

Department of Ecology

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**MISSION 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 Mission 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 Mission Creek subwatershed, particularly during critical low-flow periods (Appendix A).

This report presents synoptic survey data which measured water discharge at monitoring stations in Mission Creek for the period covering low-flow conditions from August through October 2008 - 2010.

## **2.0 Methods**

Monitoring stations were established at eight locations in the Mission Creek subwatershed (Table 1; Figure 1). At each location, a staff gage, piezometer, and Schlumberger DIVER water level logger were installed. The methods for the Synoptic data are provided in Quality Assurance Project Plan (QAPP- Appendix A). In 2009, heavy rain events caused road damage to the road which accessed the upper 3 sites. The sites themselves were also destroyed by high creek flows. Due to these issues, stations MC6, MC7 and MC8 were eliminated in 2009 and 2010.

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.

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 for installation and data collection of the piezometers is provided in Appendix B.

## **3.0 Results**

The following two sections present the synoptic survey results for low-flow conditions in Mission Creek from 2008 thru 2010.

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

Creek discharge at the Mission Creek monitoring stations for 2009 are shown on figure 2 and figure 3 represents 2010 data. Due to a high flow event in fall 2008 all monitoring stations and equipment were damaged. Also, in August and September of 2008 no

stream flow was present from MC4 to MC2. Therefore no rating curves were developed and water level recorder data could not be used for 2008. Manual discharge measurements for 2008 are listed in table 2. In 2009 staff plates and water level recorders were re-installed. An effort to re-install piezometers was unsuccessful. Also in 2009, MC4 was destroyed in a high flow event and a rating curve could not be developed.

Flows above normal low flow conditions were outside the scope of the study and were not measured. High flow events were not captured therefore water level logger data for 2009 and 2010 is not reliable above 10cfs. Average loss/gain in stream flow between stations was calculated using actual stream discharge measurements collected on the same day. Due to the nature of the watershed there were several high flow spikes within the hydrographs in 2009 and 2010. The following sections present low flow conditions and do not take into account short term increases in stream flow that are outside the study scope.

### **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 Mission Creek is shown on Figures 2, and 3. Actual discharge measurements are listed in Table 2.

In the farthest upstream reach (4.68mi) from below Sand Creek (MC5) to above Tripp Canyon (MC4) discharge declined throughout the study period. On 9/3/2008 at MC5 flow was measured at 2.97cfs. One day later on 9/4/2008 at MC4 to MC2 a dry creek bed was observed and 0.46cfs was measured at MC1. On 9/11/2009 a decline of 1.4cfs was calculated between MC5 and MC4. On 10/16/2009 a decline of .49 was calculated. More water was present in Mission Creek in 2010 therefore declines in flows were smaller, September 0.18cfs and October 0.32cfs.

In the reach from MC4 to below Tripp Canyon (MC3) discharge declined throughout the study period. Average declines were consistent when water was present. The average decline in flow was 0.46cfs for 2008-2010 in this short 0.25 mile reach.

In the reach from MC3 to above Yaksum Creek (MC2) discharge declined throughout the study period with the exception of one measurement in late October, 2010 (increase 0.15cfs). In August 2010 a 1.35cfs decline was calculated. There was an average decline of 0.40cfs in September and October for all 3 years along this 0.48mi reach.

In the reach from MC2 to below Yaksum Creek (MC1) discharge increased throughout the study period. In late August and early September 2008 increases of 0.97cfs and 0.46cfs were measured when MC2 was dry. In August and September 2009 and 2010 there was an average increase in discharge of 0.51cfs along this 0.52mi reach. It is assumed the increase in discharge is due to the contribution of Yaksum Creek.

### **4.0 Discussion**

The synoptic survey data shows that during low-flow conditions discharge in Mission Creek declines from upstream (MC5) to downstream (MC2) with the exception of the reach from MC2 to MC1. Even with a discharge increase from MC2 to MC1 there was

still an overall decline in discharge from MC5 to MC1. When measured on the same day discharge declined anywhere from 2.71cfs to 0.46cfs. The largest declines were seen in August and the smallest declines were in October. This coincides with outdoor water use. The Mission Creek subwatershed is dominated by tree fruit orchards from MC5 to MC2.

