

MEMORANDUM

Sampling Dates: January-December 2011
To: *Bear Creek Watershed Association*
From: Russell N. Clayshulte, Manager
Re: **Technical Memorandum 2011.02- Bear Creek
Kerr/Swede Gulch Summary Data**



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Segment 5 Bear Creek: Swede, Kerr, Sawmill, Troublesome, and Cold Springs Gulches, and mainstem of Cub Creek from the source to the confluence with Bear Creek.

Water Quality Standards

- Temperature =TVS(CS-II) °C;
 - April-October =18.2 (MWAT)/23.8 (DM) °C;
 - November-March =9.0 (MWAT)/13.0 (DM) °C
- D.O.=6.0 mg/l; D.O.(sp)=7.0 mg/l
- pH=6.5-9.0
- E. Coli=126/100ml (Measured as a geometric mean of data)



Figure 1 Sample Site at Kerr/Swede Confluence

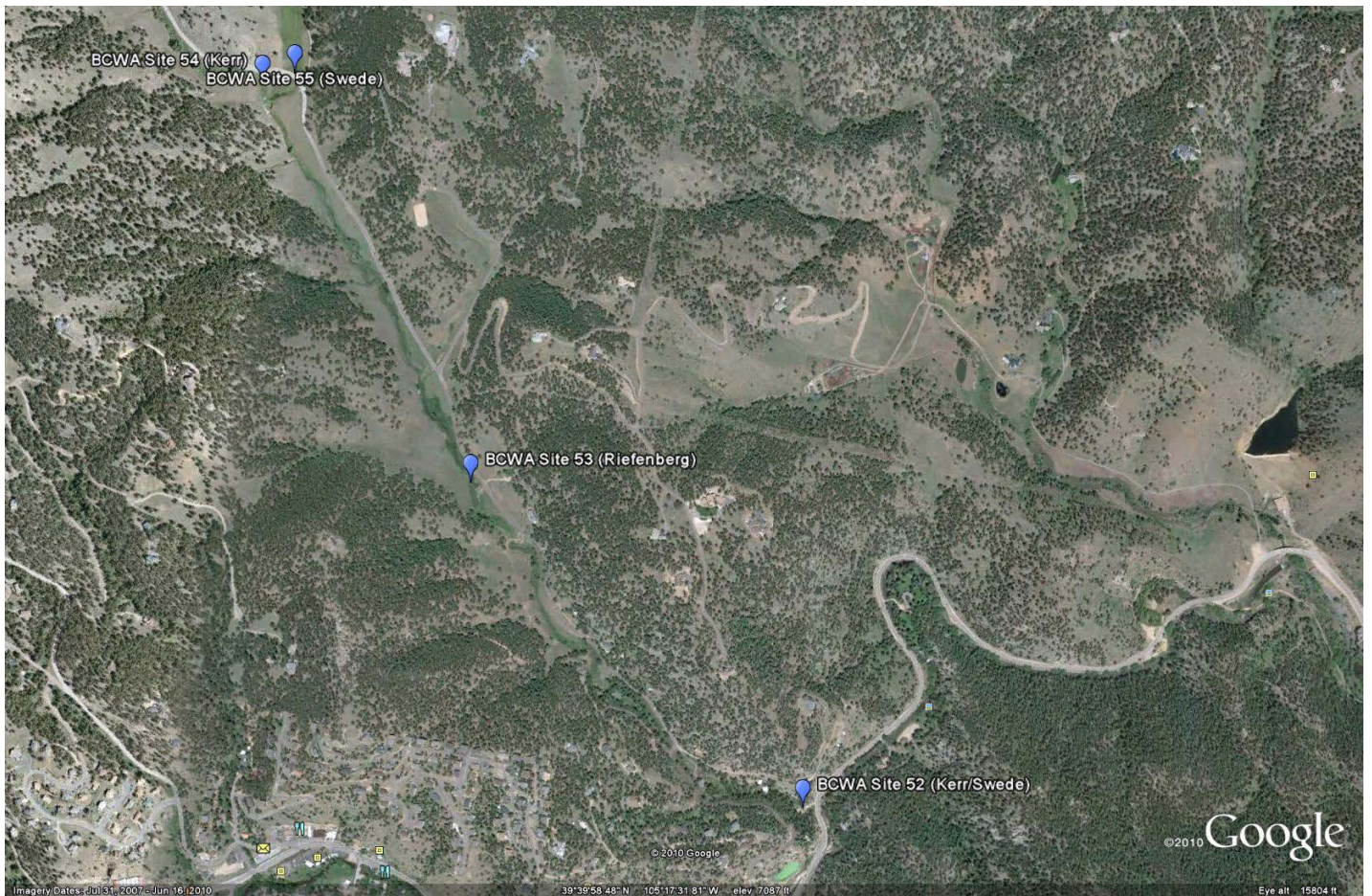


Figure 2 Kerr/Swede Gulch Sample Locations

Table 1 Kerr/Swede Gulch Sampling

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	E. Coli (Cells/100ml)
1/25/2011						
Site 52 - Confluence	9:14	-0.1	8.39	0.767	10.47	6
Site 53 - Riefenberg	9:41	-0.1	7.94	0.773	9.63	4
Site 54 - Kerr	10:04	0	7.86	0.805	8.56	15
Site 55 - Swede	9:56	0.1	7.99	0.867	9.02	12
2/22/2011						
Site 52 - Confluence	9:45	-0.1	8.57	0.877	7.87	43
Site 53 - Riefenberg	10:05	0.0	7.92	0.885	10.25	25
Site 54 - Kerr	10:32	0.0	7.81	0.878	10.26	19
Site 55 - Swede	10:25	0.4	7.64	0.924	10.01	20
3/28/2011						
Site 52 - Confluence	12:00	4.1	7.85	0.789	6.91	1
Site 53 - Riefenberg	12:12	5.3	7.89	0.81	11.52	1
Site 54 - Kerr	12:28	5.7	7.97	0.81	11.37	7
Site 55 - Swede	12:22	4.9	7.66	0.88	11.28	1

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	E. Coli (Cells/100ml)
4/27/2011						
Site 52 - Confluence	10:08	3.9	7.6	0.84	10.89	1
Site 53 - Riefenberg	10:22	4.9	7.72	0.83	10.91	1
Site 54 - Kerr	10:32	5.6	7.7	0.83	10.57	5
Site 55 - Swede	10:30	6.1	7.51	0.88	9.88	1
