

# Stream Quality Assessment of Southern Manitowoc County During the Summer of 2014



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Mill Pond-Dam in the early 1900's.

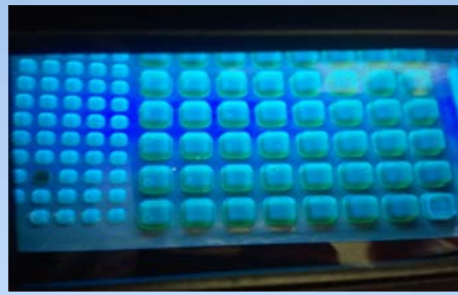


Beginning of Dam removal.



Dam and Mid-Point Sites- Summer of 2014





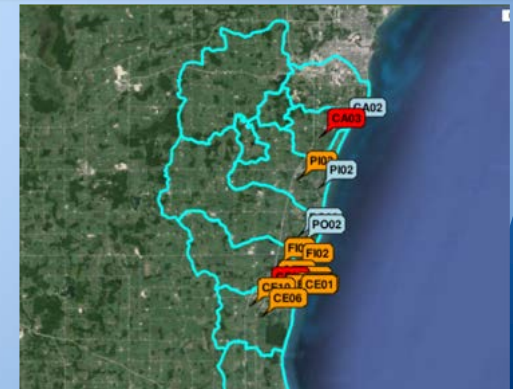
- Weekly Sampling
  - New Rain Event
- Physical Parameters
- Chemical Parameters
- Biological Parameters



# Centerville Creek

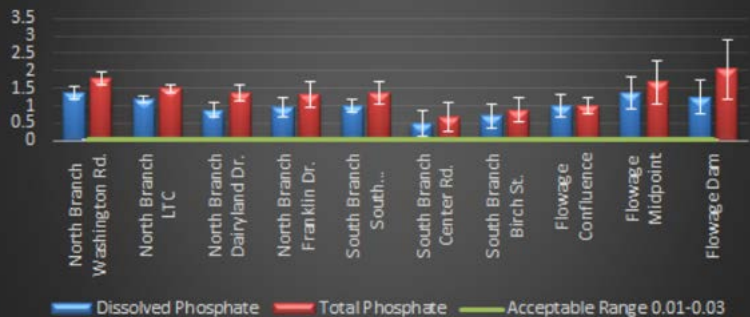


CE01	Centerville Flowage Dam
CE02	Centerville Flowage Midpoint
CE03	Centerville Flowage Confluence
CE04	Centerville South Branch Birch St.
CE05	Centerville South Branch Center Rd.
CE06	Centerville South Branch South Cleveland Rd.
CE07	Centerville North Branch Franklin Dr.
CE08	Centerville North Branch Dairyland Dr.
CE09	Centerville North Branch LTC
CE10	Centerville North Branch Washington Rd.

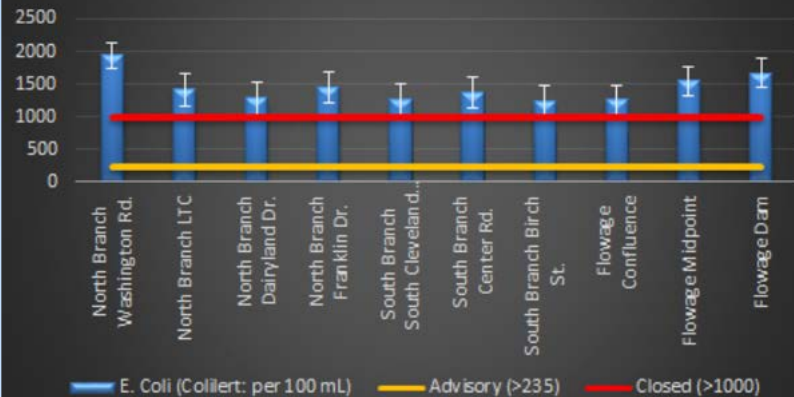


# Centerville Creek 2014 Site Averages

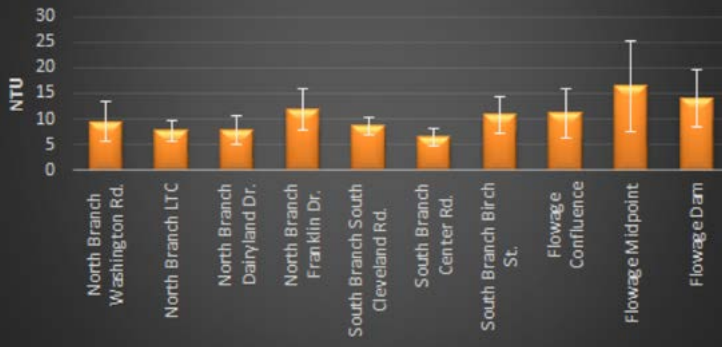
## Phosphate Averages for Centerville Creek



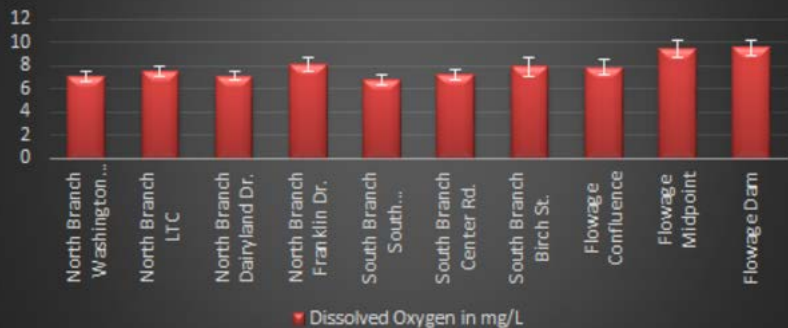
## E. Coli Averages for Centerville Creek



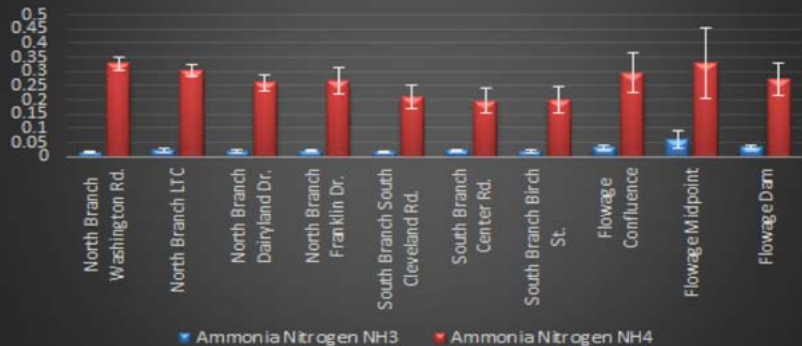
## Turbidity Averages for Centerville Creek



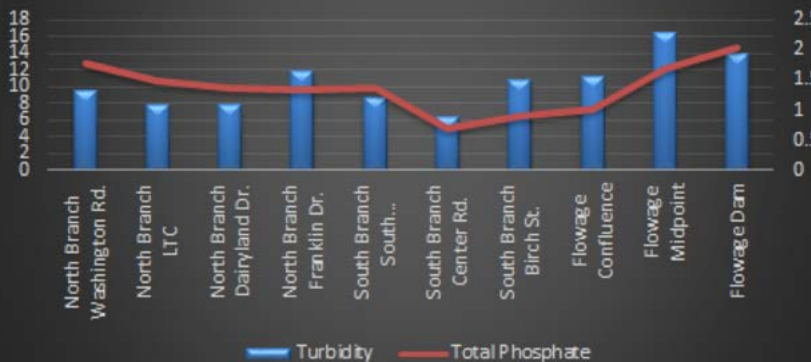
## Dissolved Oxygen Averages for Centerville Creek



