

Stream Quality Assessment of Southern Manitowoc County -Snow Melt and Summer 2016-

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Friends of Hika Bay
Calvin, Pine, Point, Fischer, Centerville Creeks

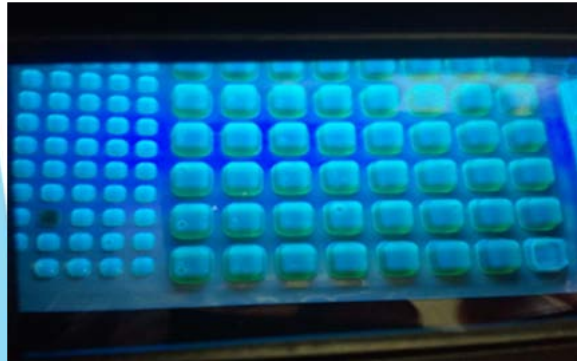
Weekly Sampling

Rain Events

Physical Parameters

Chemical Parameters

Biological Parameters



Snow Melt

Spring 2016

Samples taken at initial snowmelt

Sampling dates: 2/20/2016 and 2/28/2016

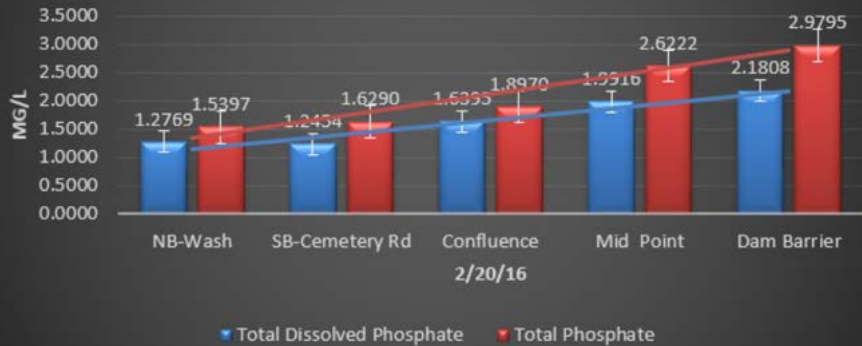
5 sites in Centerville Creek, and 1 in each of the other creeks

Total and dissolved phosphates, E. coli, temperature, stream velocities

Initial melt and rainfall data heavily suggest a relationship between themselves with high bacterial and nutrient levels

Snow Melt Data Analysis

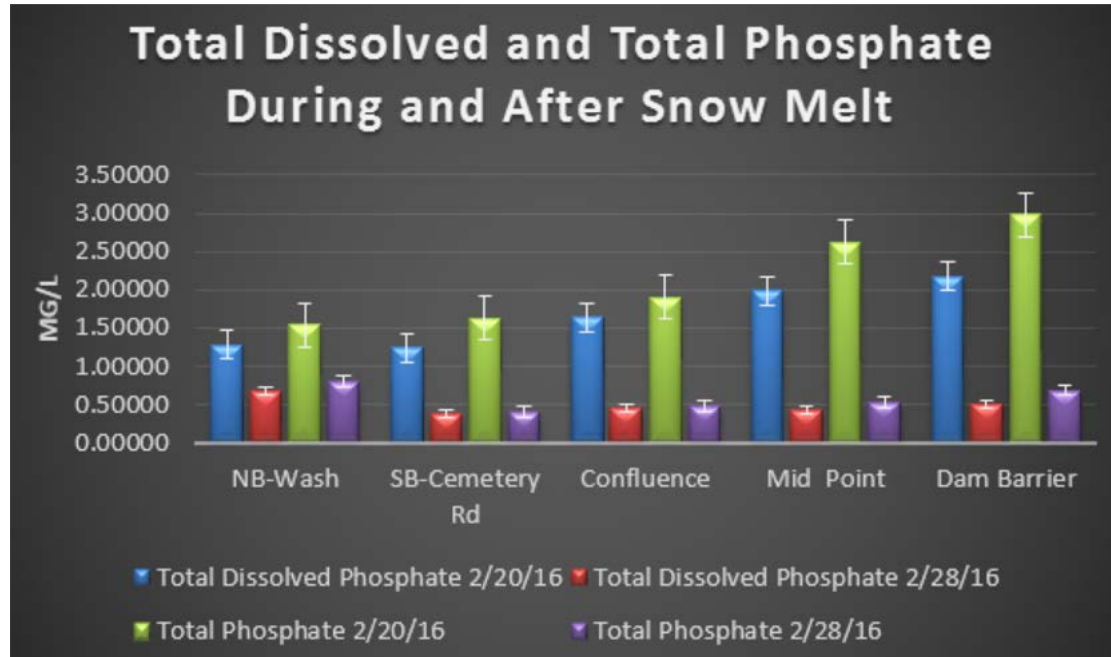
Total Dissolved and Total Phosphate During Snow Melt



Total Dissolved and Total Phosphate After Snow Melt



Snow Melt Data Analysis



Snow Melt Overall Analysis

While collecting for initial snow melt, weather was warm with little to no visible snow left

First sample waters were high, but slow moving

Second sample creeks were much lower and temperature dipped back under 32°C

Parameters did lower in previous years,

The large decrease in phosphates can mostly be attributed to most of runoff and build-up materials being deposited into the creeks during the first initial snowmelt

Rain Data Comparison

Rain events increase runoff into streams,
which can cause nutrient spikes

Raises parameters such as phosphate, E. coli,
ammonia nitrogen, etc.

Precipitation from June to August:

