



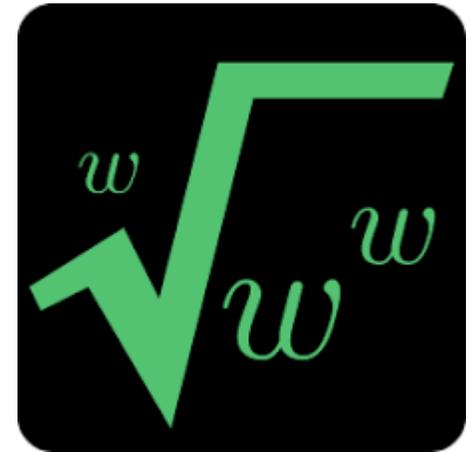
Does Education Make A Difference?
A Scientific Case Study – Greenville County, SC

SESWA Annual Conference – Louisville, KY – October 12, 2017

Typical Quantitative Assessment

- Quantitative in nature, but not quantitative in actual water quality benefits
 - Number of brochures distributed
 - Number of workshops
 - Number of clicks
- What is the time scale for impacts of public education?

Greenville County wanted to do more....



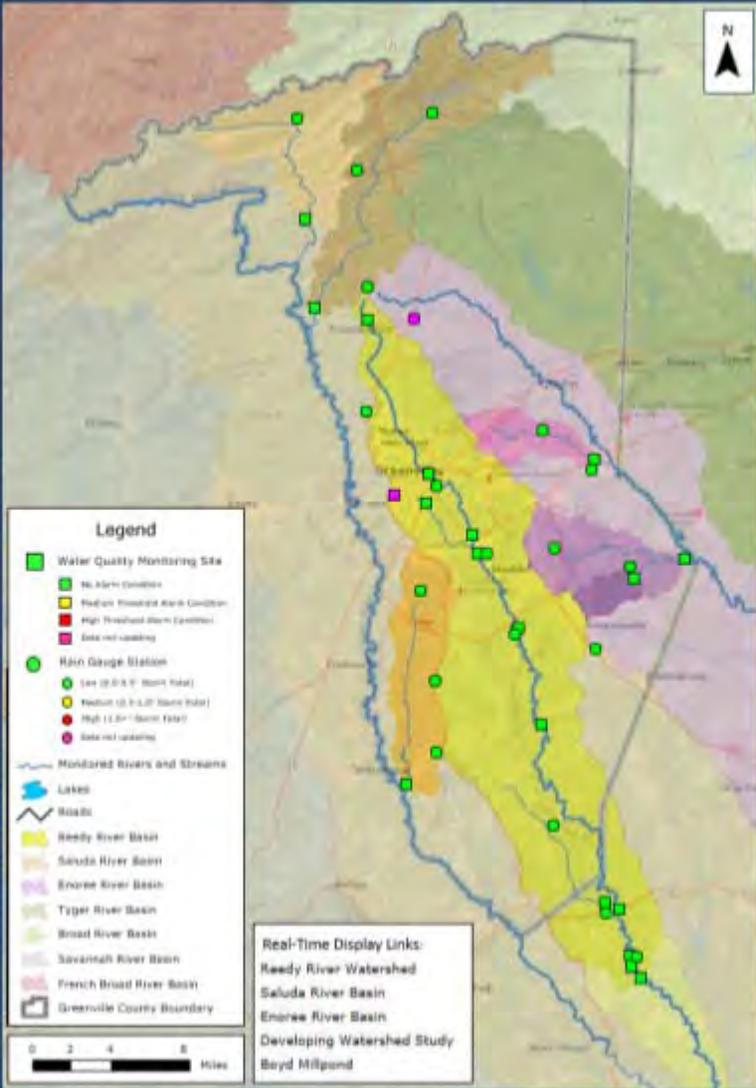
got skepticism?

County Monitoring Program



GREENVILLE COUNTY
WATER QUALITY MONITORING NETWORK

The real-time data contained herein may be affected by variable conditions such as drought, unusually heavy rains, shifting river bottoms, equipment failures, or other factors that can impact monitoring stations and the data reported in real-time. Users should be aware that this website presents raw data that has not been post-processed and should be considered provisional in nature. Although Woolpert and Greenville County work hard to keep the information and data on this site accurate, reliable, and timely, we provide no warranties, expressed or implied.



