DESIGNING MONITORING PROGRAMS TO EVALUATE BMP EFFECTIVENESS

Nancy Mesner - Utah State University, Dept of Watershed Sciences
Ginger Paige - University of Wyoming
David Stevens, Jeff Horsburgh, Doug Jackson-Smith, Darwin Sorensen, Ron Ryel – USU

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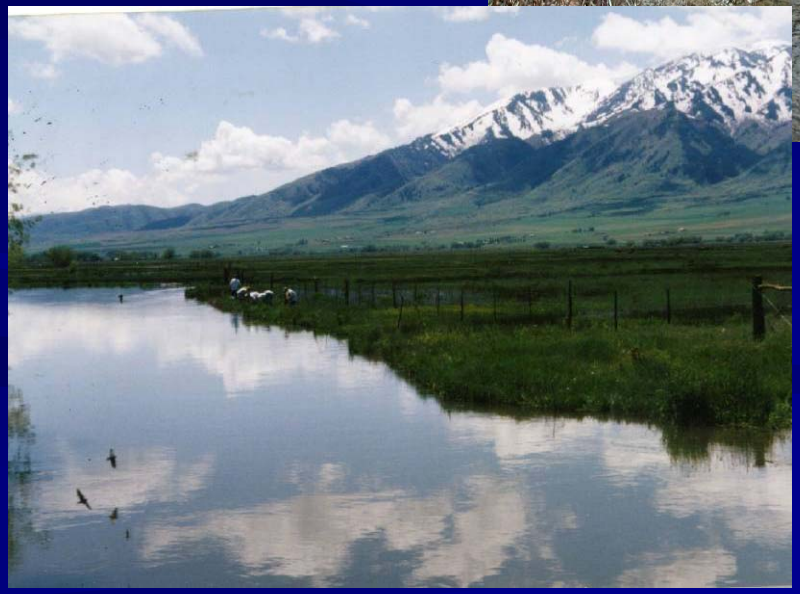
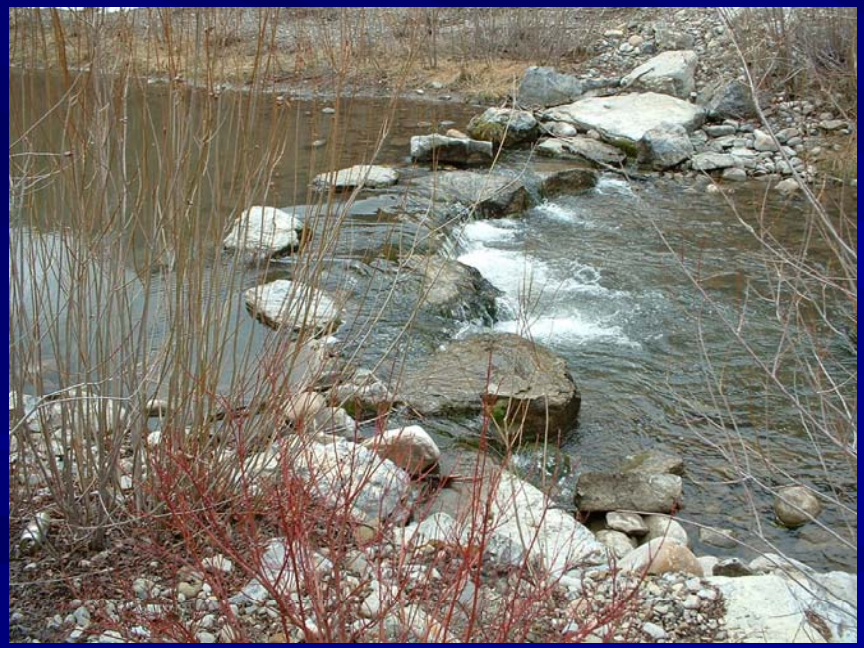
Examples from the Little Bear River CEAP Project



Pre-treatment problems:
Bank erosion, manure management, flood irrigation problems