2013: 8.25 inches

2014: 11.42 inches

2015: 11.00 inches

2016: 9.61 inches

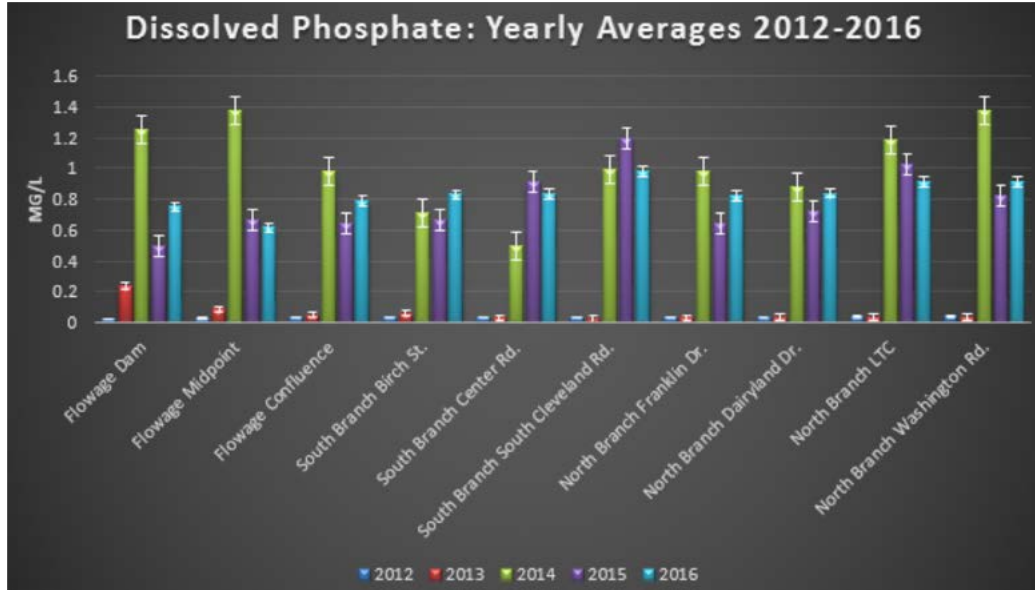




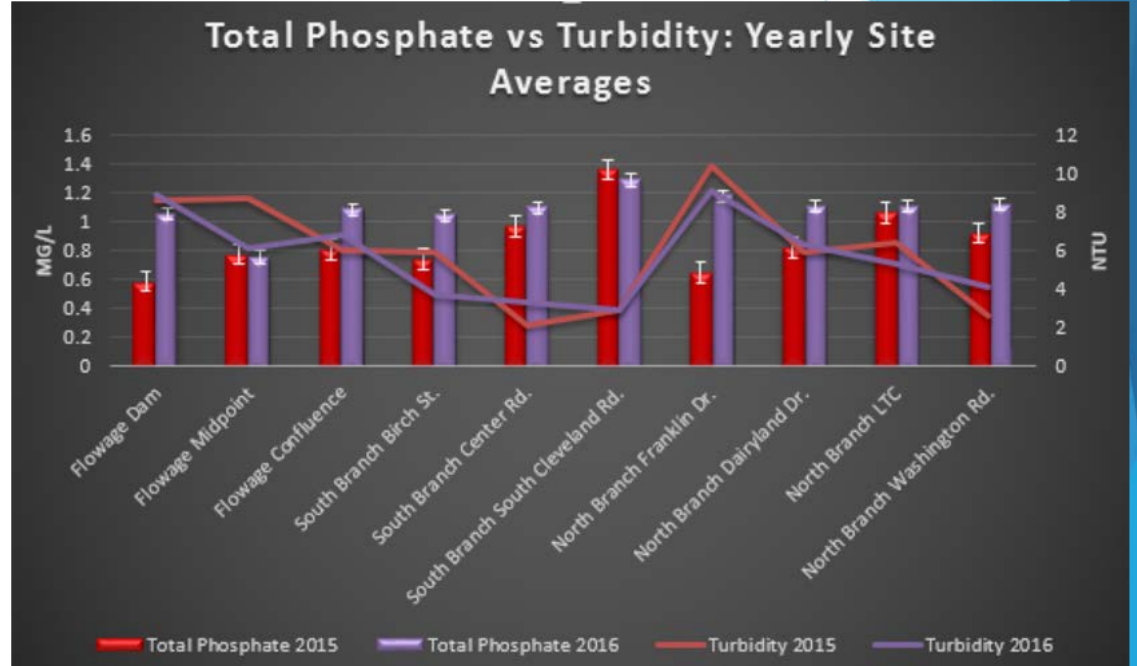
Journey
to a
New
Creek



Restoration Data



Restoration Data



Union Sites

Four new testing sites

Union Road North

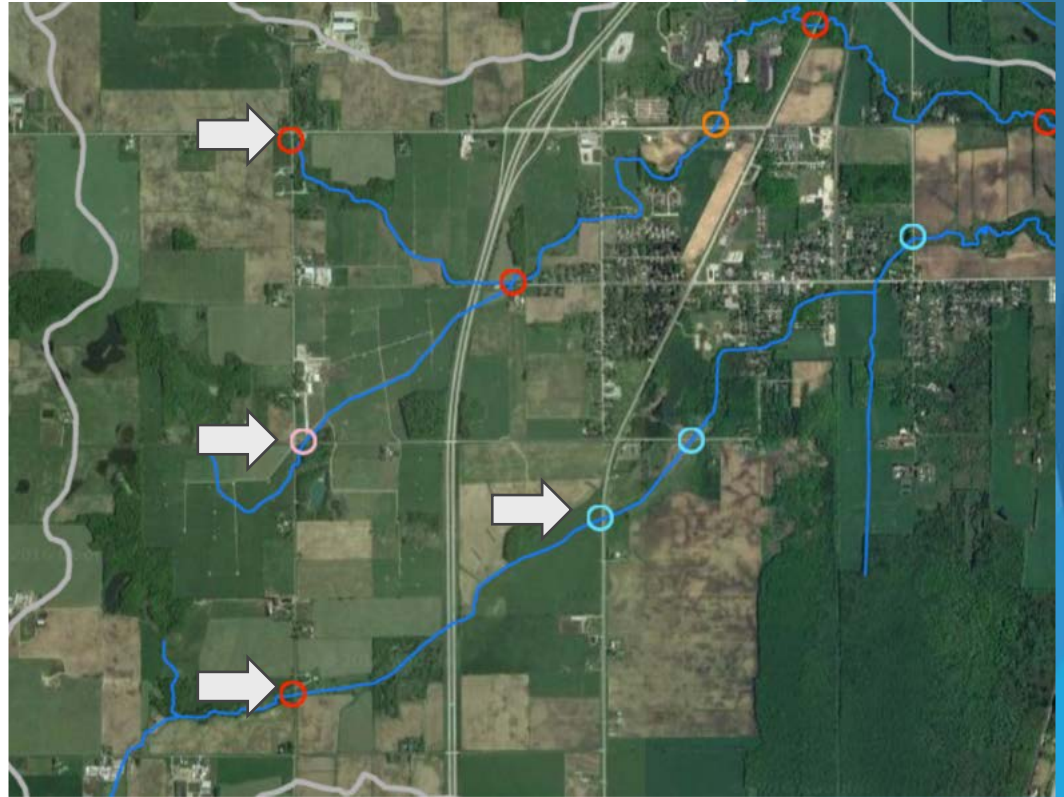
Union Road Mid

Union Road South

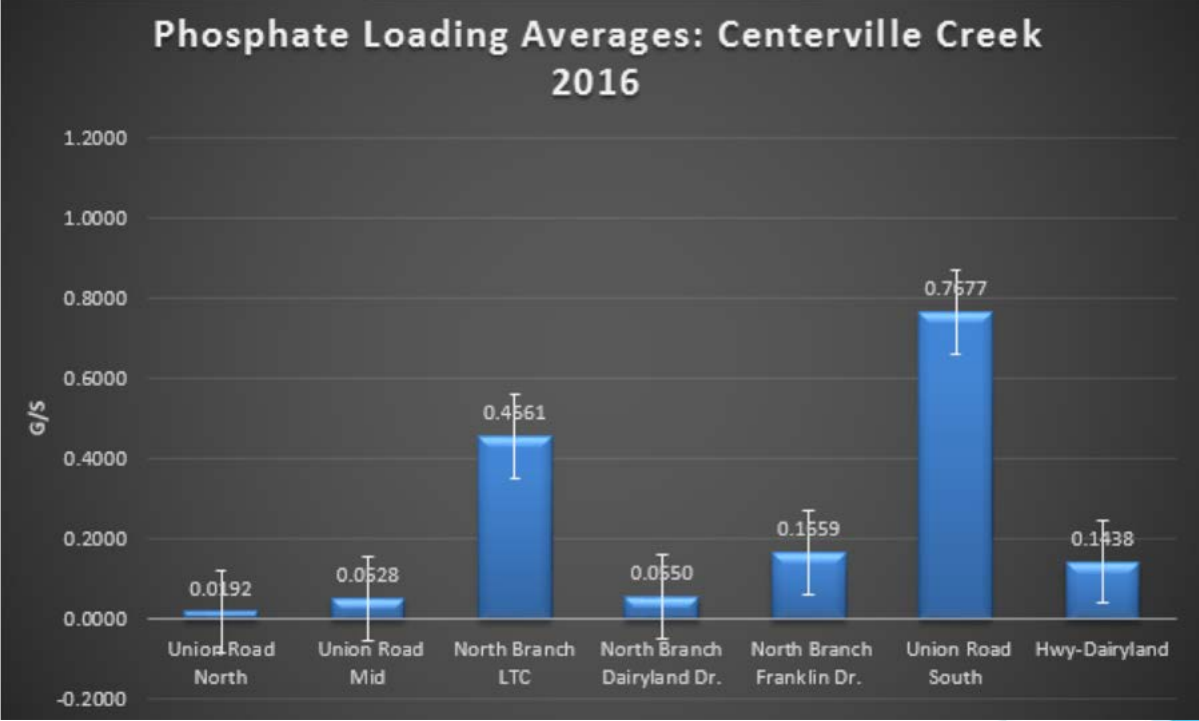
Hwy-Dairyland

Expands into watershed

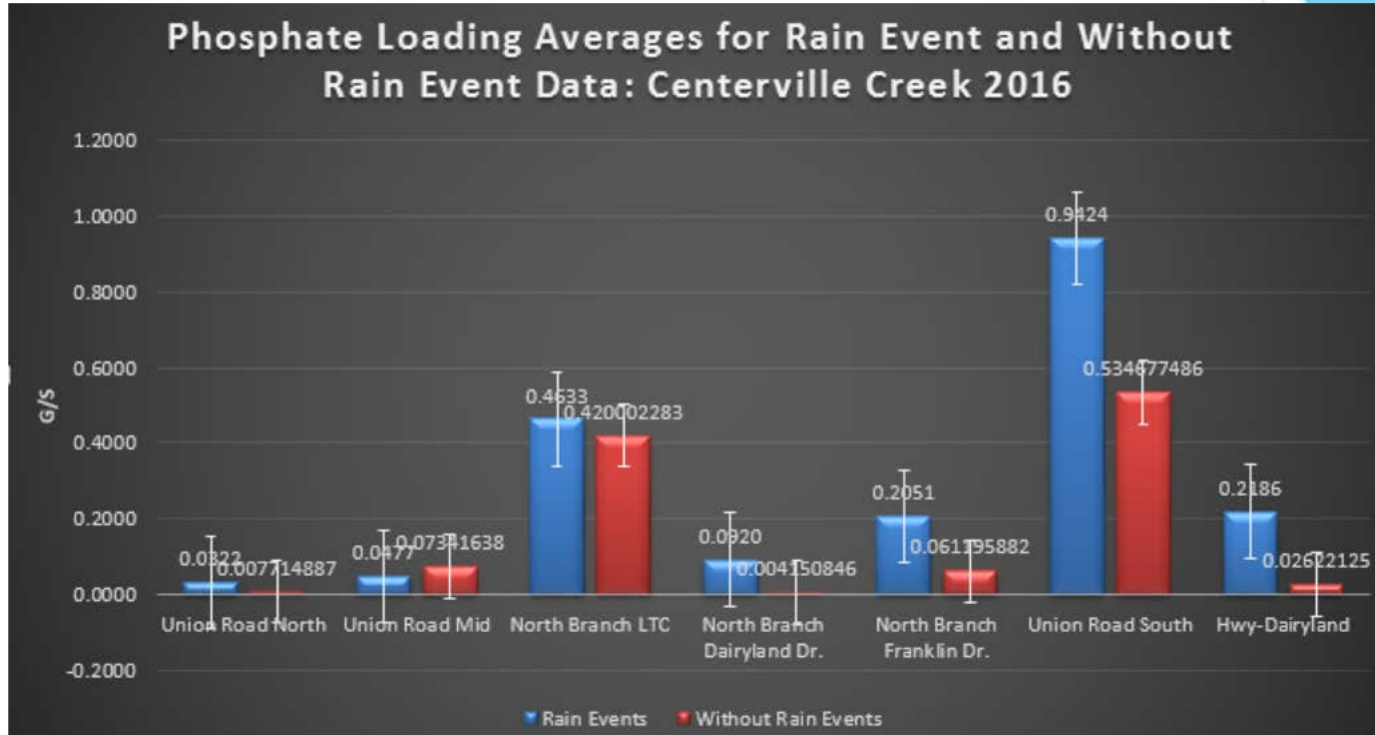
More upstream than older sites



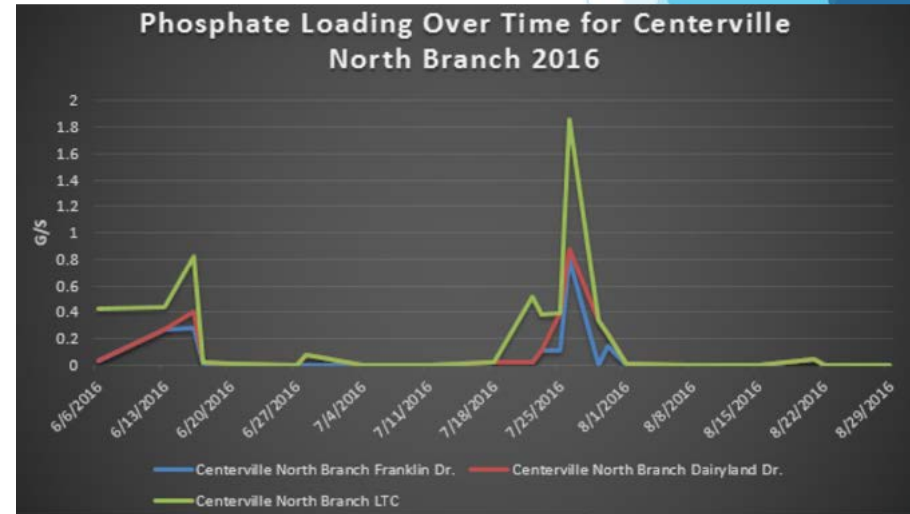
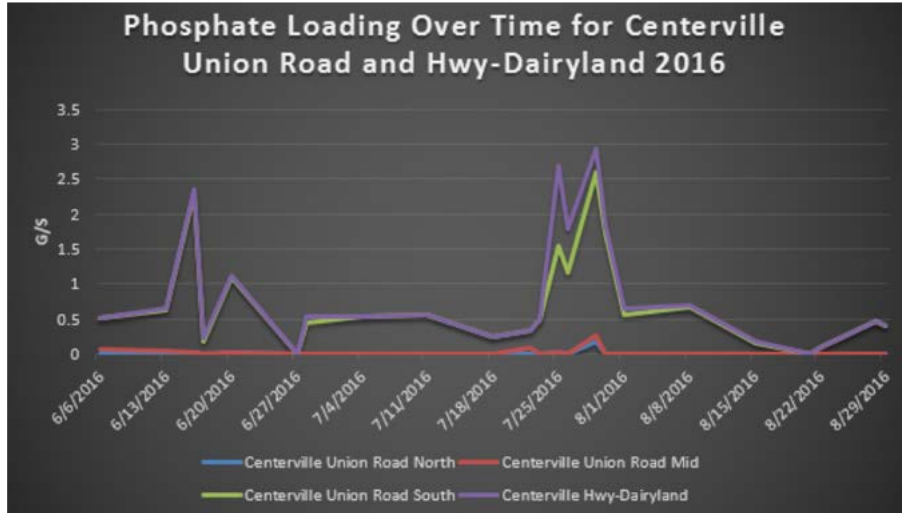
Phosphate Loading-Centerville



