

Wabash River Continuous Monitor

Agenda Item 7c

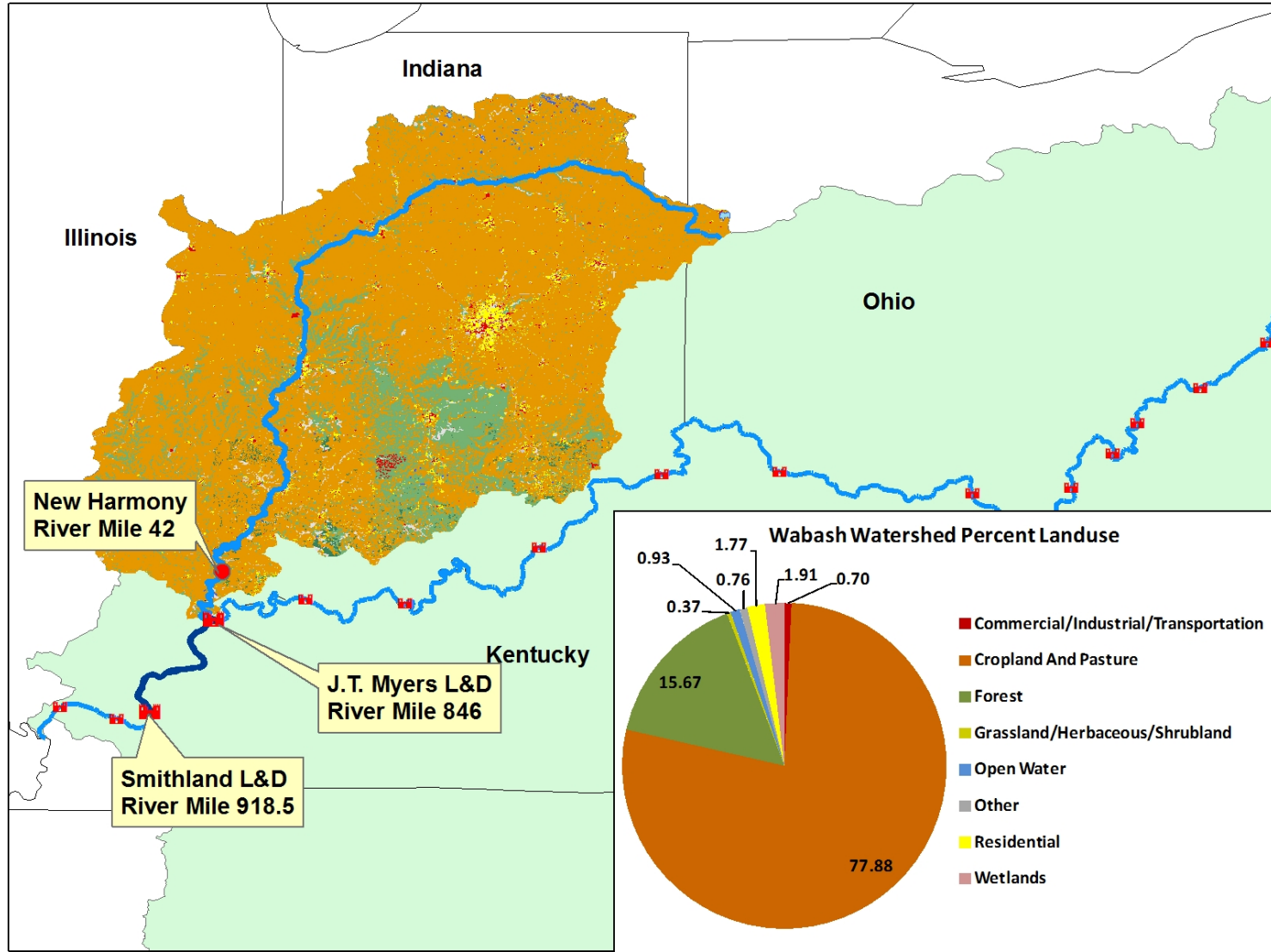


Project Goals

- 1 year project. Budget of \$98,000. Data collected from 7/1/2010 to 9/30/2011.
- Determine annual load of nutrients from Wabash River and at JT Myers on the Ohio River.
- Evaluate the Wabash River as a possible cause of low dissolved oxygen in the Smithland Pool.