5/23/2011						
Site 52 - Confluence	12:20	9.3	8.63	0.79	8.83	19
Site 53 - Riefenberg	12:30	9.8	8.3	0.77	8.39	12
Site 54 - Kerr	12:50	9.5	8.23	0.176	7.11	26
Site 55 - Swede	12:42	9.7	8.05	0.75	8.14	1
6/16/2011						
Site 52 - Confluence	11:00	13.3	8.56	0.84	7.69	11
Site 53 - Riefenberg	11:10	14.7	8.5	0.84	7.26	13
Site 54 - Kerr	11:26	15.4	8.46	0.83	6.46	1
Site 55 - Swede	11:20	165	8.4	0.93	6.42	3
7/25/2011						
Site 52 - Confluence	12:59	18.3	8.5	0.84	7.31	10
Site 53 - Riefenberg	1:14	18.5	8.4	0.83	7.05	2
Site 54 - Kerr	1:32	19.1	8.28	0.87	6.36	2
Site 55 - Swede	1:27	21.4	8.27	0.85	6.14	2
8/23/2011						
Site 52 - Confluence	11:35	14.9	8.34	0.69	7.72	44
Site 53 - Riefenberg	11:48	15.5	8.3	0.7	6.93	15
Site 54 - Kerr	12:05	16.6	8.27	0.7	7.19	1
Site 55 - Swede	12:00	17.5	8.25	0.127	6.77	8
9/26/2011						
Site 52 - Confluence	1:05	11.8	8.22	0.83	8.2	20
Site 53 - Riefenberg	1:18	13.3	8.12	0.82	7.97	112
Site 54 - Kerr	1:34	15.7	8.13	0.78	6.53	4
Site 55 - Swede	1:30	13.6	8.09	0.491	7.47	4
10/25/2011						
Site 52 - Confluence	9:55	4.3	8.39	0.762	10.61	6
Site 53 - Riefenberg	10:10	5	8.65	0.777	10.05	1
Site 54 - Kerr	10:23	5.3	8.47	0.786	9.51	7
Site 55 - Swede	10:18	5.3	8.51	0.773	9.49	1
11/28/2011						
Site 52 - Confluence	12:12	2.2	8.43	0.832	12.08	1
Site 53 - Riefenberg	12:30	1.9	8.07	0.818	11.7	1
Site 54 - Kerr	12:49	0.1	7.99	0.803	11.62	7
Site 55 - Swede	12:44	2.3	7.97	0.836	11.17	6
12/28/2011						

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	E. Coli (Cells/100ml)
Site 52 - Confluence	13:20	1.2	8.19	0.833	10.8	1
Site 53 - Riefenberg	13:35	0.7	8.1	0.82	10.98	1
Site 54 - Kerr	13:57	0	8.38	0.826	10.75	1
Site 55 - Swede	13:51	0.6	8.23	0.825	10.92	1

Note: There are no Temperature (based on single sample measurement), pH or Dissolved Oxygen exceedances of the standards.

