

**CHUMSTICK CREEK SUBWATERSHED  
Hydro-Geologic Monitoring Report**

Chelan County, Washington

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## Introduction

The Wenatchee Watershed (Water Resource Inventory Area [WRIA] 45) has been identified by the Washington State Department of Ecology (Ecology) as one of 16 watersheds in the state where water quantity is a probable limiting factor for anadromous fisheries resources. Increasing competition for hydrologic resources in the watershed in conjunction with seasonal low-flow conditions contribute to inadequate streamflows for fish, particularly during periods of late summer and early fall (Wenatchee Watershed Planning Unit [WWPU], 2006).

In an effort to address the condition of water resources within the Wenatchee Watershed, a Wenatchee Watershed Management Plan (WWMP) was completed in April 2006. The WWMP identified insufficient streamflow, diminished water quality, and a lack of geologic and hydrologic data on which to evaluate water availability and management strategies within the Chumstick Creek subwatershed as issues which should be addressed. In 2008, a Quality Assurance Project Plan (QAPP) was prepared for a study to collect creek discharge data to gain a better understanding of groundwater–surface water interactions in the Chumstick Creek subwatershed, particularly during critical low-flow periods (Appendix A).

This report presents synoptic flow, piezometer and groundwater data for monitoring stations in Chumstick Creek and Eagle Creek for the period covering low-flow conditions from August through October 2008 - 2010.

It should be noted in the summer of 2009 17 fish barrier culverts were replaced by bridges in the lower 7 miles of Chumstick Creek. Many of the culvert replacement sites were in close proximity to monitoring sites.

## 2.0 Methods

Monitoring stations were established at nine locations in the Chumstick Creek subwatershed (Table 1; Figure 1). At each location, a staff gage, piezometer, and Onset<sup>®</sup> Hobo water level logger were installed. The methods for the Synoptic data are provided in Appendix D. In 2009, due to access issues, station CC5 was eliminated and CC7 experienced equipment malfunction. Due to vandalism the water level loggers at Station EC2 did not record usable data in both 2009 and 2010.

These methods were followed for all three years of data collection. However, water level logger data collected in 2010 did not correlate well with staff gauge readings using this method. Therefore all 2010 logger data were adjusted to reflect actual recorded staff plate measurements.

Chelan County Natural Resource Department staff recorded stage height from the staff gages and measured discharge at the monitoring locations using a SonTek Acoustic Doppler Velocimeter. These measurements were used to develop discharge rating curves for the monitoring locations (Appendix C).

The piezometers were installed to determine whether groundwater was entering the creek at the monitoring location (positive vertical gradient) or whether the monitoring location was losing surface water (negative vertical hydraulic gradient). The method and analysis of the piezometer data is provided in Appendix B. Additionally two groundwater monitoring wells were drilled to better understand groundwater-surface water

interactions. The method and analysis of the groundwater data is provided in Appendix E.

## **3.0 Results**

The following three sections present the synoptic survey results for low-flow conditions in Chumstick Creek and Eagle Creek from 2008 thru 2010.

### **3.1 Monitoring Stations Discharge Record**

Discharge at the Chumstick and Eagle Creek monitoring stations for 2008 are shown on Figure 2. Figure 4 represents 2009 data and figure 5 shows 2010. In 2008 no water was present in Chumstick Creek during this study period at the two monitoring locations near the mouth of Eagle Creek (CC1 and CC4). Water was present at all monitoring stations during 2009. In 2010 no water was present at CC1 until early October and CC4 intermittently stopped flowing in August and shortly in early September. CC4 does not usually completely dry up however no flow will be observed i.e. standing water. When CC1 is completely dry Chumstick Creek goes subsurface approximately 15' downstream of CC4.

Figure 2 shows the discharge at the two monitoring stations located in Eagle Creek. No water was present at the mouth of Eagle Creek during late August to early October 2008. In addition, very little water flow occurred at Station EC2 during the month of September 2008.

One feature that is present for all monitoring sites within both creeks in 2008 are the sharp, regular drops in water level observed during the first half of September (Figure 3). This appears to be clear evidence of anthropogenic impacts to creek flow. At the most upstream monitoring station in Chumstick Creek (CC10), creek flows dropped for about a 2-hour period every morning except Sunday. With one exception, the reduction in creek flow during these periods was quite consistent. This pattern was not observed during the rest of the monitoring record period, which suggests that the observed reductions in creek flow were not due to domestic water use, but may have been associated with agricultural activities. This pattern was not observed during the 2009 and 2010 monitoring periods. However, in 2009 and 2010 irregular increases of discharge were observed only in stations CC7 and CC6 (Figure 4 & 5). These increases are not attributed to precipitation events or tributary contributions. The increase in discharge only lasts for 30-60 minutes and increases discharge by 1.50 to 2.00 times.

### **3.2 Changes in Creek Flow between Monitoring Stations**

Synoptic comparison of flows at downstream and upstream monitoring stations provides a measure of whether the reach is gaining or losing water. The change in discharge (upstream station - downstream station) within the reaches established in Chumstick Creek and Eagle Creek are shown on Figures 2, 4, and 5.

#### **3.2.1 Chumstick Creek**

In the farthest upstream reach in Chumstick Creek, from above Little Chumstick Creek (CC10) to above Clark Canyon (CC8), discharge declined. The average decline in discharge over this 1.7-mile reach during August through October 2008, 2009 and 2010 was 0.13, 0.18 and 0.16cfs respectively. The 3 year average decline was 0.16cfs.

In the reach from CC8 to below Sunitsch Canyon (CC7), discharge increased during the study period. The average increase over this 2.3-mile reach during August through October was 0.35 cfs in 2008 and 0.52 cfs in 2010. The 2 year average increase was 0.44cfs. Due to equipment failure pressure transducer data was not recorded for CC7, therefore no continuous comparison could be made in 2009. However, using actual discharge measurements (Table 2) an increase in flow from CC8 to CC7 was observed in 2009. The increase in flow between these two stations is from Sunitsch Creek a main tributary to Chumstick Creek.

In the reach from CC7 to above Spromberg Canyon (CC6), discharge declined. The average decline in discharge over this 1.3-mile reach during August to October was 0.45cfs in 2008. In 2009 a decline in discharge was observed using actual discharge measurements. During August to October 2010 an overall slight increase in flow of 0.05cfs was observed in the reach.

In the reach from CC6 to below Spromberg Canyon (CC5), discharge increased. The average increase in stream flow over this 0.4-mile reach during August to October 2008 was 0.17 cfs. The increase in flow between these two stations is from Spromberg Creek a main tributary to Chumstick Creek.

In the reach from CC5 to above Eagle Creek (CC4), discharge decreased from August thru September in 2008. The average decline in stream flow over this 0.9-mile reach during late August to early October was 0.35cfs.

Due to the elimination of Station CC5 only 2008 data could be collected. No comparison could be made for average decline or increase of discharge for CC6 to CC5 and CC5 to CC4 using water level logger data in 2009 and 2010. However comparing data from CC6 and CC4 there was an average increase in discharge of .13cfs in 2009. There were average declines in discharge of 0.18cfs in 2008 and 0.42cfs in 2010.

In the reach from CC4 to below Eagle Creek (CC1), discharge declined during the study period in 2009 and 2010. No flow present at CC1 during the study period in 2008. The average decline in discharge over this 0.25 mile reach during September to October was .26cfs in 2009 and 0.20cfs in 2010.

### **3.2.2Eagle Creek**

In the farthest upstream reach in Eagle Creek, from below Van Creek (EC3) to above Bjork Canyon (EC2), discharge declined during the study period. The average decline in discharge over this 2.1-mile reach during August to October 2008 was 0.49cfs. Due to vandalism at EC2 there is not a continuous record of discharge for 2009. Using actual discharge measurements there is no considerable increase or decrease in stream flow in 2009 and 2010.

