2.2333	0.0812
2.2667	0.5212	0.0333	0.5083	0.0169	2.2833	0.0387
2.3000	0.4953	0.0667	0.4743	0.0316	2.3333	0.0738

Sum of Area
1.007855035

Sum of Area*t
2.561822741

HRT mean
2.54185637

$$HRT_{mean} = \frac{\sum t_i c_i \Delta t_i}{\sum c_i \Delta t_i}$$

Table H.1. Control column tracer study without flowcells #1. (con't)

Time (hr)	E	dt	height	area	t	dt*h*t
2.3667	0.4534	0.0333	0.4454	0.0148	2.3833	0.0354
2.4000	0.4374	0.0667	0.4158	0.0277	2.4333	0.0674
2.4667	0.3942	0.0333	0.3862	0.0129	2.4833	0.0320
2.5000	0.3782	0.0667	0.3627	0.0242	2.5333	0.0613
2.5667	0.3473	0.0833	0.3270	0.0272	2.6083	0.0711
2.6500	0.3066	0.0875	0.2906	0.0254	2.6938	0.0685
2.7375	0.2746	0.0875	0.2592	0.0227	2.7813	0.0631
2.8250	0.2437	0.0750	0.2326	0.0174	2.8625	0.0499
2.9000	0.2215	0.0833	0.2080	0.0173	2.9417	0.0510
2.9833	0.1944	0.0833	0.1833	0.0153	3.0250	0.0462
3.0667	0.1722	0.0833	0.1636	0.0136	3.1083	0.0424
3.1500	0.1550	0.0833	0.1482	0.0123	3.1917	0.0394
3.2333	0.1414	0.0833	0.1340	0.0112	3.2750	0.0366
3.3167	0.1266	0.1667	0.1173	0.0196	3.4000	0.0665
3.4833	0.1081	0.1667	0.0976	0.0163	3.5667	0.0580
3.6500	0.0871	0.1667	0.0816	0.0136	3.7333	0.0508
3.8167	0.0760	0.1667	0.0711	0.0118	3.9000	0.0462
3.9833	0.0662	0.2500	0.0612	0.0153	4.1083	0.0629
4.2333	0.0563	0.2500	0.0520	0.0130	4.3583	0.0566
4.4833	0.0477	0.2583	0.0446	0.0115	4.6125	0.0531
4.7417	0.0415	0.2417	0.0384	0.0093	4.8625	0.0451
4.9833	0.0353	0.2500	0.0341	0.0085	5.1083	0.0436
5.2333	0.0329	0.2500	0.0304	0.0076	5.3583	0.0407
5.4833	0.0279	0.2500	0.0267	0.0067	5.6083	0.0374
5.7333	0.0255	0.3333	0.0242	0.0081	5.9000	0.0477
6.0667	0.0230	0.3333	0.0199	0.0066	6.2333	0.0414
6.4000	0.0168	0.3333	0.0150	0.0050	6.5667	0.0328
6.7333	0.0131	0.3667	0.0119	0.0044	6.9167	0.0302
7.1000	0.0107	0.4667	0.0101	0.0047	7.3333	0.0344
7.5667	0.0094					

Table H.1. Control column tracer study without flowcells #1. (con't)

