

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan

July-August 2020

CONTENTS

INTRODUCTION.....	1
WATERSHED INFORMATION	2
LAND USE	2
HISTORIC SAMPLING EFFORTS.....	3
SITE-SELECTION/METHODS	5
MONITORING FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS.....	6
BIOSURVEY AND HABITAT TABLES.....	17

INTRODUCTION

Michigan has over 76,000 miles of rivers and streams. Understanding the quality of those waters is an important part of the Michigan Department of Environment, Great Lakes, and Energy’s (EGLE) mission to protect Michigan’s environment and public health by managing air, water, land, and energy resources. All of Michigan’s watersheds are surveyed once every five years. As part of that effort, the Pentwater River watershed was sampled in 2020; 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 is helpful in understanding 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.

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

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 and meet WQS to support these uses. Parts of the Pentwater River watershed and the other associated coastal tributaries are also protected for coldwater fish since some of the streams are cold enough for trout and salmon. All sites surveyed 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 Pentwater River watershed is on the west coast of Michigan's Lower Peninsula and is made up of other smaller coastal tributaries (i.e., Quinn Creek, Silver Creek, Stony Creek, Flower Creek, Little Flower Creek). From here on out, this group of watersheds will be collectively referred to as the Pentwater River watershed, unless otherwise noted. The watershed covers approximately 335 square miles in Mason, Muskegon, and Oceana Counties. There are 18 [state regulated dams](#) or water level control structures in the watershed.

LAND USE

The type of land use in a watershed plays an important role on the water quality ([Huron River Watershed Council \[HRWC\], 1999](#)). The dominant land use in the Pentwater River watershed is natural terrestrial (39 percent) followed by agricultural (38 percent), wetlands/open water (13 percent), developed (9 percent), and barren land (1 percent; United States Geological Survey [USGS], 2014). 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

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

Pentwater River watershed is about 14 percent, compared to the 40 percent lost across the entire state ([Fizzell, 2014](#)). The highest percent of wetlands lost (63 percent) is in the Flower Creek watershed, which is a separate coastal tributary that is lumped in with the Pentwater River watershed. For more details on the land use in this watershed, please see the online [Watershed Monitoring Story Map](#).

HISTORIC SAMPLING EFFORTS

List 1 is a summary of the reports available from the last two decades. For more information about older reports and results or for any other questions about this watershed, please contact the watershed biologist by finding their contact information on the [Watershed Monitoring Story Map](#).

List 1. Historical EGLE biosurvey reports available for the Pentwater River watershed.

- ❖ 2015
 - Knoll Wilmes, M., 2017 #MI/DEQ/WRD 17/019
 - Macroinvertebrate community samples were collected at seven wadeable stations with ratings of poor or acceptable.
 - Habitat ratings were all good.
 - Fish community was assessed at three coldwater streams with only one containing brown trout and brook trout.
 - Water chemistry was sampled at three stations for nutrients and one for metals. All were meeting WQS.
 - Three stations have improperly sized and installed culverts that should be replaced.
- ❖ 2010
 - Lipsey, T., 2012 #MI/DEQ/WB-12/015
 - Macroinvertebrate community samples were collected at ten wadeable stations with ratings of acceptable or excellent.
 - Habitat ratings ranged from marginal to excellent.
 - Water chemistry was sampled at three stations with all parameters meeting WQS.
 - Six stations were observed to have nonpoint source (NPS) issues, including perched culverts, misaligned culverts, eroding road crossings, and unrestricted livestock.
- ❖ 2007
 - Rippke, M., 2008 #MI/DEQ/WB-08/086
 - Macroinvertebrate community samples were collected at two stations in the Flower Creek watershed, with acceptable ratings.
 - Habitat ratings were marginal and good.