Legend

- Water Quality Monitoring Site
- No Alarm Condition
- Medium Threshold Alarm Condition
- High Threshold Alarm Condition
- Data not available
- Rain Gauge Station
- Low (0.0-0.9" Storm Total)
- Medium (1.0-1.9" Storm Total)
- High (2.0+ Storm Total)
- Data not available

Monitored Rivers and Streams
Lakes
Roads

Reedy River Basin
Saluda River Basin
Enoree River Basin
Tyger River Basin
Broad River Basin
Savannah River Basin
French Broad River Basin
Greenville County Boundary

Real-Time Display Links:
Reedy River Watershed
Saluda River Basin
Enoree River Basin
Developing Watershed Study
Boyd Millpond

0 2 4 8 Miles





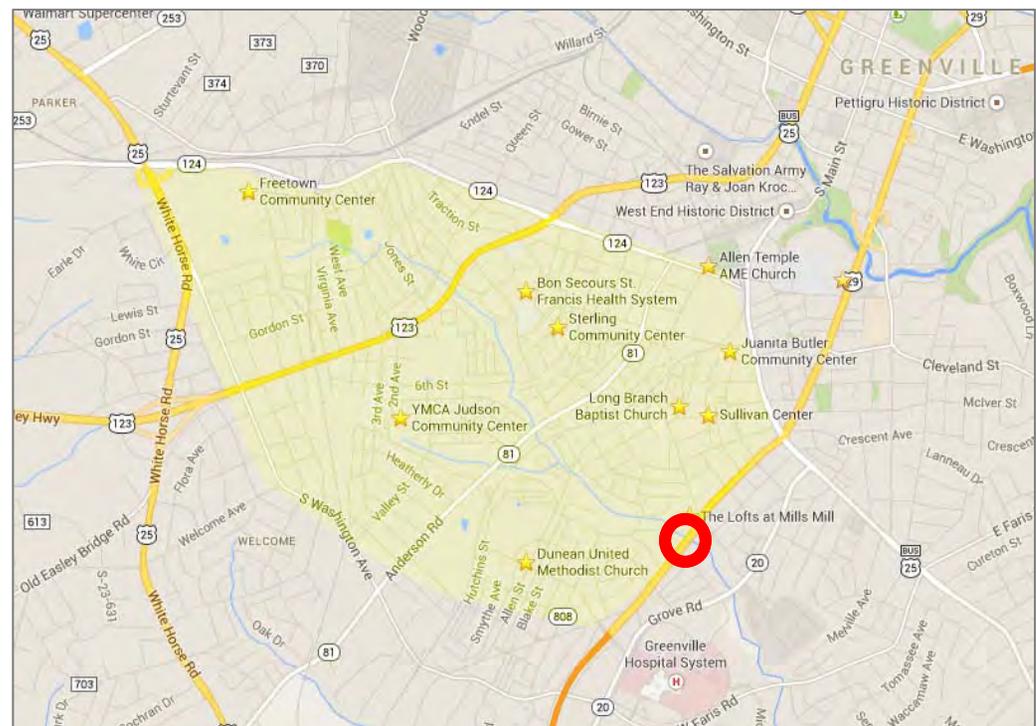
Select a river basin in the list of available Real Time Displays to navigate to a unique display for that basin.

Select a site for a summary of current data at that location.

Select a site popup table to navigate to the historical data.

Mills Avenue Watershed

- Installed continuous monitoring station at outlet in Fall 2012
- Desire to assess nutrients from urban built-out, post-construction conditions
- Identified small developed watershed with minimal typical nutrient sources:
 - No agriculture/farming
 - Sewered area w/few septic tanks
 - Few undeveloped parcels subject to construction



Mills Avenue Watershed

- Includes a YSI datasonde, Sigma autosampler
- Collects grab samples for TP, TN, and TSS
- Collects continuous 15-minute data for the following:
 - Turbidity
 - Dissolved Oxygen
 - Temperature
 - Specific Conductivity
 - pH
 - Dissolved Organic Matter
 - Stage/Flow
- Transmits via remote telemetry



Mills Avenue Watershed



Analysis Strategy

Sounds simple enough but....

- How many storms should be analyzed?
- How many samples should be collected?
- What about baseflow conditions?
- How long should we conduct the sampling/monitoring?
- What about antecedent conditions?
- What size storm should be analyzed?