## Ammonia Nitrogen Averages for Centerville Creek



## Turbidity and Total Phosphate Averages for Centerville Creek



Averages for All Creek Sample Points,	Summer 2011	Summer 2012	Summer 2013	Summer 2014	Increase/Decrease Between 2011 and 2012	Increase/Decrease Between 2012 and 2013	Increase/Decrease Between 2013 and 2014	Standard Acceptable Ranges During Summer
Water temperature (°C)	23.1	18.84	17.75	17.76	-4.26	-1.09	+0.01	10-19°C
pH	8.5	8.46	8.63	8.38	-0.04	+0.17	-0.25	5.8 to 8.5
Turbidity (NTU)	29.6	15.44	15.10	10.28	-14.16	-0.34	-4.82	1 to 5 NTU
Stream flow (M/sec)	30.5*	0.20	0.34	0.36	*	+0.14	+0.02	N/A
Conductivity (µS)	836.1	867.42	843.49	899.2	+31.3	-23.9	+55.7	N/A
Dissolved oxygen (mg/L)	8.43	7.82	8.36	13.18	-0.61	+0.54	+4.81	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.14	0.04	0.064817	0.9912901	-0.10	+0.025	+0.9264731	N/A
Total Phosphate (mg/L)	*	0.08	0.15381	1.32409	*	+0.07	+1.17028	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia nitrogen (NH3) (mg/L)	0.06	0.03	0.040075	0.026274	-0.03	+0.01	-0.01380	<0.1 mg/l
Ammonia nitrogen (NH4) (mg/L)	0.65	0.34	0.371483	0.257722	-0.31	+0.03	-0.11376	<0.5 mg/l
E. coli (MPN/100 ml)	595.7	1476.6	925.1	1397.5	+880.9	-551.5	+472.4	Advisory: >235 Closed: >1000

Orange-Decrease

Purple-Increase

\* = Exclude

# Centerville Creek Analysis

- Dissolved Phosphate average has increased (now 0.991 mg/L):
  - Since 2013: 0.926 mg/L
  - Since 2012: 0.951 mg/L
- Total Phosphate Average has also increased (now 1.374 mg/L):
  - Since 2013: 1.170 mg/L
  - Since 2012: 1.294 mg/L
  - Acceptable Range: 0.01 to 0.03 ppm and <0.1 ppm max.
- E.coli has increase by 472 MPN/100 ml since last year. (Now 1397.5 MPN/100 ml)
  - >235 Advisory and >1000 Closed

Most of the biological and chemical parameters increased since last year, and even the year before.





# Dam and Mid-Rain Event

- Run off from drainage by Mid Point
- Dam had film over it and an algal bloom after a rain event.



# Rain Data:

June 16th: 0.00 in.

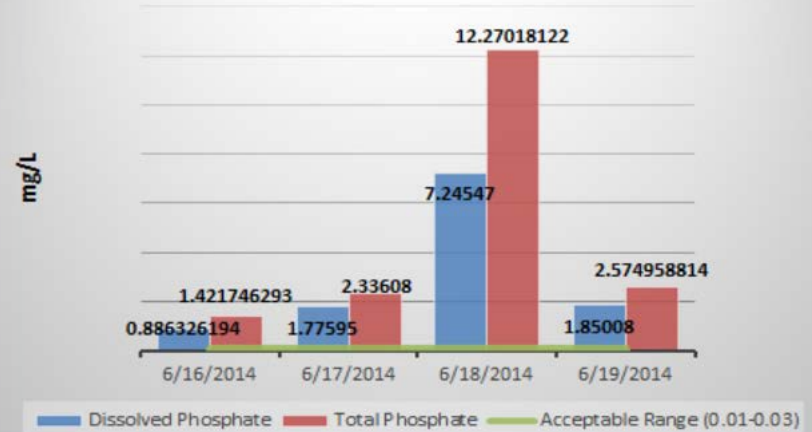
June 17th: 1.13 in.

June 18th: 1.39 in.

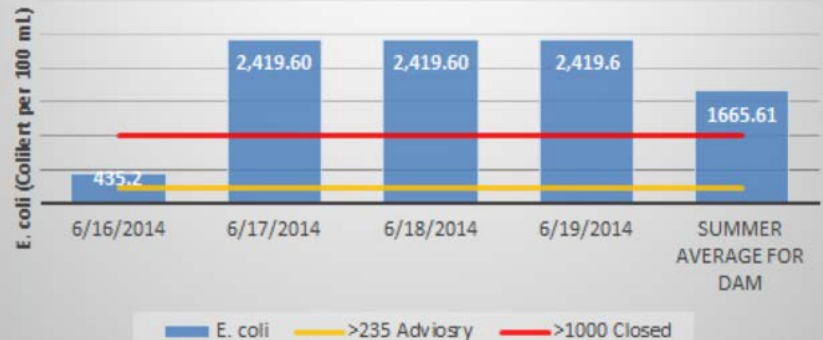
June 19th: 0.00 in.

The 17th-19th *E.coli* had levels higher than our ability to detect.

Total and Dissolved Phosphate Throughout Rain Event at Dam



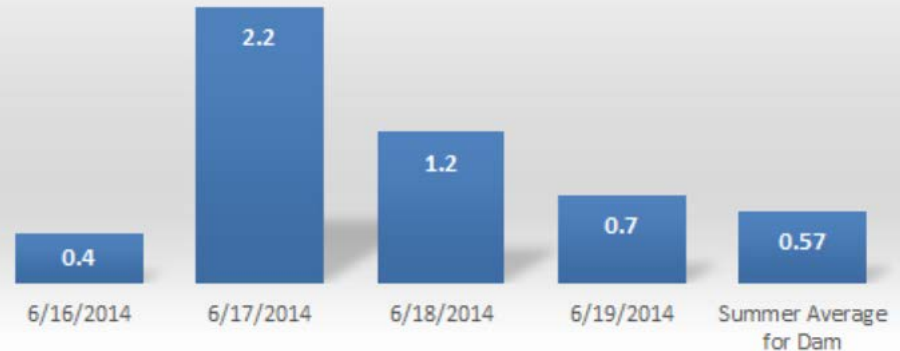
*E. coli* Averages for Dam During a Rain Event



