

Bacterial Sampling in the Marengo Watershed 2016

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Introduction

The Marengo River Watershed covers 218 square miles in Ashland and Bayfield counties. The Marengo River begins in the marshy wetlands in the Penokee Hills and drops 732 feet over 54 miles before emptying into the Bad River. The Marengo River watershed is primarily rural, with just over 1% of the watershed consisting of urban and suburban areas. Most of the human residents of the watershed are located in the northern third of the watershed. There has been a regional trend of large sections of industrial forest being broken up and sold to private land owners. These parcels tend to be bought and used for recreational purposes. Most of the private land ownership is located in the northern third of the watershed. The southern two thirds fall within the Chequamegon Nicolet National Forest and the mouth of the Marengo River is within the boundary of the Bad River Band of the Lake Superior Tribe of Chippewa Indians. The northern third of the watershed also contains areas cleared for agriculture, with dairy and beef operations being the most common type. The rugged terrain of the Penokee Hills in the upper watershed gives way to flatter terrain as the Marengo cuts through the sand deposits that mark the historic shore of glacial Lake Duluth. Near its mouth the Marengo flows through the clay plains that slope down to Lake Superior before it empties into the Bad River. While the Marengo River is quite clear near its headwaters, it picks up a great deal of sediment in its lower reaches giving it a brown muddy appearance. The impermeability of the clay in the lower reaches also causes it to experience high intensity, short duration flood events which contribute greatly to the sediment load. The most abundant type of land cover in the watershed is forest which covers 73% of the watershed.

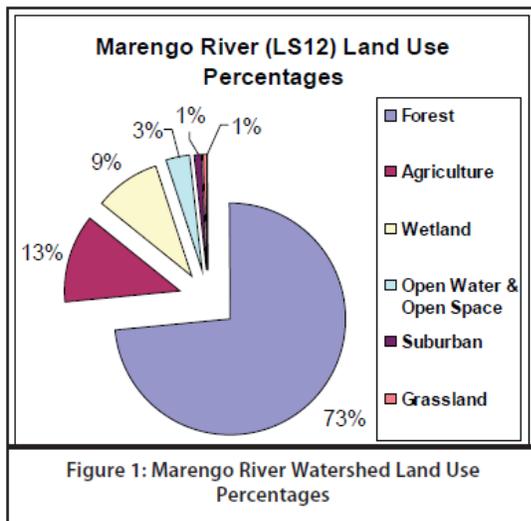


Table 1: Marengo River Watershed Land Use based on National Land Cover Dataset (NLCD) 2001		
Land Use	Acres	Percent of Area
Forest	102,034.53	73.29%
Agriculture	17,576.09	12.63%
Wetland	12,681.62	9.11%
Open Water & Open Space	4,539.08	3.26%
Suburban	1,469.14	1.06%
Grassland	883.13	0.63%
Urban	31.80	0.02%
Barren	1.11	0.00%
Total Acres in Watershed	139,216.50	

The Bad River Watershed Association (BRWA) and the Bad River Natural Resource Department (BRNR) have conducted bacteriological monitoring on the Marengo River and its tributaries. This monitoring has shown high E. coli levels are often present, particularly during high runoff events. From 2007- 2010, the BRWA has sampled E. coli 162 times across 20 locations in the Marengo River watershed. The E. coli levels exceeded 126 colonies/100 ml on 70 occasions at 12 sites and exceeded 1000 colonies/100 ml on 15 occasions at 7 sites. From 2001 – 2014, BRNR collected 130 E. coli samples across 5 sites on the mainstem. Twenty of these samples exceeded 235 CFU/100 ml. Most of these exceedances occurred on the Marengo River and Highway 13 crossing, with a maximum count of 18,685 CFU/100 ml. Other exceedances occurred at a site just upstream of that location on Reimer Road.

The objective of this project was to conduct additional bacteria monitoring consistent with NR 102 to determine if the water quality standards are being exceeded, and if so, to consider adding sections of the river to the 303d list of impaired waters. The samples were tested for both fecal coliforms and E. coli to provide data for the existing fecal coliform based listing criteria as well as to provide data for the potential future use of E. coli as criteria in lotic systems.

