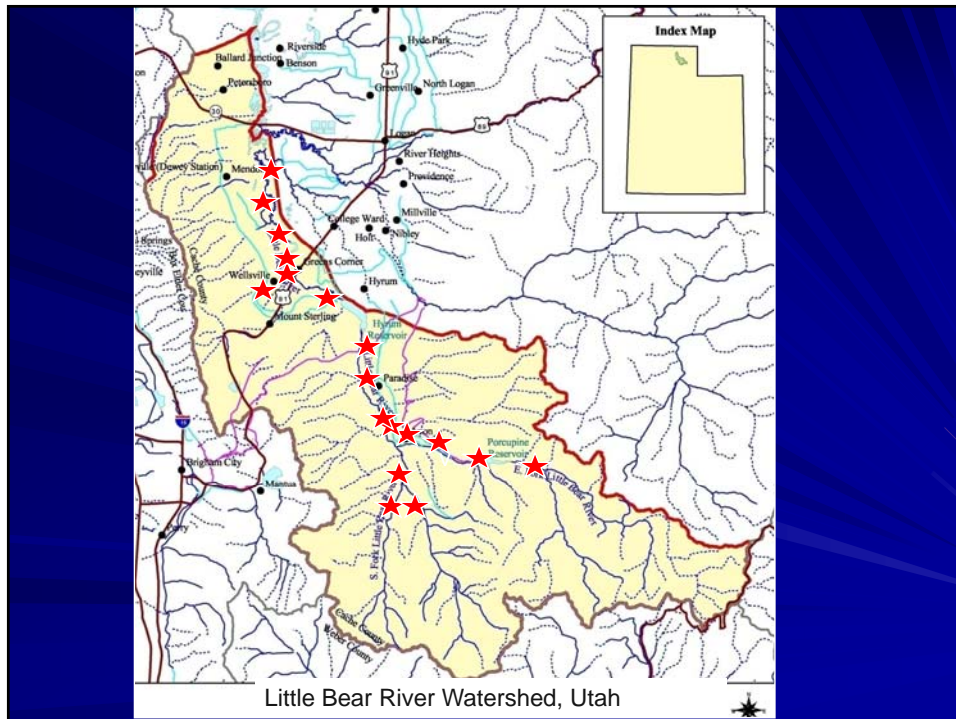


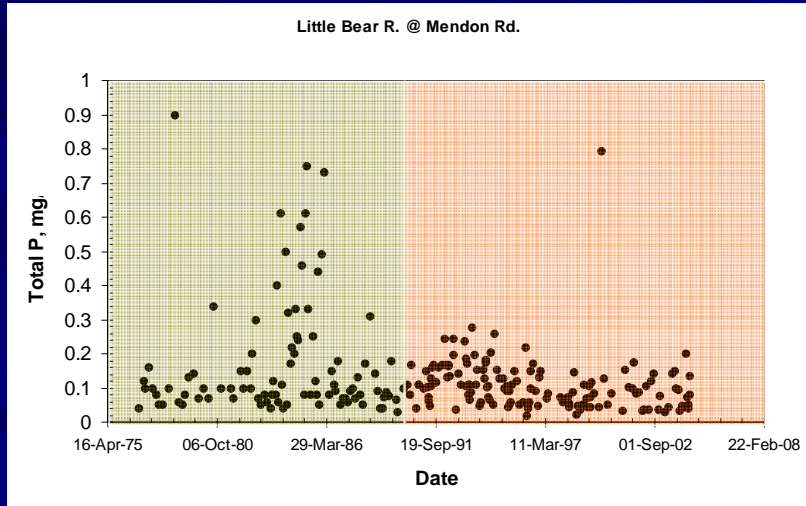
Little Bear River Conservation Effectiveness Assessment Project

Objectives

- Determine if past implementations of agricultural BMPs resulted in improved water quality in the Little Bear River
- Investigate changes in practices from producer perspective: How persistent are behavioral changes. Do behaviors change over the long term, how effective are outreach / education efforts...
- **Critically examine the strengths and weaknesses of different water quality monitoring approaches, particularly wrt identifying changes at a watershed scale.**