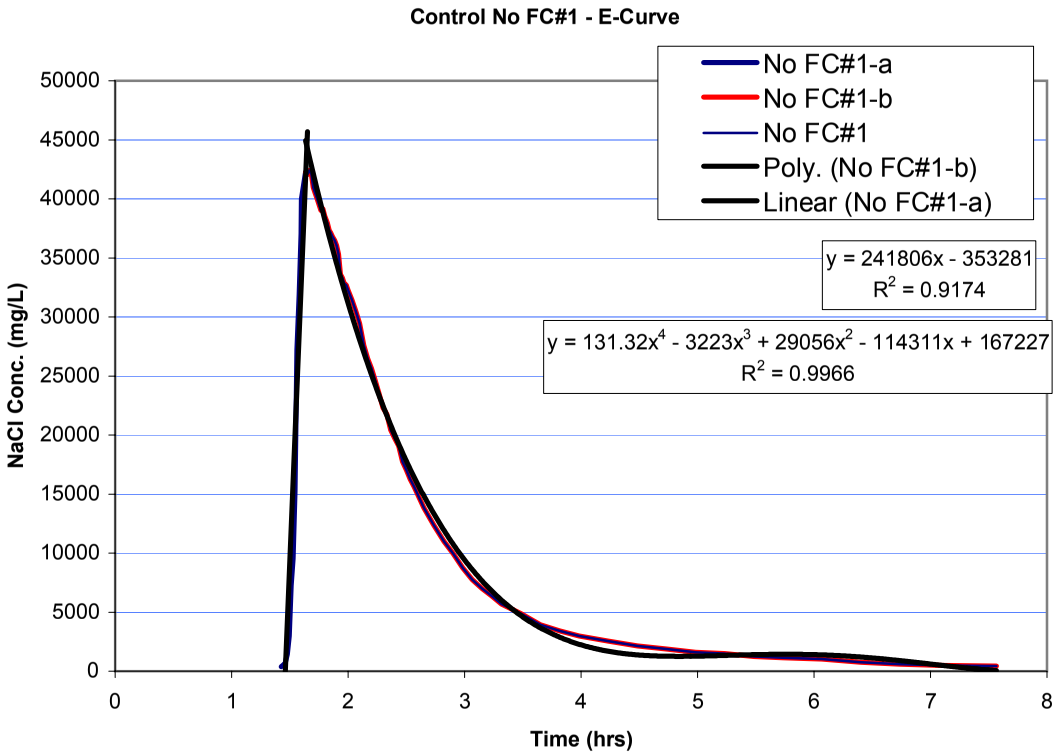

Table H.2. Control column tracer study without flowcells #2.

No Flowcell #2

2.63

Time	Conductance (mMhos)	Account for Meter setting	Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
hr	Conductivity (mMhos/cm)	conductance * 10		(mg/L)	S/area under curve of S
0.0208	1.5	14.5			
0.3333	1.4	14.1	0.0		
0.6667	1.4	14.2	0.1	36.3889	
0.8333	1.5	14.9	0.8	425.2778	
1.0000	1.5	14.9	0.8	425.2778	
1.0833	1.5	14.8	0.7	369.7222	
1.1667	1.5	15.0	0.9	480.8333	0.0097
1.2500	1.5	15.1	1.0	536.3889	0.0108
1.3333	1.6	15.8	1.7	925.2778	0.0187
1.3833	1.7	16.8	2.7	1480.8333	0.0299
1.4167	1.7	17.0	2.9	1591.9444	0.0322
1.4500	1.7	17.2	3.1	1703.0556	0.0344
1.4833	1.7	17.3	3.2	1758.6111	0.0356
1.5000	1.8	17.9	3.8	2091.9444	0.0423
1.5167	1.9	18.8	4.7	2591.9444	0.0524
1.5333	2.1	20.6	6.5	3591.9444	0.0726
1.5500	2.4	23.5	9.4	5203.0556	0.1052
1.5667	2.9	28.5	14.4	7980.8333	0.1614
1.5833	3.7	37.1	23.0	12758.6111	0.2580
1.6000	4.6	45.8	31.7	17591.9444	0.3558
1.6250	6.8	67.5	53.4	29647.5000	0.5996
1.6333	7.4	73.6	59.5	33036.3889	0.6681
1.6542	8.9	88.7	74.6	41425.2778	0.8378
1.6667	9.3	93.1	79.0	43869.7222	0.8872
1.6833	9.5	95.2	81.1	45036.3889	0.9108
1.7000	9.7	97.3	83.2	46203.0556	0.9344
1.7167	9.7	96.7	82.6	45869.7222	0.9277

Table H.2. Control column tracer study without flowcells #2. (con't)