Methods

Sampling Sites

Hundreds of miles of tributaries contribute to the Marengo River; however this report summarizes sampling conducted at four locations on the Marengo River and its tributaries (Figure 1). The Marengo River at Hwy 13 site and Trout Brook site were sampled in May and again in late July/August. One of the unnamed tributary sites (10043556) was sampled in May; the other unnamed tributary site (10043556) was sampled in late July/August (Table 2).

Table 2. Frequency of data collection at sites in the project

Site Description	SWIMS Station Number	5 samples in May	5 samples in July/August
Marengo R. DS STH 13	10043557	X	X
Trout Brook @ County Hwy C	10022077	X	X
Unnamed Trib 200ft DS CTH E	10043556	X	
Unnamed Trib 100ft US mouth	10043805		X

The sampling site at on the mainstem Marengo downstream of Highway 13 (10043557) is almost 14 river miles upstream from the Marengo’s river mouth with the Bad River. The hydrologic assessment of the Marengo River (Lake Superior Basin Partner Team, 2007) noted concerns with restricted floodplain access and sand deposition in this section of the river. Substrate is dominated by sand in this slow moving section of the river, located just downstream of the Village of Marengo. Water quality in this class 3 trout stream is heavily

influenced by watershed conditions, with the greatest concentration of open land for development and agriculture in this lower reach of the river. It is listed as an Exceptional Resource Water.

Trout Brook flows north from the outlet of English Lake and empties into the Brunswailer River on the Bad River Reservation just before the Brunswailer's confluence with the Marengo. Supporting rainbow, brown and brook trout, Highway 13 is the dividing line for trout stream designation on Trout Brook, with upper reaches a class 2 trout stream and lower reaches (the location sampled for this project) a class 3 trout stream. Several of its small feeder tributaries also support trout. The upper reaches of the Trout Brook watershed are upland hardwood while the lower reaches are pastured. Trout Brook is fed by several springs which help maintain the cold temperatures favored by trout.

Sample site 10043556 was located near the mouth of the 5.9 mile unnamed tributary with WBIC 2919600. Sample site 10043805 was located near the mouth of the 3.6 mile tributary with WBIC 2919700; this tributary is listed as a Class 1 trout stream and also an Outstanding/Exceptional Resource Water under NR 102. The percentage of the watershed in open land is just over 40% in both basins. Bayfield County Zoning Departments have received complaints of failed septic systems in both subwatersheds (Jennifer Croonborg-Murphy, personal communication).

Bacteria Sampling

At each sampling location, five samples were collected at regular intervals over a one month period to meet the sampling criteria needed to assess for 303d status. The bacteria samples were collected in a manner consistent with DNR standard operating procedures. Samples were collected in an area of water moderate flow, at a depth 6 inches below the water surface. When collecting the samples care was taken to avoid stirring up the sediment, which could influence the sample. The samples were collected in sterile bottles, placed on ice and shipped to the State Lab of Hygiene. The samples were analyzed for E. coli and fecal coliform bacteria within 24 hours of collection.

Precipitation data from the National Weather Service site in Mellen WI show rainfall on 16 days in May ranging from 0.01 – 0.74 inches. Seven days had precipitation greater than 0.25 inches; three days had rainfall greater than 0.5 inches. During July 15 – August 14, there were 8 days of rainfall ranging from 0.01 – 0.54 inches. Seven of days with precipitation had a total of 0.25 inches of rainfall or less. Flows did not appear notably elevated during any of the sampling events.