In the reach from EC2 to the mouth of Eagle Creek, discharge decreased and no surface water was observed at the mouth of the Eagle Creek during the 2008 study period. The average decline in discharge over this 3.1-mile reach during August to October was 0.02cfs. In 2009 and 2010 no comparison could be made from EC2 to the mouth due to the elimination of the DOE gauging site on Eagle Creek.

## 4.0 Discussion

The synoptic survey data shows that during low-flow conditions discharge in Chumstick Creek and Eagle Creek can fluctuate markedly within short periods of time. Regular morning declines in discharge observed during early September, 2008 in both creeks provides evidence that water use within the subwatershed can substantially reduce creek discharge.

Synoptic comparisons of creek discharge at monitoring stations show that stream flow increased in two reaches (CC8 to CC7 and CC6 to CC5) in Chumstick Creek during the study period. Between these stations Sunitsch Creek and Spromberg Creek join Chumstick and contribute to stream flow. Any increase in stream flow by these tributaries is quickly decreased as it moves downstream and has no substantial effect on downstream flow by the time it reaches CC1.

Discharge declined within all other reaches in Chumstick Creek and throughout Eagle Creek. Piezometer monitoring during low-flow conditions in Chumstick Creek showed water moving from the creek to groundwater (losing reach) at monitoring station CC7 downstream to CC6. Groundwater was entering the creek (gaining reach) at the farthest upstream stations CC10 and CC8 and the farthest downstream station with surface flow (CC5) (Appendix B). Piezometer monitoring during low-flow conditions in Eagle Creek, showed water moving from the creek to groundwater at monitoring Station EC3; groundwater was entering the creek at Station EC2 (AMEC, 2009a). It should be noted that a spring is present directly upstream of EC2.

In the spring of 2009 two monitoring wells were drilled to further investigate groundwater – surface water interaction. These wells clearly show a direct connection to surface water, no confining aquifer is present within Chumstick watershed. Piezometer data also shows a direct hydraulic connection at all stations. Both losing and gaining reaches (figure 6) determined by piezometer data correlated well with observed (measured discharge) and continuous recorded discharge (pressure transducer).

Overall, the study shows that during low-flow conditions in 2008 - 2010 there was a net loss of surface water from upstream to downstream even with tributary contribution. Based on the data collected for this study any water use within the Chumstick subwatershed has the ability to impact surface water during low flow conditions.

Attachments;  
Table 1 to 2  
Figures 1 to 6

## 5.0 REFERENCES

- AMEC (AMEC Geomatrix, Inc.), 2008, Quality Assurance Project Plan – Groundwater–Surface Water Interactions along Chumstick Creek and Mission Creek in WRIA 45, Chelan County, Washington: Chelan County Natural Resource Department, Wenatchee, Washington.
- AMEC (AMEC Geomatrix, Inc.), 2009, Piezometer Monitoring in Chumstick and Mission Creeks – Groundwater–Surface Water Interactions along Chumstick Creek and Mission Creek in WRIA 45, Chelan County, Washington: Chelan County Natural Resource Department, Wenatchee, Washington.
- AMEC (AMEC Geomatrix, Inc.), 2009 Chumstick Creek Subwatershed Discharge Rating Curves – Groundwater–Surface Water Interactions along Chumstick Creek and Mission Creek in WRIA 45, Chelan County, Washington: Chelan County Natural Resource Department, Wenatchee, Washington.
- AMEC (AMEC Geomatrix, Inc.), 2009 Chumstick Creek Subwatershed Synoptic Survey of Creek Discharge – Wenatchee Watershed Water Resource Technical Assistance, Chelan County, Washington: Chelan County Natural Resource Department, Wenatchee, Washington.
- AMEC (AMEC Geomatrix, Inc.), 2009 Groundwater Monitoring in Chumstick Creek Subwatershed – Groundwater – Surface Water Interactions along Chumstick Creek and Mission Creek in WRIA 45, Chelan County, Washington: Chelan County Natural Resource Department, Wenatchee, Washington.
- WWPU (Wenatchee Watershed Planning Unit), 2006, Final Wenatchee Watershed Management Plan: Chelan County Natural Resource Department, Wenatchee, Washington.

# Tables

TABLE 1

Chumstick Creek Gage Monitoring Locations  
**CHUMSTICK CREEK SUBWATERSHED**  
**WENATCHEE WATERSHED WATER RESOURCE TECHNICAL ASSISTANCE**  
**CHELAN COUNTY, WASHINGTON**

STATION (STATION ID)	ELEVATIO N (FEET)	LATITUDE (°N)	LONGITUDE (°W)
CC BELOW EAGLE CREEK (CC1)	1,216	47.62419	120.64659
CC ABOVE EAGLE CREEK (CC4)	1,234	47.62729	120.64443
CC BELOW SPROMBERG CANYON (CC5)	1,277	47.63837	120.64658
CC ABOVE SPROMBERG CANYON (CC6)	1,309	47.64473	120.64660
CC BELOW SUNITSCH CANYON (CC7)	1,417	47.66363	120.64175
CC ABOVE CLARK CANYON (CC8)	1,562	47.69368	120.63930
CC ABOVE LITTLE CC (CC10)	1,710	47.71682	120.63244
EC ABOVE BJORK CANYON (EC2)	1,626	47.64030	120.58543
EC BELOW VAN CREEK (EC3)	1,944	47.65525	120.54797

**ABBREVIATION(S)**

CC = CHUMSTICK CREEK  
 EC = EAGLE CREEK



Table 2. Actual Discharge Measurements

CC10		CC8		CC7		CC6		CC5	
Date	CFS	Date	CFS	Date	CFS	Date	CFS	Date	CFS
8/27/2008	0.73	8/27/2008	0.39	8/27/2008	0.76	8/27/2008	0.59	8/27/2008	0.47
9/10/2008	0.25	9/10/2008	0.10	9/10/2008	0.64	9/10/2008	0.32	9/10/2008	0.20
10/7/2008	0.58	10/7/2008	0.75	10/7/2008	1.08	10/7/2008	0.64	10/7/2008	0.36
11/18/2008	2.14	11/18/2008	2.97	11/18/2008	4.22	11/18/2008	4.00	11/18/2008	5.16
9/9/2009	1.19	9/9/2009	1.01	9/9/2009	2.23	9/9/2009	1.97		
10/14/2009	1.37	10/14/2009	1.14	10/15/2009	2.75	10/16/2009	2.17		
8/24/2010	1.18	8/18/2010	0.51	8/18/2010	0.62	8/24/2010	0.72		
9/29/2010	0.80	9/29/2010	0.65	9/29/2010	1.40	9/29/2010	1.44		
10/25/2010	1.19	10/25/2010	1.15	10/25/2010	1.93	10/25/2010	1.76		

CC4		CC1	
Date	CFS	Date	CFS
10/16/2008	0.64		
11/13/2008	30.67	11/18/2008	6.77
9/9/2009	1.49	9/9/2009	1.23
10/15/2009	2.01	10/16/2009	1.48
9/29/2010	0.94	10/1/2010	0.71
10/25/2010	1.54	10/25/2010	1.45

EC3		EC2	
Date	CFS	Date	CFS
8/27/2008	0.57	8/27/2008	0.25
9/10/2008	0.45	9/10/2008	0.08
10/7/2008	0.62	10/7/2008	0.34
11/13/2008	2.13	11/13/2008	3.28
9/10/2009	0.73	9/10/2009	0.89
10/15/2009	0.98	10/15/2009	0.80
8/18/2010	0.78	8/18/2010	0.67
9/24/2010	0.91	9/24/2010	1.01
10/19/2010	0.87	10/19/2010	0.81

\*Dates missing in August and September for CC1/CC4 are due to no measurable flow present or dry creek bed