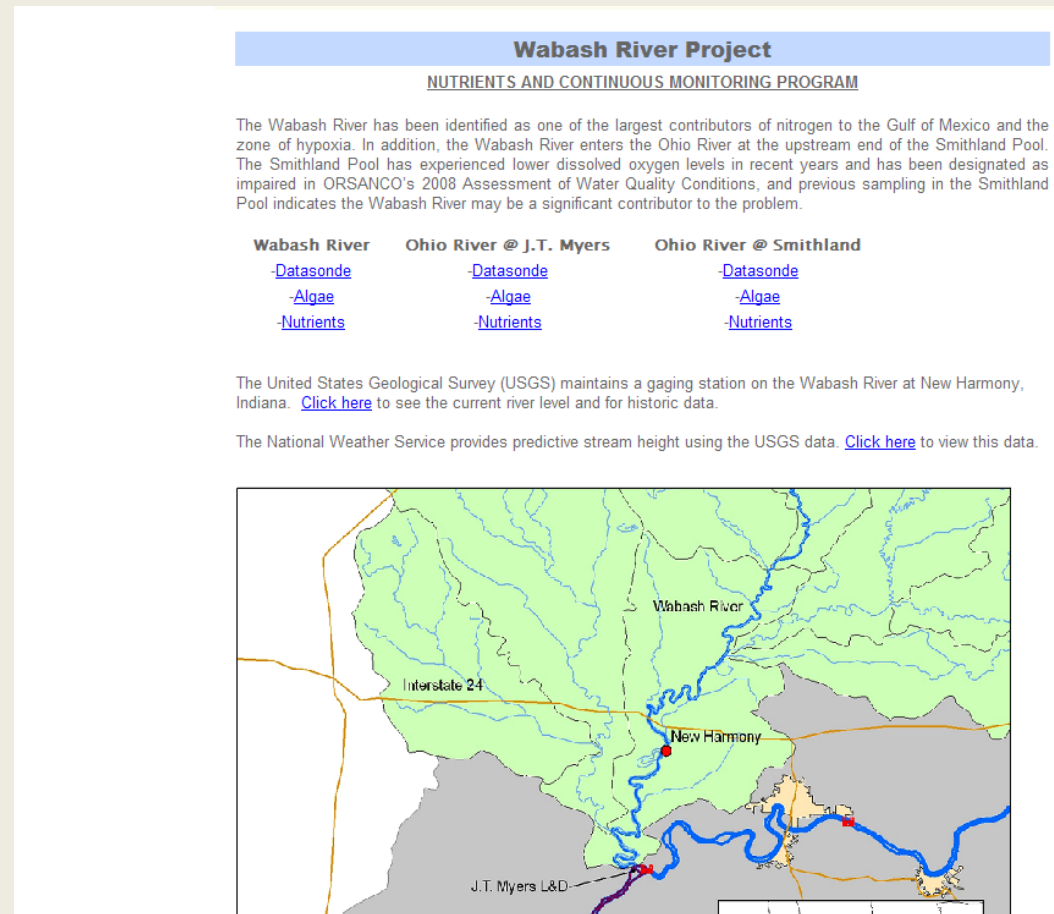


Project Location



Parameters

- Continuous monitor data downloaded 3/day
 - pH, conductivity, temp, turbidity, dissolved oxygen, chlorophyll a
- Nutrients collected every 2 weeks
 - Ammonia, TKN, Nitrate/Nitrite, Total Phosphorus, BOD, TSS, Algae, Chlorophyll
 - Ohio River samples collected during summer months
- Data available on website



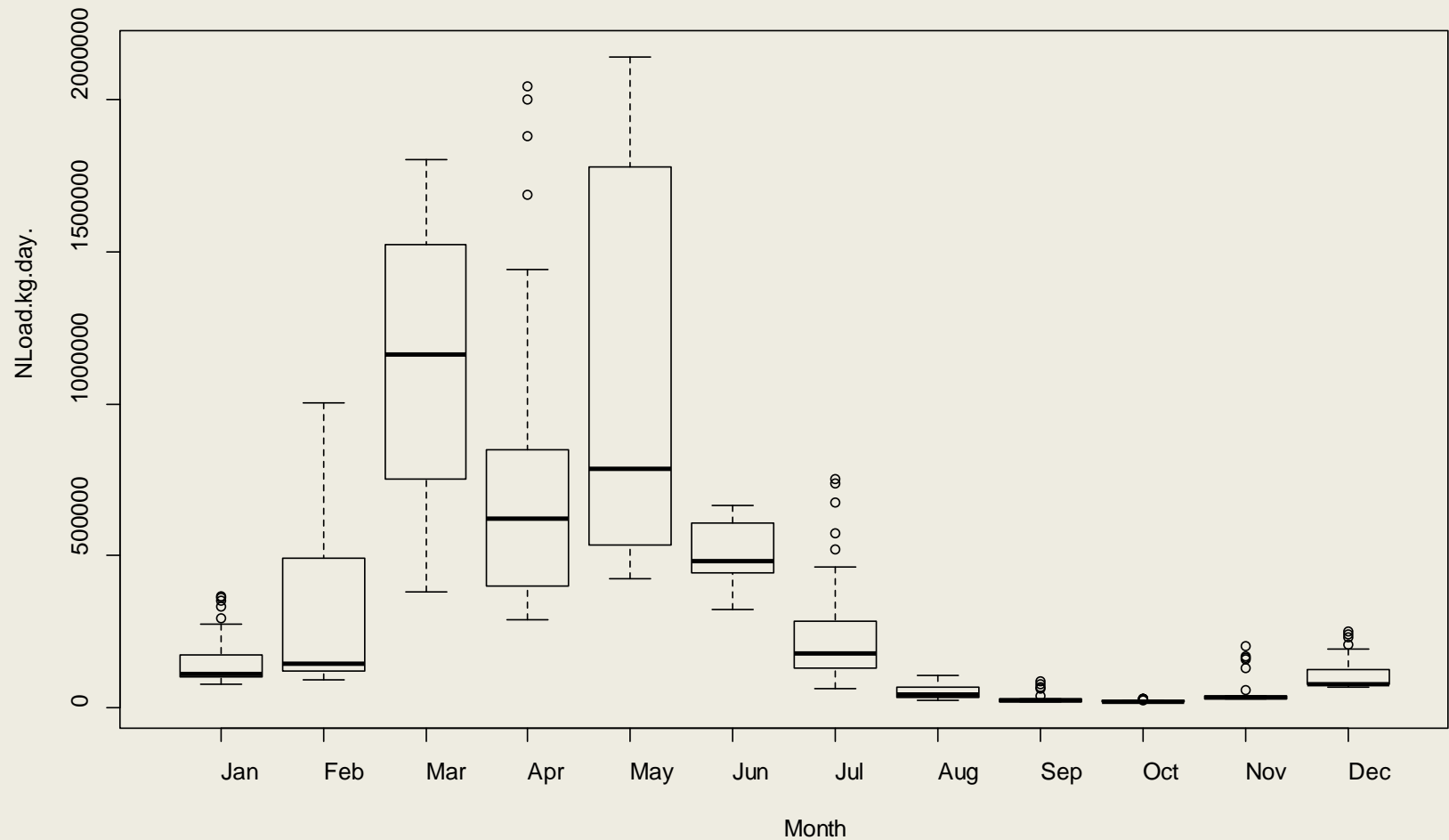
Goal 1: Load Calculation

- USGS LOADEST
 - FORTRAN program for estimating loads
- Uses a time series of streamflow and constituent concentration data.
- Develops a regression model of the constituent load.
- This model is then used to estimate loads over the specified time interval.