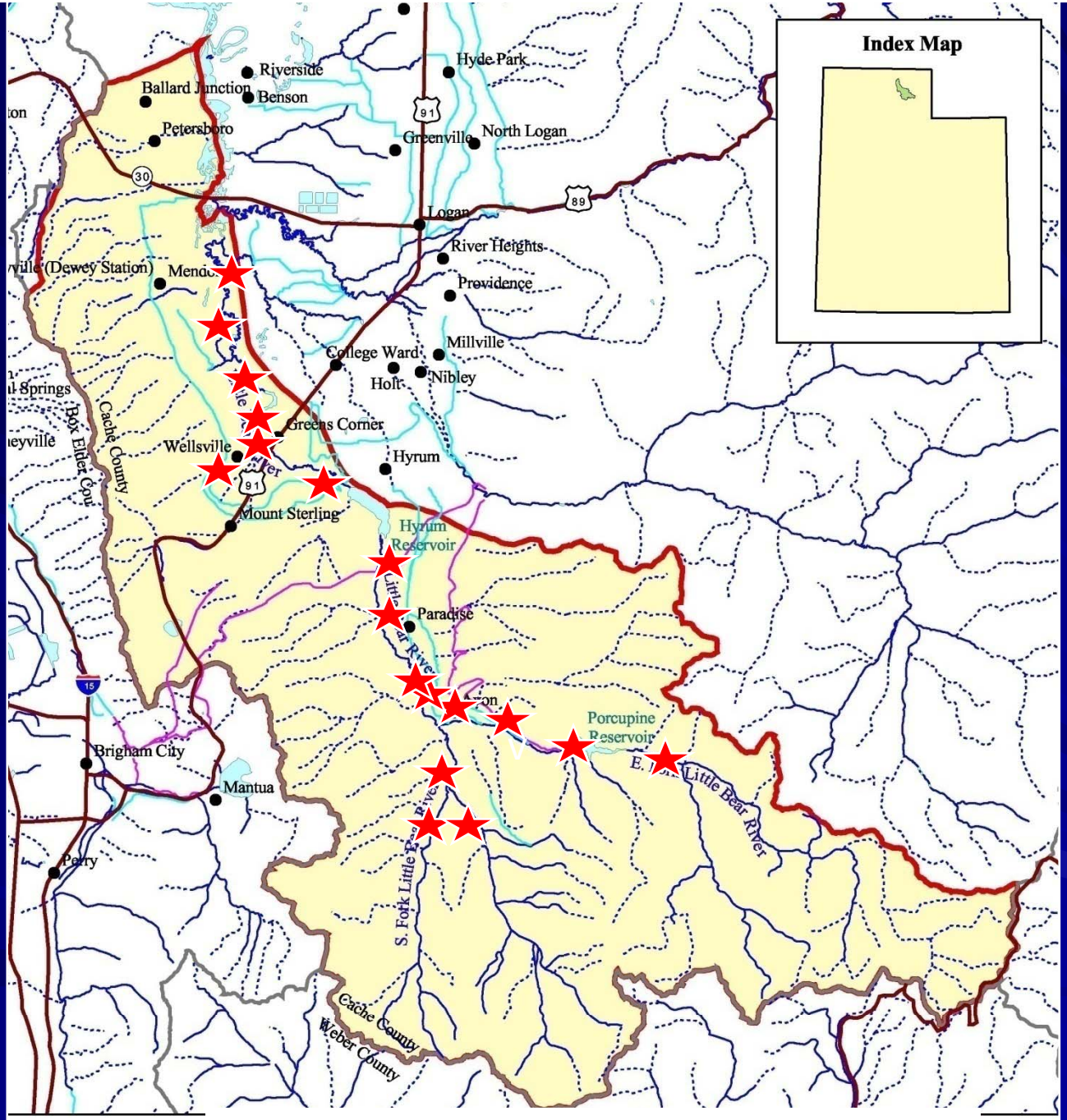


Treatments:

- bank stabilization,
- river reach restoration,
- off-stream watering,
- improved manure and water management

Common problems in BMP monitoring programs:

- Failure to design monitoring plan around BMP objectives
- A failure to understand pollutant pathways and transformations and sources of variaiblity in these dynamic system.
- Tend to draw on a limited set or inappropriate approaches



Little Bear River Watershed, Utah

Total Observations at Watershed Outlet site

	Discharge	Total phosphorus
1976 - 2004:	162	241
1994 - 2004:	72	99
1994	11	13
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

Number of observations each year

- Failure to design monitoring plan around BMP objectives
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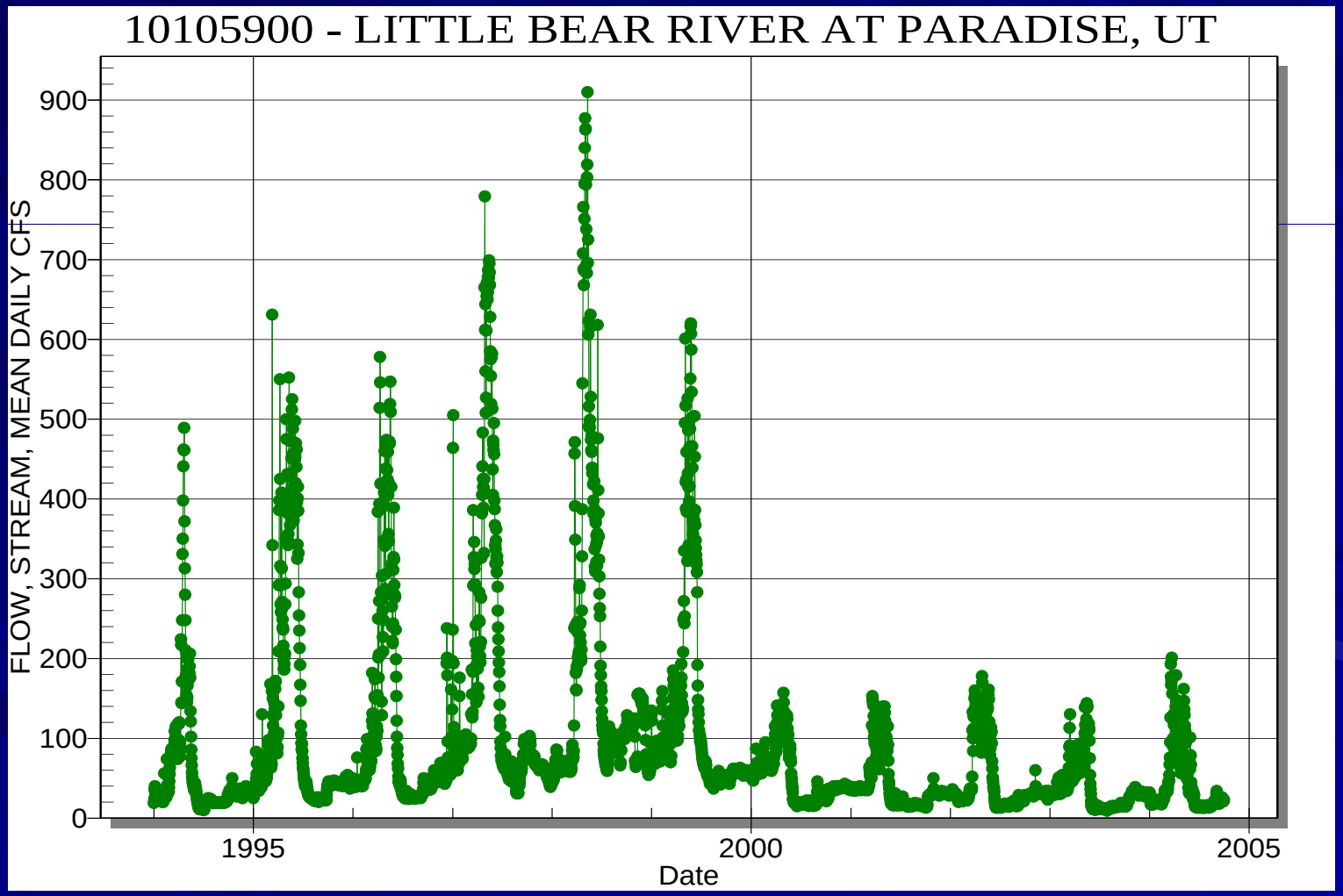
Understanding natural variability – annual variation