Phosphate Loading-Centerville



Phosphate Loading-Centerville



Union Sites

All four sites have phosphate loading data

Total Dissolved Phosphate Loading:

Union Road North:

11.6243 kg/week

25.6272 lbs/week

Union Road Mid:

31.9637 kg/week

70.4672 lbs/week

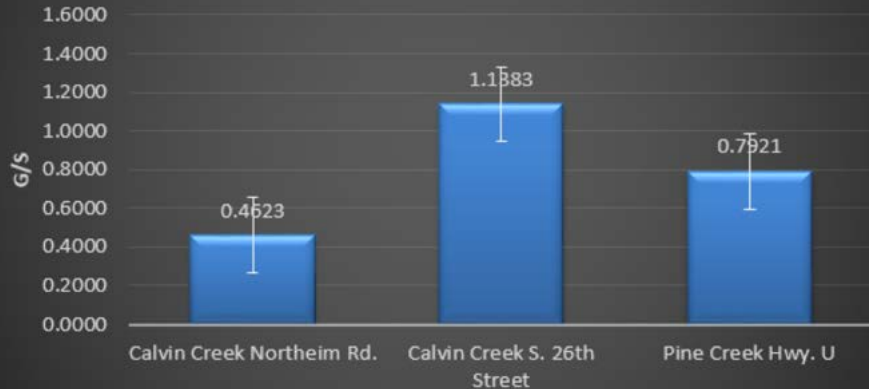
Union Road South:

464.2868 kg/week



Phosphate Loading- Other Creeks

Phosphate Loading Averages: Calvin and Pine Creek 2016



Phosphate Loading Over Time for Calvin and Pine Creek 2016



Calvin and Pine Sites

Calvin Creek

Total Dissolved Phosphate Loading:

Northeim Road:

153.6434 kg/week

338.7257 lbs/week

South 26th Street:

736.6585 kg/week

1624.0539 lbs/week

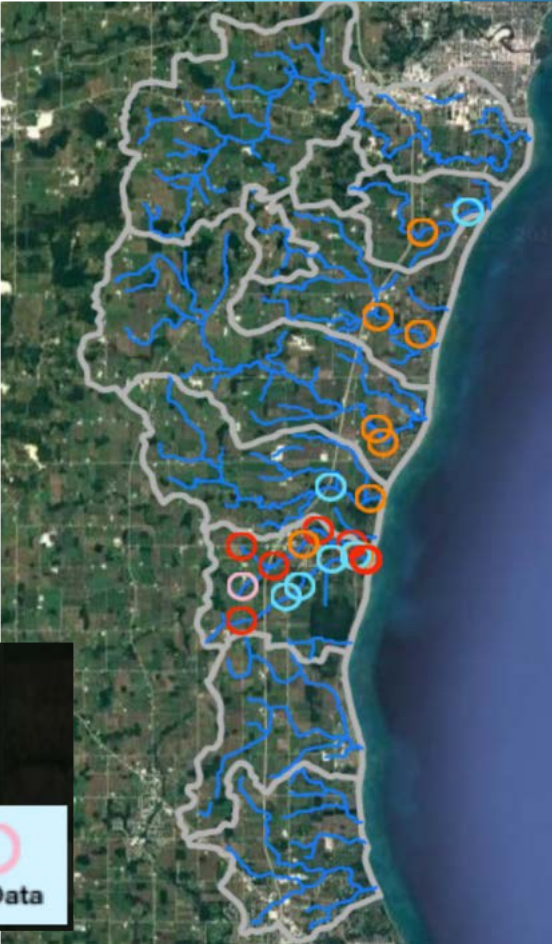
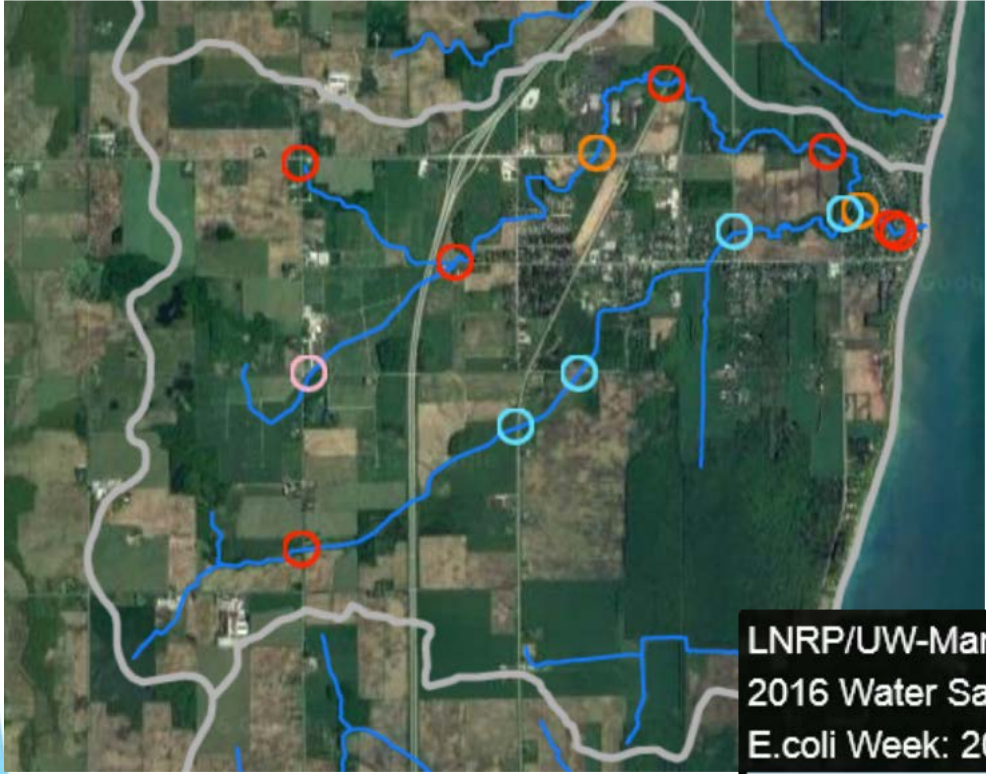
Pine Creek

Total Dissolved Phosphate Loading:

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.
CE11	Centerville Union Road North
CE12	Centerville Union Road Mid
CE13	Centerville Union Road South
CE14	Centerville Hwy-Dairyland