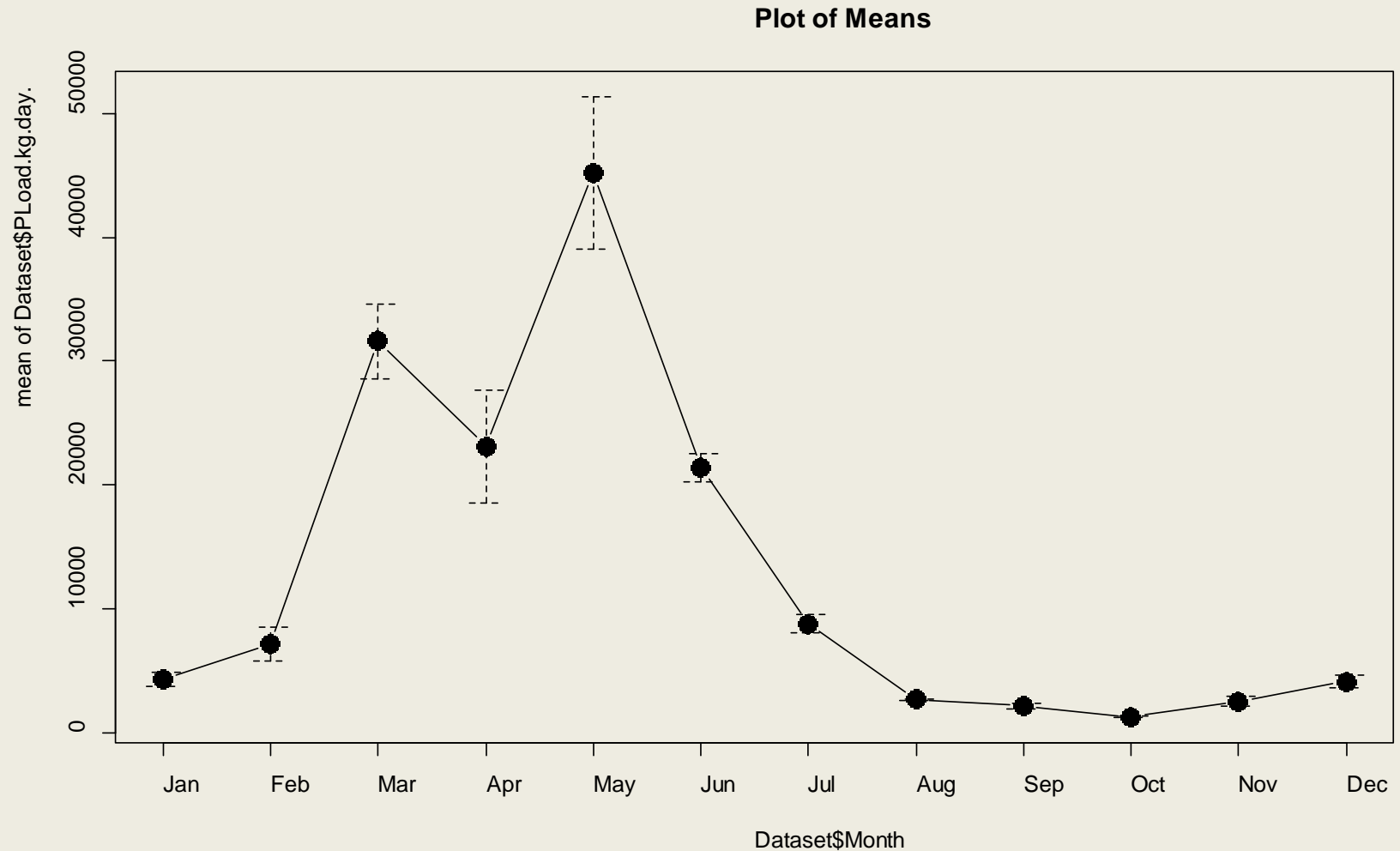
LOADEST Inputs

- Wabash River
 - 30 nutrients samples
 - TN calculated by adding TKN and Nitrate/Nitrite
 - Flow data from USGS gauge at Mt. Carmel, IL
 - Mt. Carmel 28,635 sq mi (86.5% of watershed)
 - New Harmony 29,234 sq mi (88% of watershed)
 - 599 sq mi = 2%
- Ohio River at JT Myers
 - 20 Nutrients Samples
 - Project only collects summer time data.
Additional data provided by Bi-monthly Program
 - TN calculated by adding TKN and Nitrate/Nitrite
 - Flow data from COE Cascade

Nitrogen Load - Wabash River



Phosphorus Load - Wabash River



Load Calculations

Wabash River

- 1 Year load 7/1/2010 to 6/30/2011
 - Flow for model year – 15,187,190 cfs
 - Flow for previous 10 years
 - 10,207,480 cfs – 17,737,490 cfs
 - 2nd highest flow year since 2001
- **138,976** metric tons TN
- **4,646** metric tons TP