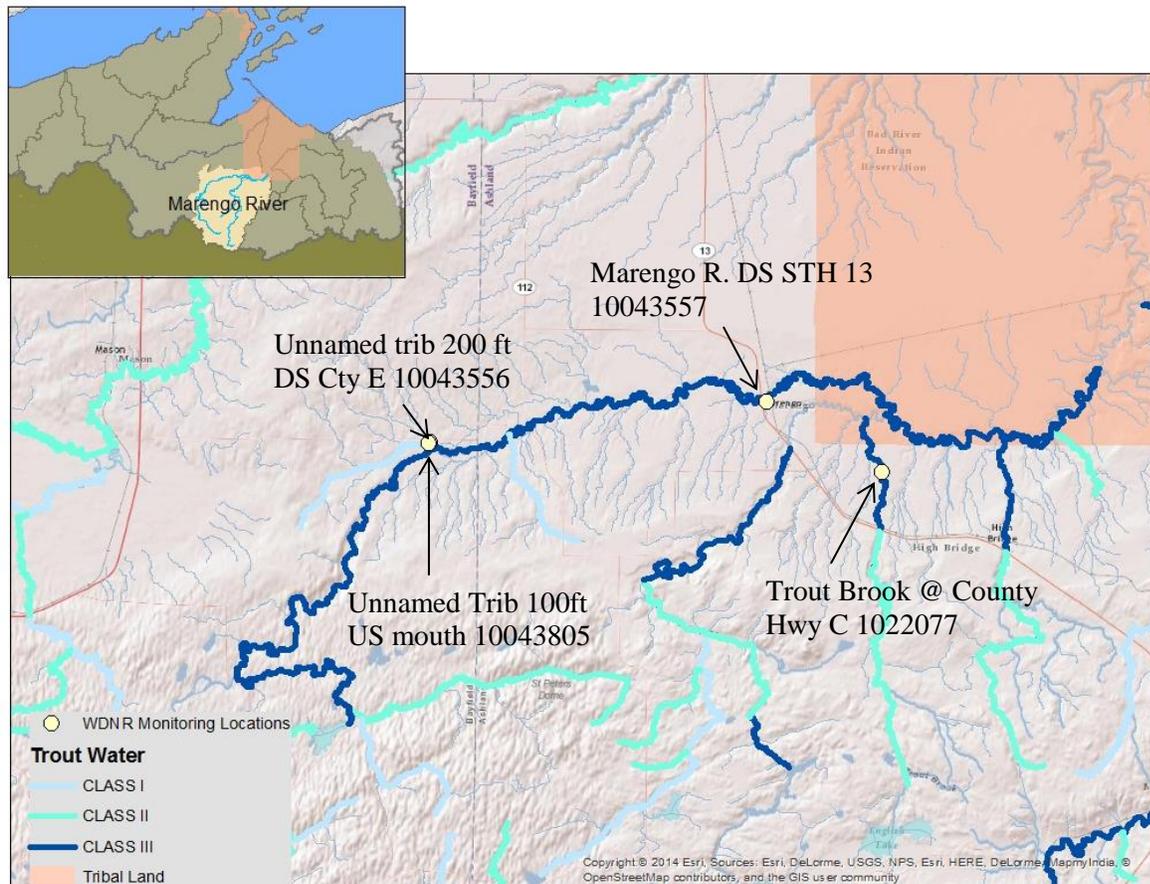


Figure 1. Trout waters and location of WDNR 2016 E. coli and fecal coliform sampling sites on the Marengo River.

Results and Discussion

Trout Brook

Trout Brook was sampled five times in the month of May as well as five times in a one month period in July and early August. To be listed, a fecal coliform sample must exceed 400 CFU/100ml and that threshold was exceeded on August 6th, 2015. Dissolved oxygen levels exceeded 8.5 mg/L at all sampling events. Temperature ranged from 8.2 to 20.9 °C, with highest temperature in late July. The established assessment unit on Trout Brook is a 3.2 mile segment that extends from the mouth upstream (Figure 2). The segment of the assessment unit recommended for listing would only apply to areas outside of the Bad River Tribe’s reservation boundary.

Table 3. Trout Brook bacteria and water quality sampling results, 2015.