LNRP/UW-Manitowoc
2016 Water Sampling Sites
E.coli Week: 2016-08-28_48hr



OK



Poor



Fail



No Data

Centerville Creek Averages

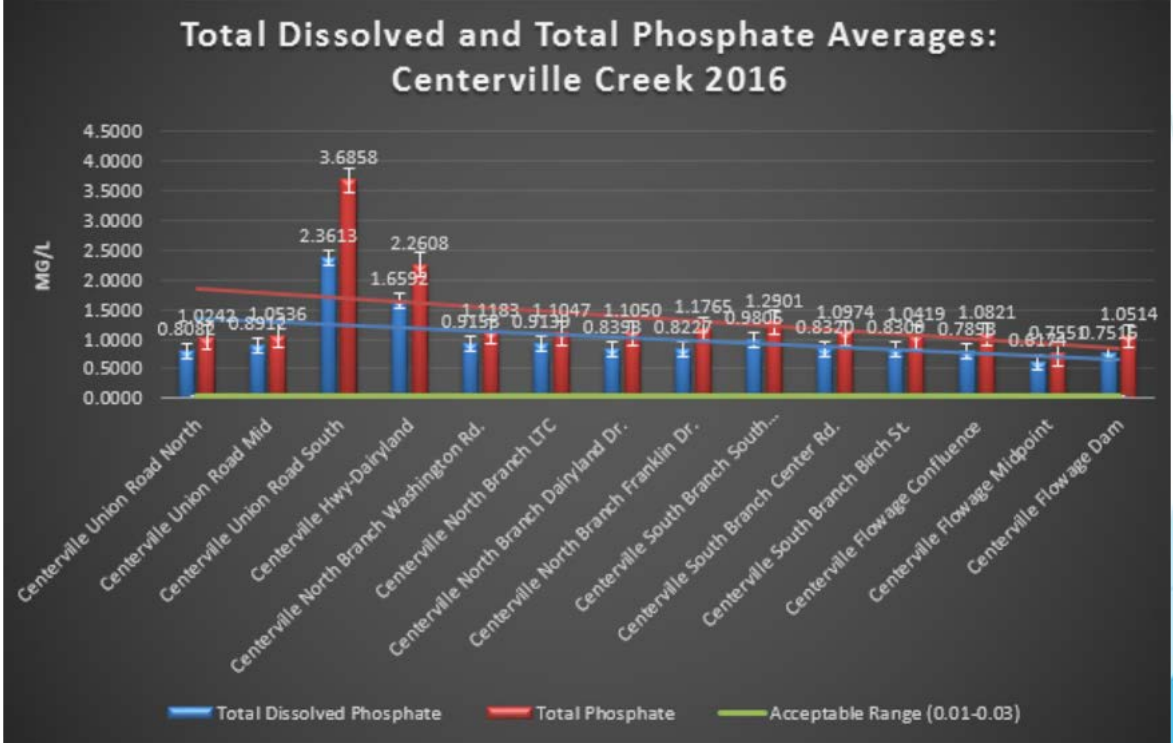
Decrease: Orange

Increase: Purple

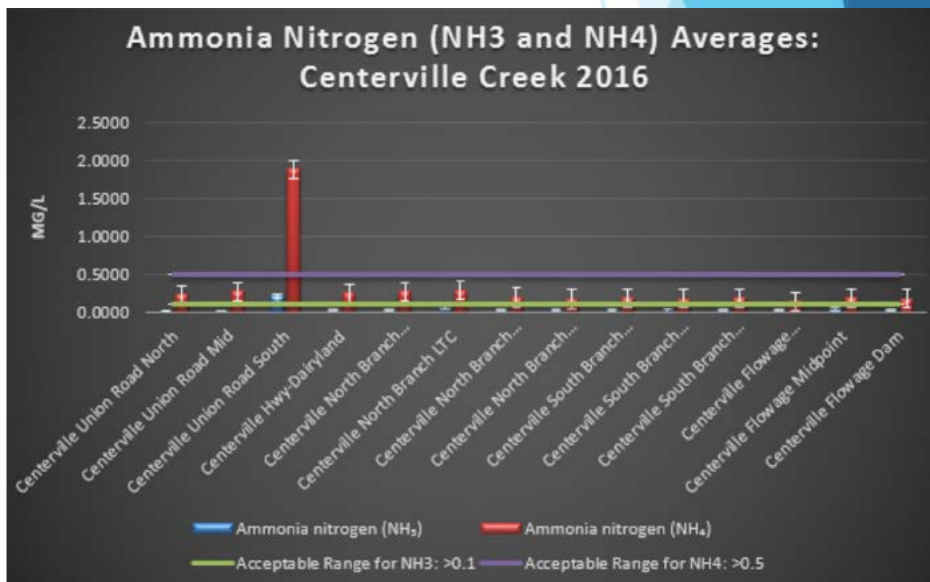
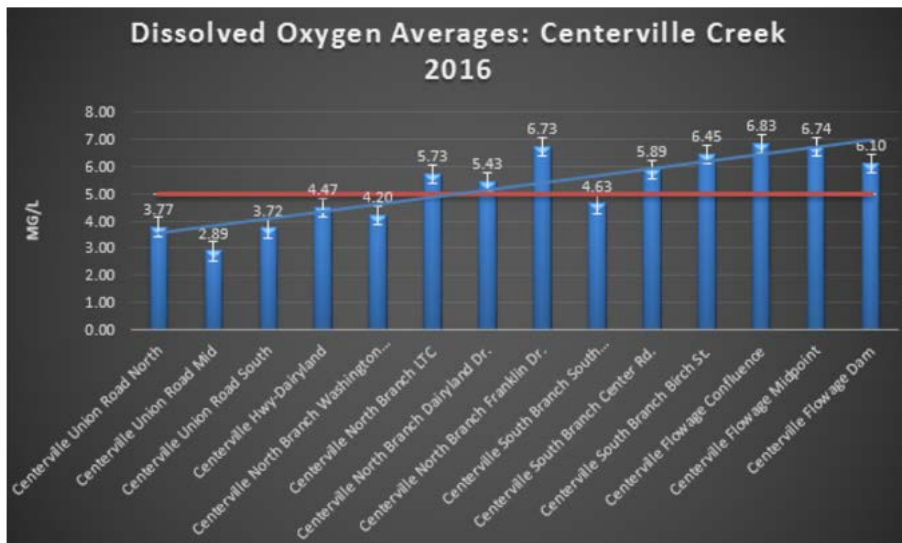
*Exclusion

Averages of All Creek Sample Points	Summer 2011	Summer 2012	Summer 2013	Summer 2014	Summer 2015	Summer 2016	Difference between Summers 2015 and 2016	Standard Acceptable Ranges During Summer
Water Temperature (°C)	23.1	18.84	17.75	17.76	17.28	18.35	+1.07	10-19°C
pH	8.5	8.46	8.63	8.38	8.73	8.07	-0.66	5.8-8.5
Turbidity (NTU)	29.6	15.44	15.10	10.28	9.33	5.11	-4.22	1 to 5 NTU
Stream Flow (m/s)	30.5*	0.20	0.34	0.36	0.29	0.23	-0.06	N/A
Conductivity (µs)	836.1	867.42	846.48	899.2	913.6	814.7	-98.9	N/A
Dissolved Oxygen (mg/L)	8.4	7.8	8.4	13.2	11.2	5.38	-5.82	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.14	0.04	0.06482	0.99129	0.98721	1.01365	+0.02644	N/A
Total Phosphate (mg/L)	*	0.08	0.15381	1.32409	1.22249	1.36287	+0.14038	0.001-0.003 ppm (<0.1 ppm max.)
Ammonia Nitrogen (NH ₃) (mg/L)	0.06	0.03	0.04008	0.02627	0.03371	0.05145	+0.01774	<0.1 mg/L
Ammonia Nitrogen (NH ₄) (mg/L)	0.65	0.34	0.37148	0.25772	0.17121	0.33838	+0.16717	<0.5 mg/L
E. coli (MPN/100 mL)	595.7	1476.6	925.1	1397.5	1333.7	1624.8	+291.1	Advisory: >235 Closed: >1000

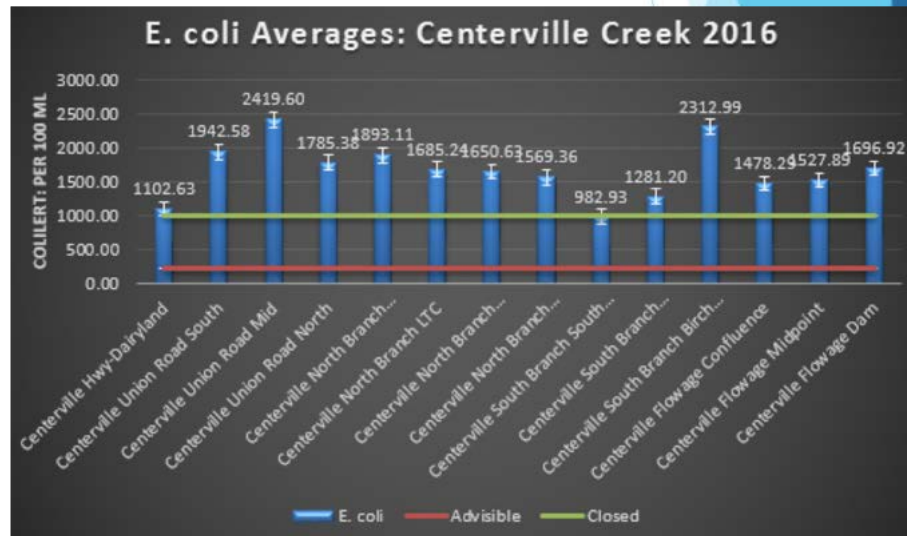
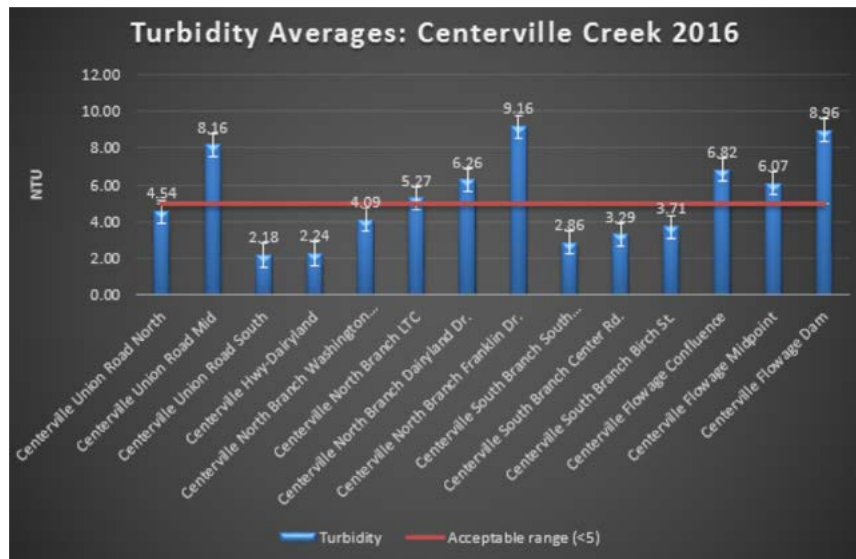
Centerville Creek Site Analysis



Centerville Creek 2016 Site Analysis



Centerville Creek 2016 Site Analysis



Centerville Creek Analysis

Similar parameter levels compared to 2015

Definite differences compared to new sites

Total Dissolved Phosphate Loading:

North Branch LTC:

275.8553 kg/week

608.1568 lbs/week

North Branch Dairyland Drive:

33.2700 kg/week

73.3478 lbs/week



Union Sites

Four new testing sites

Union Road North

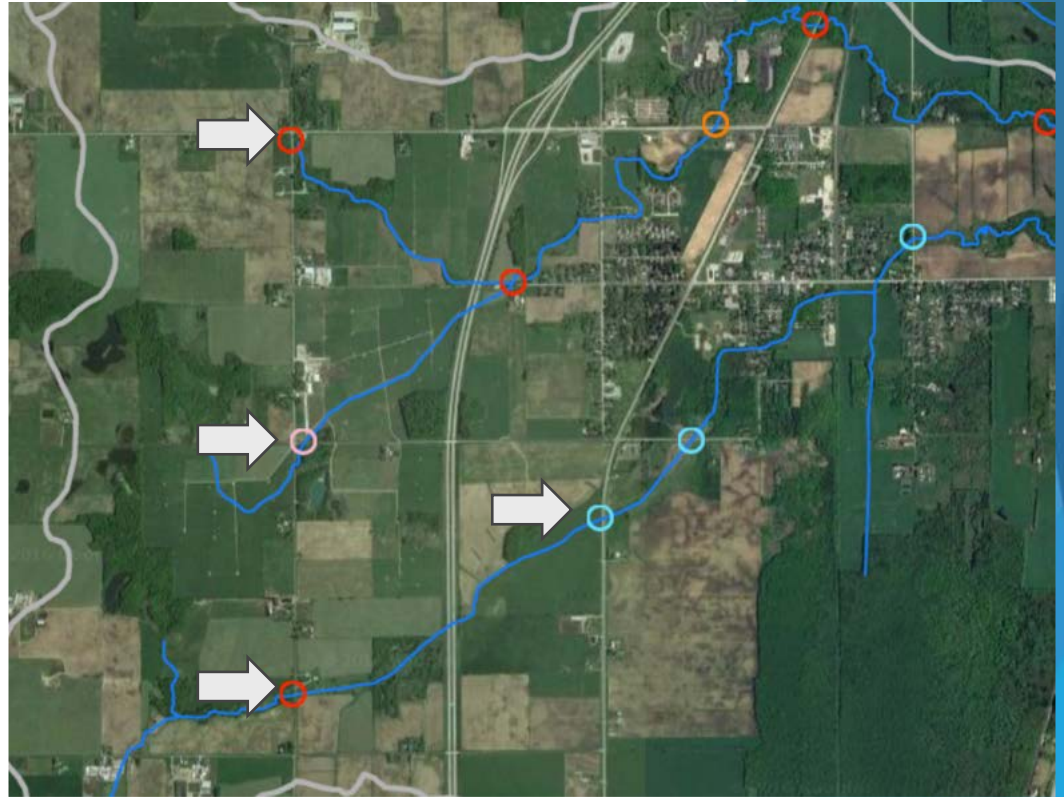
Union Road Mid

Union Road South

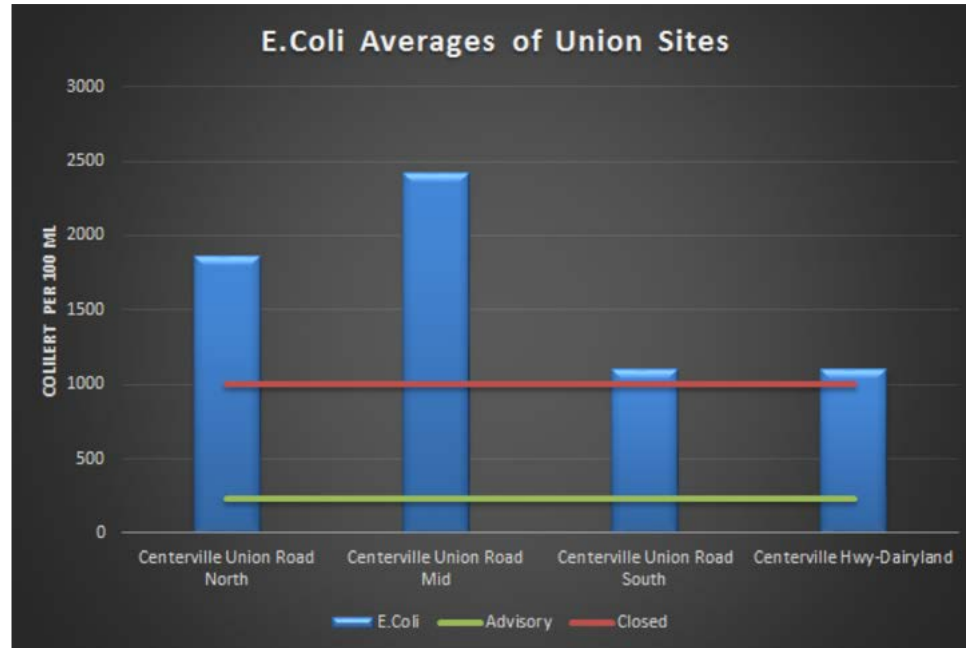
Hwy-Dairyland

Expands into watershed

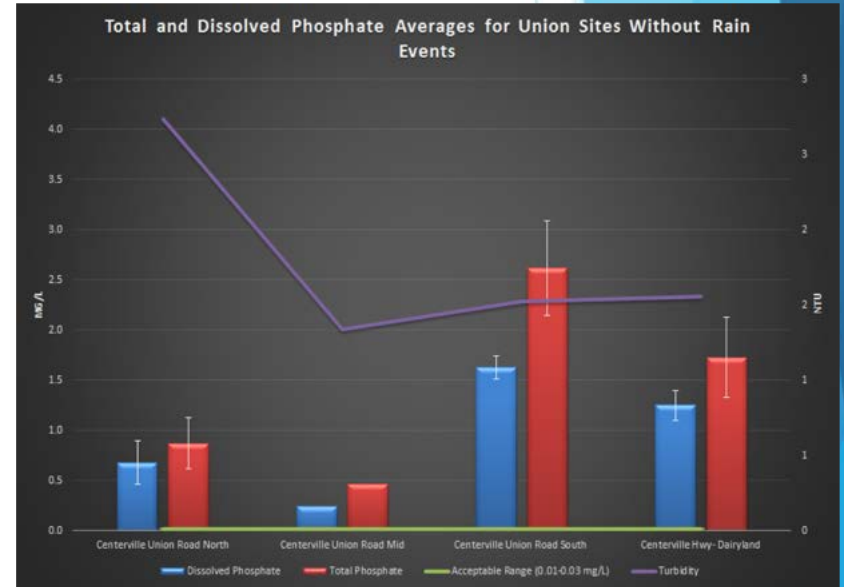
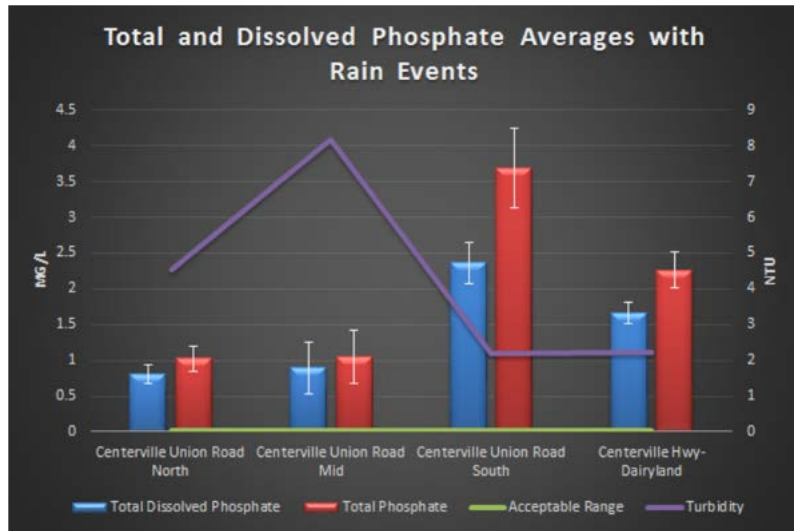
More upstream than older sites



Centerville Union Site Analysis



Centerville Union Site Analysis



Centerville Creek Union Sites Analysis

Visible issues

Continued close monitoring necessary

Union Road North

Highest levels of total and dissolved phosphate

Stagnant

Union Road Mid

Limited samples taken

Low levels

Union Road South



Fischer Creek

FI02	Fischer Creek LS
FI03	Fischer Creek Dairyland Dr.



Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Summer 2015	Summer 2016	Difference Between Summers 2015 and 2016	Standard Acceptable Ranges During Summer
Water Temperature (°C)	17.33	15.63	16.47	15.83	16.75	0.92	10-19°C
pH	8.43	8.63	9.84	8.79	8.14	-0.65	5.8 to 8.5
Turbidity (NTU)	9.27	3.48	10.91	4.30	3.39	-0.91	1 to 5 NTU
Stream Flow (M/s)	0.4	0.5	0.2	0.2	0.2	0.0	N/A
Conductivity (µs)	792.5	793.4	828.5	884.0	712.3	-171.7	N/A
Dissolved Oxygen (mg/L)	8.4	9.1	7.9	7.9	6.99	-0.91	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.03289	0.03195	0.90058	0.44642	0.50582	0.05940	N/A
Total Phosphate (mg/L)	0.08765	0.06307	1.26046	0.59247	0.62854	0.03607	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia Nitrogen (NH3) (mg/L)	0.03489	0.01756	0.03023	0.02542	0.05285	0.02743	<0.1 mg/L
Ammonia Nitrogen (NH4) (mg/L)	0.30705	0.14098	0.26262	0.15301	0.16980	0.01679	<0.5 mg/L
E. coli (MPN/100ml)	940.4	635.6	1024.3	876.0	1089.9	213.9	Advisory: >235 Closed: >1000

Fischer Creek Averages

Decrease: Orange

Increase: Purple

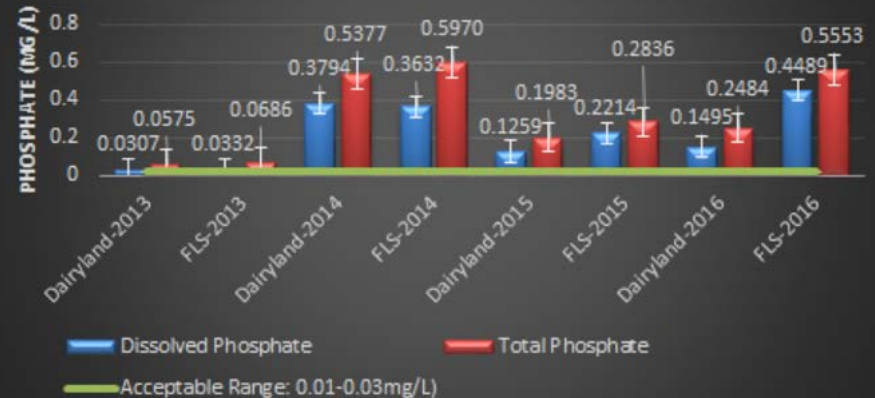
*Exclusion

Fischer Creek Analysis

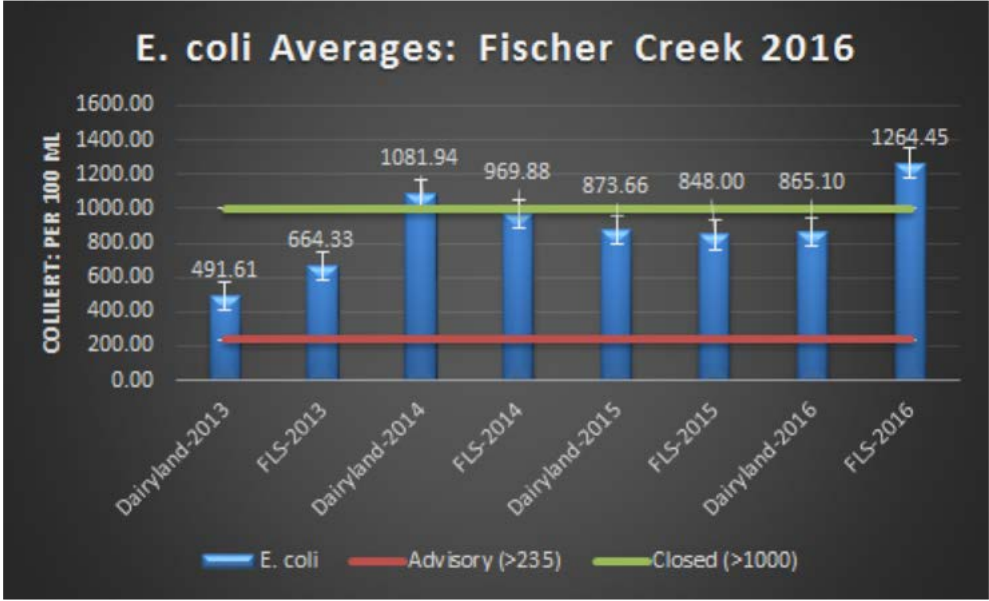
Total and Dissolved Phosphate with Rain Events - Fischer Creek