Ohio River at JT Myers

- 1 Year load 7/1/2010 to 6/30/2011
 - Flow for model year – 83,036,200 cfs
 - Flow for previous 10 years
 - 50,373,500 cfs – 87,999,200 cfs
 - 3rd highest flow year since 2001
- **427,788** Metric tons TN
- **39,337** metric tons TP

Wabash River Load Comparison

Report	TN (metric tons)	TP (metric tons)
LOADEST 2011 (adjusted for area)	160,646	5,370
ORSANCO 2003 Report (1998-1999 data)	127,414	5,432
SPARROW (2002)	194,767	7,120

Goal 2: Causes of DO Impairment

- Evaluation of DO data
- Evaluation of nutrient concentrations
- BOD as a source of DO impairment
- Algae as a source of DO impairment

Dissolved Oxygen

Station	Max Flux	# days >6mg/L Flux	# days <5 mg/L average	# days <4 mg/L instant
Wabash R.	10.94	21	0	13
JT Myers L&D	7.25	2	0	12
Smithland L&D	7.03	2	25	7

Diurnal flux is caused by algal respiration

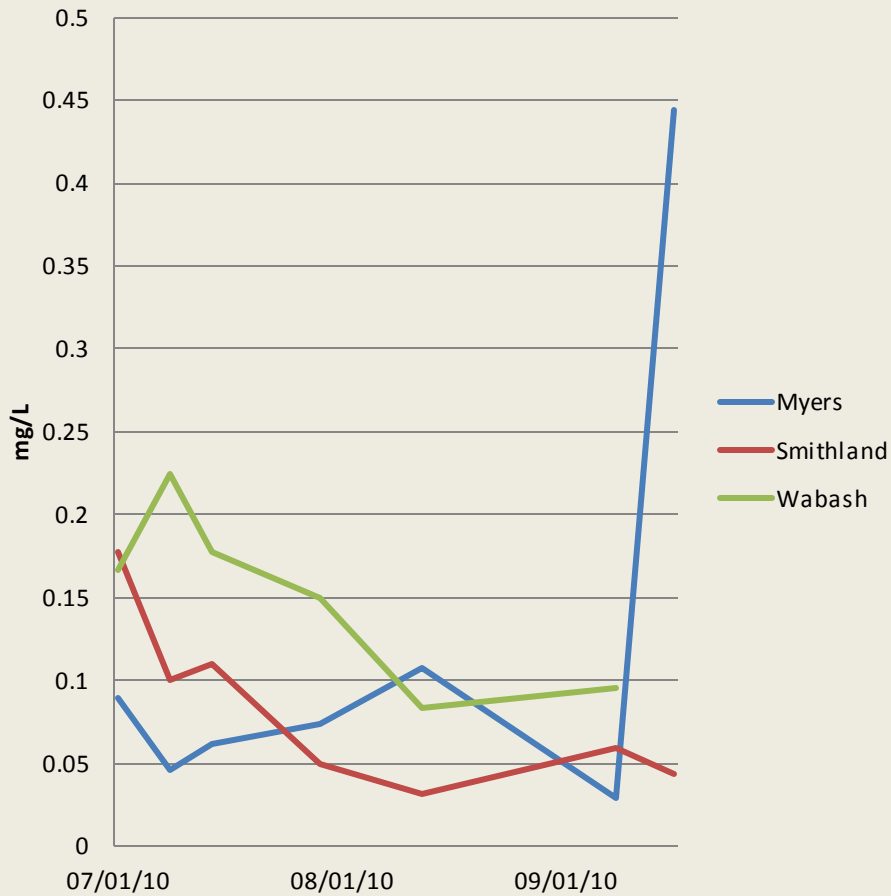
Wabash R. low DO associated with large diurnal flux

JT Myers/Smithland low DO associated with minimal diurnal flux

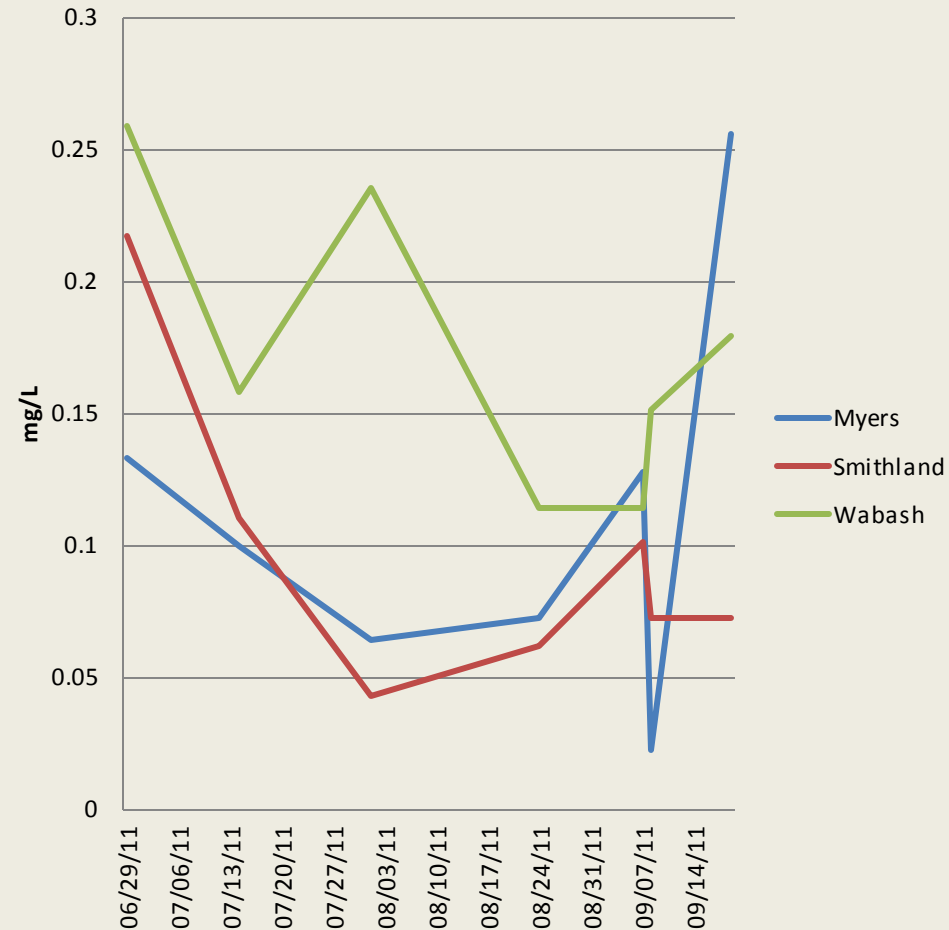
Period: 7/1/2010 to 9/30/2011 (2 summers)