Figure 1

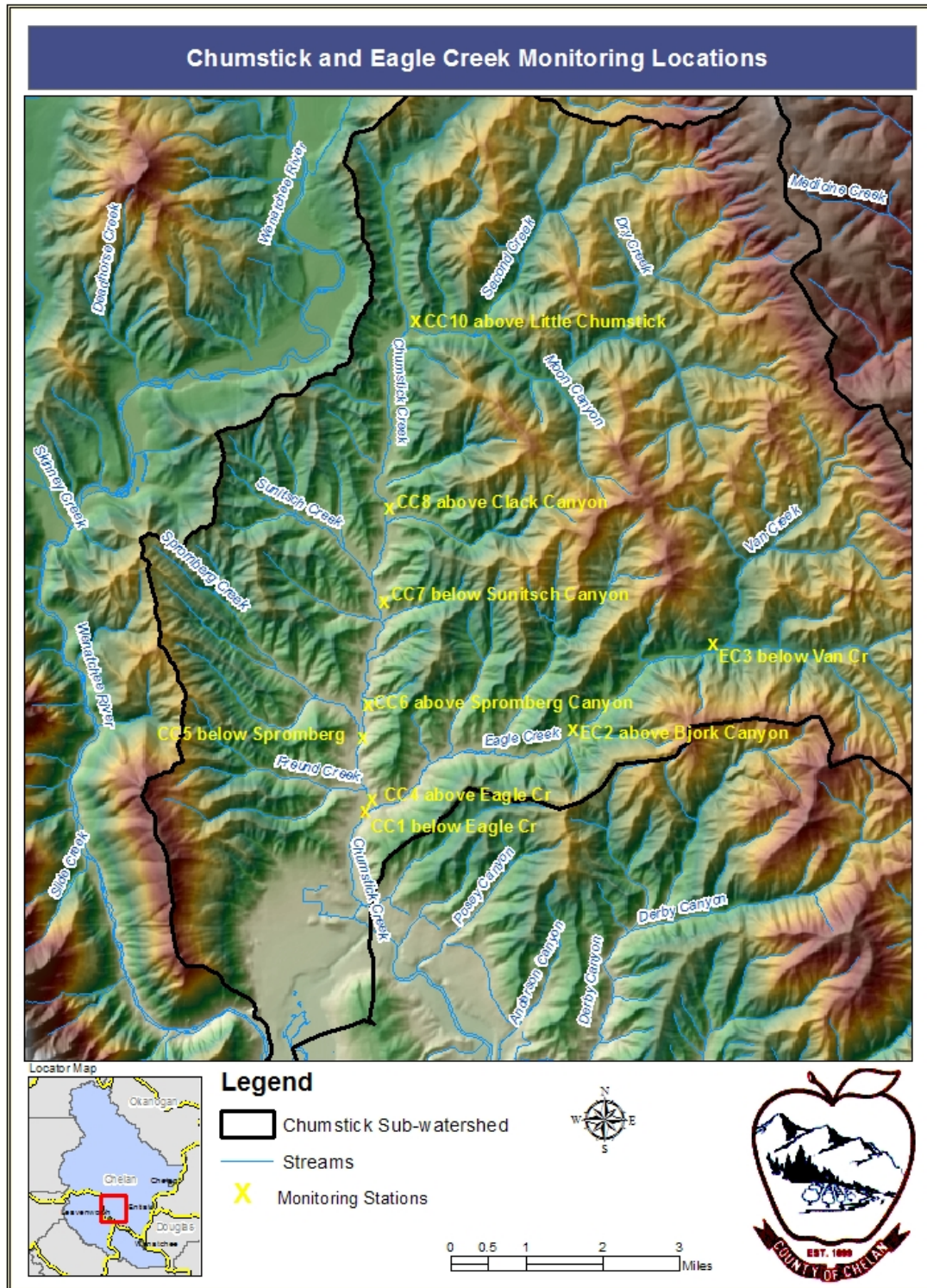
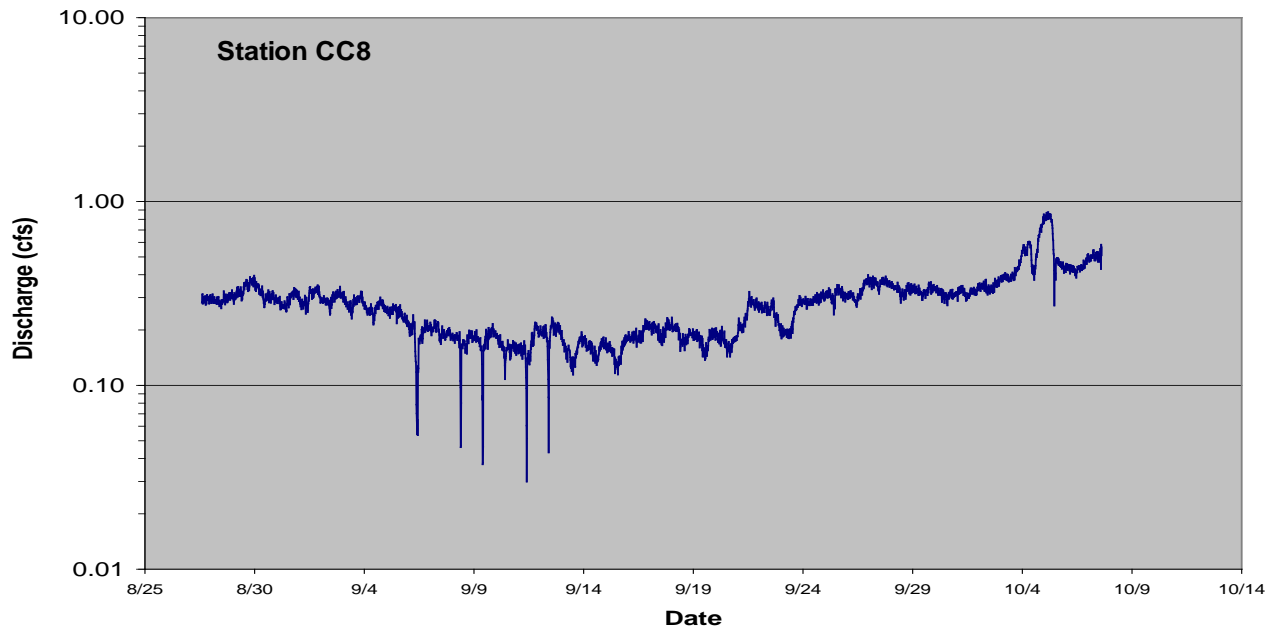
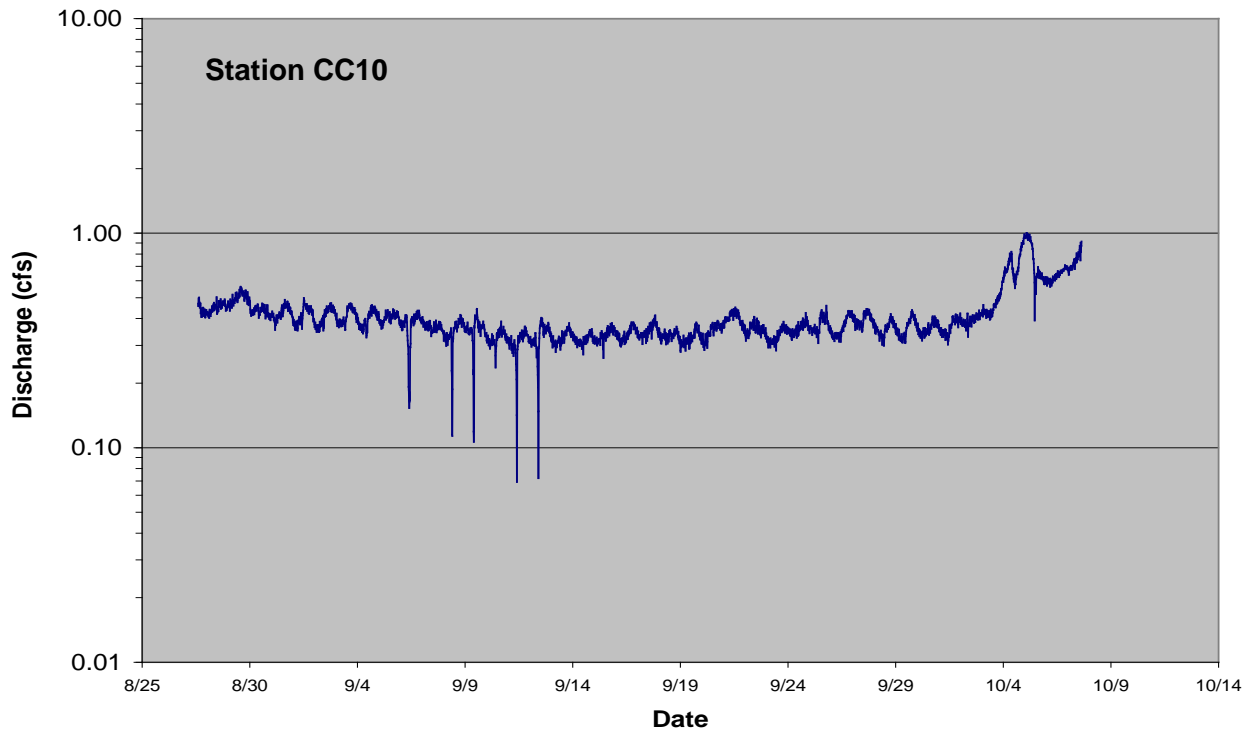
