

# Lower Clear Creek Water Quality Monitoring CC-40 and CC-59 Update

CLEAR CREEK CONSULTANTS, INC.



May 2013



## Background

### CC-40 (Kermitts)

- CC-40 stream flow gaging station operated since 1995
- Highway runoff-event water quality sampling years 2000-2005
- Continuous recording conductivity/temperature (est.2004) and seasonal turbidity (est.2008)
- Funding cooperators: UCCWA; CCWF; CDOT

### CC-59 (Golden)

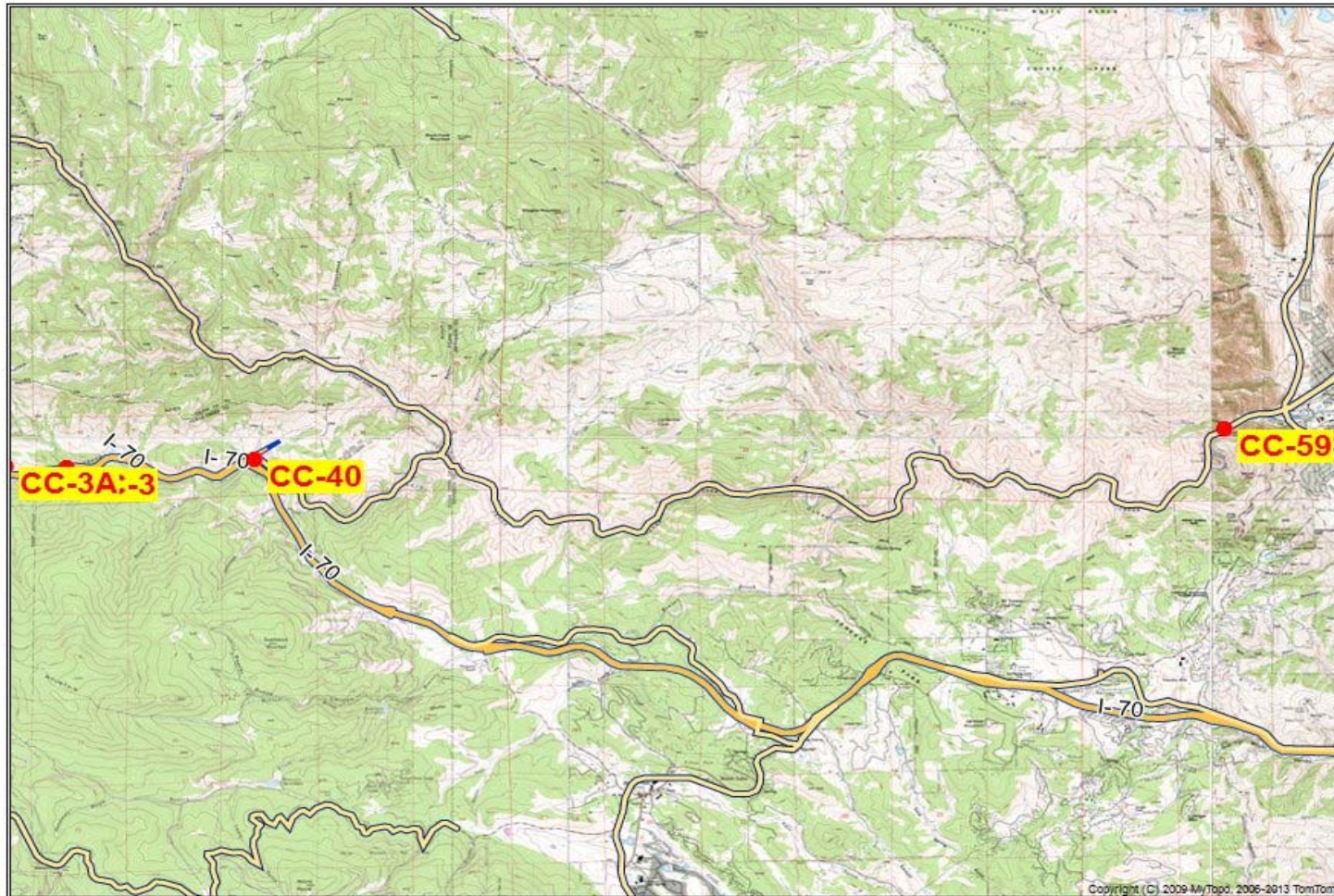
- CC-59 started in 2005 at former USGS gage upstream Church Ditch/Golden Intake
- Continuous recording of conductivity/temperature and seasonal stream stage, turbidity, pH, precip.
- Funding cooperator: City of Golden



## Objectives

- Seasonal (Apr-Oct) continuous monitoring and sample analysis for TSS, nutrients, trace metal concentrations
- Utilize continuous recording in-stream turbidity, conductivity/temperature probes to more completely monitor water quality conditions
- Develop correlation between in-stream parameters, TSS, nutrients, metals, and chloride
- Characterize water quality during storm events and other “upset” conditions
- Quantify and evaluate trends in suspended sediment, total phosphorus, metals, and chloride concentrations/loads
- Track chloride trends related to highway runoff