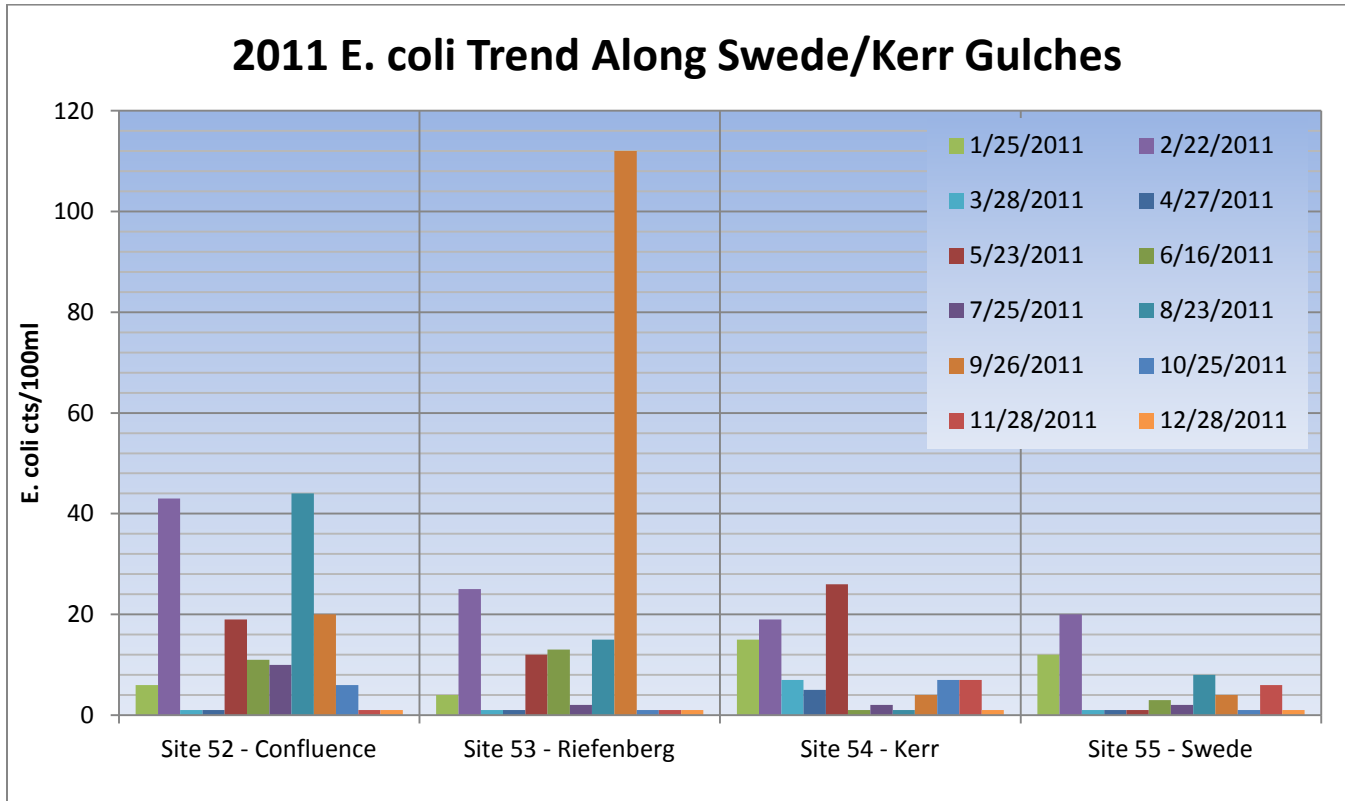


Figure 3 2011 E. coli Counts by Month

Table 2 E. Coli 2011 Geometric Mean Summary

E. coli Summary, Geometric Mean									
BCWA Site	2010	2011							
	May-Dec	J-D (Annual)	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec	May-Oct
	n=36	n=48	n=8	n=8	n=8	n=8	n=8	n=8	n=24/6
Sites 52-53			14	2	6	5	6	2	6
Site 52 - Confluence	10	6							15
Site 53 - Riefenberg	13	4							9
Site 54 - Kerr	16	5							3
Site 55 - Swede	11	3							2