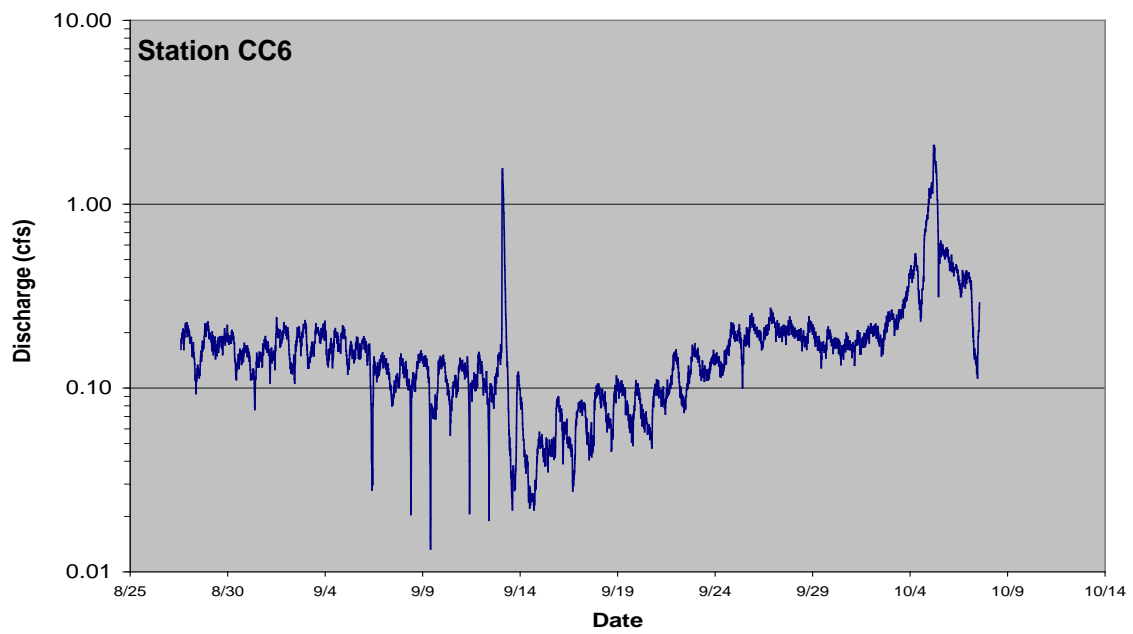
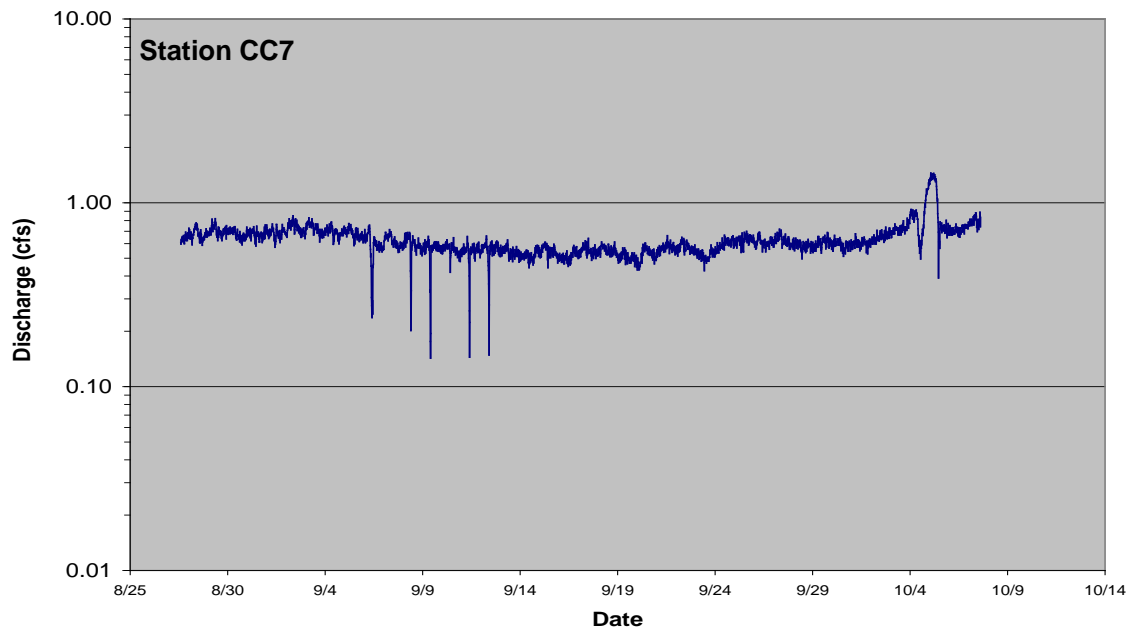
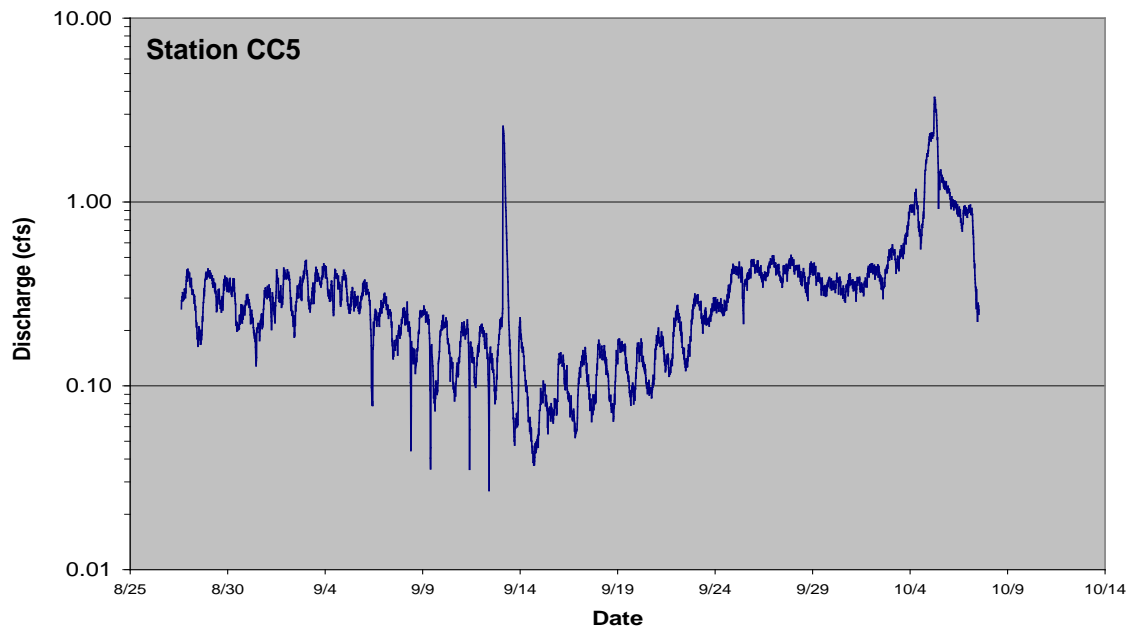


