2013 – 2015 Water Quality Assessment Report

Red Cliff Band of Lake Superior Chippewa

Clean Water Act Section 106

Assistance Agreement BG 00E73311

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Table of Contents

Section 1. Program Background

The Water Resource Program has been active since 1980, reflecting the awareness and concern for water quality and engaging tribal members within the Red Cliff Reservation. In 1989, the Clean Water Act Section 106 (CWA 106) was granted treatment in the same manner as a state status. The CWA 106 refers to the water pollution control. Likewise, the Clean Water Section Act 319 (CWA 319) was granted treatment in the same manner as a state in 2008. The CWA 319 refers to nonpoint source pollution prevention, funds which will assist in these monitoring and any project efforts.

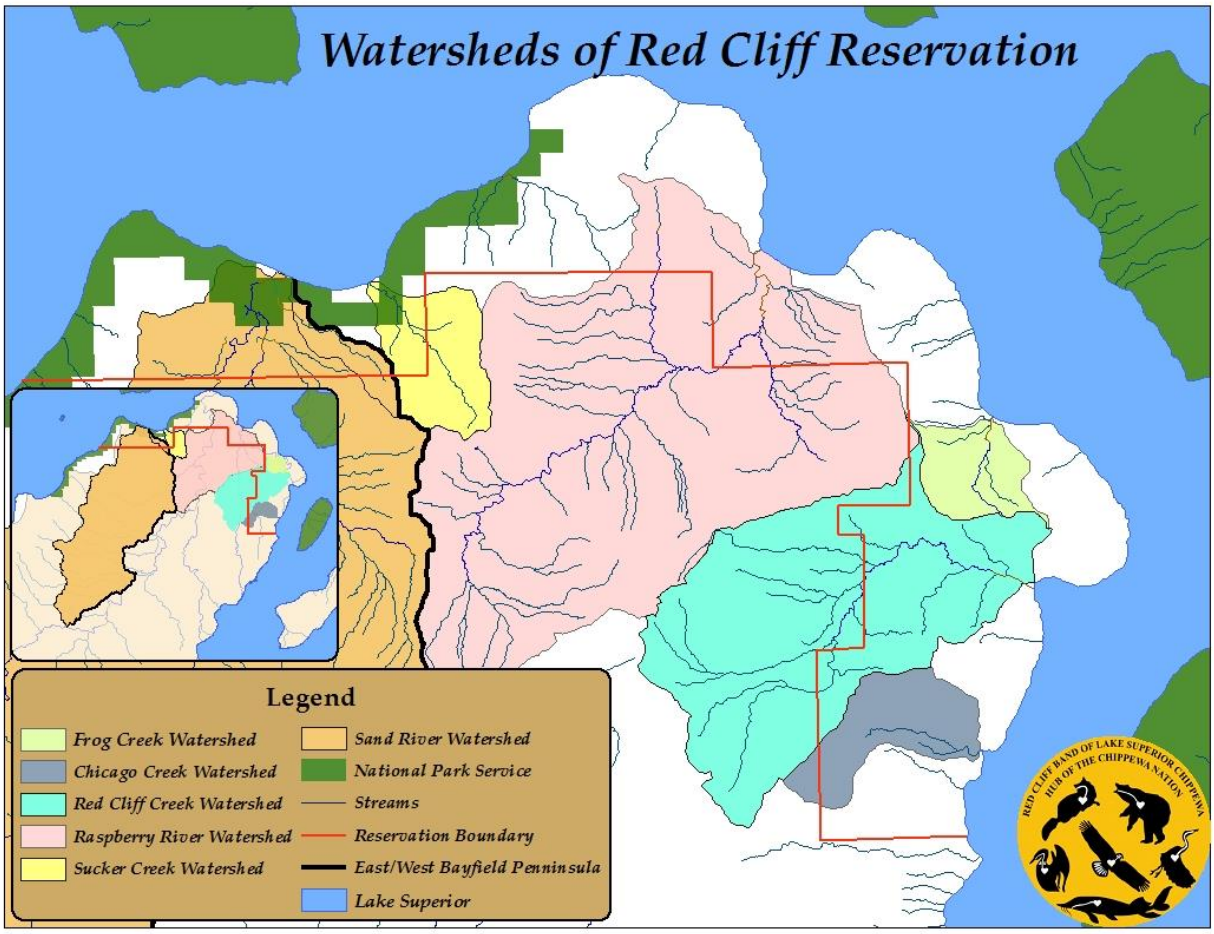
The Reservation includes approximately 47 stream miles, of which 37 miles are considered to be intermittent. These many small and unnamed intermittent streams play an important seasonal role in conveyance of water and in providing habitat for amphibians, wildlife and many types of plants. There is currently no complete inventory of the Reservation's intermittent streams and these streams are not currently monitored by the Tribe's Water Resources Program.

The following atlas table gives a description of the estimated number of stream miles, wetland acres, and Lake Superior shoreline miles for the Red Cliff Reservation (see Table 1).

Table 1. Atlas of all water resources within exterior boundaries of the Red Cliff Reservation.

ATLAS OF TRIBAL WATERS	
Total number of stream/river miles	46.1 Miles
Total number of Lake Superior shoreline	22.3 Miles
Total number of wetland acres	805 Acres

The Reservation's watersheds all discharge to Lake Superior and are found within the HUC 04010301, which is known as the "Beartrap-Nemadji" area of the southern shoreline of Lake Superior (see Map X). Located in the Superior-Ashland Clay Plain, this region of the Lake Superior Basin is often referred to as the "red clay plain" due to its highly erodible red clay soils. All of the Reservation's watersheds are located in Bayfield County, Wisconsin and fall within the Bayfield Peninsula Northwest and Bayfield Peninsula Southeast watersheds (see Map 1). Three HUC-12 sub-watersheds that fall within these larger watersheds cross the Reservation, including; the Sand River watershed, the Raspberry River watershed, and the Red Cliff Creek watershed, each of which contain smaller sub-watersheds.



Map 1 - Watersheds flowing through the Red Cliff Reservation with reservation boundaries.
Source: IRMP 2006

The Red Cliff Reservation and its' waters provide diverse habitats for a wide variety of plant and animal life. Local natural resources including the water itself are important to the Tribe for biological, cultural, sustenance, medicinal, spiritual, and economic reasons. The uses of the land and quality of the waters on the Bayfield Peninsula directly affect the resources, health, and welfare of the Tribe presently and for future generations to come.

Section 2. Purpose of Monitoring Program

The purpose of CWA Section 106 monitoring is to protect and improve all Tribal waters to the extent that water quality and associated habitat fully support all aquatic life at levels that allow for continued reproduction and biological functions, safe commercial and subsistence utilization, protection of cultural resources, and membership uses. These monitoring efforts will allow the Tribe to identify problem areas, track trends over time, identify NPS impacts, and address public health concerns.

Map 2 – Monitoring sites throughout the Red Cliff Reservation.
Source: GoogleEarth

Section 3. Monitoring Framework

The monitoring framework of the Tribe's CWA Section 106 surface water monitoring project is to sample for water quality at 16 sites during the open water season (see Map 2) in accordance with EPA approved quality assurance project plans (QAPP). Consistent collection of chemical, physical, and biological data beginning in 2012 through present by the Water Resources Program has enabled the Tribe to begin a baseline of data to aid the Tribe in creating an inventory of its water quality. The Water Resources Program conducts monthly surface water testing at 16 locations throughout the Reservation for water quality parameters during the open water season (see Table 2). Measurements of flow are taken once a month at the same sites during the open water season. Visual habitat observations will be taken periodically to document changes. Basic meteorological data are collected for calibration of field equipment and during sampling events.

<u>Baseline Water Quality Monitoring</u>
Monitoring typically includes field measurement and laboratory analysis of water chemistry parameters, stream habitat assessments, and field measurements. Funding was used to monitor eight fixed stations prior to 2013 and 16 fixed stations beginning 2013.

The following surface water quality parameters (chemical/physical) are monitored at all sites include:

Field Measured Parameters

pH, temperature, dissolved oxygen, conductivity, turbidity, flow, and visual habitat assessment

Laboratory Measured Parameters

Total Phosphorus, Total Nitrogen, Nitrates+Nitrites, Total Kjeldahl Nitrogen, Nitrogen as Ammonia, Total Suspended Solids, and E. coli.

During 2013 - 2015, Northern Lake Service, Inc. and Northland College ARE Lab were the contracted laboratories. Surface water samples were sent for analysis and in return analytical reports were provided to Red Cliff Environmental Department staff. Frequency of data collection capture seasonal hydrologic changes to establish ranges of natural baseline fluctuation within an annual hydraulic period. Sample frequency may decrease in the future to monitor for changes in the quality of local watersheds only. Flow measurements will be taken once a month during the open water season, when site conditions allow. Visual habitat observations are taken at least once per season (Spring, Summer, Fall) or when any changes (natural or induced by human activity) in the stream or upstream watershed take place.

Table 2 - Red Cliff's CWA 106 Water Quality Monitoring Sites, Parameters, and Frequency.

Monthly	Nutrients *	TSS	Chloride	E.coli	PAH	Lead
RCC01	X	X		X		
RCC03	X	X		X		
RCCM01	X	X		X		
RR01	X	X		X		
RR03	X	X		X		
RRM01	X	X		X		
SR02	X	X		X		
SRM01	X	X		X		
CCM01	X	X		X		
CC02	X	X		X		
CC03	X	X		X		
LS01	X	X		X		
FC01	X	X		X		
FCM01	X	X		X		
SC01	X	X		X		
SC02	X	X		X		

* Nutrients include: Total Phosphorus, Total Nitrogen, Nitrates+Nitrites, Total Kjeldahl Nitrogen, and Ammonia

The following table lists available criteria for comparisons (see Table 3). Several of these parameters are basic water characteristic parameters based on local geology and stream type. Water quality results are compared to threshold criteria; site specific guidelines will be developed based on past data collected when the Tribe applies for TAS for water quality standards.

Table 3 – Applicable water quality criteria used for result comparisons.

Parameter	Criteria	Source	Comment
Dissolved Oxygen	A water body capable of supporting aquatic life shall have a daily minimum dissolved oxygen standard of 5 mg/L in all cases except waters designated as a Cold Water Fishery.	Bad River WQS	For those waters designated as a Cold Water Fishery, the dissolved oxygen shall have a daily minimum of 6 mg/L at any time and 8 mg/L when and where early life stages of cold water fish occur. Bad River Band of the Lake Superior Tribe of Chippewa Indians Water Quality Standards Adopted PAGE;15,PARAGRAPH;6, Lines;4-8
pH	pH — No change is permitted greater than 0.5 units over a period of 24hours for other than natural causes. The change, upward or downward, shall not result in an adverse effect on aquatic biota, fish or wildlife.	Bad River WQS	Bad River Band of the Lake Superior Tribe of Chippewa Indians Water Quality Standards Adopted PAGE;15,PARAGRAPH;7, Lines;1-3
Temperature	Temperature — No measurable change (increase or decrease) in temperature from other than natural causes shall be allowed that causes or contributes to an adverse effect to the natural biological community. For those waters designated as a Cold Water Fishery, there shall be no measurable increase in temperature from other than natural causes.	Bad River WQS	Bad River Band of the Lake Superior Tribe of Chippewa Indians Water Quality Standards Adopted PAGE;15,PARAGRAPH;3, Lines;1-6
Turbidity	Turbidity — Shall not exceed 5	Bad River WQS	Site specific – changes

Nephelometric Turbidity Unit (NTU)	NTU over natural background turbidity when the background turbidity is 50 NTU or less, or turbidity shall not increase more than 10 percent when the background turbidity is more than 50 NTU.		induced by human activity should be minimized. Bad River Band of the Lake Superior Tribe of Chippewa Indians Water Quality Standards Adopted PAGE;15-16,PARAGRAPH;8, Lines;1-4
Total phosphorus	Min-2 ug/l Converted 0.002mg/l Max-450 ug/l Converted 0.45 mg/l 25th percentiles 5 ug/l Converted 0.005mg/l	EPA Criteria Recommendations	Ecoregion VIII subecoregion 58
E. coli	235 CFU (STV) 126 CFU (GM)	EPA Criteria Recommendations	Full body contact recreation
TSS	None	NA	Site specific – changes induced by human activity should be minimized.
Chloride	860,000 mcg/L (acute) 230000 mcg/L (Chronic)	EPA Criteria Recommendations	
Total Nitrogen	Min 0.34mg/l Max 0.84mg/l 25th percentiles 0.42mg/l	EPA Criteria Recommendations	Ecoregion VIII subecoregion 58
Nitrite/nitrate	0.03 mg/L	EPA Criteria Recommendations	Ecoregion VIII. Local criteria are in development by WI.

Macroinvertebrate Monitoring

Macroinvertebrate communities are assessed annually on a rotational basis in the various sub watersheds of the Reservation and collected at a minimum of four sites during the Fall season. The Wisconsin Department of Natural Resources (WiDNR) Basin Plan for the Lake Superior Basin notes a lack of information on the watersheds on the Reservation, but acknowledges the known existence of several rare macroinvertebrates in the Red Cliff Reservation. The advantages of using this type of biological assessment include:

1) Fluctuating environmental conditions can be monitored long-term.
2) Macroinvertebrate communities can be utilized as indicators of general ecological integrity as many genera live in stream for more than one season.

3) Macroinvertebrates are usually abundant in streams and sampling will have no detrimental affect on the community.
4) Individuals are easily identified and established tolerance values are available.
5) Bioassessment data compliments water chemistry data in that the first gives a more long-term description of water quality while the second gives a "snapshot" of conditions at the time of sampling.

The collection and identification methods are outlined in the Surface Water Macroinvertebrate Monitoring QAPP.

Macroinvertebrate sampling results will be used to calculate several different indices that relate the samples to a determination on water quality. Several different indices will be utilized in order to allow for comparison of water quality conclusions of each index. This comparison will assist in the determination of impacts to each water body sampled. The following table lists available criteria for comparisons (see Table 4). Several of these indices are based on particular impacts, local geology and/or stream type. These indices will not have a "not to exceed" criteria but will rather have a numerical indicator range.

Table 4 – Applicable Criteria for macroinvertebrate monitoring.

Parameter	Criteria	Source	Comment
Hilsenhoff Biotic Index	Calculation based on tolerance guilds	Hilsenhoff, 1987	Focuses on organic pollution disturbances to DO concentrations
Biological Community Index	Predicted community tolerance quotient compared to the sampled community quotient	Winget and Magnum, 1979	Some water chemistry required. Higher numerical result indicates better quality.
Total abundance	Sum of individuals in sample	Lille et al 2003	Higher abundance indicates higher quality
Taxonomic Richness	Total number of sampled taxa	Lille et al 2003	Lowest level of identification possible is recommended
Percent EPT (Ephemeroptera, Plecoptera, Trichoptera)	Percentage of taxa known to be sensitive to habitat disturbance	Lille et al 2003	Numerical result goes down as disturbance goes up

Section 4. Monitoring Locations

All sites are found within the HUC 04010301. All sites drain into Lake Superior and are considered part of the Lake Superior Basin. The HUC is referred to as the "Beartrap-Nemadji" area of the Southern Shoreline of Lake Superior. All of the watersheds are located on the Red Cliff Indian Reservation in Bayfield County, Wisconsin.

Baseline Water Quality Monitoring

Sampling sites are located at headwater locations, primary tributary junctions, and final river discharge areas into Lake Superior. Sites are located to provide upstream and downstream assessment capability only to identify future monitoring needs, potential problems, and simple classification of areas. Sampling sites were chosen on each sub watershed, where access was available with the above data objectives in mind (see Table 5). Access is of logistical importance to this primarily forested area. Locations will provide data for comparison at stream/river origins, tributary input locations and final discharge areas into Lake Superior.

Table 5 – Surface water monitoring sites.

Site Name	Location	
Red Cliff Creek (RCC)#01	90°49' 2.840"W	46°52' 9.462"N
Red Cliff Creek(RCC) #03	90°47' 22.26"W	46°53'14.42"N
Red Cliff Creek Mouth (RCCM) #01	90° 46.455"W	46° 52.985"N
Raspberry River (RR)#01	90°48' 43.420"W	46°55' 51.583"N
Raspberry River (RR)#03	90°50' 29.597"W	46°55' 3.020"N
Raspberry River Mouth (RRM) #01	90°49'50.69"W	46°56'7.25"N
Sand River (SR)#02	90°57' 23.344"W	46°53' 56.820"N
Sand River Mouth(SRM) #01	90° 56.051"W	46° 56.004" N
Chicago Creek Mouth (CCM)#01	90°47' 9.53"W	46°51' 29.08"N
Chicago Creek (CC) #02	90°48' 27.493"W	46°51' 44.477"N
Chicago Creek (CC)#03	90°47'18.87"W	46°51'33.38"N
Lake Superior (LS)#01	90°47' 12.683"W	46°51' 14.72"N
Frog Creek (FC)#01	90° 46.881"W	46° 54.337"N
Frog Creek Mouth (FCM)#01	90° 46.812"W	46° 54.556"N
Sucker Creek (SC)#01	90° 53.685"W	46° 54.646"N
Sucker Creek(SC) #02	90°55'1.50"W	46°55'56.50"N

Macroinvertebrate Monitoring

The Water Resources Program will conduct annual macroinvertebrate sampling at 15 locations throughout the Reservation on a rotational basis with a minimum of four sites sampled per year (see Table 5). All sites follow suit with the surface water monitoring sites, with the exception of LS01, in order to provide a more holistic view of each stream (chemical, physical and biological information together).

Section 5. Monitoring Results

Station CCM01 – Mouth of Chicago Creek

Station CCM01 is located downstream of CC02 and CC03. This site experiences seiching from Lake Superior. Also noted, is the Red Cliff Wastewater Treatment Facility discharges within 300 feet of shore and campsites located south of site.

Map 3 – Overview of CCM01.
Source: USGS Topo

2013 - Results

Staff visited monthly from May to November in 2013, with the sole exception of October, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 6 and 7 provide basic statistics and core field parameters.

Photo 1. Facing east, downstream toward Lake Superior in July.

Photo 2. Facing west, upstream in July.

Table 6. 2013 Field Data Statistics for CCM01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	20.2	105.4	86.9	9.48	34.5	0.885
Min Value	4.19	0.233	1.86	5.04	3.71	0.167
Median	13.1	42.65	5.37	7.52	13.2	0.215
Average	12.9	44.09	22.5	7.39	16.2	0.319
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 7. 2013 Lab Data Statistics for CCM01								
Statistic	**E.coli (MPN / 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	260	0.11	0.70	0.10	0.76	0.11	3.3	ND
Min Value	27	0.032	0.15	0.033	0.25	0.049	3.3	ND
Median	93	0.06	0.46	0.05	0.5	0.07	3.3	ND
Average	116	0.07	0.45	0.06	0.50	0.07	3.3	ND
# Sample	5	6	6	6	6	6	1	1
# Detections	5	6	6	6	6	6	1	0
Threshold Value	235 (STV) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Turbidity ranging from 3.71 – 34. 5 NTUs.

- Dissolved Oxygen ranging from 1.86 – 86.9 mg/L.
- E.coli ranging from 27 – 260 MPN/ 100 mL.

Sulfate values did not exceed the established threshold criteria during the visit in 2013. Based on Wisconsin Water Quality Standards, there were (2) dissolved oxygen and (2) pH values outside of the threshold criteria. Based on the EPA criteria, there were (1) E.coli, (5) Total Nitrogen, and (6) Total Phosphorus values above the threshold criteria.

2014 – Results

Station CCM01 was visited at the months for field statistics on June, October and November. Nutrient samples were taken in the months of June, July, September, October, and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 8 and 9 provide statistics per field and water chemistry parameters.

Photo 3. Facing west, September.

Table 8. 2014 Field Data Statistics for CCM01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm
Max Value	15.64	11.21	8.01	8.01	34.5	89.3
Min Value	5.18	0.01	4.25	8.01	11	0
Median	7.45	4.46	7.62	8.01	33.2	44.8
Average	9.42	5.23	6.63	8.01	26.23	44.70
#Samples (n)	3	3	3	1	3	3
#Detections	0	0	1	0	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 9. 2014 Lab Data Statistics for CCM01

Statistic	Nitrogen, ammonia as N (unfiltered) (mg/L)	Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)	Nitrogen, Kjeldahl as N (unfiltered) (mg/L)	Nitrogen, tot. as N (unfiltered) (mg/L)	Phosphorus, tot. as P (mg/L)	E.coli	TSS
Max Value	0.11	0.15	1.0	1.1	0.15	139.6	12.1
Min Value	0.032	0.026	0.26	0.39	0.036	33.6	4.2
Median	0.06	0.13	0.31	0.43	0.05	72.3	5.5
Average	0.06	0.11	0.45	0.55	0.07	78.42	6.9
# Sample	5	5	5	5	5	5	5
#Detections	0	0	0	5	5	0	0
Threshold Value		0.2 mg/L	0.1-20mg/L	0.38 mg/L	0.010mg/L	235(STV) or 126 (GM)	

Parameters of notable concerns include:

- Total Nitrogen ranging from 0.39-1.1 mg/L
- Total Phosphorus ranging from 0.036-0.15 mg/L
- Dissolved Oxygen ranging from 4.25-8.01 mg/L

Parameters of no concern include:

- Nitrites + Nitrates ranging from 0.026-0.15 mg/L
- Kjeldahl ranging from 0.26-1.0 mg/L
- E.coli ranging from 33.6-139.6 235 STV 126 GM

No E.coli or the one pH value that was taken exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was zero (0) Kjeldahl nitrogen and one (1) Dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Nitrite + Nitrate, five (5) Total Nitrogen and five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station CCM01 was visited for nutrient samples during the months of June through December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 10 and11 provide statistics per field and water chemistry parameters.

Photo 4. Facing east, downstream, November.

Photo 5. Facing west, upstream, November.

Table 10. 2015 Field Data Statistics for CCM01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	22.92	121.8	17.73	10.13	17	123
Min Value	0.14	27.7	2.59	2.44	4.38	0.111
Median	17.12	33.4	3.14	6.71	11.11	93
Average	13.58	59.84	7.156	6.43	10.90	82.22
Samples (n)	5	5	5	5	4	5
Detections	0	0	3	2	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 11. 2015 Lab Data Statistics for CCM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.092	0.43	2.7	2.9	0.13	435.20	330
Min Value	0.027	0.07	0.14	0.35	0.012	23.3	6.90
Median	0.056	0.26	0.24	0.51	0.03	52	12.70
Average	0.055	0.26	0.58	0.85	0.04	133.54	56.69
Samples	7	7	7	7	7	7	7
Detections	0	5	0	6	7	1	0
Threshold Value		**0.2 mg/L**	**0.1-20 mg/L**	**0.38 mg/L**	**0.010 mg/L**	**235(STV) or 126 (GM)**	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.59-17.73 mg/L
- Nitrite + Nitrate ranging from 0.07-0.43 mg/L
- Total Nitrogen ranging from 0.35-2.9 mg/L
- Total Phosphorus ranging from 0.012-0.13 mg/L
- E.coli ranging from 23.3-435.20

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.14-2.7 mg/L

There were 2 (two) pH and 1(one) E.coli values that exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on September 10th (435.2) however there was not enough data to determine the geometric mean over a 30-day period. Based on the Bad River Water Quality Standards there were 3 (three) Dissolved Oxygen values that were above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 5 (five) Nitrite + Nitrate, 6 (six) Total Nitrogen and 7 (seven) Total Phosphorus values that were above the reference criteria.

Station CC02 – Chicago Creek

Station CC02 is located upstream of a Highway 13 culvert and downstream of residential area. It is the closest to the headwaters of Chicago Creek, while staying within reservation boundaries.

Map 4 – Overview of CC02.
Source: USGS Topo

2013 – Results

Staff visited monthly from May to November in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 12 and 13 provide a summary of basic statistics and core field parameters.

Photo 6. Facing east, downstream, August.

Photo 7. Facing west, upstream, August.

Table 12. 2013 Field Data Statistics for CC02						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	18.44	93	62.7	7.64	15.6	0.435
Min Value	4.60	0.102	2.68	5.72	7.51	0.064
Median	12.71	34.3	6.49	6.97	9.60	0.090
Average	11.96	42.3	17.4	6.84	10.6	0.143
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 13. 2013 Lab Data Statistics for CC02								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	870	0.08	0.54	0.069	0.54	0.045	3.9	ND
Min Value	12	0.034	0.17	0.03	0.24	0.028	3.9	ND
Median	78	0.07	0.35	0.03	0.36	0.037	3.9	ND
Average	215	0.06	0.36	0.04	0.38	0.037	3.9	ND
# Sample	6	6	6	6	6	6	1	1
# Detections	6	6	6	3	6	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.68 – 62.7 mg/L.
- Conductivity ranging from 0.064 – .435 µS/cm.

No dissolved oxygen, pH, or sulfate values exceeded the established threshold criteria during the visits in 2013. Based on the EPA criteria recommendations, there were (2) E.coli, (3) Total Nitrogen, and (6) Total Phosphorus values above the reference criteria.

2014 - Results

Station CC02 was visited at the months for field statistics on July and October. Nutrient samples were taken in the months of June, July, September, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 35 and 36 provide statistics per field and water chemistry parameters.

Photo 8. Facing east, culvert, downstream, July.

Photo 9. Facing west, upstream, July.

Table 14. 2014 Field Data Statistics CC02						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	13.56	7.49	7.64	0	15.6	60.7
Min Value	6.36	3.09	3.5	0	6.7	29.8
Median	9.96	5.29	5.57	0	11.15	45.25
Average	9.96	5.29	5.57	0	11.15	45.25
#Samples (n)	2	2	2	0	2	2
#Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 15. 2014 Lab Data Statistics CC02							
Statistic	**Nitrogen, ammonia as N (unfiltered (mg/L))**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli 100 MPN**	**TSS**
Max Value	0.061	0.27	0.52	0.55	0.064	410.6	3.5
Min Value	0.030	0.028	0.29	0.34	0.023	46.5	1.8
Median	0.039	0.05	0.35	0.40	0.029	75.4	3
Average	0.043	0.10	0.36	0.44	0.035	144.1	2.74
# Sample	5	5	5	5	5	5	5
# Detections	0	1	0	3	5	1	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.028-0.27 mg/L
- Total Nitrogen ranging from 0.34-0.55 mg/L
- Total Phosphorus ranging from 0.023-0.064 mg/L
- E.coli ranging from 46.5-410.6 (235 STV or 126 GM)
- Dissolved Oxygens ranging from 3.5-7.64 mg/L

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.29-0.52 mg/L

There was one (1) E.coli value in the month of August that exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli. However, there was not enough data to determine the geometric mean over a 30 day period. Based on Bad River Water Quality Standards, there was one (1) Dissolved Oxygen value below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, one (1) Nitrite + Nitrate, three (3) Total Nitrogen and five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station CC02 was visited for nutrient samples during the months of June through December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 16 and 17 provide statistics per field and water chemistry parameters.

Photo 10. Facing north, culvert, downstream, December.

Photo 11. Facing south, upstream, December.

Table 16. 2015 Field Data Statistics CC02						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	19.08	118.5	16.21	7.45	12.5	2337
Min Value	2.32	9.5	4.31	-0.11	7.75	0.345
Median	14.51	46.1	8.62	6.63	11.45	168
Average	12.29	58.88	8.486	4.66	10.79	703.67
Samples (n)	5	5	5	5	4	5
Detections	0	0	2	1	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 17. 2015 Lab Data Statistics CC02							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.200	0.27	0.73	0.94	0.077	686.70	282.2
Min Value	0.052	0.034	0.23	0.27	0.015	11	2.00
Median	0.103	0.10	0.32	0.46	0.0485	178.9	5.00
Average	0.110	0.12	0.36	0.49	0.0455	201.13	58.89
Samples	7	7	7	7	7	7	7
Detections	0	1	0	4	6	1	0
Threshold Value		**0.2 mg/L**	**0.1-20 mg/L**	**0.38 mg/L**	**0.010 mg/L**	**235(STV) or 126 (GM)**	

Parameters of notable concern include:

- Dissolved Oxygens ranging from 4.31-16.21 mg/L
- Nitrite + Nitrate ranging from 0.034-0.27 mg/L
- Total Nitrogen ranging from 0.27-0.94 mg/L
- Total Phosphorus ranging from 0.015-0.077 mg/L
- E.coli ranging from 11-686.70 MPN/100mL

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.23-0.73 mg/L

There were 2 (two) E.coli and 1(one) pH value that exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on September 10th (686.7) and October 27th (238.2) however there was not enough data to determine the geometric mean over a 30-day period. Based on the Bad River Water Quality Standards, there were 2 (two) Dissolved Oxygen values that were above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 1 (one) Nitrite + Nitrate, 4 (four) Total Nitrogen and 6 (six) Total Phosphorus values that were above the reference criteria.

