

Fish, Macroinvertebrate, and Stream Habitat Surveys in the Manistee River Watershed, Michigan, July-August 2019

Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Water Resources Division (WRD), Surface Water Assessment Section (SWAS)

INTRODUCTION

Michigan has over 76,000 miles of rivers and streams. Understanding the quality of those waters is an important part of EGLE's mission to protect Michigan's environment and public health by managing air, water, land, and energy resources. All Michigan watersheds are surveyed once every five years. As part of that effort, the Manistee River watershed was sampled in 2019; this report includes the information collected as part of that survey.

Water quality can be measured different ways including sampling macroinvertebrate and fish communities and collecting water or sediment samples. EGLE biologists sample macroinvertebrates and fish living in our rivers and streams because some are more sensitive to pollution than others. In general, macroinvertebrate and fish communities in healthy streams include those sensitive to pollution.

Looking at the quality of the physical habitat clarifies what may be limiting the kinds of life in a stream. Habitat includes the wood, rocks, gravel, silt, and sand in the stream or river and the vegetation in the water and along the shore. Typically, a range of habitats provides for diverse types of macroinvertebrates and fish.

Sometimes water or sediment samples are collected as indicators of potential pollution. Chemicals analyzed from these samples can be compared to levels expected and determined to be safe and helps to provide additional clues to possible water quality problems. Michigan has developed [Water Quality Standards](#) (WQS) to help with this comparison process; the WQS are Rules that tell us the levels of various pollutants and other water quality conditions necessary for our rivers, streams, wetlands, and lakes to function properly.

All surface waters in Michigan are protected for "designated uses" such as swimming and wading, warmwater fish communities, eating fish, aquatic life, and wildlife. All rivers, streams, lakes, ponds, drains, creeks, and the Great Lakes must be clean enough to meet WQS and support these uses. The Manistee River watershed is also protected for coldwater fish since many streams are cold enough for trout and salmon. These streams are designated on the online [Biological Monitoring Storymap](#). Data from all surveyed sites are used to assess the ability to support designated uses through the [Integrated Report](#) process.

WATERSHED INFORMATION

A [watershed](#) is all the land that drains to a lake or stream. The Manistee River watershed is in the northwest part of Michigan's Lower Peninsula. The watershed covers approximately 1,948 square miles with 1,938 miles of stream. There are two large impoundments on the main branch of the Manistee River. These man-made lakes are created when water from the Manistee River is held back by the Hodenpyl Dam in Wexford County and Tippy Dam in Manistee County. The North Branch Manistee River, Pine River, Bear Creek, and Little Manistee River are the major rivers in the watershed.

LAND USE

Land use in a watershed is important to water quality. Here is an [example of a publication](#) that can be found online to explain the connection between land use and water quality. The land use in the Manistee River watershed consists of many natural areas like forests and wetlands. Natural areas, especially wetlands, act as natural sponges, and allow rainwater to soak into the ground, reducing the amount of water that runs off the land, filtering pollutants, and recharging groundwater. This leads to protecting water quality, minimizing flooding, and stabilizing our shorelines and stream banks. As development of land occurs, the amount of pavement, roofing, and other hard surfaces increases, and the amount of vegetation decreases, and therefore more water (and thus pollutants) quickly reaches our streams and lakes. The amount of total [wetlands](#) lost since pre-settlement times in the Manistee River watershed is relatively low (0-12 percent) when compared to the 40 percent lost across the entire state ([Fizzell, 2014](#)). The highest percent of wetlands lost in a subwatershed of the larger Manistee River watershed, is in Slagle Creek near the village of Harietta. For more details on the land use in this watershed, please see [Lipsey, 2016](#).

HISTORIC SAMPLING EFFORTS

Table 1 is a summary of the reports available for this watershed from the past two decades. For more information about older reports and results or for any other questions about this watershed, please contact the watershed biologist by going to the Watersheds tab of the [Biological Monitoring Storymap](#).

Table 1. Historical EGLE biosurvey reports available for the Manistee River watershed.

Survey Year	Report Citation Report Number	Finding/Comments
2014	Lipsey T., 2016 #MI/DEQ/WRD-16/033	<ul style="list-style-type: none">• Macroinvertebrate community samples collected at 26 wadeable stations with ratings of acceptable or excellent and 4 nonwadeable stations with excellent or good ratings.• Habitat ratings ranged from good to excellent.
2009	Lipsey, T., 2010 #MI/DEQ/WB-10/016	<ul style="list-style-type: none">• Macroinvertebrate community samples collected at 26 wadeable stations with ratings of acceptable or excellent and 5 nonwadeable stations with marginal, good, and excellent ratings.• Habitat ratings ranged from good to excellent.

Survey Year	Report Citation Report Number	Finding/Comments
		<ul style="list-style-type: none"> Several nonpoint source issues were identified in the watershed including perched culverts, misaligned or undersized culverts, erosion and sedimentation, and livestock access.
2004	Chambers, A., 2017 #MI/DEQ/WRD-17/027	<ul style="list-style-type: none"> Macroinvertebrate community samples collected at 31 stations, with ratings of excellent or acceptable. Habitat was surveyed at 39 stations. Ratings ranged from good to excellent. Water chemistry data including metals and nutrients was collected at 14 stations and WQS were met at all stations.
1999	Walker, B., 2004a #MI/DEQ/SWQ-04/017	<ul style="list-style-type: none"> Seventeen stations sampled in the Upper Manistee River and selected tributaries, Crawford and Kalkaska County for habitat, water chemistry, macroinvertebrates and/or fish communities. Nine of 10 stations had macroinvertebrate communities that scored excellent Most stations had good habitat scores. Habitat quality details are included in report. Fish communities met coldwater fisheries WQS. Water chemistry samples were collected at 7 locations for metals and nutrients. All samples met WQS.
1999	Walker, B., 2004b #MI/DEQ/SWQ-04/018	<ul style="list-style-type: none"> Fish community sampled at 3 stations in Bear Creek and selected tributaries, Manistee County. All streams met the coldwater fisheries designated use Macroinvertebrate community sampled at 5 stations, all scoring acceptable Habitat evaluated at 7 locations with good or excellent scores.
1999	Walker, B., 2004c #MI/DEQ/SWQ-04/031	<ul style="list-style-type: none"> Thirty-four stations sampled in the Lower Manistee River and selected tributaries in Manistee, Wexford, Missaukee, and Kalkaska Counties. Fifteen stations sampled for macroinvertebrate community; 13 scored excellent, 2 scored acceptable. Twenty-eight stations sampled for habitat scoring good or excellent. Details regarding habitat are available in the report.
1999	Walsh, S., 2001 #MI/DEQ/SWQ-01/011	<ul style="list-style-type: none"> Fifteen stations assessed in the Pine River Watershed, Lake, Manistee, Osceola, and Wexford Counties. Macroinvertebrate community was evaluated at 13 stations and were rated as acceptable or excellent. Fish community evaluated at 3 locations and indicated coldwater fisheries designated use was being met.

Survey Year	Report Citation Report Number	Finding/Comments
		<ul style="list-style-type: none"> Habitat sampled at all 15 stations and only Silver Creek was rated as fair, while the remaining stations had excellent or good habitat. Metal and nutrient levels from 6 water samples collected met WQS.
1999	Walker, B., 2000 #MI/DEQ/SWQ-00/001	<ul style="list-style-type: none"> Evaluation of Fairbanks Creek and effects from a major sediment release near Luther, Lake County, Michigan, December 17, 1999.
1999	Vidales, N. 2000. #MI/DEQ/SWQ-00/097	<ul style="list-style-type: none"> Nine stations assessed in the Little Manistee River watershed, Manistee, and Lake Counties. Fish community assessments at 3 stations indicated coldwater fisheries designated use being met. Macroinvertebrate community assessments at 3 stations resulted in excellent ratings Habitat ratings at 9 stations ranged from fair to excellent. Water samples were collected at 5 stations for nutrients and WQS were being met.

SAMPLING GOALS:

1. Assess the current condition of individual rivers, streams, and lakes and determine whether Michigan [WQS](#) and designated uses are being met.
2. Evaluate water quality trends across the state and over time.
3. Satisfy [targeted monitoring requests](#) submitted by EGLE staff and external customers.
4. Identify [nonpoint sources](#) of water quality pollution.

SITE SELECTION/ METHODS

In July and August 2019, 15 sites were sampled in the Manistee River watershed.

[Procedure 51: Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers](#) (Michigan Department of Environmental Quality [MDEQ], 2014) was used to collect habitat and macroinvertebrate community information. Fish were sampled at one site. Three types of site-selection methods were used in the Manistee River watershed in 2019. These include:

- (1) **Status sites:** are randomly selected across Michigan so statewide water quality summaries can be made. The random selection resulted in two sites from the Manistee River watershed to support the statewide condition portion of the SWAS Status and Trend Program (MDEQ, 2015).
- (2) **Trend sites:** Ten sites, originally selected from a random group, became trend sites that are sampled every five years. These sites will be used to report statewide trends and will be included in report following analysis of 2006-2020 data. Additionally, for the Manistee River watershed the trend sites can be evaluated for watershed-specific temporal trends that are included in this report.

- (3) **Targeted sites:** Three targeted sites were selected because sampling was requested through our [targeted monitoring request process](#).

More information regarding the site-selection process can be found on the EGLE, WRD, [Biological Assessment Web page](#).

[Procedure 51](#) is used in streams and rivers that can be safely waded (MDEQ, 2014 and Creal et al., 1996). This procedure evaluates macroinvertebrate communities based on several characteristics and combines all results into a 1-number score that ranges from +9 to -9 (Table 2). Using the [Procedure 51 scoring system](#) the macroinvertebrate community is rated as Excellent, Acceptable, or Poor. Habitat is rated as Excellent, Good, Marginal, or Poor based on measures that describe the habitat in the stream and along the banks of the stream.