# Rain Data:



Stream Velocity Throughout Rain Event for Dam



# Snow-Melt Data



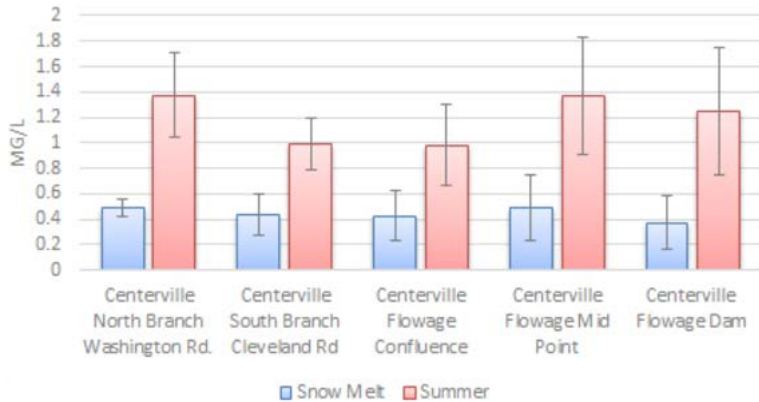
3/21/2014

4/8/2014

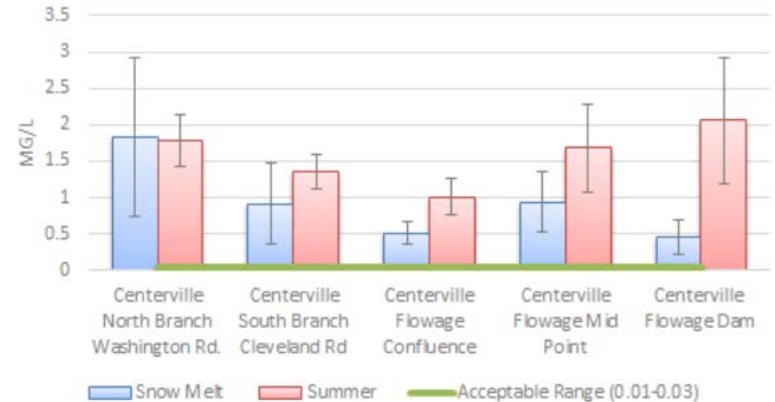
4/24/2014

5/2/2014

Dissolved Phosphate During Summer Sampling

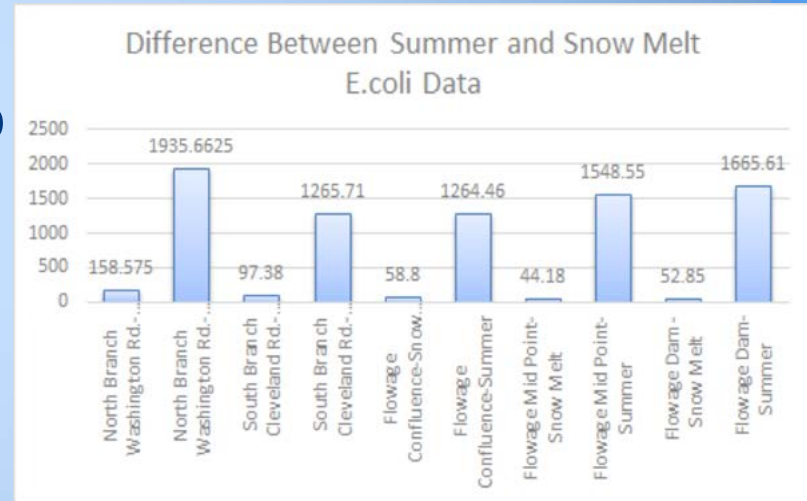


Total Phosphate During Snow - Melt



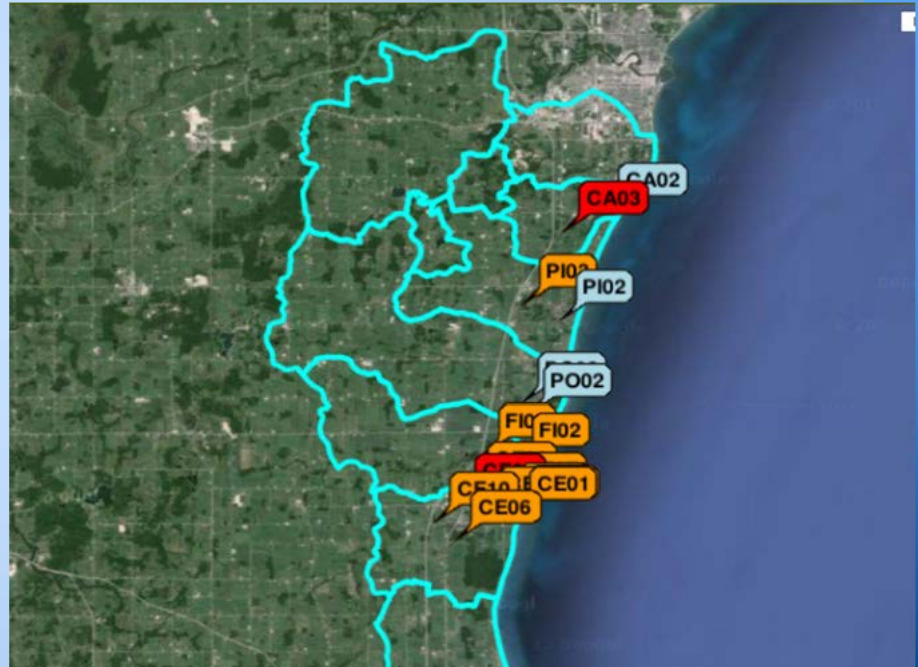
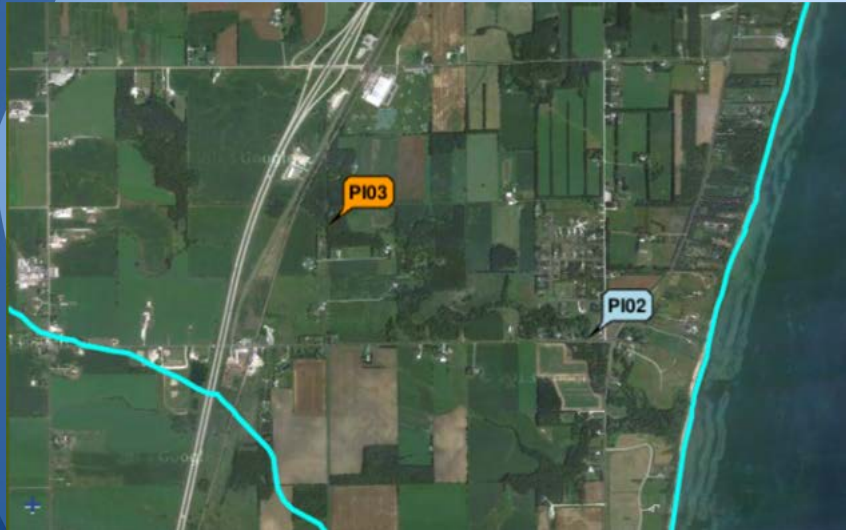
# Snow-Melt Data Continued

- Phosphate data was still high, however, some sites were closer to the acceptable range.
- E. coli levels were considerably lower.
- Both parameters decreased downstream.



# Pine Creek

PI02	Pine Creek Hwy. U
PI03	Pine Creek South Gass Lake Rd.

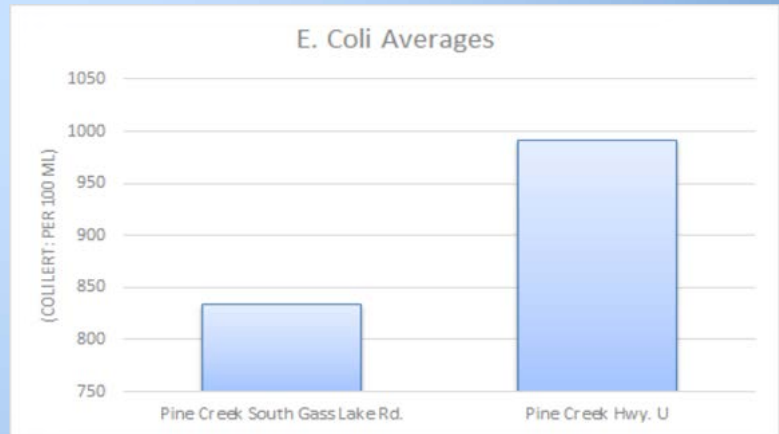
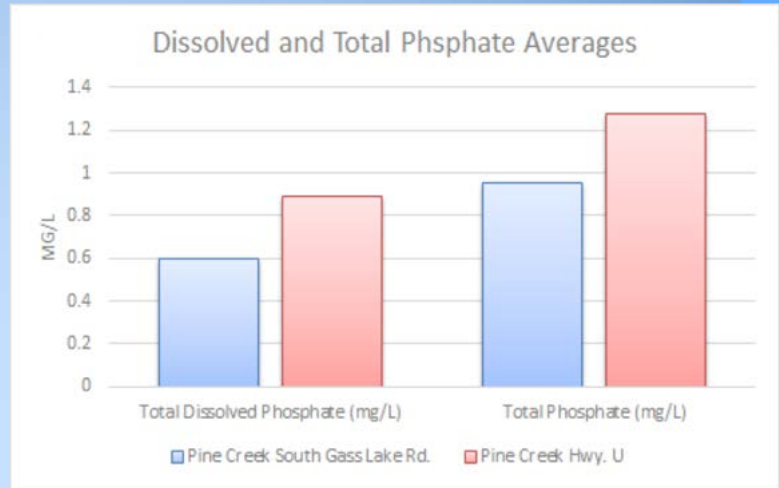


