Table 2-1
Summary of RI COPCs Before Pilot Study, May 2001–May 2013

	Year Range >>	May 2001 - May 2013			
Analyte	**Units**	Minimum	Maximum	Average	n
General Chemistry					
Ammonia as N	mg/L	0.01	0.19	0.066	8
Bicarbonate	mg/L	77	382	313	27
Carbonate	mg/L	0.5	3	1	27
Calcium, Dissolved	mg/L	237	526	469	19
Magnesium, Dissolved	mg/L	56.3	96.4	64.3	19
Potassium, Dissolved	mg/L	1.82	5.9	2.77	19
Sodium, Dissolved	mg/L	11	117	21	19
Chloride	mg/L	13.7	680	84.7	20
Fluoride	mg/L	0.137	0.586	0.361	7
Hardness	mg/L	436	1620	1411	27
Nitrate as N	mg/L	0.05	0.76	0.26	4
Nitrate/Nitrite as N	mg/L	0.02	2.1	0.38	23
Sulfate as SO_4	mg/L	42	1320	1042	29
Total Alkalinity	mg/L	77	362	301	22
Total Dissolved Solids	mg/L	18	2360	1911	35
Total Organic Carbon	mg/L	1.5	49	7.0	16
Total Phosphorus as P	mg/L	0.03	0.95	0.50	4
Total Suspended Solids	mg/L	0	580	38	27
Metals and Metalloids					
Aluminum, Dissolved	mg/L	0.0066	0.03	0.019	17
Aluminum, Total	mg/L	0.016	1.99	0.177	14
Antimony, Dissolved	mg/L	0.0005	0.0011	0.000843	13
Antimony, Total	mg/L	0.0006	0.0025	0.0011	12
Arsenic, Dissolved	mg/L	0.0006	0.405	0.0696	21
Arsenic, Total	mg/L	0.0005	0.45	0.055	16
Barium, Dissolved	mg/L	0.0345	0.0789	0.045605	21
Barium, Total	mg/L	0.0346	0.097	0.0531	14
Beryllium, Dissolved	mg/L	0.000025	0.002	0.000225	13
Beryllium, Total	mg/L	0.000025	0.005	0.00049	12
Boron, Dissolved	mg/L	0.05	0.4	0.1	13
Boron, Total	mg/L	0.037	0.0886	0.0655	12
Cadmium, Dissolved	mg/L	0.00045	0.0222	0.0075	23
Cadmium, Total	mg/L	0.0007	0.0355	0.0116	15
Chromium, Dissolved	mg/L	0.00026	0.0062	0.0011	23
Chromium, Total	mg/L	0.00048	0.0217	0.0033	14
Cobalt, Dissolved	mg/L	0.00033	0.0061	0.0018	13
Cobalt, Total	mg/L	0.00051	0.01	0.0026	13
Copper, Dissolved	mg/L	0.00029	0.01	0.0016	21
Copper, Total	mg/L	0.00056	0.009	0.0017	14
Iron, Dissolved	mg/L	0.011	0.027	0.020	17
Iron, Total	mg/L	0.01	1.57	0.20	14
Lead, Dissolved	mg/L	0.000019	0.001	0.000152	21
Lead, Total	mg/L	0.000019	0.0027	0.000364	14
Manganese, Dissolved	mg/L	0.189	2.41	0.642	21
Manganese, Total	mg/L	0.064	4.09	0.593	15
Mercury, Dissolved	mg/L	0.000043	0.000072	0.00006	13
Mercury, Total	mg/L	0.000043	0.0005	0.000111	14
Molybdenum, Dissolved	mg/L	0.0237	0.0437	0.0330	13
Molybdenum, Total	mg/L	0.021	0.0763	0.0355	12
Nickel, Dissolved	mg/L	0.129	0.187	0.157	23
Nickel, Total	mg/L	0.024	0.269	0.152	14
Selenium, Dissolved	mg/L	0.27	9.84	2.68	27
Selenium, Total	mg/L	0.269	8.63	2.49	29
Silver, Dissolved	mg/L	0.000012	0.000221	0.000049	21
Silver, Total	mg/L	0.000012	0.0021	0.000211	14
Thallium, Dissolved	mg/L	0.000029	0.000205	0.000136	13
Thallium, Total	mg/L	0.00011	0.0025	0.000379	12
Uranium, Dissolved	mg/L	0.024	0.031	0.028	11
Uranium, Total	mg/L	0.0237	0.048	0.0299	12
Vanadium, Dissolved	mg/L	0.0071	0.0153	0.0109	23
Vanadium, Total	mg/L	0.005	0.0345	0.0137	14
Zinc, Dissolved	mg/L	0.188	0.623	0.403	23
Zinc, Total	mg/L	0.03	0.701	0.416	14