	Fecal coliform CFU/100 ml	E. coli CFU/100 ml	DO mg/L	Temp °C
05/06/2015	160	225	10.9	11
05/07/2015	70	579	-	13.6
05/20/2015	50	125	12.4	8.2
05/27/2015	90	47	10.7	13.7
05/28/2015	50	22	10.7	14.9
<hr/>				
07/23/2015	140	96	9.6	20.8
07/27/2015	140	32	8.5	20.9
08/03/2015	330	130	9.6	18.9
08/06/2015	670	435	10.5	15.4
08/10/2015	170	411	9.7	16.7

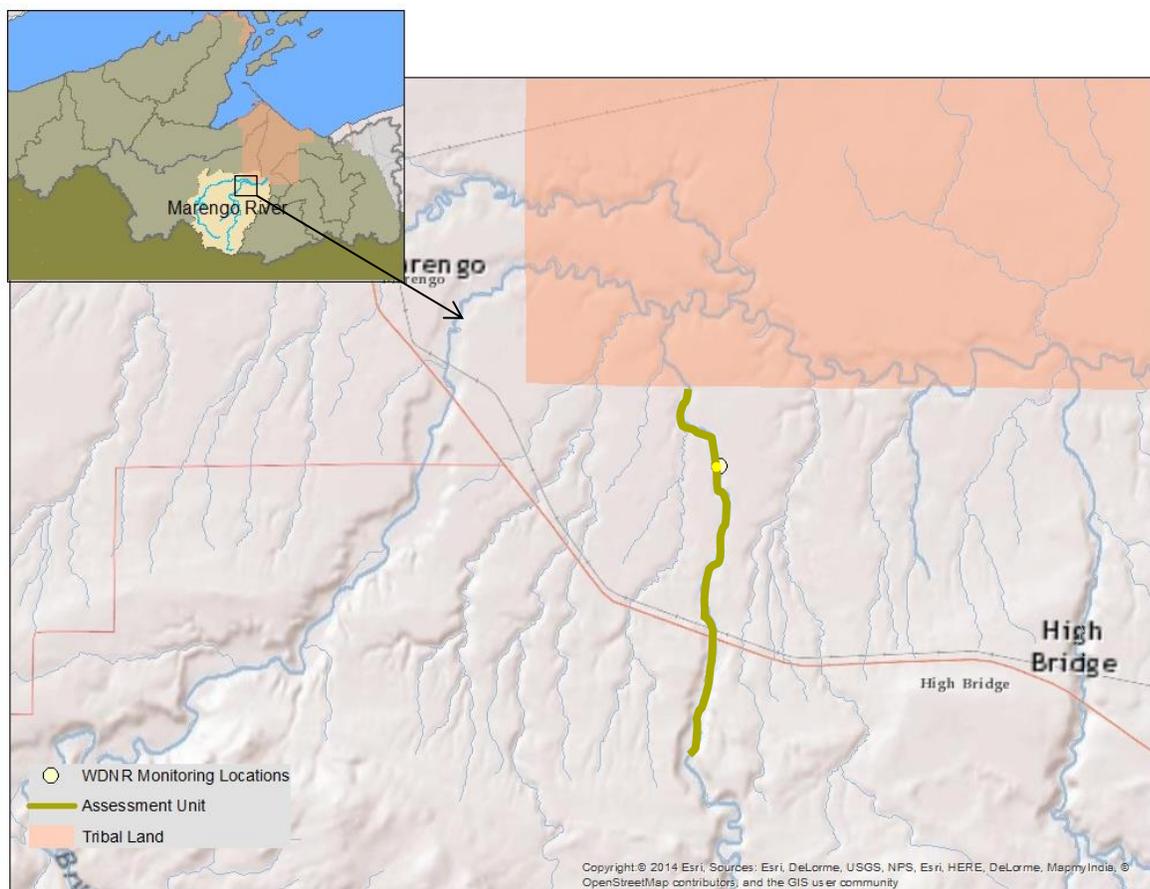


Figure 2. E. coli sampling station on Trout Brook and assessment unit recommended for listing.