Table 2. EGLE Procedure 51 macroinvertebrate and habitat scoring and rating system.

Macroinvertebrate Score	Macroinvertebrate Rating	Habitat Score	Habitat Rating
5 to 9	Excellent	> 154	Excellent
-4 to 4	Acceptable	105 to 154	Good
-5 to -9	Poor	56 to 104	Marginal
		<56	Poor

Macroinvertebrate community scores are one component used to evaluate the Other Indigenous Aquatic Life and Wildlife designated use. Procedure 51 can be used to rate the fish community in a similar way. Fish community scores are used to evaluate the warmwater and coldwater fish designated uses. Habitat scores are used to help better understand what might influence the fish and macroinvertebrate scores. More information on the metrics and scoring can be found in the [Procedure-51 Scoring Document](#).

In rivers too deep to wade, macroinvertebrate communities and habitat conditions can be assessed using [Procedure 22](#) (MDEQ, 2013). Like Procedure 51, this procedure for nonwadeable rivers evaluates the macroinvertebrate community based on several characteristics, which can be evaluated individually or combined into a 1-number score with associated rating (Table 3). There were no nonwadeable sites sampled within the Manistee River watershed in 2019.

Table 3. EGLE Procedure 22 Scores and Ratings.

Overall Procedure 22 Score	Rating
84-100	Excellent
56-83	Good
28-55	Marginal
0-27	Poor

MONITORING FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Goal 1: Determine the condition of individual waters of the state and if Michigan WQS are being met.

All stations had macroinvertebrate community ratings that were acceptable or excellent (Table 4 and Figure 1). No water chemistry samples were collected. Therefore, the Other Indigenous Aquatic Life and Wildlife designated use was being supported at all stations. The coldwater fish community was sampled in Big Cannon Creek at Naples Road and was found to be supporting the coldwater fisheries designated use. The metric used to determine attainment of the coldwater fish community is having at least 1 percent of the fish community be salmonid species.

The following site descriptions provide details regarding each station that are not available in Table 4 and Figure 1.

Anderson Creek

Anderson Creek was sampled at County Line Road (Station 1; Photo 1). Sand and coarse and fine particulate organic matter was common in this reach. *Vallisneria* plants and undercut banks were available for colonization.



Photo 1. Anderson Creek at County Line Road, Grand Traverse County, 2019.

Macroinvertebrate Community Ratings

- Excellent
- High Acceptable
- Low Acceptable
- Fish Data Only
- Site Visit

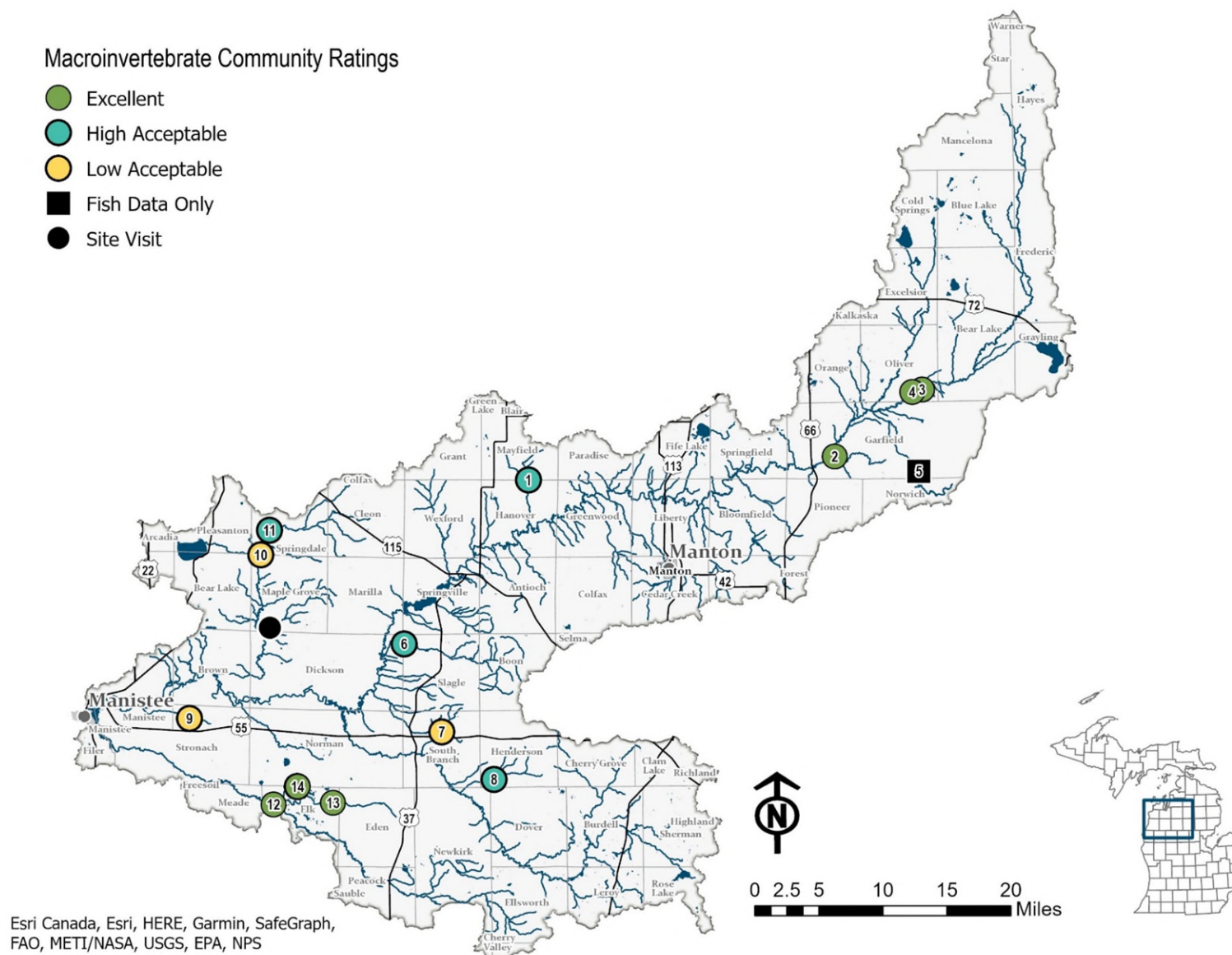


Figure 1. Macroinvertebrate ratings for stations sampled in the Manistee River watershed, June-September 2019.

Table 4. Procedure 51 sampling results for stations sampled in the Manistee River watershed, 2019. Unless otherwise noted, stations are sampled upstream of road crossings. Details regarding the metrics used to calculate the habitat and macroinvertebrate scores can be found in Tables 6-18.

Station	Stream Name	Road Crossing	STORET	Latitude	Longitude	Date 2019	Habitat Rating	Habitat Score ¹	Bug Rating	Bug Score ²	Station Type ³
1	Anderson Creek	County Line Rd	280411	44.5124	-85.6220	7/16	Excellent	155	Acceptable	1	Tr
2	Little Cannon Creek	downstream Dutch John Rd	400111	44.5364	-85.1369	7/15	Excellent	167	Excellent	6	Tr
3	Manistee River	off Weber Rd	400143	44.6110	-84.9974	8/27	Excellent	165	Excellent	6	Tr
4	Manistee River	off end of Weber Rd	400144	44.6084	-85.0130	8/27	Excellent	177	Excellent	6	Tr
5	Big Cannon Creek	Naples	400114	44.5185	-85.0042	8/28	Excellent	164	Fish Only	NA ⁴	T
6	Slagle Creek	downstream S 1 Rd	830224	44.3275	-85.8193	7/16	Excellent	175	Acceptable	1	Tr
7	Peterson Creek	downstream S 7 Rd	830225	44.2277	-85.7601	8/28	Excellent	157	Acceptable	-3	Tr
8	Poplar Creek	S 15 Rd	830131	44.1738	-85.6782	7/16	Good	141	Acceptable	1	Tr
9	Claybanks Creek	Pine Creek Rd	510277	44.2430	-86.1574	8/28	Good	132	Acceptable	-1	S

¹ **Habitat Scoring** Poor < 56, Marginal 56-104, Good 105-154, Excellent >154

² **Macroinvertebrate Scoring** Poor -9 to -5, Acceptable -4 to 4, Excellent 5-9

³ **Tr**=Trend, **T**= Targeted, **S**= Status

⁴ **NA**= Not available

Station	Stream Name	Road Crossing	STORET	Latitude	Longitude	Date 2019	Habitat Rating	Habitat Score ¹	Bug Rating	Bug Score ²	Station Type ³
10	Bear Creek	13 Mile Rd	510237	44.4282	-86.0453	7/24	Good	142	Acceptable	-1	Tr
11	Bear Creek	Leffew Rd	510233	44.4560	-86.0315	7/18	Excellent	181	Acceptable	2	S
12	Little Manistee River	11-Mile Bridge; upstream Cool Creek	430597	44.1458	-86.0250	7/16	Excellent	157	Excellent	7	Tr
13	Stronach Creek	downstream Java Rd	430619	44.1477	-85.9315	7/24	Excellent	161	Excellent	6	Tr
14	Cool Creek	upstream 12-Mile Rd. East Road Crossing	430638	44.1661	-85.9871	7/17	Good	134	Excellent	7	T
15	Cool Creek	downstream 12-Mile Rd. West Road Crossing	430639	44.1662	-85.9880	7/17	Good	112	Acceptable	3	T
SV ⁵ -1	Cedar Creek	Oravainen Rd	510260	44.3460	-86.0307	7/18	NA	NA	NA	NA	T

⁵ **SV**= Site Visit Only

Little Cannon Creek

Little Cannon Creek was sampled downstream of Dutch John Road (Station 2; Photo 2). The riparian zone was fully intact with only a small unpaved driveway running along one side of the stream. Rootwads, overhanging vegetation, large woody debris (LWD), and gravel were all available for epifaunal substrate.