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

❖ 2006

- Lipsey, T., 2007a #MI/DEQ/WB-07/082
 - Macroinvertebrate community samples were collected at three stations in Chippewa Creek, with ratings of acceptable.
 - Habitat ratings were good.
 - The fish community was sampled at one station with no salmonids collected.
 - Water chemistry samples were collected at two stations with all parameters meeting WQS.
- Lipsey, T., 2007b #MI/DEQ/WB-07/083
 - Water chemistry samples were analyzed for copper at three stations in an unnamed tributary to Pentwater Lake with all three meeting WQS.

❖ 2005

- L Lipsey, T., 2006 #MI/DEQ/WB-06/097
 - Macroinvertebrate community samples were collected at 29 stations with ratings ranging from poor to excellent.
 - Habitat ratings ranged from marginal to excellent.
 - Fish community samples were collected at four coldwater streams with salmonids only collected at two stations. An additional warmwater stream was sampled with an acceptable rating.
 - Water chemistry samples were collected from 36 sites with WQS being met at all but one site. An unnamed tributary to Pentwater Lake exceeded the WQS for Copper.

❖ 2002

- Walker, B. 2003 #MI/DEQ/WD-03/034
 - Macroinvertebrate community samples were collected at five stations with all ratings acceptable.
 - Habitat was evaluated at eight stations and ranged from marginal to excellent.
 - Fish community samples were collected at two coldwater streams with salmonids collected at both.
 - Water chemistry samples were collected from seven stations. Results from Flower Creek suggested that there were more nutrient problems than Stony Creek.

❖ 2000

- Walker, B. 2000 #MI/DEQ/SWQ-00/105
 - Macroinvertebrate community samples were collected at 16 stations with ratings ranging from acceptable to excellent.
 - Habitat was evaluated at 25 stations and ranged from fair to excellent.
 - Fish community samples were collected at ten coldwater stream stations with salmonids collected at all but one.
 - Water chemistry samples were collected from 13 stations with all meeting WQS.

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

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 [NPS](#) of water quality pollution.

SITE SELECTION/METHODS

During July-August 2020, three sites were sampled in the actual Pentwater 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 assess habitat along with macroinvertebrate and/or fish community information. Additionally, visual assessments were conducted at three sites.

Two types of site-selection methods were used in the Pentwater River watershed in 2020. These include:

- (1) **Trend sites:** One site, originally selected from a random group, became a trend site that is sampled every five years. This site will be used for a separate statewide trend report following analysis of 2006-2020 data.
- (2) **Targeted sites:** Five targeted sites were selected because sampling was requested through our [targeted monitoring request process](#). More information can be found on EGLE-WRD [Biological Assessment Web page](#).

There were no randomly selected status sites in the Pentwater River watershed to support the statewide condition portion of the GLWARMS Status and Trend Program (MDEQ, 2015).

Procedure 51 is used in streams and rivers that can be safely waded. This procedure evaluates macroinvertebrate communities based on several characteristics and combines all results into a one-number score that ranges from +9 to -9 (Table 1). Using the Procedure 51 score, the macroinvertebrate community is rated as Excellent, Acceptable, or Poor (Creal et al., 1996). 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.

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Table 1. 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 (OIALW) designated use. Procedure 51 can also be used to evaluate the warmwater fisheries and coldwater fisheries (CWF) designated uses. Habitat scores are not used to evaluate a designated use but instead 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](#).

MONITORING FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

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

Both stations sampled for macroinvertebrate community had ratings that were acceptable or excellent (Table 2, Figure 1). Therefore, the OIALW designated use was being supported at those stations. The fish community was assessed at one coldwater stream station that resulted in the stream still not supporting the CWF designated use.