Total Phosphorus Concentrations

2010 TP

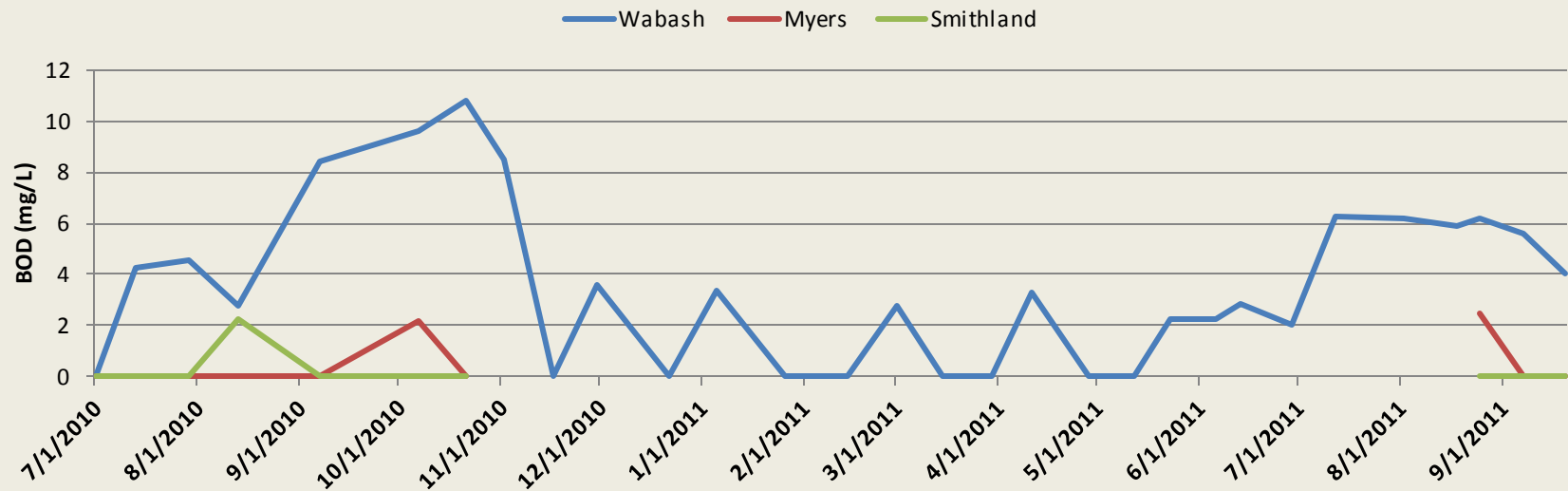


2011 TP



BOD

BOD July 2010-Sep 2011



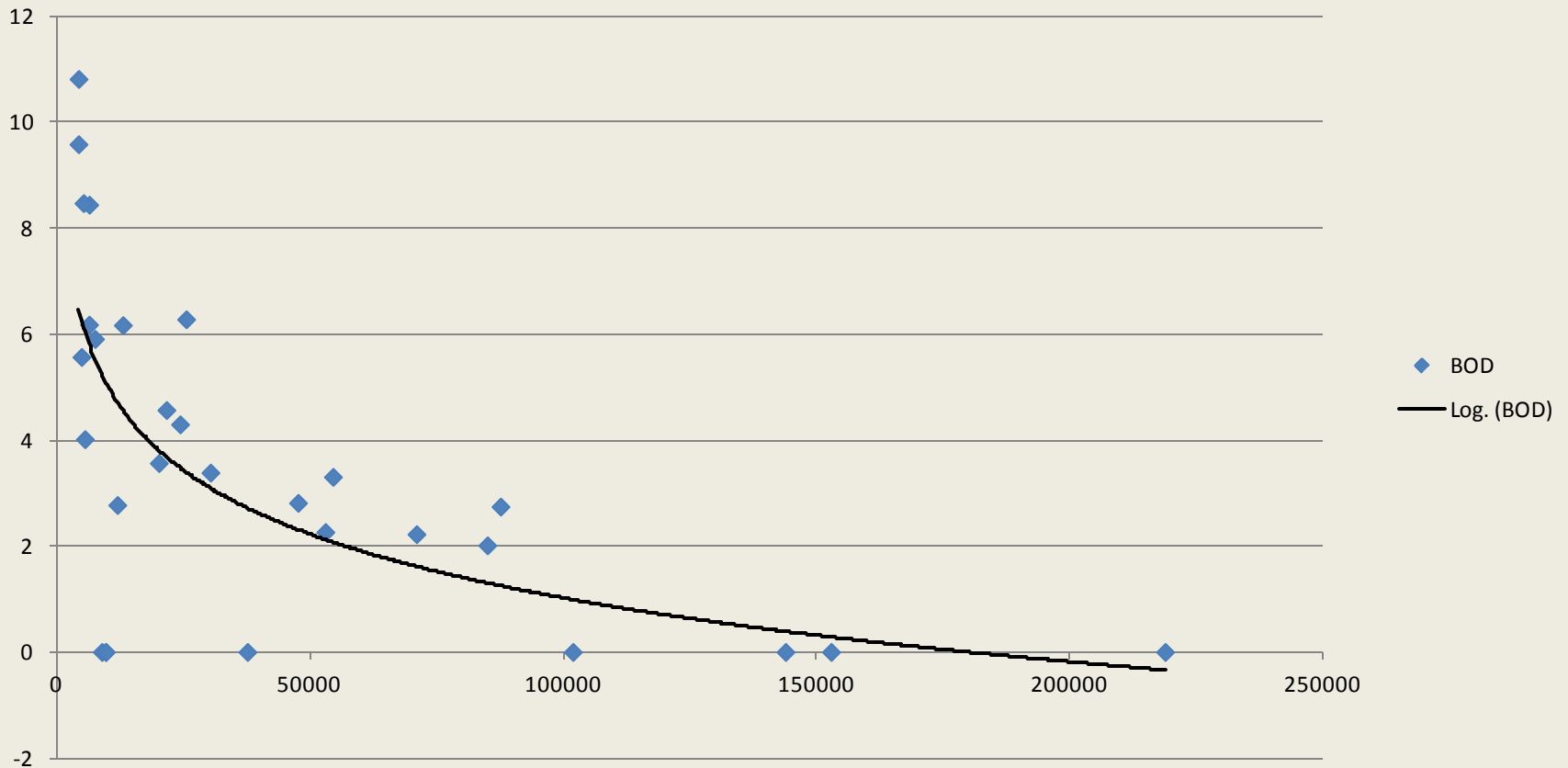
Max BOD Wabash River = 10.8 mg/L

Max BOD JT Myers = 2.51

Max BOD Smithland = 2.27

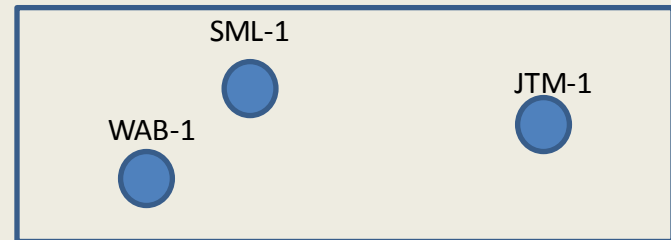
Effect of Flow on BOD

Wabash River BOD vs Flow



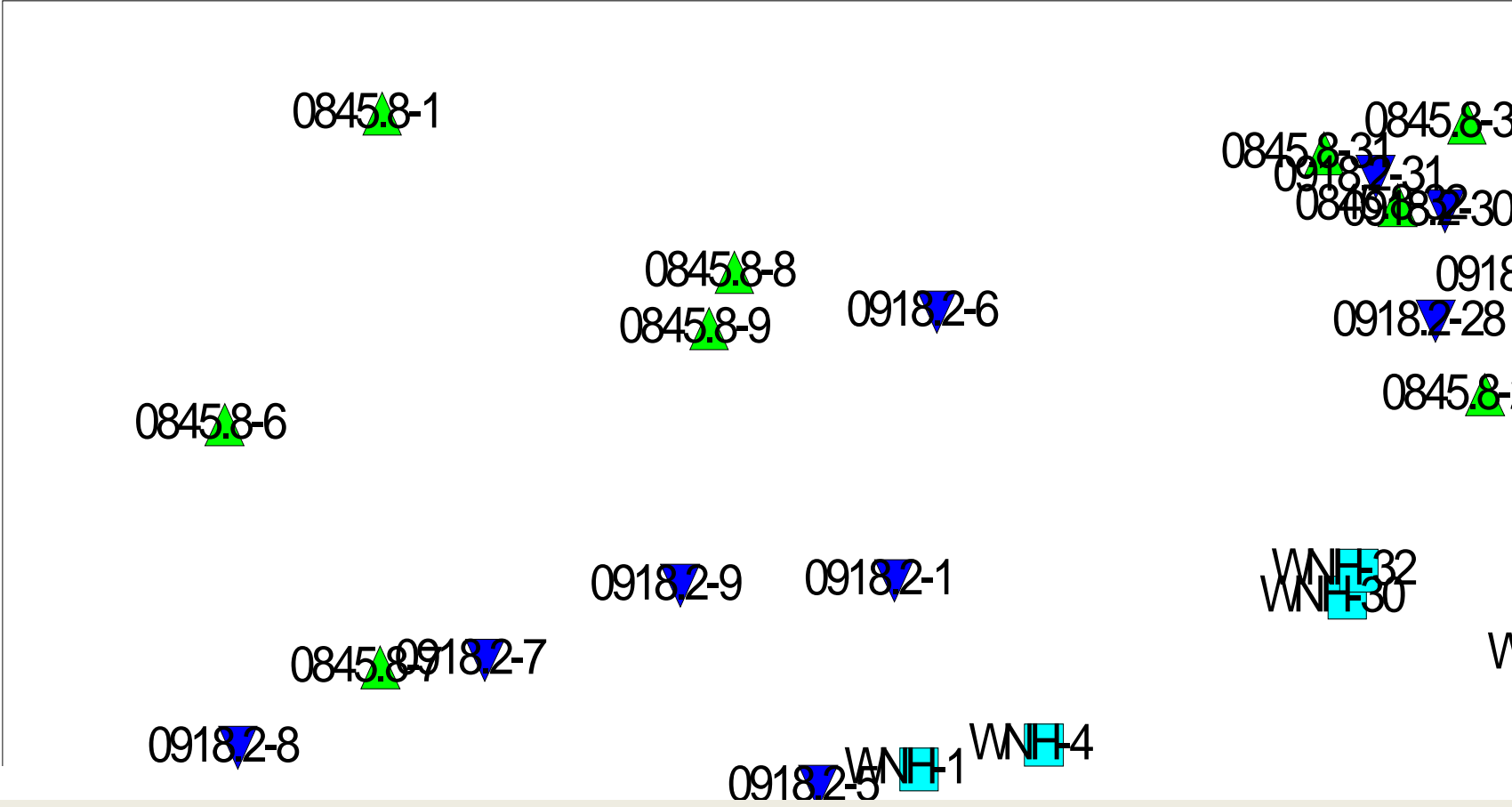
Algae Community

- Analyses performed using Primer (v5.2.9)
- Performed standardized Bray-Curtis Similarity (with no data transformation) to create a sample-similarity matrix
 - Bray Curtis disproportionately emphasizes more common species