Photo 2. Little Cannon Creek downstream of Dutch John Road, Kalkaska County, 2019.

Upper Manistee River

The upper portion of the Manistee River (i.e., from headwaters to US-131) was sampled at two stations off Weber Road. The most upstream site (Station 3) had a large amount of aquatic vegetation on the inside bend where the sand and silt had deposited. Except for the remnants of bankside fish habitat best management practices, there was a lack of LWD. The stream flow was fast throughout the reach. Gravel substrate was available on the outside bend and in deeper parts of the stream where flow was highest. Undercut banks were sparse. Station 4 is located just 1.5 miles downstream of Station 3. The flow continued to be fast, but the river was shallower and wider. There was more gravel and cobble available for colonization, and no pools were present. The periphyton growth was more noticeable as well. There continued to be a lack of LWD.



Photo 3. Manistee River off Weber Road. August 2019, Kalksaka County.

Big Cannon Creek

The stream habitat and fish community were both sampled at Big Cannon Creek at Naples Road (Station 5; Photo 4). There were deep deposits of shifting sand especially just upstream of the culvert. No gravel or cobble was available. There was a small amount of LWD and macrophytes. Pools were limited to the undercut banks found at the outside of bends. The fish community met the coldwater fish designated use requirement of at least 1 percent Salmonidae species. Five percent of the taxa found were Salmonidae (brown trout). Other species found are noted in Table 5.



Photo 4. Big Cannon Creek off Naples Road, Kalkaska County, 2019.

Table 5. Qualitative fish sampling results for Big Cannon Creek off Naples Road.

Species	Number Collected
Salmo trutta (Brown trout)	6
Umbra limi (Central mudminnow)	1
Semotilus atromaculatus (Creek chub)	47
Notropis atherinoides (Emerald shiner)	5
Luxilus cornutus (Common shiner)	5
Phoxinus eos (Northern redbelly dace)	5
Rhinichthys atratulus (Blacknose dace)	38
Cottus bairdii (Mottled sculpin)	1
Catostomus commersoni (White sucker)	8
Ameiurus melas (Black bullhead)	4
Total	120

Slagle Creek

Slagle Creek was sampled downstream of S1 Road (Station 6; Photo 5). Epifaunal substrate consisted of gravel mixed with sand and some cobble. There was a large amount of habitat diversity with overhanging vegetation, LWD, and in-stream vegetation including periphyton, filamentous algae, and macrophytes throughout the reach. Vegetation was not at nuisance levels but was denser than what is typically found in a stream of this size in the Manistee River watershed. It is an open sunny area until mid-afternoon.



Photo 5. Slagle Creek at S1 Road, Wexford County, 2019.

Peterson Creek

Peterson Creek was sampled downstream of S7 Road (Station 7; Photo 6**Error! Reference source not found.** and Photo 7). The substrate was dominated by sand and silt mixed with clay that made it slippery. LWD was present but was not available due to silt covering it. Grass was growing in the areas that formerly were sand deposits just upstream of the culvert. The culvert only had ten inches or so of clearance because the water was so high. Trees in the floodplain are dying, at least in part, due to high water levels inundating the riparian flood plain.



Photo 6. Peterson Creek at S7 Road, Wexford County, 2019. Note high water levels.



Photo 7. Peterson Creek at S7 Road, note undersized culvert in relation to stream size.

Poplar Creek

Poplar Creek is a tributary to the Pine River and was sampled at S15 Road (Station 8; Photo 8). Substrate was entirely sand with an abundance of embedded LWD, half of which was covered by sand. Large globular bunches of algae were growing in and stabilizing the sand. The reach had a lot of pool diversity. Undercut banks with overhanging grasses were available for epifaunal substrate. The riparian area was wetland in nature with the right bank being slightly impacted by the road.



Photo 8. Poplar Creek at S15 Road, Wexford County, 2019.

Claybanks Creek

Station 9 (Photo 9 and Photo 10) was on Claybanks Creek at Pine Creek Road. The stream is in a deep ravine. It is apparent that the stream is very flashy and eroding the streambed possibly during snow melt or periods of hard rain. The banks were scoured as high as five feet in places. The stream channel was braided in areas due to the large deposits of gravel and sand. LWD was present; however, much of it had been pushed outside of the channel and therefore was not available for colonization.



Photo 9. Claybanks Creek upstream of Pine Creek Road, Manistee County, 2019.



Photo 10. Sediment deposition in Claybanks Creek upstream of Pine Creek Road, Manistee County, 2019.

Bear Creek

Bear Creek is a tributary to the Manistee River that flows from north to south. The headwaters begin near Bear Lake, located adjacent to US-31, and the confluence with the Manistee River is downstream of Pine Creek. Two stations were sampled in Bear Creek.

Station 10 was sampled in Bear Creek at 13 Mile Road (Photo 11). Shifting sand and silt dominated the substrate at this site with deposits more than 1.5-feet deep in areas. Islands of sand were visible with vegetation growing on the deposits. Some gravel was present at the bottom of some of the pools but was mostly sand. LWD was plentiful and the river was deep and slow throughout the reach.

The most upstream Station 11 (Photo 12) was sampled at Leffew Road where a bridge is no longer in service. Gravel and cobble were available for epifaunal substrate. Some sand deposits from spring and early summer high flows were visible. A large pile of LWD was present. Overhanging alders provided shade for the stream reach. There was good pool variability with LWD, vegetation, and gravel making up the substrate in these pools.



Photo 11. Bear Creek at 13-Mile Road, Manistee County, 2019.



Photo 12. Bear Creek at Leffew Road, Manistee County, 2019.

Little Manistee River

The Little Manistee River was sampled at 11 Mile Road off private property upstream of the confluence of Cool Creek (Station 12; Photo 13). There are many large deep pools with gravel substrates at this station along with a large amount of sand and some silt making up the dominant substrate types.

Elodea sp. and *Vallisneria sp.* aquatic plants were common and globular clumps of algae were also present on the sand bottom.



Photo 13. Little Manistee River at 11-Mile Road, Lake County, 2019.

Stronach Creek

Station 13 (Photo 14) was sampled on Stronach Creek downstream of Java Road. This is a small stream with good perennial flow and a diversity of epifaunal substrate available for macroinvertebrate colonization. There is not much cobble, and as you reach the downstream end of the reach sand is more dominant.



Photo 14. Stronach Creek downstream Java Road, Lake County, 2019.

Cool Creek

Cool Creek was sampled upstream (Station 14) and downstream (Station 15) of 12-Mile Road due to concern regarding livestock access to the stream in-between these two stations. The upstream riffle/run habitat consisted of sand with some fine gravel. The stream was very wide and shallow. Rootwads and LWD were the primary substrates available for macroinvertebrate communities. Course particulate organic matter and leaf packs were also present. The riparian area was a cedar forest floodplain with a second terrace evident on the right side and a steep bank on the left. Trees were leaning in towards the water. We sampled upstream far enough to avoid the influence of the undersized culvert.

The riffle/run habitat at the downstream Station 15 also was dominated by sand with a mix of fine gravel. Sand deposits had emergent vegetation growing on them. The stream also continued to be uniform in width and depth. There were very few pools. There was some cobble placed to form a pool near an old dock. The right-side riparian area was about 100-feet wide and forested before the road could be seen. The left riparian area was similarly forested in a portion, but also had a lawn area for a cabin.

More information regarding these stations will be discussed later in this report.

Goal 2: Evaluate biological integrity temporal trends.

Within the Manistee/Big Sable/Lincoln Watershed Group, six sites were initially randomly-selected for inclusion as statewide trend station(s) to be sampled every five years. Statewide trend information will be summarized in a statewide report.

Five of the six statewide trend sites were in the Manistee River watershed. To understand watershed-specific biological integrity temporal trends, an additional five sites were randomly selected within the Manistee River watershed, bringing the total trend sites to ten (Table 6). These ten sites were monitored in 2009, 2014, and 2019. Trends in macroinvertebrate scores were evaluated using linear mixed models (watershed-wide) as described in the SWAS Procedure 27 (MDEQ, 2015). A significant decrease in macroinvertebrate scores watershed-wide was evident from 2009 to 2019 in the Manistee River watershed ($p = 0.02$).

Trend sites of special interest:

Bear Creek at 13-Mile Road

The macroinvertebrate community score at Bear Creek at 13-Mile Road has dropped at least 5 points since 2009. Contributing to this change in score is a drop in both the number of caddisfly families and percentage of caddisfly individuals found. There were 7 families at 31 percent of the community composition in 2009 and in 2019 there are 5 families making up only 8 percent of the sample. There was also a drop in the number of stonefly families found from 3 in 2009 to 1 in both 2014 and 2019. Both orders are sensitive to habitat degradation and pollution. Conversely, there was an increase in the percentage of amphipods. In 2009 only 16 percent of the community sampled was amphipods, and this increased to over 50 percent in both 2014 and 2019. The habitat rating has not changed significantly. However, sediment deposition at this station has always been evident and could be impacting macroinvertebrate communities.

Anderson Creek

The macroinvertebrate community score at Anderson Creek at County Line Road has dropped at least 6 points since 2009. Contributing to this lower score was that none of the stonefly taxa (which are very sensitive to pollution) were found in 2014 or 2019 compared with 2 families in 2009. Also, the number of caddisfly families (also a sensitive order) decreased from 9 in 2009, to 6 in 2014, to 4 in 2019. Finally in 2009 none of the taxa were overly dominant compared with the higher percentages of *Chironomidae* that were found in 2014 (40 percent) and 2019 (35 percent). The habitat rating has remained stable.

Peterson Creek

The macroinvertebrate community score at Peterson Creek downstream of S7 Road has dropped 10 points since 2009. Lipsey (2016) noted that sand could be seen as far back as 30 feet in the adjacent floodplain area, indicating that a large amount of sand is being deposited on the banks during high flow events. Lipsey (2010) and Lipsey (2016) noted that the road crossing culvert is undersized and this condition continued in 2019. The habitat scores and ratings have increased since 2009 and do not reflect the flooded nature of the stream channel in 2019 as noted above. The stream was visited twice in 2019 and once in 2020 and the flooded nature of the stream remains. It is likely no longer appropriate for Procedure 51.