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

North Branch Pentwater River

The North Branch Pentwater River was assessed at two locations (Stations 1 and 2). Station 1 was the furthest upstream and was sampled upstream of the former Washington Road bridge in Oceana County. This site supported an excellent (5) macroinvertebrate community with good (145) habitat (Tables 5 and 7). The riparian zone was relatively intact except for remnants of the former bridge, which added some boulder to the stream. Substrate consisted of sand with silt and a large deposit of fine organic material on the left bank (looking downstream) where an ephemeral/intermittent channel comes into the river. Additional habitat for macroinvertebrate colonization and fish consisted of moderate

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

amounts of undercut banks, overhanging vegetation, large woody debris (LWD) and aquatic plants, along with sparse rootwads (Photo 1).

Station 2 was the furthest downstream and sampled upstream of Hammett Road. This site supported a high acceptable (2) macroinvertebrate community with good (150) habitat (Tables 5 and 7). The riparian zone was a wetland containing mostly tag alders and cattails (Photo 2). The substrate was primarily sand with the banks consisting of soft silt along with moderate amounts of fine particulate organic matter (FPOM) and coarse particulate organic matter (CPOM). The main in-stream habitat was overhanging vegetation and aquatic plants (submerged and emergent) with sparse amounts of undercut banks, LWD, and rootwads.



Photo 1. North Branch Pentwater River upstream of the former Washington Road bridge, Oceana County, 2020.

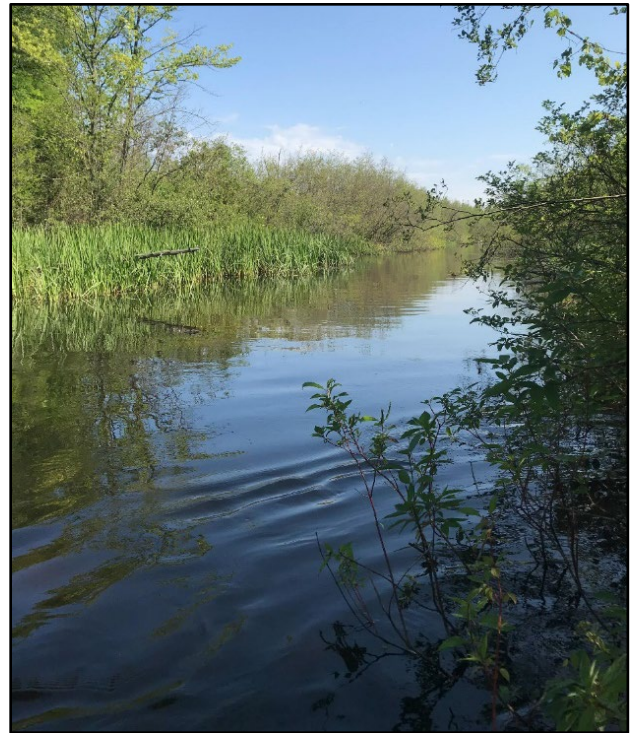


Photo 2. North Branch Pentwater River upstream of Hammett Road, Oceana County, 2020.

Chippewa Creek

Chippewa Creek was sampled downstream of Oceana Drive, behind the Hart Animal Clinic (Station 3). The riparian zone is intact through this stretch of the stream with some clearings in the canopy where ephemeral channels come in creating an herbaceous wetland area.

Substrate in the creek was mainly sand mixed with silt. In-stream habitat was limited to LWD and some aquatic plants. The depth of the creek was shallow and uniform except for a deep

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

pool at an outside bend near the upper portion of the survey reach. For more information, see the discussion regarding the targeted monitoring request under Goal 3.

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Table 2. Sampling locations and Procedure 51 sampling results for stations sampled in the Pentwater River watershed, 2020. Unless otherwise noted, stations are sampled upstream of road crossings.