Total and Dissolved Phosphate without Rain Events - Fischer Creek



Fischer Creek Analysis



Fischer Creek Analysis

Majority of parameters have increased since 2015

Turbidity corresponds with phosphate trend

Runoff raises both

E. coli and phosphate levels higher than 20

FLS E. coli is significantly higher than
other years



Point Creek

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



Point Creek Averages

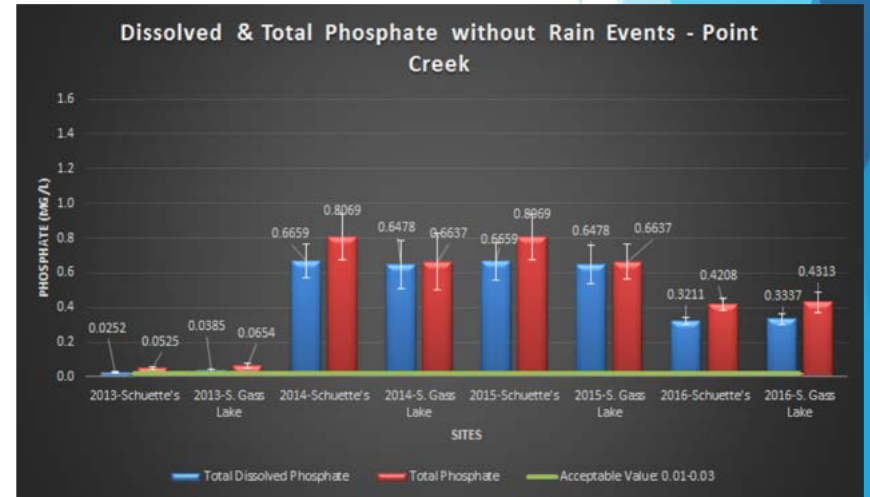
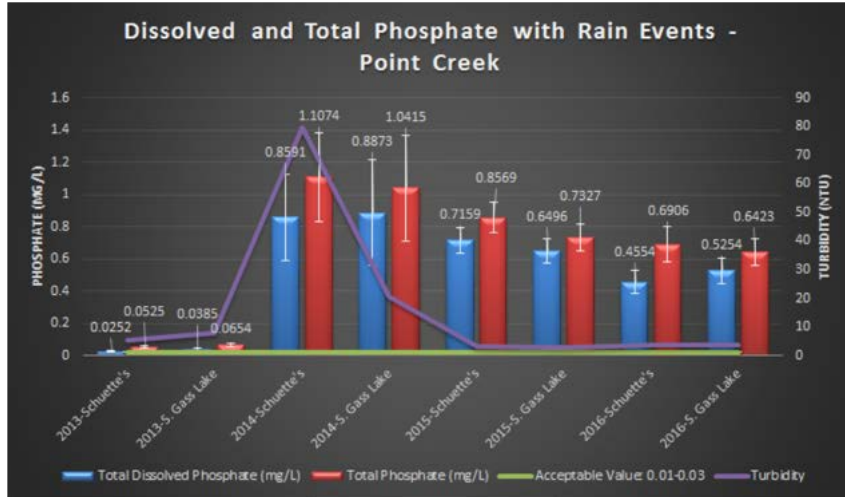
Decrease: Orange

Increase: Purple

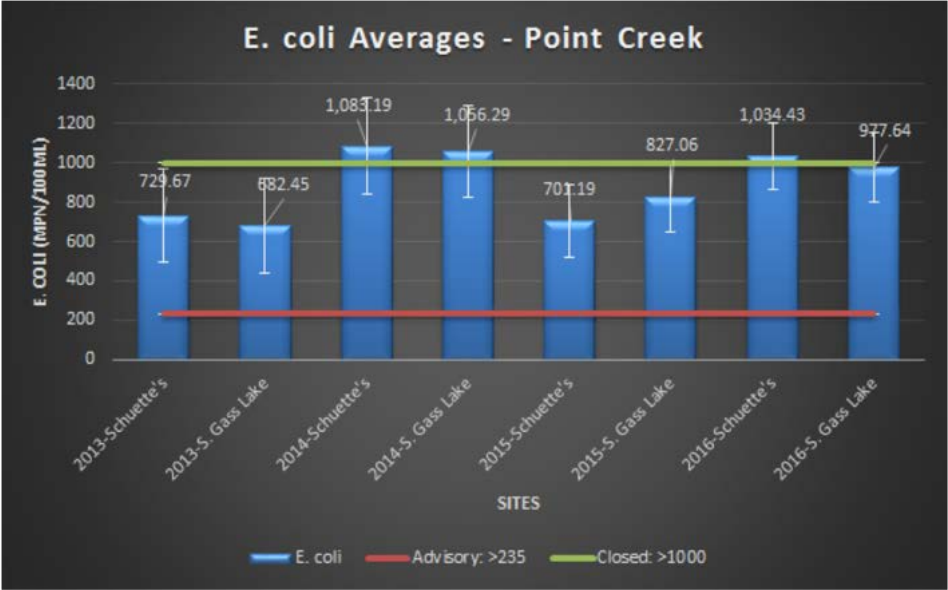
*Exclusion

Average for all Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Summer 2015	Summer 2016	Difference Between 2015 and 2016	Standard Acceptable Ranges During Summer
Water Temperature (°C)	19.21	18.15	17.99	17.46	18.84	1.38	10 to 19°C
pH	8.51	8.69	8.35	8.73	8.19	-0.54	5.8 to 8.5
Turbidity (NTU)	14.14	6.61	45.55	2.99	3.63	0.64	1 to 5 NTU
Stream Flow (M/sec)	0.4	1.3	0.5	0.5	0.34	-0.16	N/A
Conductivity (µS)	717.2	748.1	776.9	839.1	704.5	-134.6	N/A
Dissolved Oxygen (mg/L)	7.9	8.5	7.7	7.5	7.6	0.1	>5.0 ppm
Total Dissolved Phosphate (mg/L)	0.03407	0.03182	0.87317	0.68190	0.49039	-0.19151	N/A
Total Phosphate (mg/L)	0.08035	0.05895	1.04480	0.79319	0.66642	-0.12677	0.01 to 0.03 ppm (<0.1 ppm max.)
Ammonia Nitrogen (NH3) (mg/L)	0.03275	0.03081	0.01841	0.03181	0.02764	-0.00417	<0.1 mg/L
Ammonia Nitrogen (NH4) (mg/L)	0.27734	0.17162	0.23284	0.15878	0.16235	-0.00357	<0.5 mg/L
E. coli (MPN/100 mL)	841.7	706.1	1070.1	767.6	964.1	196.5	Advisory: >235 Closed: >1000

Point Creek Analysis



Point Creek Analysis



Point Creek Analysis

Most parameters decreased since last year

E. coli is higher than last year

Phosphate is continuing to decrease

Turbidity vs. phosphate:

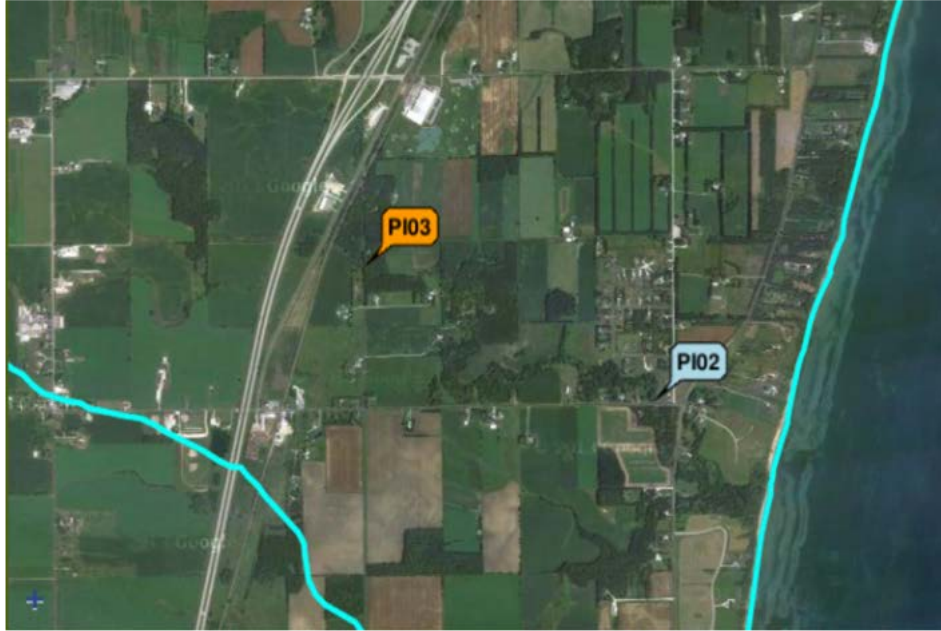
Turbidity isn't following the phosphate trend

Phosphate might be coming from things other than
run-off

No phosphate loading data



Pine Creek



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



Pine Creek Averages

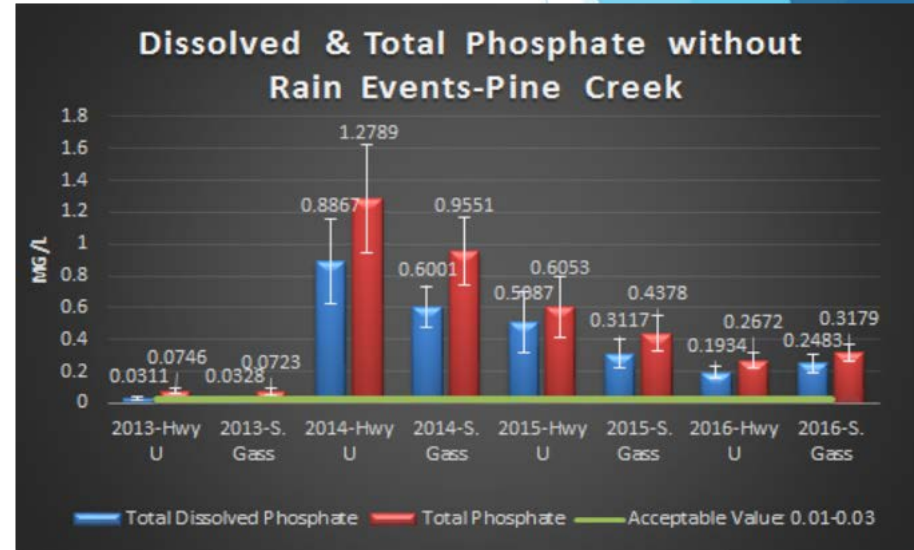
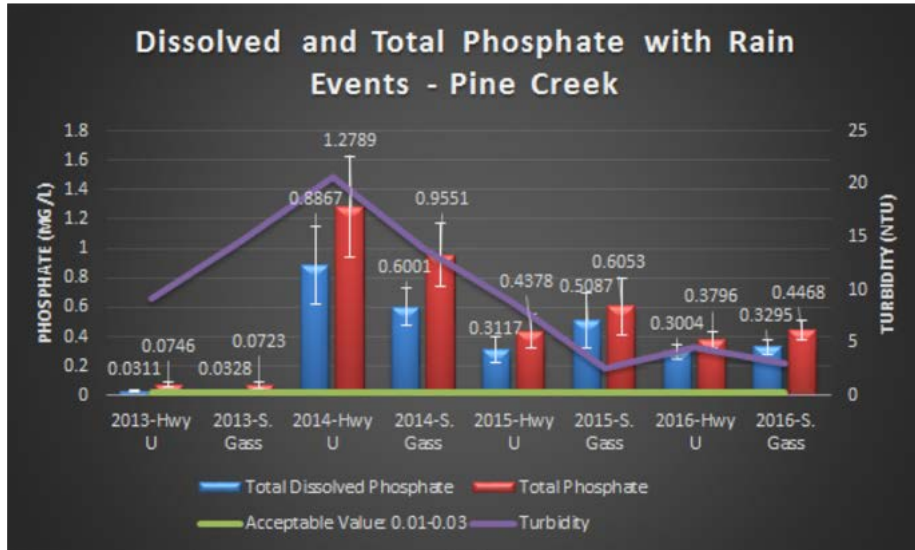
Decrease: Orange