Figure 2 – 2008 Discharge







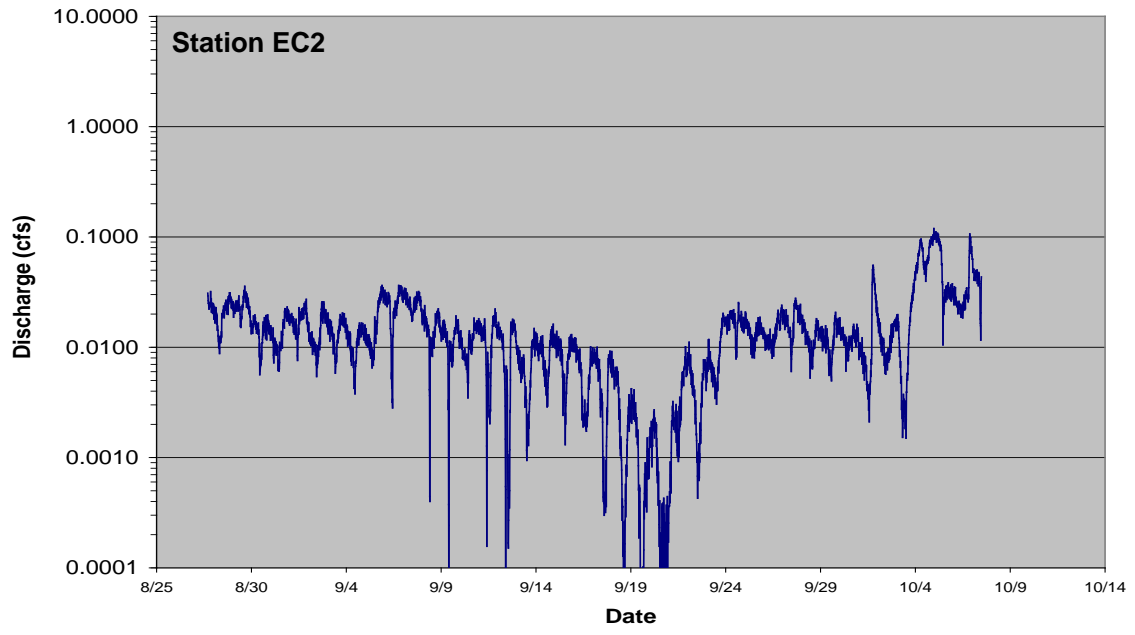
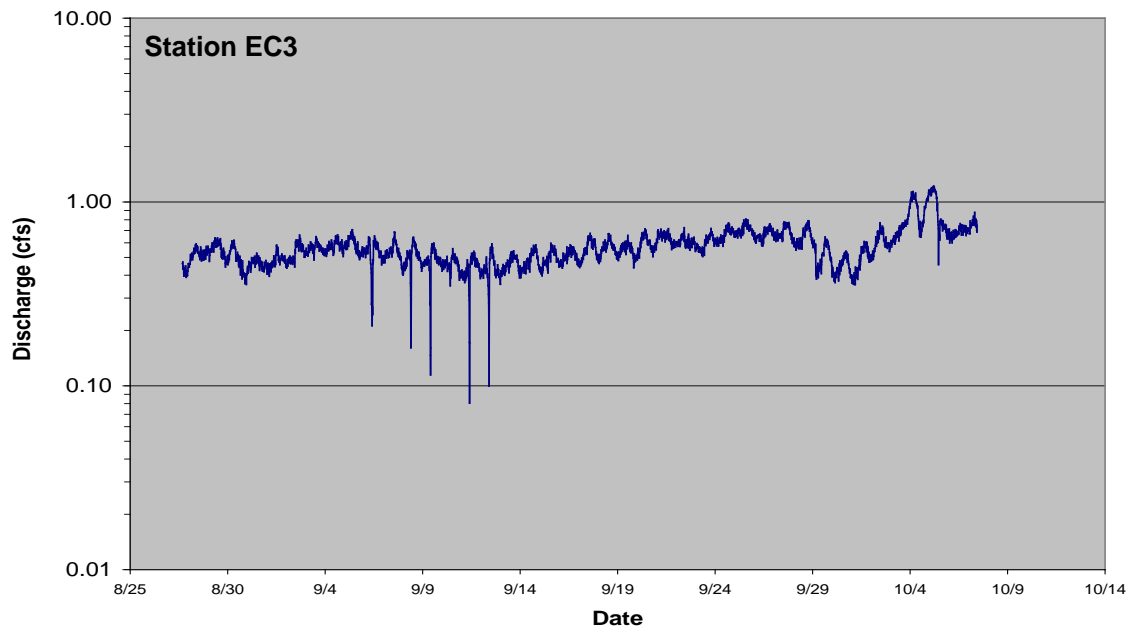