Station	Stream Name	Road Crossing	STORET	Latitude	Longitude	Habitat Score	Habitat Rating ¹	Bug Score	Bug Rating ²	Station Type ³
1	NB Pentwater River	Washington Rd	640357	43.8172	-86.24334	145	Good	5	Excellent	T
2	NB Pentwater River	Hammett Rd	640207	43.7815	-86.38669	150	Good	2	Acceptable	Tr
3	Chippewa Creek	d/s Oceana Dr	640296	43.6982	-86.35444	NA	NA	NA	NA	T
SV1	Crystal Creek	120th Ave	640211	43.7774	-86.2579	NA	NA	NA	NA	SV
SV2	Unnamed Trib to Huftile Creek	112th Ave	640339	43.6812	-86.2778	NA	NA	NA	NA	SV
SV3	Unnamed Trib to Huftile Creek	116th Ave	640338	43.6834	-86.2678	NA	NA	NA	NA	SV

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, SV= Site Visit**

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

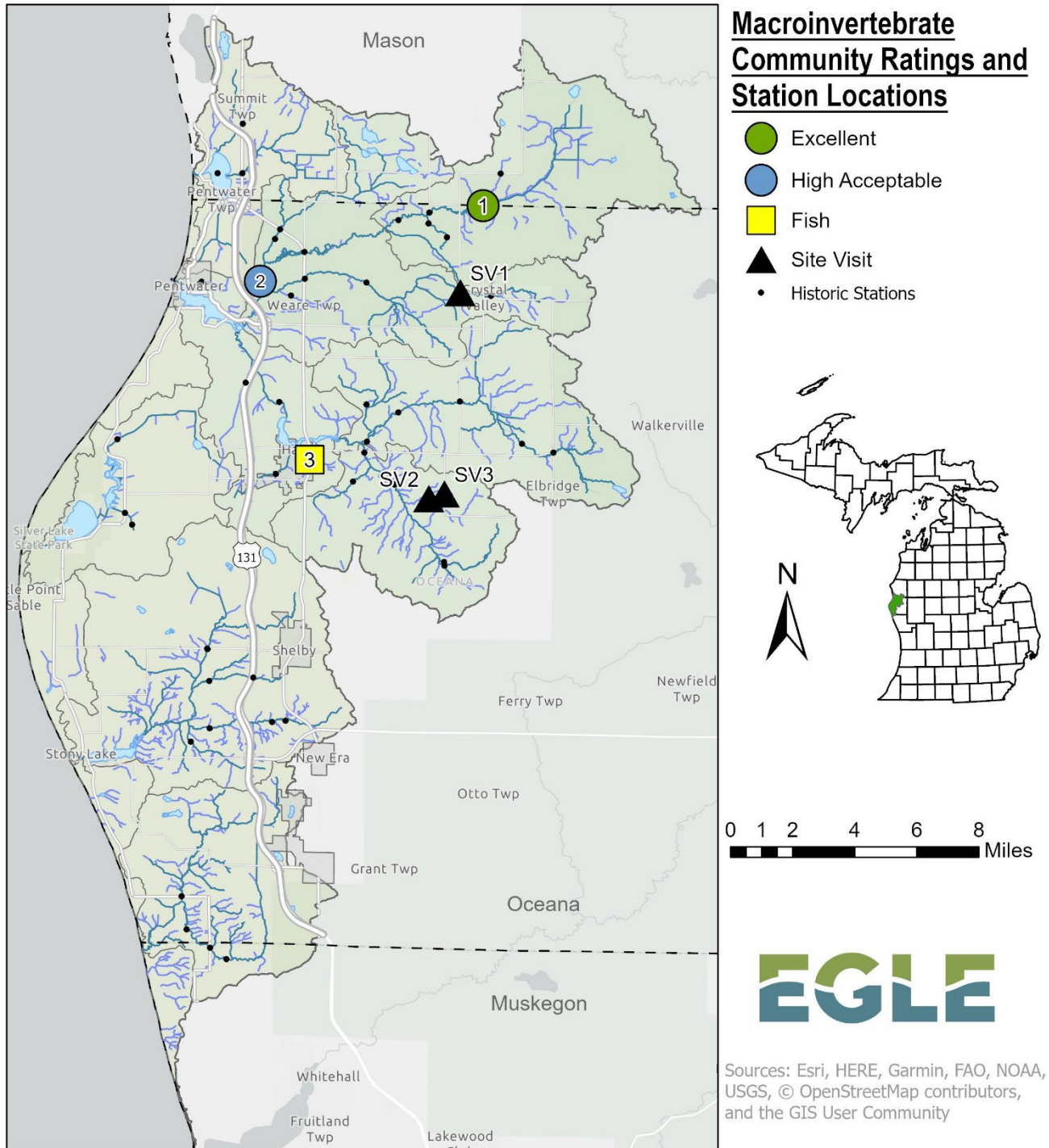


Figure 1. Sampling stations in the Pentwater River watershed for macroinvertebrates, fish, and site visits, July-August 2020.

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

Goal 2: Evaluate biological integrity temporal trends.

One site (Station 2) within the Pentwater River watershed was part of the statewide trend analysis. This location had some notable changes, but the statewide trend information will be summarized in a separate statewide report.

The North Branch Pentwater River at Hammett Road has had some notable changes since 2010. The first deals with sampling, it was originally sampled in September 2010 and the consecutive years, 2015 and 2020, sampled in July, which could lead to some seasonal differences in the macroinvertebrate community composition. Since 2010 there has been relatively no change in the healthy riparian structure; however, the substrate, in-stream cover, and channel morphology have all experienced varying degrees of change. In general, 2010 appeared to have the best in-stream habitat and macroinvertebrate communities, 2015 with the worst, and 2020 with ratings in between the two years. From 2010 to 2015 the macroinvertebrate community rating dropped from excellent (5) to acceptable (0), which is outside the normal variability (3 points) seen with this procedure, and from 2015 to 2020 the rating rose to a high acceptable (2). There does not appear to be any consistent changes in the macroinvertebrate communities, suggesting there might just be a lot of variability in the system. However, a couple of interesting observations are that the dominant taxa is always changing; in 2010 the dominant