Note -There is no exceedance of the E. coli standard with the system

Table 3 Kerr/Swede Gulch Flow Estimates (CFS)

Site	25-Jan	22-Feb	28-Mar	27-Apr	23-May	16-Jun	25-Jul	23-Aug	26-Sep	25-Oct	28-Nov	28-Dec
Site 52 - Confluence	0.28	0.53	0.57	0.44	1.17	0.62	0.36	0.53	0.23	0.68	0.83	0.35
Site 53 - Riefenberg	0.20	0.51	0.43	0.38	0.90	0.44	0.29	0.42	0.20	0.41	0.63	0.21
Site 54 - Kerr	0.19	0.39	0.37	0.27	0.30	0.21	0.16	0.19	0.12	0.15	0.25	0.20
Site 55 - Swede	0.10	0.22	0.28	0.19	0.38	0.05	0.12	0.05	0.09	0.14	0.16	0.24

Flow Estimates 2011

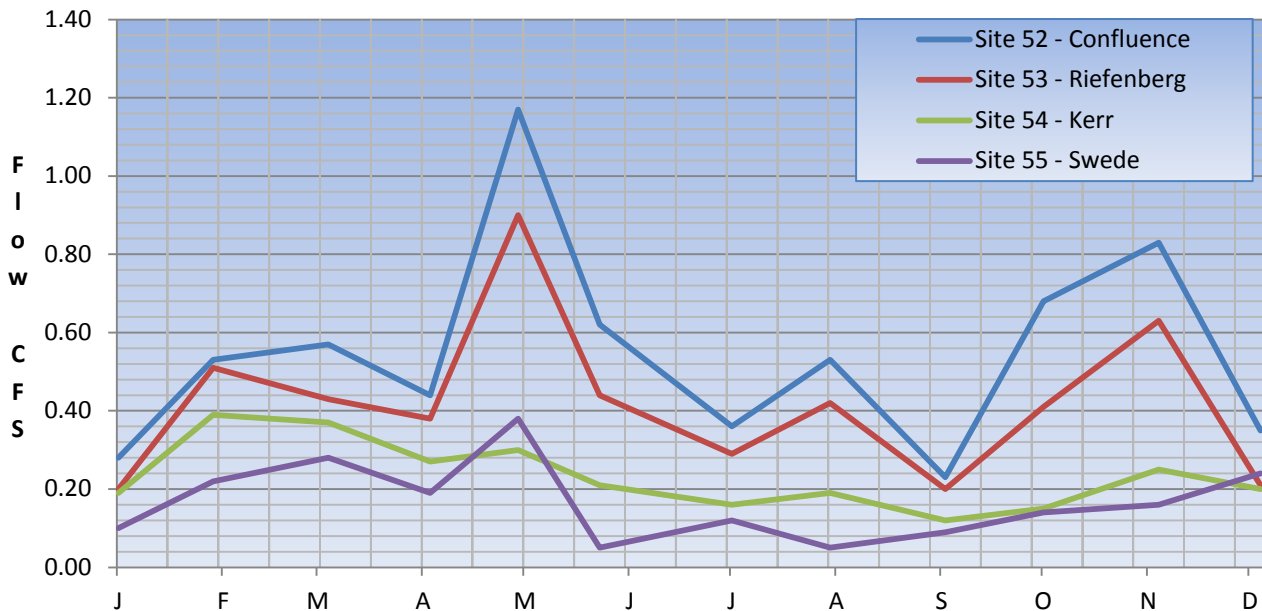


Figure 4 2011 Flow Estimates by Site

Table 4 2010 Monthly Flow Estimates (Acre-Feet/ Month)

Site	31	28	31	30	31	30	31	31	30	31	30	31	Total
Site	25-Jan	22-Feb	28-Mar	27-Apr	23-May	16-Jun	25-Jul	23-Aug	26-Sep	25-Oct	28-Nov	28-Dec	
Site 52 - Confluence	17	29	35	26	72	37	22	33	14	42	49	22	398
Site 53 - Riefenberg	12	28	26	23	55	26	18	26	12	25	37	13	302
Site 54 - Kerr	12	22	23	16	18	12	10	12	7	9	15	12	168
Site 55 - Swede	6	12	17	11	23	3	7	3	5	9	10	15	122