# Pine Creek

Orange-Decrease

Purple-Increase

Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Difference Between 2012 and 2013	Difference Between 2013 and 2014	Standard Acceptable Ranges During Summer
Water Temperature (°C)	17.50	16.82	17.26	-0.68	+0.44	10-19°C
pH	8.31	8.50	8.37	+0.19	-0.13	5.8 to 8.5
Turbidity (NTU)	10.35	11.85	17.33	+1.5	+5.48	1 to 5 NTU
Stream flow (M/sec)	0.3	0.5	0.3	+0.2	-0.3	N/A
Conductivity (µS)	841	858	779	+17	-79	N/A
Dissolved oxygen (mg/L)	7.34	8.77	7.74	+1.43	-1.03	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.01695	0.03197	0.74344	+0.01502	+0.71147	N/A
Total Phosphate (mg/L)	0.08541	0.07344	1.11698	-0.01197	+1.04354	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia nitrogen (NH3) (mg/L)	0.01901	0.02548	0.02332	+0.00679	-0.00216	<0.1 mg/l
Ammonia nitrogen (NH4) (mg/L)	0.23933	0.22241	0.26453	-0.01692	+0.04212	<0.5 mg/l
E. coli (MPN/100 ml)	771.0	722.2	914.8	-48.8	+192.6	Advisory: >235 Closed: >1000



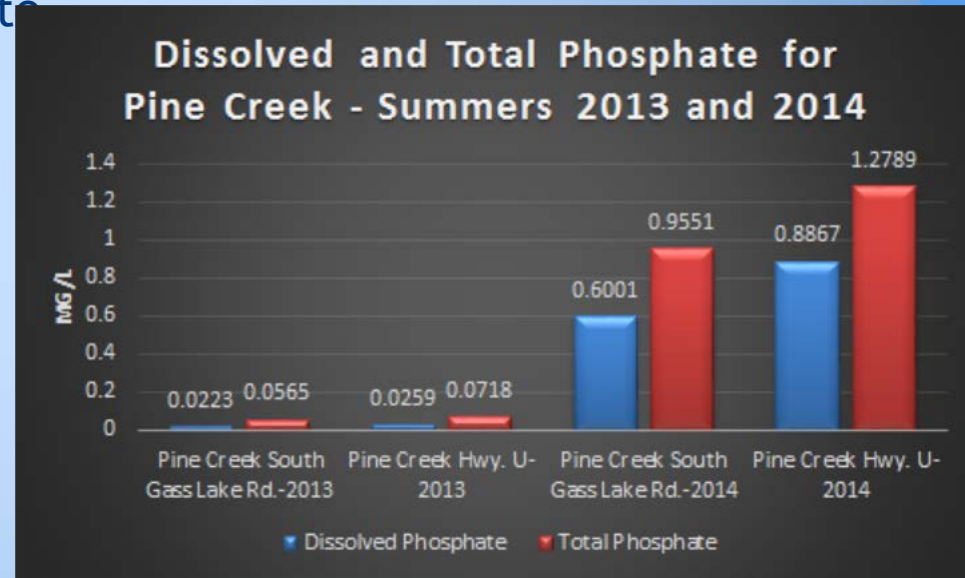


# Pine Creek-Analysis

Biggest change-

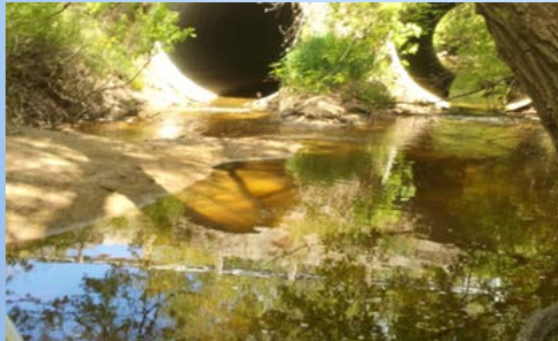
Total and Dissolved Phosphate

Most changes in 2014 returned parameters from 2013 to the 2012 averages.



# Pine Creek Analysis

- Opposite from Summers 2012 and 2013 data, phosphate levels follow the general trends seen in other streams of increasing downstream.
- Similar to data from Summer 2013, E.coli did follow the trend of increasing downstream.
- Most of the parameters that changed last year were reversed, returning the stream to the state it was in during 2012; Following an increase downstream.



# Pine Creek-Snow Melt Data

- Only Pine S. Gass Rd.

## Differences Between Snow Melt and Summer Phosphates



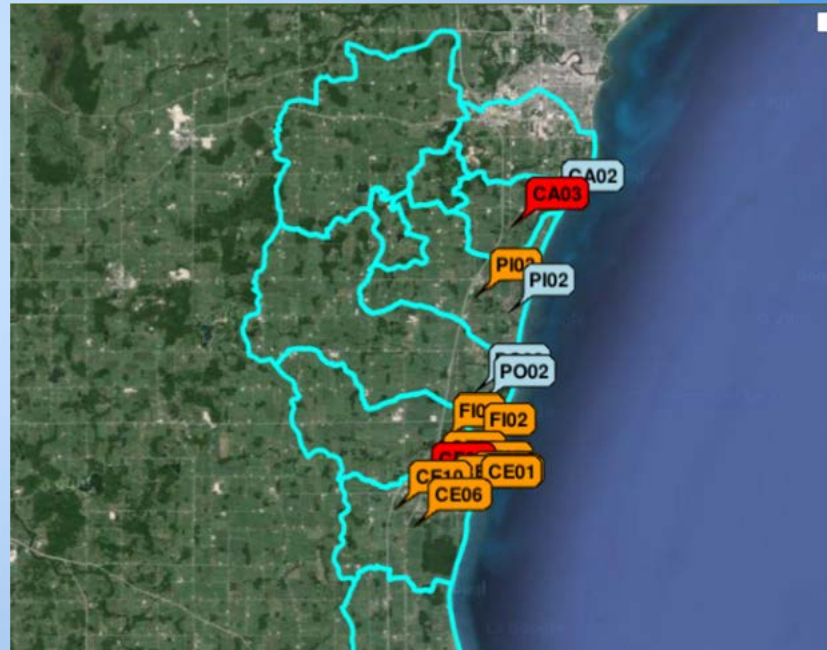
## Difference Between Snow Melt and Summer E.coli



# Point Creek



PO02	Point Creek Schutte's
PO03	Point Creek S. Gass Lake Rd.