Time	Conductance (mMhos)		Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
hr	Conductivity (mMhos/cm)	Account for Range		(mg/L)	
1.7333	9.6	96.0	81.9	45480.8333	0.9198
1.7500	9.5	95.2	81.1	45036.3889	0.9108
1.7667	9.3	93.4	79.3	44036.3889	0.8906
1.7833	9.3	93.0	78.9	43814.1667	0.8861
1.8000	9.2	92.2	78.1	43369.7222	0.8771
1.8167	9.1	91.4	77.3	42925.2778	0.8681
1.8417	9.1	90.5	76.4	42425.2778	0.8580
1.8500	8.9	88.6	74.5	41369.7222	0.8367
1.8667	8.7	86.5	72.4	40203.0556	0.8131
1.8833	8.5	84.8	70.7	39258.6111	0.7940
1.9000	8.4	84.0	69.9	38814.1667	0.7850
1.9333	8.2	82.2	68.1	37814.1667	0.7648
1.9667	8.2	81.9	67.8	37647.5000	0.7614
2.0000	8.0	79.8	65.7	36480.8333	0.7378
2.0333	7.7	76.9	62.8	34869.7222	0.7052
2.0667	7.6	76.1	62.0	34425.2778	0.6962
2.1000	7.3	72.9	58.8	32647.5000	0.6603
2.1333	7.1	71.1	57.0	31647.5000	0.6401
2.1667	6.9	69.1	55.0	30536.3889	0.6176
2.2000	6.7	67.3	53.2	29536.3889	0.5974
2.2333	6.6	66.0	51.9	28814.1667	0.5828
2.2667	6.5	64.5	50.4	27980.8333	0.5659
2.3000	6.2	61.6	47.5	26369.7222	0.5333
2.3333	6.0	60.2	46.1	25591.9444	0.5176
2.3667	5.8	58.2	44.1	24480.8333	0.4951
2.4000	5.7	56.7	42.6	23647.5000	0.4783
2.4333	5.4	54.4	40.3	22369.7222	0.4524
2.4667	5.4	53.5	39.4	21869.7222	0.4423
2.5000	5.1	51.3	37.2	20647.5000	0.4176
2.5333	5.0	50.0	35.9	19925.2778	0.4030

Table H.2. Control column tracer study without flowcells #2. (con't)

Time	Conductance (mMhos)	Account for Range	Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
hr	Conductivity (mMhos/cm)			(mg/L)	
2.5667	4.8	48.2	34.1	18925.2778	0.3828
2.6000	4.7	46.7	32.6	18091.9444	0.3659
2.6333	4.6	45.5	31.4	17425.2778	0.3524
2.6667	4.5	45.0	30.9	17147.5000	0.3468
2.7000	4.3	42.6	28.5	15814.1667	0.3198
2.7333	4.2	41.7	27.6	15314.1667	0.3097
2.7667	4.1	40.5	26.4	14647.5000	0.2962
2.8000	4.0	39.6	25.5	14147.5000	0.2861
2.8833	3.7	37.2	23.1	12814.1667	0.2592
2.9667	3.5	34.8	20.7	11480.8333	0.2322
3.0500	3.3	32.8	18.7	10369.7222	0.2097
3.1333	3.1	30.9	16.8	9314.1667	0.1884
3.2167	2.9	29.3	15.2	8425.2778	0.1704
3.3000	2.8	28.0	13.9	7703.0556	0.1558
3.4333	2.6	26.0	11.9	6591.9444	0.1333
3.5667	2.4	24.2	10.1	5591.9444	0.1131
3.7000	2.3	23.0	8.9	4925.2778	0.0996
3.8333	2.2	21.5	7.4	4091.9444	0.0828
3.9667	2.1	20.8	6.7	3703.0556	0.0749
4.1000	2.0	20.2	6.1	3369.7222	0.0682
4.2500	1.9	19.2	5.1	2814.1667	0.0569
4.5000	1.8	18.1	4.0	2203.0556	0.0446
4.7500	1.7	17.4	3.3	1814.1667	0.0367
5.0000	1.7	16.8	2.7	1480.8333	0.0299
5.2500	1.7	16.6	2.5	1369.7222	0.0277
5.5833	1.6	16.0	1.9	1036.3889	0.0210
5.9167	1.6	15.9	1.8	980.8333	0.0198
6.2500	1.6	15.7	1.6	869.7222	0.0176
6.5833	1.5	15.3	1.2	647.5000	0.0131
6.9167	1.5	15.1	1.0		
7.0000	1.5	15.2			

Table H.2. Control column tracer study without flowcells #2. (con't)

	Polynomial #1							**Area Under Curve**
Time (hr)	5	4	3	2	1			
					4706.5	**-5165.2**		
1.17					3221.363925	-6043.284		-2821.920075
1.48					5154.5588	-7644.496		-2489.9372
								331.982875
	Polynomial #2							
					2.52E+05	**-3.80E+05**		
1.48					275759.3128	-562311.2		-286551.8872
1.68					355324.6368	-638299.2		-282974.5632
								3577.324
	Polynomial #3							
		91.419	**-2644.4**	**26448**	**-111857**	**173088**		
1.68		244.6881124	-5266.284098	41802.22771	-157852.5984	290787.84		169715.8733
6.58		225525.6432	-1239283.683	2511592.991	-2421502.707	1138919.04		215251.2834
								45535.41004