Notes:
n - Number of samples
mg/L - milligrams per liter

Table 3-1
Nutrients and Amendments
Added to the Pilot Treatment System

Date	Nutrient/Amendment Dosage		
	Method	Nutrient/Amendment Type	Amount
Initial Start-Up Phase			
7/16/2013	Manual	Powdered Molasses	100 pounds
7/17/2013	Manual	Powdered Molasses	100 pounds
7/26/2013	Manual	Powdered Molasses	25 pounds
8/6/2013	Manual	Powdered Molasses	25 pounds
8/13/2013	Automated	Powdered Molasses	24 pounds
Operational Phase			
8/20/2013	Automated	Powdered Molasses	25 pounds
8/26/2013	Automated	Powdered Molasses	12 pounds
9/5/2013	Automated[a]	Powdered Molasses	25 pounds
9/9/2013	Manual	Pelletized Sugar Beet Pulp	25 pounds
9/16/2013	Manual	Pelletized Sugar Beet Pulp	10 pounds
9/20/2013	Automated	Crushed Beet Pellets	10 pounds
9/24/2013	Automated	Crushed Beet Pellets	10 pounds
9/26/2013	Automated	Crushed Beet Pellets	10 pounds
10/7/2013	Automated[a]	Crushed Beet Pellets	10 pounds
11/13/2013	Manual	Pelletized Sugar Beet Pulp	10 pounds
1/18/2014	Manual	Pelletized Sugar Beet Pulp	15 pounds
3/11/2014	Manual	Pelletized Sugar Beet Pulp	10 pounds
4/29/2014	Manual	Pelletized Sugar Beet Pulp	20 pounds
6/5/2014	Manual	Pelletized Sugar Beet Pulp	25 pounds
7/7/2014	Manual	Pelletized Sugar Beet Pulp	2.5 gallons
7/29/2014	Manual	Pelletized Sugar Beet Pulp	2.5 gallons
8/21/2014	Manual	Pelletized Sugar Beet Pulp	3 gallons
9/15/2014	Manual	Pelletized Sugar Beet Pulp	2.5 gallons
9/29/2014	Manual	Pelletized Sugar Beet Pulp	2.5 gallons
10/13/2014	Manual	Pelletized Sugar Beet Pulp	2.5 gallons
4/14/2015	Manual	Pelletized Sugar Beet Pulp	4 gallons
6/8/2015	Manual	Pelletized Sugar Beet Pulp	3 gallons
6/8/2015	Manual	Zero-Valent Iron	200 pounds [b]
6/22/2015	Manual	Pelletized Sugar Beet Pulp	3 gallons
7/6/2015	Manual	Pelletized Sugar Beet Pulp	3 gallons
7/27/2015	Manual	Pelletized Sugar Beet Pulp	3 gallons
8/3/2015	Manual	Pelletized Sugar Beet Pulp	3 gallons

Notes:

[a] Automated feeder stopped working after nutrients added to feeder on this date.

[b] Zero-Valent Iron was added to both bioreactors (100 pounds each).

Table 3-2
Lab Results from Analysis of Nutrients and Amendments

Analyte	Units	Nutrients and Amendments			
		Pelletized Beet Pulp	Powdered Molasses	Zero Valent Iron	
	Date >>	9/12/2013	8/1/2013	8/1/2013	9/19/2013
General Chemistry					
Organic Matter	mg/kg	68.6	65.2	24.5	24
Total Organic Carbon	mg/kg	39.8	37.8	14.2	13.9
Metals and Metalloids					
Aluminum	mg/kg	1220	25.4	451	521
Antimony	mg/kg	0.098	0.08	5.1	7.6
Arsenic	mg/kg	0.53	0.12	58.8	56
Barium	mg/kg	100	5.8	34.4	26.2
Beryllium	mg/kg	0.11	0.012	0.012	0.25
Boron	mg/kg	62.8	13.5	24.4	6.3
Cadmium	mg/kg	0.29	0.099	0.007	5.8
Chromium	mg/kg	30.1	0.52	1390	1510
Cobalt	mg/kg	0.65	0.55	78.8	86.1
Copper	mg/kg	22.1	8.6	2120	1780
Iron	mg/kg	1170	321	955,000	920,000
Lead	mg/kg	1.5	0.25	0.25	4.7
Manganese	mg/kg	70.6	12.8	8040	8590
Mercury	mg/kg	0.0064	0.0043	0.0043	0.0043
Molybdenum	mg/kg	2.4	0.86	164	180
Nickel	mg/kg	7.1	2.4	949	1070
Selenium	mg/kg	0.21	0.22	0.11	0.2
Silver	mg/kg	0.02	0.0027	0.88	0.78
Thallium	mg/kg	0.043	0.015	0.0048	0.096
Uranium	mg/kg	0.15	0.039	0.0091	0.1
Vanadium	mg/kg	3.8	0.72	0.09	41
Zinc	mg/kg	33	10.1	76.1	94.9