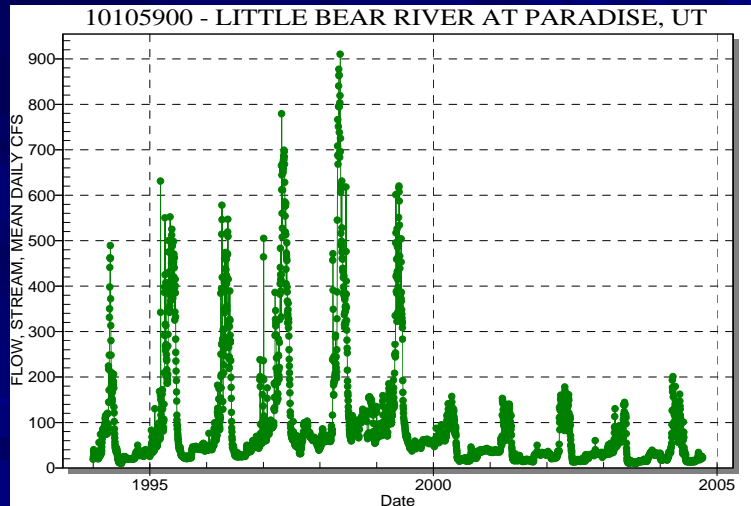
Has water quality improved?



Total Observations at Mendon Road site

	Discharge	Total phosphorus	
1976 - 2004:	162	241	
1994 - 2004:	72	99	
1994	11	13	} Number of observations each year
1995	10	13	
1996	10	13	
1997	11	4	
1998	6	10	
1999	7	10	
2000	6	5	
2001	4	7	
2002	2	8	
2003	4	8	
2004	1	8	

Between year variability



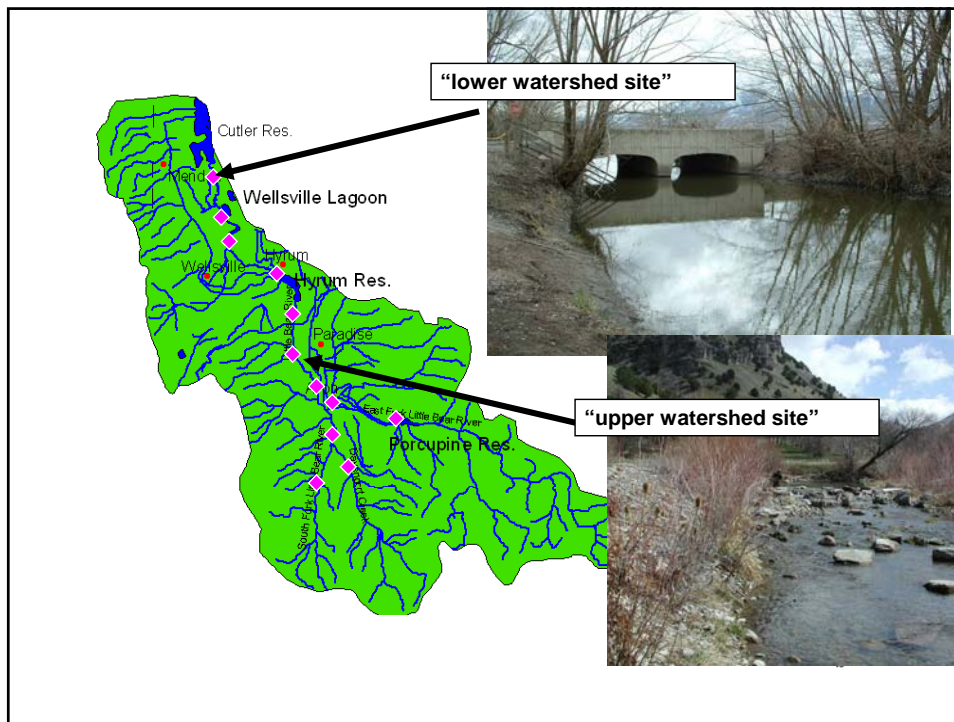
High frequency flow and turbidity data used..