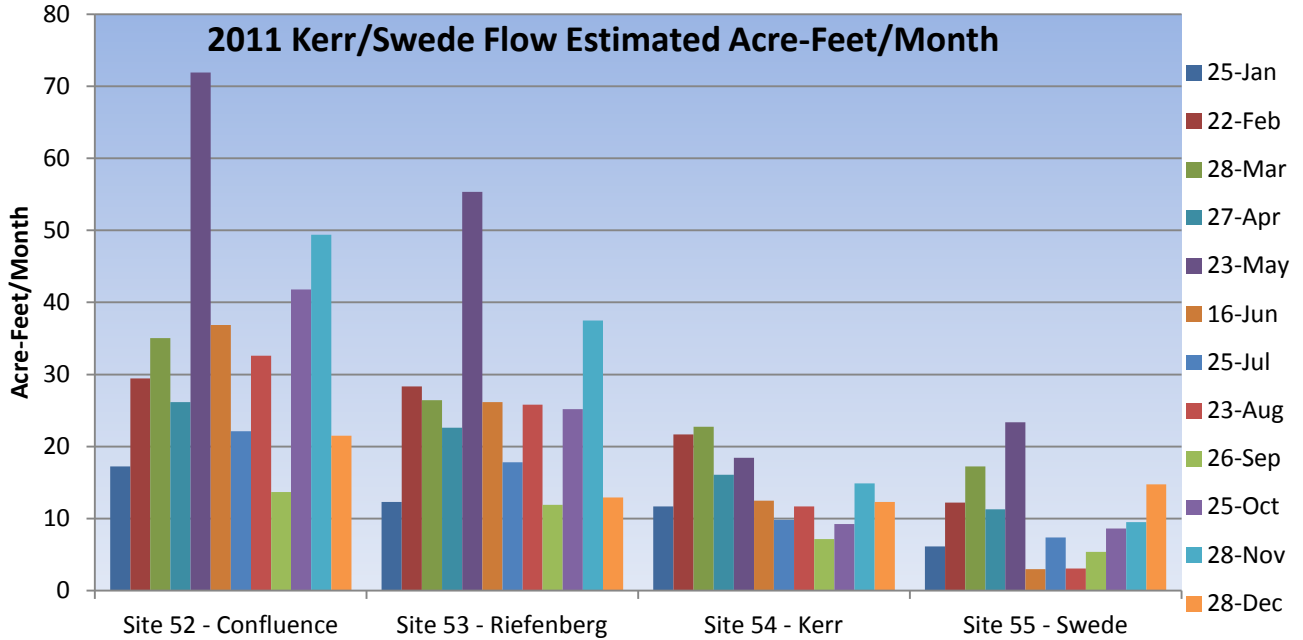


Figure 5 2010 Monthly Flow Estimates by Site

Table 5 2011 Chemistry Data Results

Site	Parameter (ug/l)	Monthly Concentrations ug/l)						
		28-Mar	23-May	16-Jun	25-Jul	23-Aug	26-Sep	28-Nov
Site 52 - Confluence	Total Nitrogen	367	346	325	408	191	729	429
	Nitrate/Nitrite as N, dissolved	206	161	213	264	198	147	286
	Ammonia Nitrogen	29	11	23	16	11	10	15
	Phosphorus, total	6	12	15	20	12	121	15
	Total Dissolved Phosphorus	6	6	6	14	8	6	12
Site 53 - Riefenberg	Total Nitrogen	280	326	188	323	206	126	267
	Nitrate/Nitrite as N, dissolved	144	128	69	132	88	53	183
	Ammonia Nitrogen	81	14	21	15	10	11	10
	Phosphorus, total	12	40	19	25	8	8	8
	Total Dissolved Phosphorus	4	7	6	11	9	7	4
Site 54 - Kerr	Total Nitrogen	417	550	252	540	117	119	466
	Nitrate/Nitrite as N, dissolved	287	279	141	238	115	56	337
	Ammonia Nitrogen	33	13	26	18	10	14	9
	Phosphorus, total	21	67	39	72	25	17	20
	Total Dissolved Phosphorus	4	8	10	13	10	6	6
Site 55 - Swede	Total Nitrogen	970	311	148	341	278	202	347
	Nitrate/Nitrite as N, dissolved	69	131	2	21	11	8	122
	Ammonia Nitrogen	45	14	19	17	11	11	17
	Phosphorus, total	320	34	25	49	93	34	40
	Total Dissolved Phosphorus	8	10	7	9	8	7	6