Station CC03 – Chicago Creek on Blueberry Road

Station CC03 is located downstream of a Blueberry Road culvert. Up until 2012, the stream was used as an ATV crossing.

Map 5 – Overview of CC03.
Source: USGS Topo

2013 –Results

Staff visited monthly from June through November in 2013, with the sole exception of October, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 18 and 19 provide a summary of basic statistics and core field parameters. No photos were taken at this site.

Table 18. 2013 Field Data Statistics for CC03						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	19.45	111.8	91.7	10.23	26.5	0.857
Min Value	4.27	0.236	2.59	5.56	4.19	0.201
Median	14.55	33.3	5.78	7.70	10.2	0.218
Average	13.02	46.1	23.57	7.81	12.0	0.343
# Sample (n)	5	5	5	5	5	5
Threshold Value			>5.0	6.0 to 9.0		

Table 19. 2013 Lab Data Statistics for CC03								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**Nitrate + Nitrite (mg/L)**	**Tot. N (mg/L)**	**Tot. P (mg/L)**	**Sulfate (mg/L)**	**Hg (µg/L)**
Max Value	330	0.063	0.9	0.12	0.96	0.08		ND
Min Value	28	0.032	0.26	0.038	0.31	0.026		ND
Median	94	0.036	0.41	0.05	0.45	0.061		ND
Average	137	0.044	0.49	0.06	0.54	0.054		ND
# Sample	4	5	5	5	5	5	0	1
# Detections	4	2	4	5	4	5	0	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.59 – 91.7 mg/L.
- Turbidity ranging from 4.19 – 26.5 NTUs.
- E.coli ranging from 28 – 330 MPN/100 mL.
- Total Nitrogen ranging from 0.31 – 0.96 mg/L.
- Total Phosphorus ranging from 0.026 – 0.08 mg/L.

Based on the Wisconsin Water Quality Standards, there were (2) pH and (2) dissolved oxygen (DO (mg/L) values above the reference criteria. Based on the EPA criteria recommendations, there were (2) E.coli, (3) Total Nitrogen, and (4) Total Phosphorus values above the reference criteria.

2014 - Results

Station CC03 was visited at the months for field statistics on June, August, October and November. Nutrient samples were taken in the months of June, July, September, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 20 and 21 provide statistics per field and water chemistry parameters.

Photo 12. Facing south, downstream, June.

Photo 13. Facing west, downstream of culvert.

Table 20. 2014 Field Data Statistics CC03						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	16.35	13.39	9.17	0	34	103
Min Value	4.25	3.27	5.36	0	5.2	33.3
Median	10.27	8.92	7.315	0	9.35	79.3
Average	10.28	8.63	7.29	0	14.48	73.725
#Samples (n)	4	4	4	0	4	4
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 21. 2014 Lab Data Statistics CC03							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.061	0.072	0.92	0.92	0.13	186	21.6
Min Value	0.060	0.048	0.19	0.21	0.027	18.5	1.1
Median	0.061	0.060	0.24	0.32	0.04	72.3	4
Average	0.061	0.060	0.38	0.41	0.05	78.06	6.72
# Sample	5	5	5	5	5	5	5
# Detections	0	0	0	1	5	0	0
Threshold Value		0.2 mg/L	0.1-20mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.21-0.92 mg/L
- Total Phosphorus ranging from 0.027-0.13 mg/L

Parameters of no concern include:

- E.coli ranging from 18.5-186 235 CFU or 126 GM
- Nitrite + Nitrate ranging from 0.048-0.072 mg/L
- Nitrogen Kjeldahl ranging from 0.19-0.92 mg/L
- Dissolved Oxygen ranging from 5.36-9.17 mg/L

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there were zero (0) Dissolved Oxygen and Kjeldahl nitrogen values above the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Nitrite + Nitrate, one (1) Total Nitrogen and five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station CC03 was visited for nutrient samples during the months of July through November. E.coli samples were taken in the months of June, July and September through November. TSS samples were taken in the months of June, July and September through November of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 22 and 23 provide statistics per field and water chemistry parameters.

Photo 14. Facing west, upstream, July.

Photo 15. Facing east, downstream, June.

Table 22. 2015 Field Data Statistics CC03

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	18.64	133.6	19.21	8.75	12.4	190
Min Value	0.53	38.5	3.92	6.91	6.2	0.216
Median	10.70	81.35	9.07	7.14	10.96	113.5
Average	10.14	83.70	10.32	7.6	9.85	104.30
Samples (n)	4	4	4	4	3	4
Detections	0	0	2	0	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 23. 2015 Lab Data Statistics CC03							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.065	0.25	0.41	0.49	0.056	178.5	7.4
Min Value	0.042	0.046	0.16	0.14	0.03	18.9	1.30
Median	0.054	0.094	0.195	0.35	0.04	83.0	3.10
Average	0.054	0.123	0.24	0.33	0.04	101.16	3.66
Samples	5	5	5	5	5	5	5
Detections	0	1	0	2	5	0	0
Threshold Value		**0.2 mg/L**	**0.1-20 mg/L**	**0.38 mg/L**	**0.010 mg/L**	**235(STV) or 126 (GM)**	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 3.92-19.21 mg/L
- Nitrite + Nitrate ranging from 0.046-0.25 mg/L
- Total Nitrogen ranging from 0.14-0.49 mg/L
- Total Phosphorus ranging from 0.03-0.056 mg/L

Parameters of no concern include:

- Kjeldahl nitrogen ranging from 0.16-0.41 mg/L
- E.coli ranging from 18.9-178.5 MPN/100mL

No E.coli or pH values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards, there were 2 (two) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there was 1 (one) Nitrite + Nitrate, 2 (two) Total Nitrogen and 5 (five) Total Phosphorus values that were above the reference criteria.

Station FC01- Frog Creek

Station FC01 is near the headwaters of Frog Creek and upstream of Station FCM01. The area is known for historic logging and currently has a tribal cabin located to the west.

Map 6 – Overview of FC01.
Source: USGS Topo

2013 - Results

Staff visited monthly from May to October in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 24 and 25 provide basic statistics and core field parameters.

Photo 16. Facing north, downstream, July.

Photo 17. Facing south, upstream, June.

Table 24. 2013 Field Data Statistics for FC01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	19.09	58.4	6.65	8.4	48.0	0.266
Min Value	9.45	29.3	2.77	6.15	1.1	0.09
Median	10.10	36.3	3.86	6.9	11.2	0.19
Average	12.15	41.4	4.50	7.1	16.4	0.19
# Sample (n)	5	5	5	5	5	5
Threshold Value			>5.0	6.0 to 9.0		

Table 25. 2013 Lab Data Statistics for FC01								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	2400	0.098	1.1	0.17	1.2	0.17	2.8	0
Min Value	6.3	0.051	0.17	0.08	0.27	0.029	2.8	0
Median	48	0.073	0.27	0.11	0.44	0.04	2.8	0
Average	516	0.074	0.56	0.12	0.65	0.06	2.8	0
# Sample	5	5	5	5	5	5	1	1
# Detections	5	3	5	4	5	5	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Turbidity ranging from 1.1 – 48.0 NTUs.
- Total Phosphorus ranging from 0.029 – 0.17 mg/L.
- Total Nitrogen ranging from 0.27 – 1.2 mg/L.
- E.coli ranging from 6.3 – 2400 MPN/100 mL.

No pH or sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there were (3) dissolved oxygen values below the reference criteria. Based on the EPA criteria recommendations, there were (1) E.coli, (3) Total Nitrogen and (5) Total Phosphorus values above the reference criteria.

2014 - Results

Station FC01 was visited at the months for field statistics on June, July, October and November. Nutrient samples were taken in the months of September through November. E.coli samples were taken in the months of August through October. TSS samples were taken in the months of August through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 26 and 27 provide statistics per field and water chemistry parameters.

Photo 18. Facing north, downstream, July.

Photo 19. Facing south, downstream, October.

Table 26. 2014 Field Data Statistics for FC01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	12.38	7.38	8.4	0	26.3	61.5
Min Value	5.66	3.86	4.75	0	1.1	36.3
Median	8.69	6.88	6.775	0	12.91	57.7
Average	8.86	6.25	6.675	0	13.305	53.3
#Samples (n)	4	4	4	0	4	4
#Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 27. 2014 Lab Data Statistics for FC01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli MPN 100**	**TSS**
Max Value	0.096	0.089	0.61	0.64	0.050	88.6	458.4
Min Value	0.033	0.033	0.20	0.29	0.033	6.3	1.4
Median	0.080	0.079	0.36	0.44	0.038	16	2
Average	0.070	0.067	0.39	0.46	0.040	36.97	115.95
# Sample	4	4	4	4	4	4	4
# Detections	0	0	0	2	3	0	0
Threshold Value		0.2 mg/L	0.1-20mg/L	0.38 mg/L	0.0 10mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.29-0.64 mg/L
- Total Phosphorus ranging from 0.033-0.050 mg/L
- Dissolved Oxygen ranging from 4.75-8.4 mg/L

Parameters of no concern include:

- Nitrogen Ammonia ranging from 0.033-0.096 mg/L
- Nitrite + Nitrate ranging from 0.033-0.089 mg/L
- Nitrogen Kjeldahl ranging from 0.20-0.61 mg/L
- E.coli ranging from 6.3-88.6 235 CFU or 126 GM

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was one (1) Dissolved oxygen value and zero (0) Nitrogen Kjeldahl above the reference criteria. Based on the EPA criteria recommendations, there were two (2) Total Nitrogen and three (3) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station FC01 was visited at the months for field statistics on July through September. Nutrient samples were taken in the months of July through November. E.coli samples were taken in the months of July through November. TSS samples were taken in the months of July through November of 2015 to conduct baseline water quality monitoring. Tables 28 and 29 provide statistics per field and water chemistry parameters.

Photo 20. Facing north, downstream, July.

Photo 21. Facing south, headwaters, July.

Table 28. 2015 Field Data Statistics for FC01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	18.3	39.2	4.05	10.34	5.35	189
Min Value	13.87	12.6	1.18	10.34	5.35	0.249
Median	16.085	25.9	2.615	10.34	5.35	94.62
Average	16.085	25.90	2.615	10.34	5.35	94.62
Samples (n)	2	2	2	1	1	2
Detections	0	0	2	1	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 29. 2015 Lab Data Statistics for FC01							
Statistic	**Ammonia as N (unfiltered) (mg/L)**	**NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.120	0.15	0.55	0.65	0.071	29.9	23.3
Min Value	0.045	0.036	0.12	0.15	0.012	9.6	0.40
Median	0.076	0.052	0.285	0.24	0.026	17.3	11.10
Average	0.081	0.075	0.31	0.34	0.033	18.94	10.84
Samples	5	5	5	5	5	5	5
Detections	0	0	0	2	5	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 1.18-4.05 mg/L
- Total Nitrogen ranging from 0.15-0.65 mg/L
- Total Phosphorus ranging from 0.012-0.071 mg/L

Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.036-0.15 mg/L
- Kjeldahl Nitrogen ranging from 0.12-0.55 mg/L
- E.coli ranging from 9.6-29.9 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 2 (two) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were no Nitrite + Nitrate, 2 (two) Total Nitrogen and 5 (five) Total Phosphorus values above the reference criteria.

Station FCM01 – Mouth of Frog Creek

Station FCM01 is located at the mouth of Frog Creek, southeast of the Frog Bay Tribal National Park. Private cabins are located to the west of the mouth. During the spring months, the mouth is often cut off from Lake Superior due to a shoal. Wild rice can be found in the last ¾ mile of the stream before Frog Creek meets Lake Superior.

Map 7 – Overview of FCM01.
Source: USGS Topo

2013- Results

Staff visited monthly from May to November in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 30 and 31 provide summary basic statistics and core field parameters.

Photo 22. Facing south, upstream, August.

Photo 23. Facing north on the beach, October.

Table 30. 2013 Field Data Statistics for FCM01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	21.57	232.2	30.1	7.41	38	0.175
Min Value	3.03	23.5	2.42	5.42	0.25	0.094
Median	13.84	44.1	4.47	6.43	5.0	0.099
Average	13.81	71.5	8.26	6.45	10	0.116
# Sample (n)	6	6	6	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 31. 2013 Lab Data Statistics for FCM01								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	34	0.091	0.61	0.39	0.93	0.034	2.5	ND
Min Value	3.1	0.042	0.13	0.031	0.35	0.007	2.5	ND
Median	16	0.068	0.34	0.32	0.40	0.019	2.5	ND
Average	19	0.067	0.36	0.24	0.48	0.020	2.5	ND
# Sample	6	6	6	6	6	6	1	1
# Detections	5	4	4	6	6	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.42 – 30.1 mg/L.
- Total Nitrogen ranging from 0.35 – 0.93 mg/L.
- Total Phosphorus ranging from 0.007 – 0.034 mg/L.

No E.coli or sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there were (4) dissolved oxygen and (1) pH values below the established criteria. Based on the EPA criteria recommendations, there were (4) Total Nitrogen and (3) Total Phosphorus values above the reference criteria.

2014 - Results

Station FCM01 was visited at the months for field statistics on June through October. Nutrient samples were taken in the months of August through October. E.coli samples were taken in the months of July through October. TSS samples were taken in the months of July through October of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 32 and 33 provide statistics per field and water chemistry parameters.

Photo 24. Aerial view of Frog Creek estuary.

Photo 25. Facing south, upstream of mouth, June.

Table 32. 2014 Field Data Statistics FCM01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	20.05	5.13	7.73	0	16.4	50.8
Min Value	8.62	3.95	5.69	0	0.25	40.7
Median	18	4.7	7.40	0	6.8	44.1
Average	15.86	4.544	6.88	0	7.5625	45.84
#Samples (n)	5	5	5	0	4	5
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 33. 2014 Lab Data Statistics FCM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.060	0.31	0.52	0.56	0.047	47.9	8.3
Min Value	0.060	0.032	0.12	0.43	0.0080	2	5.2
Median	0.060	0.28	0.16	0.44	0.010	4.1	6.75
Average	0.060	0.21	0.27	0.48	0.022	18	6.75
# Sample	3	3	3	3	3	4	4
#Detections	0	2	0	3	1	0	0
Threshold Value		0.2 mg/L	0.1-20mg/L	0.38 mg/L	0.0 10mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.032-0.31 mg/L
- Total Nitrogen, ranging from 0.43-0.56 mg/L
- Total Phosphorus, ranging from 0.0080-0.047 mg/L

Parameters of no concern include:

- Nitrogen, ammonia ranging from 0.060-0.060 mg/L
- Nitrogen Kjeldahl ranging from 0.12-0.52 mg/L
- E.coli ranging from 2-47.9 235 STV or 126 GM
- Dissolved Oxygen ranging from 5.69-7.73 mg/L

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was zero (0) Dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, two (2) Nitrites + Nitrates, three (3) Total Nitrogen and one (1) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station FCM01 was visited at the months for field statistics on July through November. Nutrient samples were taken in the months of July through November. E.coli samples were taken in the months of July through November. TSS samples were taken in the months of July through November of 2015 to conduct baseline water quality monitoring. Tables 34 and 35 provide statistics per field and water chemistry parameters.

Photo 26. Facing south, upstream, July**.**

Photo 27. Facing west, Auguse.

Table 34. 2015 Field Data Statistics for FCM01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	24.18	32.4	2.71	0	4.06	193
Min Value	19.3	32.4	1.52	0	4.06	0.109
Median	21.74	32.4	2.115	0	4.06	96.55
Average	21.74	32.40	2.115	0	4.06	96.55
Samples (n)	5	5	5	0	5	5
Detections	0	0	2	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 35. 2015 Lab Data Statistics for FCM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.110	0.52	0.75	1.3	0.13	125.0	1304
Min Value	0.035	0.056	0.13	0.47	0.0130	3	1.00
Median	0.042	0.37	0.385	0.51	0.031	7.4	18.30
Average	0.060	0.30	0.41	0.66	0.051	36.1	299.44
Samples	5	5	5	5	5	5	5
Detections	0	3	0	5	4	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 1.52-2.71 mg/L
- Nitrite + Nitrate ranging from 0.056-0.52 mg/L
- Total Nitrogen ranging from 0.47-1.3 mg/L
- Total Phosphorus ranging from 0.0130-0.13 mg/L

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.13-0.75 mg/L
- E.coli ranging from 3-125.0 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 2 (two) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 3 (three) Nitrite + Nitrate, 5 (five) Total Nitrogen and 4 (four) Total Phosphorus values above the reference criteria.

Station LS01 – Lake Superior at Buffalo Bay Marina

Station LS01 is located on the Lake Superior shoreline in front of the Legendary Waters Resort and Casino is a boat launch and small marina capable of holding approximately 30 boats. Adjacent to the boat launch is a swimming beach. Previously, the land near the current casino property was mostly forested, with an art center, church and cemetery, and forested campground. Currently, the land surrounding the casino is mostly open cut lawn with fragmented areas of trees, large parking lot, and open campground area.

Map 8 – Overview of LS01.
Source: USGS Topo

2013 - Results

Staff visited monthly from May until November, with the sole exception of October, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 36 and 37 provide basic statistics and core field parameters.

Photo 28. Facing south, June.

Photo 29. Facing north, July.

Table 36. 2013 Field Data Statistics for LS01						
Statistic	**Temp. (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	20.68	227.5	70.4	7.71	19.0	0.943
Min Value	7.79	0.101	4.02	5.6	1.26	0.095
Median	15.08	46.55	10.91	7.1	2.6	0.101
Average	14.42	73.70	22.16	6.8	7.2	0.240
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 37. 2013 Lab Statistics for LS01								
Statistic	**E.coli (MPN/100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	260	0.16	0.37	0.37	0.72	0.043	3.8	ND
Min Value	8.5	0.051	0.20	0.28	0.30	0.007	3.8	ND
Median	64	0.078	0.28	0.34	0.445	0.010	3.8	ND
Average	111	0.09	0.28	0.33	0.47	0.020	3.8	ND
# Sample	5	6	6	6	6	6	1	1
# Detections	3	5	3	6	6	5	1	0
Threshold Value	235 (STV) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 4.02 – 70.4 mg/L.

- E.coli ranging from 64 – 260 MPN/100 mL.
- Total Phosphorus ranging from 0.007 – 0.043 mg/L.

No pH or sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there was (1) dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there were (1) E.coli, (3) Total Nitrogen, and (2) Total Phosphorus values that were above the reference criteria.

2014 - Results

Station LS01 was visited at the months for field statistics on June through November. Nutrient samples were taken in the months of June through November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 38 and 39 provide statistics per field and water chemistry parameters.

Photo 30. Facing east, July.

Photo 31. Facing northwest, September.

Table 38. 2014 Field Data Statistics for LS01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	20.31	12.13	8.4	0	19	102
Min Value	7.77	3.82	4.51	0	1.9	39.6
Median	15.47	6.97	5.6	0	4.025	64.4
Average	14.15	6.864	6.022	0	7.2375	64.4
#Samples (n)	5	5	5	0	5	5
#Detections	0	0	2	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 39. 2014 Lab Data Statistics for LS01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.060	0.36	0.44	0.78	0.048	117.8	4.3
Min Value	0.027	0.30	0.13	0.49	0.008	3.1	0.9
Median	0.036	0.34	0.17	0.51	0.016	71.7	1.5
Average	0.038	0.33	0.22	0.55	0.022	63.94	1.88
# Sample	6	6	6	6	6	5	5
# Detections	0	6	0	6	2	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrites + Nitrates ranging from 0.30-0.36 mg/L
- Total Nitrogen, ranging from 0.49-0.78 mg/L
- Total Phosphorus, ranging from 0.008-0.048 mg/L
- Dissolved Oxygen ranging from 4.51-8.4 mg/L

Parameters of no concern include:

- Nitrogen Kjeldahl ranging from 0.13-0.44 mg/L
- E.coli ranging from 3.1-117.8 235 CFU or 126 GM

No E.coli values exceeded the established threshold criteria during the visits in 2014. Based on Wisconsin Water Quality Standards, there were two (2) Dissolved Oxygen values below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, six (6) Nitrites + Nitrates, six (6) Total Nitrogen and two (2) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All pH readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station LS01 was visited during the months on July through October and December for field statistics. Nutrient samples were taken in the months of May through December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June, July, and September through December of 2015 to conduct baseline water quality monitoring. Tables 40 and 41 provide statistics per field and water chemistry parameters.

Photo 65. Facing south, upstream, September.

Photo 66. Facing west, across, August.

Table 40. 2015 Field Data Statistics for LS01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	22.24	122.6	16.89	12.71	5.2	91
Min Value	2.19	40	3.48	2.47	1.22	0.107
Median	16.44	61.6	6.02	6.67	1.36	73
Average	14.01	77.74	8.726	7.28	2.29	62.22
Samples (n)	5	5	5	5	4	5
Detections	0	0	2	2	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 41. 2015 Lab Data Statistics for LS01								
Statistic	**Ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.050	0.5	ND	0.59	ND	121.1	10.00
Min Value	0.036	0.35	ND	0.35	ND	2	0.30
Median	0.044	0.41	ND	0.495	ND	4.1	1.15
Average	0.044	0.42	ND	0.49	ND	20.70	2.52
Samples	8	8	8	8	8	7	6
Detections	0	8	0	7	0	0	0
Threshold Value		**0.2 mg/L**	**0.1-20 mg/L**	**0.38 mg/L**	**0.010 mg/L**	**235(STV) or 126 (GM)**	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 3.48-16.98 mg/L
- Nitrite + Nitrate ranging from 0.35-0.5 mg/L
- Total Nitrogen ranging from 0.35-0.59 mg/L

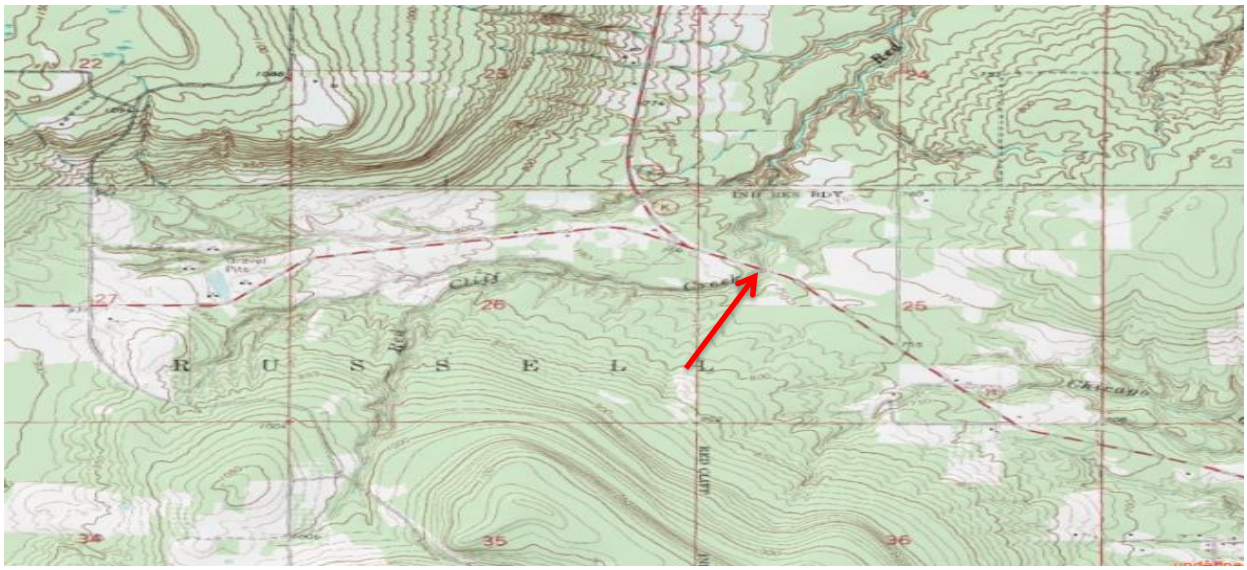
Parameters of no concern include:

- Kjeldahl nitrogen (NO DETECTIONS)
- Total Phosphorus (NO DETECTIONS)
- E.coli ranging from 2-121.1 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards, there were 2 (two) Dissolved Oxygen and 2 (two) pH values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 8 (eight) Nitrite + Nitrate and 7 (seven) Total Nitrogen values that were above the reference criteria.

Station RCC01

Station RCC01 is located upstream of the Highway 13 culvert and is samples on the west side of Highway13. It is located downstream of the Tribal Fish Hatchery discharge and UW-Steven's Point Northern Aquaculture Demonstration Facility discharge. This site is located near the headwaters of Red Cliff Creek and is known for having beaver dam civility.



Map 9 – Overview of RCC01.
Source: Bayfield County Topo

2013 - Results

Staff visited monthly May to November in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 42 and 43 provide a summary of basic statistics and core field parameters.

Photo 34. Facing west, upstream of culvert, July.

Photo 35. Facing east, downstream, July.

Table 42. 2013 Field Data Statistics for RCC01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	17.42	112.8	14.54	7.91	24.1	0.549
Min Value	5.03	24.6	2.43	5.64	3.79	0.15
Median	15.81	47.5	4.85	7.24	7.17	0.21
Average	13.15	56.0	6.65	6.95	9.22	0.25
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 43. 2013 Lab Data Statistics for RCC01								
Statistic	**E.coli (MPN/100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	100	0.12	0.69	0.32	0.91	0.099	3.5	ND
Min Value	9.7	0.066	0.28	0.11	0.45	0.062	3.5	ND
Median	48	0.081	0.50	0.22	0.685	0.084	3.5	ND
Average	51	0.090	0.48	0.21	0.697	0.082	3.5	ND
# Sample	6	6	6	6	6	6	1	1
# Detections	6	6	6	6	6	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- E.coli ranging from 9.7 – 100 MPN/100 mL.

No pH, E.coli, or sulfate values exceeded the established threshold criteria during the visits in 2013. Based on the Wisconsin Water Quality Standards, there were (3) dissolved oxygen values below the reference criteria. Based on the EPA criteria recommendations, there were (6) Total Nitrogen and (6) Total Phosphorus values that were above the reference criteria.

2014 - Results

Station RCC01 was visited a monthly for nutrient samples during the months of June through November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 44 and 45 provide basic statistics and core field parameters.

Photo36. Facing southwest, upstream, July.

Photo37. Facing northwest, across stream, July

Table 44. 2014 Field Data Statistics RCC01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	16.08	2.43	7.58	0	24.1	24.6
Min Value	16.08	2.43	7.58	0	24.1	24.6
Median	16.08	2.43	7.58	0	24.1	24.6
Average	16.08	2.43	7.58	0	24.1	24.6
#Samples (n)	1	1	1	0	1	1
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 45. 2014 Lab Data Statistics RCC01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.14	0.24	0.79	1.0	0.20	107.6	229.5
Min Value	0.060	0.095	0.25	0.42	0.055	9.7	9.4
Median	0.06	0.17	0.75	0.84	0.10	42.6	55.3
Average	0.09	0.17	0.58	0.75	0.11	51.52	83.68
# Sample	5	5	5	5	5	5	5
# Detections	0	2	0	5	5	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include

- Nitrite + Nitrate ranging from 0.095-0.24 mg/L
- Total Nitrogen ranging from 0.42-1.0 mg/L
- Total Phosphorus ranging from 0.055-0.20 mg/L

Parameters of no concern include:

- Nitrogen Kjeldahl ranging from 0.25-0.79 mg/L
- E.coli ranging from 9.7-107.6 235 CFU or 126 GM
- Dissolved Oxygen ranging from 7.58-7.58 mg/L

No E.coli or the single sample for Dissolved Oxygen value exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, two (2) Nitrites + Nitrates, five (5) Total Nitrogen and five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RCC01 was visited at the months for field statistics on July through October. Nutrient samples were taken in the months of June through December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 46 and 47 provide basic statistics and core field parameters.

Photo 38. Facing north, downstream culvert.

Photo 39. Facing west, upstream.

