

## **Butte Reduction Works Seep Investigation Results During Base Flow: 2010 to 2011**

*This summary presents stream data collected in 2010 and 2011 in the vicinity of the Butte Reduction Works (BRW) seep near Silver Bow Creek (SBC) surface water station SS-05.7.*

### **Butte Reduction Works (BRW) Seep History**

During base flow monitoring in the mid 2000's, an increased copper concentration was observed in SBC near the upper end of BRW. In 2007, monitoring of new station SS-05.7 indicated this impact to occur in the immediate vicinity of station SS-05.7. In 2008, a small seep of contaminated water near station SS-05.7 was discovered that was associated with an increased copper concentration in the stream. During 2008 and 2009, investigative work began and a remedy was proposed. Construction of the remedy to control the BRW seep was completed in December, 2010. This report compares base flow surface water samples collected in 2010 (pre-construction) to samples collected in 2011 (post-construction).

### **Results**

Base flow data collected from surface water stations SS-01 through SS-07, during 2010 and 2011, have been used to evaluate the effectiveness of the remedy. Total recoverable copper (CuTR) and dissolved copper (CuDis) concentrations were both notably lower in 2011 compared to 2010. For example, in 2010, the average CuDis concentration at station SS-05.9 was 7.08 ug/L while the 2011 average concentration was 3.51 ug/L. This equals a 50.3% decrease in concentration at station SS-05.9 from 2010 to 2011. Table 1-1 and Table 1-2 show average flow, concentrations and loads from 2010 and 2011, respectively.

Table 1-3 shows the percent change from 2010 to 2011 of copper concentrations and loads. CuDis and CuTR loads were reduced by over 50% at some stations from 2010 to 2011. Individual event data for each station during 2010 and 2011 can be found in Table 2-1 and Table 2-2, respectively.

**Table 1-1. 2010 Base Flow Averages**

	Flow (cfs)	CuDis (ug/L)	CuTR (ug/L)	Dis Load (lb/day)	TR Load (lb/day)
SS-01					
SS-04	28.1	3.54	7.21	0.535	1.091
SS-05	28.1	3.81	9.54	0.577	1.443
SS-05.7	28.7	4.77	9.51	0.738	1.470
SS-05.9	28.6	7.08	12.88	1.089	1.981
SS-05A	28.1	6.05	12.75	0.914	1.927
SS-06A	29.2	6.28	15.79	0.987	2.483
SS-06F	36.3	7.00	15.18	1.370	2.972
SS-06G	31.0	6.01	13.90	1.001	2.318
SS-06H	36.5	7.40	15.02	1.453	2.949
SS-07					

**Table 1-2. 2011 Base Flow Averages**

	Flow (cfs)	CuDis (ug/L)	CuTR (ug/L)	Dis Load (lb/day)	TR Load (lb/day)
SS-01	22.8	2.98	4.75	0.365	0.583
SS-04	27.4	2.93	6.37	0.433	0.941
SS-05	26.4	3.09	6.39	0.440	0.910
SS-05.7	28.4	3.27	7.10	0.500	1.086
SS-05.9	27.9	3.51	7.36	0.529	1.108
SS-05A	26.4	3.41	7.73	0.486	1.100
SS-06A	28.4	3.91	8.76	0.600	1.341
SS-06F	31.1	4.00	9.29	0.671	1.557
SS-06G	30.6	4.01	8.89	0.662	1.466
SS-06H	31.2	4.04	9.03	0.681	1.520
SS-07	36.8	4.86	13.43	0.962	2.661

**Table 1-3. Average Percent Change: 2010 to 2011  
Base Flow**

	Flow	CuDis	CuTR	Dis Load	TR Load
SS-01	No Data from 2010				
SS-04	-2.4%	-17.2%	-11.6%	-19.2%	-13.7%
SS-05	-5.8%	-19.1%	-33.0%	-23.8%	-36.9%
SS-05.7	-1.1%	-31.4%	-25.3%	-32.2%	-26.1%
SS-05.9	-2.2%	-50.3%	-42.9%	-51.4%	-44.1%
SS-05A	-5.8%	-43.5%	-39.4%	-46.8%	-42.9%
SS-06A	-2.6%	-37.7%	-44.5%	-39.3%	-46.0%
SS-06F	-14.3%	-42.8%	-38.8%	-51.0%	-47.6%
SS-06G	-1.1%	-33.2%	-36.1%	-33.9%	-36.8%
SS-06H	-14.3%	-45.4%	-39.9%	-53.2%	-48.5%
SS-07	No Data from 2010				