Since 2005, measure flow and turbidity at 30 minute intervals

Stage recording devices to estimate discharge

http://www.campbellsci.com

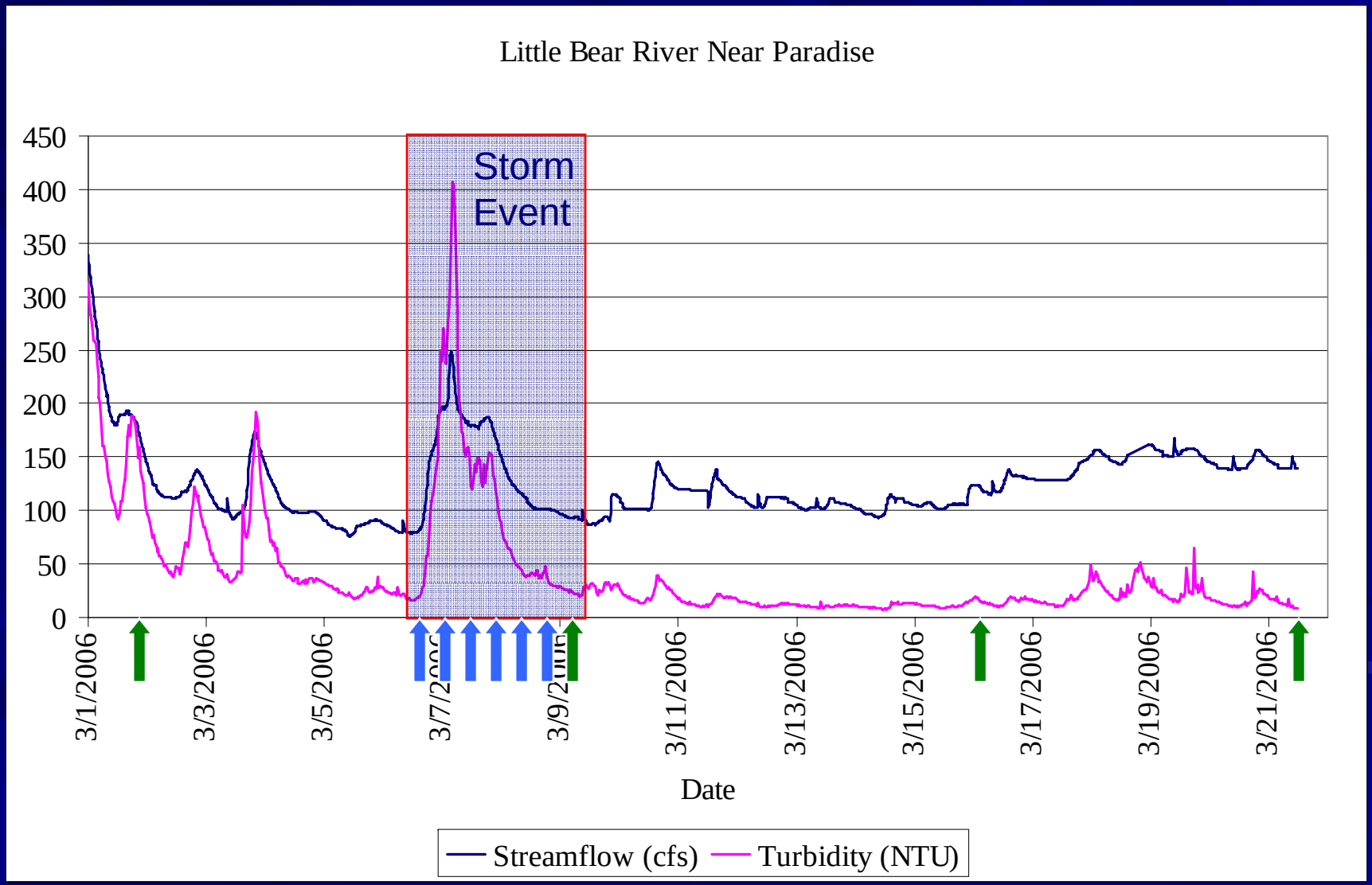
Turbidity sensors

http://www.ftsinc.com/

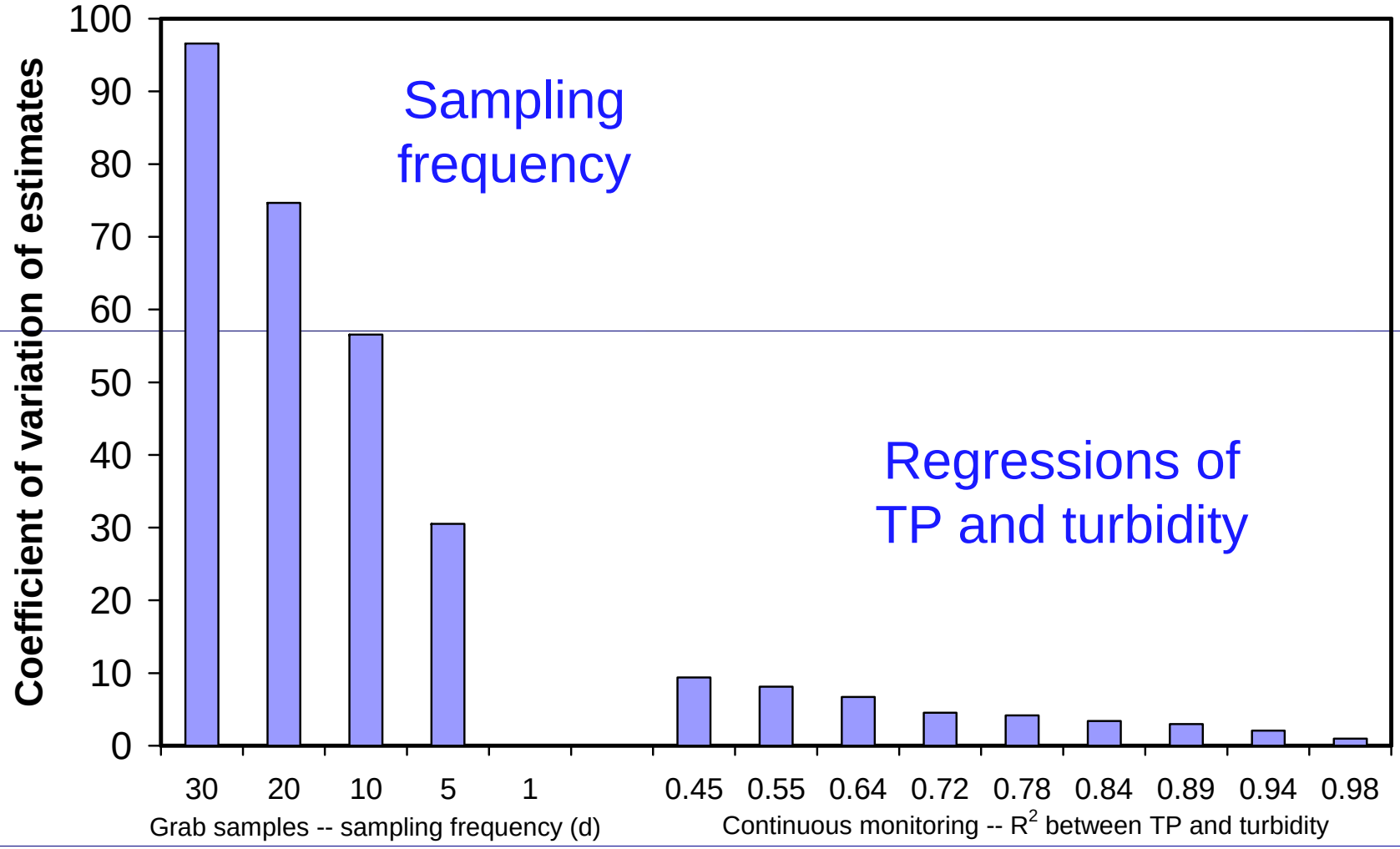
Dataloggers and telemetry equipment

http://www.campbellsci.com

Capturing pollutant movement from source to waterbody.