Notes:
mg/kg - milligram per kilogram

Table 4-1
Field Parameters, July 2013 - November 2015

Year		Analyte >>	Flow	Dissolved Oxygen	ORP	pH	SC	Temperature	Turbidity	TDS
		Units >>	gpm	mg/L	mV	SU	umhos/cm	°C	NTU	mg/L
2013	Influent	7/12/2013	2.3	--	--	--	--	--	--	--
		7/16/2013	1.03	--	--	--	--	--	--	--
		7/17/2013	1.03	4.59	97.8	6.85	1906	12.93	2.74	--
		7/18/2013	1.03	4.59	78	7.01	1919	13.3	1.54	--
		7/24/2013	1.03	4.8	317.1	6.79	1963	13.5	0	--
		7/25/2013	1.03	3.97	135.1	6.77	3084	14.11	0	--
		7/26/2013	1.03	4.23	113.3	6.87	3084	13.45	0	--
		7/29/2013	1.03	2.94	125	6.98	3087	13.27	0	--
		7/30/2013	1.03	3.59	128	6.97	3122	13.62	0	--
		7/31/2013	0.72	3.96	--	6.97	3141	14.24	1.44	--
		8/6/2013	0.49	--	--	--	--	--	--	--
		8/9/2013	1.39	--	--	--	--	--	--	--
		8/12/2013	1.39	--	--	--	--	--	--	--
		8/13/2013	1.39	--	--	--	--	--	--	--
		8/14/2013	1.39	4.03	132.7	6.96	3161	12.3	1.34	--
		8/20/2013	1.4	--	--	--	--	--	--	--
		8/26/2013	1.03	2.81	63.2	6.86	3053	14.52	--	2
		9/5/2013	1.03	--	--	--	--	--	--	--
		9/9/2013	1.03	1.48	15.3	7.01	2902.2	12.98	1.24	1
		9/16/2013	1.03	--	--	--	--	--	--	--
		9/19/2013	1.03	--	--	--	--	--	--	--
		9/20/2013	1.03	--	--	--	--	--	--	--
		9/24/2013	1.03	--	--	--	--	--	--	--
		9/26/2013	0.72	--	--	--	--	--	--	--
		10/7/2013	1.03	--	--	--	--	--	--	--
		10/10/2013	1.03	--	31.1	6.85	3205.5	8.41	0.45	--
		10/16/2013	1.03	2.96	11.3	6.89	3194	6.98	0.44	--
		11/13/2013	1.03	2.73	38.4	6.96	3129.6	5.89	2.43	--
		12/19/2013	0.72	2.14	10.2	7.06	2885.4	2.92	2.32	--
		12/19/2013	0.72	2.10	26.7	7.07	2882.2	2.97	2.65	--
	Effluent	7/12/2013	2.3	--	--	--	--	--	--	--
		7/16/2013	1.03	--	--	--	--	--	--	--
		7/17/2013	1.03	5.3	88.6	7	1895	13.88	1.47	--
		7/24/2013	1.03	1.17	-244	6.78	1987	13.85	1.84	--
		7/25/2013	1.03	1.1	-43.9	6.85	3077	14.42	0	--
		7/26/2013	1.03	1.64	9.1	6.95	3105	13.86	0	--
		7/29/2013	1.03	0.7	-98.2	6.99	3125	13.51	0	--
		7/30/2013	1.03	0.82	-62.5	7.04	3127	14.16	0	--
		7/31/2013	0.72	0.73	--	7.01	3141	14.96	3.82	--
		8/14/2013	1.39	0.5	-16.4	7.03	3163	12.95	16.7	--
		8/20/2013	1.39	--	--	--	--	--	--	--
		9/5/2013	1.03	--	--	--	--	--	--	--
		9/9/2013	1.03	0.14	-209.3	6.83	3010.6	14.3	22.4	2
		10/10/2013	1.03	--	-124.7	6.93	3211.9	8.56	3.64	2
		10/16/2013	1.03	0.21	-178.8	6.98	3176	7.78	16.79	--
		11/13/2013	1.03	0.36	-131	7.03	3128.6	5.84	33	--
		12/19/2013	0.72	0.39	-92.9	7.1	2893.7	2.8	29.5	--
		12/19/2013	0.72	0.37	-95.9	7.11	2895.8	2.63	29.3	--