Table 6. Trend sites and Procedure 51 macroinvertebrate scores for the Manistee River watershed.

Water Body	Location	Year	Score	Rating
Anderson Creek	County Line Road	2009	7	Excellent
Anderson Creek	County Line Road	2014	0	Acceptable
Anderson Creek	County Line Road	2019	1	Acceptable
Bear Creek	13 Mile Road	2009	4	Acceptable
Bear Creek	13 Mile Road	2014	-2	Acceptable
Bear Creek	13 Mile Road	2019	-1	Acceptable
Little Cannon Creek	Dutch John Rd	2009	7	Excellent
Little Cannon Creek	Dutch John Rd	2014	5	Excellent
Little Cannon Creek	Dutch John Rd	2019	6	Excellent
Little Manistee River	11 Mile Bridge	2009	6	Excellent
Little Manistee River	11 Mile Bridge	2014	6	Excellent
Little Manistee River	11 Mile Bridge	2019	7	Excellent
Manistee River	off Weber Road	2009	5	Excellent
Manistee River	off Weber Road	2014	5	Excellent
Manistee River	off Weber Road	2019	5	Excellent
Manistee River	off Weber Road near Sunset Trail	2009	6	Excellent
Manistee River	off Weber Road near Sunset Trail	2014	7	Excellent
Manistee River	off Weber Road near Sunset Trail	2019	5	Excellent
Peterson Creek	downstream S7 Road	2009	7	Excellent
Peterson Creek	downstream S7 Road	2014	7	Excellent
Peterson Creek	downstream S7 Road	2019	-3	Acceptable
Poplar Creek	15 Road	2009	3	Acceptable
Poplar Creek	15 Road	2014	1	Acceptable
Poplar Creek	15 Road	2019	1	Acceptable
Slagle Creek	downstream S1 Road	2009	3	Acceptable
Slagle Creek	downstream S1 Road	2014	5	Excellent
Slagle Creek	downstream S1 Road	2019	1	Acceptable
Stronach Creek	downstream Java Road	2009	6	Excellent
Stronach Creek	downstream Java Road	2014	8	Excellent
Stronach Creek	downstream Java Road	2019	6	Excellent

Goal 3: Satisfy targeted monitoring requests submitted by EGLE staff and external customers and Goal 4: Identify nonpoint sources of water quality pollution

Cool Creek at 12 Mile Road

Cattle have direct access to approximately 300 feet of Cool Creek at 12 Mile Road and stream banks are being trampled causing erosion. The stream has two road crossings at 12-Mile Road. One is upstream of the cattle and one is downstream of the cattle. Both crossings have undersized metal culverts that the stream flows through under the road. This has caused sand that is carried in the water during high flows to settle and build up on the stream bottom. The stream is very uniform in width and depth with few pools. The stream lacks the gravel, cobble, and aquatic plants where many macroinvertebrates prefer to live. There were small areas with large pieces of wood, sticks, and roots that could provide habitat. The macroinvertebrate scored excellent (7) upstream of the cows and acceptable (3) downstream. This change is large enough to suggest the water quality may be worse downstream.

Streambanks trampled by cows standing in a stream were photographed (Photo 15 and Photo 16). Upstream and downstream of the cows, the natural stream banks have cedar trees growing with roots holding the soil in place. The trees shade the stream and keep it cooler. [E. coli sampling](#) was also conducted upstream and downstream of the cattle crossing. *E. coli* is an indicator of pathogens in the water caused by waste from warm-blooded animals including cows. Pathogens can make people sick if the contaminated water is ingested. Results show that *E. coli* concentrations were higher downstream of the cattle and were not meeting WQS and thus are not safe for swimming and wading. Cattle were observed in the stream on more than one occasion in 2019. EGLE staff contacted the [State of Michigan Right to Farm](#) staff, who then visited the site and spoke with the owner. As of October 2020 the landowner has constructed some exclusion fencing so the cows no longer stand in the water but can access some water adjacent to the stream channel. The site should be revisited in 2024 to see if the exclusion fencing remains, and if macroinvertebrate scores and *E. coli* concentrations have improved downstream of the cattle.



Photo 15. Cows standing in Cool Creek at 12 Mile Road.



Photo 16. Impacts of cattle having direct access to Cool Creek at 12 Mile Road. Note the lack of trees, the muddy banks, and widening of stream.

Cedar Creek at Oravainen Road

Cedar Creek at Oravainen Road was revisited in 2019 due to observations in 2009 and 2014 of stream bank failure (Photos 17-22). It appears that construction of a pond that discharges to Cedar Creek via an overflow pipe connection has led to this issue that continues at this site. Efforts to work with the landowner to fix the problem would be beneficial to reduce sediment getting into the stream.



Photo 17. 2019 view from berm/stream bank.



Photo 19. 2009 view from stream. Overflow tile from pond.



Photo 18. 2014 view from berm/stream bank.



Photo 20. 2014 view from stream. Berm/streambank failing.

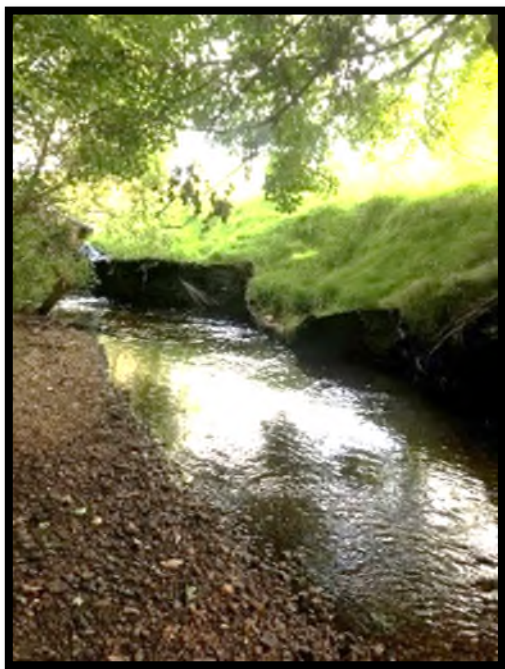


Photo 21. 2019 view of efforts to save berm/stream.



Photo 22. 2019 view from stream. Berm/stream bank is failing.

Anderson Creek at County Line Road

This station has been sampled in 2009, 2014, and 2019. The road crossing seems to be a cement slab that is within inches of the surface of the stream. Lipsey (2010 and 2016) noted that the bridge crossing at this station looks to be extremely old and if there was a flood event, it seems a large amount of sediment could potentially enter the water body (Photo 23). The macroinvertebrate community was rated excellent (7) in 2009, but only acceptable in 2014 and 2019 (0 and 1, respectively). Habitat conditions have remained stable. This location would be a good opportunity for a road crossing improvement project.



Photo 23. The County Line Road crossing at Anderson Creek, July 2019.

Big Cannon Creek at Naples Road

Naples Road consists of very loose sand that has been disturbed repeatedly by off road vehicles. Sand is pushed into the creek at the culvert crossing. Shifting sand more than a foot deep in places was observed in the stream. This station would be a good opportunity for a road crossing improvement project and possibly restrictions regarding vehicle use. The stream otherwise has very natural habitat.

This station was a targeted monitoring station for fish to determine if the coldwater fisheries designated use is being met. The percentage of trout and salmon species collected was 5 percent and thus meets the 1 percent needed for the coldwater fisheries designated use. Macroinvertebrates were not collected in 2019 but are expected to be acceptable or excellent.

Slagle Creek downstream of S1 Road

Slagle Creek has substrate consisting of gravel mixed with sand and some cobble. There was a large amount of habitat for macroinvertebrates including cobble, overhanging vegetation, and wood. Abundant aquatic plants included attached algae, filamentous algae, and Elodea species. The site is located in an open sunny area. Vegetation was not at nuisance levels but more than usually found in a stream of this size in the Manistee River watershed. The macroinvertebrate community was rated acceptable (3) in 2009, excellent (5) in 2014, and acceptable (1) in 2019. For the quality of the habitat at this station, a score of 1 is lower than would be expected.

Upstream of this station are both a private and a state fish hatchery that are permitted to discharge to the stream. Slagle Creek is meeting designated uses (Goodwin et al., 2016; Schmitt, 2015). To understand more clearly if the hatchery discharges are impacting water quality, a more in-depth sampling method with repeat sampling over a longer period may be more informative. However, it would not change designated use attainment determination.

Peterson Creek at S7 Road

The substrate at this station was very silty and slippery. A large amount of wood was present but not suitable for macroinvertebrates due to the silt covering it. Grasses were growing out of the sand deposits that have been observed downstream of the culvert since 2009.

Macroinvertebrates were rated at the lower end of acceptable (-3). Previous years indicated an excellent (7) macroinvertebrate community. Sampling this station was difficult due to the high water levels, but a drop of 8 points is concerning. Sampling should be repeated during a year with lower flows to see if conditions remain. This road crossing should be considered for culvert replacement with an open bottom bridge (Photo 6 and Photo 7).

Claybanks Creek at Pine Creek Road

Claybanks Creek at Pine Creek Road flows through a deep ravine. The sediment deposition in the channel was so extensive that the channel becomes braided in places (Photo 24, Photo 25, and Photo 26). Banks are eroded more than 5 feet above the water surface (Photo 27). The bottom substrate was sand and gravel mixed with a small amount of cobble. There was a lot of wood but much of it was not in the water and thus not available to biological communities. The

culvert at the road crossing is much too small and is perched several feet above the surface of the water on the downstream side of Pine Creek Road. This prevents fish from being able to swim upstream. Additional sediment deposits could be viewed further downstream of the road crossing (Photo 28) The United States Forest Service has completed some surveys of the site and are working with partners to find money to replace the culvert. The macroinvertebrate community was at the lower end of acceptable (-1).