The relative importance of different sources of variability



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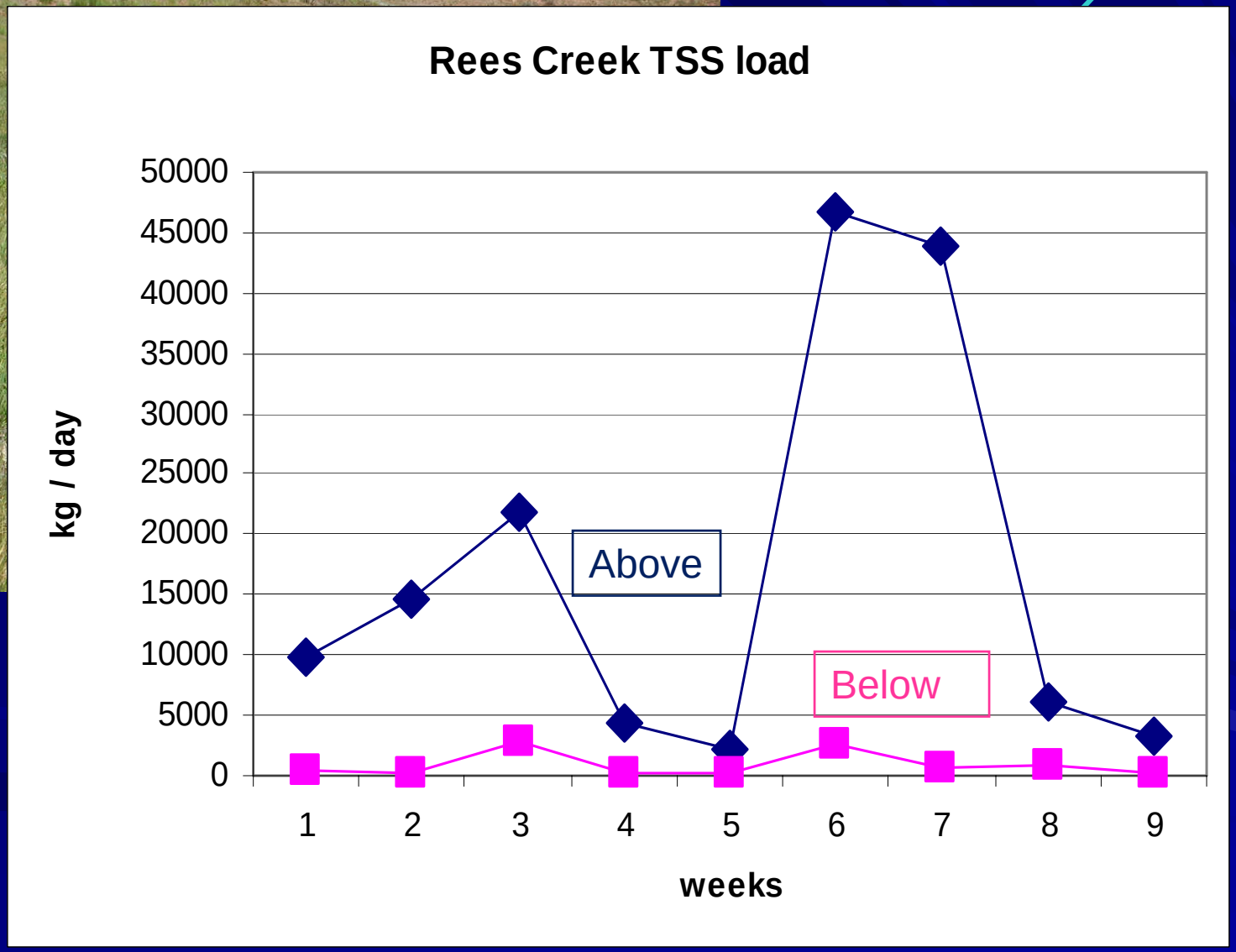