# Point Creek

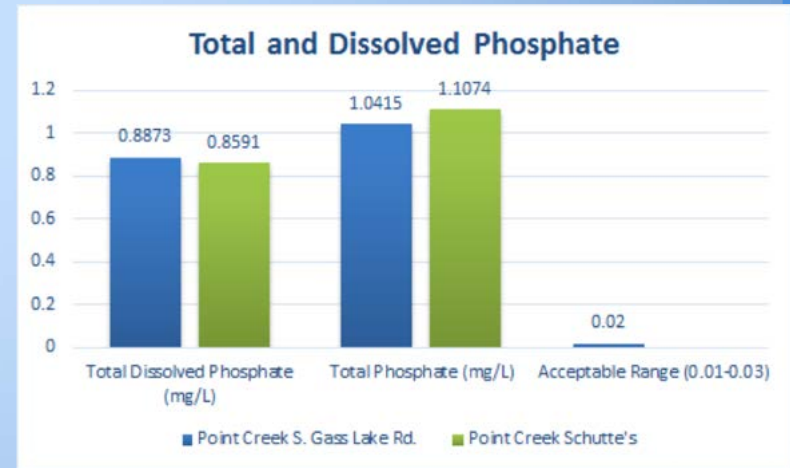
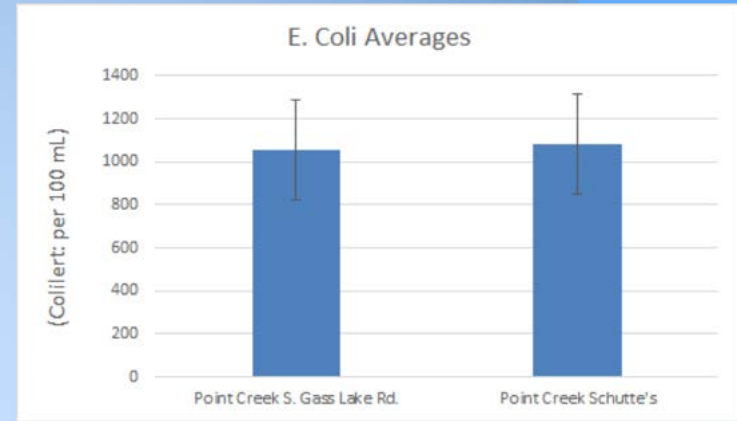
Orange-Decrease

Purple-Increase

Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Difference Between 2012 and 2013	Difference Between 2013 and 2014	Standard Acceptable Ranges During Summer
Water temperature (°C)	19.21	18.15	17.99	-1.06	-0.16	10-19°C
pH	8.51	8.69	8.35	+0.18	-0.34	5.8 to 8.5
Turbidity (NTU)	14.14	6.61	50.17	-7.53	+43.56	1 to 5 NTU
Stream flow (M/sec)	0.4	1.3	0.5	+0.9	-0.8	N/A
Conductivity (µS)	717.2	748.1	776.9	+30.9	+27.8	N/A
Dissolved oxygen (mg/L)	7.86765	8.48153	7.71865	+0.61388	-0.76288	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.03407	0.03182	0.87317	-0.00225	+0.84135	N/A
Total Phosphate (mg/L)	0.08035	0.05895	1.04480	-0.0214	+0.98585	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia nitrogen (NH3) (mg/L)	0.03275	0.03081	0.01841	-0.00194	-0.0124	<0.1 mg/l
Ammonia nitrogen (NH4) (mg/L)	0.27734	0.17162	0.23284	-0.10572	+0.06122	<0.5 mg/l
E. coli (MPN/100 ml)	841.7	706.1	1070.1	-136.6	+364.0	Advisory: >235 Closed: >1000

# Point Creek Analysis

- Opposite from the past two summers, total phosphate increased downstream.
- Phosphate levels continue to be above what is considered the acceptable range within the watershed.



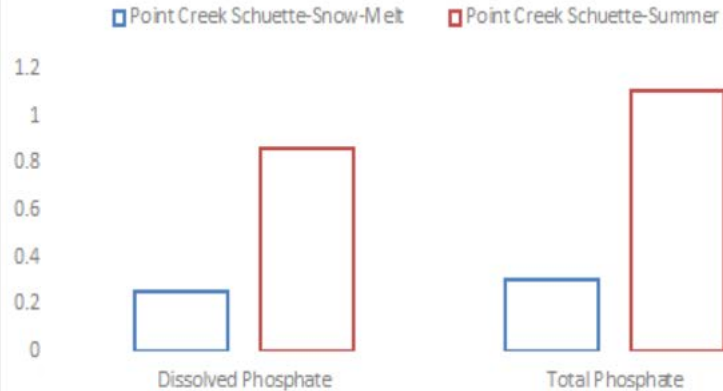
# Point Creek Rain Event



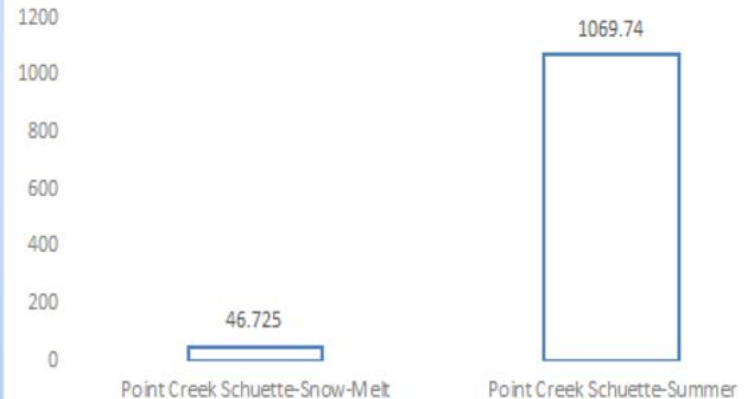
# Point Creek Snow-Melt Data

- Point Schuette

## Difference Between Snow-Melt and Summer Phosphates



## Difference Between Snow-Melt and Summer E.coli





# Fischer Creek

FI02	Fischer Creek LS
FI03	Fischer Creek Dairyland Dr.