Figure 3 – Example of Anthropogenic Impacts on Creek Flow

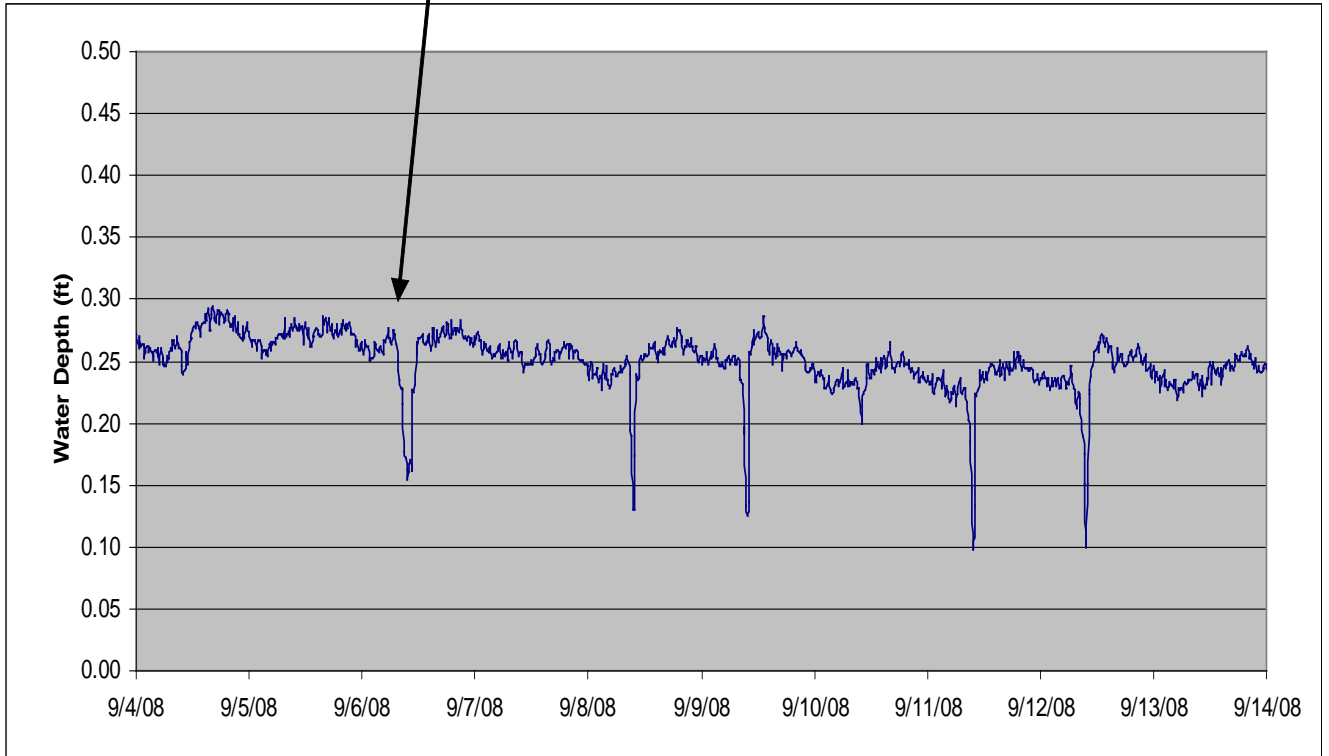
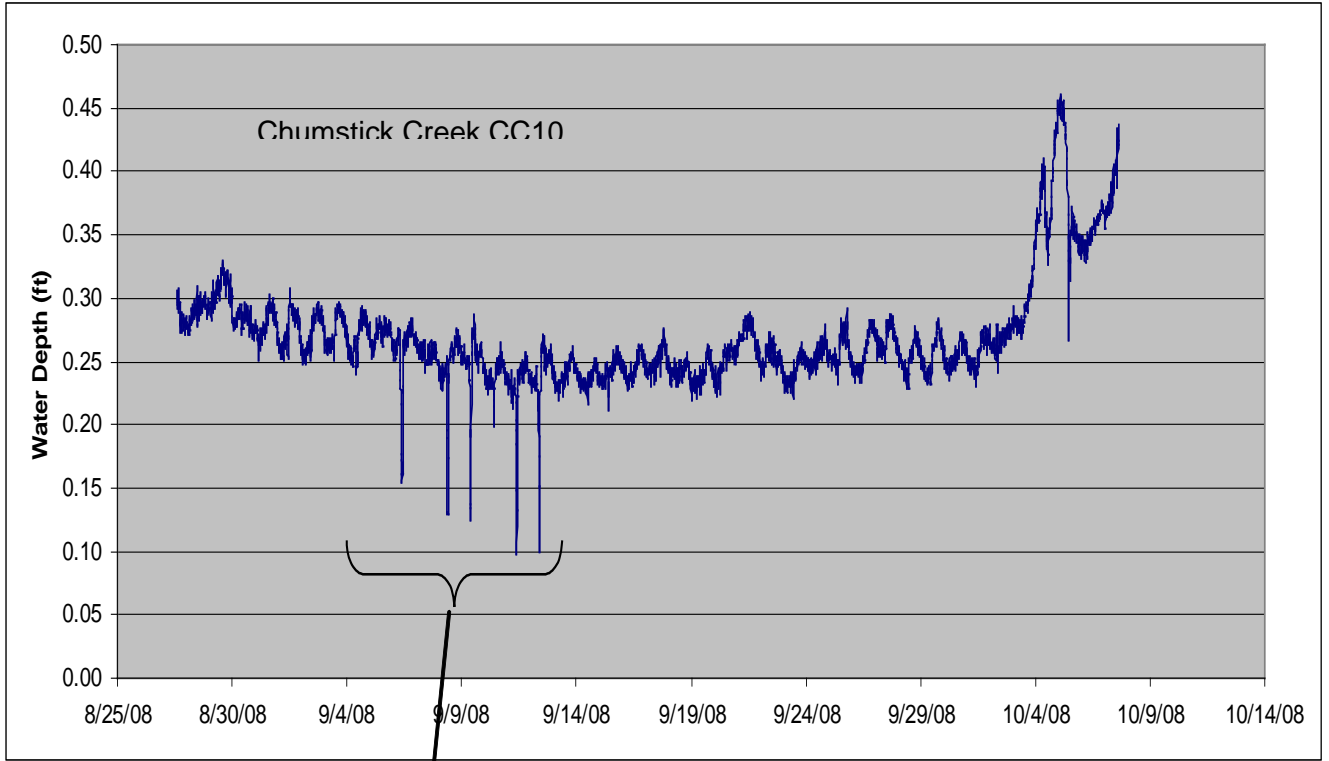
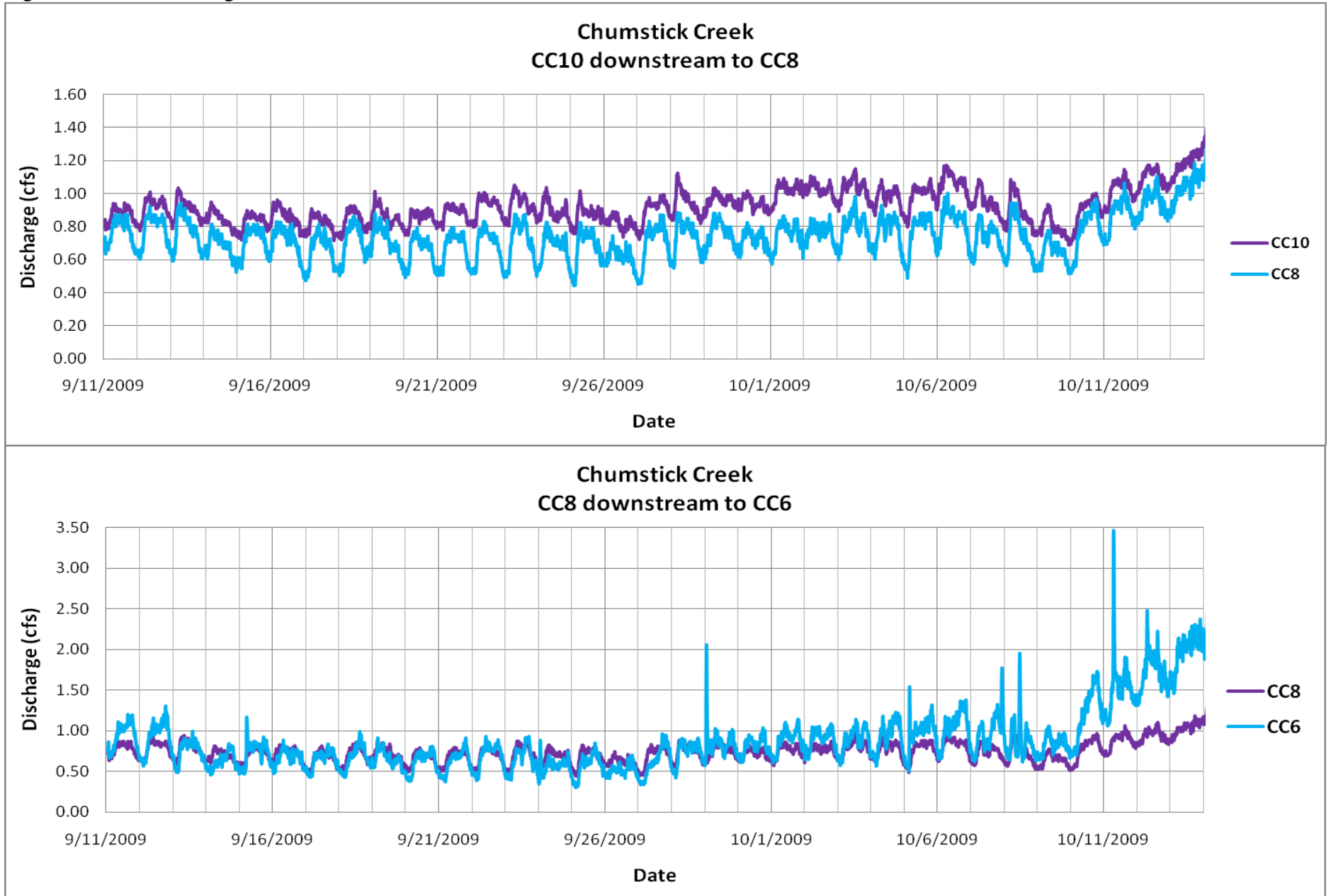
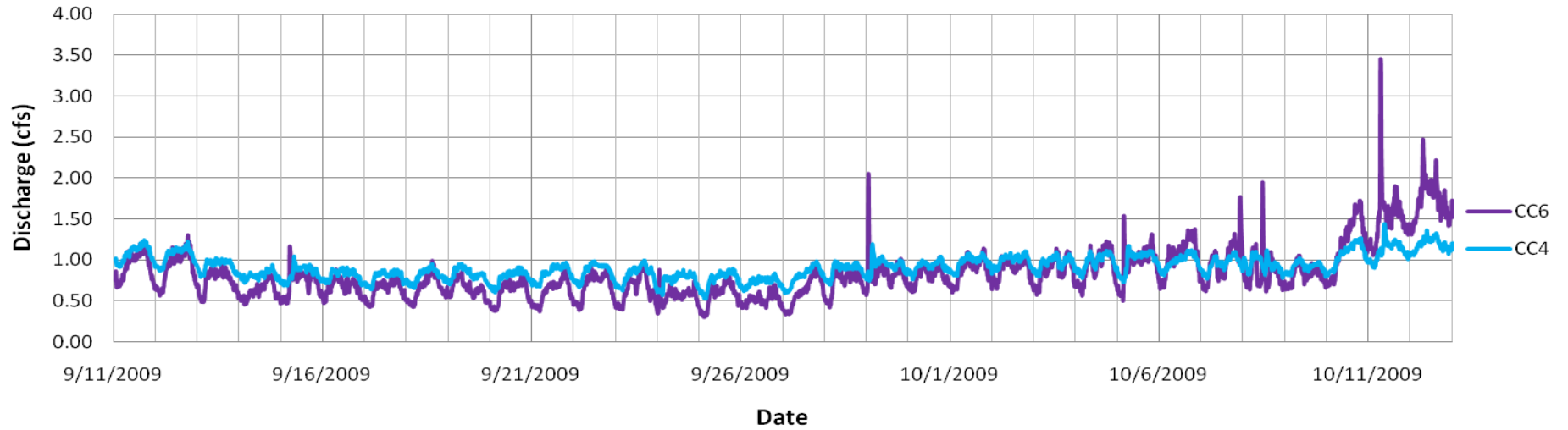