➤ to determine concentrations and loads (TSS and TP)

➤ To characterize:

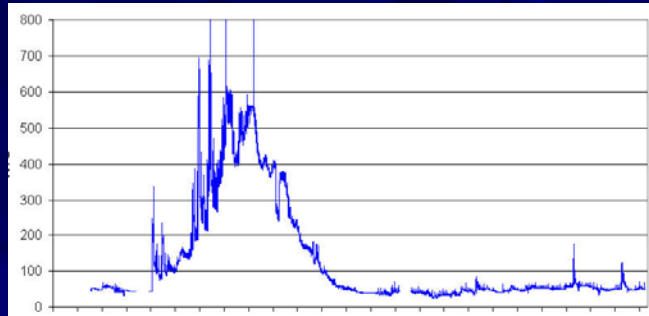
- Variability over time
 - Sampling frequency
 - Timing of sampling
- Variability between sites
- Contribution of storm events and major runoff events



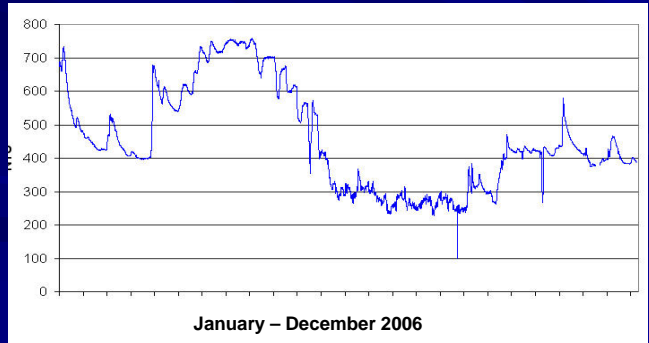


Additional monitoring:

- Automated sampling of storm events at two sites
- Ongoing monitoring program by Utah Division of Water Quality
- Periodic grab samples to establish Flow / TSS and TSS/TP relationship