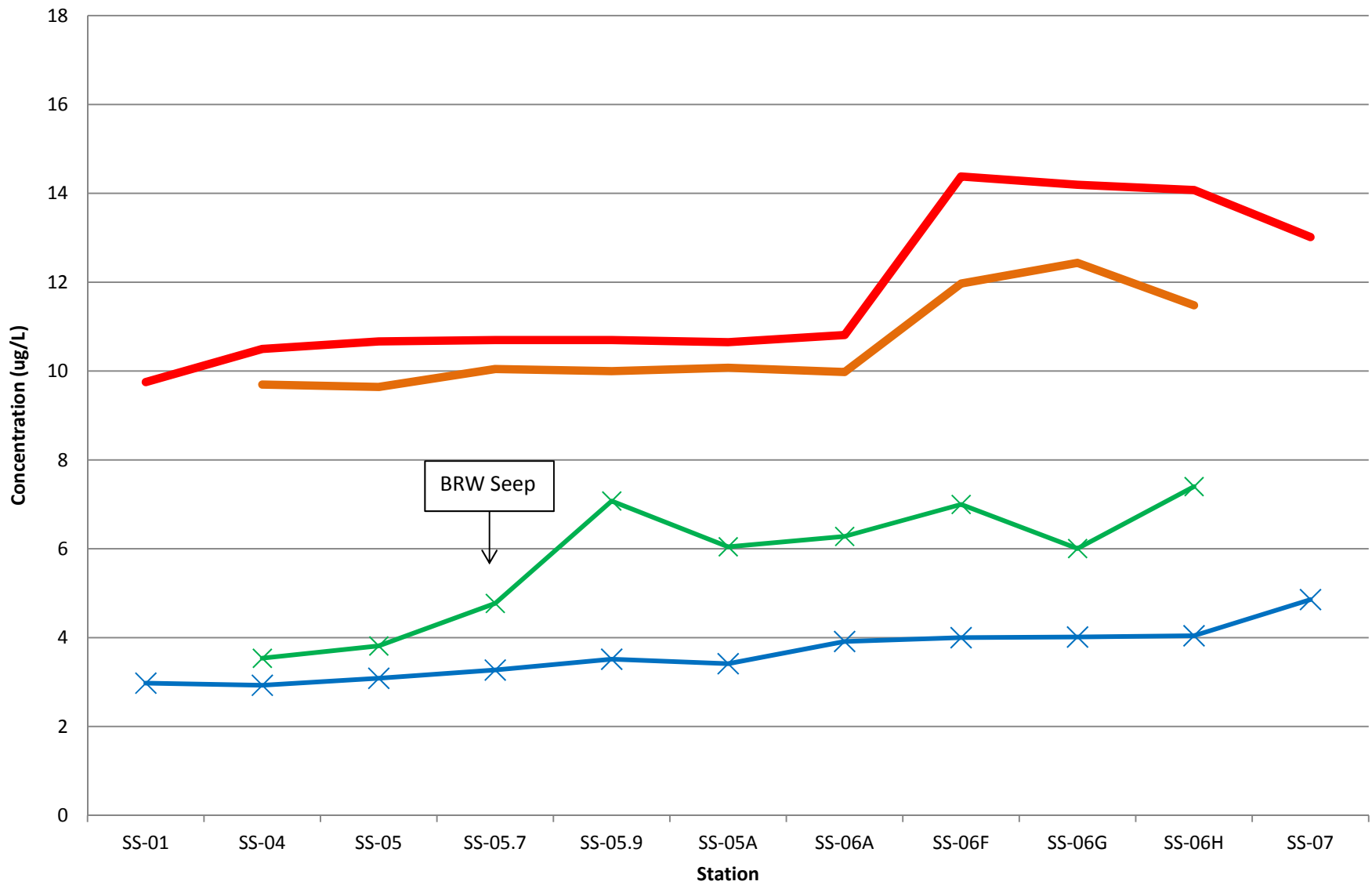
**Table 2-2. 2011 Flow, CuDis, and CuTR during Base Flow Conditions**