Total Area	**49444.71692**
% Recovery	**84.43428435**

Table H.2. Control column tracer study without flowcells #2. (con't)

Time (hrs)	E	dt	height	area	t	dt*h*t
1.166666667	0.009724666	0.333333333	0.026016711	0.008672237	1.333333333	0.011562982
1.5	0.042308756	0.05	0.073769256	0.003688463	1.525	0.005624906
1.55	0.105229757	0.05	0.230509966	0.011525498	1.575	0.01815266
1.6	0.355790174	0.054166667	0.596800082	0.032326671	1.627083333	0.052598188
1.654166667	0.83780999	0.045833333	0.88612433	0.040614032	1.677083333	0.068113116
1.7	0.934438671	0.05	0.922640983	0.046132049	1.725	0.079577785
1.75	0.910843295	0.05	0.893989456	0.044699473	1.775	0.079341564
1.8	0.877135616	0.05	0.856911008	0.04284555	1.825	0.078193129
1.85	0.836686401	0.05	0.810843846	0.040542192	1.875	0.076016611
1.9	0.785001292	0.066666667	0.773203604	0.051546907	1.933333333	0.099657353
1.966666667	0.761405916	0.033333333	0.749608229	0.024986941	1.983333333	0.049557433
2	0.737810541	0.066666667	0.717024139	0.047801609	2.033333333	0.097196605
2.066666667	0.696237736	0.033333333	0.678260307	0.022608677	2.083333333	0.04710141
2.1	0.660282878	0.066666667	0.638934681	0.042595645	2.133333333	0.09087071
2.166666667	0.617586484	0.033333333	0.60747418	0.020249139	2.183333333	0.044210621
2.2	0.597361877	0.066666667	0.581631626	0.038775442	2.233333333	0.086598487
2.266666667	0.565901376	0.033333333	0.549609331	0.018320311	2.283333333	0.041831377
2.3	0.533317286	0.066666667	0.514216267	0.034281084	2.333333333	0.079989197
2.366666667	0.495115249	0.033333333	0.486688329	0.016222944	2.383333333	0.038664684
2.4	0.478261409	0.066666667	0.46028398	0.030685599	2.433333333	0.07466829
2.466666667	0.442306551	0.033333333	0.429947069	0.014331569	2.483333333	0.035590063
2.5	0.417587586	0.066666667	0.400171952	0.02667813	2.533333333	0.067584596
2.566666667	0.382756318	0.033333333	0.374329398	0.012477647	2.583333333	0.03223392
2.6	0.365902478	0.066666667	0.356351969	0.023756798	2.633333333	0.062559568
2.666666667	0.34680146	0.033333333	0.333318388	0.011110613	2.683333333	0.029813478
2.7	0.319835316	0.066666667	0.308037628	0.020535842	2.733333333	0.056131301
2.766666667	0.296239941	0.033333333	0.291183789	0.009706126	2.783333333	0.027015385
2.8	0.286127637	0.083333333	0.272644565	0.02272038	2.841666667	0.064563748
2.883333333	0.259161493	0.083333333	0.245678421	0.020473202	2.925	0.059884115
2.966666667	0.23219535	0.083333333	0.220959457	0.018413288	3.008333333	0.055393308
3.05	0.209723563	0.083333333	0.199049465	0.016587455	3.091666667	0.051282883
3.133333333	0.188375366	0.083333333	0.179386652	0.014948888	3.175	0.047462718
3.216666667	0.170397937	0.083333333	0.163094607	0.013591217	3.258333333	0.044284716
3.3	0.155791276	0.133333333	0.144555383	0.019274051	3.366666667	0.064889305

Sum of Area
1.000556284

Sum of Area*t
2.52544052

HRT mean
2.524036439

Table H.2. Control column tracer study without flowcells #2. (con't)