taxa was Simuliidae (34 percent), in 2015 it was Baetidae (39 percent), and in 2020 it was Amphipoda (74 percent). Also, in 2015 and 2020 there have respectively been ten and nine less taxa than 2010, with most of those belonging to the sensitive groups of Ephemeroptera, Plecoptera, and Trichoptera (EPT). There are eight EPT families that were only documented in 2010, which include Baetiscidae, Ephemeridae, Pteronarcyidae, Helicopsychidae, Molannidae, Philopotamidae, Phryganeidae, and Psychomyiidae.

Goal 3: Satisfy monitoring requests submitted by EGLE staff and external customers.

North Branch Pentwater River.

The upper portion of the North Branch Pentwater River (Station 1) was targeted due to a lack of biological data in an area that has potential to be heavily impacted by agricultural activities. The macroinvertebrate community was not impaired, consisting of 30 taxa and the community scored excellent (Tables 6 and 7). The habitat was also in good condition but there were signs of sedimentation issues, limiting the available habitat for epifaunal colonization, and larger deposits of silt and FPOM throughout the reach (Table 4). Based on this site visit, there are signs of upstream issues/pollution due to the observed sedimentation but not to the degree of causing an impairment to the biological community.

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Chippewa Creek

Chippewa Creek was sampled in 2015 with an acceptable macroinvertebrate community but only eight fish were collected, resulting with the inability to make an accurate CWF assessment because at least 50 fish are needed (Knoll Wilmes, 2017). However, 2006 data indicates that Chippewa Creek was not supporting the CWF designated use. A request was received to reevaluate the fish community at this site and to make an assessment decision based on the new data. During the survey, it was noted that the water was opaque in appearance with some foam present. After sampling for 30 minutes, there were only three species recorded with no salmonids collected (Table 3). White suckers were the dominant species, with most of them being young, in the 1- and 2-inch size classes, and the largest being in the 8-inch size class. Water temperature was 62 degrees Fahrenheit, which is within the WQS for CWF designated use. However, since there were no salmonids collected, Chippewa Creek is not meeting WQS for the CWF designated use.