Flow (cfs)	2/3/11	4/6/11	6/28/11	7/6/11	7/12/11	7/19/11	9/7/11	Average
SS-01	7.9	22.0	48.9	31.0		19.2	7.7	22.8
SS-04	12.1	27.7	54.5	32.5	29.0	24.9	11.2	27.4
SS-05	10.6	24.9	52.3	33.4	29.4	23.2	11.3	26.4
SS-05.7	14.7	27.3	55.0	33.4	29.4	27.0	11.9	28.4
SS-05.9	14.0	28.3	55.0	31.7	29.4	25.8	11.4	27.9
SS-05A	12.2	25.9	52.3	33.3	25.7	23.6	11.9	26.4
SS-06A	13.1	28.1	56.3	35.4	27.6	26.6	11.9	28.4
SS-06F	15.5	31.3	58.5	38.5	29.5	29.9	14.7	31.1
SS-06G	13.5	30.1	54.8	37.1	31.3	32.5	15.0	30.6
SS-06H	14.7	31.4	58.0	37.8	29.6	31.7	15.5	31.2
SS-07	19.8	37.1	64.7	42.4	36.7	36.6	20.1	36.8

CuDis (ug/L)	2/3/11	4/6/11	6/28/11	7/6/11	7/12/11	7/19/11	9/7/11	Average
SS-01	1.0	2.7	5.0	4.2		3.2	1.8	3.0
SS-04	1.7	2.6	4.6	4.2	2.9	3.1	1.4	2.9
SS-05	1.2	2.7	5.2	4.1	3.1	3.5	1.8	3.1
SS-05.7	1.3	2.9	5.5	4.4	3.3	3.4	2.1	3.3
SS-05.9	2.2	3.0	6.3	4.3	3.3	3.5	2.0	3.5
SS-05A	1.5	3.0	5.7	4.6	3.3	3.7	2.1	3.4
SS-06A	1.4	3.3	5.9	5.0	3.9	4.6	3.3	3.9
SS-06F	1.9	3.6	5.9	4.8	4.2	4.4	3.2	4.0
SS-06G	2.0	3.7	5.8	4.9	4.2	4.4	3.1	4.0
SS-06H	1.9	3.6	6.1	4.9	4.3	4.2	3.3	4.0
SS-07	3.9	4.3	6.6	5.5	5.2	5.0	3.5	4.9

CuTR (ug/L)	2/3/11	4/6/11	6/28/11	7/6/11	7/12/11	7/19/11	9/7/11	Average
SS-01	2.1	4.1	8.6	7.1		4.6	2.0	4.8
SS-04	4.9	7.9	9.1	7.2	6.6	6.1	2.8	6.4
SS-05	4.3	7.2	10.0	7.1	6.7	6.3	3.1	6.4
SS-05.7	4.7	7.1	11.0	8.3	7.5	6.8	4.3	7.1
SS-05.9	5.9	6.7	12.0	8.4	7.2	7.0	4.3	7.4
SS-05A	5.9	7.1	13.0	8.8	7.2	7.7	4.4	7.7
SS-06A	5.3	8.0	12.0	11.0	8.9	9.3	6.8	8.8
SS-06F	8.2	7.9	13.0	11.0	9.3	9.9	5.7	9.3
SS-06G	5.4	7.6	13.0	11.0	9.1	9.9	6.2	8.9
SS-06H	5.2	8.0	13.0	11.0	10.0	9.7	6.3	9.0
SS-07	11.0	11.0	18.0	16.0	14.0	14.0	10.0	13.4