Time (hrs)	E	dt	height	area	t	dt*h*t
3.433333333	0.13331949	0.133333333	0.123207186	0.016427625	3.5	0.057496687
3.566666667	0.113094882	0.133333333	0.106353347	0.014180446	3.633333333	0.051522288
3.7	0.099611811	0.133333333	0.091184891	0.012157985	3.766666667	0.045795078
3.833333333	0.082757971	0.133333333	0.078825408	0.010510054	3.9	0.040989212
3.966666667	0.074892846	0.133333333	0.071522078	0.009536277	4.033333333	0.038462984
4.1	0.06815131	0.15	0.062533363	0.009380004	4.175	0.039161519
4.25	0.056915417	0.25	0.050735675	0.012683919	4.375	0.055492145
4.5	0.044555934	0.25	0.040623372	0.010155843	4.625	0.046970773
4.75	0.036690809	0.25	0.033320041	0.00833001	4.875	0.0406088
5	0.029949273	0.25	0.028825684	0.007206421	5.125	0.036932907
5.25	0.027702095	0.333333333	0.024331327	0.008110442	5.416666667	0.043931562
5.583333333	0.020960559	0.333333333	0.020398764	0.006799588	5.75	0.039097631
5.916666667	0.019836969	0.333333333	0.01871338	0.006237793	6.083333333	0.037946576
6.25	0.017589791	0.333333333	0.015342612	0.005114204	6.416666667	0.032816143
6.583333333	0.013095433					

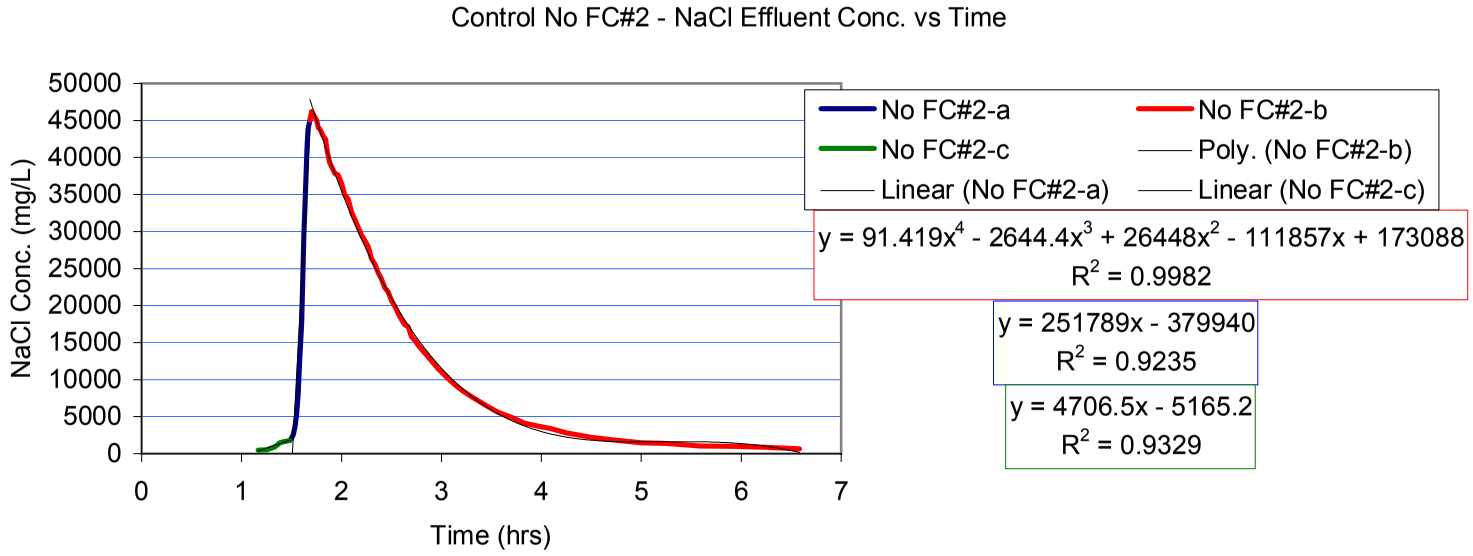

Table H.3. Control column tracer study with flowcells attached.