Table 3. Fish community sampling results for Chippewa Creek, Oceana County, August 2020.

Fish Species	Number of Individuals
Fathead Minnow (<i>Pimephales promelas</i>)	6
White Sucker (<i>Catostomus commersoni</i>)	39
Brook Stickleback (<i>Culaea inconstans</i>)	9

Goal 4: Identify potential NPS and other sources of water quality impairment.

Overall, water quality in the North Branch Pentwater River was good with some potential issues in the tributaries. There were three targeted monitoring requests about previously documented concerns related to road stream crossings.

The headwaters of the Pentwater River watershed have had three road crossings that have historically been reported to have potential impacts on water quality (Knoll Wilmes, 2017). Crystal Creek at 120th Avenue (SV-1) had a new culvert installed in 2010 at an improper angle. Based on the site visit in 2020, the culvert was still misaligned, but the banks had dense overhanging vegetation with no signs of bank erosion. The Unnamed Tributary to Huftile Creek at 112th Avenue (SV-2) was previously documented to have a perched culvert with a deep plunge pool on the downstream side. Based on the 2020 site visit, there has been no change. The Unnamed Tributary to Huftile Creek at 116th Avenue (SV-3) was previously reported to have an undersized, misaligned, and perched culvert. Based on the

Macroinvertebrate and Stream Habitat Surveys of the Pentwater River Watershed, Michigan - July-August 2020

2020 visit, there has been no change to the culvert but, on the downstream side of the road, there has been extensive earth work, potentially rerouting the stream and creating an inline pond. All this work resulted in unprotected banks eroding sediment into the stream (Photo 3).



Photo 3. Earth work on the Unnamed Tributary to Huftile Creek downstream of 116th Avenue, Oceana County, August 2020.

RECOMMENDATIONS

1. During the next basin year, the Unnamed Tributary to Huftile at 116th Avenue should be revisited to assess the status of the earthwork and sediment erosion. There is currently no biological data on that tributary so an assessment would be recommended.
2. The Pentwater River watershed consists of several other separate coastal tributaries that have not had biological assessments in the past 10-20 years. Several of these have had concerns about declining water quality (e.g., Flower Creek, Little Flower Creek, Quinn Creek) and select sites should be considered for a revisit as resources allow.

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

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**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

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**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

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**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

BIOSURVEY AND HABITAT TABLES

Table 4. Habitat evaluations for the North Branch Pentwater River in Oceana County, July 2020.

HABITAT METRICS	Station 1 NB Pentwater River at Washington Rd 7/7/2020 GLIDE/POOL	Station 2 NB Pentwater River at Hammett Rd 7/7/2020 GLIDE/POOL
Substrate and In-stream Cover		
Epifaunal Substrate/ Available Cover (20)	12	10
Embeddedness (20)	NA	NA
Velocity/Depth Regime (20)	NA	NA
Pool Substrate Characterization (20)	8	9
Pool Variability (20)	13	10
Channel Morphology		
Sediment Deposition (20)	11	11
Flow Status Maintenance Flow Volume (10)	8	10
Flow Status -Flashiness (10)	7	10
Channel Alteration (20)	20	19
Frequency of Riffles/Bends (20)	NA	NA
Channel Sinuosity (20)	15	11
Riparian and Bank Structure		
Bank Stability (L) (10)	7	10
Bank Stability (R) (10)	8	10
Vegetative Protection (L) (10)	9	10
Vegetative Protection (R) (10)	9	10
Riparian Vegetative Zone Width (L) (10)	10	10
Riparian Vegetative Zone Width (R) (10)	8	10
TOTAL SCORE (200):	145	150
HABITAT RATING:	GOOD	GOOD
Weather:	Sunny	Sunny
Air Temperature: °F	91	86
Water Temperature: °F	65	64
Average Stream Width: Feet	20.5	73.7
Average Stream Depth: Feet	1.0	2.5
Surface Velocity: Feet/Second	0.986	1.1867
Estimated Flow: Cubic Feet/Second	20.355	216.796
Stream Modifications:	None	None
Nuisance Plants (Yes/No):	No	No
STORET Number:	640357	640207
County Code:	64	64
Town Range Section:	16N16W5	16N17W18
Latitude (dd):	43.81717	43.7821
Longitude (dd):	-86.24334	-86.38655
Ecoregion:	SMNITP	SMNITP
Stream Type:	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Table 5. Qualitative macroinvertebrate community sampling results for the North Branch Pentwater River in Oceana County, July 2020.