Increase: Purple

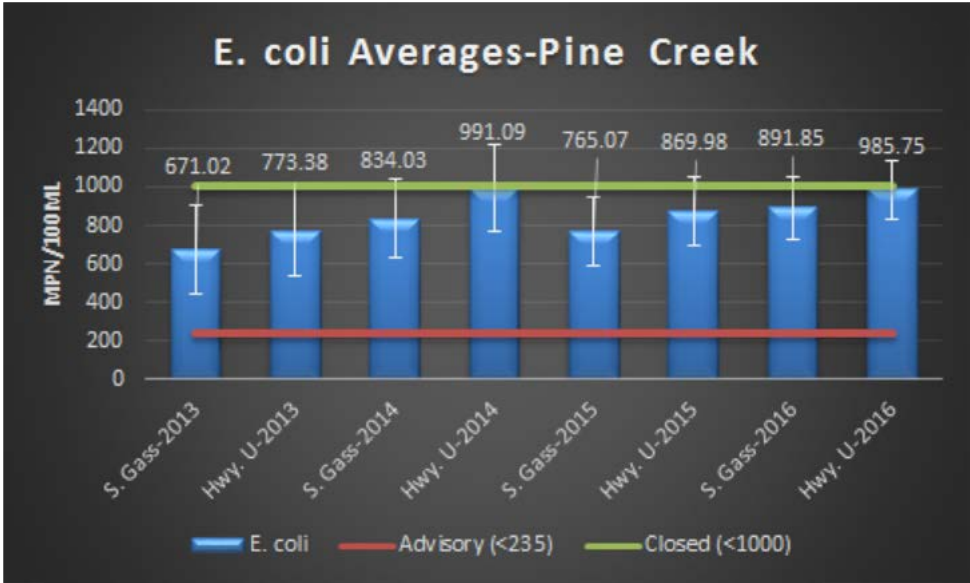
*Exclusion

Average For All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Summer 2015	Summer 2016	Difference Between Summers 2015 and 2016	Standard Acceptable Ranges During Summer
Water Temperature (°C)	17.50	16.82	17.26	16.86	17.93	+1.07	10-19°C
pH	8.31	8.50	8.37	8.6	8.10	+0.5	5.8 to 8.5
Turbidity (NTU)	10.35	11.85	17.33	5.7	3.83	-1.87	1 to 5 NTU
Stream Flow (M/s)	0.3	0.5	0.3	0.3	0.3	0.0	N/A
Conductivity (µS)	841	858	779	862	743	-119	N/A
Dissolved Oxygen (mg/L)	7.3	8.8	7.7	8.0	7.76	-0.24	>0.5 ppm
Total Dissolved Phosphate (mg/L)	0.01695	0.03197	0.074344	0.41020	0.31493	-0.09527	N/A
Total Phosphate (mg/L)	0.08541	0.07344	1.11698	0.52155	0.41362	-0.10793	0.01-0.03 ppm (<0.1 ppm max.)
Ammonia Nitrogen (NH3) (mg/L)	0.01901	0.02548	0.02332	0.03573	0.03169	-0.00404	<0.1 mg/L
Ammonia Nitrogen (NH4) (mg/L)	0.23933	0.22241	0.26453	0.17340	0.18125	+0.00785	<0.5 mg/L
<u>E.coli</u> (MPN/100 ml)	771.0	722.2	914.8	818.9	879.1	+60.2	Advisory: >235 Closed: >1000

Pine Creek Analysis

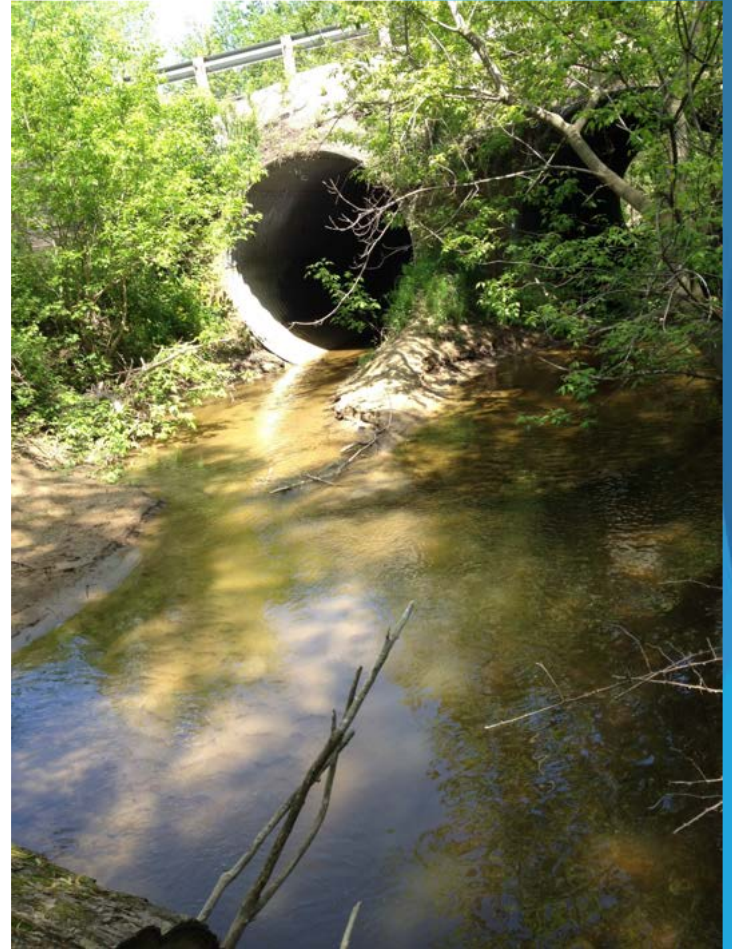


Pine Creek Analysis

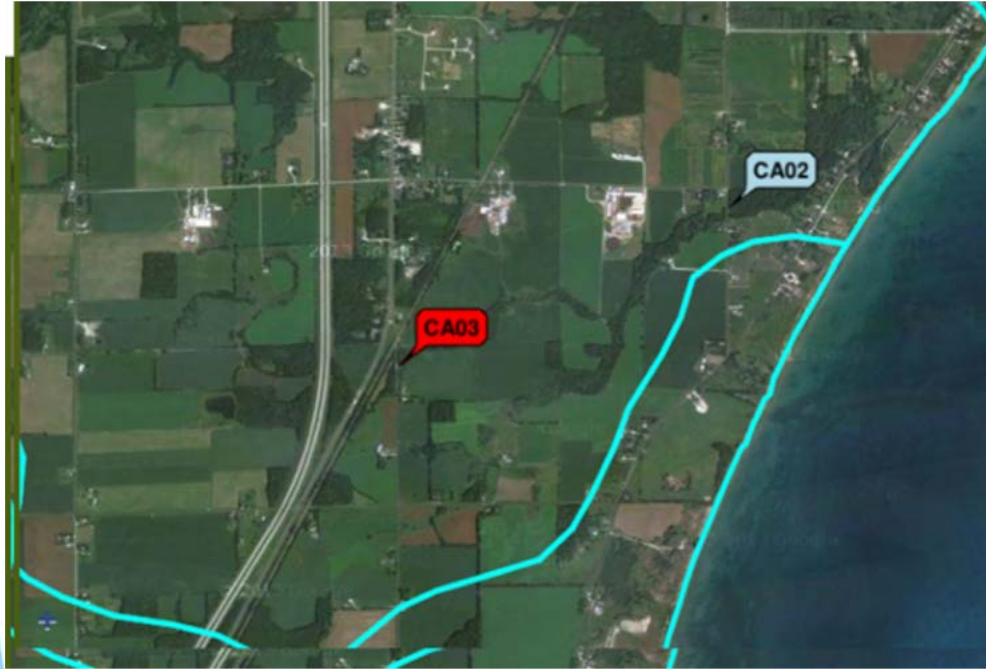


Pine Creek Analysis

- Phosphate levels continue a downward trend
- Turbidity and streamflow decreased
- E. coli increase from last year (temperature has risen)
- Total Dissolved Phosphate Loading:
 - Hwy U.
 - 479.0802 kg/week
 - 1056.1910 lbs/week