Table 4-1
Field Parameters, July 2013 - November 2015

Year		Analyte >>	Flow	Dissolved Oxygen	ORP	pH	SC	Temperature	Turbidity	TDS
		Units >>	gpm	mg/L	mV	SU	umhos/cm	°C	NTU	mg/L
2014	Influent	1/18/2014	0.72	--	--	--	--	--	--	--
		1/28/2014	1.03	--	--	--	--	--	--	--
		3/5/2014	1.39	7.08	55.5	7.02	2718.5	5.19	--	--
		3/11/2014	1.39	--	--	--	--	--	--	--
		4/29/2014	3.26	6.96	27	6.96	2384	4.8	2.07	--
		5/19/2014	1.84	8.02	95.1	7.12	2392.1	12.72	2.03	--
		7/10/2014	1	--	219	7.08	1925.1	11.9	5.23	--
		7/25/2014	1	4.04	33.7	7.29	2886.9	12.24	--	--
		8/13/2014	1	4.19	70.9	7.36	2872.5	13.71	--	--
		9/9/2014	1	--	220.4	7.23	--	11.52	--	--
		9/22/2014	1	2.77	-14.1	7.35	2875.7	11.98	--	--
		10/7/2014	1	2.88	7.1	7.4	2882.8	9.23	--	--
		10/20/2014	0.5	2.98	22.4	7.45	2871	7.81	--	--
		11/4/2014	0.5	3.31	33.4	6.91	2631.8	5.46	--	--
		11/17/2014	0.3	5.87	51.9	7.08	2686.0	3.24	--	--
	Effluent	1/18/2014	0.72	--	--	--	--	--	--	--
		1/28/2014	1.03	0.69	-52.6	7.06	2920	2.26	20.9	--
		3/5/2014	1.39	0.75	26	7.02	2753	2.87	--	--
		3/11/2014	1.39	--	--	--	--	--	--	--
		4/29/2014	--	2.5	20.5	7.33	2377	4.28	7.4	--
		5/19/2014	--	1.17	56.3	7.04	2353.2	7.7	8.13	--
		7/10/2014	1	-2.5	440.1	7.58	2146.71	14.8	11.21	--
		7/25/2014	1	0.39	-172.1	7.23	2918.3	15.34	--	--
		8/13/2014	1	0.027	-144.3	7.34	2892.2	14.97	--	--
		9/9/2014	1	-2.5	-430	7.31	1976	11.77	--	--
		9/22/2014	1	4.4	-152.6	7.42	2867.7	12.35	--	--
		10/7/2014	1	0.48	-149.7	7.47	2858.9	9.9	--	--
		10/20/2014	0.5	0.45	-95.1	7.51	2812.3	9.3	--	--
		11/4/2014	0.5	0.34	-38.4	7.01	2595.50	6.64	--	--
		11/17/2014	0.3	0.71	12	7.04	2672.9	3.85	16.1	--