## Lower Clear Creek CC-40 and CC-59

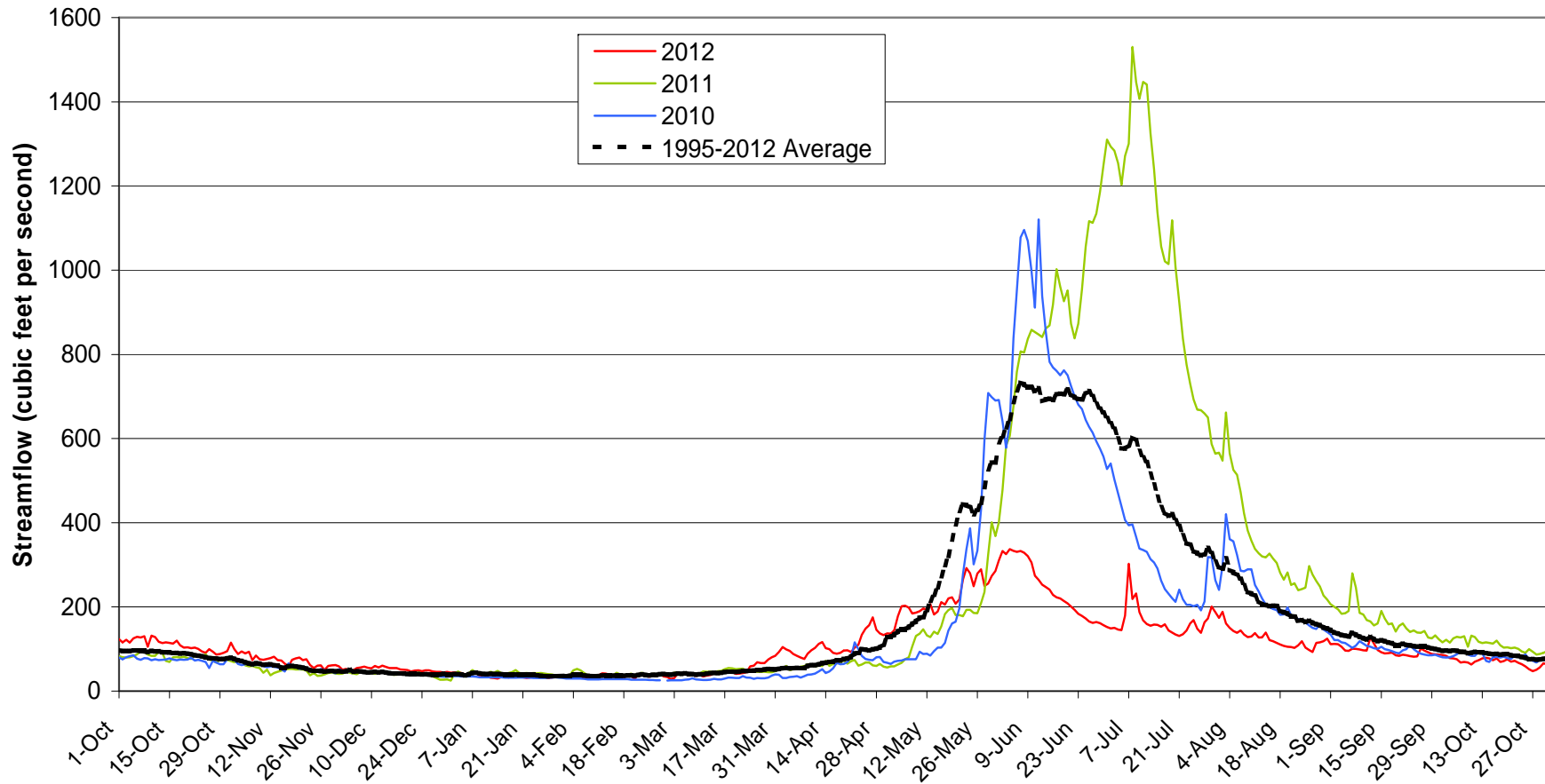


# Clear Creek CC-40 Monitoring Station



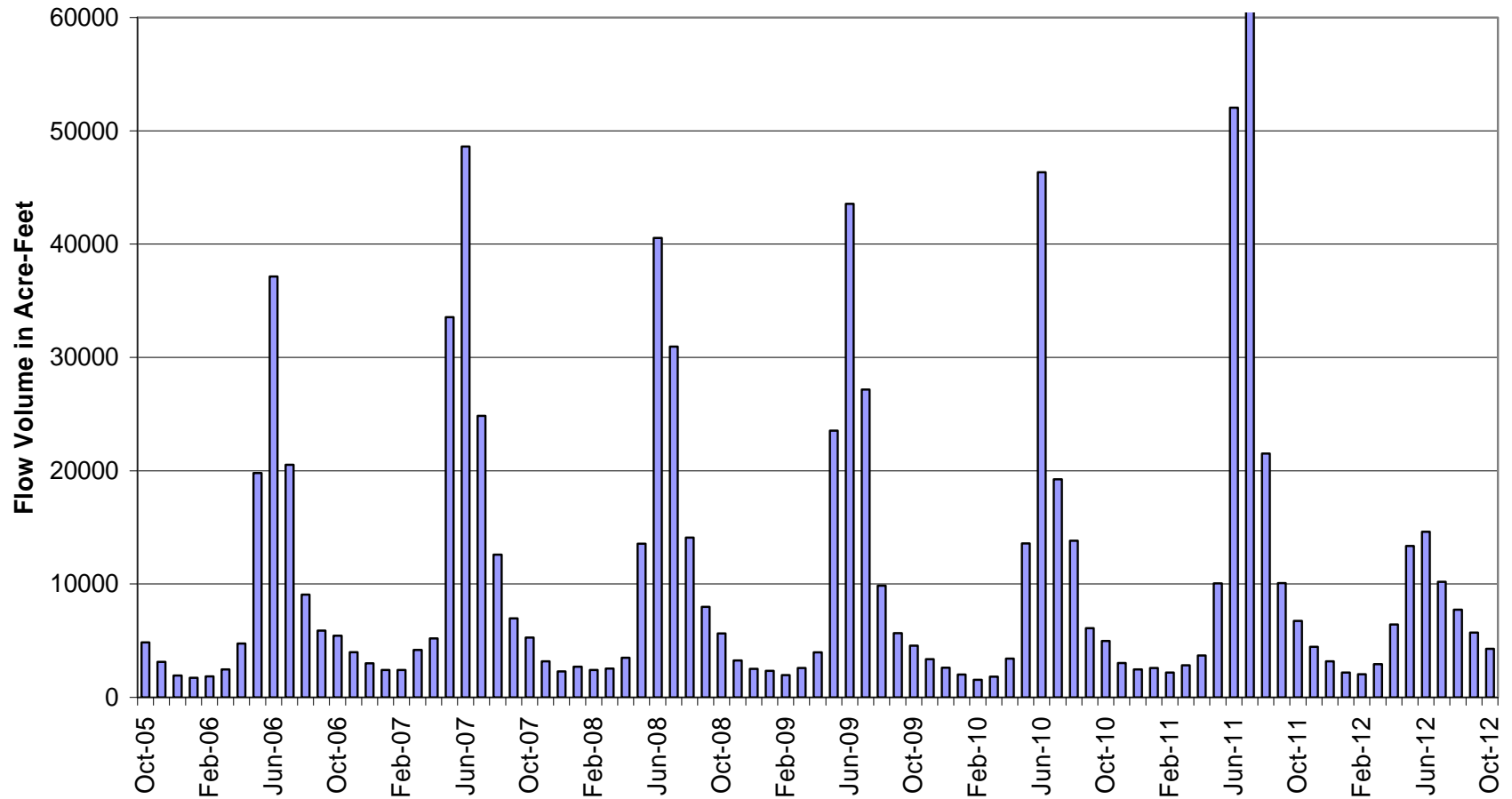
# Clear Creek CC-40 Streamflow

Clear Creek Mean Daily Streamflow by Water Year  
above Johnson Gulch near Kermitts (CC-40)  
Drainage Area = 267 square miles



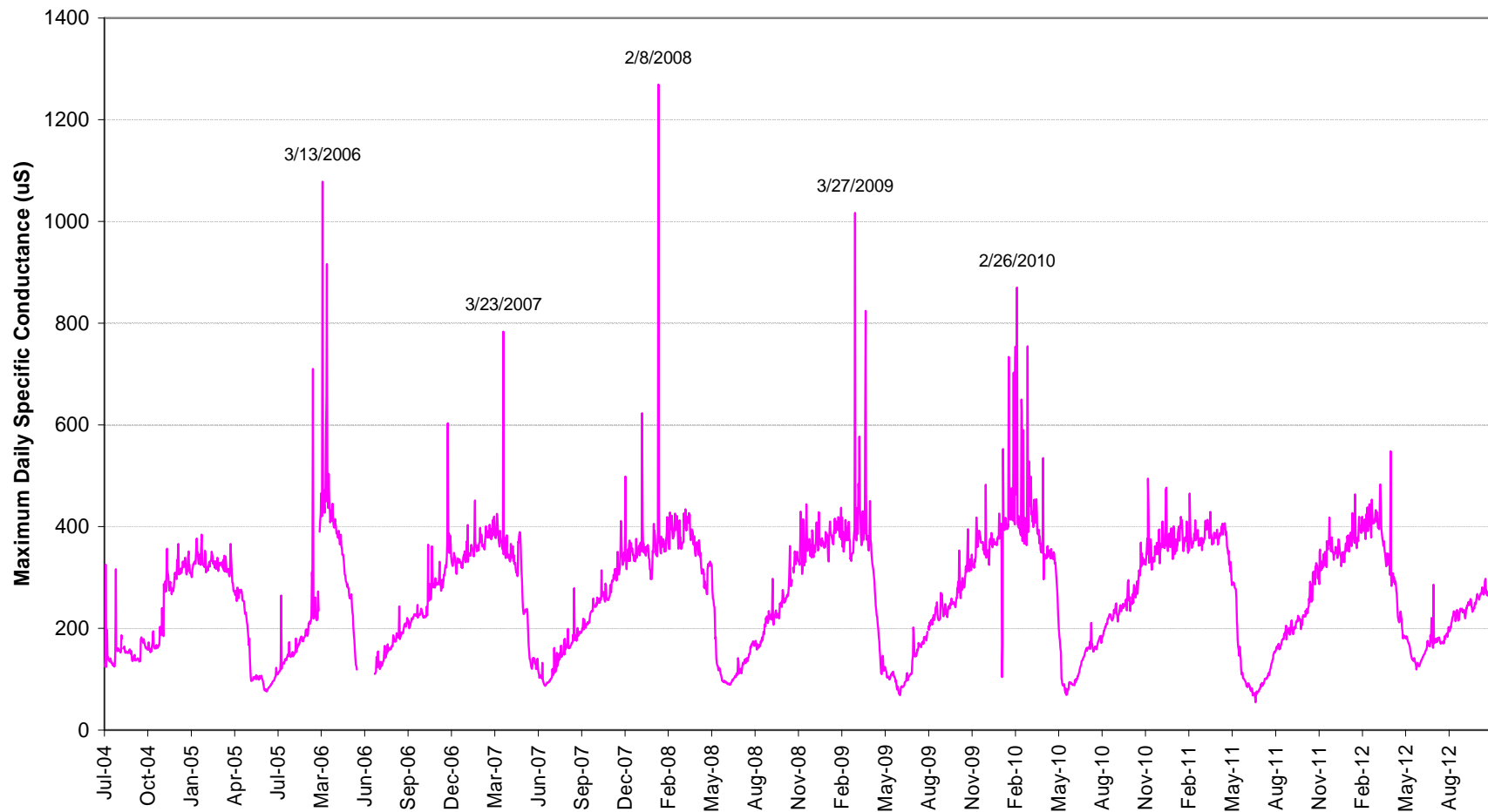
# Clear Creek CC-40 Flow Volume

Clear Creek above Johnson Gulch near Kermitts (Station CC-40)  
Monthly Flow Volume: 2006-2012