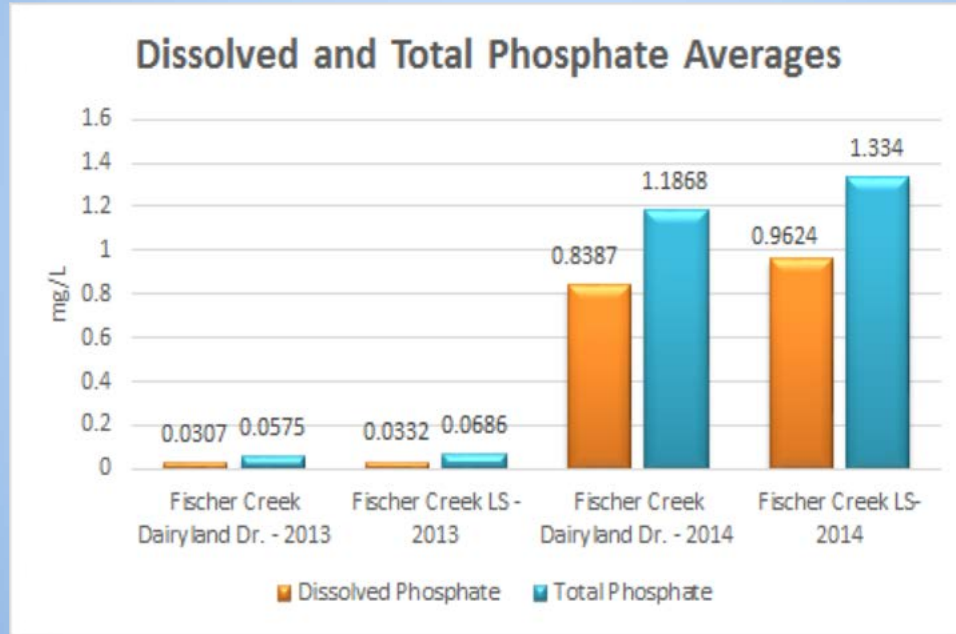
# Fischer Creek

Orange-Decrease

Purple-Increase

Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Difference Between 2012 and 2013	Difference Between Summer 2013 and 2014	Standard Acceptable Ranges During Summer
Water temperature (°C)	17.33	15.63	16.47	-1.7	+0.84	10-19°C
pH	8.43	8.63	9.84	+0.2	+1.21	5.8 to 8.5
Turbidity (NTU)	9.27	3.48	10.91	-5.79	+7.43	1 to 5 NTU
Stream flow (M/sec)	0.4	0.5	0.2	+0.1	-0.3	N/A
Conductivity (µS)	792.5	793.4	828.5	+0.09	+35.1	N/A
Dissolved oxygen (mg/L)	8.38853	9.06231	7.93081	+0.67378	-1.09229	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.03289	0.03195	0.90058	-0.00094	+0.86863	N/A
Total Phosphate (mg/L)	0.08765	0.06307	1.26046	-0.02458	+1.19739	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia nitrogen (NH3) (mg/L)	0.03489	0.01756	0.03023	-0.01733	+0.01267	<0.1 mg/l
Ammonia nitrogen (NH4) (mg/L)	0.30705	0.14098	0.26262	-0.16607	+0.12164	<0.5 mg/l
E. coli (MPN/100 ml)	940.4	635.6	1024.3	-304.8	+388.7	Advisory: >235 Closed: >1000

# Fischer Creek Analysis



# Fischer Creek Analysis



- Most Fischer Creek parameters showed very little variance within the data throughout the past 3 years of testing.
- Even though the trendline of increasing downstream is consistent with the past years, there is a major increase in phosphate.

# Fischer Creek-Snow Melt Data

- Only Dairyland Dr. Site

## Difference Between Snow Melt and Summer Phosphates

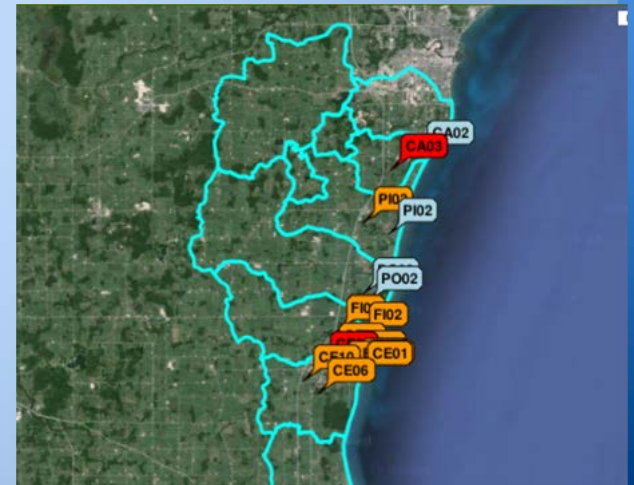
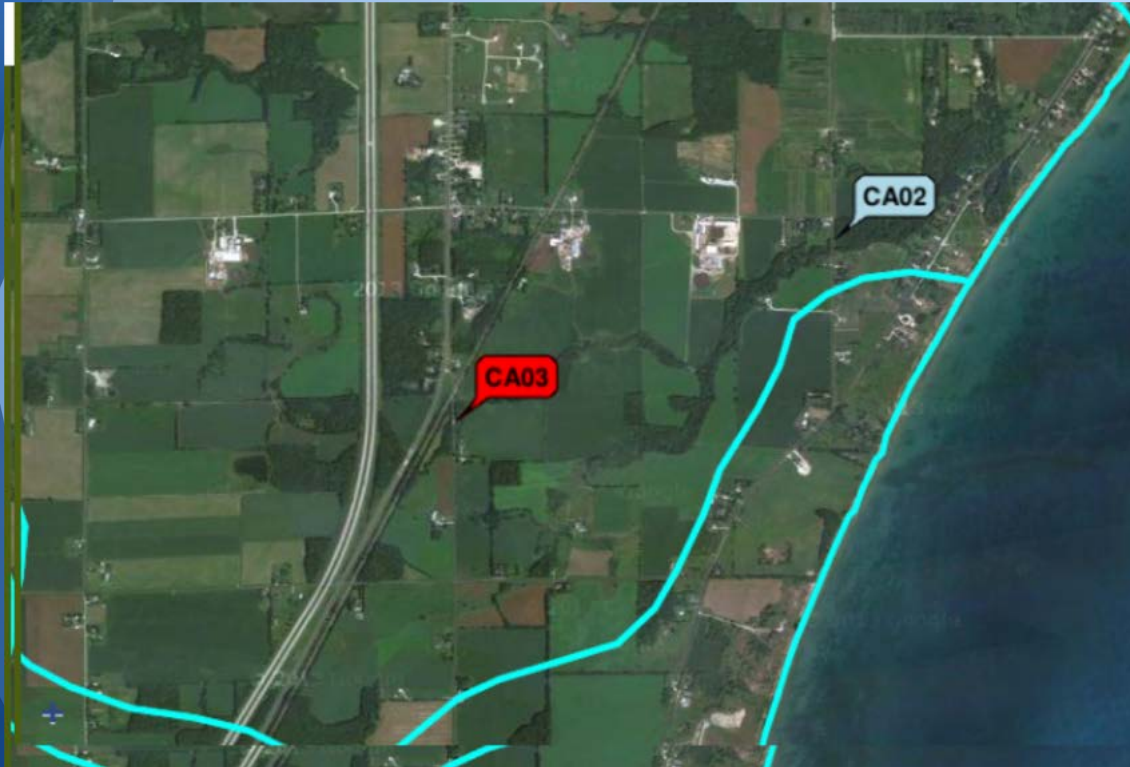


## Difference Between Snow-Melt and Summer E.coli



# Calvin Creek

CA02	Calvin Creek South 26th St.
CA03	Calvin Creek Northeim Rd.