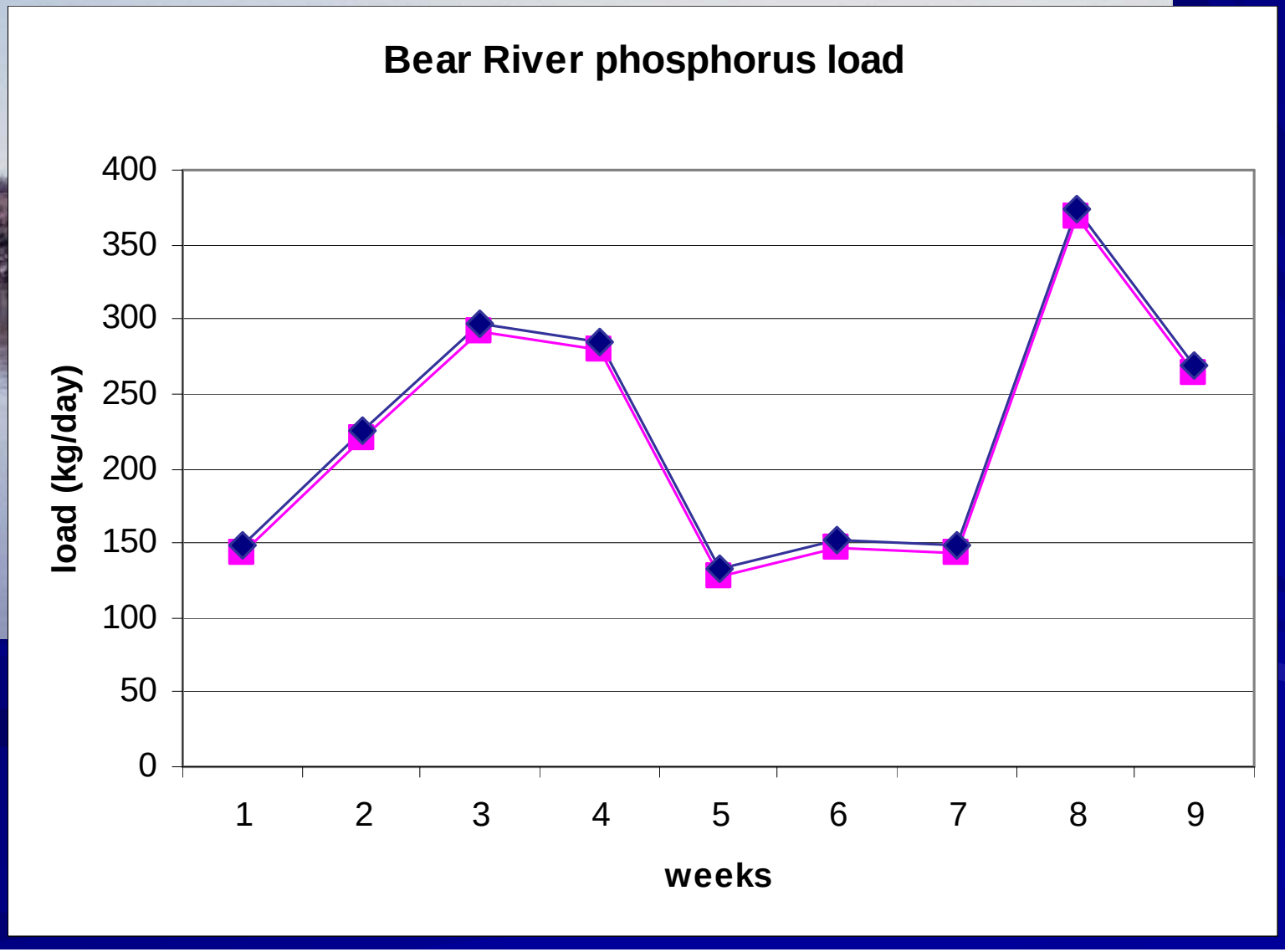
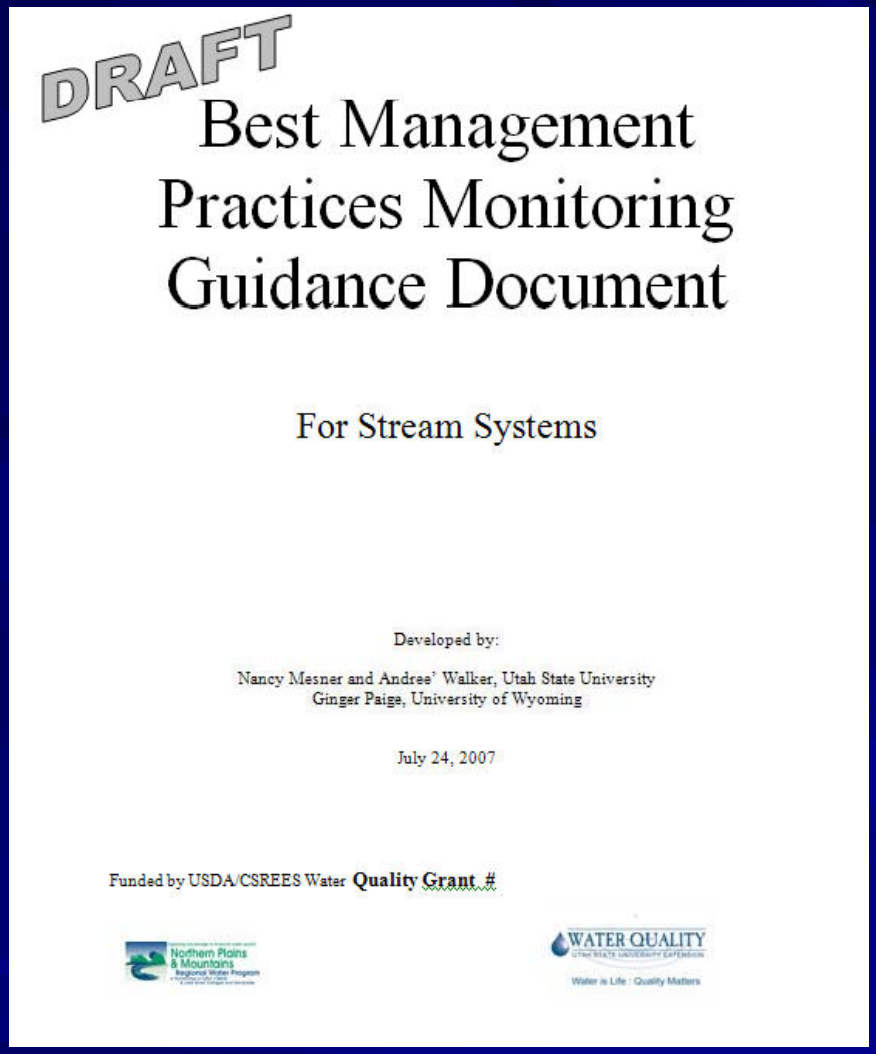
Problems with “one-size-fits-all” monitoring design