Table 6 2011 Water Quality Load Estimates

Site	Parameter (ug/l)	Monthly Loads (pounds/month)						
		28-Mar	23-May	16-Jun	25-Jul	23-Aug	26-Sep	28-Nov
Site 52 - Confluence	Total Nitrogen	35.0	67.8	32.6	24.6	16.9	27.2	57.7
	Nitrate/Nitrite as N, dissolved	19.7	31.5	21.4	15.9	17.6	5.5	38.5
	Ammonia Nitrogen	2.8	2.2	2.3	1.0	1.0	0.4	2.0
	Phosphorus, total	0.6	2.4	1.5	1.2	1.1	4.5	2.0
	Total Dissolved Phosphorus	0.6	1.2	0.6	0.8	0.7	0.2	1.6
Site 53 - Riefenberg	Total Nitrogen	20.2	49.1	13.4	15.7	14.5	4.1	35.9
	Nitrate/Nitrite as N, dissolved	10.4	19.3	4.9	6.4	6.2	1.7	24.6
	Ammonia Nitrogen	5.8	2.1	1.5	0.7	0.7	0.4	1.3
	Phosphorus, total	0.9	6.0	1.4	1.2	0.6	0.3	1.1
	Total Dissolved Phosphorus	0.3	1.1	0.4	0.5	0.6	0.2	0.5
Site 54 - Kerr	Total Nitrogen	25.8	27.6	8.6	14.5	3.7	2.3	62.7
	Nitrate/Nitrite as N, dissolved	17.8	14.0	4.8	6.4	3.7	1.1	45.3
	Ammonia Nitrogen	2.0	0.7	0.9	0.5	0.3	0.3	1.2
	Phosphorus, total	1.3	3.4	1.3	1.9	0.8	0.3	2.7
	Total Dissolved Phosphorus	0.2	0.4	0.3	0.3	0.3	0.1	0.8
Site 55 - Swede	Total Nitrogen	45.5	19.8	1.2	6.8	2.3	2.9	46.7
	Nitrate/Nitrite as N, dissolved	3.2	8.3	0.0	0.4	0.1	0.1	16.4
	Ammonia Nitrogen	2.1	0.9	0.2	0.3	0.1	0.2	2.3
	Phosphorus, total	15.0	2.2	0.2	1.0	0.8	0.5	5.4
	Total Dissolved Phosphorus	0.4	0.6	0.1	0.2	0.1	0.1	0.8