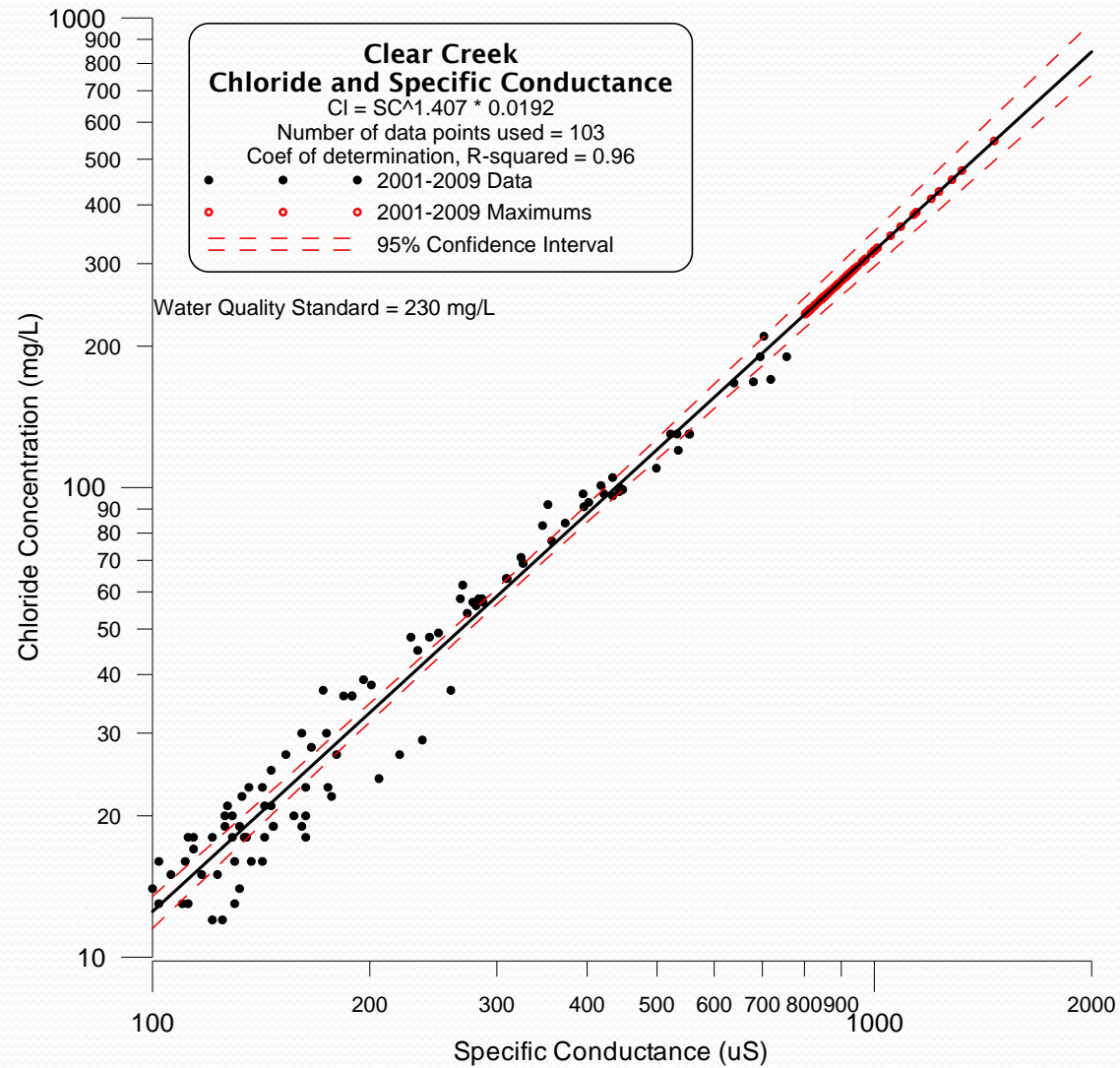
# Clear Creek CC-40 Maximum Conductivity

Clear Creek at Kermitts (CC-4) Maximum Specific Conductance  
July 2004 to October 2012

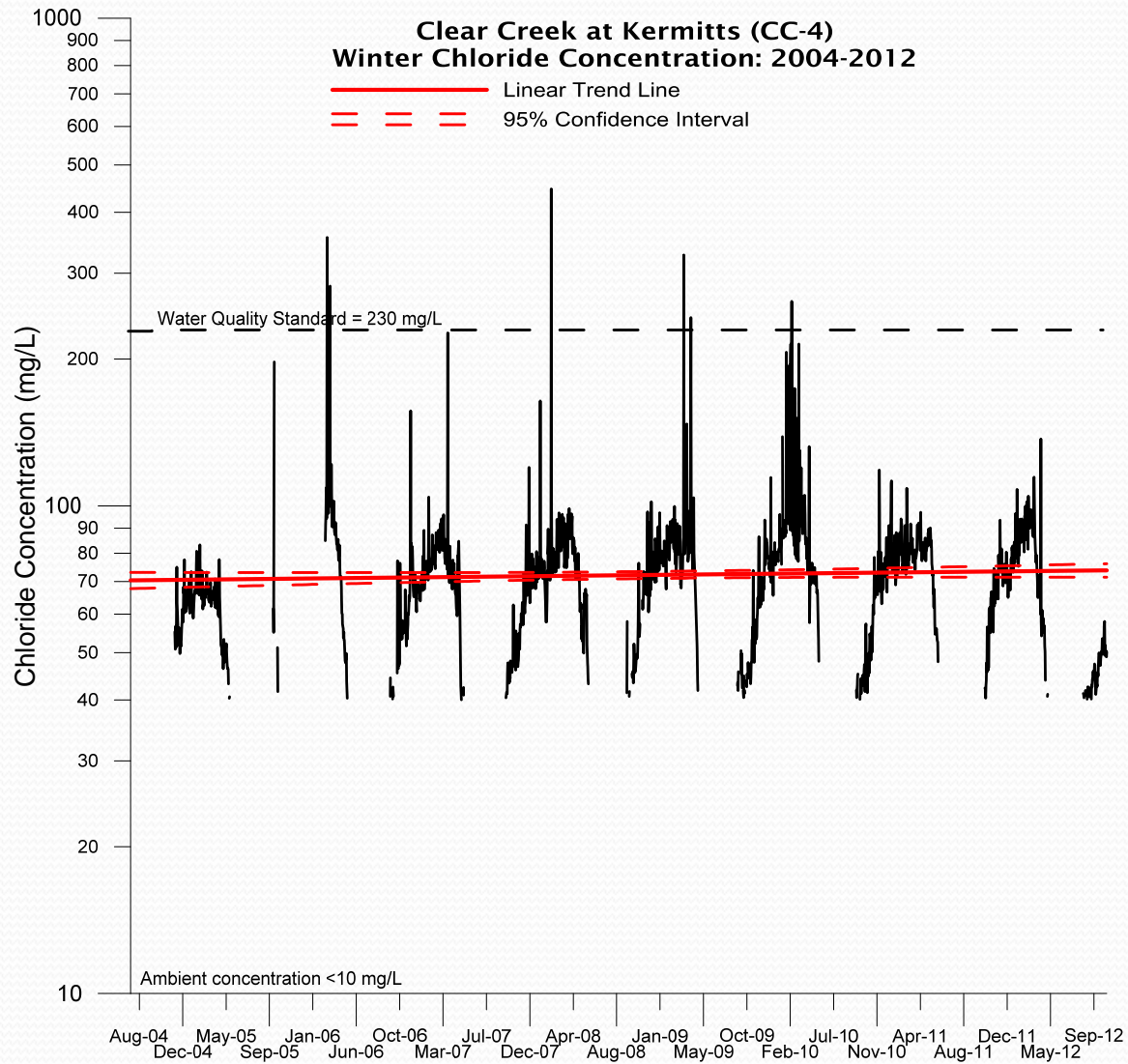




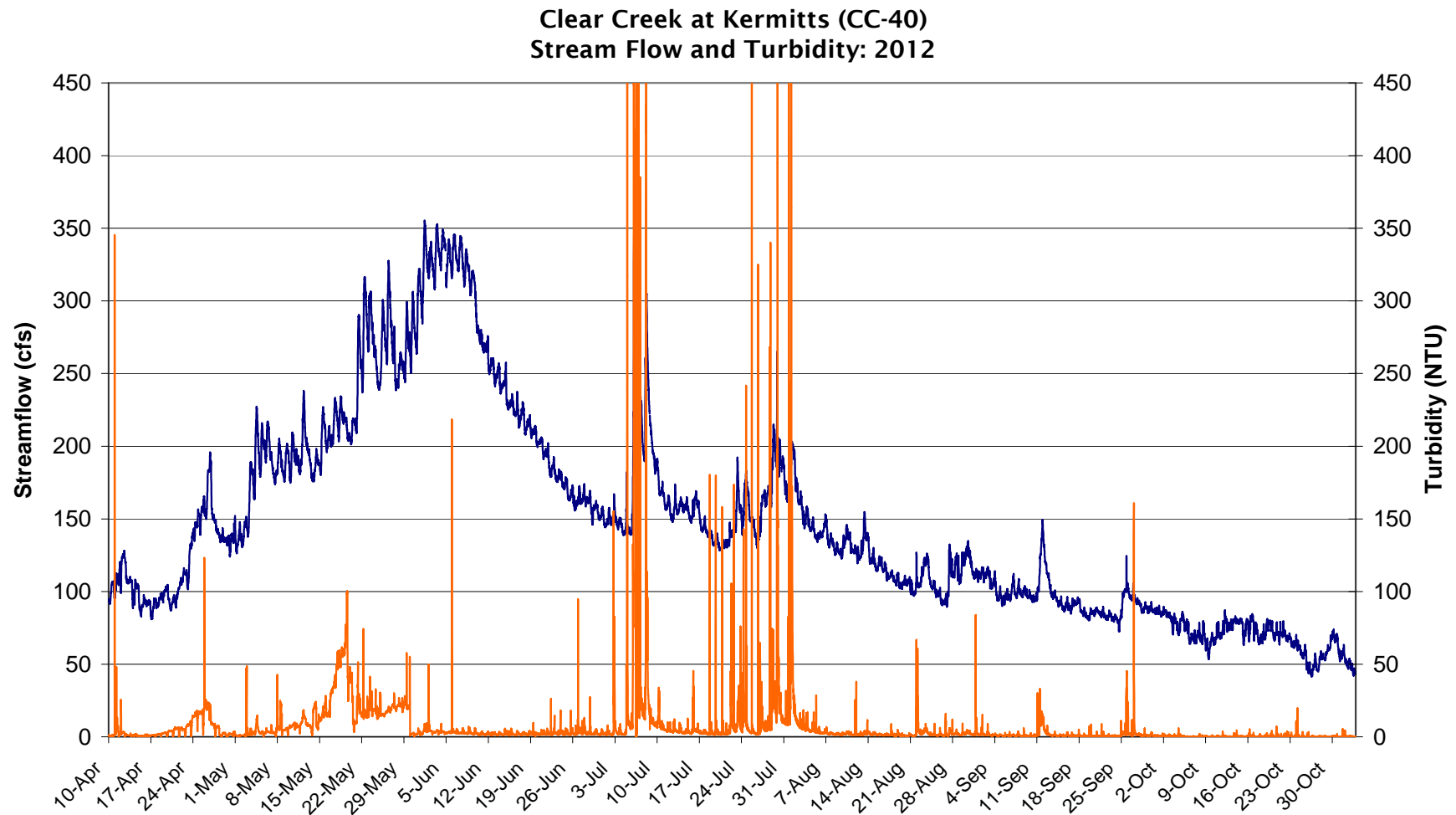
# Clear Creek Specific Conductance and Chloride