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

Attachments:

Table 1-2

Figures 1 to 4

## **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 Mission 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**  
**MISSION CREEK MONITORING LOCATIONS**  
Chelan County Natural Resource Department

<b>Station</b>	<b>Elevation (ft)</b>	<b>Latitude (°N)</b>	<b>Longitude (°W)</b>
MC below Yaksum Creek	909	47.50148	120.47682
MC above Yaksum Creek	944	47.49533	120.47713
MC below Tripp Creek	970	47.49010	120.48150
MC above Tripp Creek	984	47.48727	120.48357
MC below Sand Creek	1,385	47.43243	120.50498
MC above Sand Creek	1,458	47.42452	120.50865
East Fork MC below Crow Canyon	1,710	47.39745	120.50092
East Fork MC above Crow Canyon	1,766	47.39279	120.49760

Notes:  
MC = Mission Creek

Table 2 – Actual Discharge Measurements

MC1		MC2		MC3		MC4		MC5	
Date	CFS								
8/26/2008	0.97	8/26/2008	Dry	8/26/2008	Dry	8/26/2008	Dry		
9/4/2008	0.46	9/4/2008	Dry	9/4/2008	Dry	9/4/2008	Dry	9/3/2008	2.97
10/9/2008	1.29	10/9/2008	1.18	10/9/2008	1.73	10/9/2008	2.28	10/8/2008	2.43
9/11/2009	1.29	9/11/2009	0.77	9/11/2009	1.08	9/11/2009	1.50	9/11/2009	2.96
10/6/2009	1.70	10/8/2009	1.45	10/8/2009	1.78	10/6/2009	2.00	10/6/2009	2.49
8/3/2010	3.56	8/3/2010	3.12	8/3/2010	4.47	8/12/2010	2.76	8/3/2010	6.27
9/14/2010	4.35	9/14/2010	3.77	9/14/2010	4.19	9/14/2010	4.71	9/14/2010	4.89
10/28/2010	4.32	10/28/2010	4.28	10/28/2010	4.13	10/28/2010	4.46	10/28/2010	4.78

MC6		MC7		MC8	
Date	CFS	Date	CFS	Date	CFS
9/3/2008	1.66	9/3/2008	2.30	9/3/2008	0.68
10/8/2008	1.97	10/8/2008	2.08	10/8/2008	0.46