Bear River phosphorus load
load (kg/day)
400
350
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
weeks



DRAFT

Best Management Practices Monitoring Guidance Document

For Stream Systems

Developed by:

Nancy Mesner and Andree' Walker, Utah State University
Ginger Paige, University of Wyoming

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Northern Plains & Mountains Regional Water Program

WATER QUALITY
UTAH STATE UNIVERSITY EXTENSION
Water is Life : Quality Matters

Focuses on the considerations and decisions necessary as a project is first being considered.

NOT a “how-to” manual of protocols

Document in review
Training workshops underway

What is your objective?

- ✓ Long term trends?
- ✓ UPDES compliance?
- ✓ Educational?
- ✓ Assessment for impairment?
- ✓ Track response from an implementation?

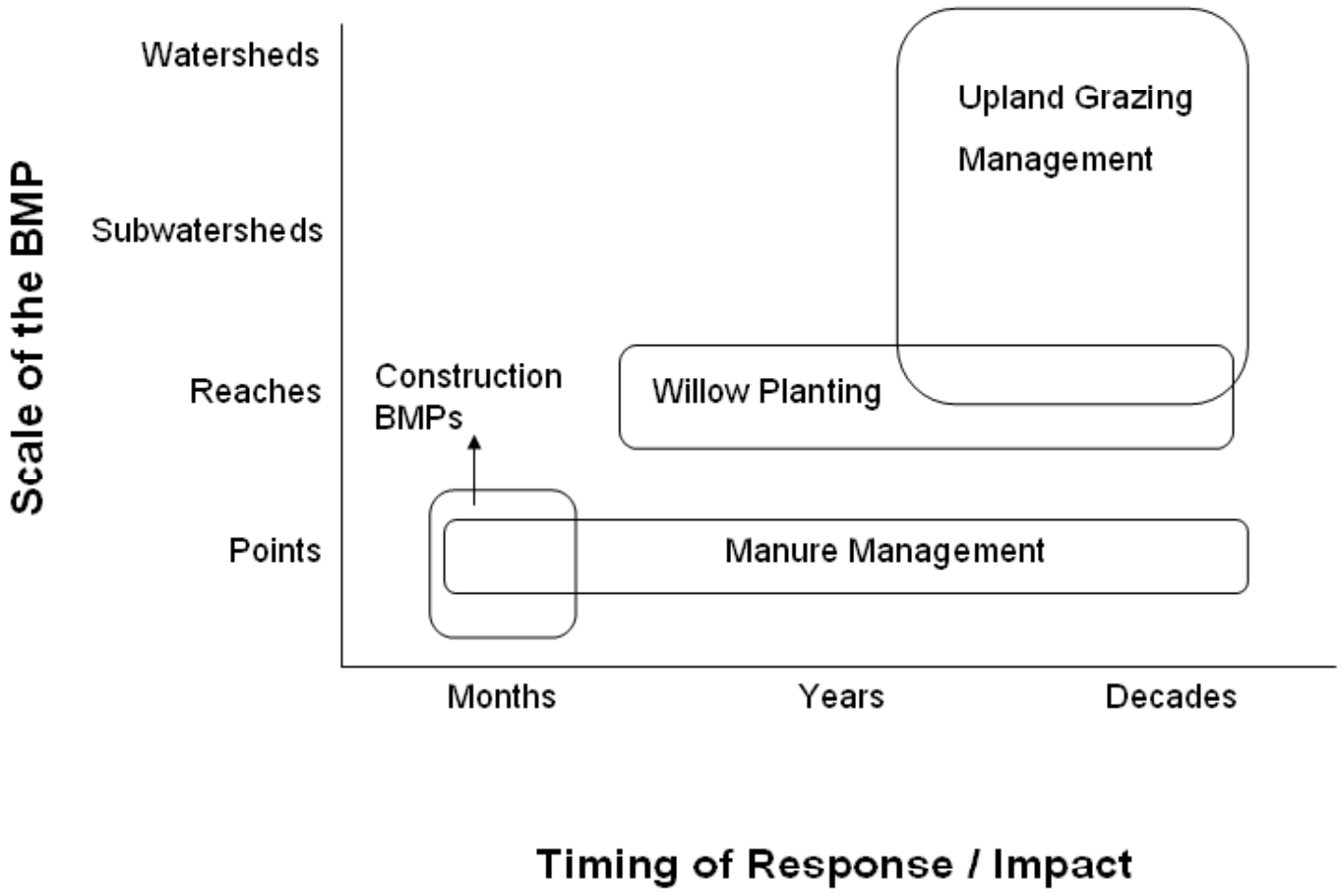
How do pollutants “behave” within your watershed.