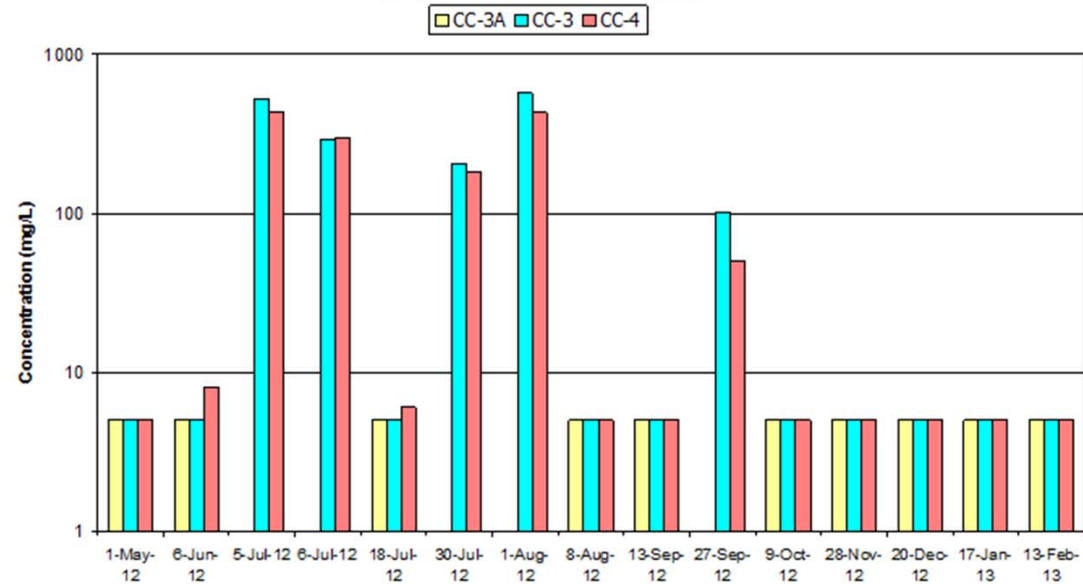
# Clear Creek CC-40 Chloride Trend



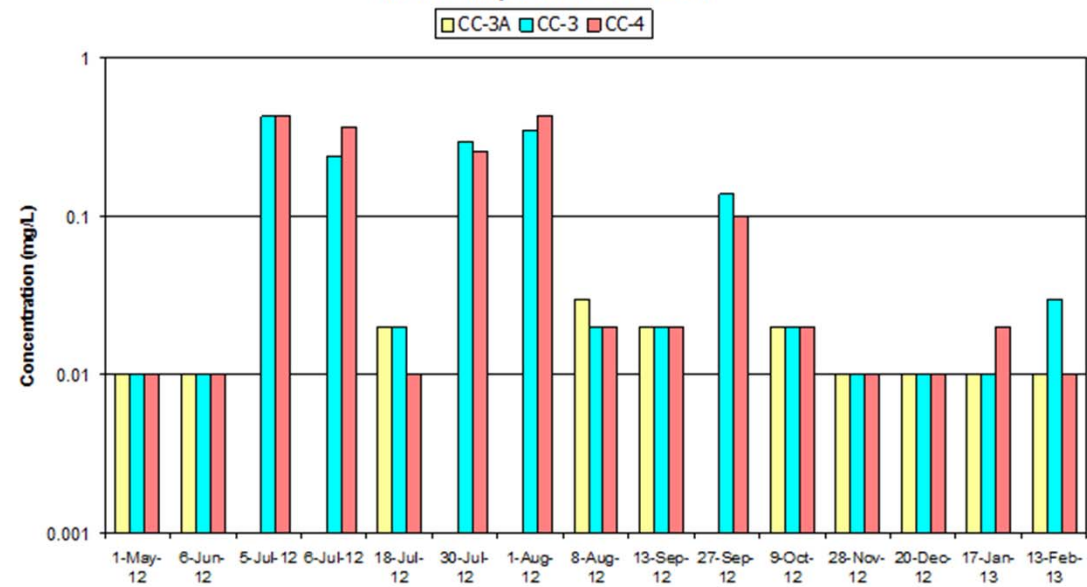
# Clear Creek CC-40 Flow and Turbidity



**Clear Creek Twin Tunnels Stations CC-3A, CC-3, CC-4  
Suspended Solids: 2012-2013**

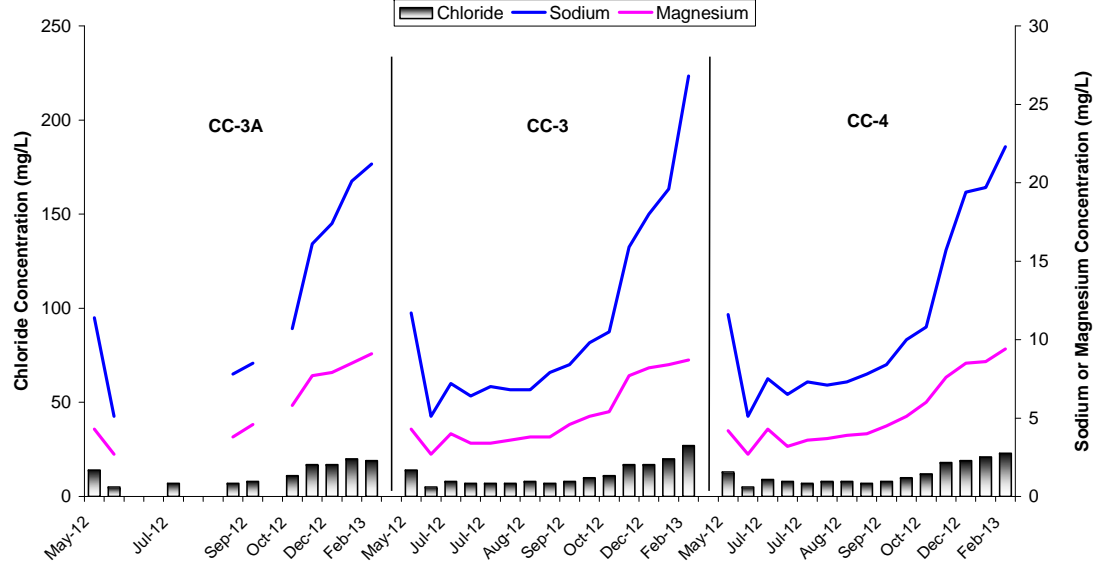


**Clear Creek Twin Tunnels Stations CC-3A, CC-3, CC-4  
Total Phosphorus: 2012-2013**

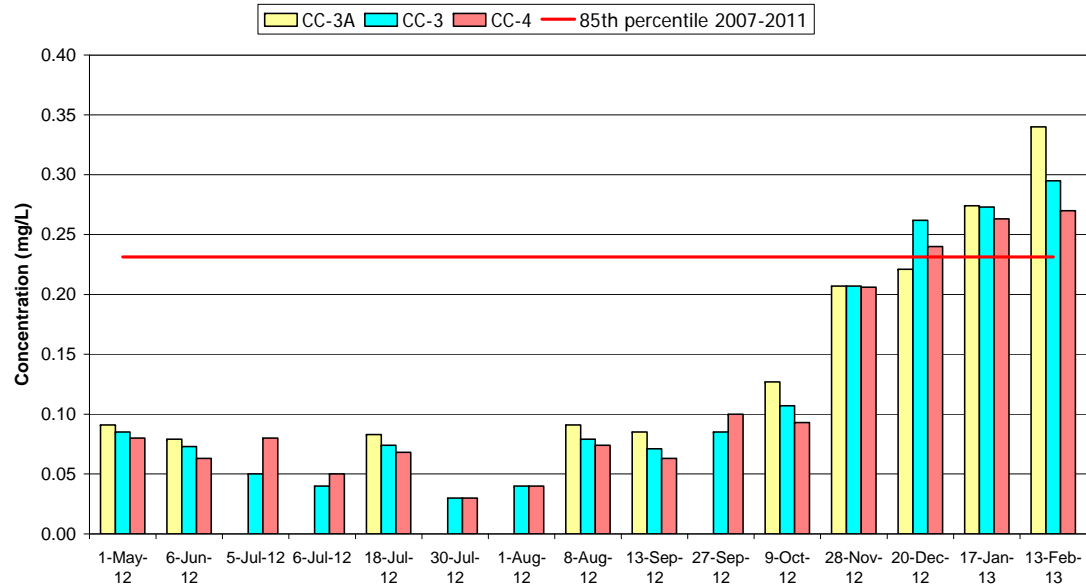




Clear Creek Twin Tunnels Stations CC-3A, CC-3, CC-4  
Chloride and Sodium/Magnesium: 2012-2013