Figures

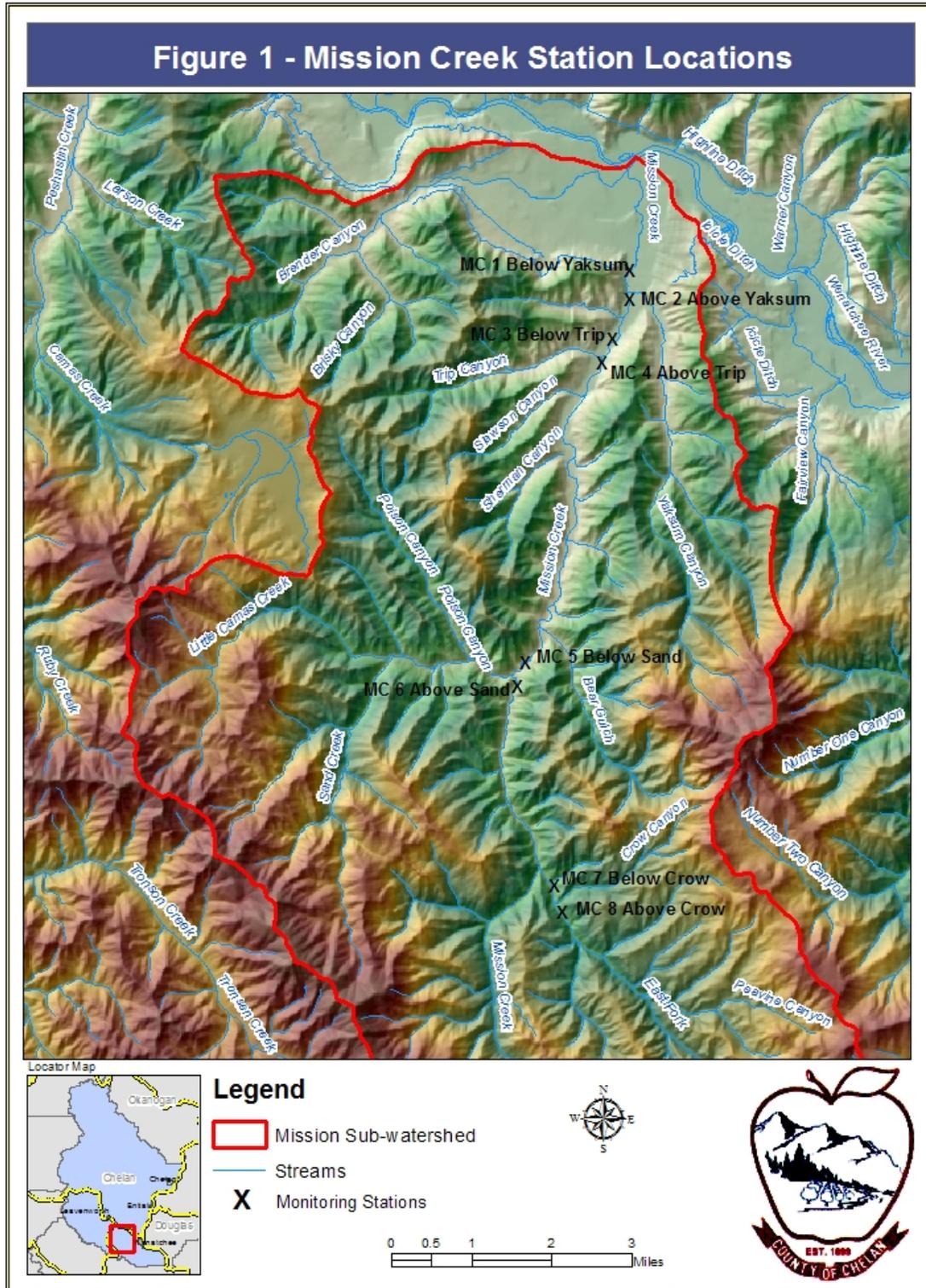
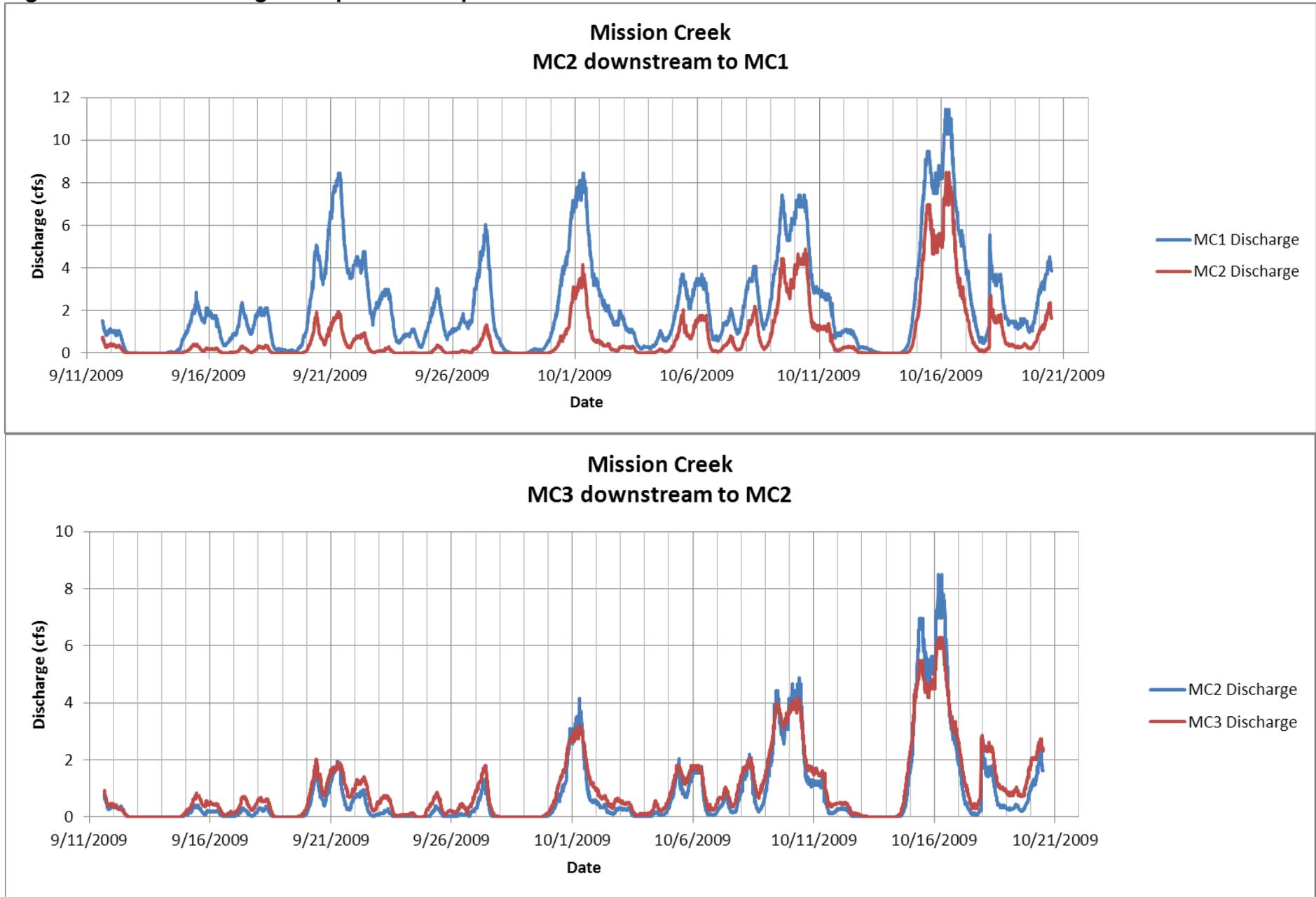