Table 4-1
Field Parameters, July 2013 - November 2015

Year		Analyte >>	Flow	Dissolved Oxygen	ORP	pH	SC	Temperature	Turbidity	TDS
		Units >>	gpm	mg/L	mV	SU	umhos/cm	°C	NTU	mg/L
2015	Influent	2/17/2015	0.5	3.66	106.7	7.14	2698	2.67	--	--
		4/14/2015	1	5.13	148	7.28	2395	5.97	--	--
		4/20/2015	1	5.1	46.5	7.21	2323.4	6.34	2.98	--
		4/27/2015	1	--	--	--	--	--	--	--
		5/5/2015	1	3.02	35.5	7.41	2413.3	7.64	--	
		5/12/2015	1	--	--	--	--	--	--	--
		5/18/2015	1	3.53	31.8	7	2272.6	8.72	7.21	--
		5/26/2015	1	--	--	--	--	--	--	--
		6/1/2015	0.9	2.59	69.3	7.12	2143.6	10.39	7.07	--
		6/8/2015	1	--	--	--	--	--	--	--
		6/15/2015	1	2.53	23.6	7.12	2307.4	12.49	--	--
		6/22/2105	1.84	--	--	--	--	--	--	--
		6/29/2015	1.84	3.48	57.9	7.16	2322.4	13.81	10.1	--
		7/6/2015	1.84	--	--	--	--	--	--	--
		7/13/2015	1.84	2.1	19.5	7.38	2291.2	14.39	--	--
		7/27/2015	1.84	--	--	--	--	--	--	--
		8/3/2015	1.84	1.39	50.9	7	2658.3	13.58	--	--
		8/18/2015	1.84	--	34.9	7.03	2486.4	15.45	--	--
		8/31/2015	1.84	1.97	-79.6	7.48	2542	15.53	8.49	--
		9/14/2015	1.84	2.84	64.8	7.15	2512.9	11.43	9.44	--
		9/30/2015	1.84	3.16	89.6	7.05	2686.4	11.47	8.61	--
		11/4/2015	1.84	5.88	206.8	6.97	2491	5.81	6.1	--
	Effluent	2/17/2015	0.5	0.98	108.4	7.24	2561	3.81	--	--
		4/14/2015	1	1.56	43.1	6.65	2410	3.84	--	--
		4/20/2015	1	0.8	-133.8	7	2333.7	6.83	52.6	--
		4/27/2015	1	--	--	--	--	--	--	--
		5/5/2015	1	0.78	-34.6	7.34	2370.8	8.59	--	--
		5/12/2015	1	--	--	--	--	--	--	--
		5/18/2015	1	0.52	-154.2	7.06	2227.9	9.74	7.21	--
		5/26/2015	1	--	--	--	--	--	--	--
		6/1/2015	0.9	0.5	29.5	7.11	2163.2	11.29	12.1	--
		6/8/2015	1	--	--	--	--	--	--	--
		6/15/2015	1	0.47	-192	7.21	2255	12.63	11.7	--
		6/22/2015	1.84	--	--	--	--	--	--	--
		6/29/2015	1.84	0.4	-139.4	7.3	2326.3	14.31	18.44	--
		7/6/2015	1.84	--	--	--	--	--	--	--
		7/13/2015	1.84	0.4	-138.5	7.31	2345.1	14.69	--	
		7/27/2015	1.84	--	--	--	--	--	--	--
		8/3/2015	1.84	0.37	-76.5	7.2	2640.6	14.7	--	--
		8/18/2015	1.84	--	-190.9	7.21	2424.7	15.97	--	--
		8/31/2015	1.84	0.8	-279.5	7.73	2420	14.9	11.2	--
		9/14/2015	1.84	0.76	-50.6	7.27	2499.4	12.58	15.08	--
		9/30/2015	1.84	0.58	-59.0	7.12	2639.3	11.73	24.10	--
		11/4/2015	1.84	3.45	72	7.07	2456	8.55	17.9	--

Notes:
NA - Not applicable
gpm - gallons per minute
mg/L - milligrams per liter
ORP - oxidation-reduction potential
mV - millivolts
SU - standard units
SC - specific conductance
umhos/cm - micromhos per centimeter
°C - degrees Celsius
NTU - nephelometric turbidity units
TDS - Total Dissolved Solids

Table 4-2
Selenium Concentrations and Percent Removal, July 2013–November 2015

Date	Flow Rate (gpm)	Influent (mg/L)		Effluent (mg/L)		Percent Removal		Ratio of Dissolved Se/Total Se	
		Total	Dissolved	Total	Dissolved	Total	Dissolved	Influent	Effluent
2013									
7/31/2013	0.72	2.17	2.16	1.34	1.34	38%	38%	100%	100%
9/9/2013	1.03	1.42	1.45	0.518	0.0868	64%	94%	102%	17%
9/19/2013	1.03	1.54	1.55	0.633	0.173	59%	89%	101%	27%
10/10/2013	1.03	1.64	1.5	0.683	0.23	58%	85%	91%	34%
10/16/2013	1.03	0.941	0.788	0.344	0.0373	63%	95%	84%	11%
11/4/2013	Not Measured	1.19	1.17	0.417	0.19	65%	84%	98%	46%
11/13/2013	1.03	1.07	1.04	0.45	0.305	58%	71%	97%	68%
12/19/2013	0.72	0.833	0.812	0.301	0.193	64%	76%	97%	64%
2014									
1/28/2014	1.03	0.944	0.897	0.346	0.17	63%	81%	95%	49%
3/5/2014	1.39	1	0.997	0.787	0.739	21%	26%	100%	94%
4/29/2014	3.26	4.96	4.92	4.7	4.08	5%	17%	99%	87%
5/19/2014	1.84	5.26	5.16	3.69	3.65	30%	29%	98%	99%
7/10/2014	1	3.26	3.05	0.81	0.177	75%	94%	94%	22%
7/25/2014	1	2.49	2.5	0.678	0.192	73%	92%	100%	28%
8/13/2014	1	1.22	1.38	0.286	0.0758	77%	95%	113%	27%
9/9/2014	1	1.48	1.42	0.366	0.146	75%	90%	96%	40%
9/22/2014	1	2	1.98	0.656	0.149	67%	92%	99%	23%
10/7/2014	1	1.52	1.24	0.298	0.0898	80%	93%	82%	30%
10/20/2014	0.5	1.66	1.76	0.349	0.223	79%	87%	106%	64%
11/4/2014	0.5	1.72	1.71	0.363	0.19	79%	89%	99%	52%
11/17/2014	0.5	1.68	1.68	0.604	0.49	64%	71%	100%	81%
2015									
2/17/2015	0.5	0.976	0.948	0.89	0.728	9%	23%	97%	82%
4/14/2015	1	4.61	4.24	1.27	0.908	72%	79%	92%	71%
4/20/2015	1	4.82	4.72	1.24	0.12	74%	97%	98%	10%
5/5/2015	1	2.11	2.08	0.767	0.509	64%	76%	99%	66%
5/18/2015	1	5.26	5.28	0.715	0.32	86%	94%	100%	45%
6/1/2015	0.9	3.07	3.06	0.853	0.9	72%	71%	100%	106%
6/15/2015	1	5.03	4.83	0.619	0.207	88%	96%	96%	33%
6/29/2015	1.84	5.31	4.8	0.941	0.756	82%	84%	90%	80%
7/13/2015	1.84	3.92	3.99	0.795	0.597	80%	85%	102%	75%
8/3/2015	1.84	3.51	3.78	0.687	0.537	80%	86%	108%	78%
8/18/2015	1.84	3	3.49	0.0862	0.0202	97%	99%	116%	23%
8/31/2015	1.84	3.1	3.45	0.0454	0.0198	99%	99%	111%	44%
9/14/2015	1.84	2.85	2.96	1.34	1.44	53%	51%	104%	107%
9/30/2015	1.84	2.48	2.49	0.323	0.234	87%	91%	100%	72%
11/4/2015	1.84	2.13	2.34	0.878	0.993	59%	58%	110%	113%
Averages by Operational Phase									
Initial Startup	0.72	2.17	2.16	1.34	1.34	38%	38%	100%	100%
Operation/Maintenance	1.32	2.028	2.067	0.518	0.295	72%	85%	100%	50%
Cold Weather Shutdown	0.001	0.973	0.947	0.674	0.546	31%	43%	97%	75%
Spring Restart	1.43	4.49	4.34	1.64	1.27	64%	71%	97%	66%