With Flowcells

Time	Conductance (mMhos)		Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve	
hr	Conductivity (mMhos/cm)	Account for Range		(mg/L)		
0.0250	1.42	14.2				
0.5542	1.38	13.8	0			
0.7167	1.39	13.9	0.1	36.3889		Flow rate mL/min 0.95
0.8833	1.39	13.9	0.1	36.3889		
1.0500	1.38	13.8	0	-19.1667		
1.2167	1.38	13.8	0	-19.1667		
1.5000	1.38	13.8	0	-19.1667		
1.6667	1.38	13.8	0	-19.1667		
1.8333	1.38	13.8	0	-19.1667		
2.0000	1.38	13.8	0	-19.1667		
2.0833	1.37	13.7	-0.1	-74.7222		
2.1667	1.38	13.8	0	-19.1667		
2.2500	1.38	13.8	0	-19.1667		
2.3333	1.39	13.9	0.1	36.3889		
2.4167	1.38	13.8	0	-19.1667		
2.4750	1.39	13.9	0.1	36.3889		
2.5250	1.4	14	0.2	91.9444		
2.5500	1.4	14	0.2	91.9444		
2.5875	1.4	14	0.2	91.9444		
2.6167	1.4	14	0.2	91.9444		
2.6500	1.4	14	0.2	91.9444		
2.6833	1.4	14	0.2	91.9444		
2.7167	1.41	14.1	0.3	147.5000		
2.7500	1.42	14.2	0.4	203.0556		
2.7833	1.41	14.1	0.3	147.5000		
2.8167	1.42	14.2	0.4	203.0556		
2.8500	1.43	14.3	0.5	258.6111		
2.8833	1.45	14.5	0.7	369.7222		

Table H.3. Control column tracer study with flowcells attached.

Time	**Conductance (mMhos)**		**Conductance - Initial Conduct.**	**Added NaCl Conc. from tracer pulse**	**E-curve**
hr	**Conductivity (mMhos/cm)**	**Account for Range**		**(mg/L)**	
2.9167	1.46	14.6	0.8	425.2778	0.0093
2.9500	1.46	14.6	0.8	425.2778	0.0093
2.9875	1.47	14.7	0.9	480.8333	0.0105
3.0000	1.49	14.9	1.1	591.9444	0.0129
3.0167	1.52	15.2	1.4	758.6111	0.0165
3.0333	1.53	15.3	1.5	814.1667	0.0177
3.0500	1.57	15.7	1.9	1036.3889	0.0225
3.0667	1.65	16.5	2.7	1480.8333	0.0322
3.0833	1.73	17.3	3.5	1925.2778	0.0419
3.1000	1.86	18.6	4.8	2647.5000	0.0576
3.1167	2.07	20.7	6.9	3814.1667	0.0830
3.1333	2.32	23.2	9.4	5203.0556	0.1132
3.1500	2.68	26.8	13	7203.0556	0.1567
3.1667	3.01	30.1	16.3	9036.3889	0.1966
3.1833	3.48	34.8	21	11647.5000	0.2534
3.2000	3.85	38.5	24.7	13703.0556	0.2981
3.2167	4.37	43.7	29.9	16591.9444	0.3610
3.2333	4.69	46.9	33.1	18369.7222	0.3997
3.2500	4.96	49.6	35.8	19869.7222	0.4323
3.2667	5.12	51.2	37.4	20758.6111	0.4517
3.2847	5.18	51.8	38	21091.9444	0.4589
3.3000	5.21	52.1	38.3	21258.6111	0.4625
3.3167	5.33	53.3	39.5	21925.2778	0.4770
3.3333	5.28	52.8	39	21647.5000	0.4710
3.3500	5.22	52.2	38.4	21314.1667	0.4637
3.3667	5.18	51.8	38	21091.9444	0.4589
3.3833	5.16	51.6	37.8	20980.8333	0.4565
3.4167	5.14	51.4	37.6	20869.7222	0.4541
3.4500	5.1	51	37.2	20647.5000	0.4492
3.4667	5.09	50.9	37.1	20591.9444	0.4480
3.5833	4.94	49.4	35.6	19758.6111	0.4299

Table H.3. Control column tracer study with flowcells attached.