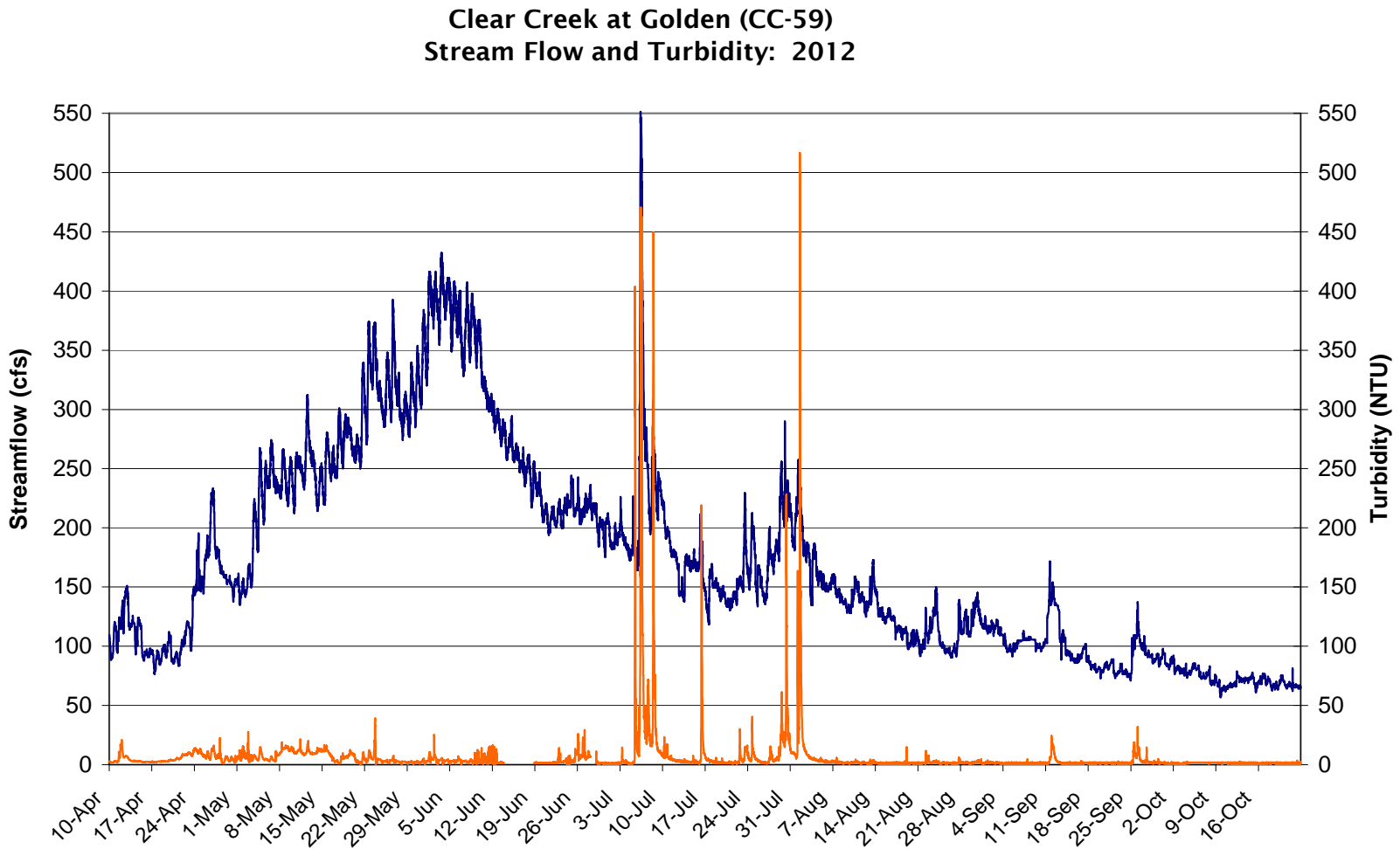
Clear Creek Twin Tunnels Stations CC-3A, CC-3, CC-4  
Zinc Dissolved: 2012-2013



## 2012 Samples at Clear Creek Station CC-59

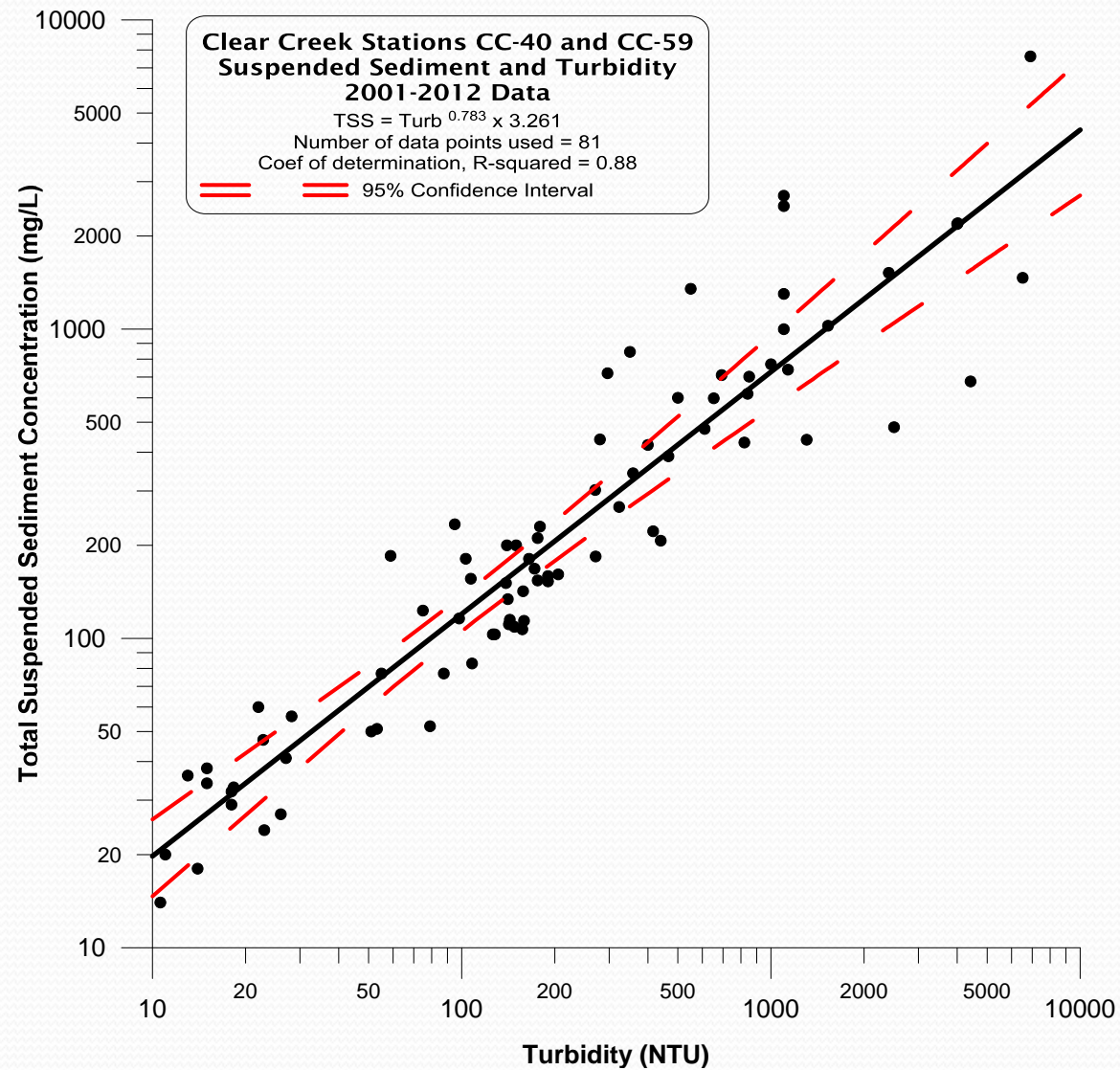
Date	Sample Type	Flow (cfs)
April 22	48-hr Ambient	98
April 23	48-hr Ambient	114
May 20	48-hr Ambient	271
May 21	48-hr Ambient	264
June 24	48-hr Ambient	211
June 24	48-hr Ambient	227
July 6	Event	177
July 7	Event	546
July 29	48-hr Ambient	181
July 30	48-hr Ambient	227
August 1	Event	226
August 2	Event	255
August 26	48-hr Ambient	97
August 27	48-hr Ambient	95
September 23	48-hr Ambient	77
September 24	48-hr Ambient	80