Table 46. 2015 Field Data Statistics for RCC01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	13.35	118.2	13.89	8.76	10.05	184
Min Value	8.08	73.6	8.15	0.43	4.5	0.255
Median	11.385	95	10.03	4.595	5.11	151.5
Average	11.05	95.45	10.525	4.595	6.19	121.81
Samples (n)	4	4	4	4	4	4
Detections	0	0	0	1	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 47. 2015 Lab Data Statistics for RCC01								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate, as SO4 (Unfiltered)**	**E.coli (MPN/100mL)**	**(r**
Max Value	0.200	0.4	0.68	0.8	0.09	0	49.60	
Min Value	0.036	0.079	0.15	0.39	0.039	0	2	
Median	0.086	0.29	0.27	0.58	0.06	0	24.1	1
Average	0.106	0.25	0.33	0.58	0.06	0	21.27	1
Samples	7	7	7	7	7	0	7	
Detections	0	4	0	7	7	0	0	
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.079-0.4 mg/L
- Total Nitrogen ranging from 0.39-0.8 mg/L
- Total Phosphorus ranging from 0.039-0.09 mg/L

Parameters of no concern include:

- Dissolved Oxygen ranging from 8.15-13.89 mg/L
- Kjeldahl Nitrogen ranging from 0.15-0.68 mg/L

No E.coli and pH values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were no detections above the reference criteria for Dissolved Oxygens. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 4 (four) Nitrite + Nitrate, 7 (seven) Total Nitrogen and 7 (seven) Total Phosphorus values above the reference criteria.

Station RCC03 – Red Cliff Creek on Blueberry Road

Station RCC03 is located upstream of Blueberry Rd. culvert and is located in between sites RCC01 and RCCM01. This waterbody experiences flash flooding with lots of woody debris. The culvert is inadequate for this size of creek.

Map 10 – Overview of RCC03.
Source: USGS Topo

2013 - Results

Staff visited monthly from May through November in 2013 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 48 and 49 provide a summary of basic statistics and core field parameters.

Photo 40. Facing west, upstream of culvert, August.

Photo 41. Facing east, downstream, August.

Table 48. 2013 Field Data Statistics for RCC03						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	20.7	138.2	14.9	7.63	31.6	0.223
Min Value	3.99	32.2	2.89	4.01	9.2	0.041
Median	14.7	68.7	8.67	7.31	24.1	0.176
Average	13.4	75.8	9.19	6.67	21.4	0.162
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 49. 2013 Lab Data Statistics for RCC03								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	1700	0.071	0.91	0.20	0.99	0.20	3.4	ND
Min Value	4.1	0.032	0.24	0.038	0.29	0.043	3.4	ND
Median	84	0.053	0.52	0.10	0.62	0.07	3.4	ND
Average	416	0.052	0.53	0.10	0.63	0.08	3.4	ND
# Sample	6	6	6	6	6	6	1	1
# Detections	6	6	6	6	6	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- E.coli ranging from 4.1 – 1700 MPN/ 100 mL.
- Total Phosphorus ranging from 0.043 – 0.20 mg/L.

No sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there was (1) dissolved oxygen and (1) pH value that were below the reference criteria. Based on EPA criteria recommendations, there were (3) E.coli, (6) Total Nitrogen, and (6) Total Phosphorus values above the reference criteria.

2014 – Results

Station RCC03 was visited for field statistics on June and October. Nutrient samples were taken in the months of June, July, September, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were

collected and analyzed for chemical parameters. Tables 50 and 51 provide basic statistics and core field parameters.

Photo 42. Facing north**,** July.

Photo 43. Facing northeast,upstream, July.

Table 50. 2014 Field Data Statistics for RCC03						
Statistic	**Temp *c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	17.55	15.68	7.57	0	31.6	138.2
Min Value	4.39	6.31	5.67	0	9.2	62.5
Median	11.34	10.97	6.635	0	13.7	97.4
Average	11.15	10.9825	6.6275	0	17.05	98.875
#Samples (n)	4	4	4	0	4	4
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 51. 2014 Lab Data Statistics for RCC03							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.042	0.056	0.99	1.0	0.13	131.4	9.6
Min Value	0.029	0.025	0.24	0.30	0.023	25.9	4
Median	0.037	0.039	0.35	0.40	0.04	54.6	6.6
Average	0.036	0.039	0.46	0.49	0.05	63.56	6.72
# Sample	5	5	5	5	5	5	5
# Detections	0	0	0	3	5	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.30-1.0 mg/L
- Total Phosphorus ranging from 0.023-0.13 mg/L

Parameters of no concern include:

- Dissolved Oxygen ranging from 5.67-13.17 mg/L
- Nitrite + Nitrate ranging from 0.025-0.056 mg/L
- Kjeldahl nitrogen ranging from 0.24-0.99 mg/L
- E.coli ranging from 25.9-131.4 235 CFU or 126 GM

No E.coli values exceeded threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was zero (0) Dissolved oxygen values that exceeded the reference criteria. Based on the EPA criteria recommendations there was zero (0) nitrite + nitrate/Kjeldahl nitrogen, three (3) Total Nitrogen and five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RCC03 was visited at the months for field statistics on July through October. Nutrient samples were taken in the months of June through November. E.coli samples were taken in the months of July through November. TSS samples were taken in the months of August through November of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 52 and 53 provide basic statistics and core field parameters.

Photo 44. Facing west, upstream, August.

Photo 45. Facing northeast, downstream, August.

Table 52. 2015 Field Data Statistics for RCC03

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	19.06	133.5	15.96	8.27	22.6	191
Min Value	7.38	-99.9	-24.83	7.45	13.3	0.227
Median	16.45	30.45	2.845	7.86	20.65	167.5
Average	14.835	23.63	-0.795	7.86	19.30	131.56
Samples (n)	4	4	4	4	4	4
Detections	0	0	2	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 53. 2015 Lab Data Statistics for RCC03							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.110	0.31	0.36	0.6	0.052	108.6	13
Min Value	0.027	0.041	0.12	0.23	0.039	5.2	2.30
Median	0.055	0.105	0.215	0.33	0.044	74.9	10.45
Average	0.056	0.1265	0.22	0.35	0.05	59.180	9.05
Samples	6	6	6	6	6	5	4
Detections	0	1	0	3	6		
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from – 24.83-15.96 mg/L
- Nitrite + Nitrate ranging from 0.041-0.31 mg/L
- Total Nitrogen ranging from 0.23-0.6 mg/L
- Total Phosphorus ranging from 0.039-0.052 mg/L

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.12-0.36 mg/L
- E.coli ranging from 5.2-108.6 MPN/100mL

No E.coli or pH values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 2 (two) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 1 (one) Nitrite + Nitrate, 3 (three) Total Nitrogen and 6 (six) Total Phosphorus values above the reference criteria.

Station RCCM01 – Mouth of Red Cliff Creek

Station RCCM01 is located at the mouth of Red Cliff Creek, downstream of Stations RCC01 and RCC03. It is noted that a private marina is located to the east of the creek and private residential to the west.

Map 11 – Overview of RCCM01.
Source: USGS Topo

2013 - Results

Staff visited monthly May to November in 2013, excluding August and September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 54 and 55 provide a summary of basic statistics and core field parameters.

Photo 46. Facing east, downstream, July.

Photo 47. Facing east towards shoreline, July.

Table 54. 2013 Field Data Statistics for RCCM01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	19.4	929.8	174.4	19.8	40.5	0.686
Min Value	2.49	0.156	2.77	6.16	14	0.09
Median	16.01	34.9	4.56	7.75	28.75	0.14
Average	14.08	179.9	62.2	9.33	28.82	0.22
# Sample (n)	6	6	5	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 55. 2013 Lab Data Statistics for RCCM01								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	490	0.13	0.59	0.23	0.74	0.084	3.6	ND
Min Value	20	0.025	0.24	0.054	0.20	0.041	3.6	ND
Median	115	0.07	0.43	0.18	0.47	0.067	3.6	ND
Average	185	0.08	0.42	0.16	0.47	0.066	3.6	ND
# Sample	4	5	5	5	5	5	1	1
# Detections	4	5	4	4	5	5	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.77 – 174.4 mg/L.
- pH ranging from 6.16 – 19.8.
- E.coli ranging from 20 – 490 MPN/ 100 mL.

No sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there were (3) dissolved oxygen and (1) pH values that were outside the reference criteria. Based on EPA criteria recommendations, there were (2) E.coli, (4) Total Nitrogen, and (5) Total Phosphorus values that were above the reference criteria.

2014 - Results

Station RCCM01 was visited at the months for field statistics on June, August, September, October, and November. Nutrient samples were taken in the months of July through November. E.coli samples were taken in the months of July through September. TSS samples were taken in the months of July through September and November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 56 and 57 provide statistics per field and water chemistry parameters.

Photo 48. Aerial view, May.

Table 56. 2014 Field Data Statistics RCCM01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	21.22	11.94	7.81	0	74.9	99.3
Min Value	7.27	2.95	6.09	0	2.1	0.135
Median	17.55	5.97	7.01	0	28	51.8
Average	14.54	6.462	7.084	0	29.76	48.647
#Samples (n)	5	5	5	0	5	5
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 57. 2014 Lab Data Statistics RCCM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.032	0.35	0.42	0.63	0.041	23.1	6.6
Min Value	0.032	0.15	0.17	0.39	0.008	6.3	0.9
Median	0.042	0.22	0.33	0.51	0.034	9.8	4.6
Average	0.047	0.24	0.29	0.51	0.027	13.07	4.175
# Sample	5	5	5	5	5	3	4
# Detections	0	3	0	5	4	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.15-0.35 mg/L
- Total Nitrogen ranging from 0.39-0.63 mg/L
- Total Phosphorus ranging from 0.008-0.041 mg/L

Parameters of no concern include:

- Kjeldahl nitrogen ranging from 0.17-0.42 mg/L

- E.coli ranging from 6.3-23.1 235 CFU or 126 GM
- Dissolved Oxygen ranging from 6.09-7.81 mg/L

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was zero (0) Dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, three (3) Nitrites + Nitrates, five (5) Total Nitrogen and four (4) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RCM01 was visited at the months for field statistics on August and October. Nutrient samples were taken in the months of July through November. E.coli samples were taken in the months of July, September through November. TSS samples were taken in the months of July, September through November of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 58 and 59 provide statistics per field and water chemistry parameters.

Photo 49. Facing east, across stream, August.

Photo 50. Facing south, August.

Table 58. 2015 Field Data Statistics for RCCM01						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	18.71	111.5	12.57	9.24	37.7	98
Min Value	10	111.5	1.17	9.24	37.7	81
Median	14.355	111.5	6.87	9.24	37.70	89.5
Average	14.355	111.50	6.87	9.24	37.70	89.5
Samples (n)	2	2	2	1	1	2
Detections	0	0	1	1	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 59. 2015 Lab Data Statistics for RCCM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.067	0.42	0.45	0.86	0.061	235.9	10.6
Min Value	0.025	0.31	0.13	0.48	0.013	6.3	4.90
Median	0.039	0.37	0.26	0.63	0.029	21.95	7.60
Average	0.043	0.37	0.276	0.65	0.031	71.525	7.68
Samples	5	5	5	5	5	4	4
Detections	0	5	0	5	5	1	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 1.17-12.57 mg/L
- Nitrite + Nitrate ranging from 0.31-0.42 mg/L
- Total Nitrogen ranging from 0.48-0.86 mg/L
- Total Phosphorus ranging from 0.013-0.061 mg/L
- E.coli ranging from 6.3-235.9 MPN/100mL

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.13-0.45 mg/L

There were 1 (one) pH and 1(one) E.coli value that exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235

cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on November 3rd (235.9) however there was not enough data to determine the geometric mean over a 30-day period. Based on the Bad River Water Quality Standards there were 1 (one) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 5 (five) Nitrite + Nitrate, 5 (five) Total Nitrogen and 5 (five) Total Phosphorus values above the reference criteria.

Station RR01 – Raspberry River at Campground Boat Ramp

Station RR01 is located upstream of RRM01 and downstream of RR03. Historical logging is prevalent in this watershed. The area is used as a launch site for boats, fishing, recreational swimming, and cultural harvest of significant wetland plants; wild rice is known to grow on this riverway.

Map 12 – Overview of RCCM01.
Source: USGS Topo

2013 – Results

Station RR01 was visited monthly May to November in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 60 and 61 provide basic statistics and core field parameters.

Photo 51. Facing south, July.

Photo 52. Facing southeast, October

Table 60. 2013 Field Data Statistics RR01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	19.95	239.1	30.81	7.58	28.1	0.189
Min Value	4.67	49.3	4.46	5.0	2.8	0.085
Median	12.47	61.6	6.30	6.7	13.9	0.116
Average	13.37	114.2	12.97	6.44	15.0	0.123
# Sample (n)	6	6	6	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 61. 2013 Lab Data Statistics RR01								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	160	0.095	1.9	0.11	2.0	0.40	ND	ND
Min Value	5.2	0.04	0.42	0.03	0.49	0.030	ND	ND
Median	42	0.08	0.61	0.07	0.63	0.05	ND	ND
Average	69	0.07	0.90	0.07	0.94	0.11	ND	ND
# Sample	6	6	6	6	6	6	1	1
# Detections	6	6	6	5	6	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 4.46 – 30.81 mg/L.
- Total Nitrogen ranging from 0.49 – 2.0 mg/L.
- Total Phosphorus ranging from 0.030 – 0.40 mg/L.

No E.coli values exceeded the established threshold criteria during the visits in 2013. Based on the Wisconsin Water Quality Standards, there was (1) dissolved oxygen and (1) pH values below the reference criteria. Based on the EPA criteria recommendations, there were (2) E.coli, (6) Total Nitrogen and (6) Total Phosphorus values above the reference criteria.

2014 - Results

Station RR01 was visited at the months for field statistics on June, September, and October. Nutrient samples were taken in the months of June, July, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Tables 62 and 63 provide statistics per field and water chemistry parameters.

Photo 53. Facing south, across stream, July.

Photo 54. Facing west, downstream, August.

Table 62. 2014 Field Data Statistics RR01

Statistic	Temperature (°C)	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	17.6	7.64	7.58	0	26.9	64
Min Value	7.49	3.34	3.13	0	11	35.2
Median	13.87	5.36	6.01	0	25	52.3
Average	12.99	5.45	5.57	0	20.97	50.50
#Samples (n)	3	3	3	0	3	3
#Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 63. 2014 Lab Data Statistics RR01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.097	0.045	0.83	0.83	0.090	37.9	15.9
Min Value	0.031	0.038	0.50	0.54	0.045	8.6	1.3
Median	0.064	0.042	0.68	0.70	0.064	26.2	4.4
Average	0.064	0.042	0.67	0.69	0.066	23.26	6.5
# Sample	4	4	4	4	4	5	5
# Detections	0	0	0	4	4	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.54-0.83 mg/L
- Total Phosphorus ranging from 0.045-0.090 mg/L
- Dissolved Oxygen ranging from 3.13-7.58 mg/L

Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.038-0.045 mg/L
- Nitrogen, Kjeldahl ranging from 0.50-0.83 mg/L
- E.coli ranging from 8.6-37.9 235 CFU or 126 GM

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was one (1) Dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Nitrite + nitrate/Kjeldahl nitrogen, four (4) Total Nitrogen and four (4) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RR01 was visited at the months for field statistics on July through October and December. Nutrient samples were taken in the months of May through October and December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Tables 64 and 65 provide statistics per field and water chemistry parameters.

Photo 55. Facing east, August.

Photo 56. Facing west, December.

Table 64. 2015 Field Data Statistics RR01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	23.67	87.5	12.77	8.6	17.1	179
Min Value	0.05	25.3	2.23	7.21	9.2	0.206
Median	15.37	28.6	2.86	7.88	12.00	126
Average	13.672	46.82	5.562	7.90	12.77	99.04
Samples (n)	5	5	5	3	3	5
Detections	0	0	3	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 65. 2015 Lab Data Statistics RR01								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate (Unfiltered)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.093	0.77	2.2	3	0.091	10	1119.90	140
Min Value	0.013	0.031	0.32	0.35	0.023	10	7.5	1.70
Median	0.056	0.052	0.42	0.44	0.037	10	72.7	7.90
Average	0.052	0.190	0.67	0.81	0.042	10	202.71	25.80
Samples	7	7	7	7	7	1	7	7
Detections	0	1	0	6	7	0	1	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.23-12.77 mg/L
- Nitrite + Nitrate ranging from 0.031-0.77 mg/L
- Total Nitrogen ranging from 0.35-3 mg/L
- Total Phosphorus ranging from 0.023-0.091 mg/L
- E.coli ranging from 7.5-1119.90 MPN/100mL

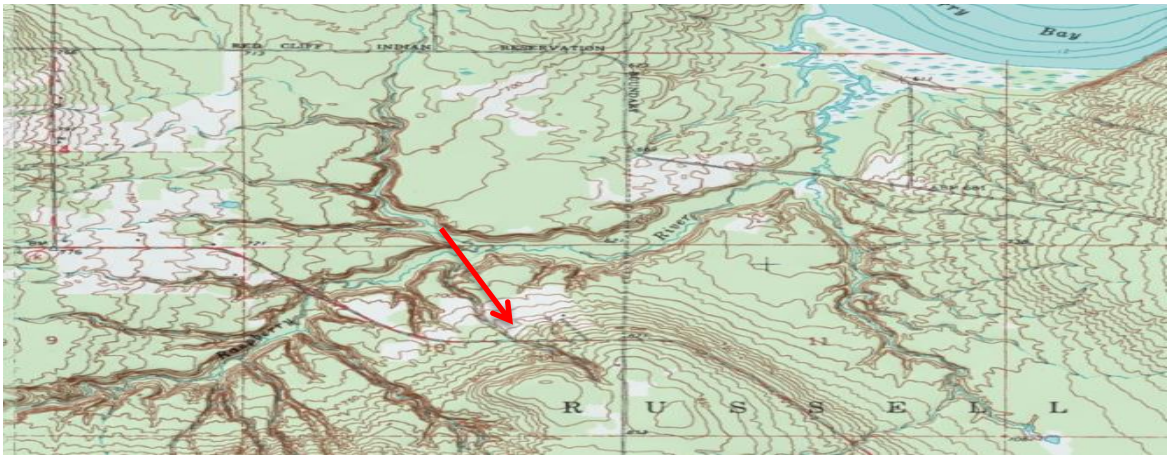
Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.32-2.2 mg/L

No pH values that exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on August 4th (1119.90) however there was not enough data to determine the geometric mean over a 30-day period. Based on the Bad River Water Quality Standards there were3 (three) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 1 (one) Nitrite + Nitrate, 6 (six) Total Nitrogen and 7 (seven) Total Phosphorus values above the reference criteria.

Station RR03 – Raspberry River on Rowley Road

Station RR03 is located upstream of RRM01 and RR01. Historical logging is prevalent in this watershed. The area is mainly residential and some small scale logging operations occur. Fishing, recreational swimming, and cultural harvest of significant wetland plants are uses of this watershed; wild rice is known to grow on this riverway. Rowley Road crosses Raspberry River; the culvert is in adequate to handle this size of river. There are future plans to remove the culvert and put in a bridge. This site also has an overflow way.



Map 13 – Overview of RR03.
Source: Bayfield Topo

2013 - Results

Station RR03 was visited monthly from May to November in 2013, except August and September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 66 and 67 provide basic statistics and core field parameters.

Photo 57. Facing east, upstream, August.

Photo 58. Facing west, downstream, August.

Table 66. 2013 Field Data Statistics RR03						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	20.7	358.1	46.52	7.71	29.5	0.18
Min Value	3.92	32.3	2.89	4.75	4.62	0.085
Median	12.0	71.2	7.62	7.07	18.46	0.11
Average	12.3	116.2	13.78	6.83	18.02	0.12
# Sample (n)	6	6	6	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 67. 2013 Lab Data Statistics RR03								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	140	0.09	0.78	0.12	0.78	0.067	2.6	0
Min Value	20	0.043	0.44	0.035	0.49	0.033	2.6	0
Median	110	0.06	0.50	0.08	0.55	0.048	2.6	0
Average	86	0.06	0.55	0.08	0.58	0.051	2.6	0
# Sample	5	5	5	5	5	5	1	1
# Detections	5	5	5	2	5	5	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.89 – 46.52 mg/L.

No sulfate values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there were (2) dissolved oxygen and (1) pH values below the reference criteria. Based on the EPA criteria recommendations, there were (1) E.coli, (5) Total Nitrogen, and (5) Total Phosphorus values above the reference criteria.

2014 - Results

Station RR03 was visited at the months for field statistics on June and October. Nutrient samples were taken in the months of June, July, September, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of

2014 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Tables 68 and 69 provide statistics per field and water chemistry parameters.

Photo 59. Facing west, upstream, September.

Photo 60. Facing east, overflow way, August.

Table 68. 2014 Field Data Statistics RR03

Statistic	Temperature (°C)	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	13.4	9.71	7.71	0	29.5	79.6
Min Value	6.84	4.11	5.2	0	17	39.4
Median	10.12	6.91	6.455	0	23.25	59.5
Average	10.12	6.91	6.455	0	23.25	59.5
#Samples (n)	2	2	2	0	2	2
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 69. 2014 Lab Data Statistics RR03

Statistic	Nitrogen, ammonia as N (unfiltered) (mg/L)	Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)	Nitrogen, Kjeldahl as N (unfiltered) (mg/L)	Nitrogen, tot. as N (unfiltered) (mg/L)	Phosphorus, tot. as P (mg/L)	E.coli (MPN/ 100 mL)	TSS
Max Value	0.060	0.13	0.75	0.75	0.091	66.3	4
Min Value	0.033	0.042	0.32	0.45	0.027	11	1.6
Median	0.043	0.09	0.54	0.58	0.027	55.2	3.95
Average	0.045	0.09	0.52	0.56	0.043	47.2	3.375
#Sample	5	5	5	5	5	5	5
#Detections	0	0	0	5	5	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.45-0.75 mg/L
- Total Phosphorus ranging from 0.027-0.091 mg/L

Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.042-0.13 mg/L
- Kjeldahl Nitrogen ranging from 0.32-0.75 mg/L
- E.coli ranging from 11-66.3 (235 STV or 126 GM)
- Dissolved Oxygen ranging from 5.2-7.71 mg/L

No E.coli or pH values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was zero (0) Dissolved oxygen value above the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Nitrite + Nitrate/Kjeldahl Nitrogen, (5) Total Nitrogen and (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RR03 was visited at the months for field statistics on August through October and December. Nutrient samples were taken in the months of May through October and December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Tables 61 and 62 provide statistics per field and water chemistry parameters.

Photo 61. Facing west, upstream, December.

Photo 62. Facing east, downstream, December.

Table 70. 2015 Field Data Statistics RR03

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (uS/cm)
Max Value	16.54	122.4	17.86	9.15	16.3	200
Min Value	0.07	46.8	4.53	6.05	7.23	45
Median	9.435	86.55	9.86	8.33	11.77	148
Average	8.87	85.58	10.53	7.84	11.77	135.25
Samples (n)	4	4	4	3	2	4
Detections	0	0	1	1	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 71. 2015 Lab Data Statistics RR03

Statistic	Nitrogen, ammonia as N (unfiltered) (mg/L)	Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)	Nitrogen, Kjeldahl as N (unfiltered) (mg/L)	Nitrogen, tot. as N (unfiltered) (mg/L)	Phosphorus, tot. as P (mg/L)	Sulfate, (Unfiltered)	E.coli (MPN/100mL)	TSS (mg/L)
Max Value	0.130	0.12	0.57	0.68	0.041	3.5	114.50	16
Min Value	0.046	0.026	0.31	0.36	0.018	3.5	2	1.20
Median	0.063	0.10	0.46	0.55	0.032	3.5	49.6	3.0
Average	0.078	0.08	0.47	0.54	0.032	3.5	50.49	5.61
Samples	7	7	7	7	7	1	7	7
Detections	0	0	0	6	7	0	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 4.53-17.86 mg/L
- Total Nitrogen ranging from 0.36-0.68 mg/L
- Total Phosphorus ranging from 0.018-0.041 mg/L

Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.026-0.12 mg/L
- Kjeldahl Nitrogen ranging from 0.31-0.57 mg/L
- E.coli ranging from 2-114.50 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 1 (one) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were no Nitrite + Nitrate, 6 (six) Total Nitrogen and 7 (seven) Total Phosphorus values above the reference criteria.

Station RRM01 – Mouth of Raspberry River

Station RRM01 is located downstream of RR03 and RR01. Historical logging is prevalent in this watershed. The area is mainly forested with a few residential spots and tribal campground. Fishing, recreational swimming, and cultural harvest of significant wetland plants are uses of this watershed; wild rice is known to grow on this riverway.

Map 14 – Overview of RRM01.
Source: USGS Topo

2013 - Results

Station RR03 was visited monthly from May to November in 2013, except August and September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 72 and 73 provide basic statistics and core field parameters.

Photo 63. Facing Northeast to Lake Superior.

Photo 64. Facing Southwest.

Table 72. 2013 Field Data Statistics RRM01

Statistic	Temperature (°C)	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (µS/cm)
Max Value	20.78	475.6	64.7	7.75	45	0.13
Min Value	3.26	25.0	2.28	5.01	0.22	0.097
Median	18.52	99.5	8.8	6.41	12	0.11
Average	14.59	163.7	19.9	6.57	17	0.11
# Sample (n)	5	5	5	5	5	5
Threshold Value			>5.0	6.0 to 9.0		

Table 73. 2013 Lab Data Statistics RRM01							
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Mercury (µg/L)**
Max Value	490	0.14	1.2	0.32	1.4	0.98	0
Min Value	65	0.077	0.20	0.098	0.44	0.017	0
Median	172	0.08	0.52	0.19	0.68	0.07	0
Average	242	0.10	0.55	0.20	0.75	0.23	0
# Sample	4	5	5	5	5	5	1
# Detections	4	4	5	5	5	5	0
Threshold Value	235 (STV) or 126 (GM)				0.38	0.010	1.3 or 0.196

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.28 – 64.7 mg/L.
- E.coli ranging from 65 – 490 MPN/ 100 mL.
- Total Nitrogen ranging from 0.44 – 1.4 mg/L.
- Total Phosphorus ranging from 0.017 – 0.98 mg/L.

Based on Wisconsin Water Quality Standards, there were (2) dissolved oxygen and (1) pH values below the reference criteria. Based on the EPA criteria recommendations, there were (3) E.coli, (5) Total Nitrogen, and (5) Total Phosphorus values above the reference criteria.

2014 - Results

Station RRM01 was visited at the months for field statistics on June, September, and October. Nutrient samples were taken in the months of June, September, and October. E.coli samples were taken in the months of June, July, September, and October. TSS samples were taken in the months of July through October of 2014 to conduct baseline water quality monitoring. Tables 74 and 75 provide statistics per field and water chemistry parameters.

Photo 65. Facing northeast, upstream, July.

Photo 66. Facing northeast, upstream, October.

Table 74. 2014 Field Data Statistics RRM01						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm**
Max Value	19.67	7.08	7.75	0	19	62.8
Min Value	9.94	2.28	4.22	0	0.95	25
Median	18	4.98	6.3	0	3.70	52.4
Average	15.83	4.78	6.09	0	7.88	46.733
#Samples (n)	3	3	3	0	3	3
#Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 75. 2014 Lab Data Statistics RRM01							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.061	0.31	0.71	0.74	0.080	50.4	3.6
Min Value	0.027	0.033	0.18	0.49	0.015	2	1.4
Median	0.042	0.26	0.29	0.55	0.027	6.5	2.5
Average	0.043	0.20	0.39	0.59	0.041	16.35	2.5
# Sample	3	3	3	3	3	4	3
# Detections	0	2	0	3	3	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.033-0.31 mg/L
- Total Nitrogen ranging from 0.49-0.74 mg/L
- Total Phosphorus ranging from 0.015-0.080 mg/L
- Dissolved Oxygen ranging from 4.22-7.75 mg/L

Parameters of no concern include:

- Nitrogen, Kjeldahl ranging from 0.18-0.71 mg/L
- E.coli ranging from 2-50.4 235 CFU or 126 GM

No pH or E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample

maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was one (1) Dissolved oxygen values below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, two (2) Nitrites + Nitrates, three (3) Total Nitrogen, three (3) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station RRM01 was visited at the months for field statistics on August through October and December. Nutrient samples were taken in the months of August through October and December. E.coli samples were taken in the months of July through December. TSS samples were taken in the months of July through December of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 76 and 77 provide statistics per field and water chemistry parameters.