Calvin Creek



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



Calvin Creek Averages

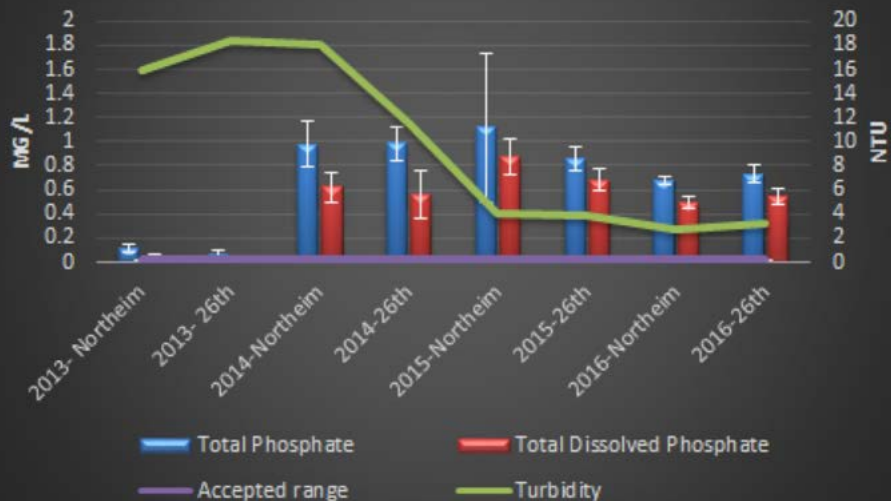
Increase: Purple

Decrease: Orange

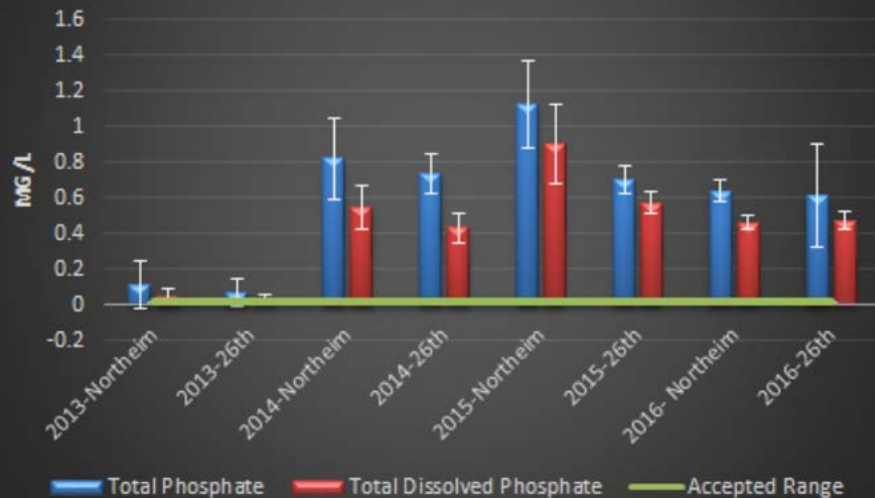
Averages for All Creek Sample Points	Summer 2012	Summer 2013	Summer 2014	Summer 2015	Summer 2016	Difference Between Summers 2015 and 2016	Standard Acceptable Ranges During Summer
Water Temperature (C°)	18.55	18.30	18.57	18.18	19.62	+1.44	10-19°C
pH	8.37	8.57	8.32	8.53	8.06	-0.47	5.8 to 8.5
Turbidity (NTU)	12.46	17.18	14.72	3.83	2.95	-0.88	1 to 5 NTU
Stream Flow (M/s)	0.1	0.6	0.6	0.6	0.5	-0.1	N/A
Conductivity (µS)	674	695	727	1015	548	-467	N/A
Dissolved Oxygen (mg/L)	6.8	8.1	6.8	6.0	7.9	+1.9	>0.5 ppm
Total Dissolved Phosphate (mg/L)	0.03873	0.04292	0.59416	0.75943	0.51841	-0.24102	N/A
Total Phosphate (mg/L)	0.10408	0.09352	0.98363	0.97193	0.70560	-0.26633	0.01 to 0.03 ppm (<0.1 ppm max.)
Ammonia Nitrogen (NH3) (mg/L)	0.02850	0.03748	0.02823	0.06451	0.05067	-0.01384	<0.1 mg/L
Ammonia Nitrogen (NH4) (mg/L)	0.39064	0.29440	0.27685	0.33014	0.23490	-0.09524	<0.5 mg/L
E. Coli (Colilert/100 mL)	1396.3	1279.6	1588.6	1348.5	1333.1	-15.4	Advisory: >235 Closed: >1000

Calvin Creek Analysis

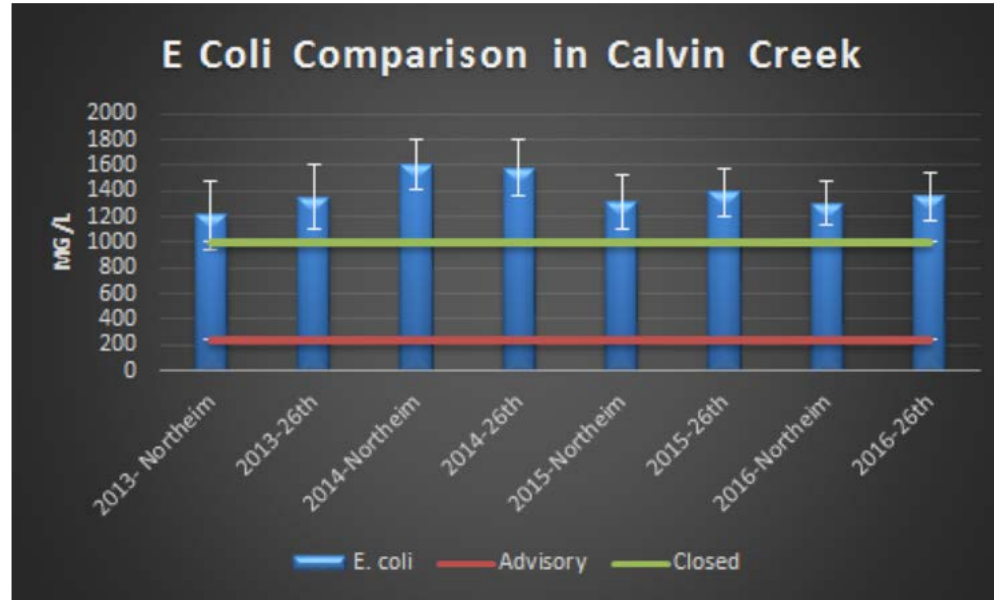
Turbidity and Phosphate Comparison in Calvin Creek Including Rain Events



Phosphate Comparison in Calvin Creek Without Rain Events



Calvin Creek Analysis



Calvin Creek Analysis

Small decrease in most parameters from previous years

Phosphates have slight decreases throughout the past 3 years

Not much difference in rain event phosphate averages when compared to non-rain event averages

Turbidity not following Phosphate trend

Indicating there are other sources besides runoff

Total Dissolved Phosphate Loading:

Norheim Road:

153.6434 kg/week

338.7257 lbs/week



Overall Analysis

New Union sites: Union South has much higher phosphate and ammonia levels

Other than Calvin and Point Creek, phosphate levels this year generally decreased as the creeks ventured north through Manitowoc County

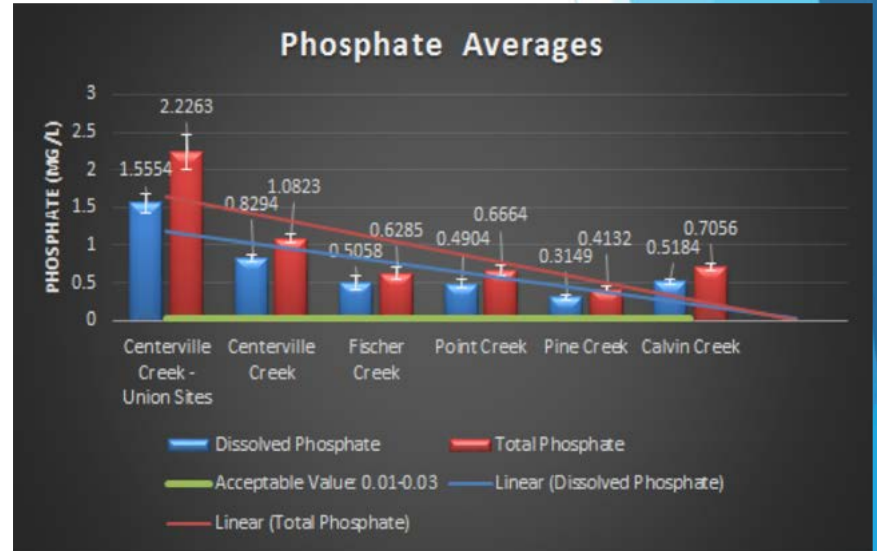
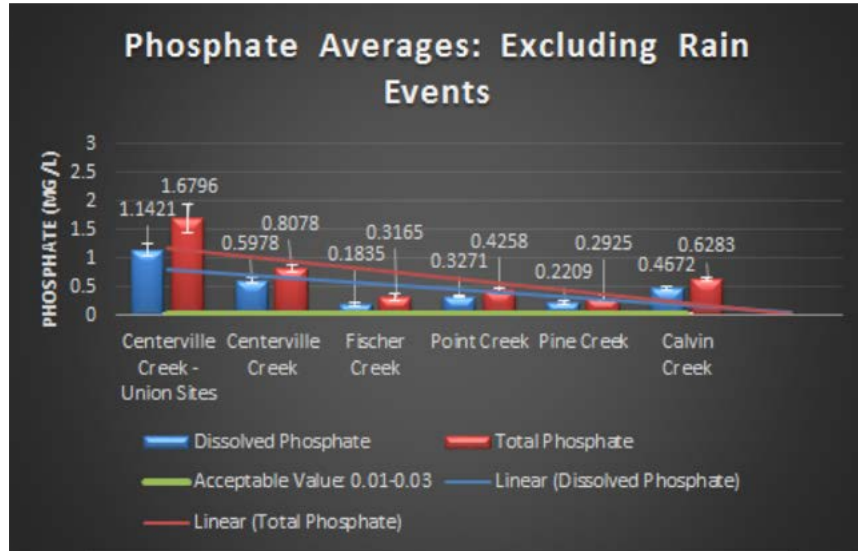
Further into urban areas, less runoff

Phosphate loading into streams spiked during 07/25 rain event

Major parameters (phosphate & E. coli) increased for Centerville and Fischer, but decreased for Point, Pine and Calvin Creeks

Possible reasons: rain total lower in 2016, but rain events occurred later in

Overall Analysis



Course of Action

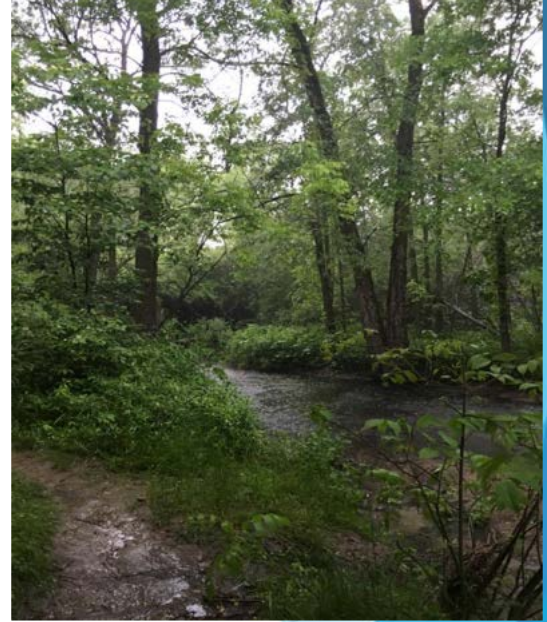
Continued monitoring and analysis of stream sites

Continued communication with collaborators

Increased communication with community



Questions, Comments, & Concerns:



Thank you for coming!