# Clear Creek CC-59 Flow and Turbidity



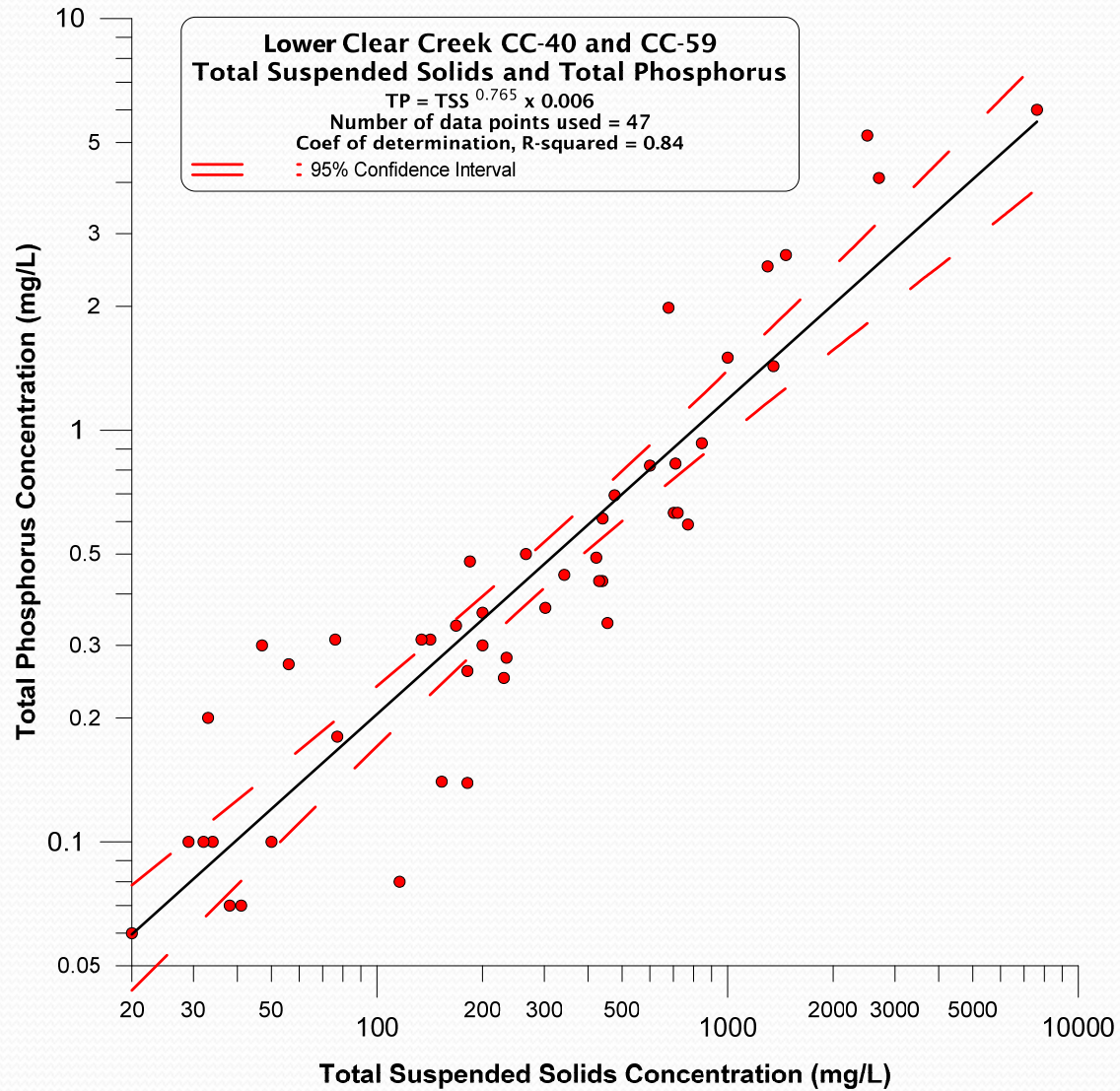


# Clear Creek Turbidity and TSS



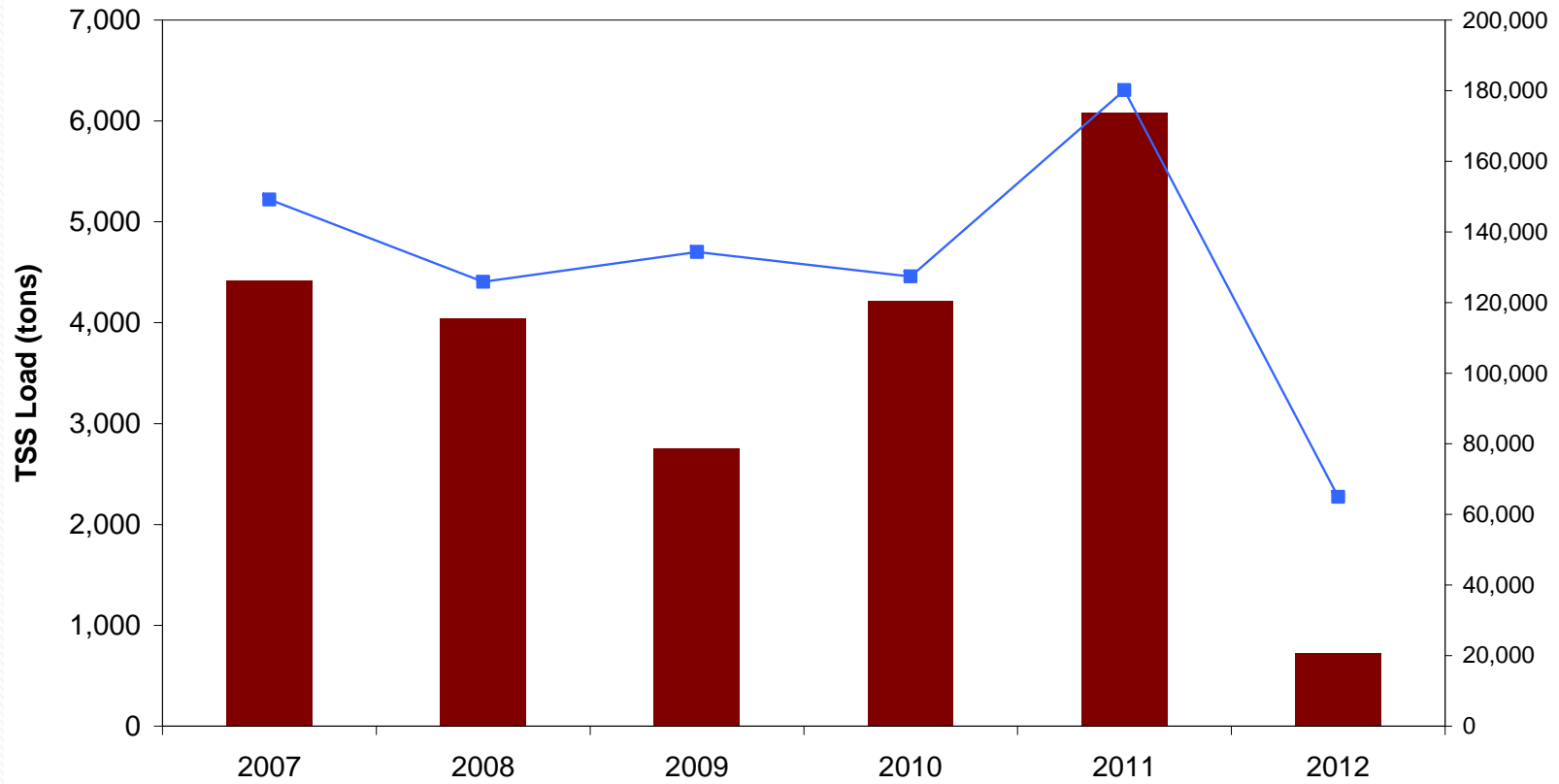


# Clear Creek CC-40/CC-59 Total Phosphorus and TSS



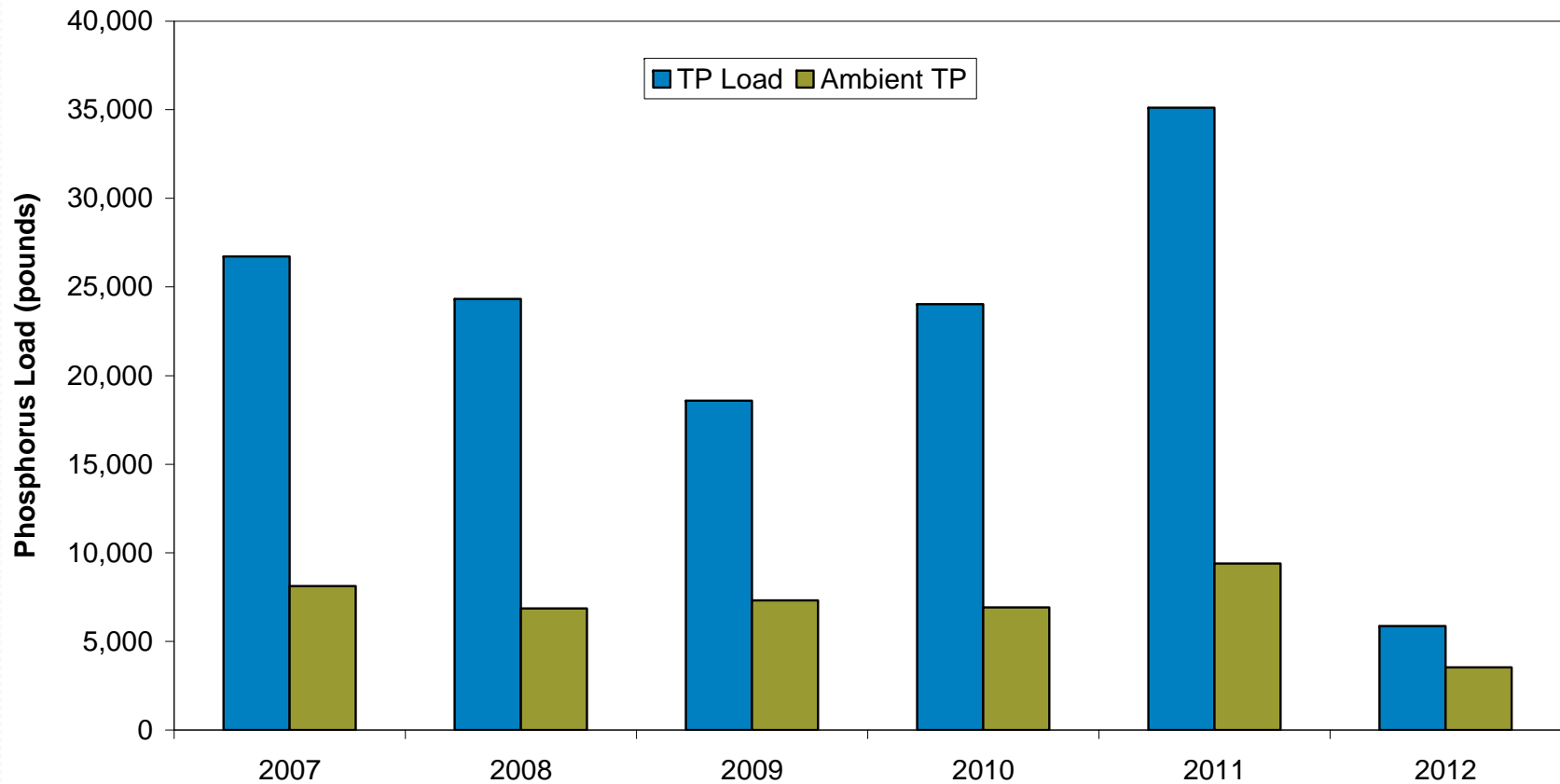
# Clear Creek CC-59 TSS Load

Clear Creek Station CC-59  