Photo 67. Facing northeast,downstream, August.

Photo 68. Facing east, across stream, September.

Table 76. 2015 Field Data Statistics RRM01						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	18.86	118.2	13.88	13.32	11.4	103
Min Value	0	89.8	2.56	6.58	11.4	41
Median	12.695	94.9	10.89	8.91	11.40	86
Average	11.06	100.97	9.555	9.60	11.40	79
Samples (n)	4	4	4	3	1	4
Detections	0	0	1	1	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 77. 2015 Lab Data Statistics RRM01								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate, (Unfiltered)**	**E.coli (MPN/100mL)**	**TSS (mg/L)**
Max Value	0.043	0.34	0.72	0.82	0.027	3.6	98.80	94.5
Min Value	0.035	0.072	0.21	0.32	0.013	3.6	7.3	3.70
Median	0.039	0.174	0.295	0.57	0.025	3.6	27.4	7.40
Average	0.039	0.19	0.38	0.57	0.023	3.6	40.57	21.98
Samples	4	4	4	4	4	1	6	6
Detections	0	2	0	3	4	0	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.56-13.88 mg/L
- Nitrite + Nitrate ranging from 0.072-0.34 mg/L
- Total Nitrogen ranging from 0.32-0.82 mg/L
- Total Phosphorus ranging from 0.013-0.027 mg/L

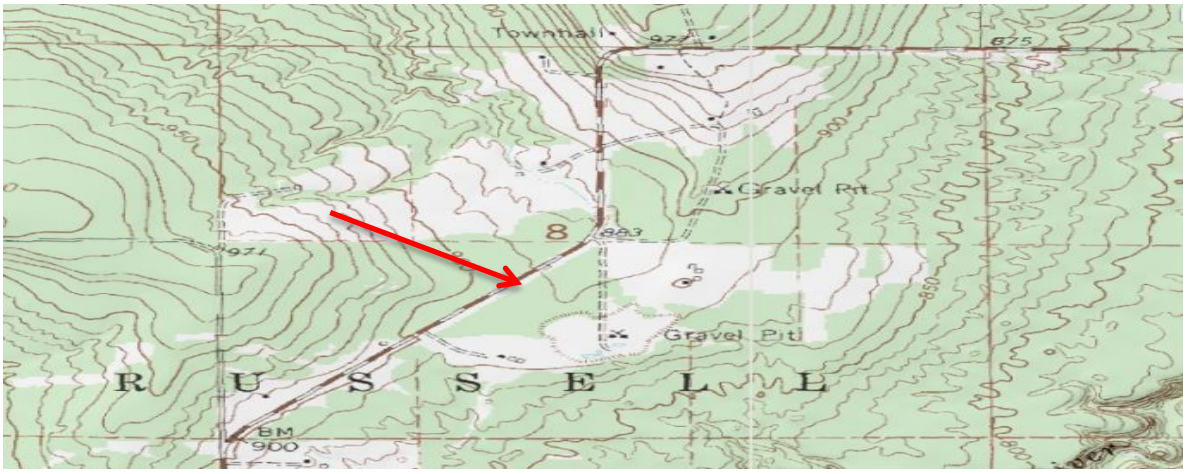
Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.21-0.72 mg/L
- E.coli ranging from 7.3-98.80 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 1 (one) Dissolved Oxygen value above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 2 (two) Nitrite + Nitrate, 3 (three) Total Nitrogen and 4 (four) Total Phosphorus values above the reference criteria.

Station SC01 – Sucker Creek on County K Road

The site is located along County Highway K, in a drainage ditch, which serves as the headwater source. There is hobby farm with some animals downstream from the site. This area is primarily forested with historical logging and some small scale logging operation still occurs in the watershed.



Map 15 – Overview of SC01.
Source: Bayfield Topo

2013 – Results

Station SC01 was visited monthly from May to August in 2013, with the sole exception of July, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 78 and 79 provide basic statistics and core field parameters.

Photo 69. Facing East off County Road K, August.

Photo 70. Facing West off County Road K, August.

Table 78. 2013 Field Data Statistics SC01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	20.08	47.8	4.83	7.11	45	0.092
Min Value	12.73	17.7	1.61	6.3	2.8	0.054
Median	17.02	38.2	4.05	7.0	5.7	0.060
Average	16.61	34.6	3.50	6.8	17.8	0.069
# Sample (n)	3	3	3	3	3	3
Threshold Value			>5.0	6.0 to 9.0		

Table 79. 2013 Lab Data Statistics SC01							
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**
Max Value	310	0.085	1.3	0	1.3	0.11	ND
Min Value	44	0.063	0.55	0	0.55	0.036	ND
Median	177	0.083	1.2	0	1.2	0.07	ND
Average	177	0.077	1.0	0	1.0	0.07	ND
# Sample	3	3	3	3	3	3	1
# Detections	2	3	3	0	3	3	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10

Parameters of notable concern include:

- Total Nitrogen ranging from 0.55 – 1.3 mg/L.
- Total Phosphorus ranging from 0.036 – 0.11 mg/L.

No pH values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there were (3) dissolved oxygen values below the reference criteria. Based on the EPA criteria recommendations, there were (1) E.coli, (3) Total Nitrogen and (3) Total Phosphorus values above the reference criteria.

2014 - Results

Station SC01 was visited only twice in 2014 surface water sampling season. There were insufficient water levels to sample for water chemistry parameters, which is why information is not presented in this report.

Photo 71. Culvert, source of Sucker Creek, August.

Photo 72. Facing southeast, August.

Table 80. 2014 Field Data Statistics SC01

Statistic	Temperature (°C)	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	17.86	4.83	7.02	0	9	47.8
Min Value	17.02	3.84	6.3	0	5.7	42.7
Median	17	4.335	6.66	0	7.35	45.25
Average	17.44	4.335	6.66	0	7.35	45.25
#Samples (n)	2	2	2	0	2	2
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

No parameters of concern.

This site will be relocated in the near future to adequately carry out water chemistry sampling in the headwater area.

2015 - Results

This site was not sampled for 2015 as it was dry every site visit conducted June through October.

Station SCM02

This area is primarily forested and minimal residential impacts. There is a cultural gathering area west of the mouth of Sucker Creek. Beaver dam activity has been noted. It is common for the mouth to develop shoals during the fall and spring. This site is historical for steelhead runs.

Map 16 – Overview of SCM02.
Source: USGS Topo

2013 - Results

Station SCM02 was visited in May and July during 2013 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 81 and 82 provide basic statistics and core field parameters.

Photo 73. Facing northwest, downstream, August.

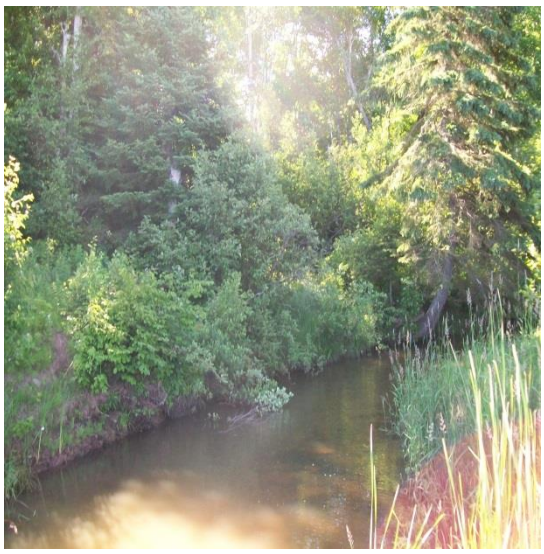


Photo 74. Facing southeast, upstream, August.

Table 81. 2013 Field Data Statistics SCM02						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	16.9	75.8	8.81	8.7	11.3	0.116
Min Value	8.89	22.6	2.18	5.56	3.67	0.05
Median	14.2	50.0	5.12	6.5	11.3	0.07
Average	13.3	49.5	5.37	6.9	8.8	0.08
# Sample (n)	3	3	3	3	3	3
Threshold Value			>5.0	6.0 to 9.0		

Table 82. 2013 Lab Data Statistics SCM02								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	37.4	0.078	0.28	0.16	0.35	0.025	8.7	
Min Value	11	0.059	0.19	0.16	0.28	0.017	8.7	
Median	24	0.069	0.24	0.16	0.32	0.021	8.7	
Average	24	0.069	0.24	0.16	0.32	0.021	8.7	
# Sample	2	2	2	2	2	2	1	0
# Detections	2	2	2	1	2	2	1	
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

There were no parameters of notable concern; all values were within a reasonable range.

No pH, E.coli, sulfate, or Total Nitrogen values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there was (1) dissolved oxygen value below the reference criteria. Based on the EPA criteria recommendations, there were (2) Total Phosphorus values above the reference criteria.

2014 - Results

Station SCM02 was visited at the months for field statistics on June, July and October. Nutrient samples were taken in the months of July, September, October and November. E.coli samples were taken in the months of June, July and September. TSS samples were taken in the months of July, August and September of 2014 to conduct baseline water quality monitoring. Core measurements were collected and

analyzed for chemical parameters. Tables 83 and 84 provide statistics per field and water chemistry parameters.

Photo 75. Facing east, across stream, October.

Photo 76. Facing southeast, upstream, July.

Table 83. 2014 Field Data Statistics SCM02						
Statistic	**Temp °C**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	20.4	10.04	8.7	0	14	81.9
Min Value	6.29	2.18	4.8	0	3.67	22.6
Median	17	8.14	7.04	0	8.835	81.4
Average	14.53	6.79	6.85	0	8.84	61.97
#Samples (n)	3	3	3	0	2	3
#Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 84. 2014 Lab Data Statistics SCM02							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli 100 MPN**	**TSS**
Max Value	0.053	0.34	0.42	0.49	0.050	579.4	8
Min Value	0.028	0.028	0.15	0.33	0.015	1	4
Median	0.035	0.07	0.29	0.42	0.033	42.4	6
Average	0.039	0.13	0.29	0.42	0.033	179.36	6
# Sample	4	4	4	4	4	7	2
# Detections	0	1	0	2	4	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235 (STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrite + Nitrate ranging from 0.028-0.34 mg/L
- Total Nitrogen ranging from 0.33-0.49 mg/L
- Total Phosphorus ranging from 0.050-0.015 mg/L
- Dissolved Oxygen ranging from 4.8-8.7 mg/L
- E.coli ranging from 1-579.4

Parameters of no concern include:

- Nitrogen, Kjeldahl ranging from 0.15-0.42 mg/L

Two (2) E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on September 8, 2014. Four more samples were collected on September 15th (52), 24th (18.9), 25th (12.1) and 29th (686.7) to find the geometric mean of 269.82 which exceeded the geometric mean threshold criteria. Based on Bad River Water Quality Standards, there was one (1) Dissolved oxygen values below the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, (1) Nitrites + Nitrates, (2) Total Nitrogen, (4) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station SCM02 was visited at the months for field statistics on July through September and December. Nutrient samples were taken in the months of June through October. E.coli samples were taken in the months of July through November. TSS samples were taken in the months of July through November of 2015 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Tables 85 and 86 provide statistics per field and water chemistry parameters.

Photo 77. Facing southeast, upstream, September.

Photo 78. Facing northwest, downstream, September.

Table 85. 2015 Field Data Statistics SCM02						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	19.31	113.3	16.47	8.2	7.36	158
Min Value	0.2	45.6	4.37	4.15	7.06	0.167
Median	16.42	53.95	5.18	6.175	7.21	101
Average	13.09	66.70	7.8	6.175	7.21	90.04
Samples (n)	4	4	4	2	2	4
Detections	0	0	2	1	0	0
Threshold Value			**>5.0 mg/L**	**6.0 to 9.0**		

Table 86. 2015 Lab Data Statistics SCM02								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate, as SO4 (Unfiltered)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.061	0.18	0.44	0.48	0.028	0	55.4	24.7
Min Value	0.038	0.03	0.2	0.23	0.01	0	3.1	0.60
Median	0.054	0.10	0.3	0.43	0.017	0	14.8	2.90
Average	0.051	0.10	0.29	0.37	0.018	0	26.0	6.74
Samples	5	5	5	5	5	0	5	5

Detections	0	0	0	3	4	0	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 4.37-16.47 mg/L
- Total Nitrogen ranging from 0.23-0.48 mg/L
- Total Phosphorus ranging from 0.01-0.028

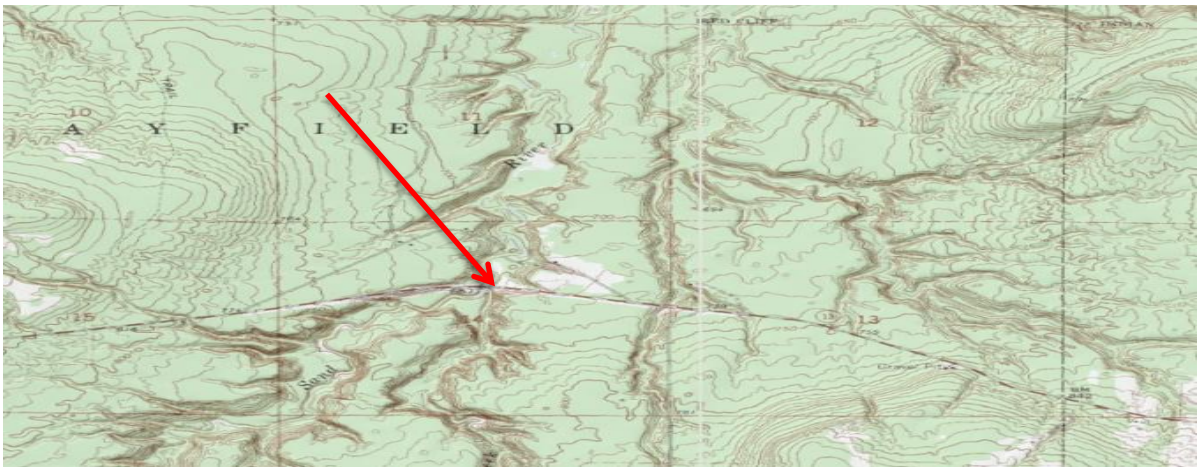
Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.03-0.18 mg/L
- Kjeldahl Nitrogen ranging from 0.2-0.44 mg/L
- E.coli ranging from 3.1-55.4 MPN/100mL

No E.coli values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were 2 (two) Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were no Nitrite + Nitrate, 3 (three) Total Nitrogen and 4 (four) Total Phosphorus values above the reference criteria.

Station SR02 – Highway 13 Overpass

This area is primarily forested and minimal residential impacts. Beaver dam activity has been noted upstream of Highway 13. Historical logging is prevalent in this watershed; there is on-going small scale logging operations.



Map 17 – Overview of SR02.
Source: Bayfield Topo

2013 - Results

Station SR02 was visited monthly from May to November in 2013, with the sole exception of September, to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Table 87 and 88 provide basic statistics and core field parameters.

Photo 79. Facing north, downstream, July.

Photo 80. Facing south, upstream, July.

Table 87. 2013 Field Data Statistics SR02						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	18.34	96.3	12.61	8.23	65	0.216
Min Value	3.5	23.8	2.21	5.14	24.4	0.079
Median	11.18	64.8	7.56	6.50	41.5	0.091
Average	11.02	59.3	6.83	6.56	41.9	0.110
# Sample (n)	6	6	6	6	6	6
Threshold Value			>5.0	6.0 to 9.0		

Table 88. 2013 Lab Data Statistics SR02								
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**N Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**	**Mercury (µg/L)**
Max Value	300	0.15	0.9	0.072	0.93	0.16	2.6	0
Min Value	9.7	0.027	0.43	0.029	0.43	0.037	2.6	0
Median	42	0.052	0.56	0.033	0.60	0.10	2.6	0
Average	82	0.062	0.65	0.041	0.68	0.10	2.6	0
# Sample	6	6	6	6	6	6	1	1
# Detections	6	6	5	5	5	6	1	0
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10	1.3 or 0.196

Parameters of notable concern include:

- Total Phosphorus ranging from 0.037 – 0.16 mg/L.

No sulfate values exceeded the established threshold criteria during the visits in 2013. Based on the Wisconsin Water Quality Standards, there were (2) dissolved oxygen and (2) pH values below the reference criteria. Based on the EPA criteria recommendation, there were (1) E.coli, (5) Total Nitrogen, and (6) Total Phosphorus values above the reference criteria.

2014 – Results

Station SR02 was visited at the months for field statistics on June, August and October. Nutrient samples were taken in the months of June, July, September, October and November. E.coli samples were taken in the months of June through October. TSS samples were taken in the months of July through November of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 89 and 90 provide statistics per field and water chemistry parameters.

Photo 81. facing downstream.

Photo 82. facing downstream.

Table 89. 2014 Field Data Statistics SR02						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (mS/cm)**
Max Value	13.1	9.08	8.23	0	51.3	88.4
Min Value	6.18	2.73	2.84	0	31	26.1
Median	13.06	9.06	7.77	0	38	73.2
Average	10.78	6.96	6.28	0	40.1	62.57
#Samples (n)	3	3	3	0	3	3
#Detections	0	0	1	0	0	0
Threshold Value			>5.0	6.0 to 9.0		

Table 90. 2014 Lab Data Statistics SR02							
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli**	**TSS**
Max Value	0.051	0.038	0.79	0.79	0.13	98.8	32.7
Min Value	0.051	0.033	0.22	0.26	0.030	21.8	6
Median	0.051	0.036	0.41	0.44	0.06	45.7	10.8
Average	0.051	0.036	0.44	0.45	0.07	60.06	14.16
# Sample	5	5	5	5	5	5	5
# Detections	0	0	0	3	5	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen ranging from 2.84-8.23 mg/L

- Total Nitrogen ranging from 0.26-0.79 mg/L
- Total Phosphorus ranging from 0.030-0.13 mg/L

Parameters of no concern include:

- Nitrite + Nitrate ranging from 0.033-0.038 mg/L
- Kjeldahl nitrogen ranging from 0.22-0.79 mg/L
- E.coli ranging from 21.8-98.8 235 CFU or 126 GM

No E.coli or pH values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there was one (1) Dissolved oxygen value above the reference criteria. Based on the EPA criteria recommendations there was three (3) Total Nitrogen, five (5) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 – Results

Station SR02 was visited at the months for field statistics on July through October and December. Nutrient samples were taken in the months of June through October and December. E.coli samples were taken in the months of June through December. TSS samples were taken in the months of June through December of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 91 and 92 provide statistics per field and water chemistry parameters.

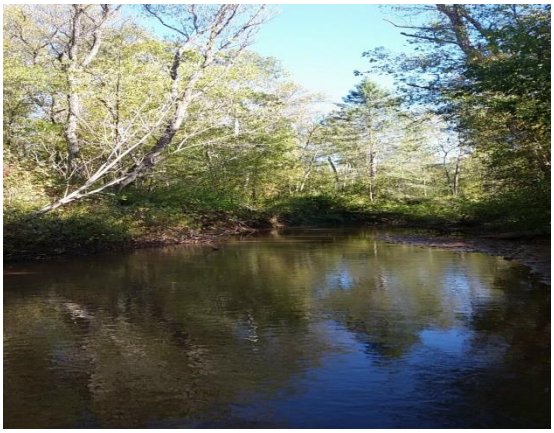


Photo 83. facing downstream.

Photo 84. facing bridge.

Table 91. 2015 Field Data Statistics SR02						
Statistic	**Temp °C**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	16.57	126.9	17.49	8.4	10.88	175
Min Value	0.32	69.4	7.15	7.4	6.26	0.214
Median	9.39	114.8	13.14	8.24	10.53	143
Average	9.594	102.30	12.04	8.01	9.22	100.44
Samples (n)	5	5	5	3	3	5
Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 92. 2015 Lab Data Statistics SR02								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate, (Unfiltered)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.068	0.130	0.550	0.680	0.051	0.000	83.90	29.7
Min Value	0.025	0.03	0.26	0.15	0.012	0	8.6	2.40
Median	0.0355	0.053	0.405	0.26	0.02	#NUM!	36	5.70
Average	0.039	0.064	0.405	0.36	0.03	#DIV/0!	37.58	8.34
Samples	6	6	6	6	6	0	7	7
Detections	0	0	0	1	6	0	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Total Nitrogen ranging from 0.15-0.680 mg/L
- Total Phosphorus ranging from 0.012-0.051 mg/L

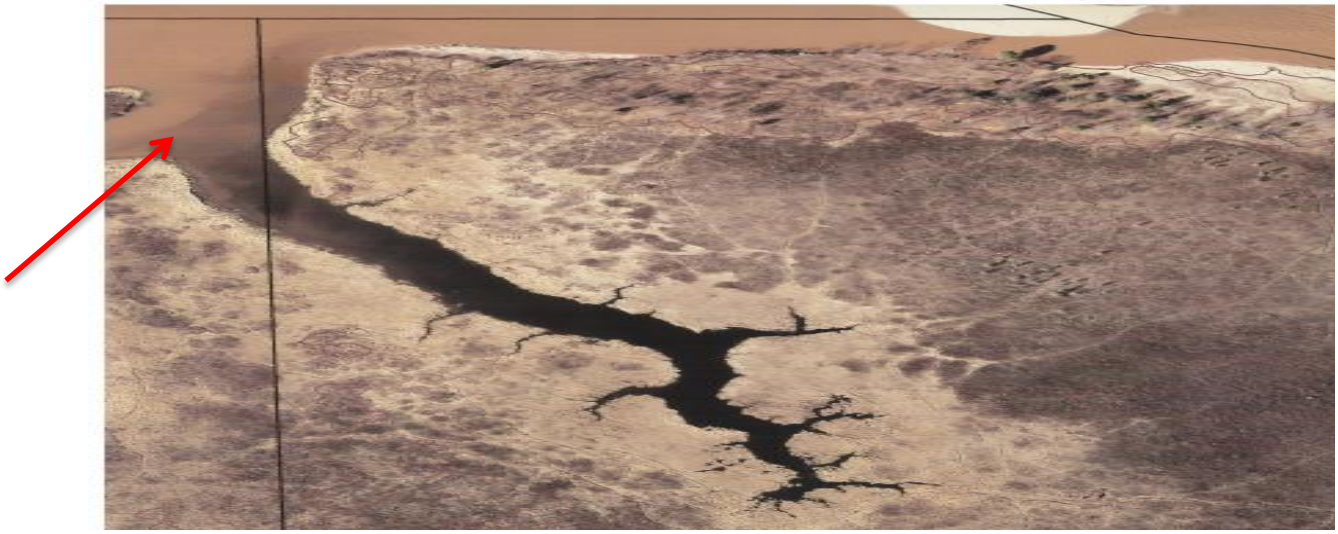
Parameters of no concern include:

- Dissolved Oxygen ranging from 7.15-17.49 mg/L
- Nitrite + Nitrate ranging from 0.03-0.130 mg/L
- Kjeldahl Nitrogen ranging from 0.26-0.550 mg/L
- E.coli ranging from 8.6-83.90 MPN/100mL

No E.coli or pH values exceeded the established threshold criteria during the visits in 2015. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on the Bad River Water Quality Standards there were no Dissolved Oxygen values above the reference criteria. Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were no Nitrite + Nitrate, 1 (one) Total Nitrogen and 6 (six) Total Phosphorus values above the reference criteria.

Station SRM01- Mouth of Sand River

This area is primarily forested and minimal residential impacts. Beaver dam in the estuary system. Historical logging is prevalent in this watershed; there is on-going small scale logging operations. This land is also monitored by the Apostle Island National Park Service, within reservation boundaries. Wild rice is also present in the area.



Map 18 – Overview of SM01.
Source: USGS Topo

2013 - Results

Station SRM01 was visited in May, July, and September of 2013 to conduct baseline water quality monitoring. Core measurements were collected and analyzed for chemical parameters. Table 93 and 94 provide basic statistics and core field parameters.

Photo 84. Facing west, upstream, July.

Photo 85. Facing west, upstream, September.

Table 93. 2013 Field Data Statistics SRM01						
Statistic	**Temperature (°C)**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (µS/cm)**
Max Value	16.48	71.9	8.05	7.14	30.1	0.14
Min Value	10.52	48.5	4.74	6.05	10.22	0.118
Median	13.50	60.2	6.40	6.60	20.16	0.13
Average	13.50	60.2	6.40	6.60	20.16	0.13
# Sample (n)	3	3	3	3	3	3
Threshold Value			>5.0	6.0 to 9.0		

Table 94. 2013 Lab Data Statistics SRM01							
Statistic	**E.coli (MPN/ 100 mL)**	**Ammonia (mg/L)**	**N Kjeldahl (mg/L)**	**Nitrate + Nitrite (mg/L)**	**Nitrogen Total (mg/L)**	**Phosphorus Total (mg/L)**	**Sulfate (mg/L)**
Max Value	98.7	0.075	0.44	0.22	0.55	0.051	3.1
Min Value	30	0.068	0.19	0.12	0.42	0.026	3.1
Median	64	0.072	0.32	0.17	0.49	0.039	3.1
Average	64	0.072	0.32	0.17	0.49	0.039	3.1
# Sample	2	2	2	2	2	2	1
# Detections	3	3	3	3	3	3	1
Threshold Value	235 (STU) or 126 (GM)				0.38	0.010	10

No particular parameters of notable concern; all values are within a reasonable range.

No pH or E.coli values exceeded the established threshold criteria during the visits in 2013. Based on Wisconsin Water Quality Standards, there was (1) dissolved oxygen value below the reference criteria. Based on EPA criteria recommendations, there were (2) Total Nitrogen and (2) Total Phosphorus values above the reference criteria.

2014 - Results

Station SRM01 was visited at the months for field statistics on July through October. Nutrient samples were taken in the months of August through October. E.coli samples were taken in the months of July through October. TSS samples were taken in the months of July through October of 2014 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 95 and 96 provide statistics per field and water chemistry parameters.

Photo 86. Facing north, downstream, September.

Photo 87. Facing west, upstream, September.

Table 95. 2014 Field Data Statistics SRM01

Statistic	Temp °c	DO %	DO (mg/L)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Max Value	23.29	9.57	8.6	0	7.9	111.8
Min Value	9.43	3.6	6.22	0	5	38.2
Median	17.71	6.74	7.535	0	6.45	65.05
Average	17.03	6.6625	7.47	0	6.45	70.025
#Samples (n)	4	4	4	0	2	4
#Detections	0	0	0	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 96. 2014 Lab Data Statistics for SRM01							
Statistic	**Ammonia as N (unfiltered) (mg/L)**	**NO_2 + NO_3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**E.coli (100 MPN)**	**TSS**
Max Value	0.048	0.35	0.22	0.55	0.036	58.3	6.1
Min Value	0.034	0.18	0.20	0.38	0.026	9.7	3.5
Median	0.041	0.18	0.20	0.41	0.027	22.9	4.6
Average	0.041	0.24	0.21	0.45	0.030	28.45	4.7
# Sample	3	3	3	3	3	4	4
# Detections	0	1	0	2	3	0	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L	235(STV) or 126 (GM)	

Parameters of notable concern include:

- Nitrate + Nitrite ranging from 0.18-0.35 mg/L
- Total Nitrogen ranging from 0.38-0.55 mg/L
- Total Phosphorus ranging from 0.026-0.036 mg/L

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.20-0.22 mg/L
- E.coli ranging from 9.7-58.3 235 CFU or 126 GM
- Dissolved Oxygen ranging from 6.22-8.6 mg/L

No E.coli values exceeded the established threshold criteria during the visits in 2014. The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was not exceeded for E.coli. Based on Wisconsin Water Quality Standards, there were zero (0) Dissolved oxygen values above the reference criteria. Based on the EPA criteria recommendations, there was zero (0) Kjeldahl nitrogen, one (1) Nitrites + Nitrates, (NO_2+NO_3), two (2) Total Nitrogen, three (3) Total Phosphorus values that were above the reference criteria.

Due to staff turnover in 2014 certain data were unable to be taken or lost. Some months during this field season for field data may not available for this reason. All field readings may be limited or not in range, due to calibration issues with the YSI probe.

2015 - Results

Station SRM01 was visited at the month for field statistics in August. Nutrient samples were taken in the months of July through October. E.coli samples were taken in the months of July through November. TSS samples were taken in the months of July through November of 2015 to conduct baseline water quality monitoring. Core measurements were completed and water samples were collected and analyzed for chemical parameters. Tables 97 and 98 provide statistics per field and water chemistry parameters.