Marengo River

The Marengo River was sampled at a site roughly 200 meters downstream of Highway 13. This site was sampled by WDNR staff five times in May and five times during a one month period spanning from July to early August. The Marengo River was also sampled by the Bad River Natural Resources at two sites: at Highway 13 about 200m upstream of the WDNR site (monitoring station id number 10033482), and at Reimer Road about two miles further upstream (monitoring station id number 10012278). The Bad River Natural Resources samples were collected using the EPA-approved Surface Water Monitoring QAPP (2014). Their samples were analyzed at the Tribal Laboratory using the Coliscan method. In WDNR collected samples, dissolved oxygen levels ranged from 9.0 to 10.4 mg/L and water temperature was between 10.1 and 23.4 °C. Fecal coliform levels exceeded the 400 CFU/100 ml water criteria for listing on May 27, 2015 (Table 4). All other samples were below the criteria and geometric means were below 200 CFU/100 ml. Data collected by BRNR indicate that fecal coliform levels in the assessment unit exceed the 400 CFU/100 ml criteria on 8 additional occasions. The assessment unit on the Marengo River from the Bad River reservation boundary upstream to Marengo Lake was recommended for listing.

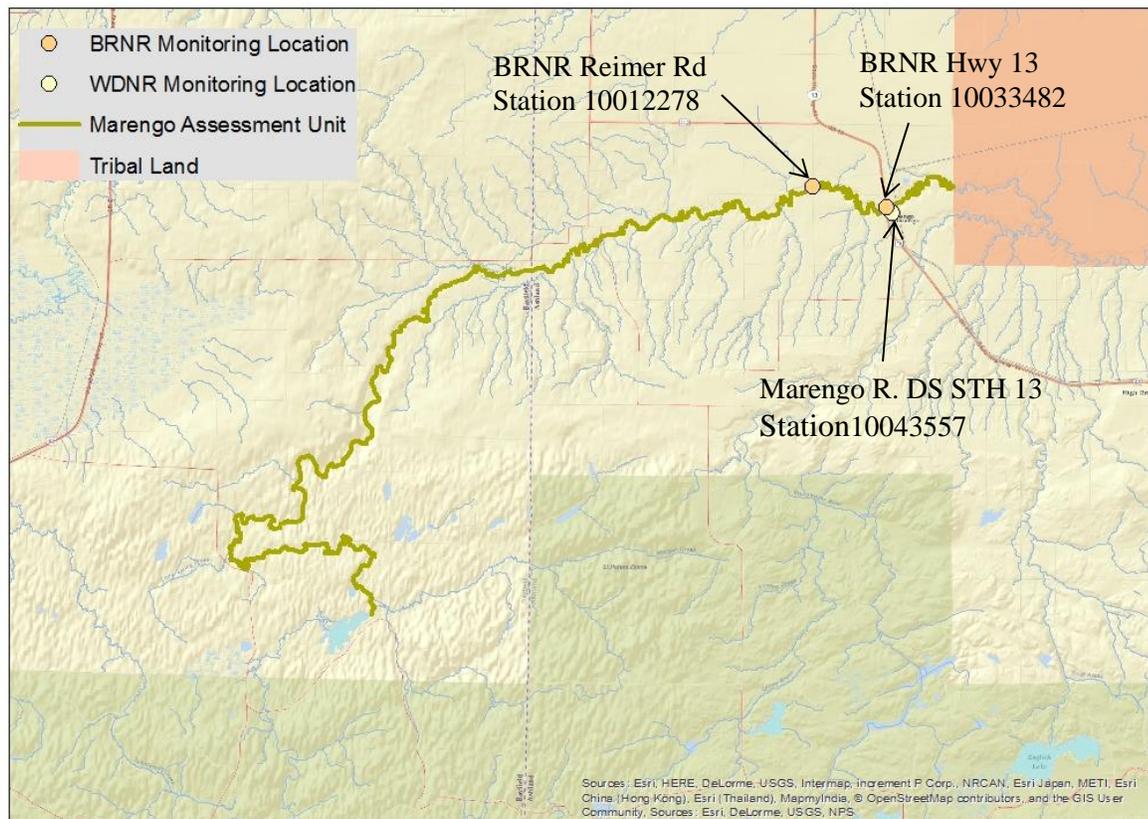


Figure 5. WDNR and BRNR bacteria monitoring sites on the mainstem Marengo River and Assessment Unit 17712 recommended for listing.