April 15 to October 15 Total Suspended Solids Load



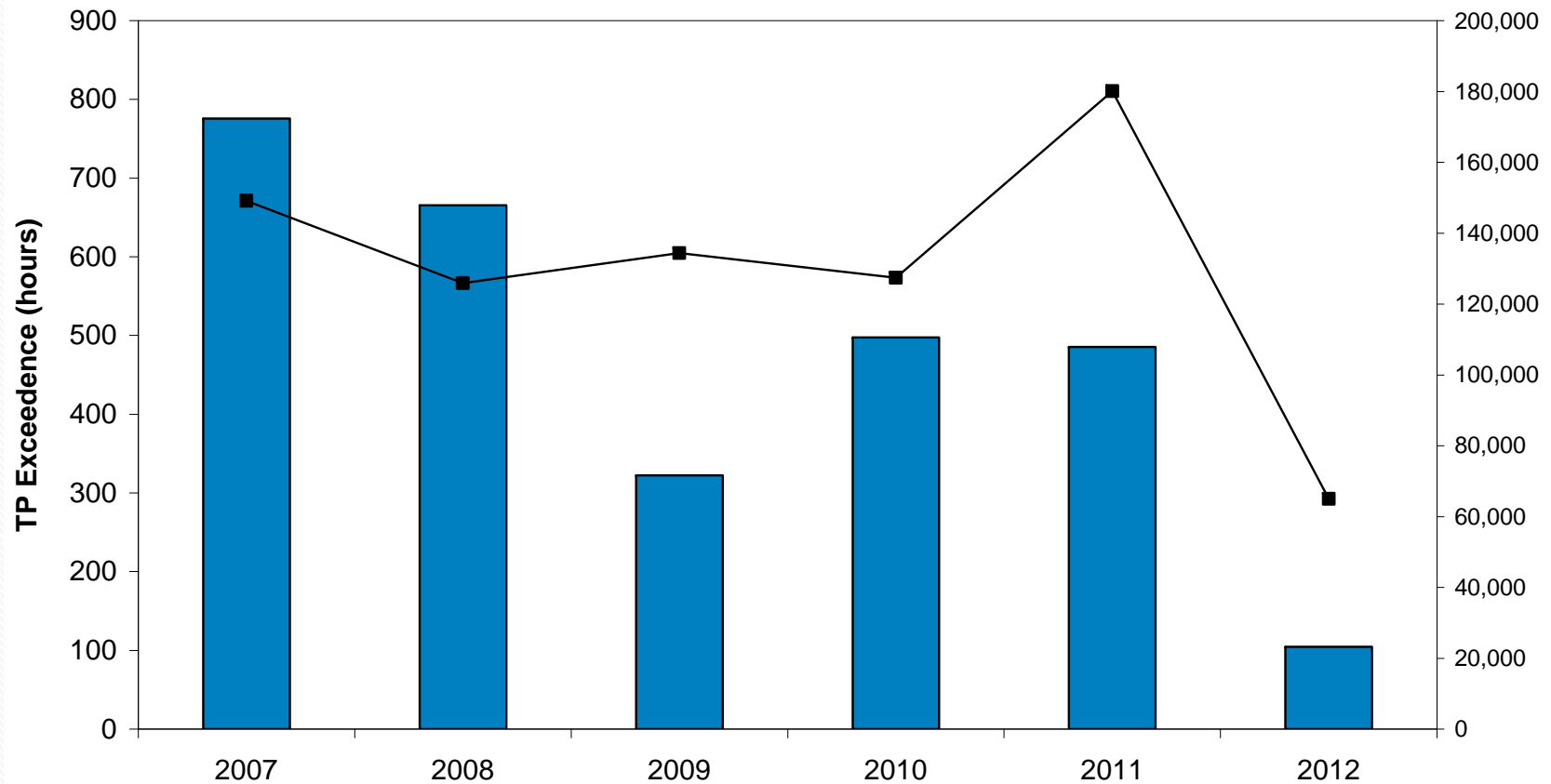
# Clear Creek CC-59 Phosphorus Load

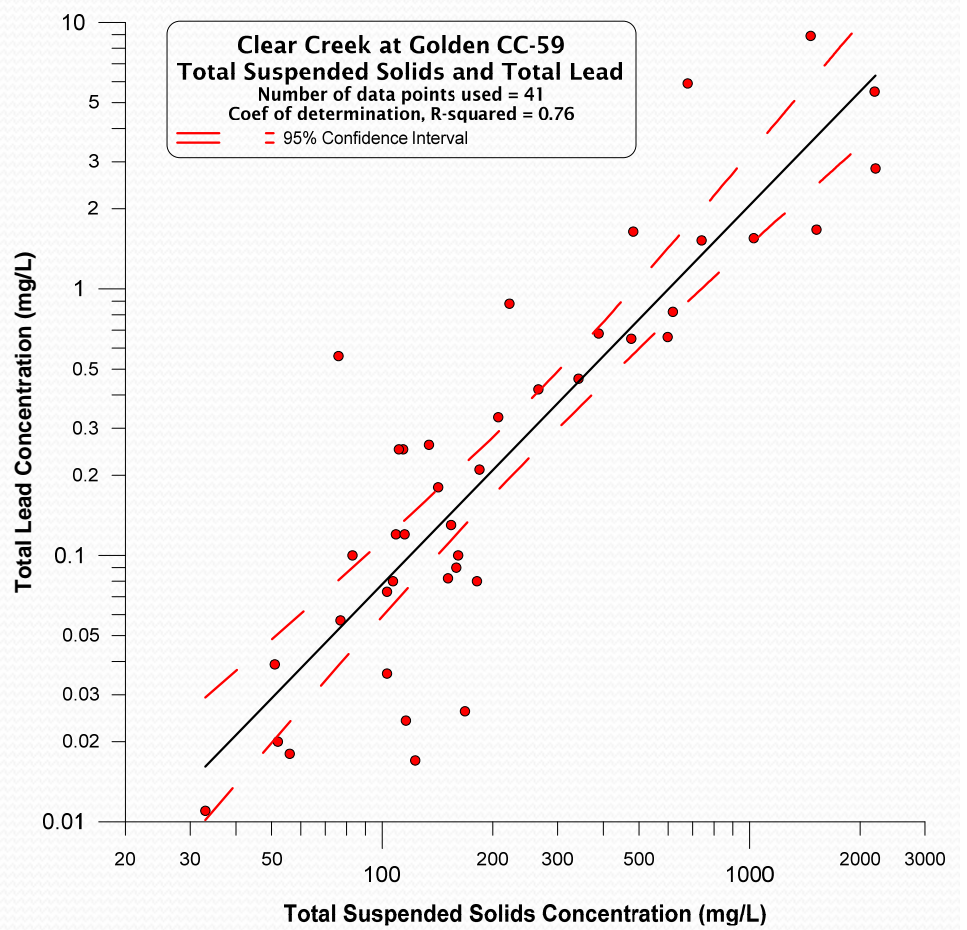
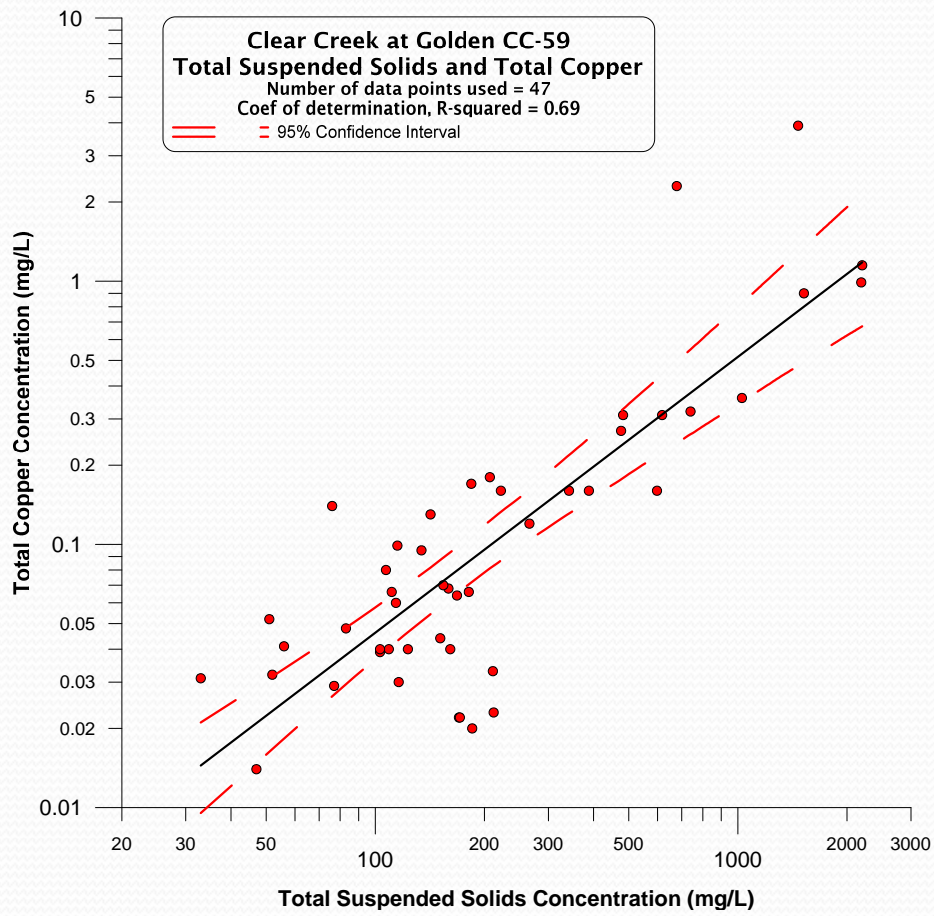
Clear Creek Station CC-59  
April 15 to October 15 Total Phosphorus Load