Figure 2 – 2009 Discharge Comparison Graphs



Mission Creek  
MC5 downstream to MC3

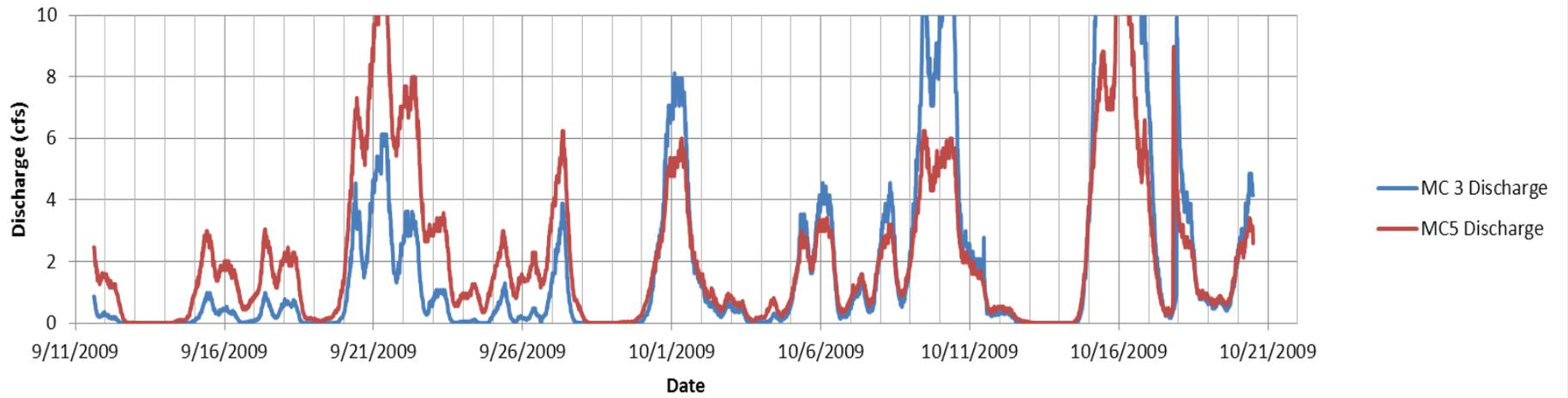
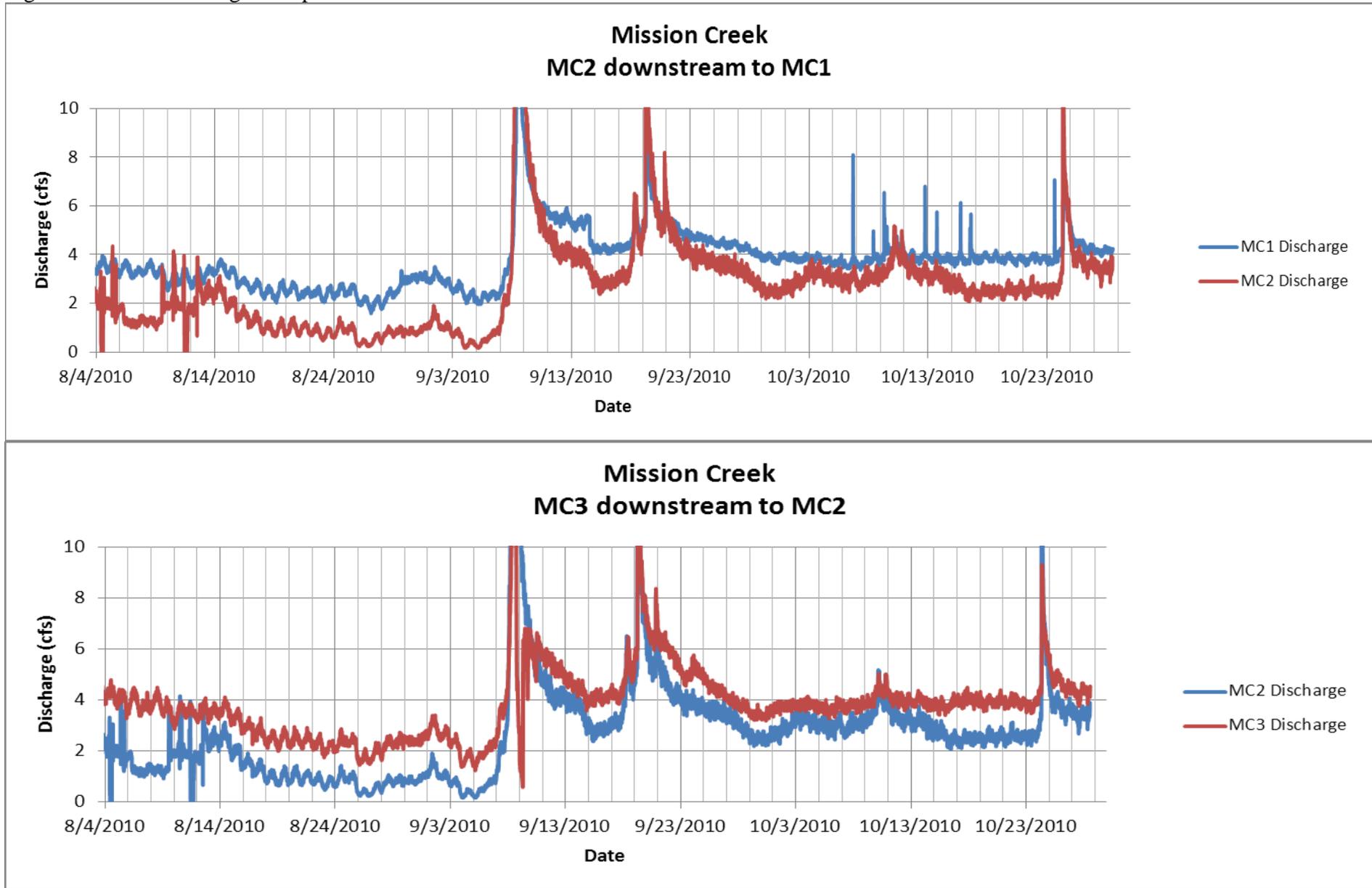
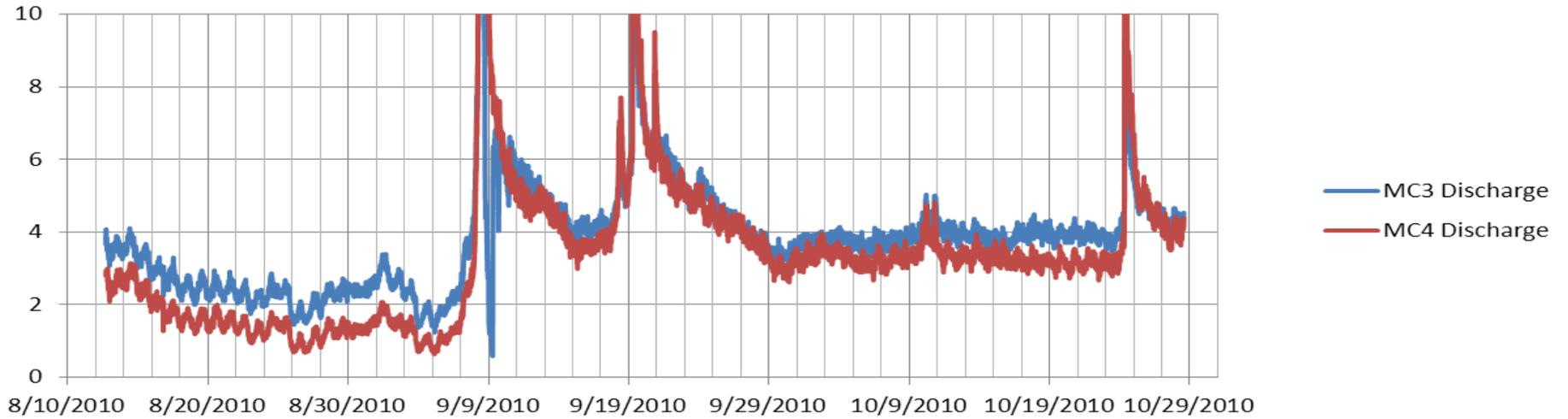