Table 4. Bacteria and water quality data collected by WDNR and BRNR on the Mainstem Marengo River, 2013 – 2015. Samples in exceedance of 400 CFU/100 ml are highlighted in bold font.

Date	Fecal coliform CFU/100 ml	E. coli CFU/100 ml	DO mg/L	Temp °C
Downstream Hwy 13 ID 10043557				
05/06/2015	60	162	10.2	12.5
05/07/2015	100	78	9.5	14.2
05/20/2015	70	49	11	10.1
05/27/2015	510	63	10.3	13.8
05/28/2015	60	45	9.2	15.7
07/23/2015	140	299	9.0	22.6
07/27/2015	160	196	7.9	23.4
08/03/2015	70	167	9.9	18.6
08/06/2015	30	82	10.4	16.9
08/10/2015	50	91	10	18.7

BRNR Hwy 13	Station ID 10033482	
04/13/2013	0	0
05/08/2013	20	20
06/14/2013	180	40
07/20/2013	380	160
08/01/2013	180	120
10/03/2013	600	340
10/07/2013	600	340
10/16/2013	1440	1120
01/23/2014	0	0
04/23/2014	0	0
06/03/2014	880	880
07/02/2014	100	80
08/08/2014	40	0
09/04/2014	440	240

Table 4 continued.

BRNR Reimer Rd. Station ID 10012278				
Date	Fecal coliform CFU/100 ml	E. coli CFU/100 ml	DO mg/L	Temp °C
04/24/2013	40	20		
05/08/2013	20	20		
06/14/2013	120	0		
07/30/2013	60	20		
08/01/2013	100	100		
10/07/2013	500	410		
01/22/2014	20	20		
04/23/2014	0	0		
06/03/2014	620	390		
07/02/2014	300	60		
08/08/2014	240	80		
09/04/2014	440	240		

The WDNR website states “Past documentation indicates an effluent ditch near the community of Marengo carries septage to the river. The impact of this is unknown, ... and it is unknown if this ditch is open to human access.” During the course of sampling at Marengo River site, small bare-footed prints in the mud were observed (Figure 5). The water on left of the picture is the effluent ditch that drains into the Marengo. A sample with a fecal coliform count of 510 CFU/100ml was collected at this location less than a month after this photo was taken. People are in contact with the river at this location; high levels of bacteria in the river may pose a human health risk.



Figure 6. Photo of children’s footprints near sample site.

Unnamed Marengo River Tributaries

Two unnamed tributaries to the Marengo River near Four Corners Road were sampled in 2015. Unnamed tributary WBIC 2919600 was sampled at Station 10043556 five times in the month of May. The sample taken at May 6th at this site exceeded the 400 CFU/100ml listing criteria and has been recommended for listing. E. coli measurements exceeded the 236 CFU/100 ml criteria used for beaches on 2 occasions at this site. Dissolved oxygen ranged from 10-12.4 mg/L and water temperatures ranged from 7.8 to 13 °C throughout the sampling period.

Unnamed tributary WBIC 2919700 was sampled five times during a one month period during July and early August. During this period neither the 400 CFU/100ml threshold nor the 200 CFU/100ml geometric mean were exceeded at this site. E. coli measurements exceeded the 236 CFU/100 ml criteria used for beaches on 1 occasion at this site. This segment has not been recommended for listing. Dissolved oxygen ranged from 8.4-10.4 mg/L and water temperatures ranged from 13.8 to 20.4 °C throughout the sampling period.