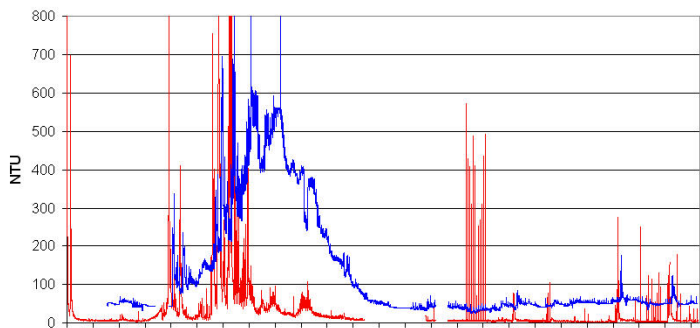


**Upper Site
Flow (cfs)**

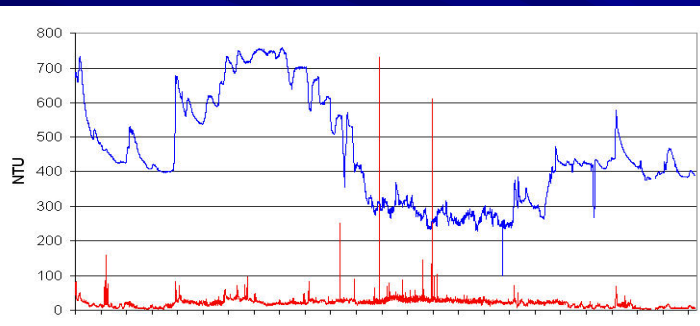


**Lower Site
Flow (cfs)**

January – December 2006

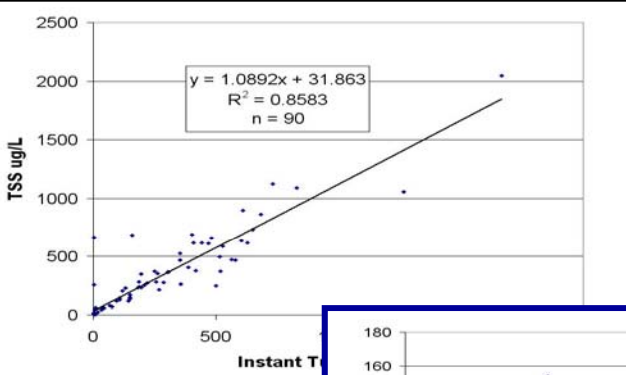
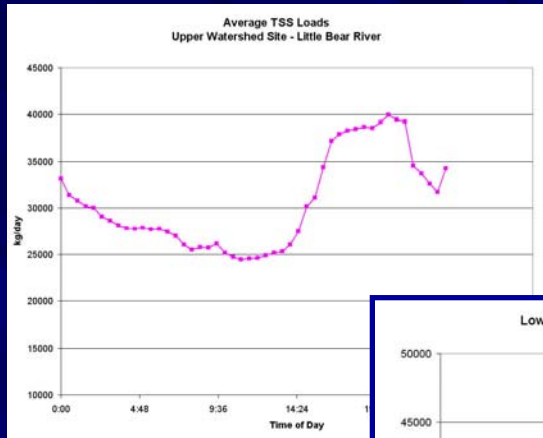