Photo 24. Claybanks Creek upstream of Pine Creek Road, August 2019.



Photo 26. Claybanks Creek upstream of Pine Creek Road, August 2019.



Photo 25. Claybanks Creek upstream of Pine Creek Road, August 2019.



Photo 27. Claybanks Creek downstream of Pine Creek Road, August 2019. Image is a perched culvert.



Photo 28. Claybanks Creek downstream of Pine Creek Road, August 2019.

SUMMARY OF RECOMMENDATIONS

1. *E. coli* concentrations in Cool Creek downstream of 12 Mile Road exceeded WQS, most likely due to cattle having direct access to the stream just upstream of the road crossing. Macroinvertebrates in the same location are acceptable but degraded compared to upstream of the cattle. Cattle exclusion fencing was constructed in October 2020. This site should be revisited in 2024 to see if cattle exclusion fencing remains in place, and if macroinvertebrate scores improve.
2. Severe stream bank erosion continues in Cedar Creek off Oravainen Road due to a pond overflow pipe. Efforts to work with the landowner to fix the problem would be beneficial to reduce sediment getting into the stream.
3. The road crossing of Anderson Creek at County Line Road should be replaced. The macroinvertebrate community rating, while acceptable, has dropped 6 points since 2009.
4. The Naples Road crossing of Big Cannon Creek consists of very loose sand that has been disturbed repeatedly by off-road vehicles and is being pushed into the stream. This station would be a good opportunity for a road crossing improvement project and possibly restrictions regarding vehicle use.
5. Peterson Creek at S7 Road is experiencing very high water levels compared to past years. Sampling should be repeated during a year with lower flows to see if conditions remain. This road crossing should be considered for culvert replacement with an open bottom bridge.
6. The culvert for Claybanks Creek at Pine Creek Road is much too small and is perched several feet, preventing fish from being able to swim upstream. The United States Forest Service has completed some surveys of the site and are working with partners to find money to replace the culvert. If a replacement occurs, habitat and macroinvertebrate community surveys could be repeated to see if scores improve.

CREDITS

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Table 7. Habitat evaluations for Anderson and Little Cannon Creek and the Manistee River in Grand Traverse and Kalkaska County, July and August 2019.⁶

	Station 1 Anderson Creek at County Line Road	Station 2 Little Cannon Creek at Dutch John Road	Station 3 Manistee River at Weber Road/Sunset Trail	Station 4 Manistee River at end of Weber Rd.
Date	7/16/2019	7/15/2019	8/27/2019	8/27/2019
HABITAT METRICS	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL	GLIDE/POOL
Substrate and Instream Cover				
Epifaunal Substrate/ Available Cover (20)	13	17	15	15
Embeddedness (20) ⁷		11		
Velocity/Depth Regime (20) ⁷		13		
Pool Substrate Characterization (20) ⁸	10		17	18
Pool Variability (20) ⁸	15		13	15
Channel Morphology				
Sediment Deposition (20)	10	15	14	17
Flow Status -Maintenance Flow Volume (10)	10	10	10	10
Flow Status -Flashiness (10)	9	10	10	10
Channel Alteration (20)	18	18	18	20
Frequency of Riffles/Bends (20) ⁷		15		
Channel Sinuosity (20) ⁸	10		19	18
Riparian and Bank Structure				
Bank Stability (L) (10)	10	10	10	10
Bank Stability (R) (10)	10	9	8	9
Vegetative Protection (L) (10)	10	10	9	10
Vegetative Protection (R) (10)	10	10	7	8
Riparian Vegetative Zone Width (L) (10)	10	10	10	10
Riparian Vegetative Zone Width (R) (10)	10	9	5	7
TOTAL SCORE (200):	155	167	165	177
HABITAT RATING:	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT
Weather:	sunny	rainy	partly cloudy	partly cloudy
Air Temperature: °F	76	65	70	70
Water Temperature: °F	70	56	62	61
Average Stream Width: Feet	22.7	29	63.3	74.5
Average Stream Depth: Feet	NA	NA	2.7	1.94
Surface Velocity: Feet/Second	0.8	1.7	2	3
Estimated Flow: Cubic Feet/Second	22.7	60.9	352	474
Stream Modifications:	none	none	none	none
Nuisance Plants (Yes/No):	No	No	Yes	Yes
STORET No.:	280411	400111	400143	400144
County Code:	28	40	40	40
Town Range Section:	25N11W34	25N07W27	26N06W35	26N06W34
Latitude (dd):	44.51235	44.53646	44.611	44.60839
Longitude (dd):	-85.62202	-85.13686	-84.99744	-85.01299
Ecoregion:	NCHF	NLAF	NLAF	NLAF

⁶ Note that individual metrics may better describe conditions directly affecting the biological community while the habitat rating describes the general riverine environment at the site(s).

⁷ Applies only to Riffle/Run stream surveys.

⁸ Applies only to Glide/Pool stream surveys.

Table 8. Qualitative macroinvertebrate community sampling results for Anderson and Cannon Creeks and the Manistee River in Grand Traverse and Kalkaska County, July and August 2019.

	Station 1 Anderson Creek at County Line Road	Station 2 Little Cannon Creek at Dutch John Road	Station 3 Manistee River at Weber Road/Sunset Trail	Station 4 Manistee River at end of Weber Rd.
Taxa	7/16/2019	7/15/2019	8/27/2019	8/27/2019
PORIFERA (sponges)	1			
PLATYHELMINTHES (flatworms)				
Turbellaria	1			1
NEMATOMORPHA (roundworms)				
BRYOZOA (moss animals)				
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	1		0
Oligochaeta (worms)	12	14	3	6
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	9	14	7	2
Decapoda (crayfish)	7	1	1	1
Isopoda (sowbugs)		1	15	2
Arachnoidea				
Hydracarina	2	1	9	3
Insecta				
Ephemeroptera (mayflies)				
Ametropodidae				
Baetiscidae	1		6	8
Baetidae	1	4	70	18
Caenidae	11		1	0
Ephemerellidae		5	5	0
Ephemeridae	1	2	2	1
Heptageniidae	2	4	1	4
Isonychiidae		1		0
Leptophlebiidae			2	1
Metretopodidae				
Oligoneuridae				
Polymitarcyidae				
Potamanthidae				
Siphonuridae				
Tricorythidae		5	2	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	11	1		6
Cordulegastridae		1		
Corduliidae				
Gomphidae	16	1	1	1

	Station 1 Anderson Creek at County Line Road	Station 2 Little Cannon Creek at Dutch John Road	Station 3 Manistee River at Weber Road/Sunset Trail	Station 4 Manistee River at end of Weber Rd.
Taxa	7/16/2019	7/15/2019	8/27/2019	8/27/2019
Libellulidae				
Macromiidae				
Zygoptera (damselflies)				
Calopterygidae	9	1	1	10
Coenagrionidae	3			
Lestidae				
Plecoptera (stoneflies)				
Capniidae				0
Chloroperlidae				
Leuctridae				
Nemouridae		1		
Peltoperlidae				
Perlidae		1		1
Perlodidae			6	
Pteronarcyidae		1	1	
Taeniopterygidae				
Hemiptera (true bugs)				
Belostomatidae				
Corixidae				36
Gelastocoridae				0
Gerridae		1		1
Mesoveliidae				1
Naucoridae				
Nepidae				
Notonectidae				
Pleidae				
Saldidae				
Veliidae	1	1		
Megaloptera				
Corydalidae (dobson flies)	1	1		
Sialidae (alder flies)			1	1
Neuroptera (spongilla flies)				
Sisyridae				
Trichoptera (caddisflies)				0
Brachycentridae	5	12	15	82
Glossosomatidae		1		0
Helicopsychidae		1		6
Hydropsychidae	4	223	27	52
Hydroptilidae			0	
Lepidostomatidae		1	21	5
Leptoceridae	45	1	8	8

	Station 1 Anderson Creek at County Line Road	Station 2 Little Cannon Creek at Dutch John Road	Station 3 Manistee River at Weber Road/Sunset Trail	Station 4 Manistee River at end of Weber Rd.
Taxa	7/16/2019	7/15/2019	8/27/2019	8/27/2019
Limnephilidae				0
Molannidae	3			1
Odontoceridae				
Philopotamidae		2		
Phryganeidae				
Polycentropodidae			3	8
Psychomyiidae				
Rhyacophilidae		1		
Sericostomatidae				
Uenoidae				
Lepidoptera (moths)				
Noctuidae				
Pyalidae				
Coleoptera (beetles)				
Chrysomelidae (adults)				
Curculionidae (adults)				
Dytiscidae (total)				
Gyrinidae (adults)		1		
Halplidae (adults)				
Heteroceridae (total)				
Hydraenidae (total)				
Hydrophilidae (total)			1	
Lampyridae (adults)				
Limnichidae (adults)				
Noteridae (adults)				
Psephenidae (adults)				
Ptilodactylidae (adults)				
Scirtidae (adults)				
Chrysomelidae (larvae)				
Curculionidae (larvae)				
Dryopidae				
Elmidae	10	7	2	7
Gyrinidae (larvae)	2			
Halplidae (larvae)				
Lampyridae (larvae)				
Limnichidae (larvae)				
Noteridae (larvae)				
Psephenidae (larvae)				
Ptilodactylidae (larvae)				
Scirtidae (larvae)				
Diptera (flies)				

Taxa	Station 1 Anderson Creek at County Line Road	Station 2 Little Cannon Creek at Dutch John Road	Station 3 Manistee River at Weber Road/Sunset Trail	Station 4 Manistee River at end of Weber Rd.
	7/16/2019	7/15/2019	8/27/2019	8/27/2019
Athericidae			7	3
Ceratopogonidae	1		2	
Chaoboridae				
Chironomidae	89	30	40	26
Culicidae				
Dixidae				
Dolichopodidae				
Empididae				
Ephydriidae				
Muscidae				
Psychodidae				
Ptychopteridae				
Sciomyzidae				
Simuliidae		8	47	5
Stratiomyidae				
Syrphidae				
Tabanidae		1	4	
Thaumaleidae				
Tipulidae				
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1			
Bithyniidae				
Hydrobiidae				2
Lymnaeidae				
Physidae			6	7
Planorbidae	1			
Pleuroceridae		1		
Pomatiopsidae				
Valvatidae				
Viviparidae				
Pelecypoda (bivalves)				
Corbiculidae				
Dreissenidae				
Pisidiidae	6	3		2
Sphaeriidae (clams)				
Unionidae (mussels)	1			
Uenoidae				
Total Individuals	257	356	317	318

Table 9. Macroinvertebrate metric evaluation for Anderson and Little Cannon Creeks and the Manistee River in Grand Traverse and Kalkaska County, July and August 2019.