Need continuous data for nutrients to truly assess impacts of the public education efforts



Regression Analysis



Approach

- Two Years of Continuous Data
 - Pre-Education Feb 2014 – Jan 2015
 - Post-Education Feb 2015 – Jan 2016

- Flow-Based Analysis
 - No two rainfall events are the same
 - Similar rainfall doesn't necessarily produce similar runoff
 - Flow binning to assess water quality



	Flow Rate Binning Ranges (cfs)									
	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Bin 9	Bin 10
	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 75	75 - 100	100 - 150	> 150
Number of 2014-2015 values falling within bin	28,951	984	301	133	77	65	59	76	47	41
Number of 2015-2016 values falling within bin	29,801	1,263	361	138	99	75	97	95	95	102

Results – Statistical Significance

	Flow Range (cfs)									
	0-10	10-20	20-30	30-40	40-50	50-60	60-75	75-100	100-150	>150
Turbidity	Orange	White	White	Orange	White	Blue	White	Blue	Blue	Blue
TP	Orange	White	White	Orange	White	Blue	White	Blue	Blue	Blue
TSS	Orange	White	White	Orange	White	Blue	White	Blue	Blue	Blue
Sp Cond	Orange	Orange	Orange	Orange	Orange	Orange	White	Orange	Orange	Orange
pH	Orange	Orange	Orange	White	White	White	White	White	White	White
DO	Blue	Orange	White	White	White	White	White	White	White	Blue
Temp	Orange	Blue	White	White	White	White	White	White	White	Orange

Indicates no statistically significant difference at the 95% confidence level

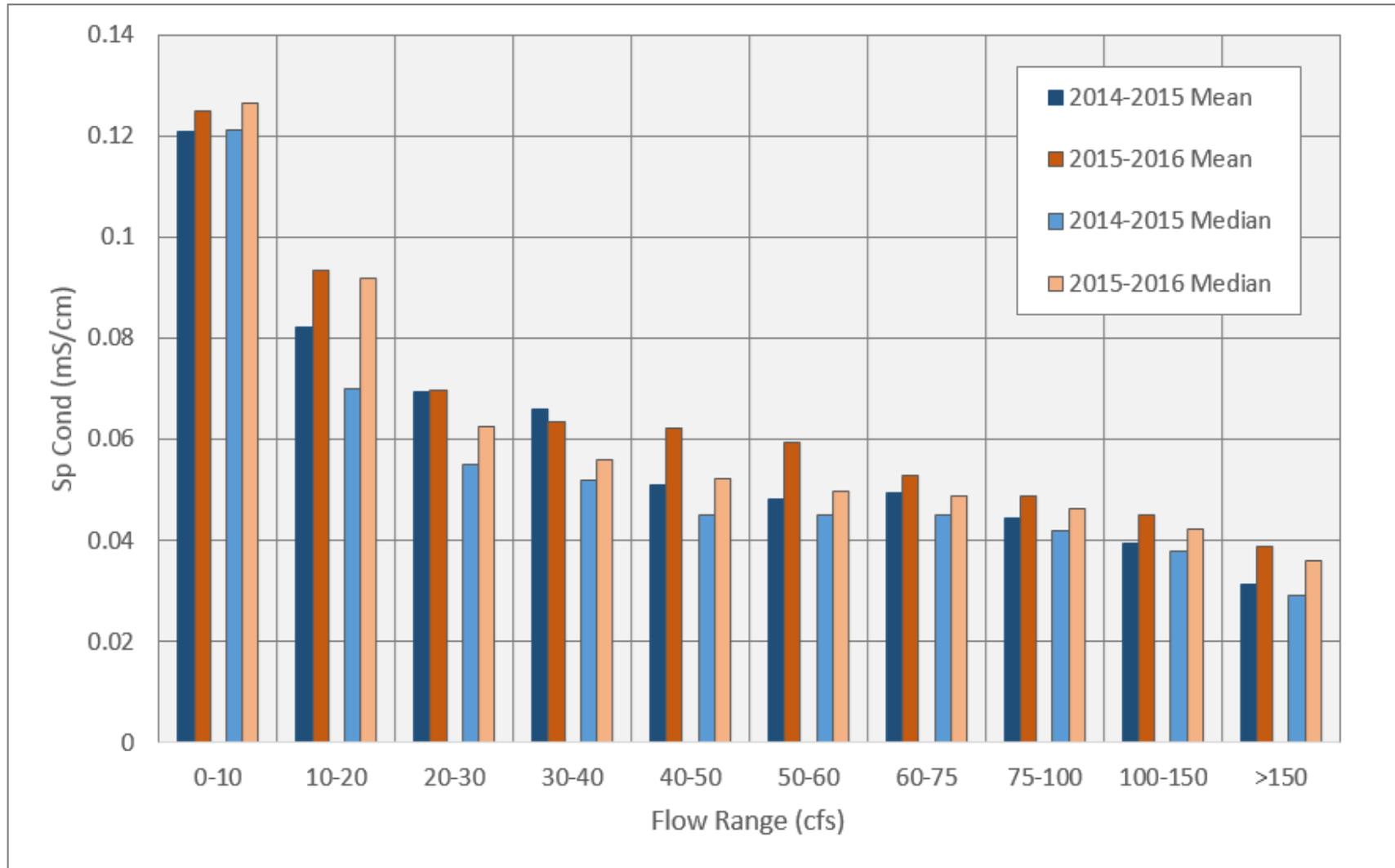
Indicates a statistically significant **increase** in parameter from 2014-2015 year to 2015-2016 year