- ✓ How does the pollutant move from the source to the waterbody?
- ✓ How is the pollutant processed or transformed within a waterbody?
- ✓ What is the natural variability of the pollutant? Will concentrations change throughout a season? Throughout a day?
- ✓ What long term changes within your watershed may also affect this pollutant?
- ✓ What else must be monitored to help interpret your data?

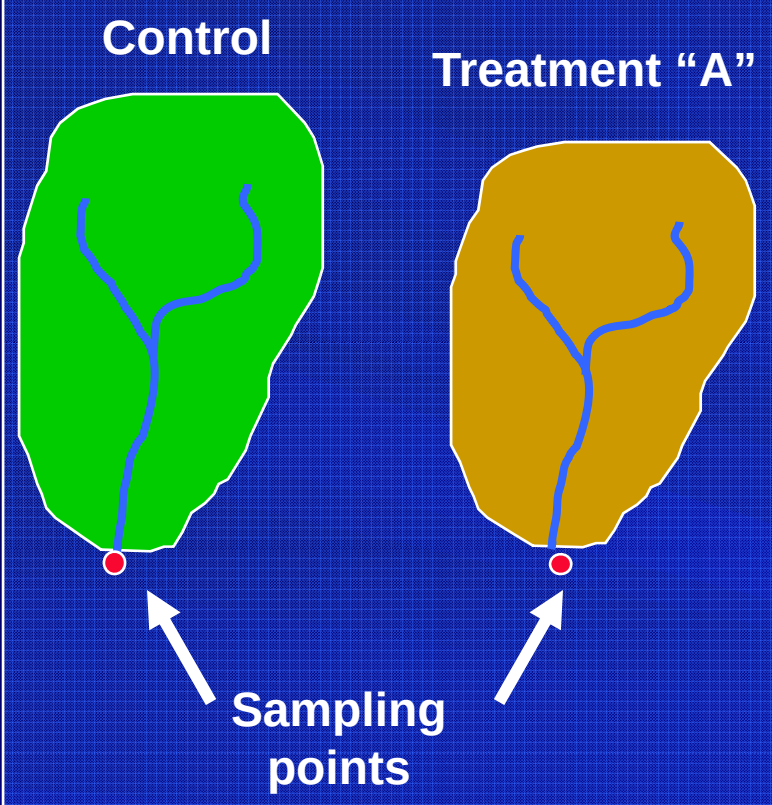
What to monitor?

- Monitor the pollutant(s) of concern?
- Monitor a “surrogate” variable?
- Monitor a response variables?
- Monitor the impacted beneficial use?
- Monitor the BMP itself?
- Monitor human behavior?
- Model the response to a BMP implementation.
- Collect other data necessary to interpret monitoring results OR calibrate and validate the model?

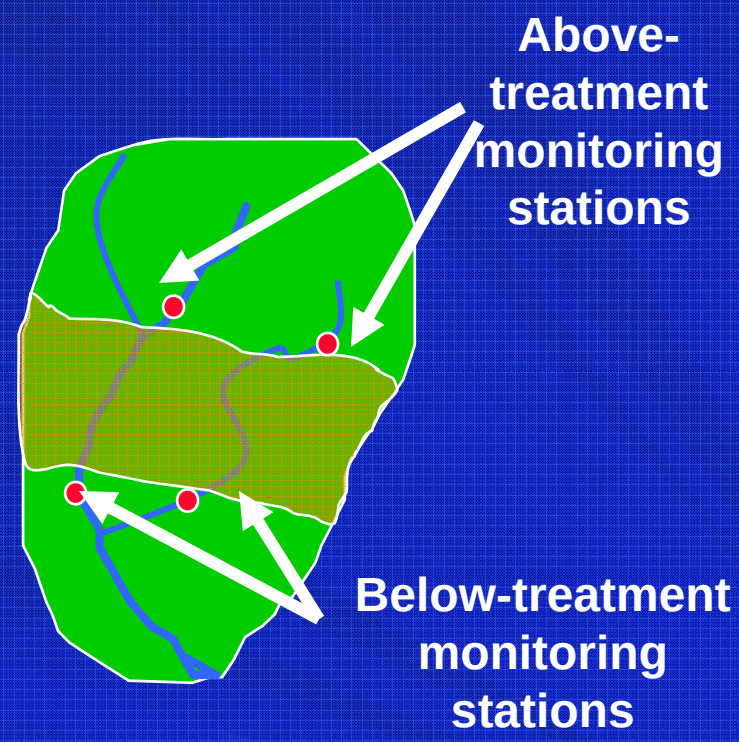
Where and when to monitor?