Photo 88. Facing south, upstream, September.

Photo 89. Facing south, upstream,August.

Table 97. 2015 Field Data Statistics SRM01						
Statistic	**Temp °c**	**DO %**	**DO (mg/L)**	**pH**	**Turbidity (NTU)**	**Conductivity (uS/cm)**
Max Value	19.77	-99.9	-9.85	0	7.19	141
Min Value	19.77	-99.9	-9.85	0	7.19	141
Median	19.77	-99.9	-9.85	0	7.19	141
Average	19.77	-99.90	-9.85	0	7.19	141
Samples (n)	1	1	1	0	1	1
Detections	0	0	1	0	0	0
Threshold Value			>5.0 mg/L	6.0 to 9.0		

Table 98. 2015 Lab Data Statistics SRM01								
Statistic	**Nitrogen, ammonia as N (unfiltered) (mg/L)**	**Nitrogen, NO2 + NO3 as N (unfiltered) (mg/L)**	**Nitrogen, Kjeldahl as N (unfiltered) (mg/L)**	**Nitrogen, tot. as N (unfiltered) (mg/L)**	**Phosphorus, tot. as P (mg/L)**	**Sulfate, as SO4 (Unfiltered)**	**E.coli (MPN/100 mL)**	**TSS (mg/L)**
Max Value	0.130	0.41	0.29	0.53	0.027	0	248.1	6.8
Min Value	0.027	0.25	0.12	0.44	0.007	0	2	1.70
Median	0.0385	0.35	0.21	0.5	0.017	0	43.5	3.80
Average	0.059	0.34	0.21	0.49	0.017	0	97.867	3.90
Samples	4	4	4	4	4	0	5	5
Detections	0	4	0	4	1	0	1	0
Threshold Value		0.2 mg/L	0.1-20 mg/L	0.38 mg/L	0.010 mg/L		235(STV) or 126 (GM)	

Parameters of notable concern include:

- Dissolved Oxygen -9.85 mg/L
- Nitrite +Nitrate ranging from 0.25-0.41 mg/L
- Total Nitrogen ranging from 0.44-0.53 mg/L
- Total Phosphorus ranging from 0.007-0.027 mg/L
- E.coli ranging from 2-248.1 MPN/100mL

Parameters of no concern include:

- Kjeldahl Nitrogen ranging from 0.12-0.29 mg/L

The threshold values for E.coli have been established at 235 cfu/100mL single sample maximum and 126 cfu/100mL as a geometric mean of at least 5 samples collected over a 30 day period. The single sample maximum was exceeded for E.coli on July 29th (248.1) however there was not enough data to determine the geometric mean over a 30-day period. Based on the Bad River Water Quality Standards there was 1 (one) Dissolved Oxygen value above the reference criteria (NOTE: Only 1 probe reading for Dissolved Oxygen). Based on the EPA reference criteria for Ecoregion VIII sublevel ecoregion 58, there were 4 (four) Nitrite + Nitrate, 4 (four) Total Nitrogen and 1 (one) Total Phosphorus values above the reference criteria.

Reccomendation: calibration of the multi-use probe for DO and pH.

Macroinvertebrate Monitoring

Table 99. Macroinvertebrate HBI scoring from 2009 – 2015.

Site	2009	2010	2011	2012	2013	2014	2015
CC02	Good 4.96			Very poor 9.48			Poor 8.23
CC03							Very good 4
CCM01				Fair 6.28		Fairly poor 6.86	
FC01							Fairly poor *only 106 vs. required 125 samples 6.56
FCM01						Fairly poor 7.21	
RR01	Good 5.15				Fair 6.30	Very good 4.21	
RR03					Very good 4.02	Poor 7.96	
RRM01							Fair 6.34
RCC01				Fair 5.79		Very good 4.45	
RCC03	Very good 4.00			Good 5.15		Good 4.90	
RCCM01							Fair 6.41
SC01							
SCM01						NA	
SR02	Excellent 3.34				Fair 5.77	Good 4.62	
SRM01							Fair 5.92

HBI	Water Quality	Degree of organic pollution
0.00-3.50	Excellent	None
3.51-4.50	Very Good	Slight
4.51-5.50	Good	Some
5.51-6.50	Fair	Fairly significant
6.51-7.50	Fairly Poor	Significant
7.51-8.50	Poor	Very significant
8.51-10.00	Very Poor	Severe

Chicago Creek:

Biotic index scores, shown in Appendix B, indicate that the stream's ecological status has slightly worsened. The Highway 13 (CC02) sample site went from "good" in 2009 to "very poor" in 2012, to "poor" in 2015, and the mouth (CCM01) sample site went from "fair" in 2012 to "fairly poor" in 2014. Samples were taken at the Blueberry Road (CC03) site for the first time in 2015 and it received a biotic index score of "very good."

Frog Creek:

Biotic index scores can be found in Appendix B. The FC01 site was sampled for aquatic macroinvertebrates in 2015 and was assigned a biotic index score of "fairly poor" due to their only being 106 versus the required 125 samples. The mouth sample site (FCM01) was sampled in 2014 and was designated "fairly poor."

Raspberry River:

Biotic index scores, shown in Appendix B, indicate that the stream's ecological status has varied. The Raspberry Campground boat ramp (RR01) sample site went from "good" in 2009 to "fair" in 2013 and up to "very good" in 2014.The Rowley Road (RR03) sample site went from "very good" in 2013 to "poor" in 2014. Aquatic macroinvertebrate samples were taken for the first time at the mouth (RRM01) site in 2015 and it was assigned a biotic index score of "fair."

Red Cliff Creek:

Biotic index scores, shown in Appendix B, indicate that the stream's ecological status has slightly improved. The Highway 13 (RCC01) sample site went from "fair" in 2012 to "good" in 2014 and the Blueberry Road (RCC03) sample site went from "good" in 2012 to "very good" in 2014. Aquatic

macroinvertebrate samples were taken at the mouth (RCCM01) site for the first time in 2015 and it received a biotic index rating of "fair."

Sand River:

Biotic index scores, shown in Appendix B, indicate that the stream's ecological status has varied over the past three years, but remains relatively good. Scores at the Highway 13 site (SR02) have ranged from "excellent" in 2009, to "fair" in 2013, and back to "good" in 2014. The mouth sample site (SRM01) was sampled for macroinvertebrates for the first time in 2015 and it received a biotic index score of "fair."

Sucker Creek:

Biotic index scores, shown in Appendix B, indicate that the stream's ecological status is very poor. The Old County K site (SC01) has never been sampled for aquatic macroinvertebrates due to its intermittency. The only sample ever taken at the mouth site (SCM01) occurred in 2014 and there weren't enough macroinvertebrates present to assign a score, thus yielding a score of "NA."

Water Quality Concerns

Overall, the water quality of the Red Cliff Reservation is high. Some areas of the Reservation are negatively impacted by excess sediment, nutrients, and human or animal waste as indicated by E.coli concentrations. The sources of these impacts are considered to be land uses such as outdated septic systems, outhouses, small amounts of agriculture, logging practices and possibly aquaculture discharges. This rural area is largely forested and the soils are highly susceptible to erosion. Due to the highly erodible soils, sedimentation is a major concern across the region. Some NPS inputs are likely the result of upstream land use management in forestry and roads.

Lake Superior:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that boat ramp/beach site is impacted by NPS pollution. Turbidity and phosphorus levels continue to decline at the site, with temperatures remaining consistent. Nitrogen levels are persistent at the site, likely due to the manicured lawn just uphill. Dissolved oxygen remains consistently low, which can be attributed to the marina break wall that reduces water flow and aeration through the marina. Although Canada Geese can generally be found on the casino grounds and beach area, E.coli levels have not exceeded criteria at this site since 2013.

Chicago Creek:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Chicago Creek is impacted by NPS pollution, and the creek's water quality has slightly declined over the past three years. The stream's temperature appears to be generally increasing, and as expected the dissolved oxygen levels are slowly declining. Phosphorus and turbidity levels appear to be improving, while nitrogen levels have experienced a slight increase at the Highway 13 (CC02) and stream mouth (CCM01) sample sites. Nitrogen sources may be linked to historic land use in the headwaters area and septic systems located near the stream south of Highway 13. E.coli levels in the stream are persistent and regularly exceed the threshold (235 CFU) at the mouth (CCM01) sample site. Land uses in the area indicate that the source of E.coli may also be linked to older septic systems and outhouses.

Frog Creek:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Frog Creek is impacted by NPS pollution, and the creek's water quality has slightly declined over the past three years. The mouth of Frog Creek is regularly closed off by a sand bar. This common blockage of flow appears to be influencing the stream's water quality near the mouth (FCM01) by trapping nutrients such as nitrogen and phosphorus. This elevated level of nutrients has in turn led to increased plant growth, which can cause eutrophication. This increased plant growth also causes anaerobic decay when the plants die, which has led to decreases in the stream's dissolved oxygen. Higher temperatures and lower flow rates due to the stream blockage have also likely influenced the stream's dissolved oxygen.

Raspberry River:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Raspberry River's water quality has slightly worsened over the past three years. While it appears that nitrogen and phosphorus levels are improving, this is probably due to outliers in the 2013 sampling season, which likely resulted from a storm event. Without considering these outliers, nitrogen and phosphorus levels have remained relatively the same. E.coli levels have also remained seemingly constant, with two exceedances of criteria in the 2015 sampling season occurring at the Raspberry Campground boat ramp site (RR01). Temperatures are on the incline, while corresponding dissolved oxygen levels are declining. This is most likely due to beaver dam impoundments that have decreased stream velocity. Turbidity results are decreasing, which may also be due to beaver dam impoundments that are trapping sediment upstream.

Red Cliff Creek:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Red Cliff Creek's water quality has remained relatively the same over the last three years. E.coli, temperature, turbidity, and phosphorus levels all appear to be constant in the stream. Dissolved oxygen remains stable at the mouth site (RCCM01) and is increasing at the Highway 13 site (RCC01), while it is slightly declining at the Blueberry Road site (RCC03). The apparent decline in dissolved oxygen at the Blueberry Road site is likely due to upstream beaver dams and stream blockage that slows the stream's velocity and causes a slight increase in temperature. Nitrogen levels appear to show a slight downward trend at the Blueberry Road and Highway 13 sites, however nitrogen appears to be increasing at the mouth, which is potentially related to septic systems and possibly the Tribe's old wastewater retention pond.

Sand River:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Sand River is somewhat impacted by NPS pollution, but the stream's water quality remains relatively stable. While E.coli is continually present in the stream, only one exceedance of criteria occurred in the past three years. Turbidity levels remain approximately the same at the mouth site (SRM01) and appear to be declining at the Highway 13 site (SR02), which is potentially due to upstream blockages in the channel. Phosphorus and nitrogen levels are also declining at the Highway 13 site, which is also likely due to upstream blockages. Nitrogen and phosphorus levels appear to be remaining relatively constant at the mouth site; these inputs are likely due to logging activities occurring in the watershed. Temperatures at both sites have remained stable and dissolved oxygen appears to be improving at the Highway 13 site. Dissolved oxygen is continuously low at the mouth site, which can be correlated to the estuary complex that holds a high amount of aquatic plants that are cycling through growth and anaerobic decay.

Sucker Creek:

Review of the Water Resource Program's water quality data from 2013-2015 (see Appendix A) indicates that Sucker Creek is impacted by NPS pollution and the stream's water quality is continuing to degrade. This is an intermittent stream and the channel is often dry at the Old County K sample site (SC01), thus samples are not able to be taken as regularly as they are on other streams. Although turbidity appears to be stable or declining at both sample sites, nitrogen and phosphorus levels are persistent at the mouth site (SCM01) and are increasing at the Old County K sample site. E. coli levels did not breach criteria in the 2015 sample season, but also appear to be persistent in the stream. Temperatures are increasing at both sites, with dissolved oxygen remaining consistently low at both sites and often breaching criteria- although dissolved oxygen was not measured at the Old County K site during the 2015 sampling season.

Data collection of hydrological, biological, chemical parameters through the Water Resources Program has enabled the Tribe to create a baseline of data to aid in creating an assessment of its water quality. Data collection has indicated non-point sources may negatively impact water resources. Continued baseline monitoring is needed to assist the Tribe in future management decisions and to assess water quality trends as NPS BMPs are implemented. More in depth discussion of NPS issues and comprehensive review of all existing data can be found in the tribe's NPS Assessment Report.

References

Bayfield County MapViewer, http://www.bayfieldcounty.org, 2016.

Red Cliff Band of Lake Superior Chippewa, Integrated Resource Management Plan, 2006-2016.

Red Cliff Band of Lake Superior Chippewa, Macroinvertebrate Monitoring Quality Assurance Project Plan, 2016.

Red Cliff Band of Lake Superior Chippewa, Surface Water Quality Assurance Project Plan, 2016.

USGS Topographic Maps, https://www.usgs.gov/products/maps/topo-maps, 2016.

Wisconsin Department of Natural Resources, Lake Superior Basin Plan, Bayfield Peninsula Southeast Watershed (LS07). http://www.dnr.state.wi.us/org/gmu/superior/BasinPlan/ws07.html.

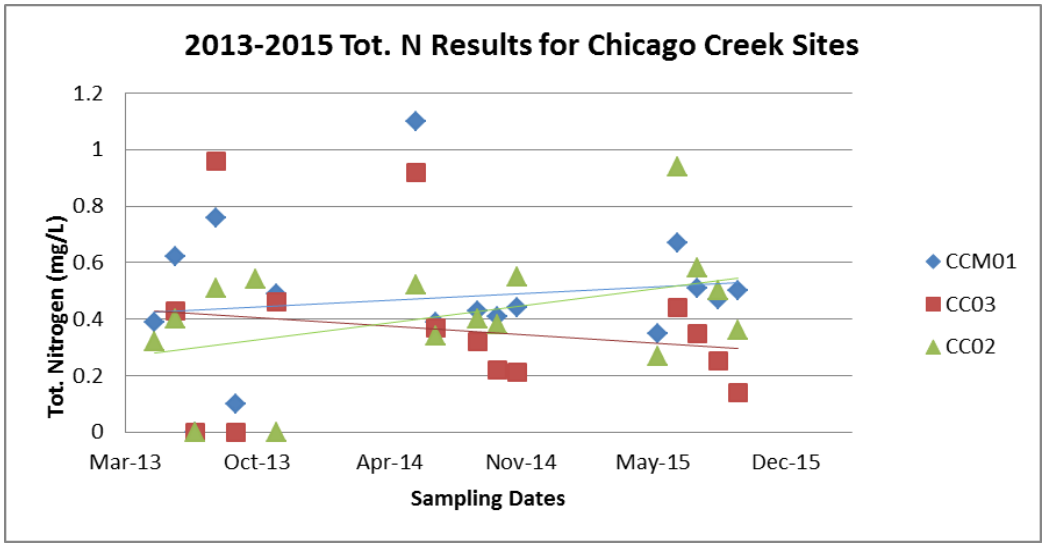
Wisconsin Department of Natural Resources, Surface Water Data Viewer. http://dnrmaps.wi.gov/SL/Viewer.html?Viewer=SWDV&runWorkflow=Wetland

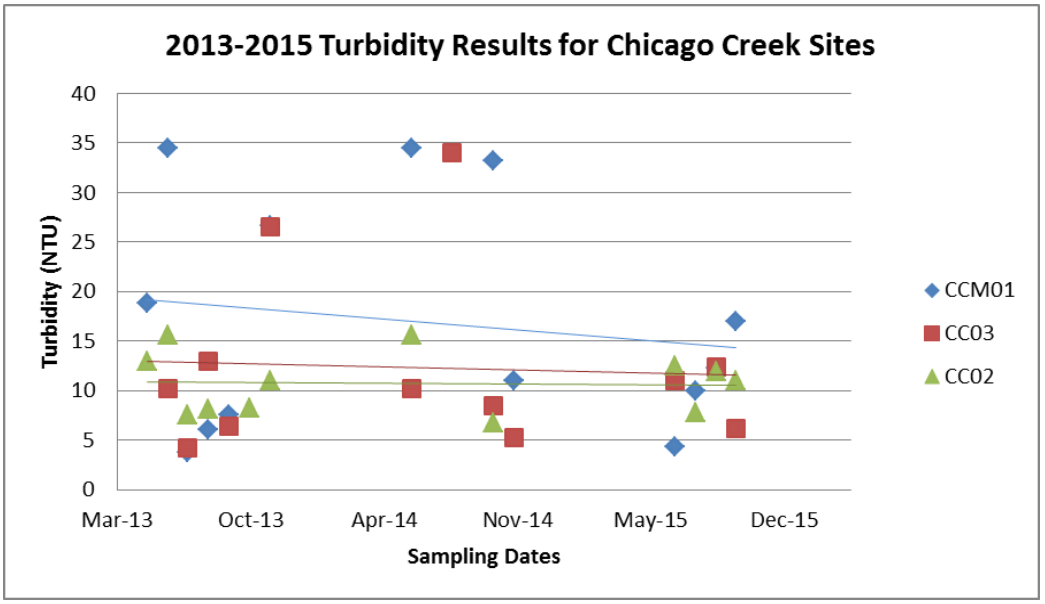
Appendices

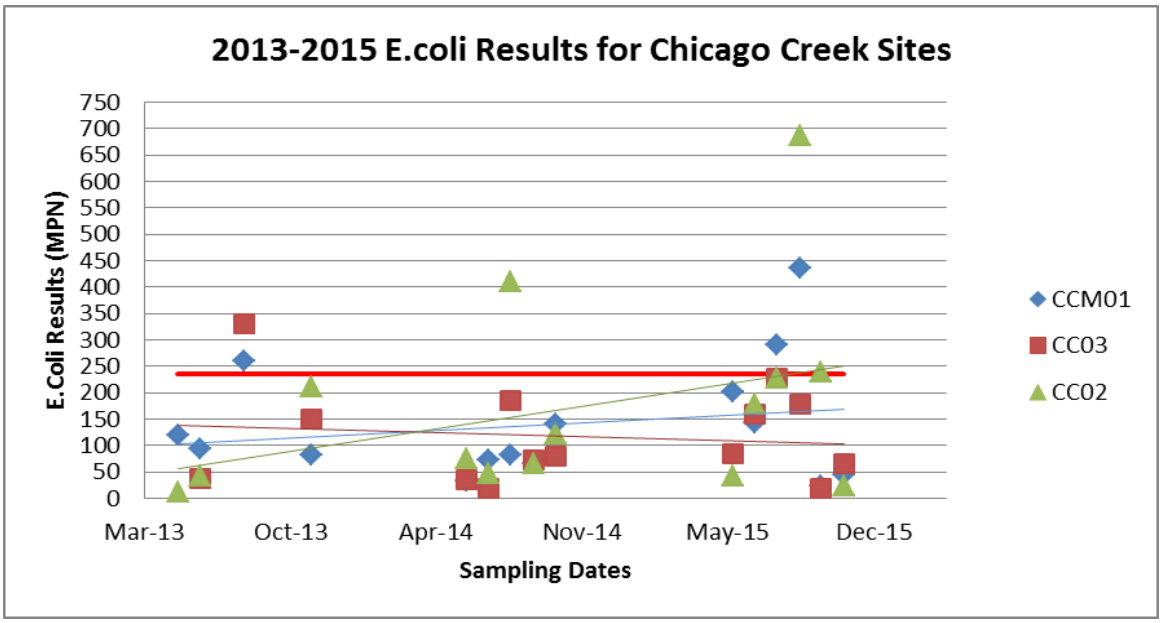
Appendix A-

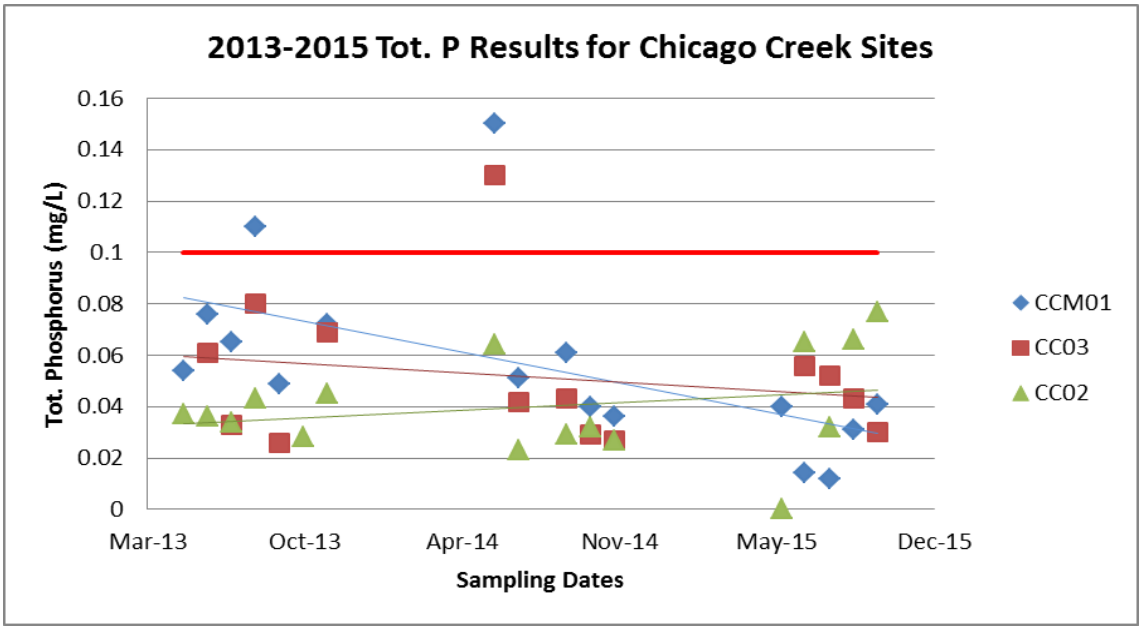
Red Cliff Water Resource Program's CWA 106 Water Quality Monitoring Data Graphs

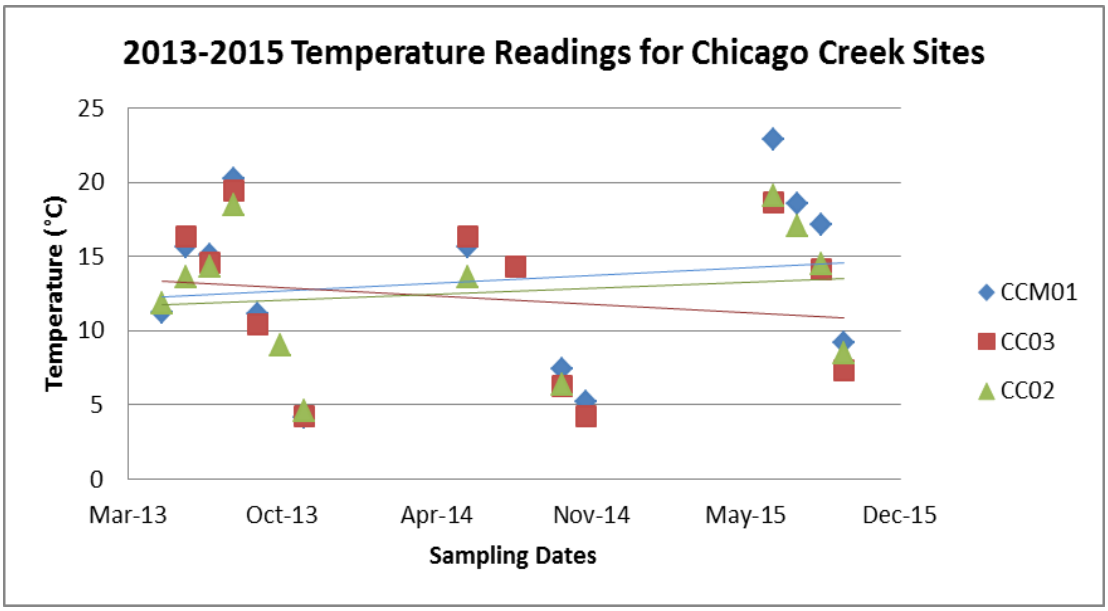
Chicago Creek Results

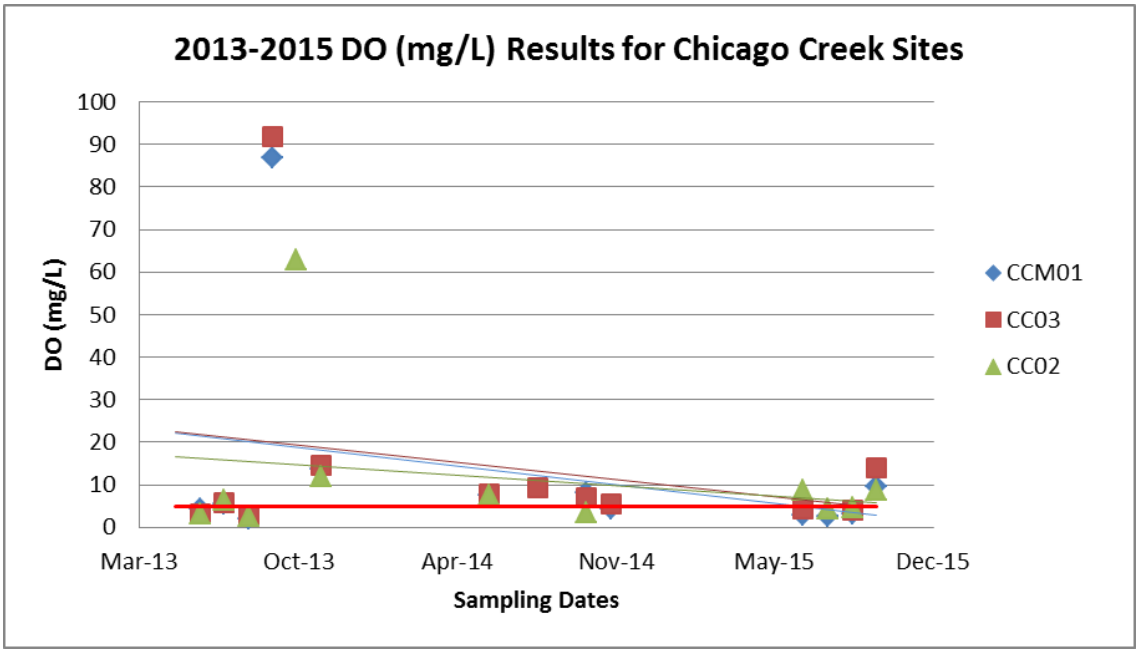




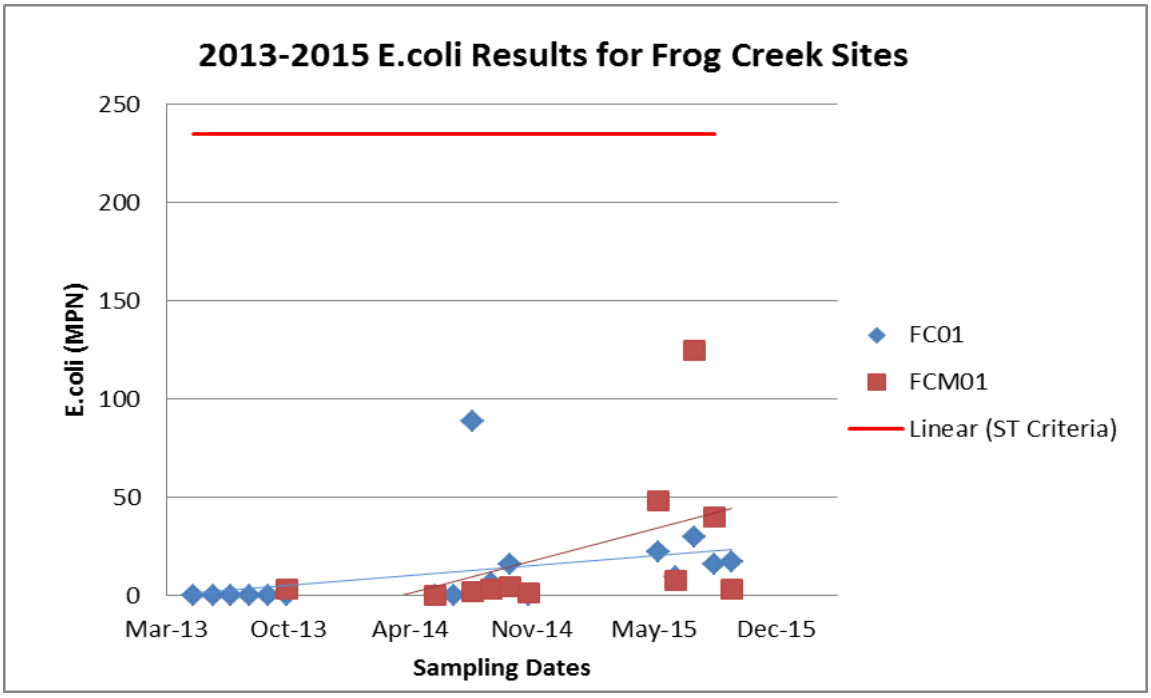

2013-2015 E.coli Results for Chicago Creek Sites
E.Coli Results (MPN)
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
CCM01
CC03
CC02