- Performed a Two-way nested Analysis of Similarity (ANOSIM) using 'Location' (JTM, SML, WAB) and Visit (1-32) as factors using 9999 permutations
 - 2-way nested performed because you want to know the relative similarity of 'location' within each visit
 - e.g. The analyses looks at the relative distance between samples within each round
 - SML-1 and WAB-1 are most similar
 - SML-1 and JTM-1 are medially similar
 - WAB-1 and JTM-1 are least similar



NMDS Results By Location

Wabash Algae



Two-Way ANOSIM Results

- TESTS FOR DIFFERENCES BETWEEN Visit GROUPS

- (averaged across all Location groups)

- Groups too small

- TESTS FOR DIFFERENCES BETWEEN Location GROUPS

- (using Visit groups as samples)

- Global Test

- Sample statistic (Global R): 0.034

- Significance level of sample statistic: 17.6%

- Number of permutations: 9999 (Random sample from a large number)

- Number of permuted statistics greater than or equal to Global R: 1761

- Pairwise Tests

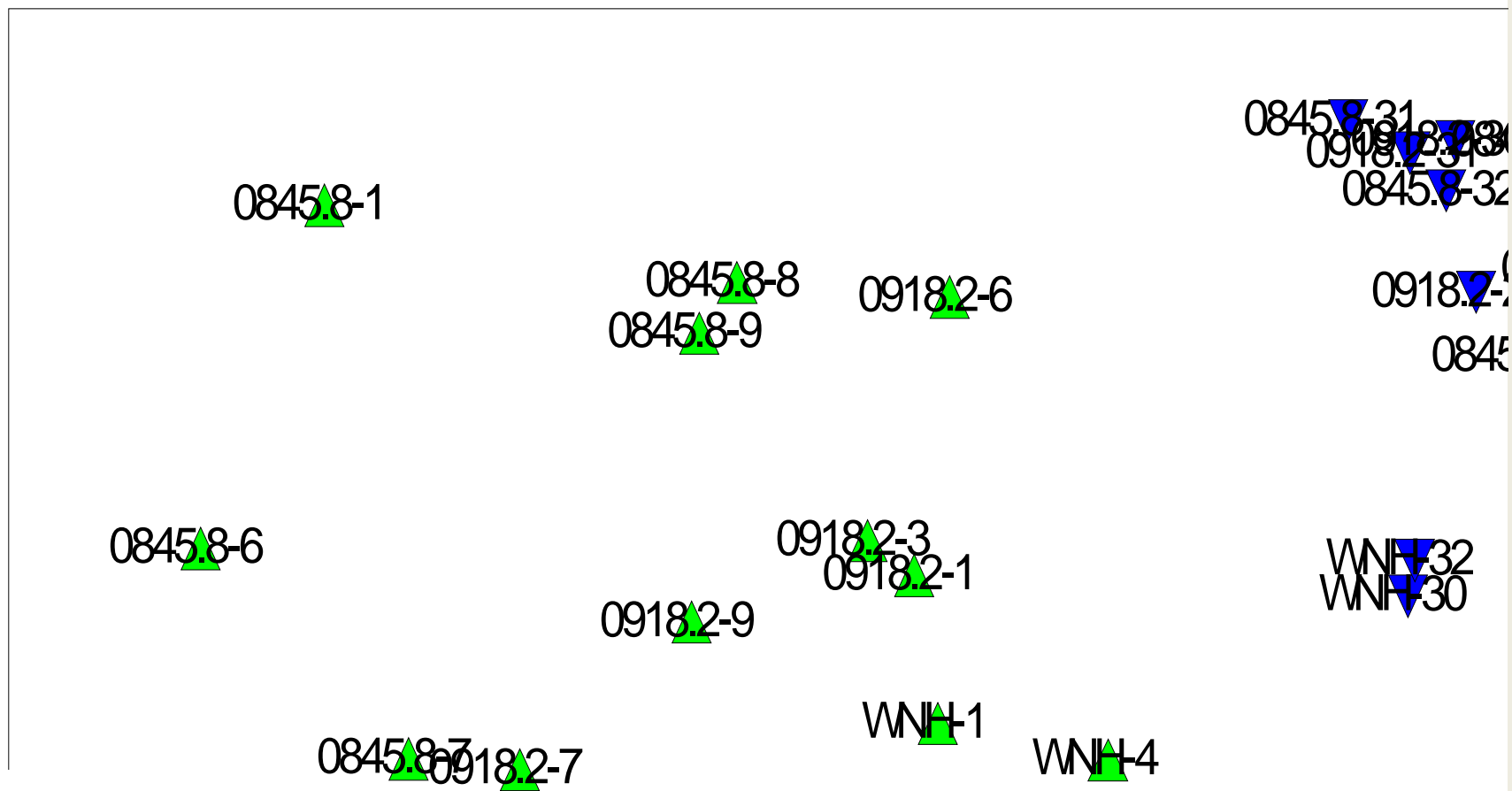
	R	Significance	Possible	Actual	Number >=	
Groups	Statistic	Level %	Permutations	Permutations	Observed	
•JT Meyers, Smithland	-0.058	87.5	5200300	9999	8749	
•JT Meyers, Wabash River	0.111	4.8	5200300	9999	474	
•Smithland, Wabash River	0.056	14.9	5200300	9999	1484	