# Calvin Creek

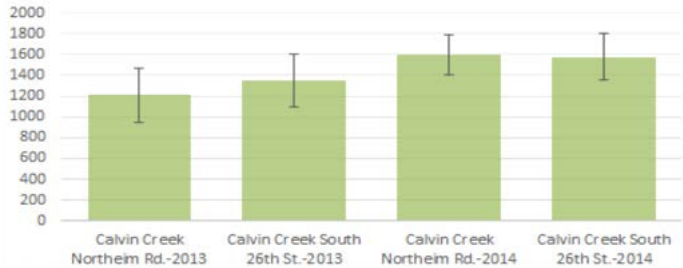
Orange-Decrease

Purple-Increase

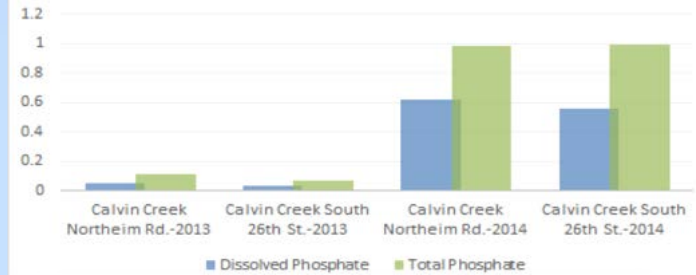
Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Difference Between 2012 and 2013	Difference Between 2013 and 2014	Standard Acceptable Ranges During Summer
Water temperature (°C)	18.55	18.30	18.57	-0.25	+0.27	10-19°C
pH	8.37	8.57	8.32	+0.2	-0.25	5.8 to 8.5
Turbidity (NTU)	12.46	17.18	14.72	+4.72	-2.46	1 to 5 NTU
Stream flow (M/sec)	0.1	0.6	0.6	+0.5	0.0	N/A
Conductivity (µS)	674	695	727	+21	+32	N/A
Dissolved oxygen (mg/L)	6.77061	8.09961	6.75917	+1.32900	-1.34044	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.03873	0.04292	0.59146	+0.00419	+0.54854	N/A
Total Phosphate (mg/L)	0.10408	0.09352	0.98363	-0.01056	+0.89011	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia nitrogen (NH3) (mg/L)	0.02850	0.03748	0.02823	+0.00898	-0.00925	<0.1 mg/l
Ammonia nitrogen (NH4) (mg/L)	0.39064	0.28440	0.27685	-0.10624	-0.00755	<0.5 mg/l
E. coli (MPN/100 ml)	1396.3	1279.6	1588.6	-116.7	+309.0	Advisory: >235 Closed: >1000

# Calvin Creek Analysis

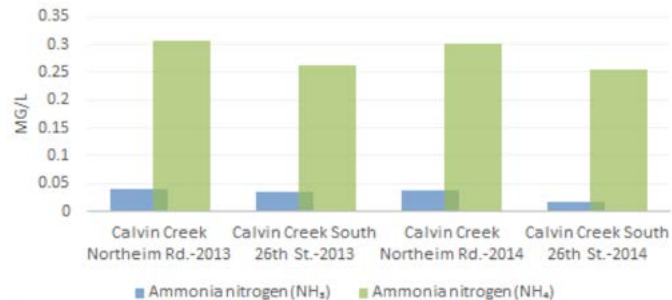
## E. COLI CHANGES WITHIN CALVIN CREEK



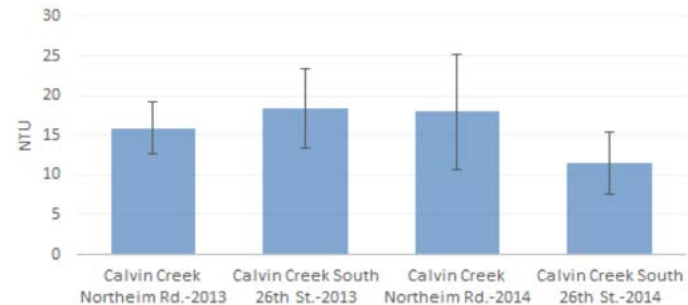
## Phosphate Changes within Calvin Creek



## Ammonia Nitrogen Changes Within Calvin Creek



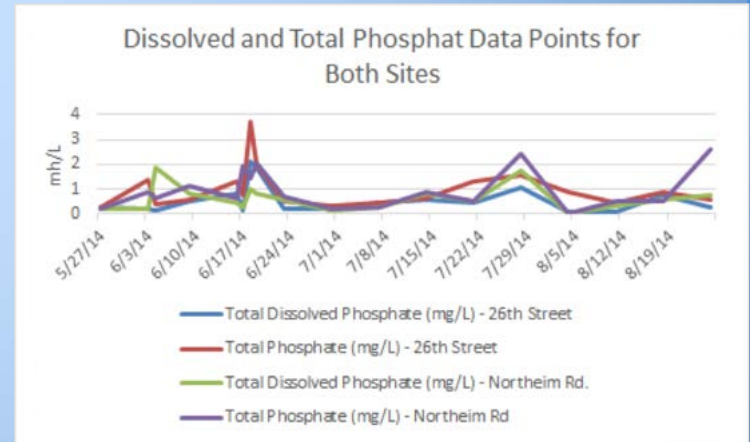
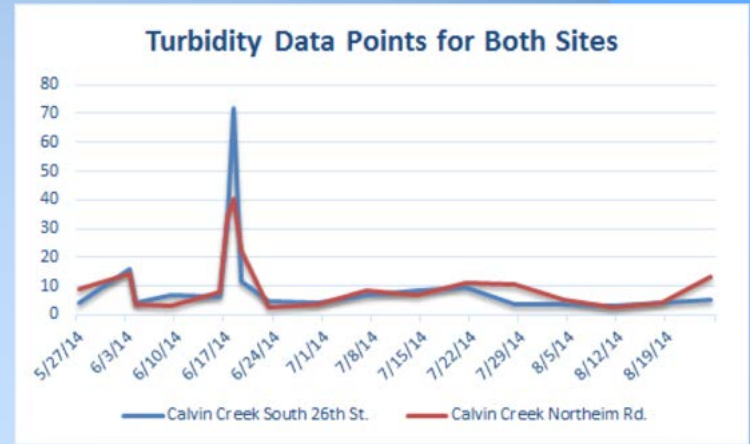
## Turbidity Changes Within Calvin Creek





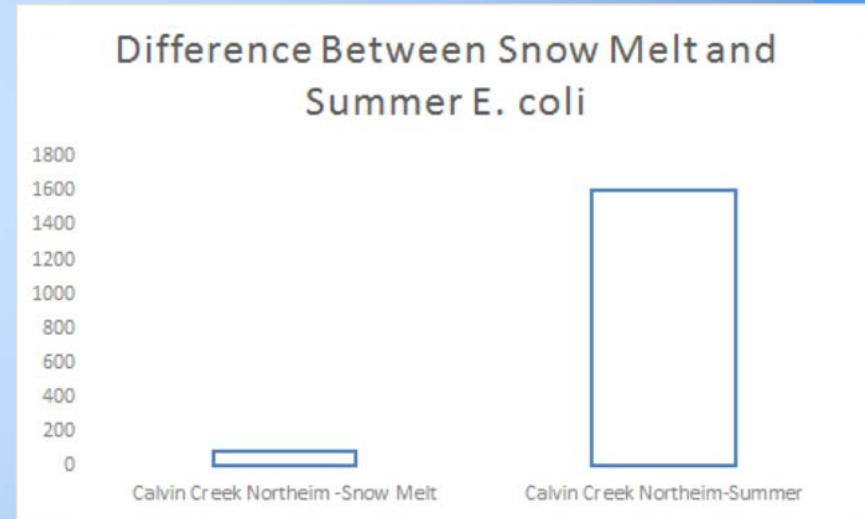
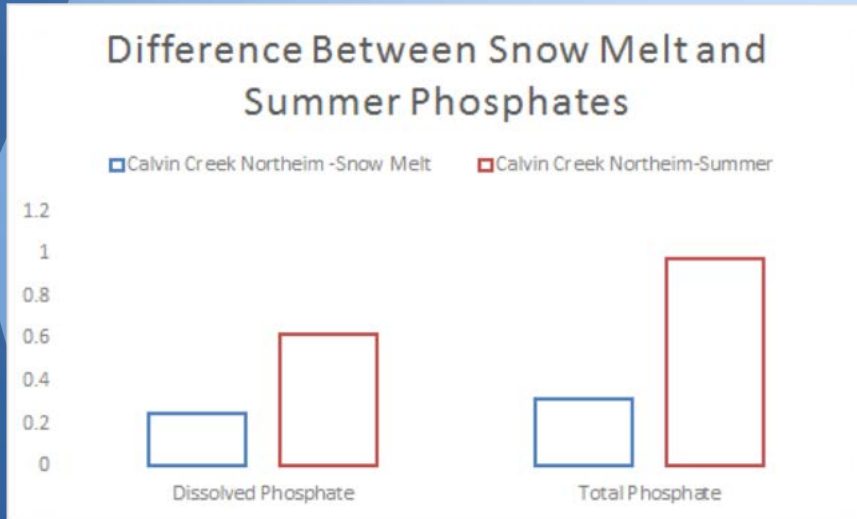
# Calvin Creek Analysis

- Two pulses shown in data.
- Opposite of summer 2013, E. coli and turbidity decreased downstream.
- Similar to summer 2013, Ammonia Nitrogen and Total and Dissolved Phosphate decrease downstream.