Notes:
mg/L - milligrams per liter
gpm - gallons per minute
% - percent
[a] Initial Startup 7/16/13-8/16/13
Operations/Maintenance 8/17/13-11/30/13, 6/1/14-11/30/14, 6/1/15-11/30/15
Cold Weather Shutdown 12/1/13-3/31/14, 12/1/14-3/31/15, 12/1/15-6/15/16
Spring Restart 4/1/14-5/31/14, 4/1/15-5/31/15

Table 4-3
TCLP Results for Biological Treatment Media

		Analyte >>	% Dry Solids	Final pH	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
		Units >>	%	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		Regulatory Level [a] >>	NA	NA	5	100	1	5	5	0.2	1	5
Location	**Sample [b]**	**Sample Description**										
Bioreactor 1	Sample 01	Remaining nutrient materials	11.4	6.84	0.0082 U	0.156 J	0.00088 U	0.0168	0.0036 U	0.00034	0.331	0.0016 U
Bioreactor 1	Sample 02	Bioreactor material and bio-ring	15.6	6.77	0.0082 U	0.154 J	0.00088 U	0.003 J	0.0036 U	0.0003	0.03 J	0.0016 U
Bioreactor 1	Sample 03	Bioreactor material only	53.3	6.18	0.0082 U	0.148 J	0.00088 U	0.0026 J	0.0074 J	0.00058	0.018 U	0.0016 U
Bioreactor 2	Sample 04	Bioreactor material and bio-ring	73	6.4	0.01 J	0.223	0.00088 U	0.0043 J	0.005 J	0.00022	0.018 U	0.0016 U
Bioreactor 2	Sample 05	Bioreactor material only	17	6.51	0.0082 U	0.255	0.00088 U	0.003 J	0.0036 U	0.00012 J	0.018 U	0.0016 U
Effluent	Sample 06	Solid material from discharge	9.99	5.46	0.0082 U	0.108 J	0.0042	0.0016 J	0.0036 U	0.00013 J	0.16	0.0016 U

Notes:

% - percent

mg/L - milligrams per liter

NA - Not applicable

SU - standard units

TCLP - Toxicity Characteristic Leaching Procedure

Qualifiers defined as follows: J - result is an estimated quantity; U - not detected at detection limit

a - United States Environmental Protection Agency (EPA), 1994. Technical Assistance Document for Complying with the TC Rule and Implementing the Toxicity Characteristic Leaching Procedure (TCLP), EPA-902-B-94-001, Revised May 1994.

b - Samples collected on June 16, 2016.