## 2010 & 2011 Average CuDis Concentration



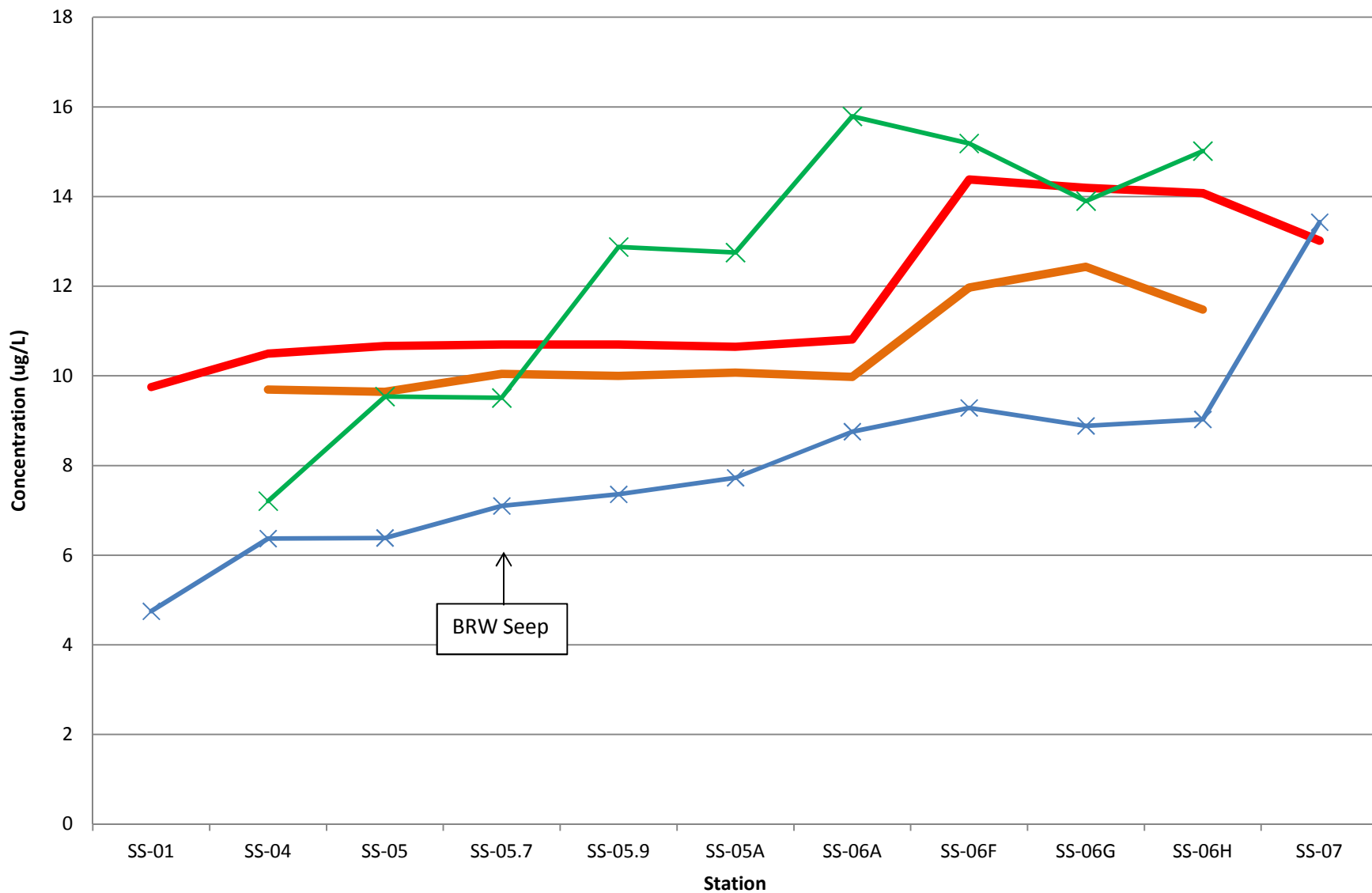
—x— 2011 CuDis Concentration

—x— 2010 CuDis Concentration

— 2010 Standard

— 2011 Standard