Taxa	Station 1 NB Pentwater River at Washington Rd 7/7/2020	Station 2 NB Pentwater River at Hammett Rd 7/7/2020
NEMATOMORPHA (roundworms)	1	
ANNELIDA (segmented worms)		
Oligochaeta (worms)	6	1
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	11	240
Decapoda (crayfish)	2	1
Isopoda (sowbugs)		10
Arachnoidea		
Hydracarina	2	
Insecta		
Ephemeroptera (mayflies)		
Baetidae	108	10
Caenidae	1	
Ephemerellidae	1	
Heptageniidae	4	1
Isonychiidae		5
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	3	1
Zygoptera (damselflies)		
Calopterygidae	5	4
Plecoptera (stoneflies)		
Perlidae		2
Hemiptera (true bugs)		
Belostomatidae		1
Corixidae	1	2
Gerridae	1	2
Veliidae	4	
Megaloptera		
Corydalidae (dobson flies)	2	1

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Taxa	Station 1 NB Pentwater River at Washington Rd 7/7/2020	Station 2 NB Pentwater River at Hammett Rd 7/7/2020
Trichoptera (caddisflies)		
Brachycentridae	46	19
Hydropsychidae	22	1
Leptoceridae		9
Limnephilidae	4	1
Polycentropodidae	2	2
Psychomyiidae	1	
Coleoptera (beetles)		
Dytiscidae (total)	1	
Gyrinidae (adults)	1	
Hydrophilidae (total)	7	
Diptera (flies)		
Athericidae		1
Chironomidae	77	6
Dixidae		1
Simuliidae	48	
Stratiomyidae	1	
Tabanidae	1	
Tipulidae	1	
MOLLUSCA		
Gastropoda (snails)		
Physidae	3	4
Pelecypoda (bivalves)		
Pisidiidae	2	
Total Individuals	369	325

**Macroinvertebrate and Stream Habitat Surveys of the
Pentwater River Watershed, Michigan - July-August 2020**

Table 6. Macroinvertebrate metric evaluation for the North Branch Pentwater River in Oceana County, July 2020.

METRIC	Station 1 NB Pentwater River at Washington Rd 7/7/2020 Value	Station 1 NB Pentwater River at Washington Rd 7/7/2020 Score	Station 2 NB Pentwater River at Hammett Rd 7/7/2020 Value	Station 2 NB Pentwater River at Hammett Rd 7/7/2020 Score
Total Number of Taxa	30	1	23	0
Number of Mayfly Taxa	4	1	3	0
Number of Caddisfly Taxa	5	1	5	1
Number of Stonefly Taxa	0	-1	1	1
Percent Mayfly Composition	30.89	1	4.92	0
Percent Caddisfly Composition	20.33	0	9.85	0
Percent Dominant Taxon	29.27	0	73.85	-1
Percent Isopod, Snail, Leech	0.81	1	4.31	0
Percent Surface Air Breathers	4.34	1	1.54	1
TOTAL SCORE		5		2
Macroinvertebrate Community Rating	Excellent	Excellent	Acceptable	Acceptable

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