Table 4-4
Selenium Removal and Operational Parameters, 2013 - 2015

	Percent Removal		Field Parameters						Nutrients						Operational notes
			Dissolved Oxygen		ORP		Temperature		Total Phosphorus as P		Nitrate/Nitrite as N		Sulfate as SO_4		
Units >>	%	%	mg/L		mV		°C		mg/L		mg/L		mg/L		
Phase [a]	Total	Dissolved	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	
2013															
Initial Startup	38%	38%	3.96	0.73	NA	NA	14.24	14.96	0.164	0.060	0.466	0.101	1020	1130	Powdered molasses was added to the system in two large initial doses and three additional smaller doses.
Operation & Maintenance	62%	85%	2.28	0.29	22.20	-138.80	6.69	6.99	0.066	0.132	0.337	0.049	1086	1076	Powdered molasses was added three times. When molasses was no longer locally available, pelletized sugar beet pulp was added seven times during this operational phase.
2014															
Cold Weather Shutdown	42%	53%	6.84	0.72	48.6	-13.3	3.77	2.57	0.048	0.048	0.446	0.199	1075	1110	Pelletized sugar beet pulp was added twice during this operational phase.
Spring Restart	18%	23%	7.49	1.84	61.05	38.4	8.76	5.99	0.054	0.042	0.465	0.606	1185	1175	Pelletized sugar beet pulp was added twice during this operational phase.
Operation & Maintenance	74%	89%	72.85	1.05	53.04	-37.51	9.45	10.89	0.070	0.060	0.677	0.100	1090	1083	Pelletized sugar beet pulp was added six times during this operational phase.
2015															
Cold Weather Shutdown	9%	23%	3.66	0.98	106.7	108.4	2.67	3.81	0.019	0.019	0.933	0.485	1030	998	Extended winter period wiith no feeding.
Spring Restart	77%	85%	3.63	0.72	58.94	-83.06	9.34	9.60	0.051	0.113	0.578	0.074	1160	1143	Pelletized sugar beet pulp was added three times during this operational phase. Zero valent iron was added once during this operational phase.
Operation & Maintenance	71%	71%	4.09	2.02	118.41	-30.25	9.73	11.32	0.037	0.074	0.669	0.137	1118	1047	Pelletized sugar beet pulp was added three times during this operational phase.

Notes:

[a] Initial Startup 7/16/13-8/16/13
Operations/Maintenance 8/17/13-11/30/13, 6/1/14-11/30/14, 6/1/15-11/30/15
Cold Weather Shutdown 12/1/13-3/31/14, 12/1/14-3/31/15, 12/1/15-6/15/16
Spring Restart 4/1/14-5/31/14, 4/1/15-5/31/15

ORP - Oxidation-Reduction Potential
mg/L - milligrams per liter
mV - millivolts
°C - degrees Celsius