Time	**Conductance (mMhos)**		**Conductance - Initial Conduct.**	**Added NaCl Conc. from tracer pulse**	**E-curve**
hr	**Conductivity (mMhos/cm)**	**Account for Range**		**(mg/L)**	
3.6667	4.78	47.8	34	18869.7222	0.4106
3.7500	4.73	47.3	33.5	18591.9444	0.4045
3.8333	4.55	45.5	31.7	17591.9444	0.3828
3.9167	4.38	43.8	30	16647.5000	0.3622
4.0000	4.26	42.6	28.8	15980.8333	0.3477
4.0833	4.17	41.7	27.9	15480.8333	0.3368
4.1667	4.06	40.6	26.8	14869.7222	0.3235
4.2500	3.95	39.5	25.7	14258.6111	0.3102
4.3333	3.8	38	24.2	13425.2778	0.2921
4.4167	3.68	36.8	23	12758.6111	0.2776
4.5000	3.57	35.7	21.9	12147.5000	0.2643
4.5833	3.48	34.8	21	11647.5000	0.2534
4.6667	3.41	34.1	20.3	11258.6111	0.2450
4.8333	3.22	32.2	18.4	10203.0556	0.2220
5.0000	3.12	31.2	17.4	9647.5000	0.2099
5.1708	2.94	29.4	15.6	8647.5000	0.1881
5.3333	2.82	28.2	14.4	7980.8333	0.1736
5.5000	2.7	27	13.2	7314.1667	0.1591
5.6667	2.59	25.9	12.1	6703.0556	0.1458
5.8333	2.5	25	11.2	6203.0556	0.1350
6.0000	2.39	23.9	10.1	5591.9444	0.1217
6.2542	2.25	22.5	8.7	4814.1667	0.1047
6.5000	2.16	21.6	7.8	4314.1667	0.0939
6.7500	2.05	20.5	6.7	3703.0556	0.0806
7.0000	1.96	19.6	5.8	3203.0556	0.0697
7.3375	1.91	19.1	5.3	2925.2778	0.0636
7.7250	1.79	17.9	4.1	2258.6111	0.0491
8.0000	1.74	17.4	3.6	1980.8333	0.0431
8.3375	1.7	17	3.2	1758.6111	0.0383
8.6667	1.66	16.6	2.8	1536.3889	0.0334
9.0000	1.62	16.2	2.4	1314.1667	0.0286

Time	Conductance (mMhos)		Conductance - Initial Conduct.	Added NaCl Conc. from tracer pulse	E-curve
hr	Conductivity (mMhos/cm)	Account for Range		(mg/L)	
9.3333	1.58	15.8	2	1091.9444	0.0238
9.6667	1.56	15.6	1.8	980.8333	0.0213
10.0167	1.53	15.3	1.5	814.1667	0.0177
10.3500	1.51	15.1	1.3	703.0556	0.0153
10.6833	1.5	15	1.2	647.5000	0.0141

Table H.3. Control column tracer study with flowcells attached. (Con't)

Table H.3. Control column tracer study with flowcells attached.

				Polynomial #1			Area Under Curve
Time (hr)	5	4	3	2	1		
				213493	**-1.26304E+06**	**1.86765E+06**	
2.95				1826957.452	-5495802.8	5509567.5	1840722
3.3				2557432.647	-6877252.8	6163245	1843425
							2702.695
	Polynomial #2						
		3.01	**-172.09**	**3278.4**	**-26444**	**79493**	
3.3		235.5950659	-5102.128622	39271.9536	-143987.58	262326.9	152744.7
10.6833		83776.7699	-560424.7924	1332468.523	-1509065.189	849247.5669	196002.9
							43258.14
						Total Area	**45960.83**
						% Recovery	**78.48503**

Table H.3. Control column tracer study with flowcells attached. Values for HRT calc.

Time (hrs)	E	dt	height	area	t	dt*h*t
2.9500	0.0093	0.0375	0.0099	0.0004	2.9688	0.0011
2.9875	0.0105	0.0125	0.0117	0.0001	2.9938	0.0004
3.0000	0.0129	0.0167	0.0147	0.0002	3.0083	0.0007
3.0167	0.0165	0.0167	0.0171	0.0003	3.0250	0.0009
3.0333	0.0177	0.0167	0.0201	0.0003	3.0417	0.0010
3.0500	0.0225	0.0167	0.0274	0.0005	3.0583	0.0014
3.0667	0.0322	0.0167	0.0371	0.0006	3.0750	0.0019
3.0833	0.0419	0.0167	0.0497	0.0008	3.0917	0.0026
3.1000	0.0576	0.0167	0.0703	0.0012	3.1083	0.0036
3.1167	0.0830	0.0167	0.0981	0.0016	3.1250	0.0051
3.1333	0.1132	0.0167	0.1350	0.0022	3.1417	0.0071
3.1500	0.1567	0.0167	0.1767	0.0029	3.1583	0.0093
3.1667	0.1966	0.0167	0.2250	0.0038	3.1750	0.0119
3.1833	0.2534	0.0167	0.2758	0.0046	3.1917	0.0147
3.2000	0.2981	0.0167	0.3296	0.0055	3.2083	0.0176
3.2167	0.3610	0.0167	0.3803	0.0063	3.2250	0.0204
3.2333	0.3997	0.0167	0.4160	0.0069	3.2417	0.0225
3.2500	0.4323	0.0167	0.4420	0.0074	3.2583	0.0240
3.2667	0.4517	0.0181	0.4553	0.0082	3.2757	0.0269
3.2847	0.4589	0.0153	0.4607	0.0070	3.2924	0.0232
3.3000	0.4625	0.0167	0.4698	0.0078	3.3083	0.0259
3.3167	0.4770	0.0167	0.4740	0.0079	3.3250	0.0263
3.3333	0.4710	0.0167	0.4674	0.0078	3.3417	0.0260
3.3500	0.4637	0.0167	0.4613	0.0077	3.3583	0.0258
3.3667	0.4589	0.0167	0.4577	0.0076	3.3750	0.0257
3.3833	0.4565	0.0333	0.4553	0.0152	3.4000	0.0516
3.4167	0.4541	0.0333	0.4517	0.0151	3.4333	0.0517
3.4500	0.4492	0.0167	0.4486	0.0075	3.4583	0.0259
3.4667	0.4480	0.1167	0.4390	0.0512	3.5250	0.1805
3.5833	0.4299	0.0833	0.4202	0.0350	3.6250	0.1269
3.6667	0.4106	0.0833	0.4075	0.0340	3.7083	0.1259
3.7500	0.4045	0.0833	0.3936	0.0328	3.7917	0.1244