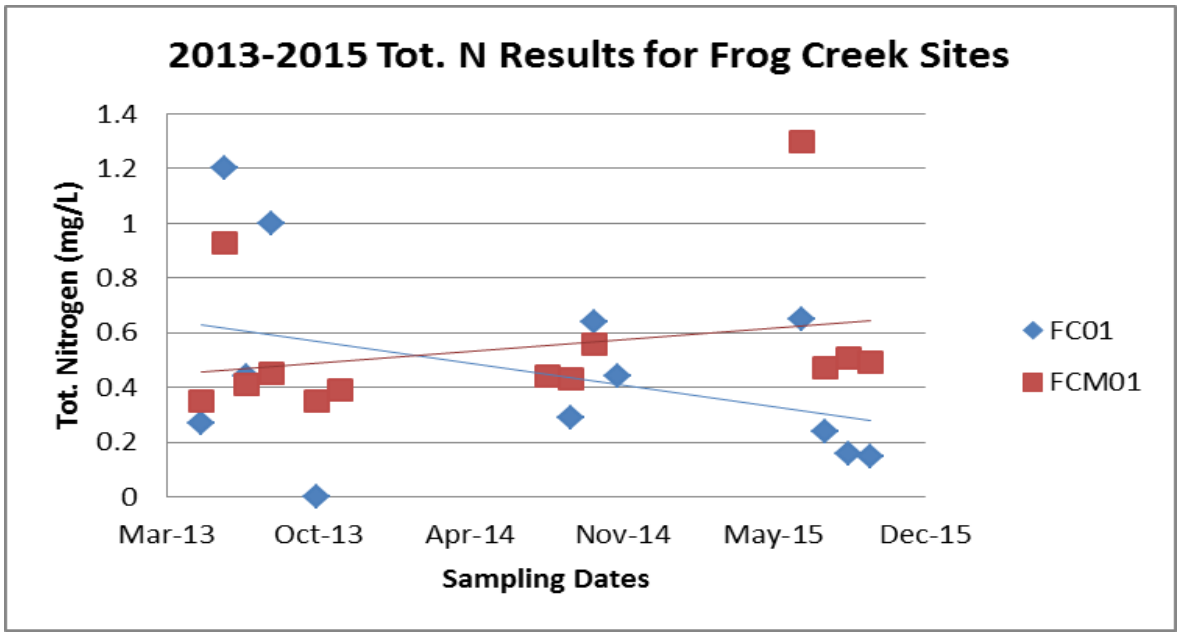

2013-2015 Tot. P Results for Chicago Creek Sites
Tot. Phosphorus (mg/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
CCM01
CC03
CC02

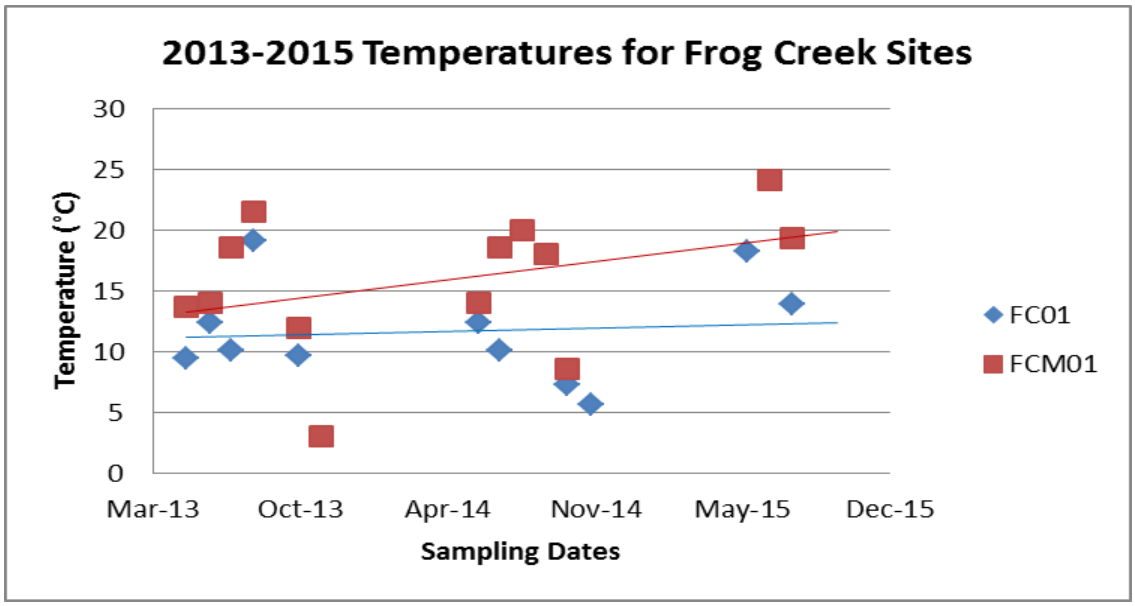

2013-2015 Temperature Readings for Chicago Creek Sites
Temperature (°C)
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
CCM01
CC03
CC02

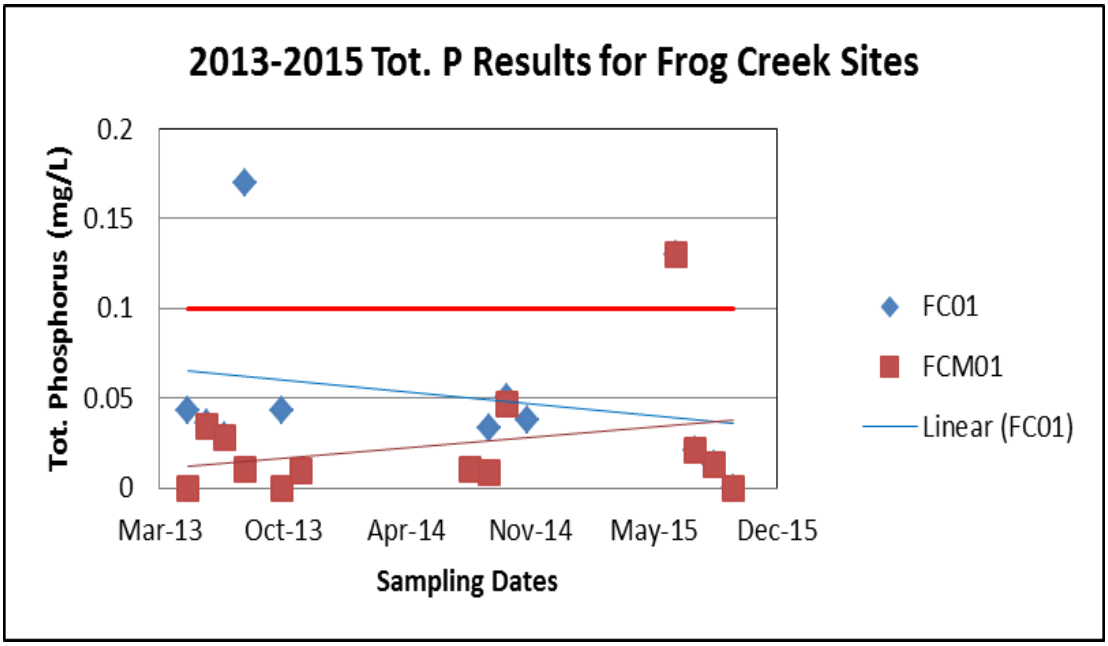

2013-2015 DO (mg/L) Results for Chicago Creek Sites
DO (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
CCM01
CC03
CC02

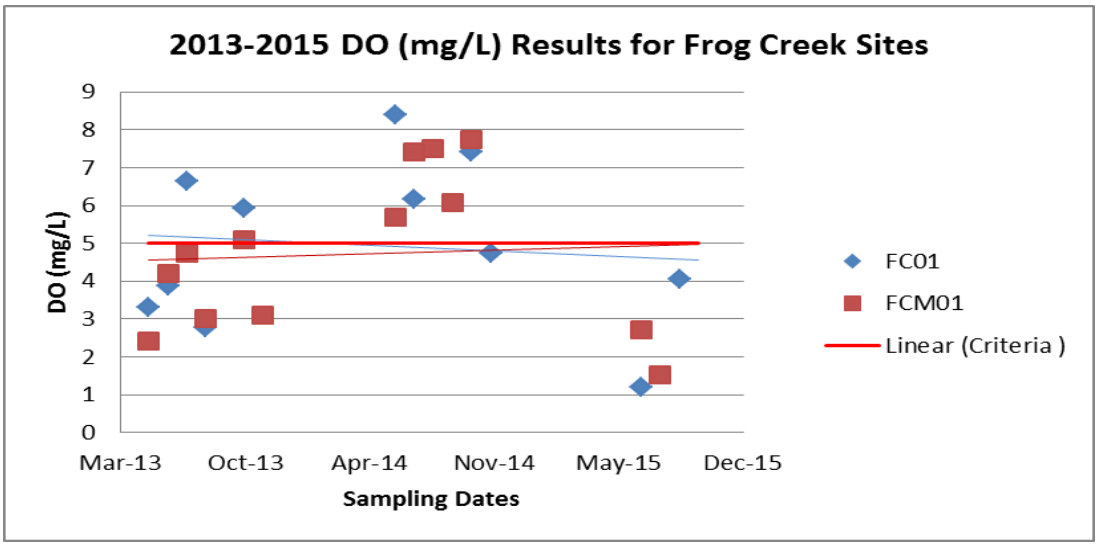
Frog Creek Results

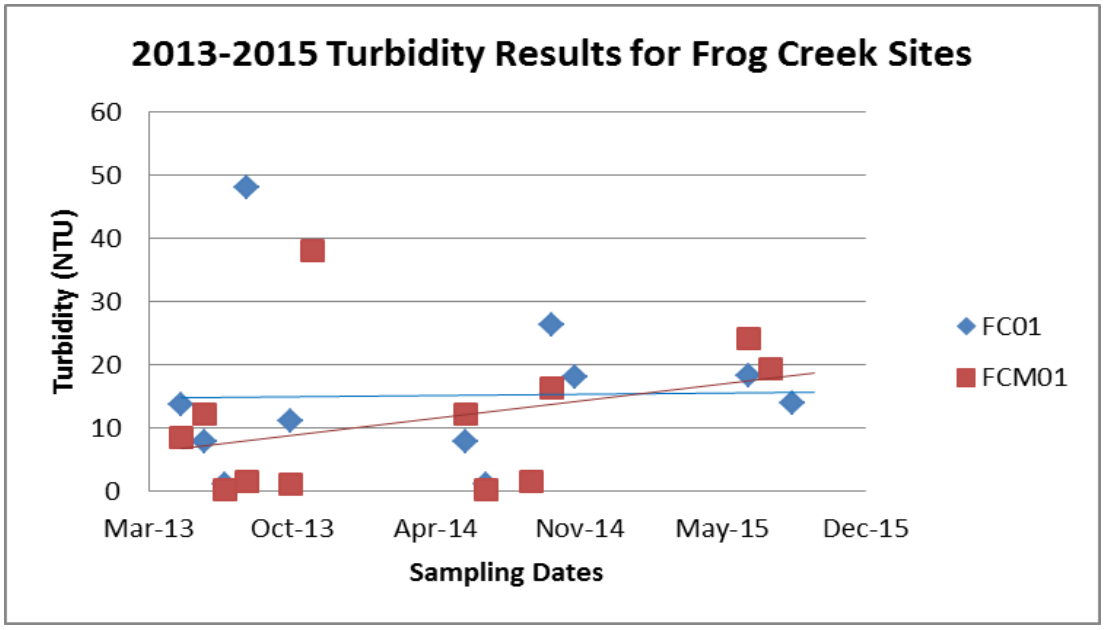




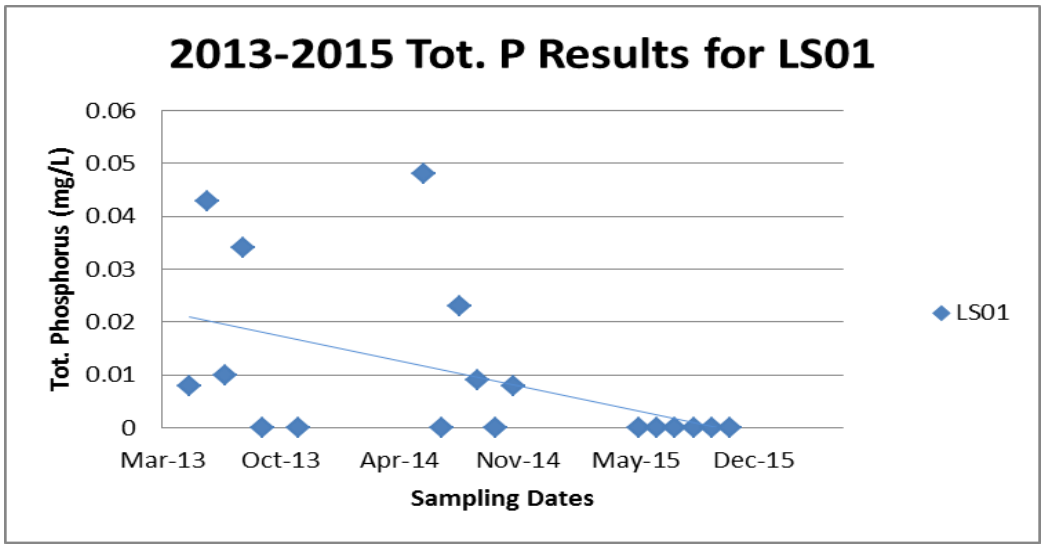

2013-2015 Temperatures for Frog Creek Sites
Temperature (°C)
30
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
FC01
FCM01

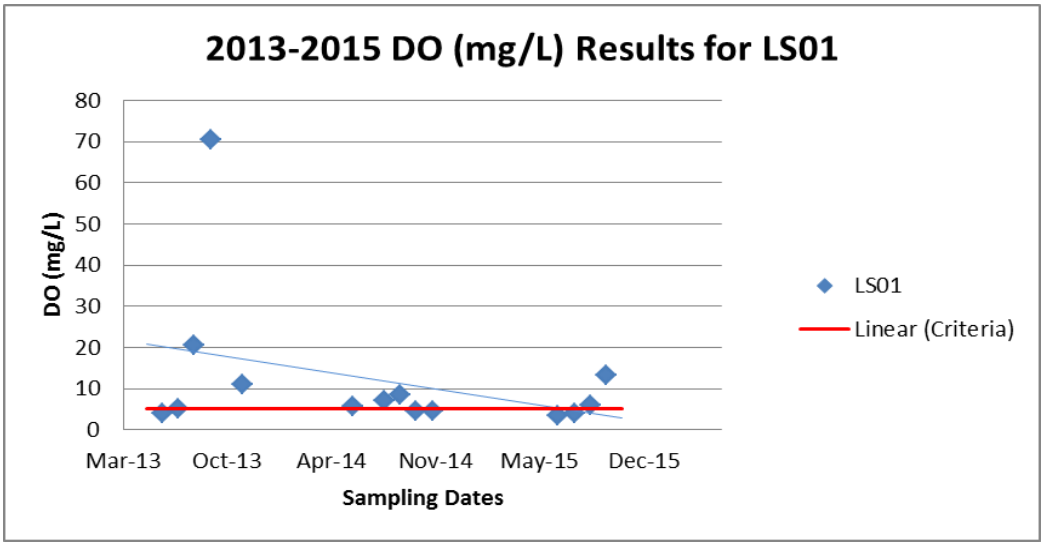

2013-2015 Tot. P Results for Frog Creek Sites
Tot. Phosphorus (mg/L)
0.2
0.15
0.1
0.05
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
FC01
FCM01
Linear (FC01)

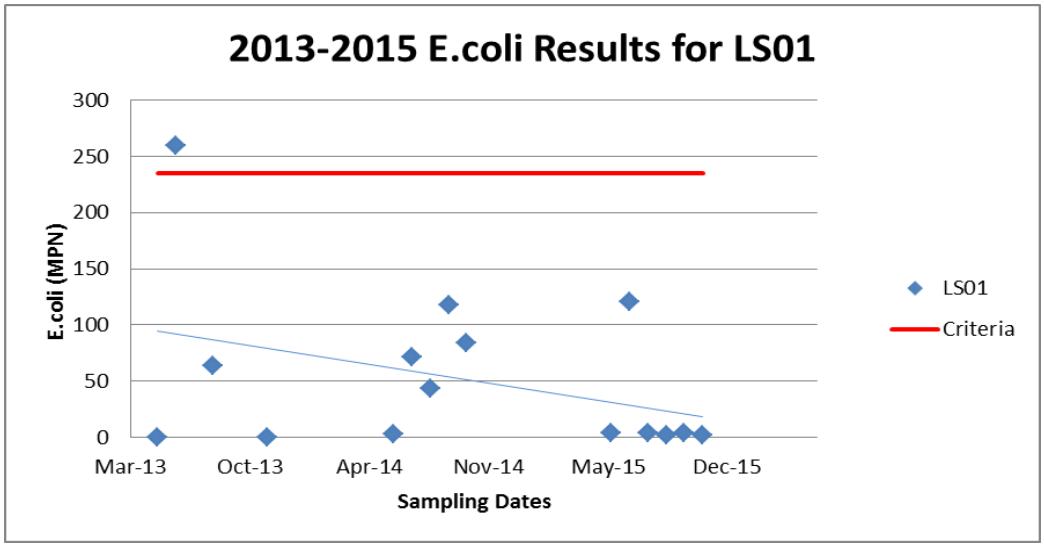

2013-2015 DO (mg/L) Results for Frog Creek Sites
DO (mg/L)
9
8
7
6
5
4
3
2
1
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
FC01
FCM01
Linear (Criteria)

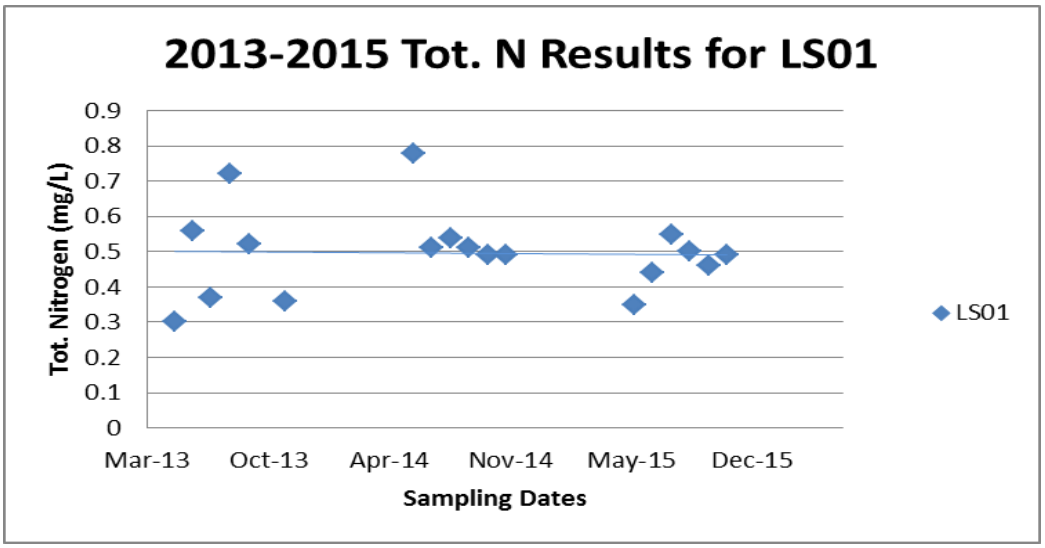

2013-2015 Turbidity Results for Frog Creek Sites
Turbidity (NTU)
60
50
40
30
20
10
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
FC01
FCM01

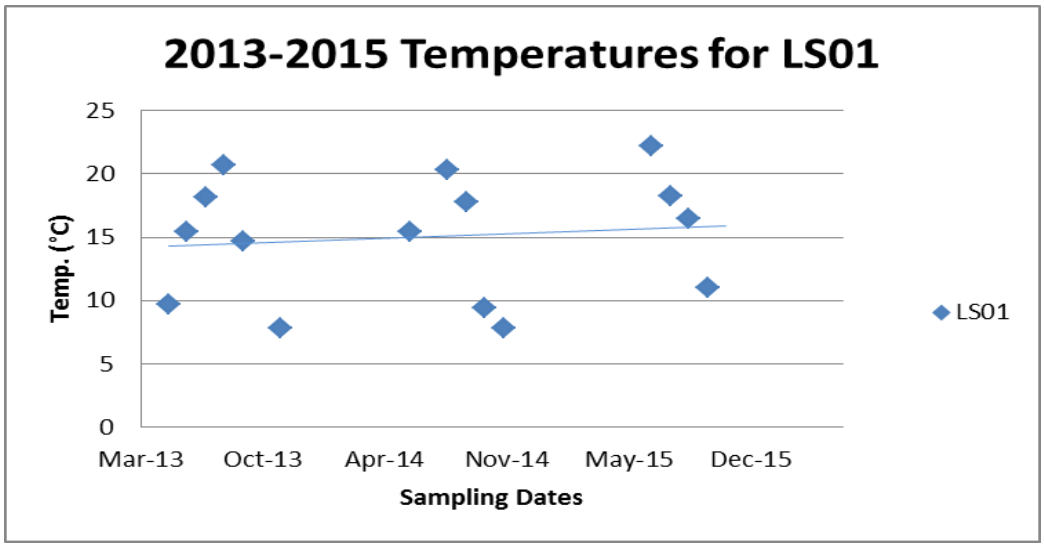
Lake Superior Results

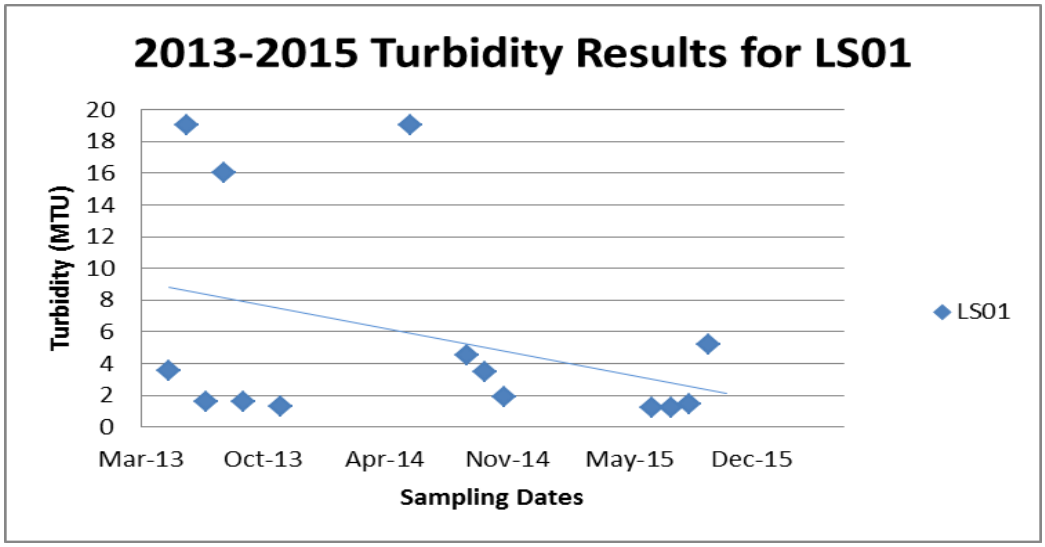




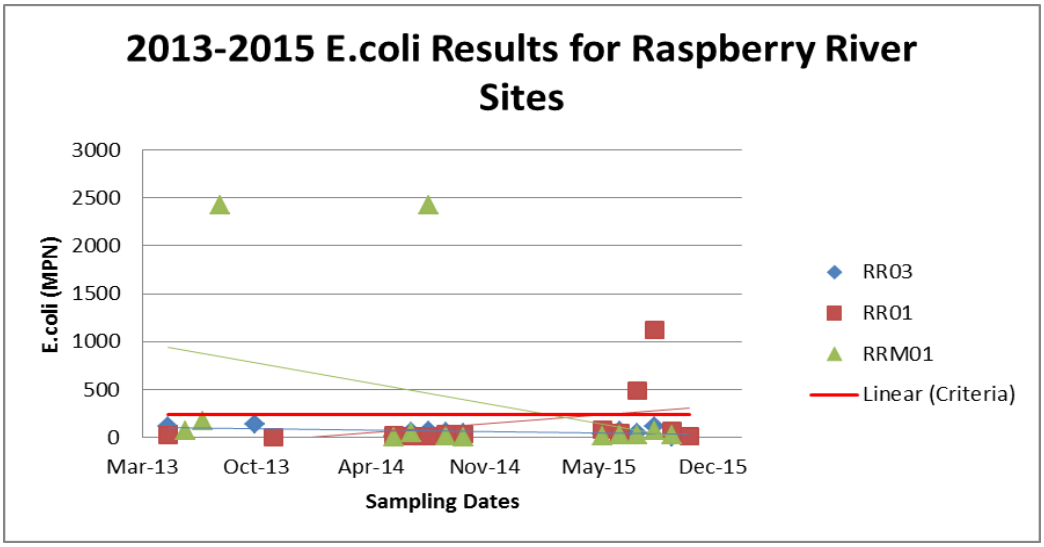

2013-2015 E.coli Results for LS01
300
250
200
150
100
50
0
E.coli (MPN)
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
LS01
Criteria

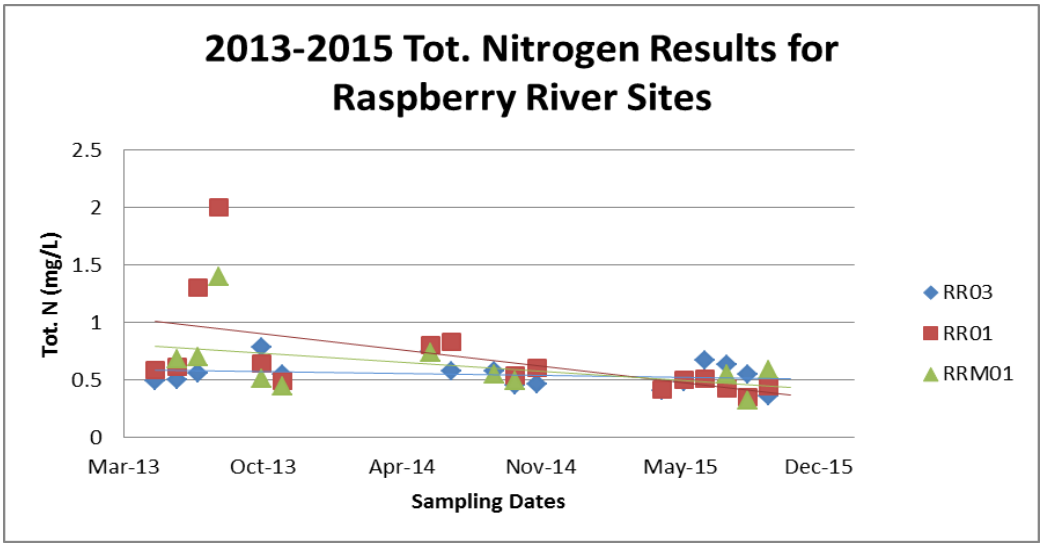

2013-2015 Tot. N Results for LS01
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Tot. Nitrogen (mg/L)
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
LS01