Table 4-5
Summary of RI COPCs During Pilot Study, July 2013–November 2015

Year Range >>		July 2013 - November 2015							
		Influent				Effluent			
Analyte	**Units**	Minimum	Maximum	Average	n	Minimum	Maximum	Average	n
General Chemistry									
Bicarbonate	mg/L	267	305	290	10	274	322	298	10
Carbonate	mg/L	0	1	0.3	10	0	1	0.3	10
Calcium, Dissolved	mg/L	470	639	533	10	473	705	543	10
Magnesium, Dissolved	mg/L	70.6	109	84.1	10	71.3	112	84.8	10
Potassium, Dissolved	mg/L	2.5	3.9	3.0	10	2.45	7.77	3.64	10
Sodium, Dissolved	mg/L	16.6	25	22	10	16.9	26.3	22	10
Chloride	mg/L	78.9	438	222	10	81.8	437	226	10
Fluoride	mg/L	0.17	1.08	0.71	10	0.145	2.49	0.817	10
Hardness	mg/L	1490	2050	1659	12	1490	2220	1675	12
Nitrate/Nitrite as N	mg/L	0.276	1.06	0.55	36	0.022	0.843	0.13	36
Sulfate as SO_4	mg/L	560	1240	1106	36	568	1220	1091	36
Total Alkalinity	mg/L	267	305	290	10	274	322	298	10
Total Dissolved Solids	mg/L	800	2750	2154	36	784	2790	2155	36
Total Organic Carbon	mg/L	2.37	6.71	3.2	36	2.47	24.1	5.0	36
Total Phosphorus as P	mg/L	0.019	0.186	0.058	36	0.016	0.441	0.093	36
Total Suspended Solids	mg/L	0	12	5	10	4	12	7	10
Metals and Metalloids									
Aluminum, Dissolved	mg/L	0.023	0.036	0.032	10	0.023	0.036	0.032	10
Aluminum, Total	mg/L	0.023	0.28	0.087	11	0.023	0.0398	0.034	10
Antimony, Dissolved	mg/L	0.00057	0.0023	0.000955	11	0.00051	0.0011	0.00067	10
Antimony, Total	mg/L	0.00066	0.0016	0.00090	10	0.00049	0.00092	0.00065	10
Arsenic, Dissolved	mg/L	0.00062	0.0031	0.0012	11	0.00031	0.0034	0.0011	10
Arsenic, Total	mg/L	0.00078	0.003	0.002	11	0.00047	0.0027	0.001	10
Barium, Dissolved	mg/L	0.033	0.0551	0.041	10	0.034	0.0693	0.044	10
Barium, Total	mg/L	0.033	0.0576	0.042	10	0.0329	0.0731	0.0432	10
Beryllium, Dissolved	mg/L	0.000048	0.00037	0.00013	10	0.000048	0.00037	0.00015	10
Beryllium, Total	mg/L	0.000048	0.00037	0.00012	10	0.000048	0.00037	0.00012	10
Boron, Dissolved	mg/L	0.113	0.3	0.18	10	0.116	0.314	0.187	10
Boron, Total	mg/L	0.111	0.309	0.186	10	0.113	0.316	0.185	10
Cadmium, Dissolved	mg/L	0.00087	0.0078	0.0031	10	0.000079	0.0024	0.00078	10
Cadmium, Total	mg/L	0.013	0.0367	0.023	10	0.0091	0.021	0.012	10
Chromium, Dissolved	mg/L	0.00019	0.0018	0.00068	10	0.00024	0.0013	0.00059	10
Chromium, Total	mg/L	0.00022	0.0031	0.0011	10	0.00025	0.00098	0.00052	10
Cobalt, Dissolved	mg/L	0.00015	0.002	0.000937	10	0.00012	0.0021	0.00091	10
Cobalt, Total	mg/L	0.00017	0.0016	0.00094	10	0.000092	0.0014	0.00072	10
Copper, Dissolved	mg/L	0.00035	0.0012	0.00059	10	0.00015	0.0036	0.00059	10
Copper, Total	mg/L	0.00037	0.0023	0.00086	10	0.00018	0.00095	0.00049	10
Iron, Dissolved	mg/L	0.023	0.148	0.049	36	0.026	5.63	0.97	36
Iron, Total	mg/L	0.026	0.636	0.15	36	0.048	5.94	1.22	36
Lead, Dissolved	mg/L	0.000031	0.00011	0.000046	10	0.000031	0.00024	0.000061	10
Lead, Total	mg/L	0.000031	0.00051	0.000122	10	0.000031	0.00007	0.000041	10
Manganese, Dissolved	mg/L	0.129	0.706	0.429	10	0.19	0.941	0.437	10
Manganese, Total	mg/L	0.141	0.864	0.460	10	0.195	0.988	0.427	10
Mercury, Dissolved	mg/L	0.00004	0.000045	0.000044	10	0.00004	0.000045	0.000044	10
Mercury, Total	mg/L	0.00004	0.000045	0.000044	10	0.00004	0.00005	0.000044	10
Molybdenum, Dissolved	mg/L	0.0225	0.0376	0.0291	10	0.0167	0.0362	0.0266	10
Molybdenum, Total	mg/L	0.0226	0.0361	0.0291	10	0.0194	0.0359	0.0278	10
Nickel, Dissolved	mg/L	0.144	0.23	0.17	10	0.0411	0.252	0.13	10
Nickel, Total	mg/L	0.147	0.209	0.172	10	0.0549	0.216	0.125	10
Selenium, Dissolved	mg/L	0.788	5.28	2.49	36	0.0198	4.08	0.649	36
Selenium, Total	mg/L	0.833	5.31	2.50	36	0.0454	4.7	0.90	36
Silver, Dissolved	mg/L	0.000012	0.00012	0.000029	10	0.000012	0.000036	0.000019	10
Silver, Total	mg/L	0.000012	0.00006	0.000024	10	0.000013	0.000037	0.000022	10
Thallium, Dissolved	mg/L	0.000091	0.00056	0.000169	10	0.00001	0.000073	0.000031	10
Thallium, Total	mg/L	0.00014	0.00036	0.00019	10	0.000052	0.00014	0.000091	10
Uranium, Dissolved	mg/L	0.0234	0.0301	0.0266	10	0.0222	0.0305	0.0258	10
Uranium, Total	mg/L	0.023	0.0289	0.026	10	0.0212	0.028	0.025	10
Vanadium, Dissolved	mg/L	0.0069	0.0141	0.0097	10	0.0036	0.0101	0.0069	10
Vanadium, Total	mg/L	0.0089	0.017	0.011	10	0.0041	0.0118	0.0074	10
Zinc, Dissolved	mg/L	0.376	0.73	0.49	10	0.008	0.539	0.12	10
Zinc, Total	mg/L	0.529	0.795	0.634	10	0.387	0.576	0.468	10

Notes:
n - Number of samples
mg/L - milligrams per liter