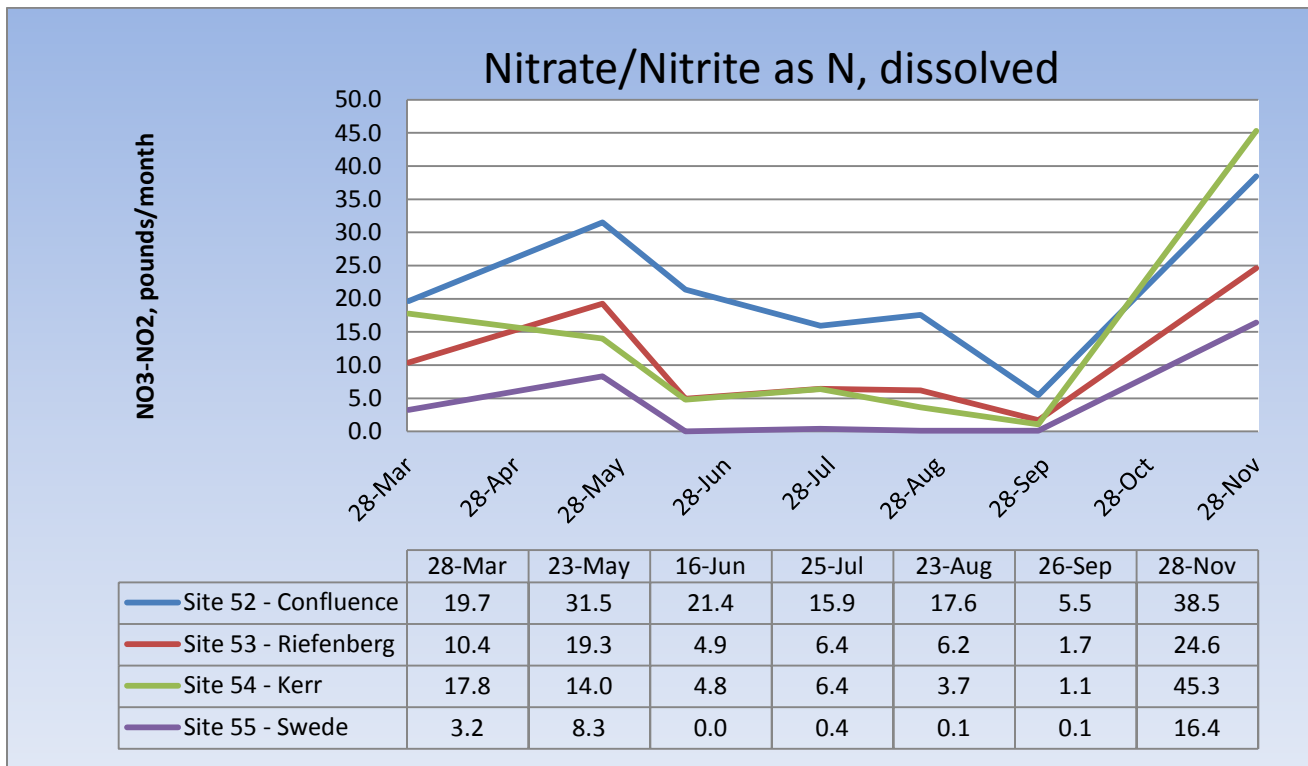


Figure 6 Nitrate/Nitrite Loading in Kerr/Swede System

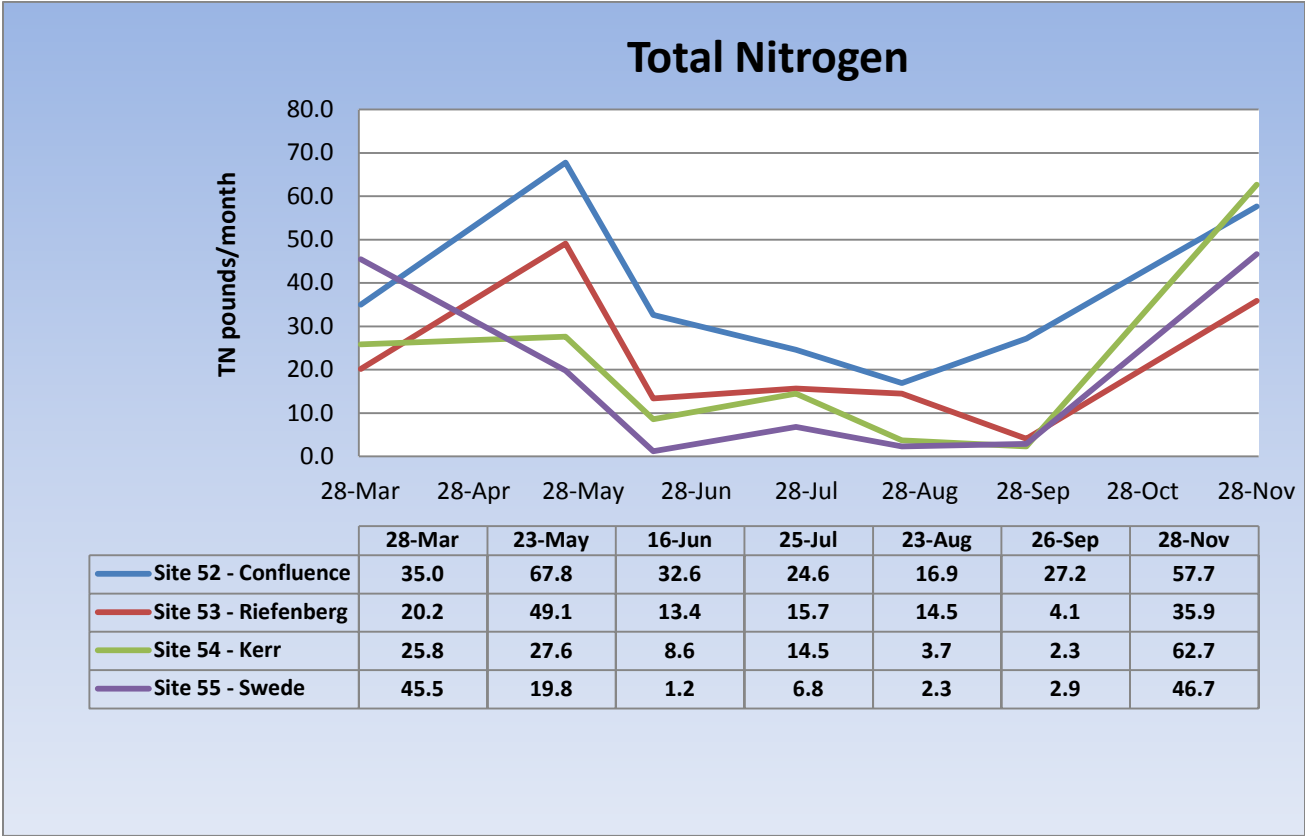