Sum of Area
1.004

Sum of Area*t
5.000

HRT mean
4.981

Table H.3. Control column tracer study with flowcells attached.

Time (hrs)	E	dt	height	area	t	dt*h*t
3.8333	0.3828	0.0833	0.3725	0.0310	3.8750	0.1203
3.9167	0.3622	0.0833	0.3550	0.0296	3.9583	0.1171
4.0000	0.3477	0.0833	0.3423	0.0285	4.0417	0.1153
4.0833	0.3368	0.0833	0.3302	0.0275	4.1250	0.1135
4.1667	0.3235	0.0833	0.3169	0.0264	4.2083	0.1111
4.2500	0.3102	0.0833	0.3012	0.0251	4.2917	0.1077
4.3333	0.2921	0.0833	0.2849	0.0237	4.3750	0.1039
4.4167	0.2776	0.0833	0.2709	0.0226	4.4583	0.1007
4.5000	0.2643	0.0833	0.2589	0.0216	4.5417	0.0980
4.5833	0.2534	0.0833	0.2492	0.0208	4.6250	0.0960
4.6667	0.2450	0.1667	0.2335	0.0389	4.7500	0.1848
4.8333	0.2220	0.1667	0.2160	0.0360	4.9167	0.1770
5.0000	0.2099	0.1708	0.1990	0.0340	5.0854	0.1729
5.1708	0.1881	0.1625	0.1809	0.0294	5.2521	0.1544
5.3333	0.1736	0.1667	0.1664	0.0277	5.4167	0.1502
5.5000	0.1591	0.1667	0.1525	0.0254	5.5833	0.1419
5.6667	0.1458	0.1667	0.1404	0.0234	5.7500	0.1346
5.8333	0.1350	0.1667	0.1283	0.0214	5.9167	0.1265
6.0000	0.1217	0.2542	0.1132	0.0288	6.1271	0.1763
6.2542	0.1047	0.2458	0.0993	0.0244	6.3771	0.1557
6.5000	0.0939	0.2500	0.0872	0.0218	6.6250	0.1445
6.7500	0.0806	0.2500	0.0751	0.0188	6.8750	0.1291
7.0000	0.0697	0.3375	0.0667	0.0225	7.1688	0.1613
7.3375	0.0636	0.3875	0.0564	0.0219	7.5313	0.1646
7.7250	0.0491	0.2750	0.0461	0.0127	7.8625	0.0997
8.0000	0.0431	0.3375	0.0407	0.0137	8.1688	0.1122
8.3375	0.0383	0.3292	0.0358	0.0118	8.5021	0.1003
8.6667	0.0334	0.3333	0.0310	0.0103	8.8333	0.0913
9.0000	0.0286	0.3333	0.0262	0.0087	9.1667	0.0800
9.3333	0.0238	0.3333	0.0225	0.0075	9.5000	0.0714
9.6667	0.0213	0.3500	0.0195	0.0068	9.8417	0.0673
10.0167	0.0177	0.3333	0.0165	0.0055	10.1833	0.0560
10.3500	0.0153	0.3333	0.0147	0.0049	10.5167	0.0515
10.6833	0.0141					

Table H.3. Control column tracer study with flowcells attached. NaCl conc. vs. time.