# Calvin Creek-Snow Melt Data

- Only Northeim Data



# Northeim

- Construction at CA02 occurred between Spring and Summer sampling.
- Possible explanations to increased phosphate results
  - Increased Rain Events
  - Runoff related to construction



# All Creek Analysis



Why?

This increase in parameters could be a result of the increase of rain we received this summer.

Precipitation from  
June-August  
2014: 11.42 inches  
2013: 8.25 inches



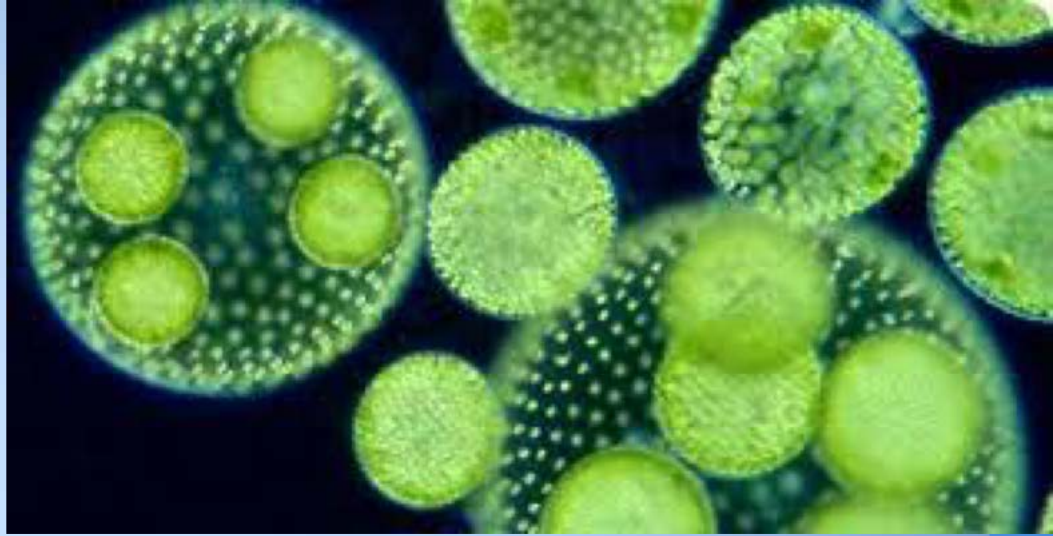
# All Creek Analysis



- Constant trend of significantly higher phosphate levels this year.
- Reaching up to 12 mg/L when 0.01-0.03 is “acceptable.”

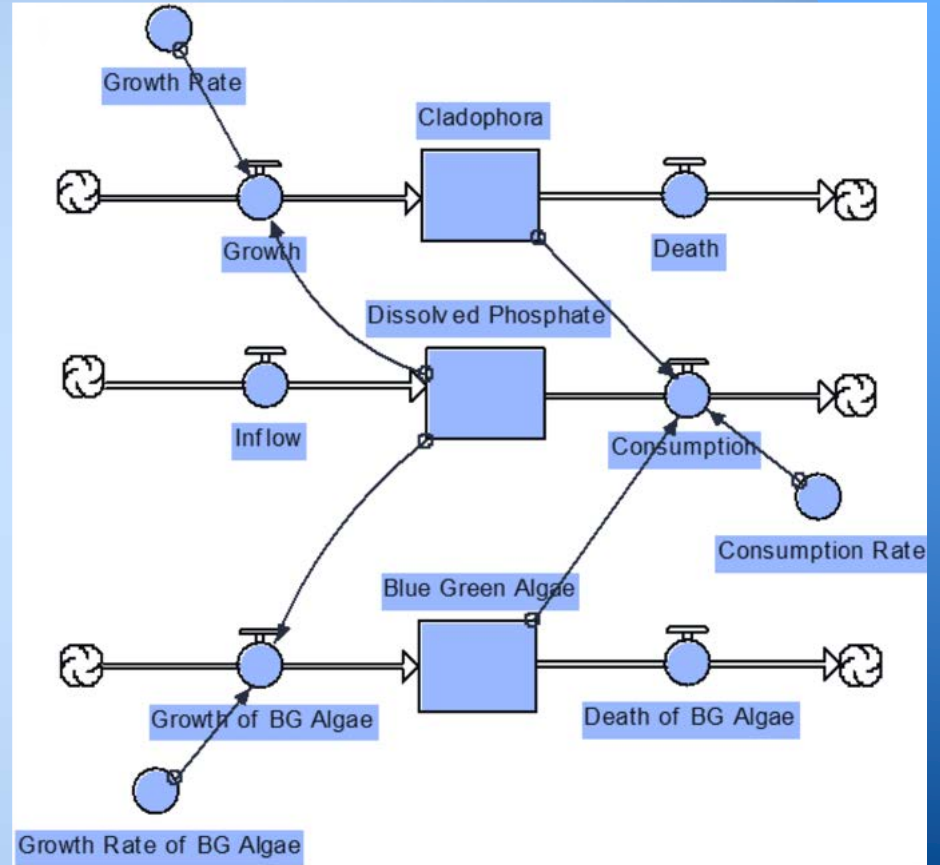
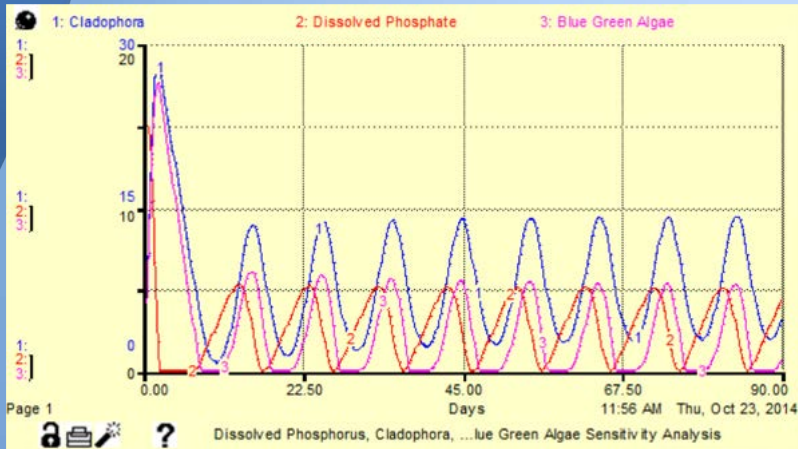
# Phosphate

Limiting factor in plant/algae growth.



Where does it come from?

The drainage basin, biological decomposition, runoff from human activity (fertilizing lawns, soaps, etc.) and agricultural areas (fertilizers and manure.)



# How to lessen phosphate pollution:

- Buffers
- Reduce detergents
- Different soaps
- Less/natural fertilizers
- Careful Application





# Suggestions for future sampling:

- Increase communication with collaborators.
- Continue with the new rain event threshold.
- The addition of sample sites to the creeks with a stronger emphasis on sampling farther inland to assess land use.

**Questions, comments, and  
Concerns:**