Indicates a statistically significant **decrease** in parameter from 2014-2015 year to 2015-2016 year

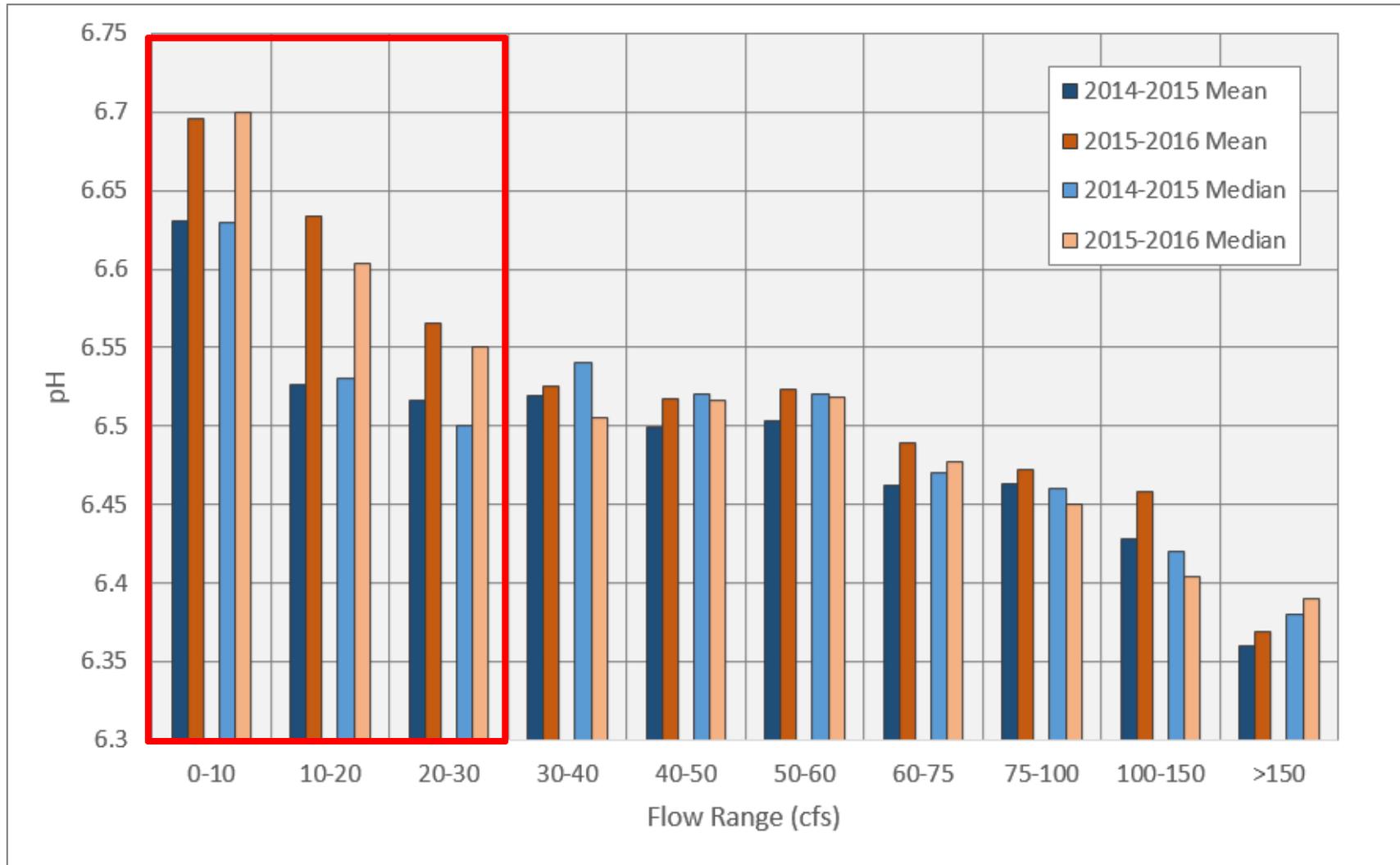


Conductivity & pH

Results - Conductivity

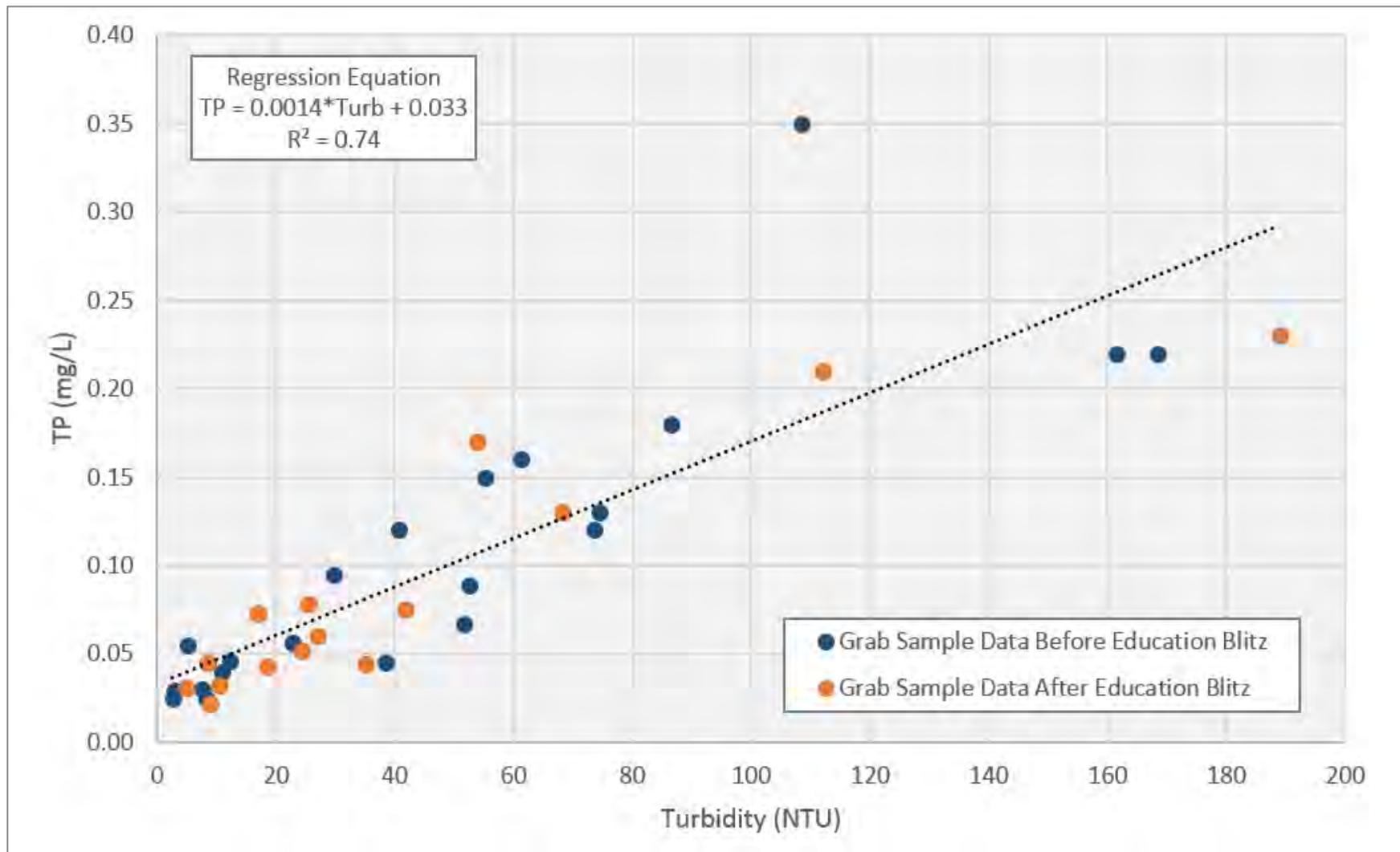


Results - pH