Summary of Results:

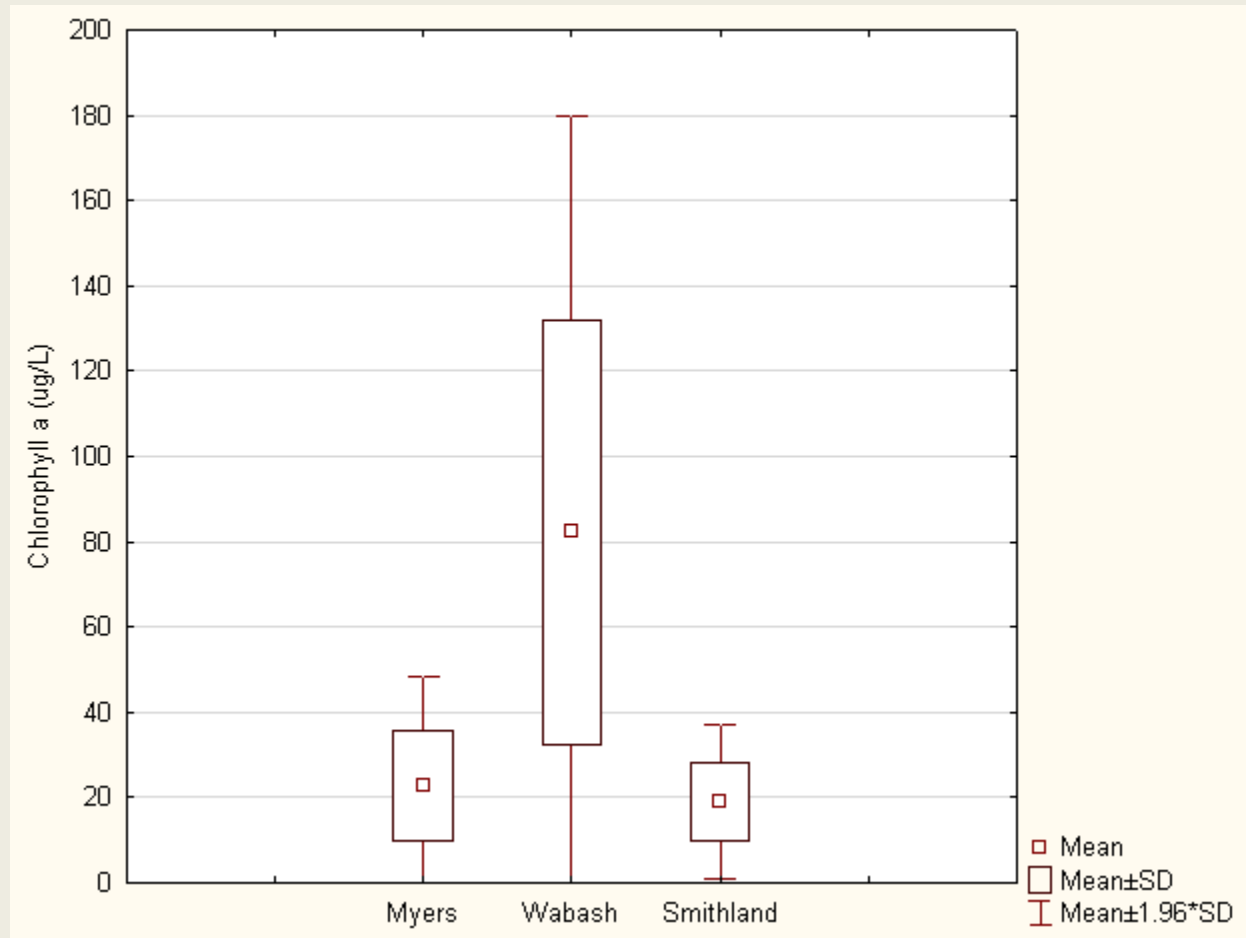
- Very little variance is accounted for in this 2-way ANOSIM – Global R= -0.034
- No sig diff between 3 Locations $p < 0.176$
- Not enough power to test for differences between visits
- Significant pairwise difference exhibited b/w JTM & Wabash ($p < 0.048$)
 - The relative magnitude of pairwise p-values indicate there is a marginal influence of the Wabash Algae assemblage to the Ohio River

NMDS Results By Year

Wabash Alg



Chlorophyll *a*



Conclusions

- Wabash River continues to be a major source of nutrients.
 - For study period Wabash River was 23% of N load, 12% of P load
- DO pattern indicates Ohio River low DO not caused by algae
- Algae Community shows effect of Wabash River on Smithland Pool
- Algae concentration does not show effect of Wabash River on Smithland Pool
- High water year on the Wabash River. Low problem year for DO on the Ohio River
- Wabash River is a source of BOD to Ohio River.
 - Appears to be a point source issue

Next Steps

- Grant ends April 2, 2012
- Discuss this presentation with IDEM staff and potentially USGS. Incorporate suggestions into final report.
- 3 more years on Wabash River