**Upper Site
Flow (cfs)
and turbidity**



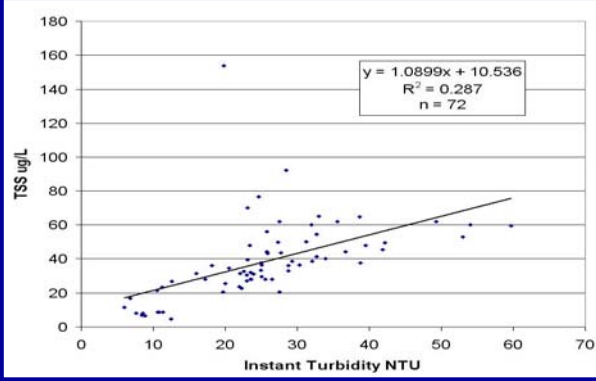
**Lower Site
Flow (cfs)
and turbidity**

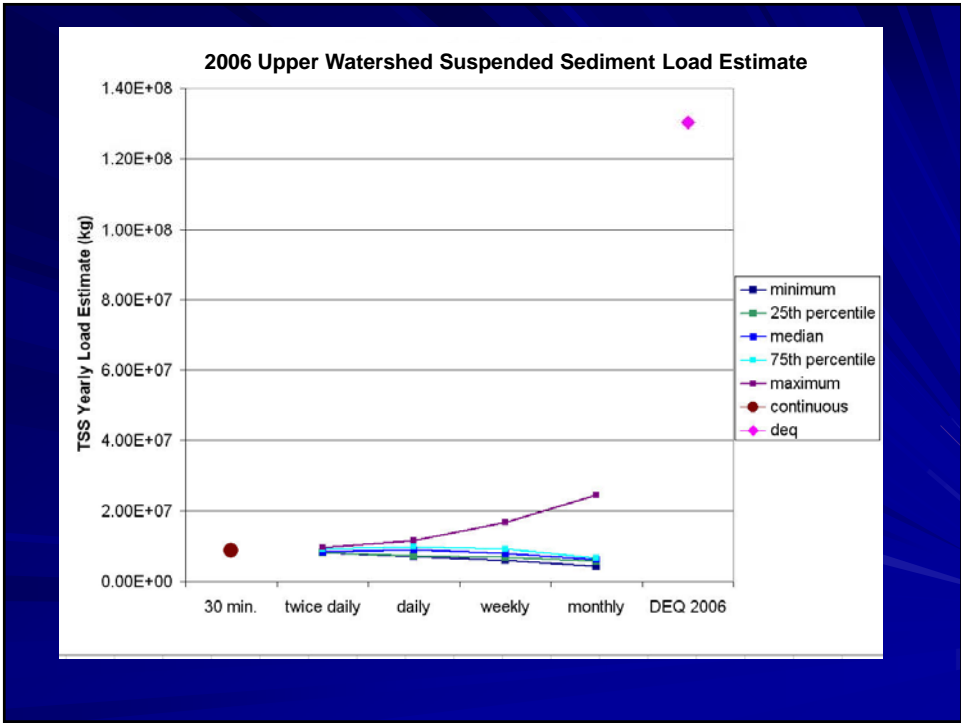
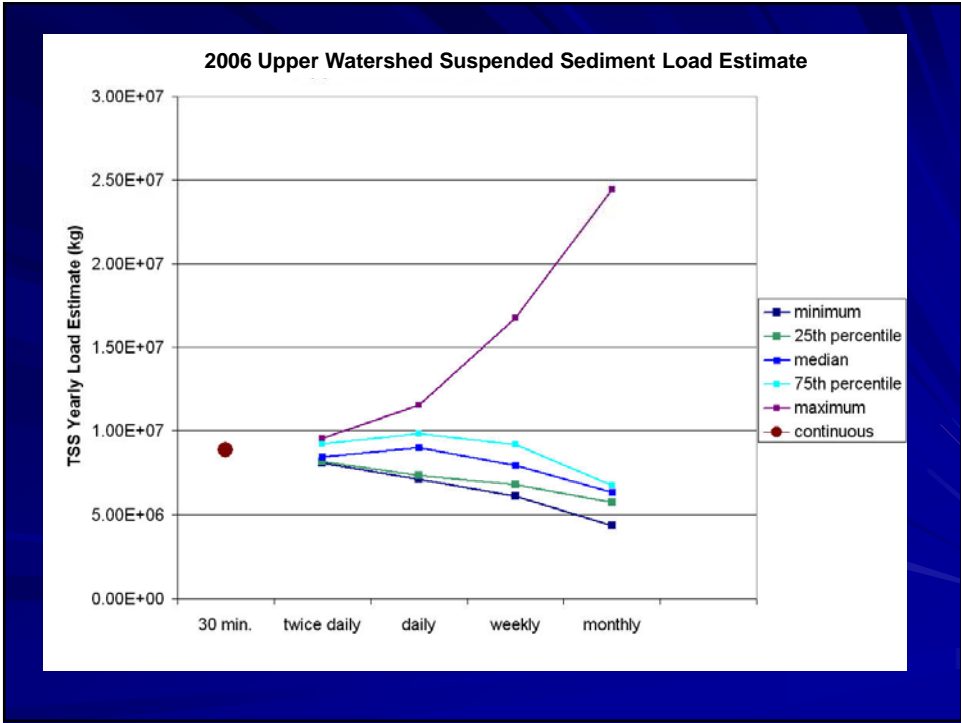
January – December 2006