## 2010 & 2011 Average CuTR Concentration



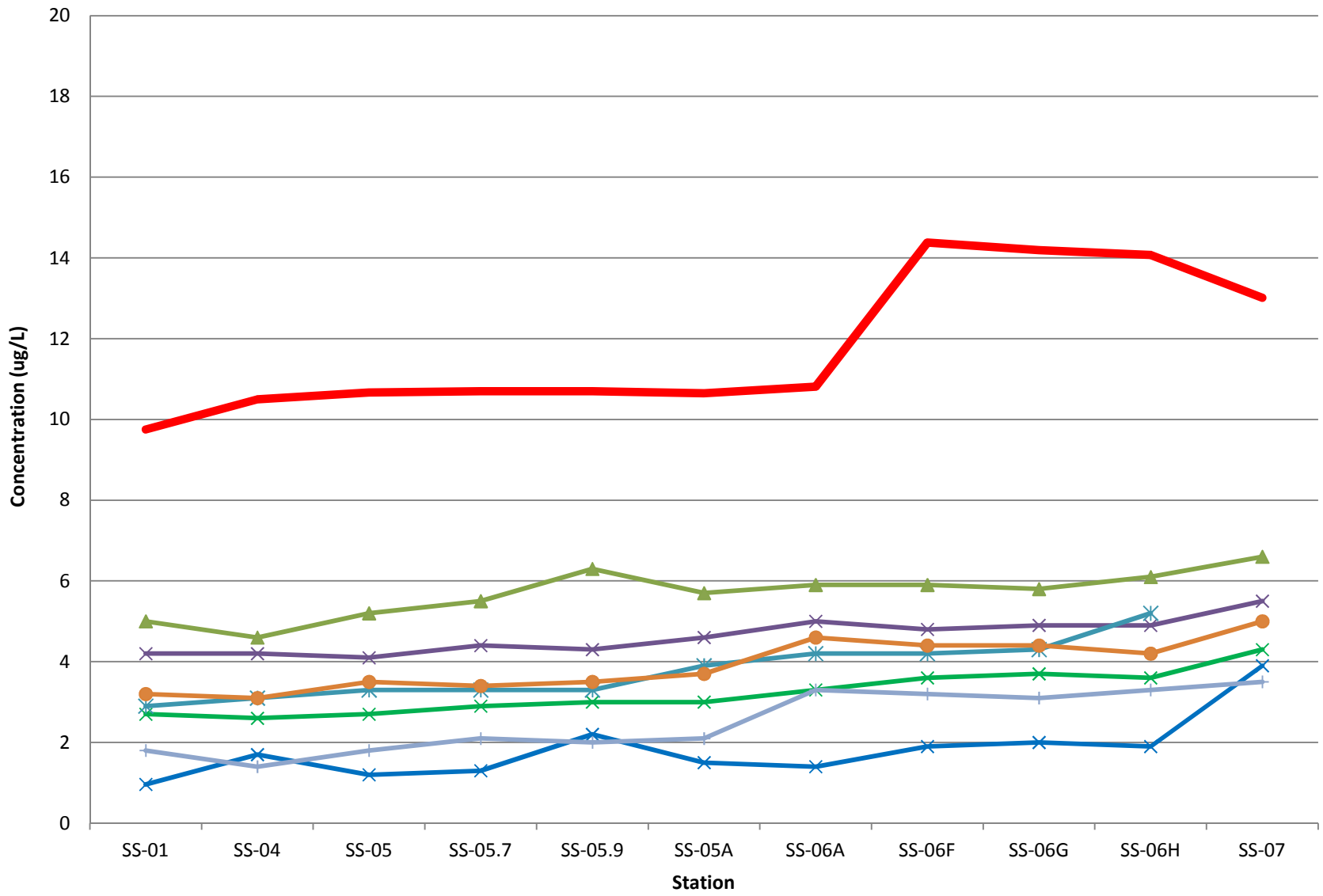
2010 Standard

2011 Standard

2011 CuTR Concentration

2010 CuTR Concentration

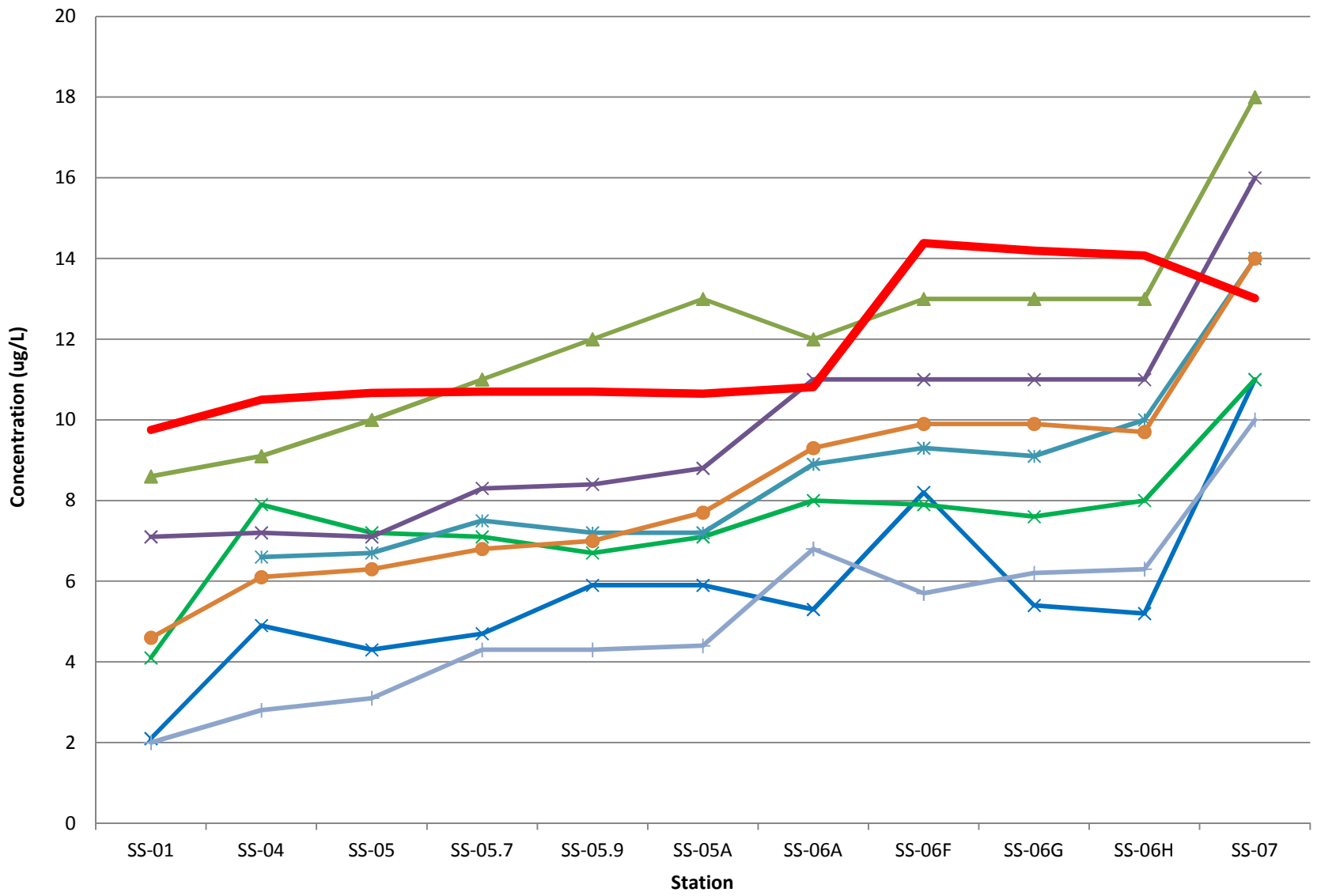
# 2011 CuDis by Event



2/3/11 4/6/11 6/28/11 7/6/11 7/12/11 7/19/11 9/7/11 2011 Standard



## 2011 CuTR by Event



x 2/3/11   
 x 4/6/11   
 ▲ 6/28/11   
 x 7/6/11   
 x 7/12/11   
 ● 7/19/11   
 + 9/7/11   
 — 2011 Standard