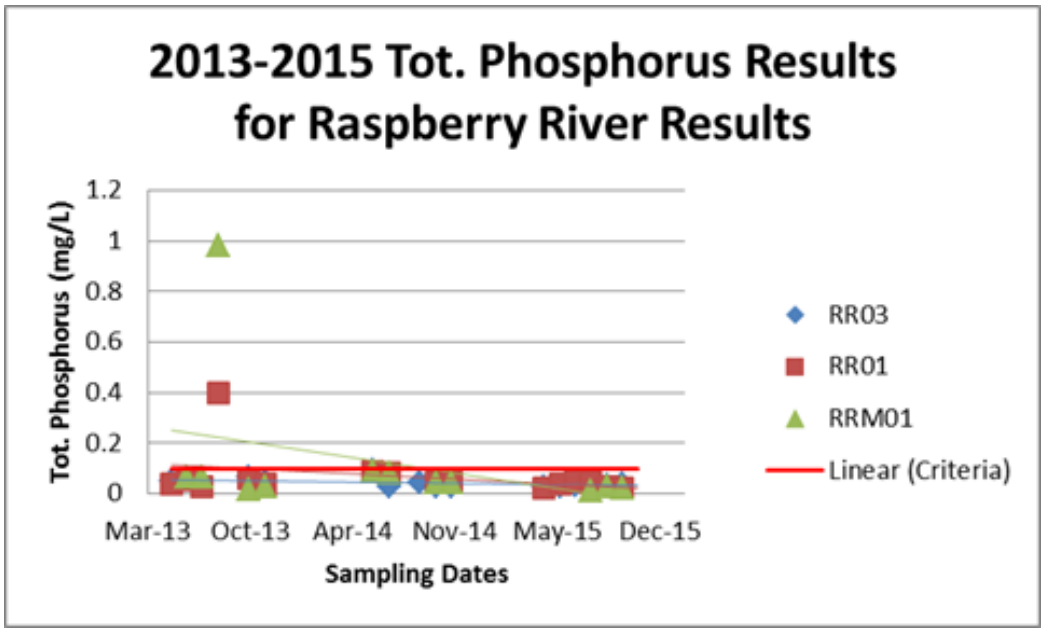

2013-2015 Temperatures for LS01
25
20
15
10
5
0
Temp. (°C)
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
LS01



Raspberry River Results






2013-2015 Tot. Phosphorus Results for Raspberry River Results
Tot. Phosphorus (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
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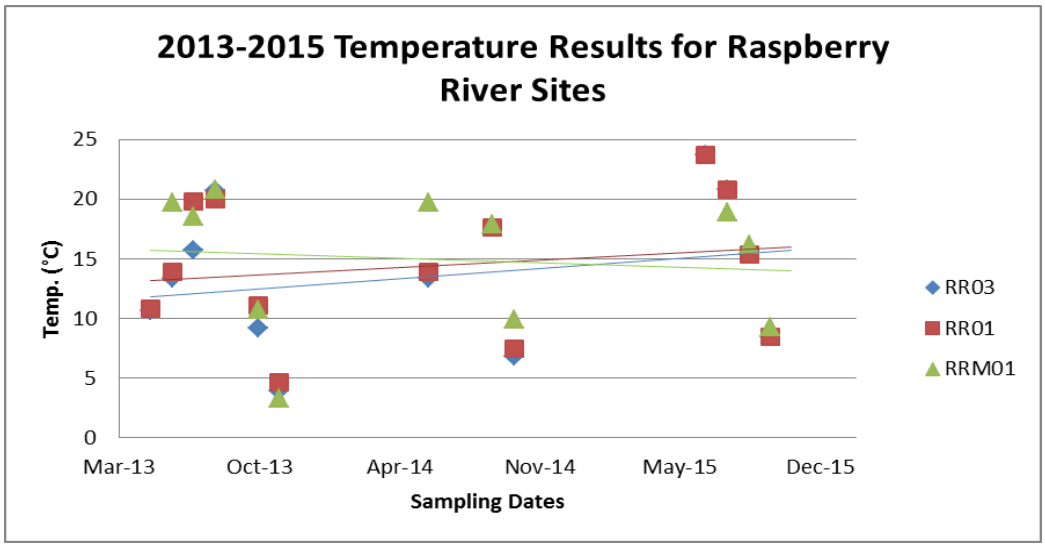
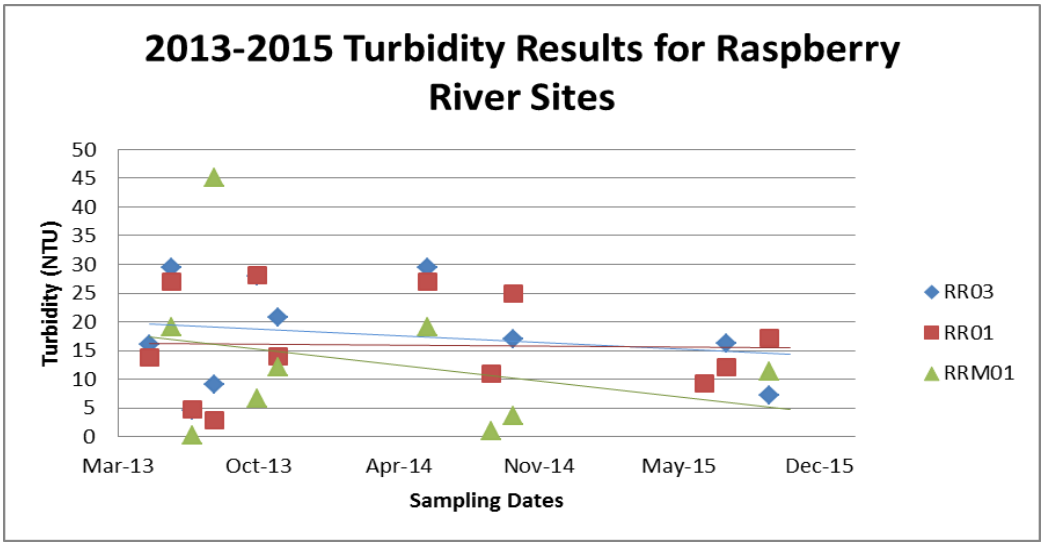
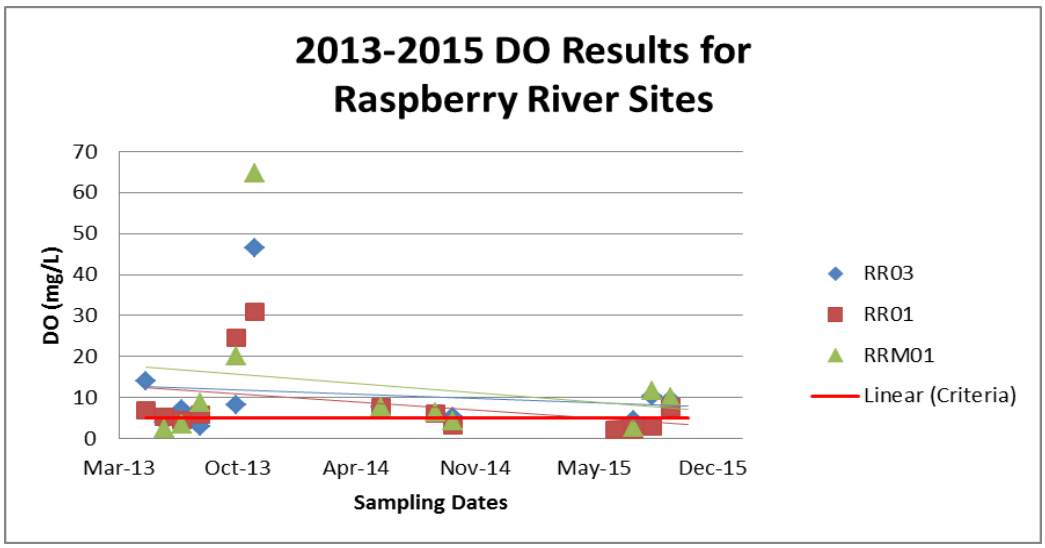
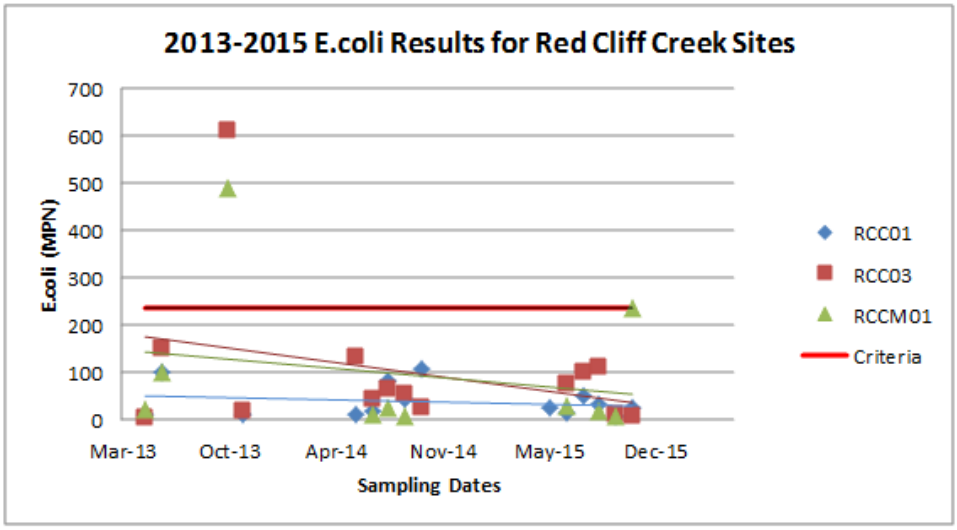
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RR03
RR01
RRM01
Linear (Criteria)

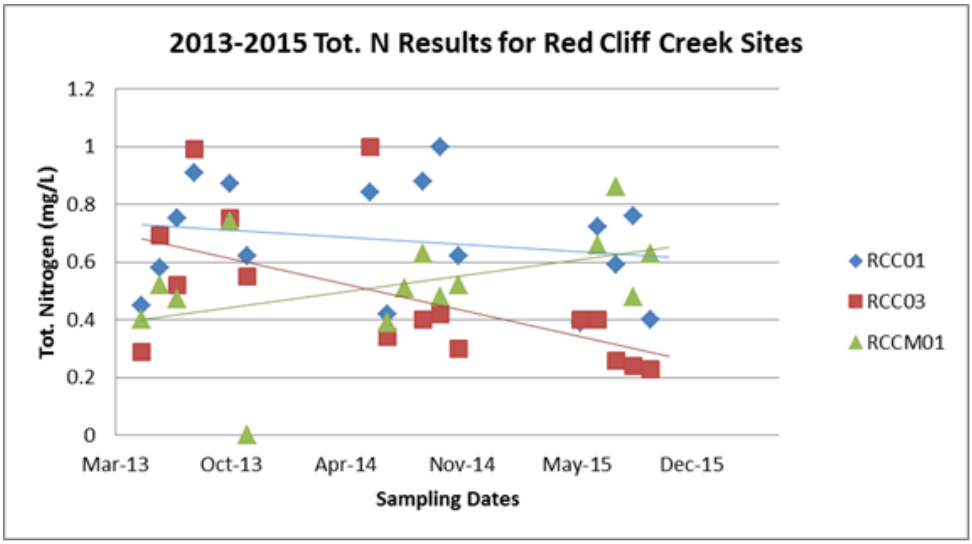

2013-2015 Temperature Results for Raspberry River Sites
Temp. (°C)
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RR03
RR01
RRM01

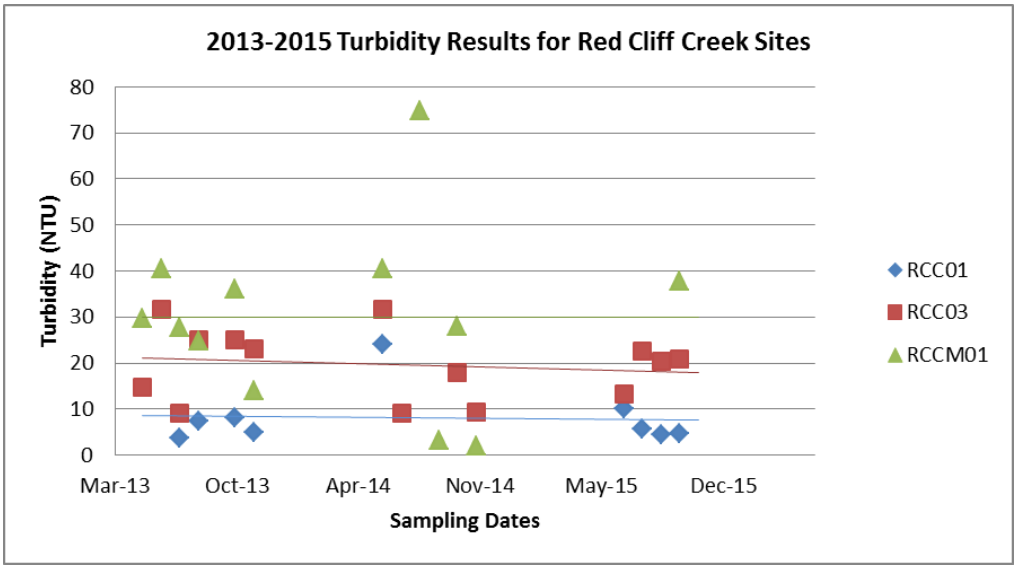

2013-2015 Turbidity Results for Raspberry River Sites
Turbidity (NTU)
50
45
40
35
30
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RR03
RR01
RRM01

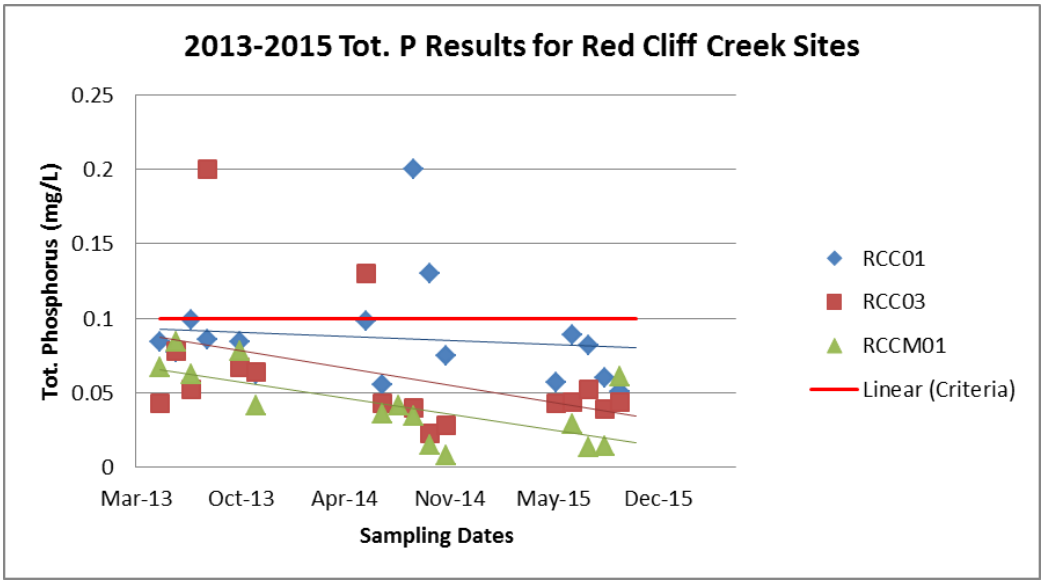


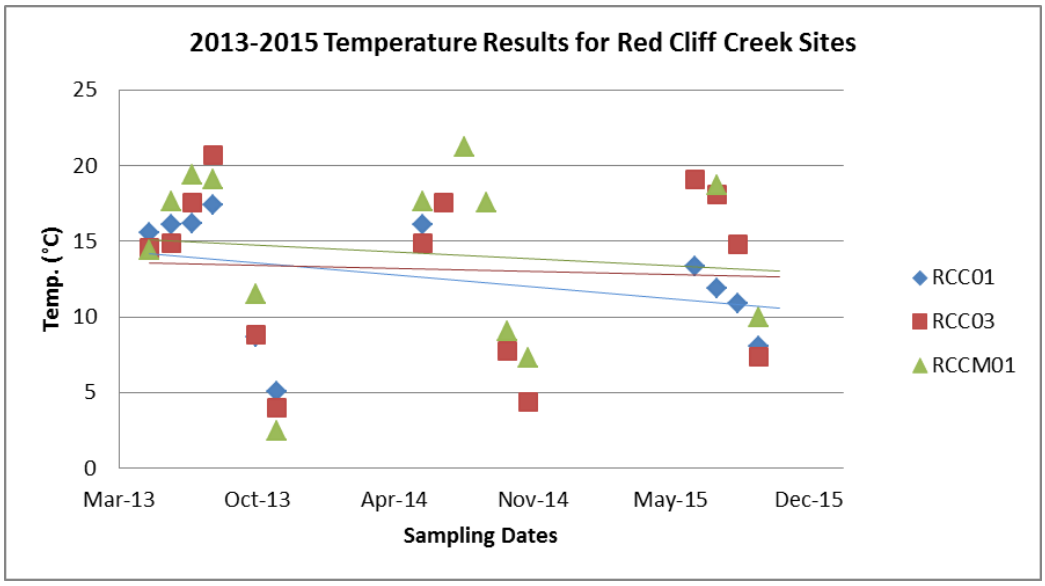
Red Cliff Creek Results

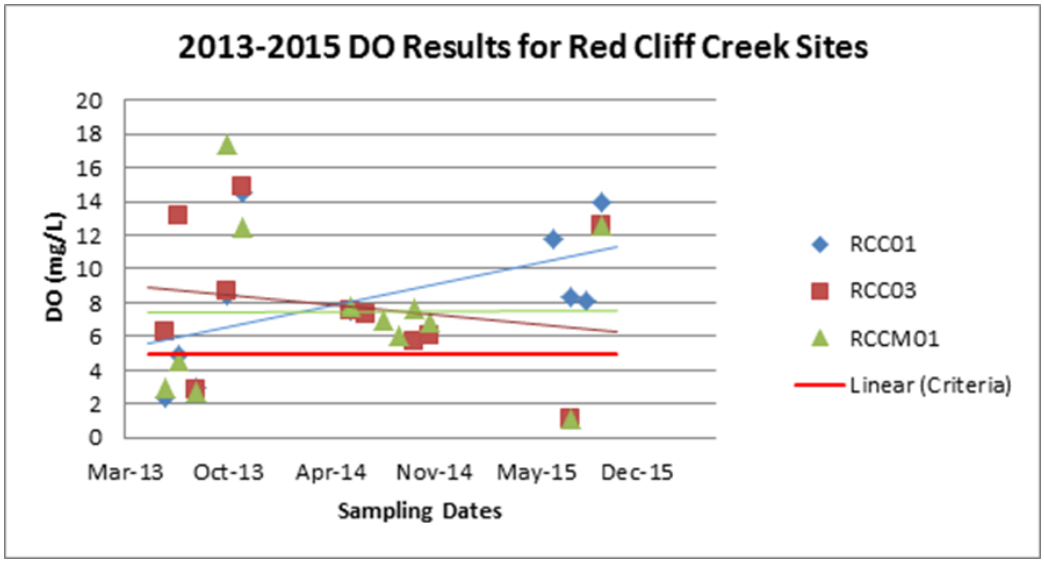




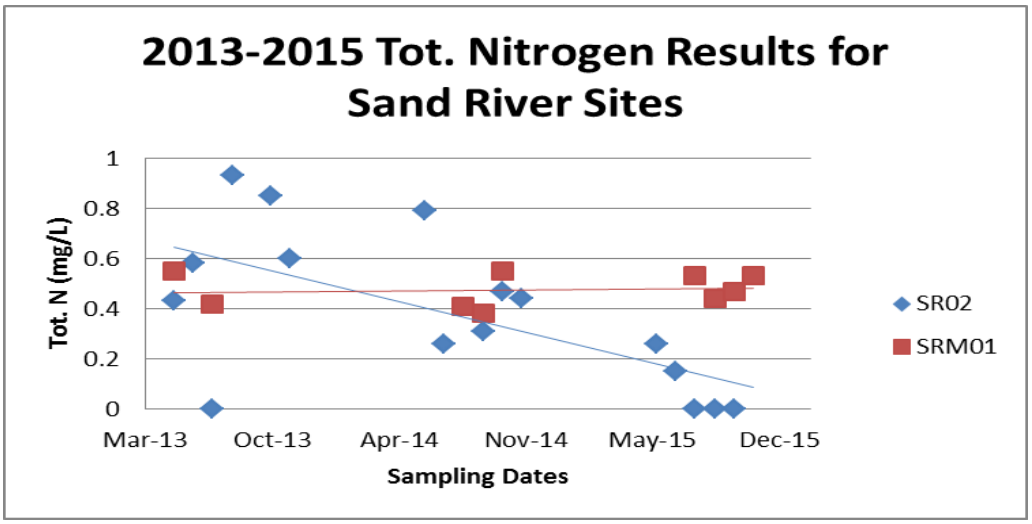

2013-2015 Turbidity Results for Red Cliff Creek Sites
Turbidity (NTU)
80
70
60
50
40
30
20
10
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RCC01
RCC03
RCCM01

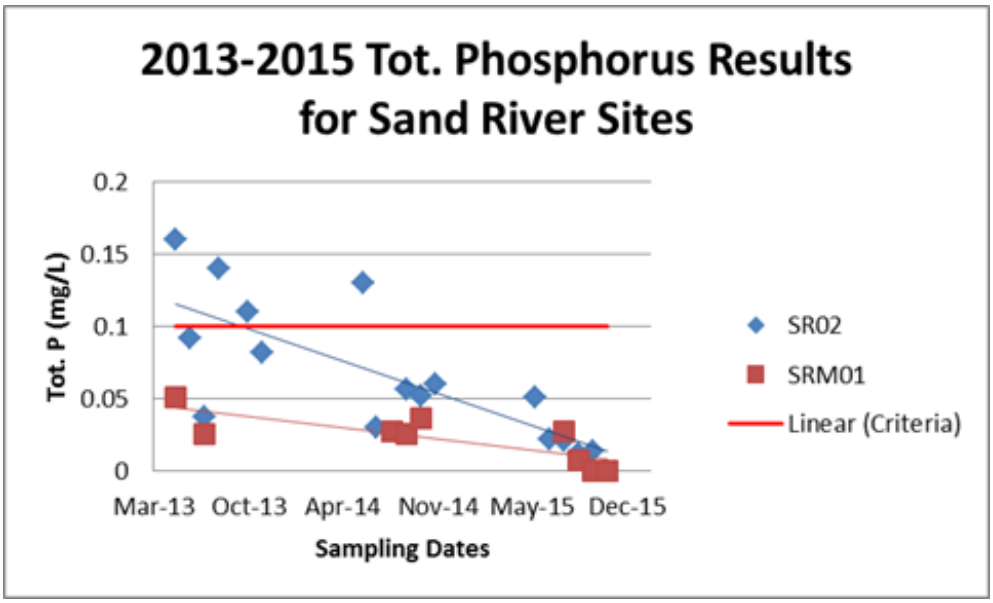

2013-2015 Tot. P Results for Red Cliff Creek Sites
Tot. Phosphorus (mg/L)
0.25
0.2
0.15
0.1
0.05
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RCC01
RCC03
RCCM01
Linear (Criteria)

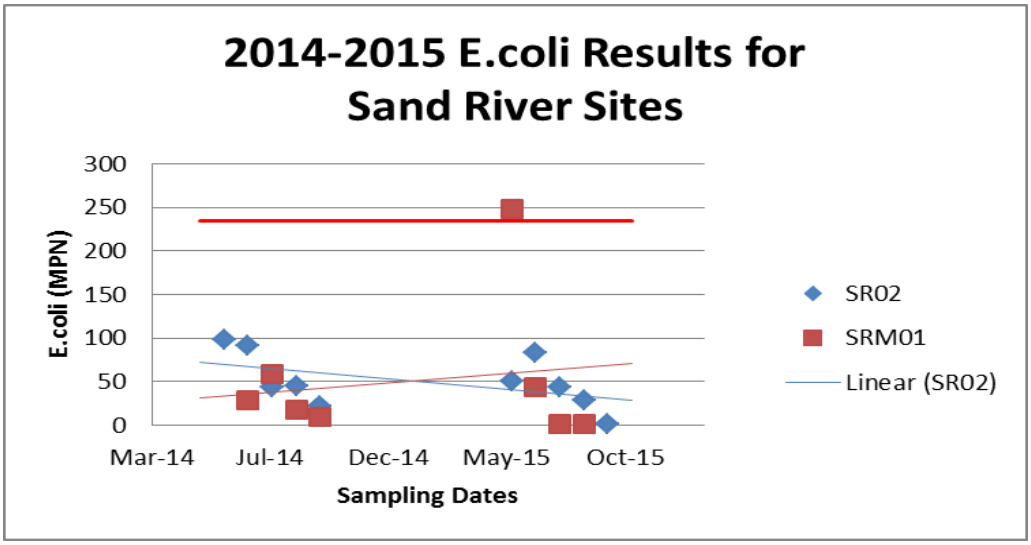

2013-2015 Temperature Results for Red Cliff Creek Sites
Temp. (°C)
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
RCC01
RCC03
RCCM01