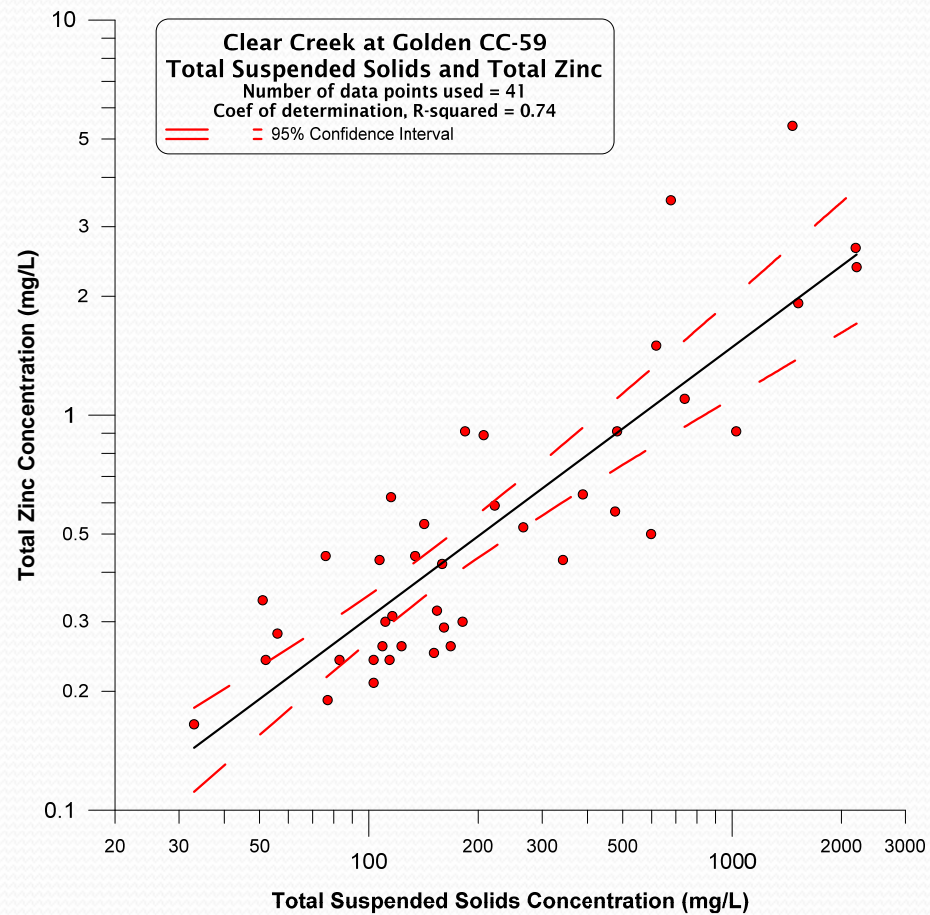
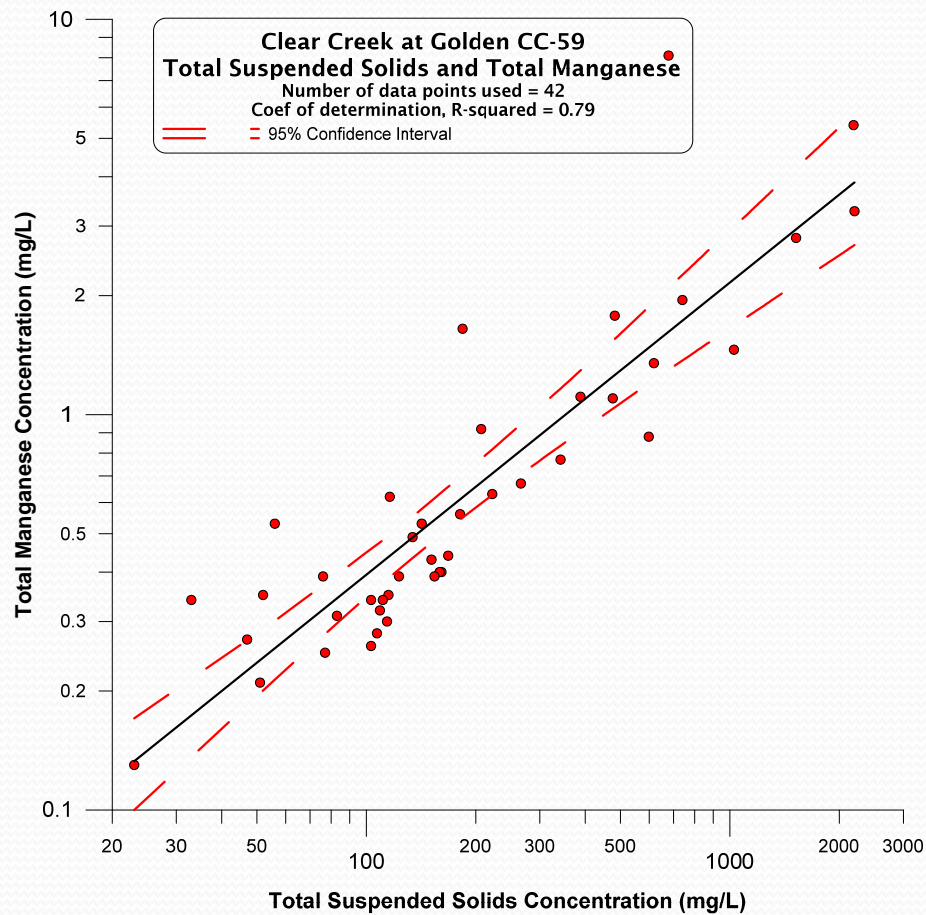


# Clear Creek Phosphorus Exceedence By Year

Clear Creek Station CC-59  
Number of Hours Total Phosphorus Exceeded 0.11 mg/L Standard











## Clear Creek Summary

- Flows in 2012 were only 61 percent of average
- Continuous recording in-stream water quality monitoring probes have provided more complete water quality characterization while reducing the need to collect samples
- Robust statistical correlations have been established between SC/chloride and turbidity/suspended solids/total phosphorus
- Maximum chloride shows a slight increasing trend but remained below standards in winter 2011 and 2012
- Highway construction at Twin Tunnels did not contribute to any appreciable changes in Clear Creek water quality during 2012
- High TSS is correlated with high nutrient and total metal concentrations that exceed standards each year
- Approximately 30-35% of seasonal total phosphorus load is ambient while 65-70% is attributable to nonpoint sources