Figure 4 – 2009 Discharge





**Chumstick Creek  
CC6 downstream to CC4**



**Chumstick Creek  
CC4 downstream to CC1**

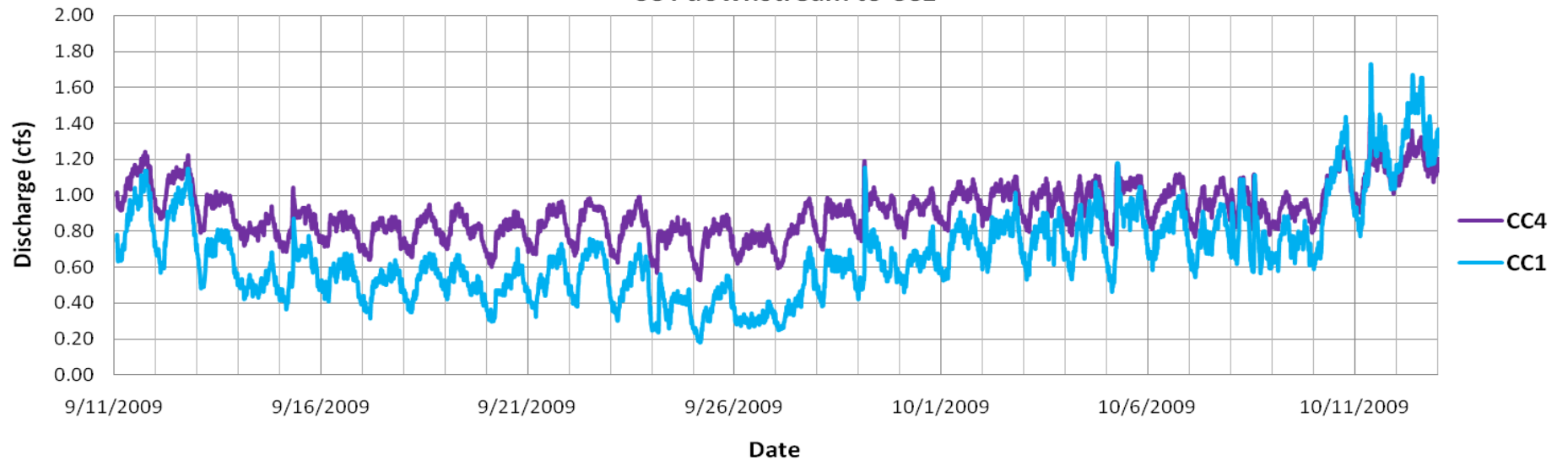
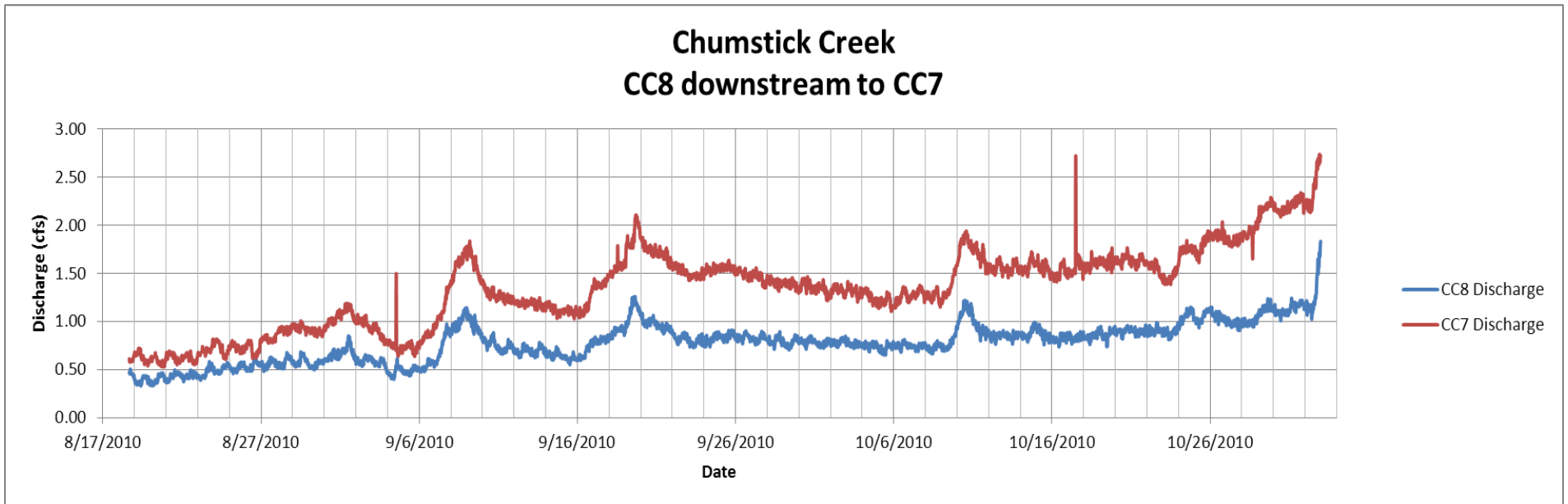
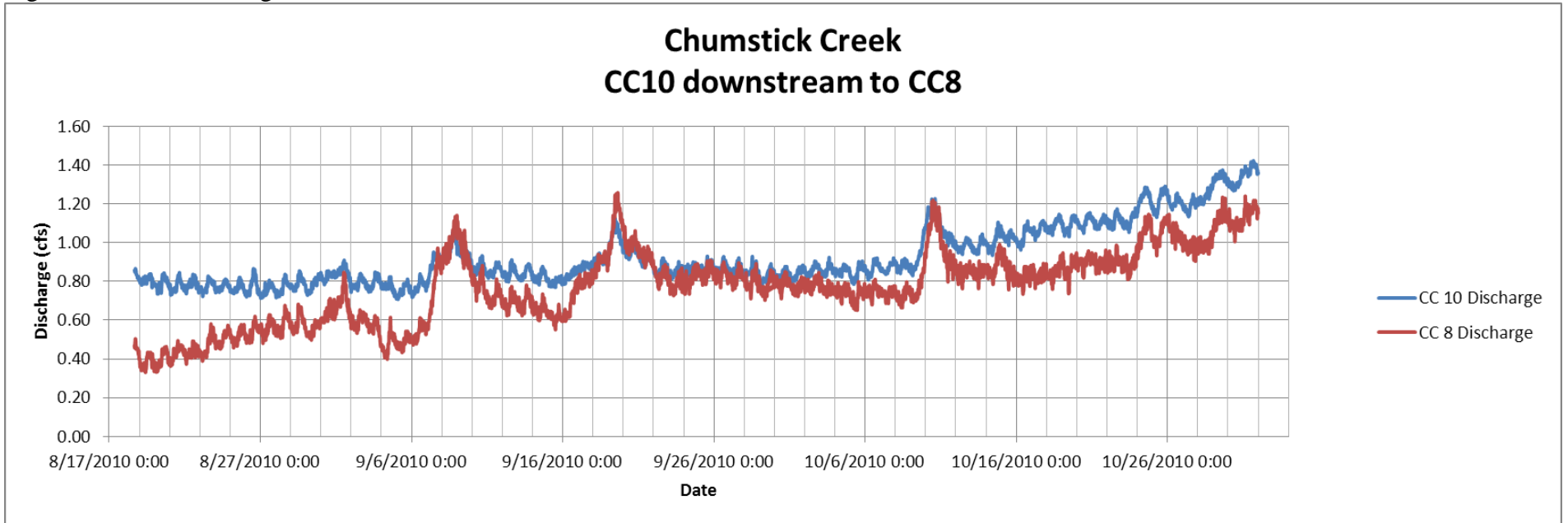
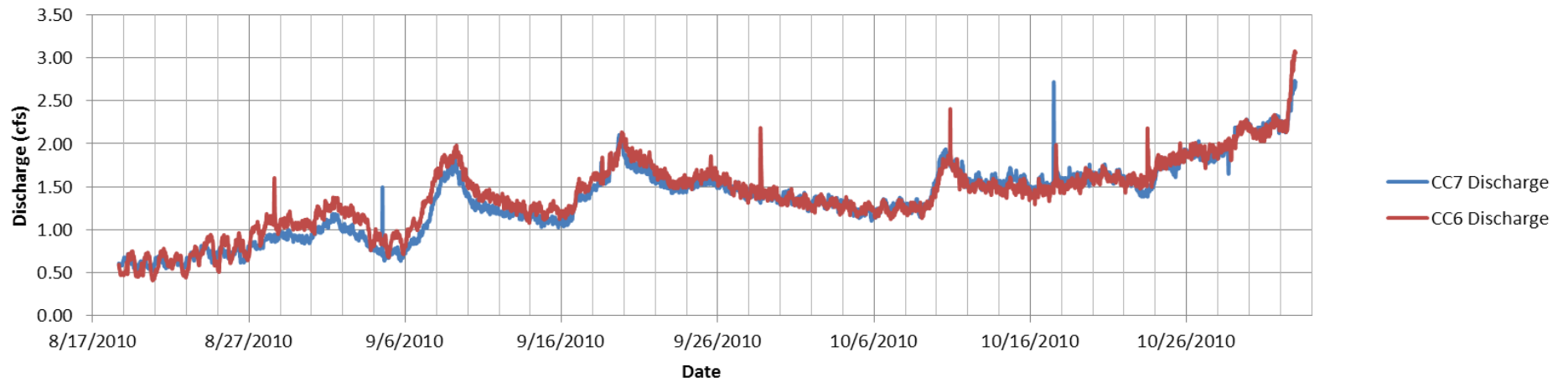