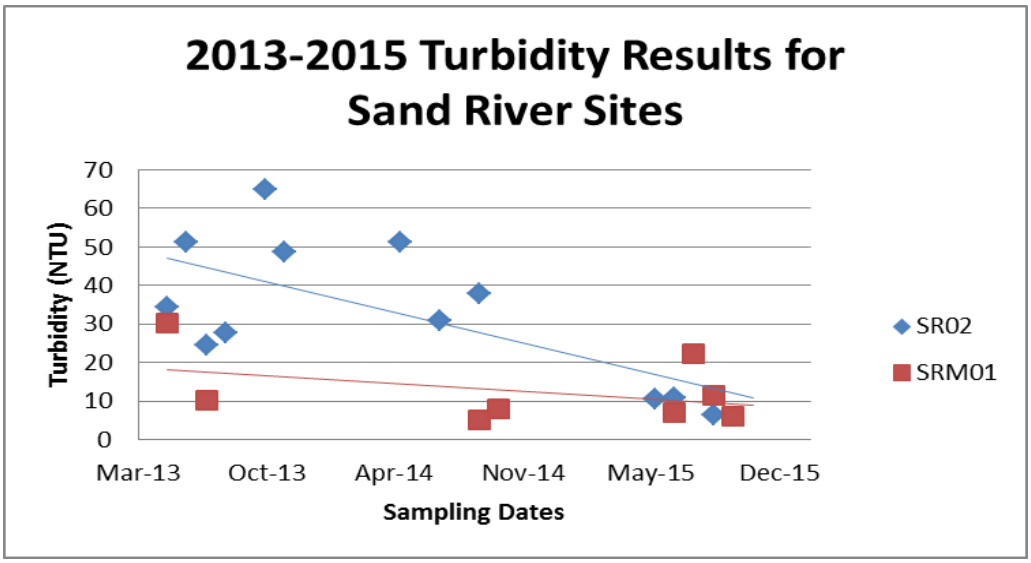


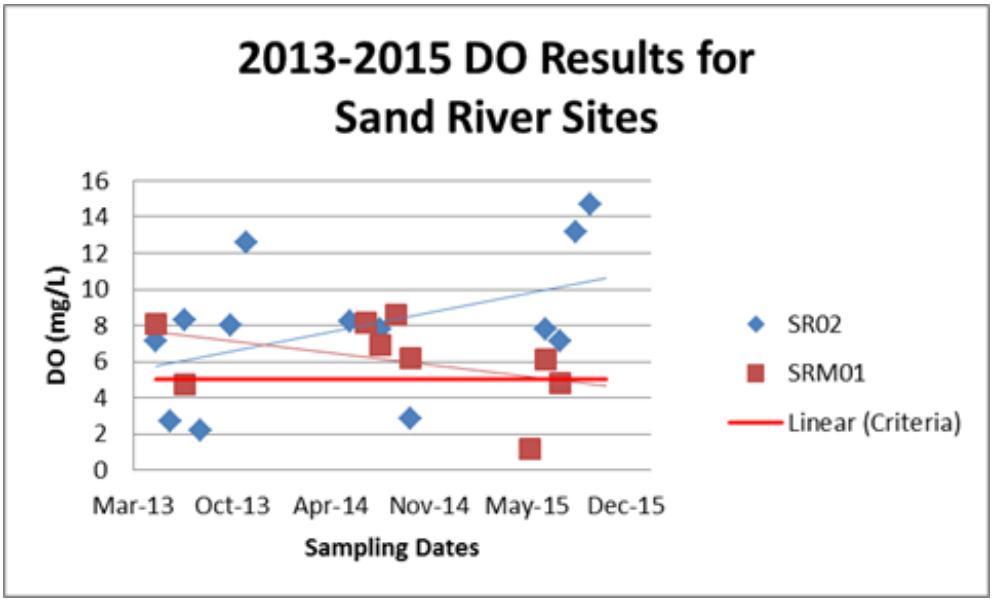
Sand River Results



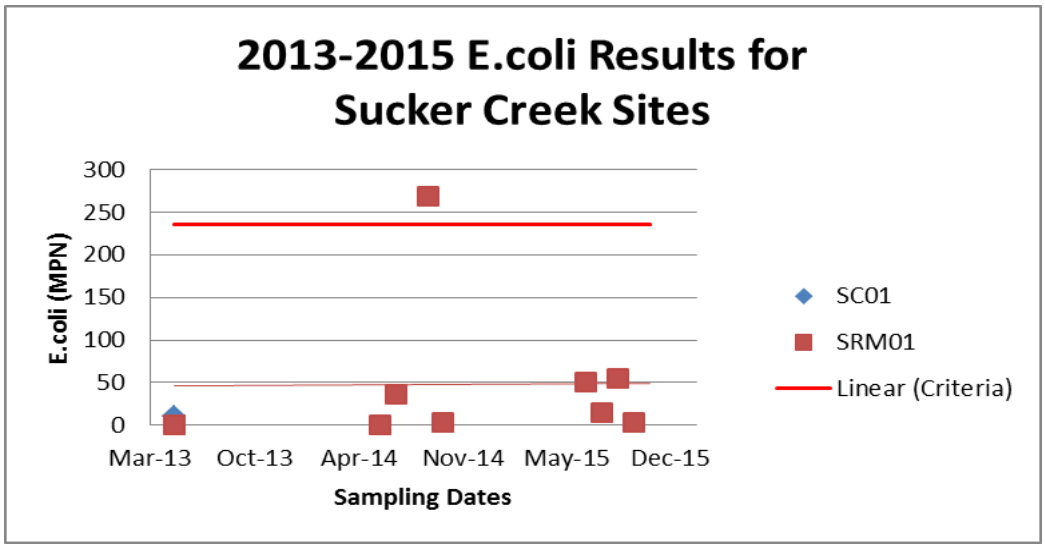


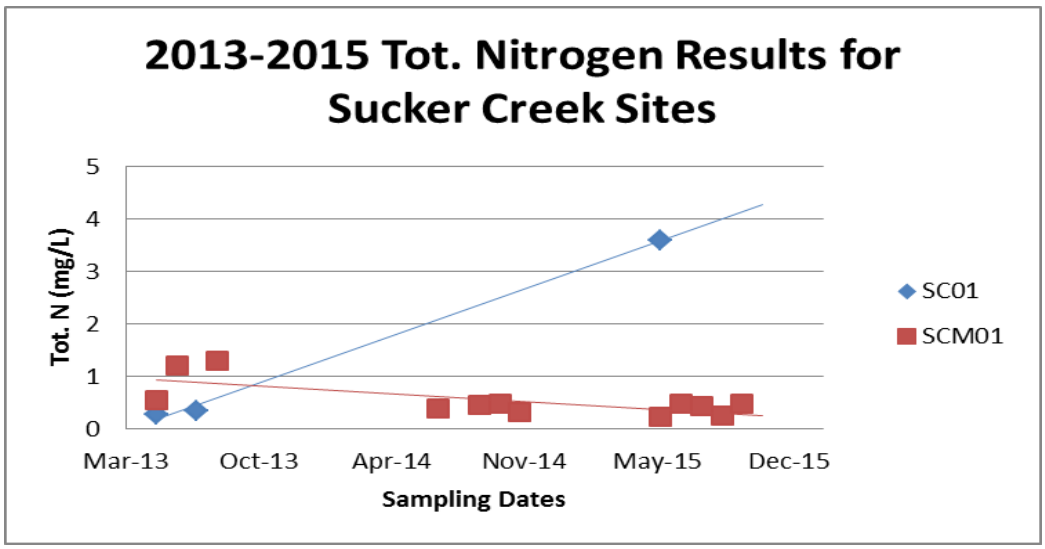

2014-2015 E.coli Results for Sand River Sites
E.coli (MPN)
300
250
200
150
100
50
0
Mar-14
Jul-14
Dec-14
May-15
Oct-15
Sampling Dates
SR02
SRM01
Linear (SR02)

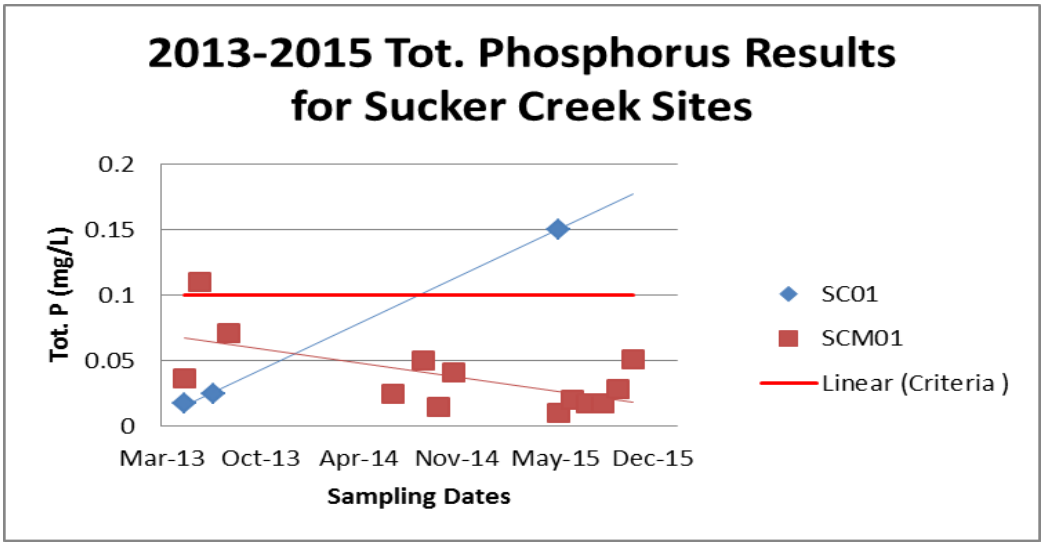

2013-2015 Turbidity Results for Sand River Sites
Turbidity (NTU)
70
60
50
40
30
20
10
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SR02
SRM01

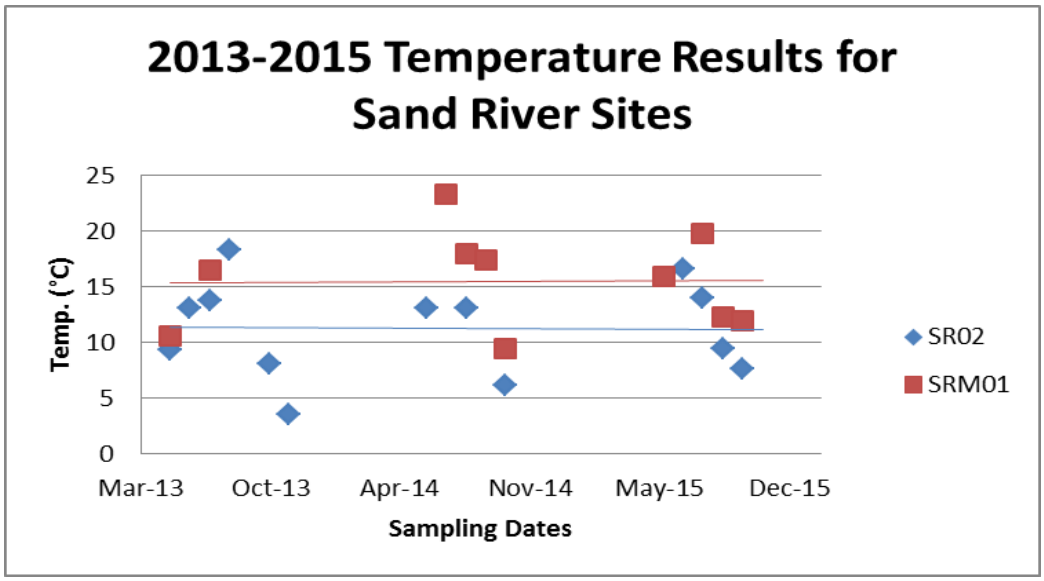

2013-2015 DO Results for Sand River Sites
DO (mg/L)
16
14
12
10
8
6
4
2
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SR02
SRM01
Linear (Criteria)

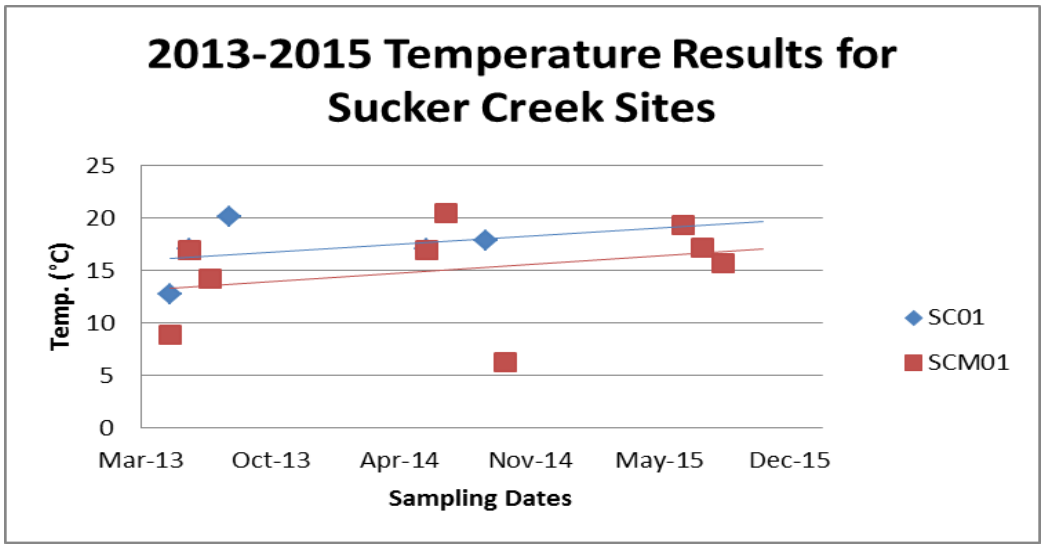
Sucker Creek Results

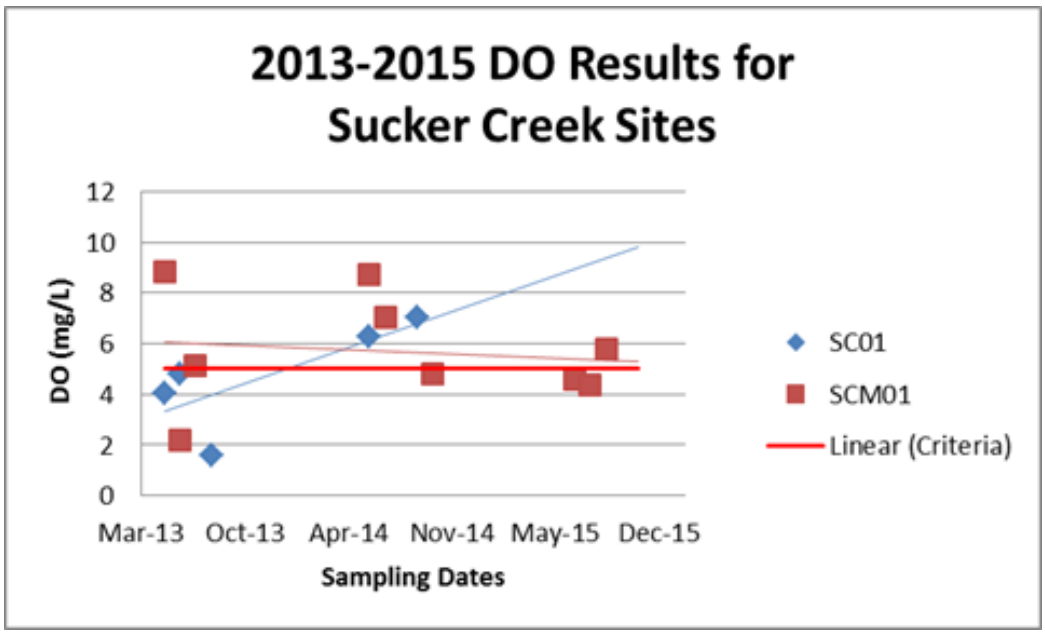


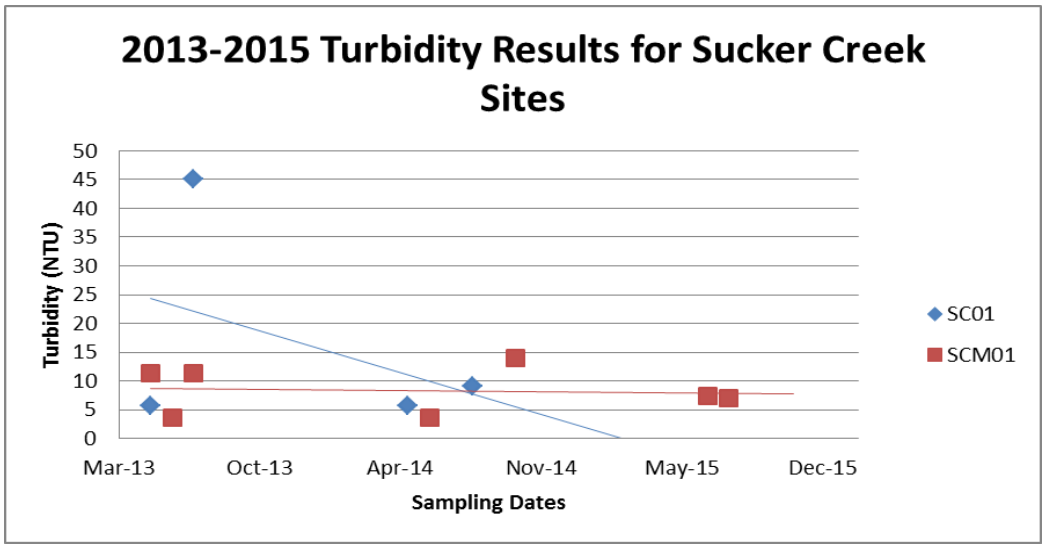




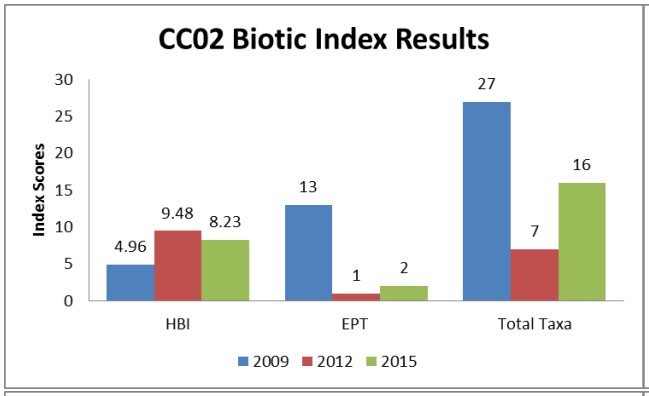

2013-2015 Temperature Results for Sand River Sites
Temp. (°C)
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SR02
SRM01

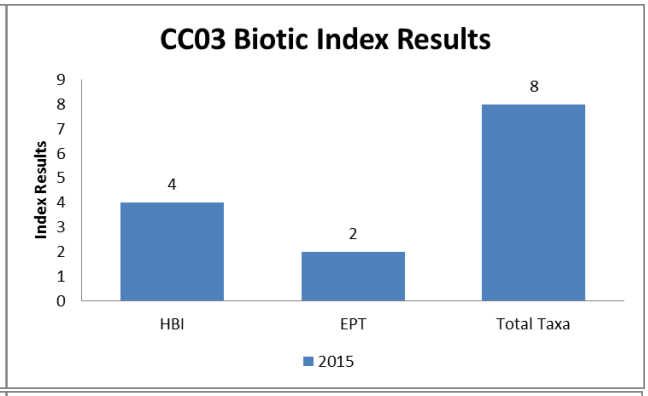

2013-2015 Temperature Results for Sucker Creek Sites
Temp. (°C)
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SC01
SCM01

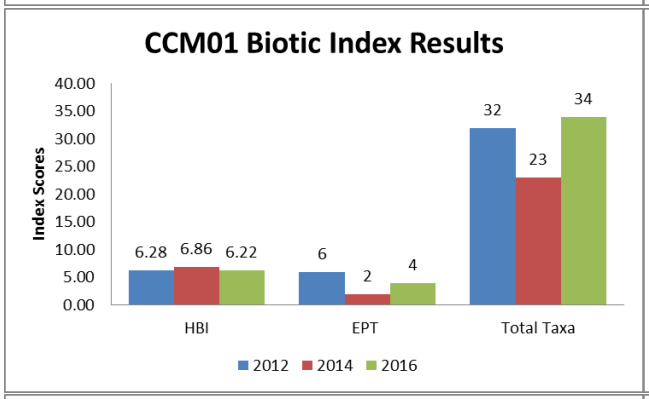

2013-2015 DO Results for Sucker Creek Sites
DO (mg/L)
12
10
8
6
4
2
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SC01
SCM01
Linear (Criteria)

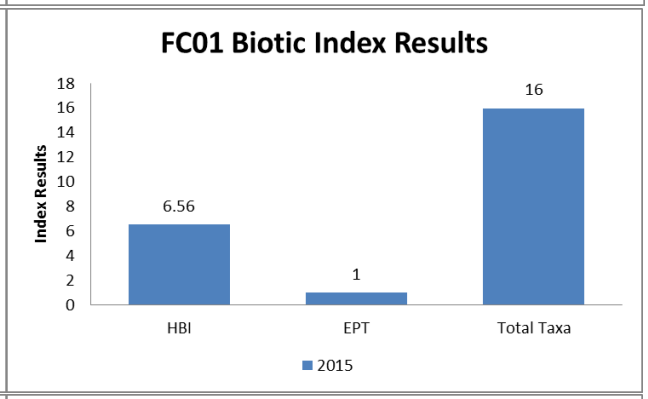

2013-2015 Turbidity Results for Sucker Creek Sites
Turbidity (NTU)
50
45
40
35
30
25
20
15
10
5
0
Mar-13
Oct-13
Apr-14
Nov-14
May-15
Dec-15
Sampling Dates
SC01
SCM01

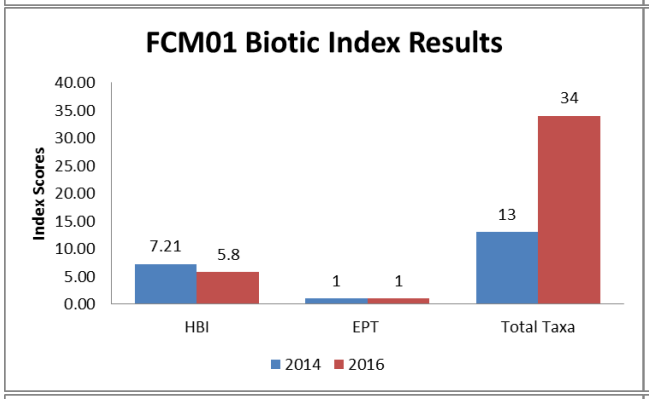
Appendix B –
Red Cliff Water Resource Program's Macroinvertebrate Monitoring Data Graphs

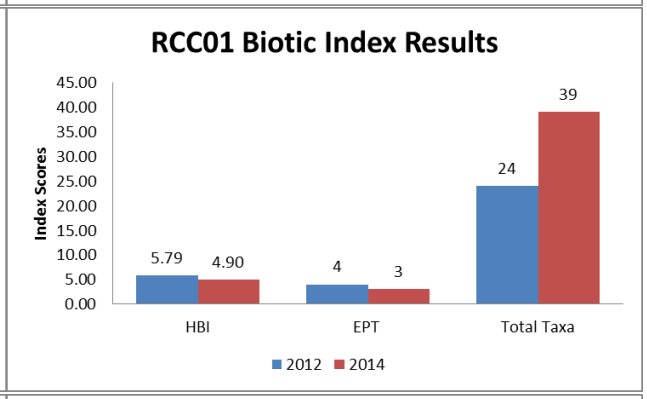


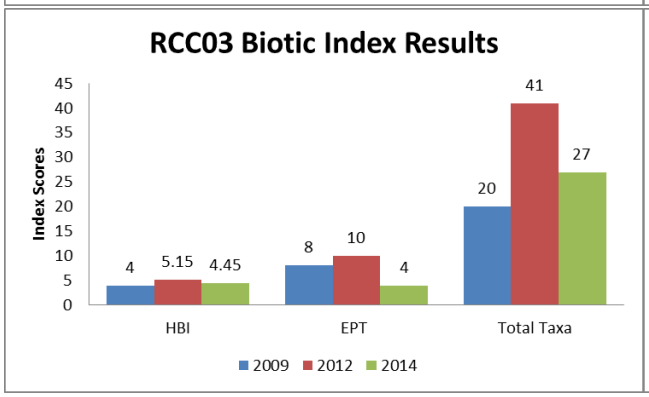


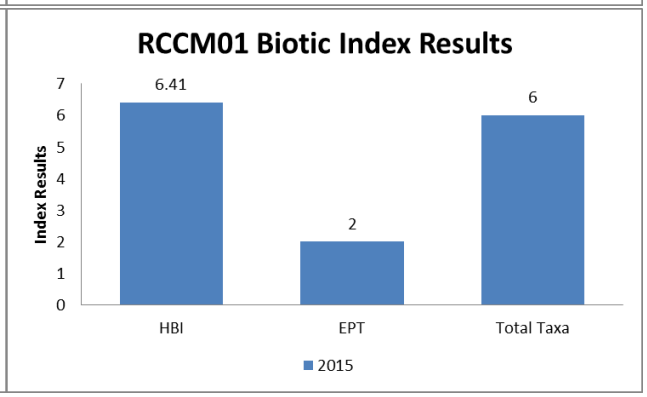


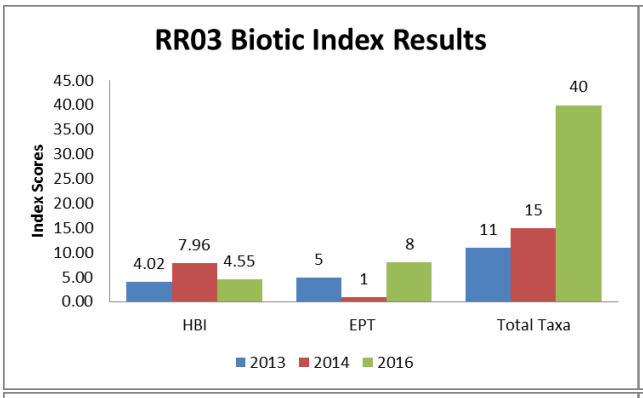


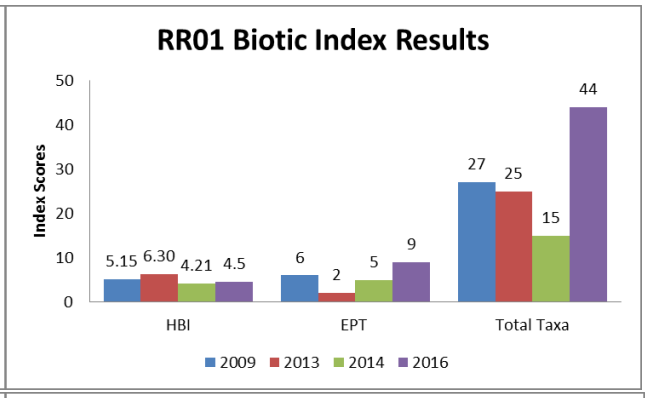


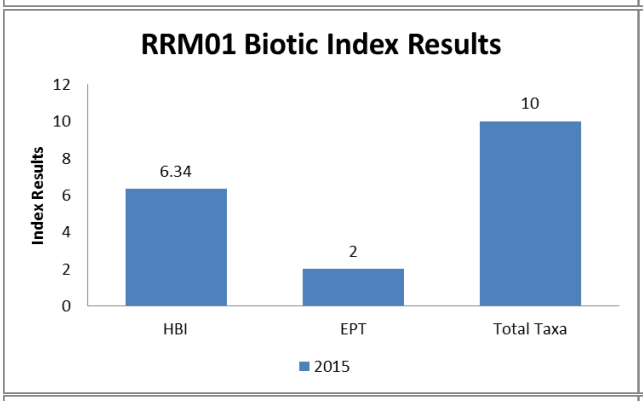


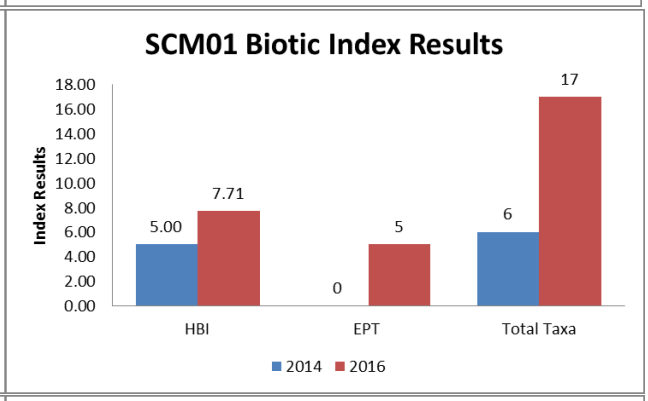


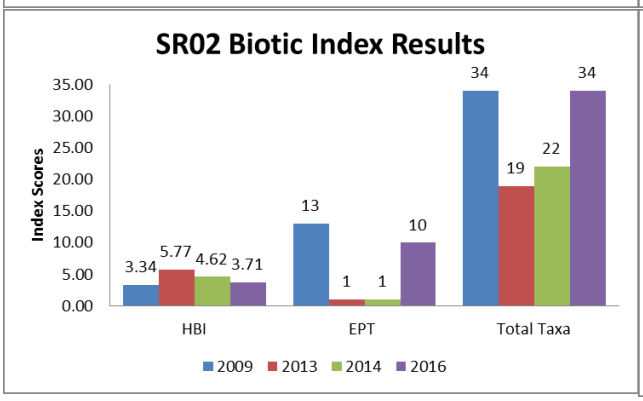


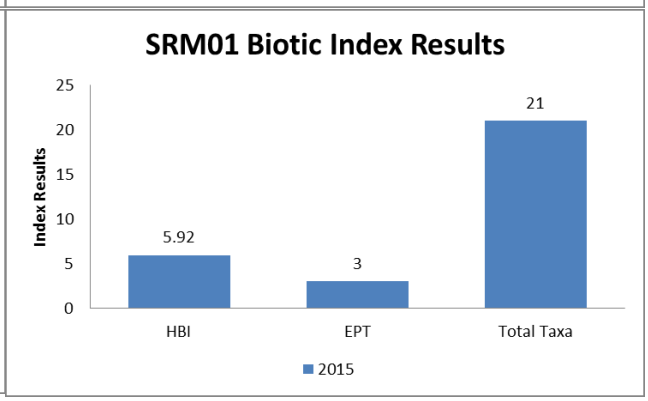

RR03 Biotic Index Results
Index Scores
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
4.02
7.96
4.55
5
1
8
11
15
40
HBI
EPT
Total Taxa
2013
2014
2016


RR01 Biotic Index Results
Index Scores
50
40
30
20
10
0
5.15
6.30
4.21
4.5
6
2
5
9
27
25
15
44
HBI
EPT
Total Taxa
2009
2013
2014
2016


RRM01 Biotic Index Results
Index Results
12
10
8
6
4
2
0
6.34
2
10
HBI
EPT
Total Taxa
2015


SCM01 Biotic Index Results
Index Results
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
5.00
7.71
0
5
6
17
HBI
EPT
Total Taxa
2014
2016


SR02 Biotic Index Results
Index Scores
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
3.34
5.77
4.62
3.71
13
1
1
10
34
19
22
34
HBI
EPT
Total Taxa
2009
2013
2014
2016


SRM01 Biotic Index Results
Index Results
25
20
15
10
5
0
5.92
3
21
HBI
EPT
Total Taxa
2015