METRIC	Station 1 Anderson Creek at County Line Road		Station 2 Little Cannon Creek at Dutch John Road		Station 3 Manistee River at Weber Road/Sunset Trail		Station 4 Manistee River at end of Weber Road	
	7/16/2019		7/15/2019		8/27/2019		8/27/2019	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	29	1	37	1	124	1	124	1
NUMBER OF MAYFLY TAXA	5	1	6	1	15	1	15	1
NUMBER OF CADDISFLY TAXA	4	0	8	1	17	1	17	1
NUMBER OF STONEFLY TAXA	0	-1	3	1	9	1	9	1
PERCENT MAYFLY COMPOSITION	6.23	-1	5.90	0	28.08	1	10.06	0
PERCENT CADDISFLY COMPOSTITION	22.18	0	67.98	1	23.34	0	50.94	1
PERCENT DOMINANT TAXON	34.63	0	62.64	-1	22.08	0	25.79	0
PERCENT ISOPOD, SNAIL, LEECH	1.17	0	0.84	1	6.62	0	3.46	1
PERCENT SURFACE AIR BREATHERS	0.39	1	0.84	1	0.32	1	11.95	0
TOTAL SCORE		1		6		6		6
MACROINVERTEBRATE COMMUNITY RATING	Acceptable		Excellent		Excellent		Excellent	

Table 10. Habitat evaluations for Big Cannon, Slagle, Peterson, and Poplar Creeks in Kalkaska and Wexford Counties, July and August 2019.⁶

	Station 5 Big Cannon Creek at Naples Road	Station 6 Slagle Creek downstream of S1 Road	Station 7 Peterson Creek downstream of S7 Road	Station 8 Poplar Creek at S15 Road
Date	8/28/2019	7/16/2019	8/28/2019	7/16/2019
HABITAT METRICS	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL	GLIDE/POOL
Substrate and Instream Cover				
Epifaunal Substrate/ Available Cover (20)	11	18	9	8
Embeddedness (20) ⁷		11		
Velocity/Depth Regime (20) ⁷		18		
Pool Substrate Characterization (20) ⁸	20		9	6
Pool Variability (20) ⁸	18		11	15
Channel Morphology				
Sediment Deposition (20)	10	14	16	7
Flow Status -Maintenance Flow Volume (10)	10	10	10	10
Flow Status -Flashiness (10)	9	10	10	10
Channel Alteration (20)	17	18	18	18
Frequency of Riffles/Bends (20) ⁷		18		
Channel Sinuosity (20) ⁸	20		20	12
Riparian and Bank Structure				
Bank Stability (L) (10)	9	9	9	10
Bank Stability (R) (10)	8	10	9	10
Vegetative Protection (L) (10)	8	9	8	7
Vegetative Protection (R) (10)	8	10	8	9
Riparian Vegetative Zone Width (L) (10)	10	10	10	10
Riparian Vegetative Zone Width (R) (10)	6	10	10	9
TOTAL SCORE (200):	164	175	157	141
HABITAT RATING:	EXCELLENT	EXCELLENT	EXCELLENT	GOOD
Weather:	partly cloudy	sunny	cloudy	sunny
Air Temperature: °F	60	84	60	86
Water Temperature: °F	65	56	56	56
Average Stream Width: Feet	14	29.7	9.3	15
Average Stream Depth: Feet	NA	NA	NA	
Surface Velocity: Feet/Second	NA	4.7	0.46	1.581196581
Estimated Flow: Cubic Feet/Second	NA	128.3	NA	23.59848053
Stream Modifications:	none	none	none	none
Nuisance Plants (Yes/No):	No	No	No	N
STORET No.:	400114	830224	830225	830131
County Code:	40	83	83	83
Town Range Section:	25N06W21	22N12W06	21N12W10	21N11W32
Latitude (dd):	44.55174	44.327457	44.22769	44.17384
Longitude (dd):	-85.04477	-85.819301	-85.76011	-85.67823
Ecoregion:	NLAF	NLAF	NLAF	NLAF

Table 11. Qualitative macroinvertebrate community sampling results for Big Cannon, Slagle, Peterson, and Poplar Creeks in Kalkaska and Wexford Counties, July and August 2019.

	Station 5 Big Cannon at Naples Road	Station 6 Slagle Creek downstream of S1 Road	Station 7 Peterson Creek downstream of S7 Road	Station 8 Poplar Creek at S15 Road
Taxa	Fish only	7/16/2019	8/28/2019	7/16/2019
PORIFERA (sponges)				
PLATYHELMINTHES (flatworms)				
Turbellaria				
NEMATOMORPHA (roundworms)				
BRYOZOA (moss animals)				
ANNELIDA (segmented worms)				
Hirudinea (leeches)				
Oligochaeta (worms)		62	14	9
ARTHROPODA				
Crustacea				
Amphipoda (scuds)		15	1	23
Decapoda (crayfish)				
Isopoda (sowbugs)		2		1
Arachnoidea				
Hydracarina		4	1	16
Insecta				
Ephemeroptera (mayflies)				
Ametropodidae				
Baetiscidae				
Baetidae		42	28	6
Caenidae				
Ephemerellidae		13		2
Ephemeridae			2	1
Heptageniidae			1	
Isonychiidae				
Leptophlebiidae			5	
Metretopodidae				
Oligoneuriidae				
Polymitarcyidae				
Potamanthidae				
Siphonuridae				
Tricorythidae				
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	
Cordulegastridae			1	
Corduliidae				
Gomphidae			1	
Libellulidae				
Macromiidae				

	Station 5 Big Cannon at Naples Road	Station 6 Slagle Creek downstream of S1 Road	Station 7 Peterson Creek downstream of S7 Road	Station 8 Poplar Creek at S15 Road
Taxa	Fish only	7/16/2019	8/28/2019	7/16/2019
Zygoptera (damselflies)				
Calopterygidae			1	
Coenagrionidae				
Lestidae				
Plecoptera (stoneflies)				
Capniidae				
Chloroperlidae				
Leuctridae				
Nemouridae		2		1
Peltoperlidae				
Perlidae				
Perlodidae				
Pteronarcyidae				
Taeniopterygidae				
Hemiptera (true bugs)				
Belostomatidae				
Corixidae			1	
Gelastocoridae				
Gerridae				1
Mesoveliidae				
Naucoridae				
Nepidae				
Notonectidae				
Pleidae				
Saldidae				
Veliidae				
Megaloptera				
Corydalidae (dobson flies)				
Sialidae (alder flies)				
Neuroptera (spongilla flies)				
Sisyridae				
Trichoptera (caddisflies)				
Brachycentridae		8		2
Glossosomatidae		1		
Helicopsychidae				
Hydropsychidae		2		1
Hydroptilidae				
Lepidostomatidae		5		1
Leptoceridae		1		
Limnephilidae		11	1	8
Molannidae		1		
Odontoceridae				
Philopotamidae		4		

	Station 5 Big Cannon at Naples Road	Station 6 Slagle Creek downstream of S1 Road	Station 7 Peterson Creek downstream of S7 Road	Station 8 Poplar Creek at S15 Road
Taxa	Fish only	7/16/2019	8/28/2019	7/16/2019
Phryganeidae				
Polycentropodidae				
Psychomyiidae				
Rhyacophilidae				
Sericostomatidae				
Uenoidae				
Lepidoptera (moths)				
Noctuidae				
Pyrilidae				
Coleoptera (beetles)				
Chrysomelidae (adults)				
Curculionidae (adults)				
Dytiscidae (total)				1
Gyrinidae (adults)			1	1
Halipidae (adults)			1	1
Heteroceridae (total)				
Hydraenidae (total)				
Hydrophilidae (total)			1	
Lampyridae (adults)				
Limnichidae (adults)				
Noteridae (adults)				
Psephenidae (adults)				
Ptilodactylidae (adults)				
Scirtidae (adults)				
Chrysomelidae (larvae)				
Curculionidae (larvae)				
Dryopidae				
Elmidae		3		
Gyrinidae (larvae)				
Halipidae (larvae)				
Lampyridae (larvae)				
Limnichidae (larvae)				
Noteridae (larvae)				
Psephenidae (larvae)				
Ptilodactylidae (larvae)				
Scirtidae (larvae)				
Diptera (flies)				
Athericidae				
Ceratopogonidae			8	3
Chaoboridae				
Chironomidae		125	282	203
Culicidae				
Dixidae		1		

Taxa	Station 5 Big Cannon at Naples Road	Station 6 Slagle Creek downstream of S1 Road	Station 7 Peterson Creek downstream of S7 Road	Station 8 Poplar Creek at S15 Road
	Fish only	7/16/2019	8/28/2019	7/16/2019
Dolichopodidae				
Empididae				
Ephydriidae				
Muscidae				
Psychodidae				
Ptychopteridae				
Sciomyzidae				
Simuliidae		72		5
Stratiomyidae				
Syrphidae				
Tabanidae		1		
Thaumaleidae				
Tipulidae		1		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				
Bithyniidae				
Hydrobiidae				
Lymnaeidae				
Physidae		4	100	
Planorbidae				1
Pleuroceridae				
Pomatiopsidae				
Valvatidae				
Viviparidae				
Pelecypoda (bivalves)				
Corbiculidae				
Dreissenidae				
Pisidiidae		6	1	
Sphaeriidae (clams)				
Unionidae (mussels)				
Uenoidae				
Total Individuals		387	452	288

Table 12. Macroinvertebrate metric evaluations for the for Big Cannon, Slagle, Peterson, and Poplar Creeks in Kalkaska and Wexford Counties, July and August 2019.