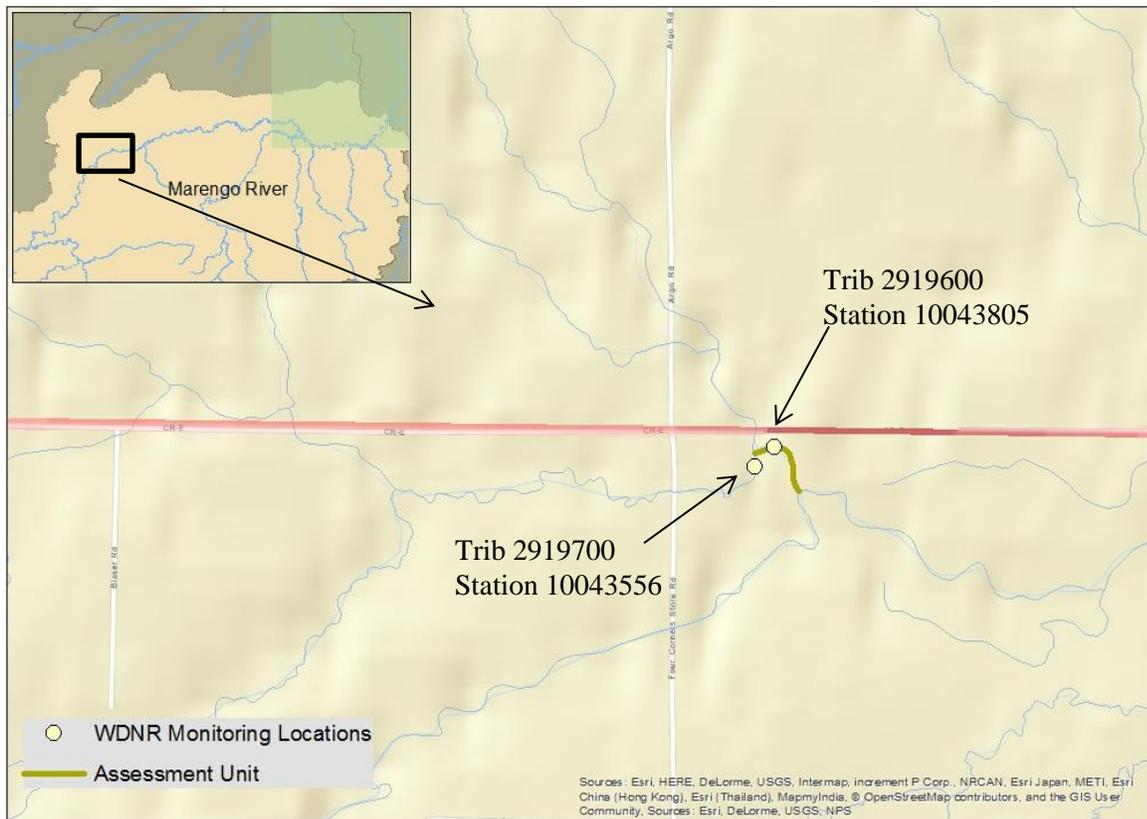
Table 5. Bacteria sampling results for two unnamed tributaries to the Marengo River, 2015.

Date	Fecal coliform CFU/100 ml	E. coli CFU/100 ml	DO mg/L	Temp °C
05/06/2015	410	387	10.9	9.3
05/07/2015	180	161	10.7	12.1
05/20/2015	10	43	12.4	7.8
05/27/2015	370	579	10.7	12.2
05/28/2015	190	166	10	13.8

Unnamed Trib (WBIC 2919700) 100 ft US of Mouth

Date	Fecal coliform CFU/100 ml	E. coli CFU/100 ml	DO mg/L	Temp °C
07/23/2015	60	131	9.5	20.2
07/27/2015	140	214	8.4	20.4
08/03/2015	280	185	10.1	16.4
08/06/2015	110	435	10.4	13.8
08/10/2015	60	111	10.1	15.2

Figure 7. Sampling stations on unnamed tributaries. Assessment Unit highlighted in green is recommended for listing.



References

BRWA. 2011. Marengo River Watershed Partnership Watershed Action Plan. 205 p.

Lake Superior Basin Partner Team. 2007. Marengo River Watershed Test Case: Assessing the Hydrologic Condition of the Marengo River Watershed, Wisconsin. Prepared for Wisconsin Lake Superior Basin Partner Team by Stable Solutions, LLC. and Community GIS, Inc.