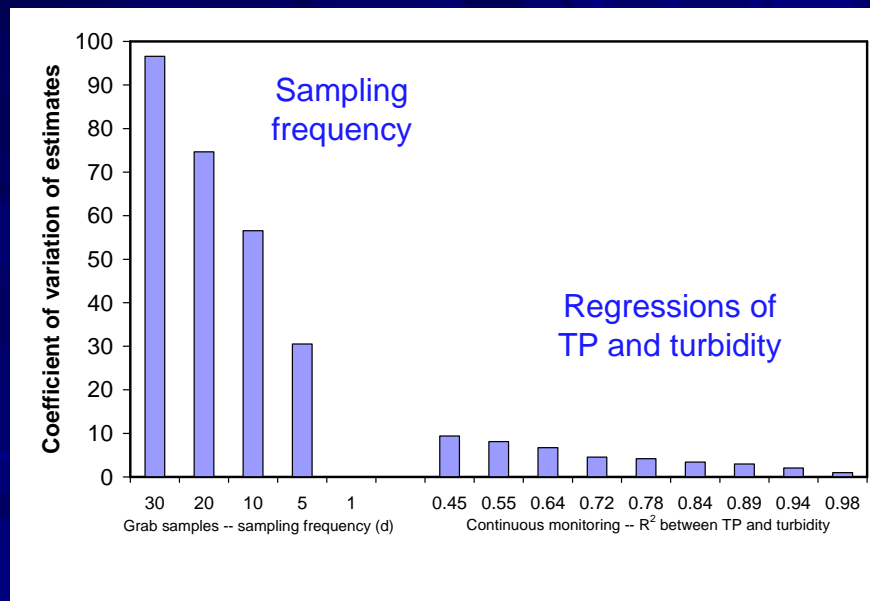
Upper Site
Turbidity vs TSS

Lower Site
Turbidity vs TSS

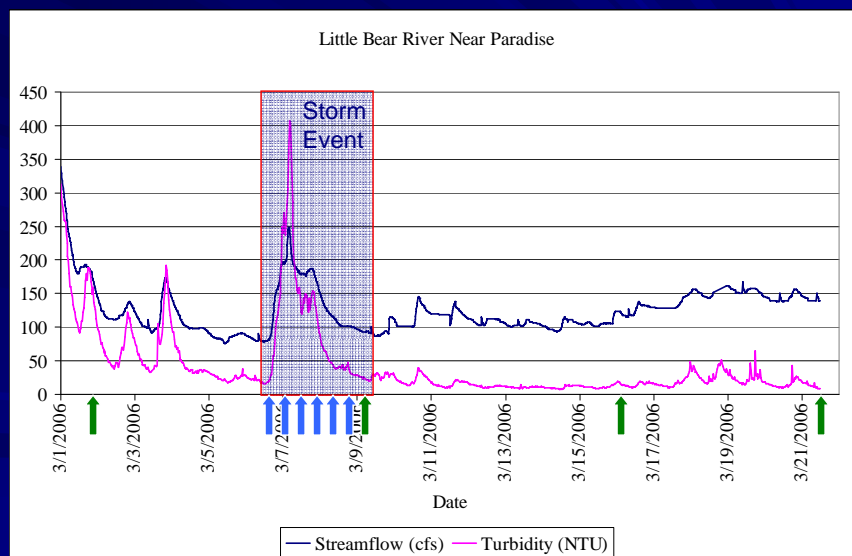


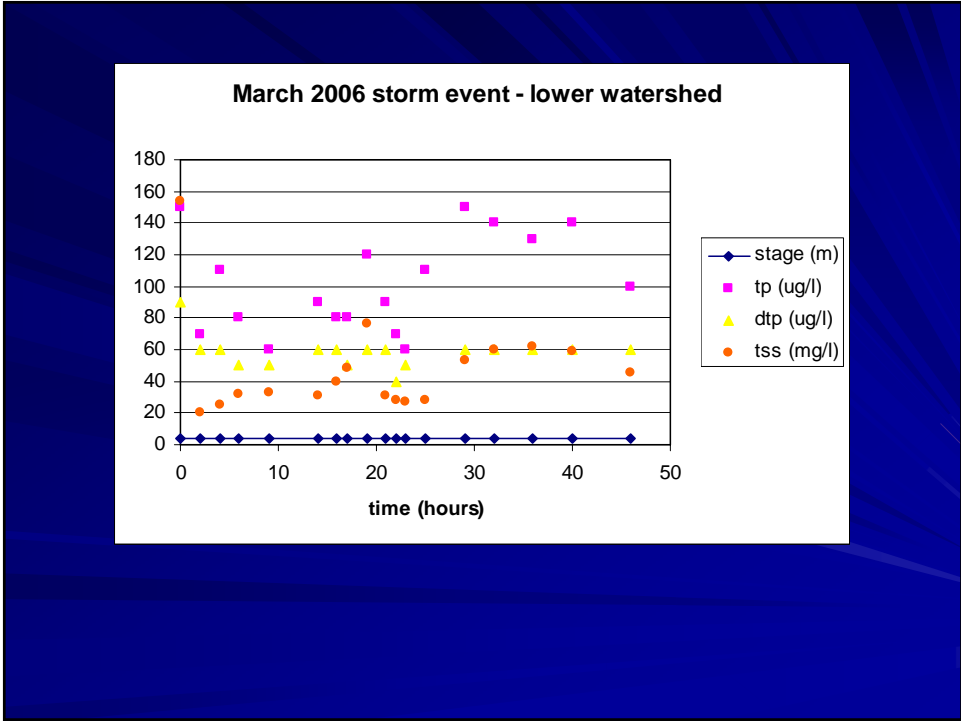
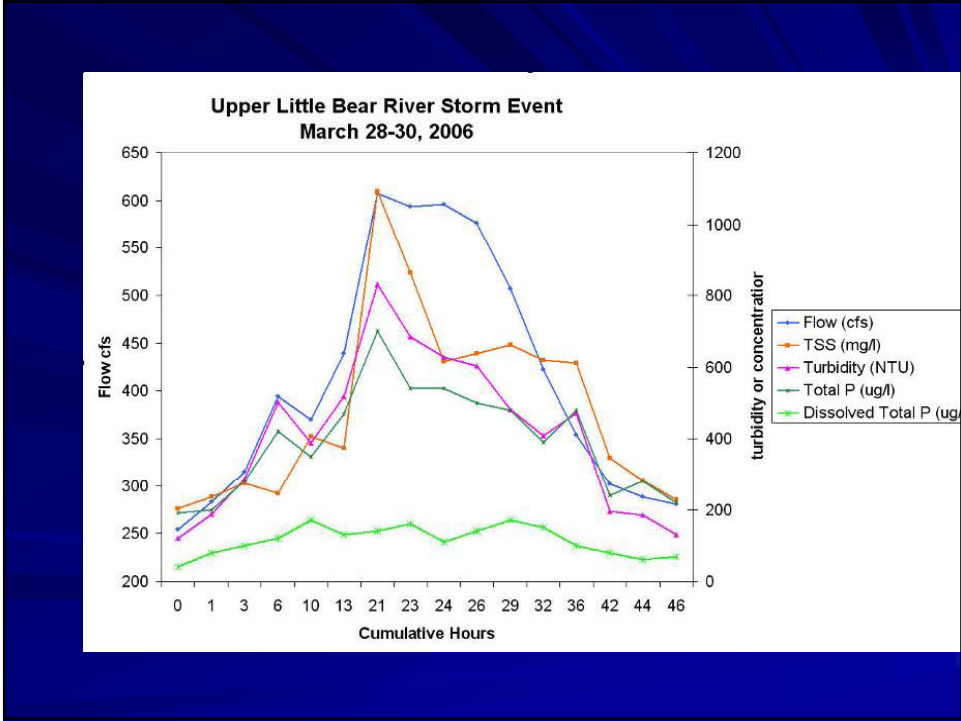


The relative importance of different sources of variability



Continuous Monitoring Data Little Bear River Near Paradise





<u>TSS Load</u>	<u>Upper Site</u>	<u>Lower Site</u>
Annual (kg)	8.9 X 10 ⁶	1.4 X 10 ⁷
Runoff (% of total)	89%	54%
Baseflow (% of total)	11%	46%
Storms (% of baseflow)	<1%	16%

Conclusions

- High frequency surrogate monitoring can greatly improve estimates of loads
- Monthly sampling results in highly variable loading estimates.
- Predictable diel patterns → potential for systematic error
- Two sites in same watershed show very different annual patterns
- In west, spring runoff delivers up to 90% of total load
- Storms may represent significant portion of baseflow loads