METRIC	Big Cannon at Naples Road		Station 6 Slagle Creek downstream of S1 Road		Station 7 Peterson Creek downstream of S7 Road		Station 8 Poplar Creek at S15 Road	
	Fish Only		7/16/2019		8/28/2019		7/16/2019	
	Value	Score	Value	Score	Value	Score	Value	Score

TOTAL NUMBER OF TAXA			24	0	20	0	21	0
NUMBER OF MAYFLY TAXA			2	-1	4	1	3	0
NUMBER OF CADDISFLY TAXA			8	1	1	-1	4	0
NUMBER OF STONEFLY TAXA			1	0	0	-1	1	0
PERCENT MAYFLY COMPOSITION			14.21	0	7.96	0	3.13	0
PERCENT CADDISFLY COMPOSTITION			8.53	0	0.22	-1	4.17	0
PERCENT DOMINANT TAXON			32.30	-1	62.39	-1	70.49	-1
PERCENT ISOPOD, SNAIL, LEECH			1.55	1	22.12	-1	0.69	1
PERCENT SURFACE AIR BREATHERS			0.00	1	0.88	1	1.39	1
TOTAL SCORE				1		-3		1
MACROINVERTEBRATE COMMUNITY RATING			Acceptable		Acceptable		Acceptable	

Table 13. Habitat evaluations for Claybanks and Bear Creeks and the Little Manistee River, Manistee and Lake Counties, July and August 2019.⁶

	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek downstream of Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
Date	8/28/2019	7/14/2019	7/18/2019	7/16/2019
HABITAT METRICS	RIFFLE/RUN	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL
Substrate and Instream Cover				
Epifaunal Substrate/ Available Cover (20)	7	14	17	10
Epifaunal Substrate/ Available Cover (20)	15		16	
Embeddedness (20) ⁷	11		18	
Velocity/Depth Regime (20) ⁷		11		15
Pool Substrate Characterization (20) ⁸		15		14
Pool Variability (20) ⁸				
Channel Morphology	3	8	14	10
Sediment Deposition (20)	4	10	10	10
Flow Status -Maintenance Flow Volume (10)	6	9	10	10
Flow Status -Flashiness (10)	18	16	19	20
Channel Alteration (20)	19		19	
Frequency of Riffles/Bends (20) ⁷		11		20
Riparian and Bank Structure				
Bank Stability (L) (10)	5	8	10	6
Bank Stability (R) (10)	8	7	10	10
Vegetative Protection (L) (10)	8	8	9	7
Vegetative Protection (R) (10)	8	9	9	10
Riparian Vegetative Zone Width (L) (10)	10	7	10	5
Riparian Vegetative Zone Width (R) (10)	10	9	10	10
TOTAL SCORE (200):	132	142	181	157
HABITAT RATING:	GOOD	GOOD	EXCELLENT	EXCELLENT
Weather:	cloudy	cloudy	sunny	sunny
Air Temperature: °F	67	80	89	60
Water Temperature: °F	57	68	NA	60
Average Stream Width: Feet	11.7	45.7	25.6	35.7
Average Stream Depth: Feet	NA	NA	NA	NA
Surface Velocity: Feet/Second	1.0	1.1	2.3	2.6
Estimated Flow: Cubic Feet/Second	1.5	81.0	68.8	224.7
Stream Modifications:	none	canopy removal	none	none
Nuisance Plants (Yes/No):	No	No	No	No
STORET No.:	510277	510237	510233	430597
County Code:	51	51	51	43
Town Range Section:	21N15W8	24N14W31	24N14W29	20N14W07
Latitude (dd):	44.24301	44.42838	44.45604	44.14515
Longitude (dd):	-86.15744	-86.04512	-86.03154	-86.0238
Ecoregion:	NLAF	NCHF	NCHF	NLAF

Table 14. Qualitative macroinvertebrate community sampling results for Claybanks and Bear Creeks and the Little Manistee River, Manistee and Lake Counties, July and August 2019.

	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek downstream of Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
Taxa	8/28/2019	7/14/2019	7/18/2019	7/16/2019
PORIFERA (sponges)				
PLATYHELMINTHES (flatworms)				
Turbellaria				
NEMATOMORPHA (roundworms)				
BRYOZOA (moss animals)				
ANNELIDA (segmented worms)				
Hirudinea (leeches)				
Oligochaeta (worms)	1	1	1	20
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	26	150	110	10
Decapoda (crayfish)		1		5
Isopoda (sowbugs)	15	16	15	1
Arachnoidea				
Hydracarina	1			7
Insecta				
Ephemeroptera (mayflies)				
Ametropodidae			11	
Baetiscidae			20	
Baetidae	14	10	6	19
Caenidae				21
Ephemerellidae		4		20
Ephemeridae		2		
Heptageniidae	5	4		4
Isonychiidae				
Leptophlebiidae				
Metretopodidae				
Oligoneuriidae				
Polymitarcyidae				
Potamanthidae				
Siphonuridae				
Tricorythidae		27	46	12
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	7	1	2	1
Cordulegastridae	1			
Corduliidae				
Gomphidae		1	1	2
Libellulidae				
Macromiidae				

	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek downstream of Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
Taxa	8/28/2019	7/14/2019	7/18/2019	7/16/2019
Zygoptera (damselflies)				
Calopterygidae	6	3	24	9
Coenagrionidae				
Lestidae				
Plecoptera (stoneflies)				
Capniidae				
Chloroperlidae				
Goeridae		1	19	
Leuctridae				
Nemouridae				
Peltoperlidae				
Perlidae		1	1	7
Perlodidae	7			2
Pteronarcyidae				9
Taeniopterygidae				
Hemiptera (true bugs)				
Belostomatidae				
Corixidae				
Gelastocoridae				
Gerridae			1	
Mesoveliidae				
Naucoridae				
Nepidae				
Notonectidae				
Pleidae				
Saldidae				
Veliidae		2		
Megaloptera				
Corydalidae (dobson flies)	12		2	1
Sialidae (alder flies)				
Neuroptera (spongilla flies)				
Sisyridae				
Trichoptera (caddisflies)				
Brachycentridae	1	3	14	2
Glossosomatidae				
Helicopsychidae			2	
Hydropsychidae	7	10	87	6
Hydroptilidae				
Lepidostomatidae			1	1
Leptoceridae		7	2	14
Limnephilidae	1	1		1
Molannidae				
Odontoceridae				

	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek downstream of Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
Taxa	8/28/2019	7/14/2019	7/18/2019	7/16/2019
Philopotamidae	3		9	
Phryganeidae				
Polycentropodidae				
Psychomyiidae				
Rhyacophilidae				
Sericostomatidae				
Uenoidae				
Lepidoptera (moths)				
Noctuidae				
Pyrilidae				
Coleoptera (beetles)				
Chrysomelidae (adults)				
Curculionidae (adults)				
Dytiscidae (total)			1	
Gyrinidae (adults)			1	
Haliplidae (adults)				
Heteroceridae (total)				
Hydraenidae (total)				
Hydrophilidae (total)		1	1	1
Lampyridae (adults)				
Limnichidae (adults)				
Noteridae (adults)				
Psephenidae (adults)				
Ptilodactylidae (adults)				
Scirtidae (adults)				
Chrysomelidae (larvae)				
Curculionidae (larvae)				
Dryopidae				
Elmidae	4	1	21	
Gyrinidae (larvae)				
Haliplidae (larvae)				
Lampyridae (larvae)				
Limnichidae (larvae)				
Noteridae (larvae)				
Psephenidae (larvae)				
Ptilodactylidae (larvae)				
Scirtidae (larvae)				
Diptera (flies)				
Athericidae	8	1	8	2
Ceratopogonidae		1		
Chaoboridae				
Chironomidae	61	10	16	40
Culicidae				

Taxa	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek downstream of Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
	8/28/2019	7/14/2019	7/18/2019	7/16/2019
Dixidae	1			
Dolichopodidae				
Empididae				
Ephydriidae				
Muscidae				
Psychodidae				
Ptychopteridae				
Sciomyzidae				
Simuliidae	13	2	8	42
Stratiomyidae				
Syrphidae				
Tabanidae	3	2	2	1
Thaumaleidae				
Tipulidae	2		1	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Bithyniidae				
Hydrobiidae				
Lymnaeidae				2
Physidae	6	2	2	2
Planorbidae				
Pleuroceridae				
Pomatiopsidae				
Valvatidae				
Viviparidae				
Pelecypoda (bivalves)				
Corbiculidae				
Dreissenidae				
Pisidiidae		2	1	12
Sphaeriidae (clams)				
Unionidae (mussels)				
Uenoidae				
Total Individuals	265	267	439	276

Table 15. Macroinvertebrate metric evaluations for Claybanks and Bear Creeks and the Little Manistee River, Manistee and Lake Counties, July and August 2019.