Choose appropriate monitoring or modeling



BACI Design

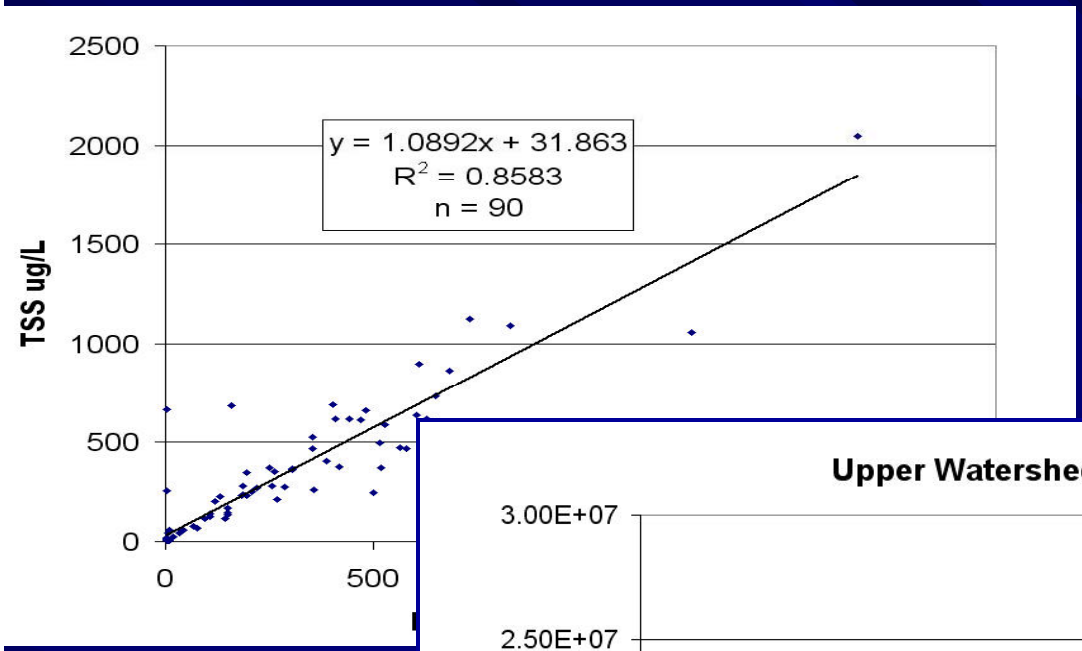
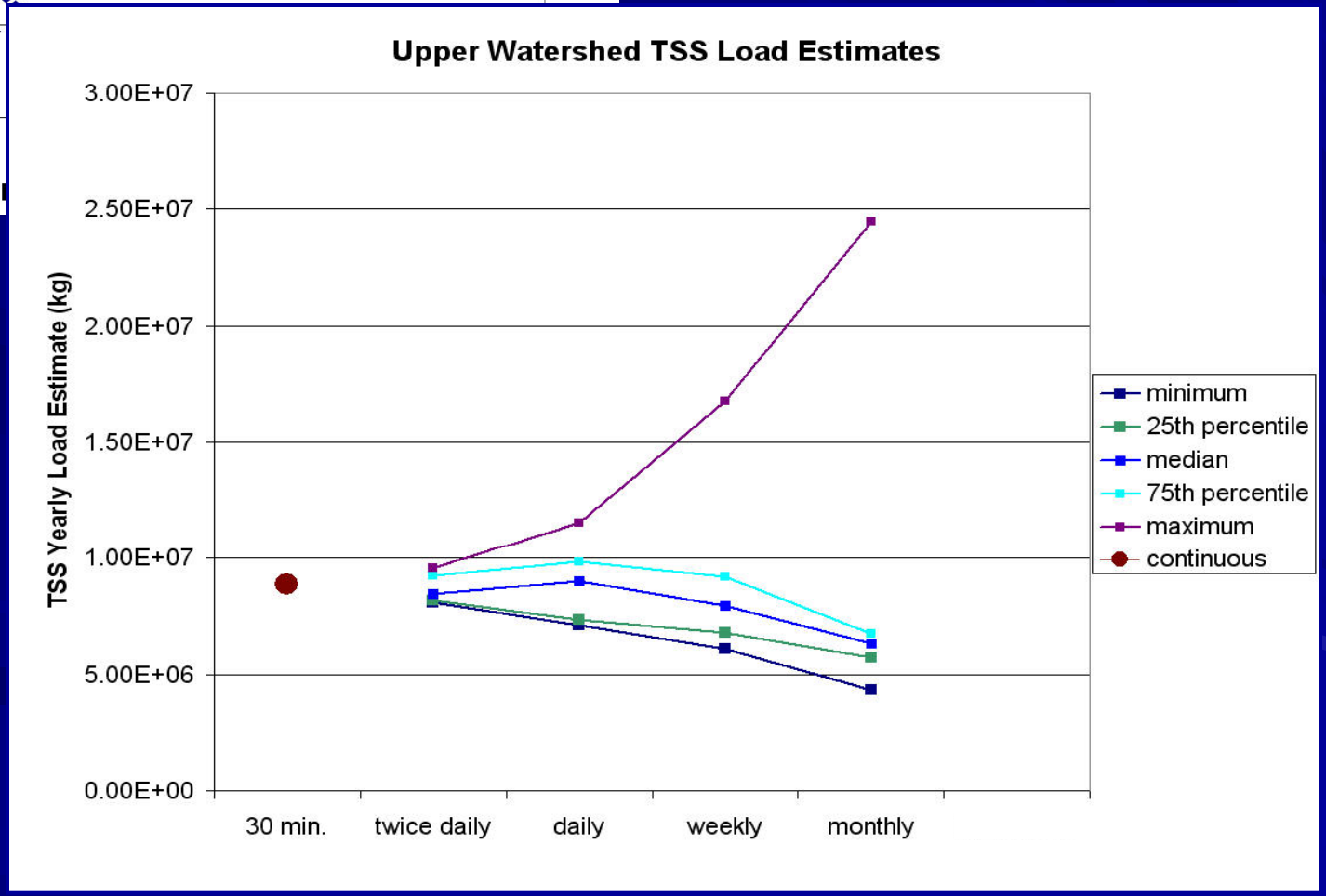


Above and below treatment design

How to monitor?

- ✓ points in time versus continuous
- ✓ integrated versus grab samples
- ✓ consider:
  - cost
  - skill and training required
  - accessibility of sites

The road to more effective monitoring….

- Monitoring plans require careful thought before anything is implemented.
- Consider how the data will be used to demonstrate change.
- Use your understanding of your watershed and how the pollutants of concern behave to target monitoring most effectively
- Use different approaches for different BMPs

different sources of variability in estimates of loads