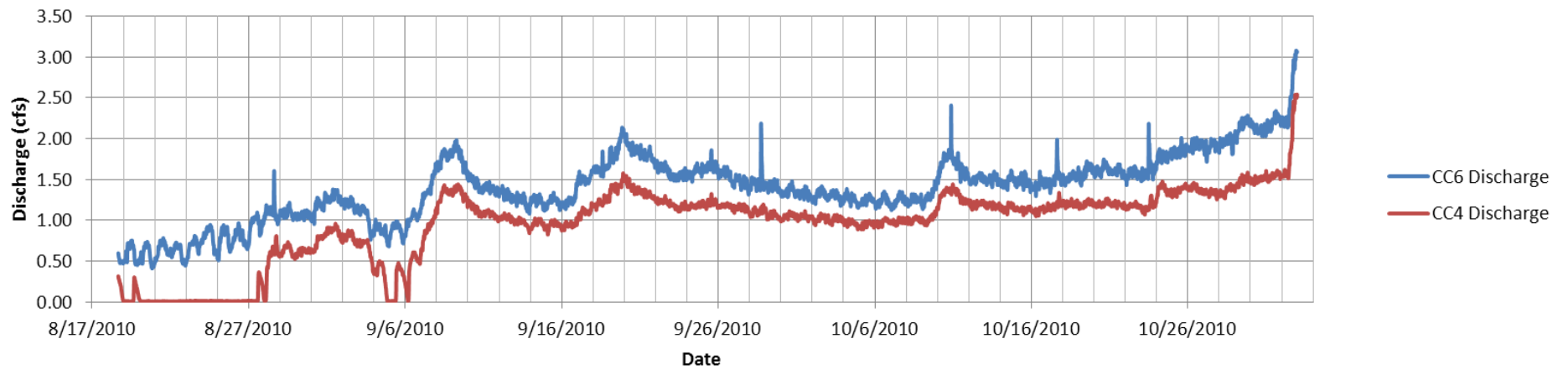
Figure 5 – 2010 Discharge

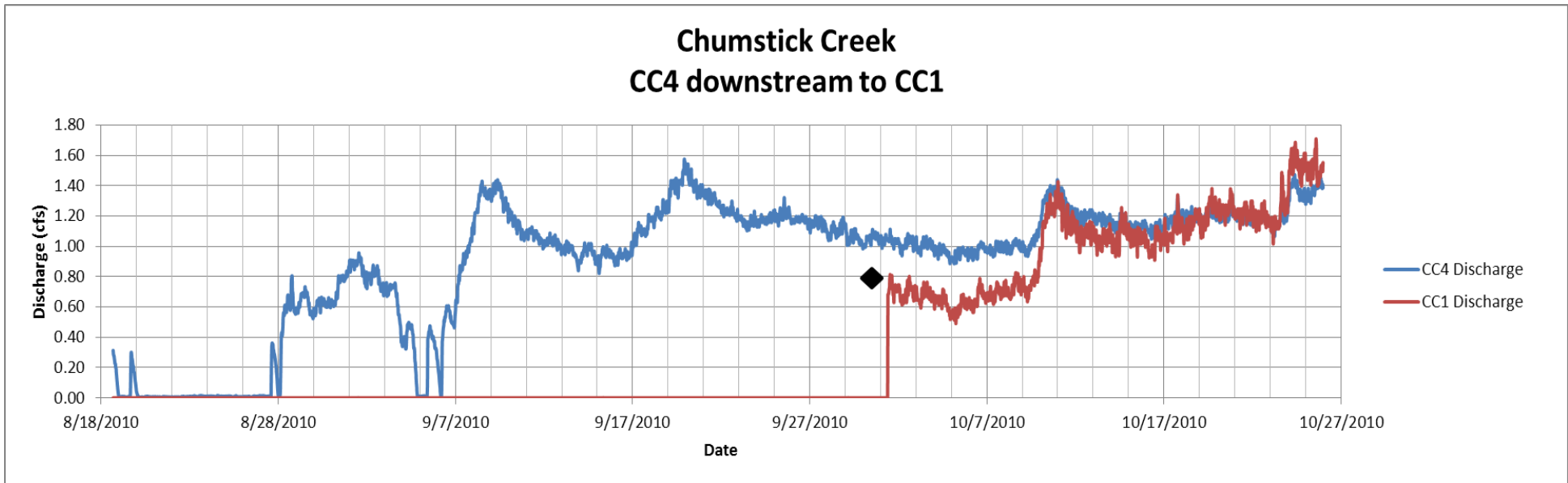


### Chumstick Creek CC7 downstream to CC6



### Chumstick Creek CC6 downstream to CC4





◆ Pressure transducer re-installed on 10/1 after equipment was not logging correctly. Creek was dry during station visits on 8/18 & 8/24. For the period between 9/7 until just prior to re-installation flows may have been present.

Figure 6 – Comparison of Upstream-Downstream Discharge in Chumstick and Eagle Creeks