METRIC	Station 9 Claybanks Creek at Pine Creek Road	Station 10 Bear Creek at 13-Mile Road	Station 11 Bear Creek at Leffew Road	Station 12 Little Manistee River at 11-Mile Bridge
	8/28/2019	7/14/2019	7/18/2019	7/16/2019

	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	28	1	33	1	30	1
NUMBER OF MAYFLY TAXA	2	-1	5	1	4	0	5	1
NUMBER OF CADDISFLY TAXA	4	0	5	0	7	1	5	0
NUMBER OF STONEFLY TAXA	1	0	1	0	1	0	3	1
PERCENT MAYFLY COMPOSITION	7.17	0	17.60	0	18.91	0	27.54	1
PERCENT CADDISFLY COMPOSITION	4.53	0	8.24	-1	30.52	0	8.70	0
PERCENT DOMINANT TAXON	32.45	-1	56.18	-1	25.06	0	15.22	1
PERCENT ISOPOD, SNAIL, LEECH	7.92	0	6.74	-1	4.10	-1	1.81	1
PERCENT SURFACE AIR BREATHERS	0.00	1	1.12	0	0.91	1	0.36	1
TOTAL SCORE		-1		-1		2		7
MACROINVERTEBRATE COMMUNITY RATING	Acceptable		Acceptable		Acceptable		Excellent	

Table 16. Habitat evaluations for Stronach Creek and Cool Creek in Lake and Manistee Counties, July and August 2019.

		Station 14 Cool Creek upstream 12-Mile East Road Crossing	Station 15 Cool Creek downstream 12-Mile West Road Crossing
	Station 13 Stronach Creek downstream of Java Road		
Date	7/24/2019	7/17/2019	7/17/2019
HABITAT METRICS	RIFFLE/RUN	GLIDE/POOL	GLIDE/POOL
Substrate and Instream Cover			
Epifaunal Substrate/ Available Cover (20)	15	8	11
Embeddedness (20) ⁷	15		
Velocity/Depth Regime (20) ⁷	15		
Pool Substrate Characterization (20) ⁸		10	7
Pool Variability (20) ⁸		8	2
Channel Morphology			
Sediment Deposition (20)	13	6	6
Flow Status -Maintenance Flow Volume (10)	10	10	5
Flow Status -Flashiness (10)	10	10	10
Channel Alteration (20)	19	19	16
Frequency of Riffles/Bends (20) ⁷	14		
Channel Sinuosity (20) ⁷		12	11
Riparian and Bank Structure			
Bank Stability (L) (10)	9	9	9
Bank Stability (R) (10)	9	8	9
Vegetative Protection (L) (10)	9	8	5
Vegetative Protection (R) (10)	7	8	8
Riparian Vegetative Zone Width (L) (10)	9	10	6
Riparian Vegetative Zone Width (R) (10)	7	8	7
TOTAL SCORE (200):	161	134	112
HABITAT RATING:	Excellent	GOOD	GOOD
Weather:	sunny	sunny	sunny
Air Temperature: °F	75	85	83
Water Temperature: °F	60	78	NA
Average Stream Width: Feet	6.4	29.7	31.3
Average Stream Depth: Feet		NA	NA
Surface Velocity: Feet/Second	1.228354978	1.1	1.2
Estimated Flow: Cubic Feet/Second	3.764225589	21.5	27.6
Stream Modifications:	Canopy removal	none	canopy removal
Nuisance Plants (Yes/No):	No	No	No
STORET No.:	430619	430638	430639
County Code:	43	43	43
Town Range Section:	20N14W01	20N14W4	21N14W34
Latitude (dd):	44.14772	44.166127	44.166216
Longitude (dd):	-85.93149	-85.987055	-85.988026
Ecoregion:	NLAF	NLAF	NLAF

Table 17. Qualitative macroinvertebrate community sampling results for Stronach and Cool Creeks in Lake and Manistee Counties, July and August 2019.

	Station 13 Stronach Creek downstream of Java Road	Station 14 Cool Creek upstream 12-Mile East Road Crossing	Station 15 Cool Creek downstream 12-Mile West Road Crossing
Taxa	7/24/2019	7/17/2019	7/17/2019
PORIFERA (sponges)			
PLATYHELMINTHES (flatworms)			
Turbellaria			
NEMATOMORPHA (roundworms)			
BRYOZOA (moss animals)			
ANNELIDA (segmented worms)			
Hirudinea (leeches)		1	1
Oligochaeta (worms)	11	8	11
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	22	28	26
Decapoda (crayfish)	1	3	10
Isopoda (sowbugs)			1
Arachnoidea			
Hydracarina	4		3
Insecta			
Ephemeroptera (mayflies)			
Ametropodidae			
Baetiscidae			
Baetidae	43	7	
Caenidae		7	
Ephemerellidae	1	2	3
Ephemeridae			
Heptageniidae	4	16	8
Isonychiidae			
Leptophlebiidae			
Metretopodidae			
Oligoneuriidae			
Polymitarcyidae			
Potamanthidae			
Siphonuridae			
Tricorythidae		3	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	2	13	
Cordulegastridae	6		6
Corduliidae			
Gomphidae		3	2

Taxa	Station 13 Stronach Creek downstream of Java Road	Station 14 Cool Creek upstream 12-Mile East Road Crossing	Station 15 Cool Creek downstream 12-Mile West Road Crossing
	7/24/2019	7/17/2019	7/17/2019
Libellulidae			
Macromiidae			
Zygoptera (damselflies)			
Calopterygidae	1	6	5
Coenagrionidae			
Lestidae			
Plecoptera (stoneflies)			
Capniidae			
Chloroperlidae			
Leuctridae	73		
Nemouridae	7		
Peltoperlidae			
Perlidae	1	3	3
Perlodidae			
Pteronarcyidae			
Taeniopterygidae			
Hemiptera (true bugs)			
Belostomatidae			
Corixidae			
Gelastocoridae			
Gerridae	1		1
Mesoveliidae			
Naucoridae			
Nepidae			
Notonectidae			
Pleidae			
Saldidae			
Veliidae			
Megaloptera			
Corydalidae (dobson flies)	1	1	3
Sialidae (alder flies)			
Neuroptera (spongilla flies)			
Sisyridae			
Trichoptera (caddisflies)			
Brachycentridae	3	2	
Goeridae	9		
Glossosomatidae			2
Helicopsychidae		5	5
Hydropsychidae	17	46	27
Hydroptilidae			
Lepidostomatidae	3		

	Station 13 Stronach Creek downstream of Java Road	Station 14 Cool Creek upstream 12-Mile East Road Crossing	Station 15 Cool Creek downstream 12-Mile West Road Crossing
Taxa	7/24/2019	7/17/2019	7/17/2019
Leptoceridae		26	6
Limnephilidae	3	2	7
Molannidae			7
Odontoceridae			
Philopotamidae	1	1	1
Phryganeidae	5		
Polycentropodidae		1	
Psychomyiidae			
Rhyacophilidae			
Sericostomatidae			
Uenoidae			
Lepidoptera (moths)			
Noctuidae			
Pyrilidae			
Coleoptera (beetles)			
Chrysomelidae (adults)			
Curculionidae (adults)			
Dytiscidae (total)			
Gyrinidae (adults)			
Halplidae (adults)			
Heteroceridae (total)			
Hydraenidae (total)			
Hydrophilidae (total)			1
Lampyridae (adults)			
Limnichidae (adults)			
Noteridae (adults)			
Psephenidae (adults)			
Ptilodactylidae (adults)			
Scirtidae (adults)			
Chrysomelidae (larvae)			
Curculionidae (larvae)			
Dryopidae			
Elmidae	40	27	20
Gyrinidae (larvae)			
Halplidae (larvae)			
Lampyridae (larvae)			
Limnichidae (larvae)			
Noteridae (larvae)			
Psephenidae (larvae)			
Ptilodactylidae (larvae)			
Scirtidae (larvae)			

	Station 13 Stronach Creek downstream of Java Road	Station 14 Cool Creek upstream 12-Mile East Road Crossing	Station 15 Cool Creek downstream 12-Mile West Road Crossing
Taxa	7/24/2019	7/17/2019	7/17/2019
Diptera (flies)			
Athericidae			
Ceratopogonidae	2		
Chaoboridae			
Chironomidae	25	43	29
Culicidae			
Dixidae		1	
Dolichopodidae			
Empididae			
Ephydriidae			
Muscidae			
Psychodidae			
Ptychopteridae			
Sciomyzidae			
Simuliidae	16	1	
Stratiomyidae			
Syrphidae			
Tabanidae		1	
Thaumaleidae			
Tipulidae	1		3
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)			5
Bithyniidae		1	
Hydrobiidae			
Lymnaeidae			
Physidae	1	2	9
Planorbidae			
Pleuroceridae			1
Pomatiopsidae		2	
Valvatidae			
Viviparidae			
Pelecypoda (bivalves)			
Corbiculidae		17	
Dreissenidae			15
Pisidiidae	1		
Sphaeriidae (clams)			
Unionidae (mussels)			1
Uenoidae			
Total Individuals	305	279	222

Table 18. Macroinvertebrate metric evaluation for Stronach and Cool Creeks in Lake and Manistee Counties, July and August 2019.

METRIC	Station 13 Stronach Creek downstream of Java Road		Station 14 Cool Creek upstream 12-Mile East Road Crossing		Station 15 Cool Creek downstream 12-Mile West Road Crossing	
	8/28/2019		7/17/2019		7/17/2019	
	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	29	1	30	1	30	1
NUMBER OF MAYFLY TAXA	3	1	5	1	2	-1
NUMBER OF CADDISFLY TAXA	7	1	7	1	7	1
NUMBER OF STONEFLY TAXA	3	1	1	0	1	0
PERCENT MAYFLY COMPOSITION	15.74	0	12.54	0	4.95	0
PERCENT CADDISFLY COMPOSITION	13.44	0	29.75	1	24.77	0
PERCENT DOMINANT TAXON	23.93	0	16.49	1	13.06	1
PERCENT ISOPOD, SNAIL, LEECH	0.33	1	2.15	1	7.66	0
PERCENT SURFACE AIR BREATHERS	0.33	1	0.00	1	0.90	1
TOTAL SCORE		6		7		3
MACROINVERTEBRATE COMMUNITY RATING	Excellent		Excellent		Acceptable	