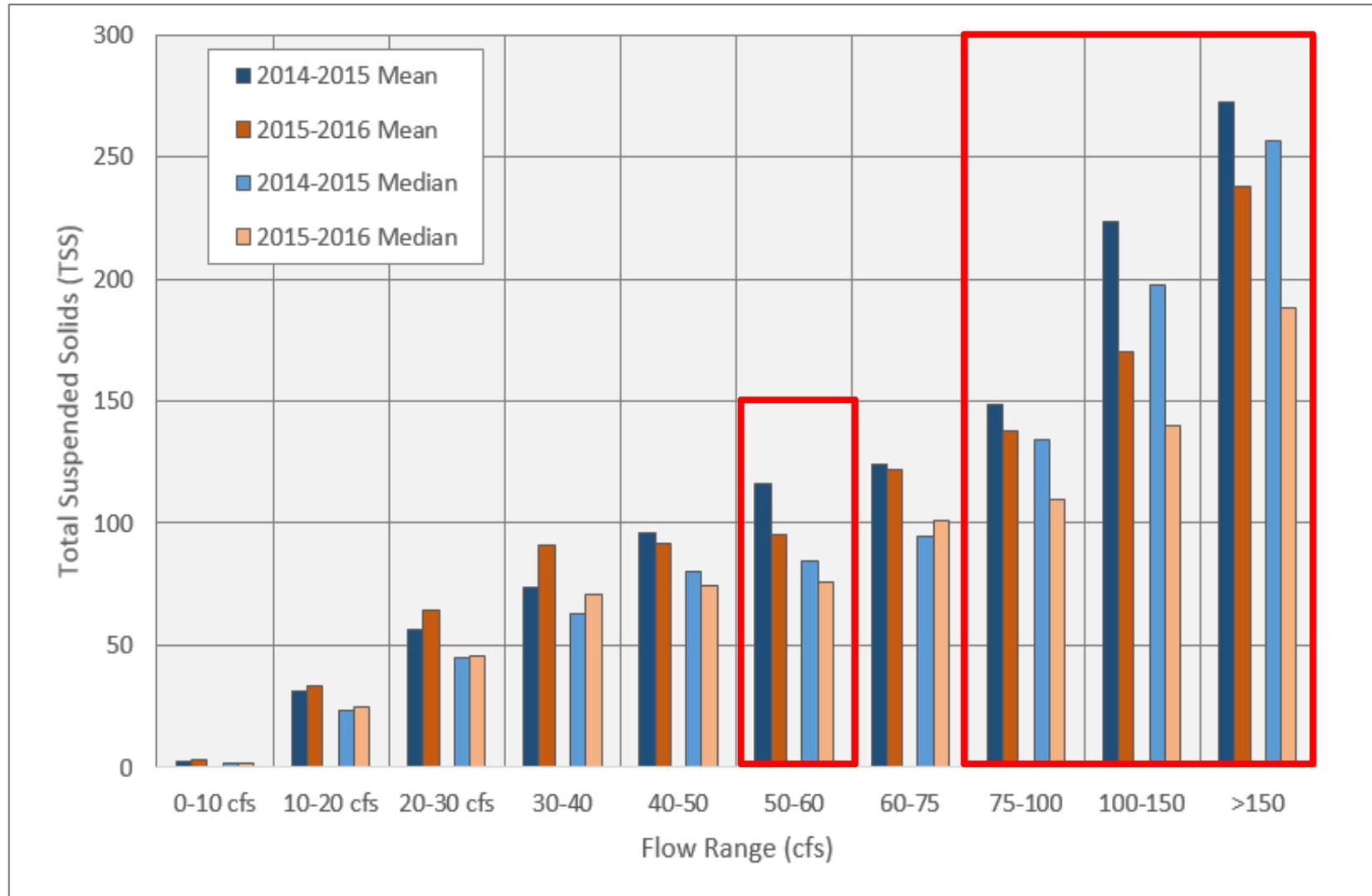


Total Suspended Solids & Total Phosphorus

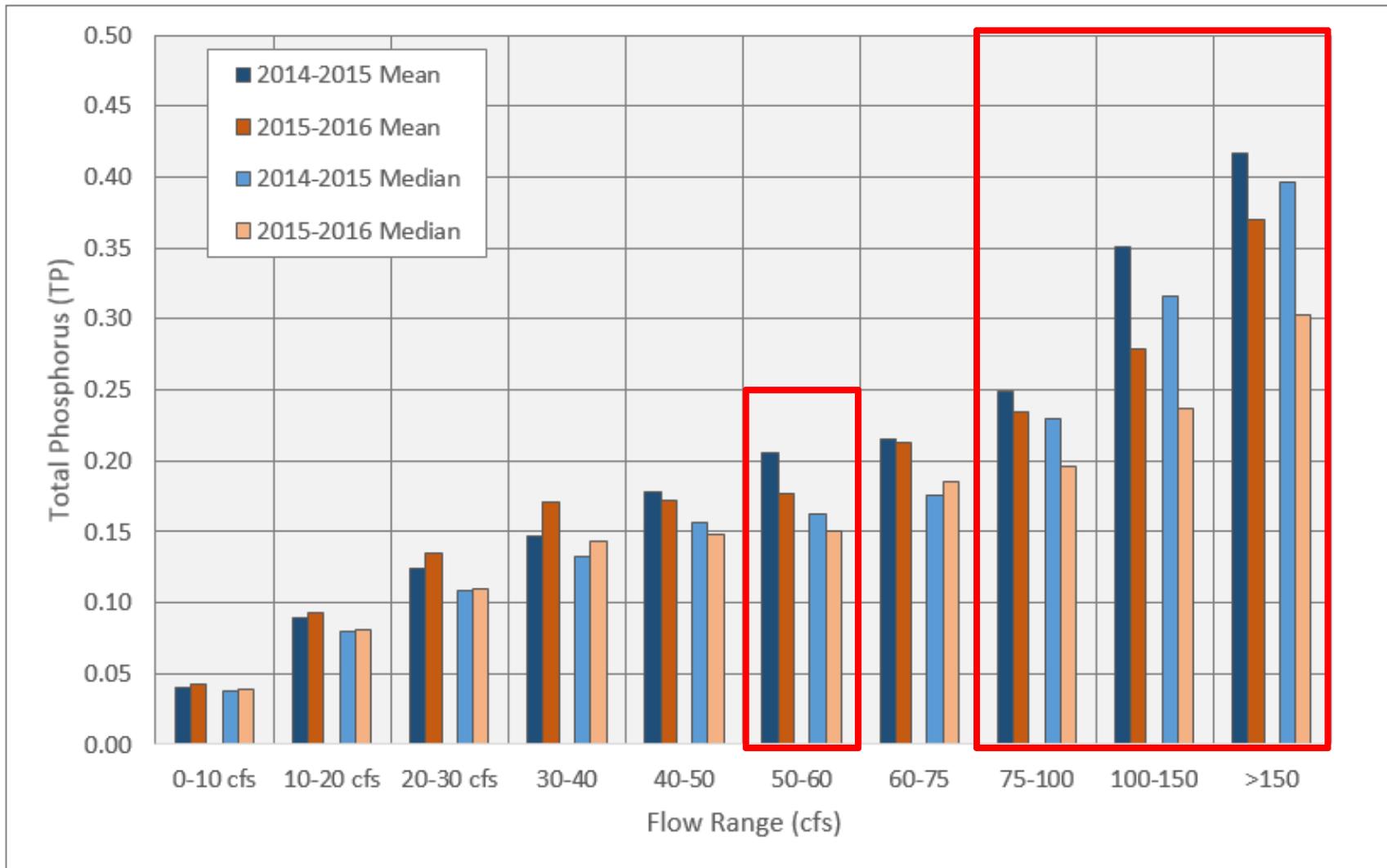
Analysis Strategy



Results - TSS



Results - TP



Take Aways/Next Steps

- Not practical form of analysis for many public education initiatives
- Difficult to control all contributing variables
- Don't "over interpret" limited sample results when evaluating BMP performance
- Be attentive and active in the development of TMDLs or other numerical MS4 permit requirements – don't set yourself up to fail
- Every little bit helps
- Attempting similar exercise to evaluate structural BMP – stream stabilization project

Questions?



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