Figure 3 – 2010 Discharge Comparison



### Mission Creek MC4 downstream to MC3



### Mission Creek MC5 downstream to MC4

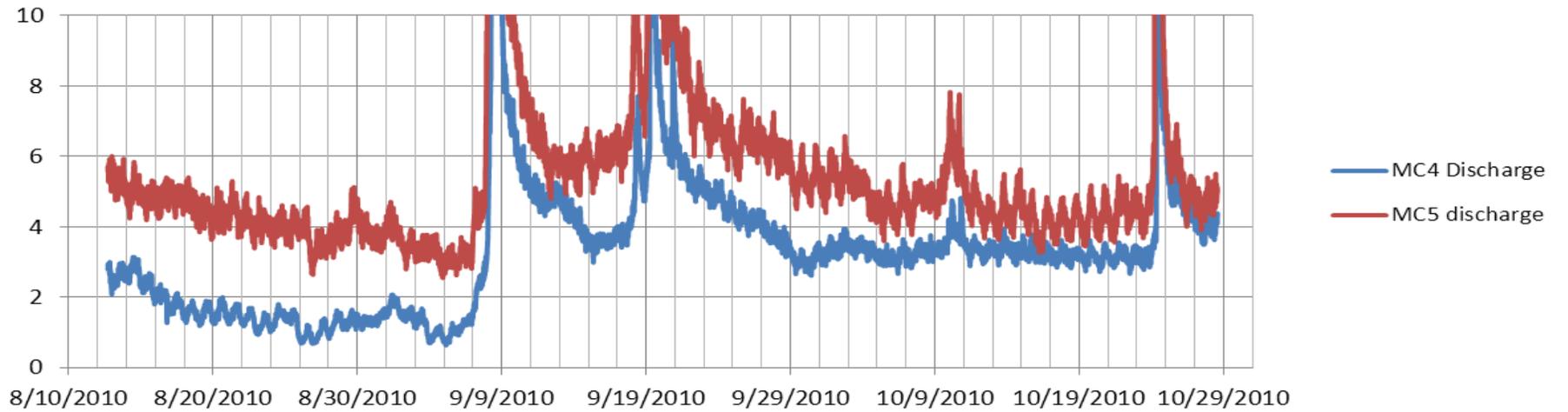


Figure 4- Comparison of Upstream-Downstream Discharge in Mission Creek