Figure 7 Total Nitrogen Loading in Kerr/Swede System

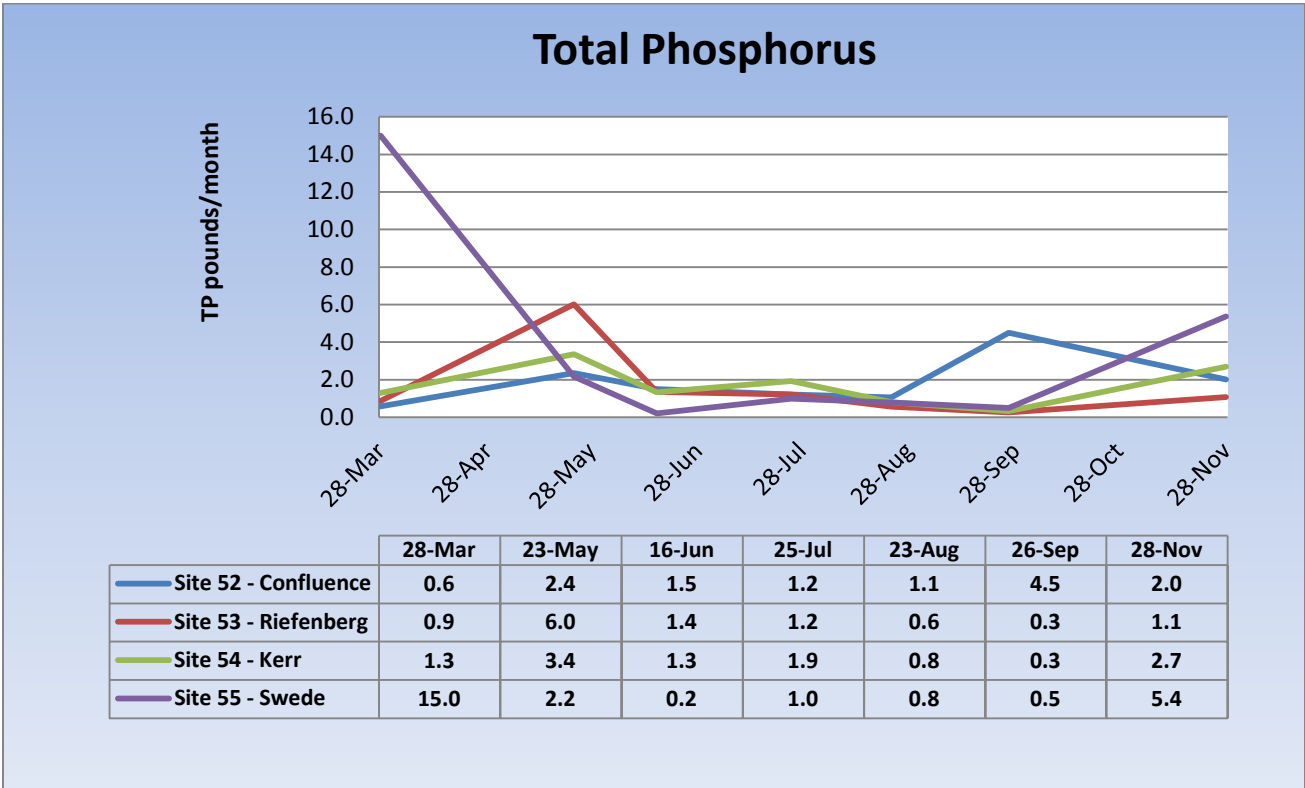


Figure 8 Total Phosphorus Loading in Kerr/ Swede System